



NATIONAL
SCIENCE
FOUNDATION

**Environmental Impact Statement
for the Green Bank Observatory
Green Bank, West Virginia**

**Draft
Appendixes**



November 9, 2017

Appendix 3.1A
Biology Correspondence



United States Department of the Interior

FISH AND WILDLIFE SERVICE

West Virginia Field Office
694 Beverly Pike
Elkins, West Virginia 26241



April 13, 2017

Ms. Elizabeth Pentecost
National Science Foundation
Division of Astronomical Sciences
4201 Wilson Boulevard, Suite 1045
Arlington, Virginia 22230

Re: Green Bank Observatory, Green Bank, Pocahontas County, West Virginia
(FWS File #: 2017-I-0068)

Dear Ms. Pentecost:

This responds to your request of March 16, 2017, for information regarding the potential occurrence of federally listed threatened and endangered species with regards to proposed changes to the operations of Green Bank Observatory, a National Science Foundation (NSF) funded facility. In a correspondence dated October 20, 2016, the U.S. Fish and Wildlife Service (Service) determined that the Green Bank Observatory is within a known use area for the federally listed endangered Indiana bat (*Myotis sodalists*) and threatened northern long-eared bat (*Myotis septentrionalis*), and that proposed changes had the potential to affect these species. The proposed Alternatives for the draft Environmental Impact Statement will each be evaluated for these impacts. These comments are provided pursuant to the Endangered Species Act (ESA) (87 Stat. 884, as amended; 16 U.S.C. 1531 *et seq.*).

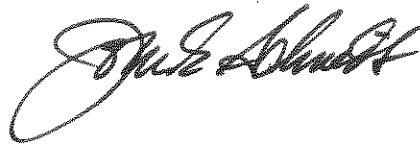
The Alternatives are: A: Collaboration with interested parties for science- and education-focused operations with reduced NSF-funded scope; B: Collaboration with interested parties for operation as a technology and education park; C: Mothballing of facilities (suspension of operations in a manner such that operations could resume efficiently at a later date); D: Deconstruction and site restoration; and a No-Action Alternative, with continued NSF investment for science-focused operations. None of the five Alternatives would involve tree clearing; therefore, the Service concurs with NSF's determination that any Alternative selected by NSF would have no effect on federally listed bat species, and no biological assessment or further section 7 consultation under the ESA is required with the Service.

Ms. Elizabeth Pentecost
April 13, 2017

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Should project plans change or amendments be proposed that we have not considered in your proposed action, or if additional information on listed and proposed species becomes available, or if new species become listed or critical habitat is designated, this assessment may be reconsidered. If you have any questions regarding this letter, please contact Amanda Selnick of my staff at (304) 636-6586, Ext. 24, or at the letterhead address.

Sincerely,

A handwritten signature in black ink, appearing to read "John E. Schmidt". The signature is written in a cursive style with a large, looping initial "J".

John E. Schmidt
Field Supervisor



United States Department of the Interior

FISH AND WILDLIFE SERVICE

West Virginia Field Office
694 Beverly Pike
Elkins, West Virginia 26241



Contact Name: Elizabeth Pentecost

Email Address or Fax Number: epenteco@nsf.gov

FWS File # 2017-I-0068 All future correspondence should clearly reference this file #.


Project: Green Bank Observatory Changes, Pocahontas County

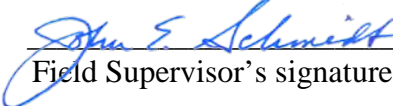
Date of Letter Request: March 17, 2017

This is in response to your letter requesting threatened and endangered species information in regard to the proposed project listed above. These comments are provided pursuant to the Endangered Species Act (ESA, 87 Stat. 884, as amended; 16 U. S. C. 1531 *et seq.*).

We have made a “no effect” determination that the project will not affect federally listed endangered or threatened species. Therefore no biological assessment or further section 7 consultation under the ESA is required with the Fish and Wildlife Service. Should project plans change or amendments be proposed that we have not considered in your proposed action, or if additional information on listed and proposed species becomes available, or if new species become listed or critical habitat is designated, this determination may be reconsidered.

Definitive determinations of the presences of waters of the United States, including wetlands, in the project area and the need for permits, if any, are made by the U.S. Army Corps of Engineers. They may be contacted at Huntington District, Regulatory Branch, 502 Eighth Street, Huntington, West Virginia, 25701, telephone (304) 399-5710.


03/28/2017
Reviewer's signature and date


3/29/2017
Field Supervisor's signature and date

**NATIONAL SCIENCE FOUNDATION
4201 WILSON BOULEVARD
ARLINGTON, VIRGINIA 22230**



**DIVISION OF ASTRONOMICAL
SCIENCES**

March 16, 2017

Ms. Elizabeth Stout, Biologist
U.S. Fish and Wildlife Service
West Virginia Ecological Services Field Office
694 Beverly Pike
Elkins, WV 26241

Subject: Determination of Impacts for Proposed Changes to Green Bank Observatory,
Green Bank, West Virginia

Dear Ms. Stout:

In October 2016, the National Science Foundation (NSF) requested input on relevant issues that would influence the scope of the environmental analysis needed to evaluate NSF's proposed operational changes due to funding constraints for the Green Bank Observatory, in Green Bank, West Virginia. Figure 1 provides the location of the Observatory.

The U.S. Fish and Wildlife Service (the Service) response, dated October 20, 2016, indicated that the NSF Proposed Action would have the potential to affect the endangered Indiana bat (*Myotis sodalis*) and the threatened northern long-eared bat (*Myotis septentrionalis*). No other species were identified by the Service as being potentially affected by the Proposed Action. Further, no critical habitat was identified by the Service in the project area.

There are four Action Alternatives, in addition to the No-Action Alternative (continued NSF investment for science-focused operations), that are under consideration by NSF, including the following:

- Collaboration with interested parties for science- and education-focused operations with reduced NSF-funded scope.
- Collaboration with interested parties for operation as a technology and education park.
- Mothballing of facilities (suspension of operations in a manner such that operations could resume efficiently at some future date).
- Deconstruction and site restoration.

The attached *Alternatives Considered* document provides descriptions of the considered action alternatives. Figure 2 shows the structures that are on the Observatory.

The Indiana bat and the northern long-eared bat were identified as potentially using the general area for foraging and roosting between April 1 and November 15. In addition, the Service identified that the Observatory was within an Indiana bat hibernacula known use area.

Via a site evaluation, NSF has determined that deconstruction, including staging and support areas, under the considered alternatives would be confined to existing disturbed areas where vegetation is landscaped

and maintained in a mowed state. See Figure 3 for photographs that depict the landscape at the Observatory. Undeveloped portions of the Observatory property would not be disturbed under any of the alternatives. No removal of trees greater than 3-inch diameter breast height and no disturbance to forested habitats would occur. Additionally, based on field observations there are no caves or mine openings at or adjacent to any of the structures that would be deconstructed. Foraging habitat is not likely to be affected due to the lack of meaningful habitat around the structures to be deconstructed and because no forest clearing would occur as part of the Proposed Action.

Because NSF is avoiding impacts to the Indiana bat, an Indiana Bat Conservation Plan has not been developed. Forested areas will be clearly marked as off limits during construction.

Because there would be no tree removal, no disturbance of forested habitats, and no disturbance of caves or mine openings, NSF has determined that its Proposed Action would not affect the endangered Indiana bat or the threatened northern long-eared bat.

No critical habitat has been designated within the Observatory boundary. There would be no potential for adverse modification of critical habitat for any listed species under the Proposed Action.

The NSF requests concurrence with this no effect determination. Because there would be no effects to listed species, additional consultation under Section 7 of the Endangered Species Act is not necessary for this project.

The NSF point-of-contact for the NEPA analysis is Ms. Elizabeth Pentecost, National Science Foundation, Division of Astronomical Sciences, Suite 1045, 4201 Wilson Boulevard, Arlington, Virginia 22230; telephone: (703) 292-4907; email: epenteco@nsf.gov.

We appreciate your assistance in this matter and look forward to your response. If you require any additional information or documentation, please contact Ms. Pentecost.

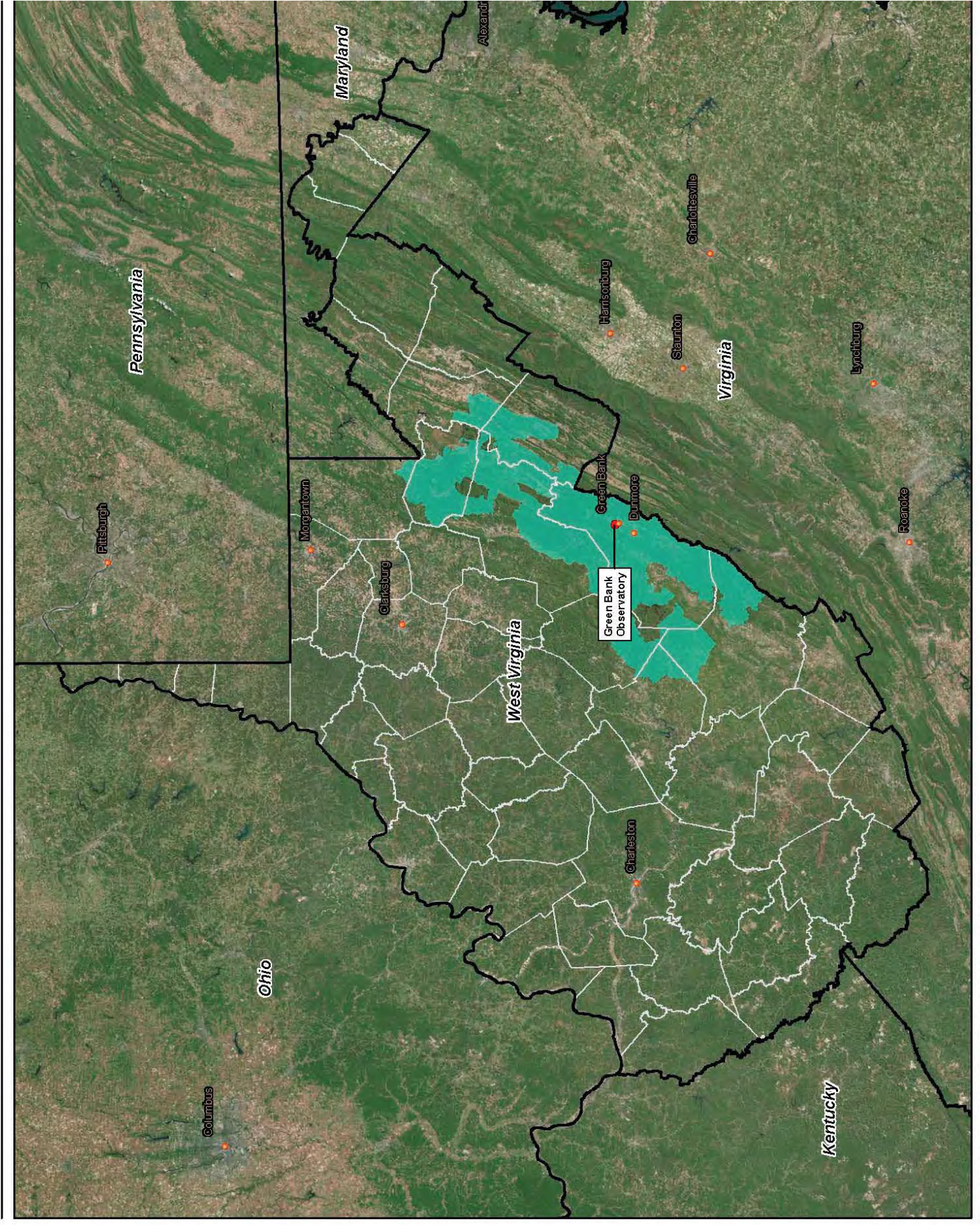
Sincerely,



Ralph A. Gaume
Acting Division Director

Enclosure: Figure 1 Project Location Map
 Figure 2 Site Layout
 Figure 3 Photographs
 Description of Alternatives

Cc: K. Hamilton
 M. Rau









Alternatives Considered

This section describes the proposed Alternatives to be considered in the Draft Environmental Impact Statement (DEIS). The basis for these proposed Alternatives was input received from the scientific community.

Action Alternative A: Collaboration with Interested Parties for Science- and Education-focused Operations with reduced NSF-funded Scope

Action Alternative A would involve collaborations with new stakeholder(s) who would use and maintain Green Bank Observatory (GBO) for science- and education-focused operations. The National Science Foundation (NSF) would reduce its funding of the Observatory and the new stakeholder(s) would be responsible for future maintenance and upgrades. Action Alternative A would involve the least change to the current facility and would retain the Green Bank Telescope, other appropriate telescopes, and appropriate supporting facilities for education and research as determined by NSF and the new and/or existing stakeholder(s). Any structures not needed to meet the anticipated operational goals would be safe-abandoned¹, mothballed², or deconstructed as appropriate, and the resulting implementation activities are anticipated to be like those found under Action Alternatives C and D (discussed below) for those structures.

This proposed Alternative is defined by the reduction of NSF funding and the continuance of science- and education- focused operations, not the disposition of any one facility or structure. Because reduction of NSF funding may require the safe-abandonment, mothballing, or deconstruction of facilities, this DEIS describes this proposed Alternative under the most conservative (highest impact) scenario in terms of NSF's analysis of potential changes to facilities, so that it may be inclusive of the full range of potential environmental impacts. Table 1 provides a detailed list of facilities identified for potential retention, deconstruction, safe-abandonment, or mothballing under this Alternative, for the purpose of NSF's environmental review. However, it must be emphasized that a collaboration may not require the full extent of activities analyzed, and could involve none of the activities listed in Table 1, or a subset of the activities. NSF's Record of Decision would contain an explanation of which components of any selected proposed Alternative would be implemented.

The anticipated activities to implement any required deconstruction under Action Alternative A include the following:

- Prepare buildings and structures to be mothballed and turn off non-essential utilities. See Table 1 for a list of facilities to be mothballed.
- Prepare facilities to be safe-abandoned, including installing security fencing and turning off utilities.
- Conduct a hazardous materials assessment for asbestos-containing material (ACM), lead-based paint (LBP), and other conditions of concern for structures to be deconstructed. Remediate as necessary.
- Deconstruct buildings and structures that are no longer needed. Concrete buildings would be removed using hammerhoes, jackhammers, and other heavy equipment.

¹ Safe-Abandonment: To remove a building or facility from service without demolishing it. This includes removing furnishings, disconnecting utilities, and isolating the structure from public access by fencing or other means to reduce fall and tripping hazards and preclude vandalism. The structure is also made secure from environmental damage due to wind, rain, humidity, and temperature extremes. Pest and insect damage must also be taken into account and biodegradable items must be removed to the maximum extent practicable. Under safe-abandonment, the structures would never be brought back to operational status.

² Mothball: To remove a facility or structure from daily use while maintaining the general condition for a defined period. Equipment and structures are kept in working order but are not used.

- Segregate, load, and transport waste materials to appropriate offsite landfills and recycling centers.
- Establish soil in areas where buildings were removed from bedrock and landscape areas of bare soil.

The period for any required deconstruction for Action Alternative A is expected to last 21 weeks. All structures that would be deconstructed are within areas that are maintained with mowed landscape grasses. Additional maintained areas are available for staging and support during deconstruction. No tree removal or disturbances to unmaintained areas would be necessary to deconstruct the structures.

Operations would be expected to continue at non-affected facilities during any scheduled deconstruction activities. Deconstruction activities that could interfere with the use of the Green Bank Telescope and other telescopes and data collection would be coordinated with GBO staff to minimize the potential for disrupting scientific work.

Operations after any scheduled deconstruction activities would be similar to current operations.

This proposed Alternative would meet the purpose and need of reducing the funding required from NSF, while allowing continued benefits to the scientific and educational communities. However, implementation of this proposed Alternative could only occur if new and/or existing collaborators come forward to participate as collaborating parties with viable proposed plans to provide additional non-NSF funding in support of their science- and education-focused operations. Collaborators are being sought and could include agencies, educational institutions, industrial or commercial ventures, or private individuals.

Action Alternative B: Collaboration with Interested Parties for Operation as a Technology and Education Park

Action Alternative B would involve collaborating with outside entities to operate and maintain GBO as a Technology and Education Park. In this scenario, the site would have more of a tourism and local attraction focus and the Science Center, residential hall, cafeteria, and 40-foot telescope would remain.

This Alternative is defined by the reduction of NSF funding and the use of the site as a technology and education park. Because reduction of NSF funding may require the safe-abandonment, mothballing, or deconstruction of facilities, this DEIS describes this Alternative under the most conservative (highest impact) scenario in terms of NSF's analysis of potential changes to facilities, so that it may be inclusive of the full range of potential environmental impacts. Table 1 provides a detailed list of facilities identified for potential retention, deconstruction, safe-abandonment, or mothballing under this proposed Alternative, for the purpose of NSF's environmental review. However, it must be emphasized that a collaboration may not require the full extent of activities analyzed, and could involve none of the activities listed in Table 1, or a subset of the activities. NSF's Record of Decision would contain an explanation of which components of any selected proposed Alternative would be implemented.

The anticipated activities to implement deconstruction activities associated with Action Alternative B include the following:

- Prepare buildings and structures to be mothballed and turn off non-essential utilities.
- Prepare facilities to be safe-abandoned, including installing fencing and turning off utilities.
- Conduct a hazardous materials assessment for ACM, LBP, and other conditions of concern for structures to be deconstructed. Remediate as necessary.

- Deconstruct or safe-abandon facilities that are no longer needed. Concrete buildings would be removed using hammerhoes, jackhammers, and other heavy equipment.
- Segregate, load, and transport waste materials to appropriate offsite landfills and recycling centers.
- Establish soil in areas where buildings were removed from bedrock. Landscape areas of bare soil.

The deconstruction period for Action Alternative B is expected to last 22 weeks. All structures that would be deconstructed are within areas that are maintained with mowed landscape grasses. Additional maintained areas are available for staging and support during deconstruction. No tree removal or disturbances to unmaintained areas would be necessary to deconstruct the structures.

Operations would be expected to continue during deconstruction activities. Deconstruction activities that could interfere with the use of the 40-foot telescope and data collection would be coordinated with GBO staff to minimize the potential for disrupting scientific work.

Operations after deconstruction would be comparable to current operations. It is anticipated that a staff comparable in size to current operations would work onsite under this proposed Alternative.

Action Alternative C: Mothballing of Facilities

Action Alternative C would involve mothballing (preservation of) essential buildings, telescopes, and other equipment, with periodic maintenance to keep them in working order. This method would allow the facility to suspend operations in a manner that would permit operations to resume efficiently at some time in the future. It is not known what type of operations would be implemented when the mothball phase ends. Operations at the time of resumption could be similar to current operations, other science-based operations, education-based operations, or some other type of operations. Because of this uncertainty, it is assumed impacts after resumption of operations would be similar to Alternatives A and B and the resumption of operations under Alternative C is not considered part of this proposed Alternative.

Supporting structures would be evaluated to determine whether they are critical to the operation of the telescopes. Based on input NSF received from the scientific community, up to nine structures and facilities may be determined to be obsolete and not needed. Any such structures would be removed. Table 1 provides a detailed list of the nine facilities that would be removed, and the 45 facilities that would be mothballed under this proposed Alternative.

A maintenance program would be required to protect the facilities from deterioration, vandalism, and other damage. Regular security patrols would be performed to monitor the site. Common mothballing measures, such as providing proper ventilation, keeping roofs and gutters cleaned of debris, and performing ground maintenance and pest control, would be implemented. Lubrication and other deterioration-preventing measures would be required on the remaining telescopes.

Visitor housing and recreational areas would be closed indefinitely, with water lines drained and electricity turned off. All supplies, books, photographs, furnishings, and other items not needed for periodic maintenance would be removed from the site. Equipment, tools, machinery, furniture, and ancillary items that would not be needed for resumption of operations and that have salvage value would be disposed of in accordance with federal law.

Site restoration to establish landscaping where buildings were previously located would occur. Gates and fencing would be evaluated to determine whether upgrades would be needed to provide appropriate security and access around portions of the site that would require protection.

The anticipated activities to implement the deconstruction components of Action Alternative C include the following:

- Prepare buildings and structures to be mothballed and turn off non-essential utilities.
- Conduct a hazardous materials assessment for ACM, LBP, and other conditions of concern for structures to be deconstructed. Remediate as necessary.
- Deconstruct structures and buildings that are no longer needed. Concrete buildings would be removed using hammerhoes, jackhammers, and other heavy equipment.
- Segregate, load, and transport waste materials to appropriate offsite landfills and recycling centers.
- Establish soil in disturbed areas where buildings were removed from bedrock. Landscape areas of bare soil.
- Complete other limited site restoration activities.
- Establish site security and facilities maintenance.

The deconstruction period for Action Alternative C is expected to last 24 weeks. All structures that would be deconstructed are within areas that are maintained with mowed landscape grasses. Additional maintained areas are available for staging and support during deconstruction. No tree removal or disturbances to unmaintained areas would be necessary to deconstruct the structures.

Landscaped areas would be maintained during the mothball period. All infrastructure related to the telescopes would be conditioned for safe storage to prevent degradation of equipment and allow operations to be restarted. Regular vegetation maintenance would be implemented to keep vegetation from overgrowing the dishes.

For purposes of the analyses in this DEIS, it is assumed operations would be suspended for an indefinite time and then resumed at some point in the future. It is anticipated that technical staff responsible for operating the telescopes, scientific support staff, and cafeteria workers would not be retained. However, it is expected that current staffing levels for facilities maintenance would mostly remain the same under this proposed Alternative due to the level of maintenance required to keep the infrastructure operable.

Action Alternative D: Deconstruction and Site Restoration

Action Alternative D involves the removal of all structures. Table 1 provides a list of all of the facilities that would be removed under Action Alternative D.

Deconstruction would be accomplished using conventional demolition equipment (cranes, hydraulic excavator equipped with hydraulic-operated shears, grapplers, and hoe rams), other conventional heavy and light duty construction equipment, trades personnel, and trained demolition crews. For safe demolition of the Green Bank Telescope, 43-meter telescope, and water tower, initial demolition (bringing structures to ground level) would be accomplished using explosives (in the form of shaped charges) and conventional demolition/construction equipment.

Equipment, tools, machinery, furniture, and ancillary items that have a salvage value could be transported to another NSF facility, sold, or donated by GBO prior to demolition activities. All remaining facilities and structures (with exception of existing perimeter fencing) would be demolished including exposed below grade structures (to a maximum of 4 feet to enable the restoration of the ground surface topography without limiting future surface operations or activities where foundations exist to beyond that depth).

The anticipated activities to implement the deconstruction activities of Action Alternative D include the following:

- Turn off and cap utilities.
- Conduct a hazardous materials assessment for ACM, LBP, and other conditions of concern for structures to be deconstructed. Remediate as necessary.
- Demolish structures identified in Table 1.
- Flush or otherwise clean and drain wastewater treatment pond. Evaluate need to remove sludge from bottom and fill pond in with soil.
- Demolish all ancillary structures including roads, airstrip, building, sheds, fences (except for perimeter), and gates.
- Segregate, load, and transport waste materials to appropriate offsite landfills and recycling centers.
- Conduct site restoration work: re-grade affected areas to desired elevations and contours; use available concrete rubble as necessary; bring in fill as needed to establish grade.
- Install soil and vegetation: place soil where needed to support growth of desired vegetation; seed and transplant native species; install temporary erosion control (biodegradable fiber mats) where needed; maintain (appropriate watering as needed and weed control) until desired vegetation is established.

The deconstruction period for Action Alternative D is expected to last 36 weeks. All structures that would be deconstructed are within areas that are maintained with mowed landscape grasses. Additional maintained areas are available for staging and support during deconstruction. No tree removal or disturbance to unmaintained areas would be necessary to accomplish deconstruction.

Areas revegetated following deconstruction activities would be maintained for a period of up to 18 months, less if target revegetation (80 percent cover by desired species) is achieved sooner. A vegetation maintenance staff would be retained through this period.

Operations at GBO would cease. It is anticipated that under this proposed Alternative that staffing levels would not be maintained.

alyzed in this DEIS, by Alternative

<p>Alternative A: Collaboration with Interested Parties for Science- and Education-focused Operations with Reduced NSF-funded Scope</p> <p>Note that the deconstruction, safe-abandoning, and mothballing activities described below are meant to describe the most inclusive and conservative (in terms of environmental impacts) scenario, but none of these activities, or a subset of these activities, may ultimately be chosen based on the needs of the collaboration, should this proposed Alternative be selected.</p>	<p>Alternative B: Collaboration with Interested Parties for Operation as a Technology and Education Park</p> <p>Note that the deconstruction, safe-abandoning, and mothballing activities described below are meant to describe the most inclusive and conservative (in terms of environmental impacts) scenario, but none of these activities, or a subset of these activities, may ultimately be chosen based on the needs of the collaboration, should this proposed Alternative be selected.</p>	<p>Alternative C: Mothballing of Facilities</p>	<p>Alternative D: Complete Deconstruction and Site Restoration</p>
<ol style="list-style-type: none"> 40-foot Telescope Bunk House (Dormitory) New and Old Jansky Laboratory Maintenance Lot Science Center Warehouse Building by Water Tower Water Tower Works Area Wastewater Treatment Plant Airfield Residence Hall & Cafeteria Townhouse Units 	<ol style="list-style-type: none"> 45-foot Telescope 300-foot Telescope Control Building (Laser Lab) Coaxial Cable Building Telescope 85-1 (Tatel Telescope) Telescope 85-2 Telescope 85-3 Control Building 85-1 Control Building Interferometer Range Barns Interferometer Range Concrete Slab Miscellaneous Yard Items including the Calibration Horn Paint Shop Building Recreation Area Nut Bin Shinnaberry Redwood House Tracey House Riley House Beard House Hill House Hannah House House 2 House 3 House 4 	<p>None</p>	<p>None</p>
<ol style="list-style-type: none"> 40-foot Telescope Coaxial Cable Building Green Bank Telescope New and Old Jansky Laboratory Maintenance Lot Science Center Warehouse Building by Water Tower Water Tower Works Area Wastewater Treatment Plant Airfield Residence Hall & Cafeteria Townhouse Units Calibration Horn Paint Shop Building (Paint Booth) Science Center 	<ol style="list-style-type: none"> 45-foot Telescope 300-foot Telescope Control Building (Laser Lab) Coaxial Cable Building Telescope 85-1 (Tatel Telescope) Telescope 85-2 Telescope 85-3 Control Building 85-1 Control Building Interferometer Range Barns Interferometer Range Concrete Slab Miscellaneous Yard Items including the Calibration Horn Paint Shop Building Recreation Area Nut Bin Shinnaberry Redwood House Tracey House Riley House Beard House Hill House Hannah House House 2 House 3 House 4 	<ol style="list-style-type: none"> Telescope 85-1 (Tatel Telescope) Telescope 85-2 Telescope 85-3 Control Building 85-1 Control Building Interferometer Range Barns Interferometer Range Concrete Slab Miscellaneous Yard Items including the Calibration Horn Beard House 	<ol style="list-style-type: none"> 20-meter Telescope 40-foot Telescope 43-meter Telescope (140-foot Telescope) 45-foot Telescope 300-foot Telescope Control Building (Laser Lab) Coaxial Cable Building Bunk House (Dormitory) Green Bank Telescope Reber Radio Telescope Jansky Replica Antenna Ewen-Purcell Horn Telescope 85-1 (Tatel Telescope) Telescope 85-2 Telescope 85-3 Control Building 85-1 Control Building Interferometer Range Barns Interferometer Range Concrete Slab New and Old Jansky Laboratory Maintenance Lot (Laydown Yard) Miscellaneous Yard Items including the Calibration Horn Paint Shop Building (Paint Booth) Science Center

alyzed in this DEIS, by Alternative

<p>on Alternative A: Collaboration with Interested Parties for Operation as a Technology and Education Park</p> <p>Note that the deconstruction, safe-abandoning, and mothballing activities described below are meant to describe the most inclusive and conservative (in terms of environmental impacts) scenario, but none of these activities, or a subset of these activities, may ultimately be chosen based on the needs of the collaboration, should this proposed Alternative be selected.</p>	<p>Action Alternative B: Collaboration with Interested Parties for Operation as a Technology and Education Park</p> <p>Note that the deconstruction, safe-abandoning, and mothballing activities described below are meant to describe the most inclusive and conservative (in terms of environmental impacts) scenario, but none of these activities, or a subset of these activities, may ultimately be chosen based on the needs of the collaboration, should this proposed Alternative be selected.</p>	<p>Action Alternative C: Mothballing of Facilities</p>	<p>Action Alternative D: Complete Deconstruction and Site Restoration</p>
<p>House 9 House 10 House 11 House 14 House 16 House 19 House 21 House 23 House 24</p>	<p>25. House 5 26. House 6 27. House 7 28. House 8 29. House 9 30. House 10 31. House 11 32. House 14 33. House 16 34. House 19 35. House 21 36. House 23 37. House 24</p>		<p>24. Warehouse Building by Water Tower 25. Water Tower 26. Works Area 27. Wastewater Treatment Plant 28. Airfield (Airstrip) 29. Recreation Area 30. Residence Hall & Cafeteria 31. Nut Bin 32. Shinnaberry 33. Redwood House 34. Tracey House 35. Townhouse Units 36. Riley House 37. Beard House 38. Hill House 39. Hannah House 40. House 2 41. House 3 42. House 4 43. House 5 44. House 6 45. House 7 46. House 8 47. House 9 48. House 10 49. House 11 50. House 14 51. House 16 52. House 19 53. House 21 54. House 23 55. House 24</p>
<p>20-meter Telescope 43-meter Telescope (140-foot Telescope) Green Bank Telescope</p> <p>1. Reber Radio Telescope 2. Jansky Replica Antenna 3. Ewen-Purcell Horn</p>	<p>1. 20-meter Telescope 2. 43-meter Telescope (140-foot Telescope) 3. Green Bank Telescope</p>	<p>None</p> <p>1. 20-meter Telescope 2. 40-foot Telescope 3. 43-meter Telescope (140-foot Telescope) 4. 45-foot Telescope 5. 300-foot Telescope Control Building</p>	<p>None</p>
<p>20-meter Telescope 43-meter Telescope (140-foot Telescope)</p> <p>1. Reber Radio Telescope 2. Jansky Replica Antenna 3. Ewen-Purcell Horn</p>	<p>1. 20-meter Telescope 2. 43-meter Telescope (140-foot Telescope) 3. Green Bank Telescope</p>	<p>None</p> <p>1. 20-meter Telescope 2. 40-foot Telescope 3. 43-meter Telescope (140-foot Telescope) 4. 45-foot Telescope 5. 300-foot Telescope Control Building</p>	<p>None</p>

alyzed in this DEIS, by Alternative

on Alternative A: Collaboration with Interested Parties for Science- and Education-focused Operations with Reduced NSF-funded Scope

that the deconstruction, safe-abandoning, and mothballing activities described below are meant to describe the most inclusive and conservative (in terms of environmental impacts) scenario, but none of these activities, or a subset of these activities, may ultimately be chosen based on the needs of the collaboration, should this proposed Alternative be selected.

Action Alternative B: Collaboration with Interested Parties for Operation as a Technology and Education Park

Note that the deconstruction, safe-abandoning, and mothballing activities described below are meant to describe the most inclusive and conservative (in terms of environmental impacts) scenario, but none of these activities, or a subset of these activities, may ultimately be chosen based on the needs of the collaboration, should this proposed Alternative be selected.

Action Alternative D: Complete Deconstruction and Site Restoration

Action Alternative C: Mothballing of Facilities

- (Laser Lab)
- 6. Coaxial Cable Building
- 7. Bunk House (Dormitory)
- 8. Green Bank Telescope
- 9. Reber Radio Telescope
- 10. Jansky Replica Antenna
- 11. Ewen-Purcell Horn
- 12. New and Old Jansky Laboratory
- 13. Maintenance Lot (Laydown Yard)
- 14. Paint Shop Building (Paint Booth)
- 15. Science Center
- 16. Warehouse Building by Water Tower
- 17. Water Tower
- 18. Works Area
- 19. Wastewater Treatment Plant
- 20. Airfield (Airstrip)
- 21. Recreation Area
- 22. Residence Hall & Cafeteria
- 23. Nut Bin
- 24. Shinnaberry
- 25. Redwood House
- 26. Tracey House
- 27. Townhouse Units
- 28. Riley House
- 29. Hill House
- 30. Hannah House
- 31. House 2
- 32. House 3
- 33. House 4
- 34. House 5
- 35. House 6
- 36. House 7
- 37. House 8
- 38. House 9
- 39. House 10
- 40. House 11
- 41. House 14
- 42. House 16
- 43. House 19
- 44. House 21
- 45. House 23
- 46. House 24

From: Pentecost, Elizabeth A.
To: [Rau, Michelle/COS](#)
Subject: FW: Notice of Intent To Prepare an Environmental Impact Statement and Initiate Consultation for Proposed Changes to Green Bank Observatory Operations, Green Bank, West Virginia; Notice of Public Scoping Meetings and Comment Period [EXTERNAL]
Date: Thursday, October 20, 2016 8:55:26 AM

FYI

National Science Foundation
Division of Astronomical Sciences
Room 1045
4201 Wilson Boulevard
Arlington, VA 22230
Tel: 703-292-4907
Fax: 703-292-9034

From: "Pentecost, Elizabeth A." <epenteco@nsf.gov>
Date: Wednesday, October 19, 2016 at 1:51 PM
To: "Schmidt, John" <john_schmidt@fws.gov>
Cc: Caroline Blanco <cblanco@nsf.gov>, "Hamilton, Kristen" <KRIHAMIL@nsf.gov>, "Pentecost, Elizabeth A." <epenteco@nsf.gov>
Subject: Re: Notice of Intent To Prepare an Environmental Impact Statement and Initiate Consultation for Proposed Changes to Green Bank Observatory Operations, Green Bank, West Virginia; Notice of Public Scoping Meetings and Comment Period

Dear Mr. Schmidt,

Thank you for your email regarding the EIS for Green Bank Observatory. Tree removal could occur if necessary to implement the alternative that is ultimately chosen. Because certain alternatives require deconstruction activities (which may or may not involve tree removal), it would be helpful for NSF to hear about any resource concerns relating to trees (or trees as habitat) in the project area so we can be sure to accurately assess potential impacts in the EIS. Given that we expect to consult with your office per Section 7 of ESA, we'd be happy to coordinate a teleconference with you if that might be helpful at any point in this process.

We look forward to working with your office on this important activity.

Sincerely,

Elizabeth Pentecost

National Science Foundation

Division of Astronomical Sciences
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From: "Schmidt, John" <john_schmidt@fws.gov>

Date: Wednesday, October 19, 2016 at 11:36 AM

To: "Pentecost, Elizabeth A." <epenteco@nsf.gov>

Subject: Re: Notice of Intent To Prepare an Environmental Impact Statement and Initiate Consultation for Proposed Changes to Green Bank Observatory Operations, Green Bank, West Virginia; Notice of Public Scoping Meetings and Comment Period

Elizabeth,

Will there be any tree clearing associated with activities associated covered by the EIS?

John Schmidt

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On Wed, Oct 19, 2016 at 10:58 AM, Pentecost, Elizabeth A. <epenteco@nsf.gov> wrote:

Dear interested party:

Please see the attached Notice of Intent (NOI) to Prepare an Environmental Impact Statement and Initiate Section 106 Consultation for Proposed Changes to Green Bank Observatory, Green Bank, WV and Notice of Public Scoping Meetings and Comment Period. As indicated in the NOI, scoping comments may be submitted to the National Science Foundation during the public comment period, which extends through November 19, 2016, via this email (envcomp-AST-greenbank@nsf.gov) or via mail to Ms. Elizabeth Pentecost, National Science Foundation, Division of Astronomical Sciences, Suite 1045, 4210 Wilson Blvd, Arlington VA 22230. Comments may also be provided during the public scoping meeting scheduled for November 9, 2016 at the following location:

November 9, 2016, 3:00 p.m. - 5:00 p.m. and 6:00 pm – 8:00 p.m.

Green Bank Science Center

155 Observatory Road

Green Bank, WV 24915

Tel: 304-456-2011

Information will be posted throughout the process at: www.nsf.gov/AST.

If you wish to be removed from or added to this email distribution list, please reply to this email indicating as such.

Appendix 3.2A
Cultural Resource Evaluation

FINAL

Cultural Resources Evaluation

Green Bank Observatory
Green Bank, West Virginia

Prepared for

National Science Foundation

May 2016



Executive Summary

This Cultural Resources Evaluation has been prepared for the Green Bank Observatory (GBO), a National Science Foundation facility located near Green Bank, West Virginia. Evaluation of the property is being conducted to assess potential effects on historic built environment properties from future divestment activities or alternate operational agreements.

Several of the telescopes at GBO are notable because they are more than 50 years old and have contributed to the development of astronomical research; some telescopes may also be notable due to their engineering design. The study of potential built environment resources in the project area was undertaken in order to characterize future needs with regard to cultural resource management and the effects of any divestment alternatives. The project's Area of Potential Effects (APE) was defined as the boundary of the existing GBO property. No archaeological work was included in the scope of this project. As such, this document only addresses the built environment. The background research included a search in the National Register Information System to identify any built environment resources within the proposed APE that had already been evaluated for inclusion in the National Register of Historic Places (NRHP). The field survey encompassed standing structures built in or before 1969, which is 46 years from the present year (2015). Archival research and interviews with observatory staff were conducted at GBO. Further online research was performed in order to produce a historic context for the observatory and surrounding region. All potential built environment resources that had not been previously evaluated within the GBO boundary were surveyed and assessed, including a determination of eligibility for listing in the NRHP. Buildings and structures were evaluated individually as well as part of a potential historic district.

The background research indicated that there is one NRHP-listed structure within the APE. The field work concluded that there are four telescope instruments on the property that are individually eligible for listing in the NRHP, including the Interferometer, which includes three large telescopes. Additionally, the GBO is an NRHP-eligible historic district. There are 44 built environment resources that contribute to the NRHP-eligible historic district. Therefore, there is a potential for adverse effects to historic properties from the divestment of the GBO site.

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Acronyms and Abbreviations

APE	Area of Potential Effects
CFR	Code of Federal Regulations
GBO	Green Bank Observatory
GBT	Robert C. Byrd Green Bank Telescope
NHPA	National Historic Preservation Act
NPS	National Park Service
NSF	National Science Foundation
NRAO	National Radio Astronomy Observatory
NRHP	National Register of Historic Places
NRQZ	National Radio Quiet Zone
SETI	Search for Extra-Terrestrial Intelligence
SHPO	State Historic Preservation Officer
USNO	United States Naval Observatory

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Introduction

The National Science Foundation (NSF) is an independent federal agency created by Congress in 1950 "to promote the progress of science; to advance the national health, prosperity, and welfare; to secure the national defense..." (NSF, 2014). NSF is the funding source for approximately 20 percent of all federally supported basic research conducted by America's colleges and universities (NSF, 2014). NSF fulfills its mission chiefly by issuing limited-term grants (currently about 10,800 new awards per year, with an average duration of 3 years) to fund specific research proposals that have been judged the most promising by a rigorous and objective merit-review system (NSF, 2014). Most of these awards go to institutions supporting individual investigators or small groups of investigators. Others provide funding for research centers, instruments, and facilities that allow scientists, engineers, and students to work at the outermost frontiers of knowledge.

NSF also funds equipment and infrastructure that is needed by scientists and engineers, but that is often too expensive for any one group or researcher to afford; examples of such major research equipment include optical and radio telescopes. NSF's Division of Astronomical Sciences is the primary supporter of the United States' ground-based astronomy efforts.

NSF's Directorate for Mathematical and Physical Sciences, Division of Astronomical Sciences, through a series of academic community-based reviews, has identified the need to divest several facilities from its portfolio in order to retain the balance of capabilities needed to deliver the best performance on the key science of the present decade and beyond. Facilities under consideration for divestment options include several telescopes and related structures located at Green Bank Observatory (GBO) in West Virginia.

GBO is part of the National Radio Astronomy Observatory (NRAO), a federally funded research and development center. GBO's primary instrument, the Robert C. Byrd Green Bank Telescope (GBT), is used by scientists around the world to study astronomy, chemistry, physics, and radar receiving by passively detecting radio waves.

GBO is a highly visible technical asset in the state of West Virginia. West Virginia University identifies astronomy as an important area of research and depends significantly on the observing capabilities of GBT. West Virginia University committed \$1 million in fiscal year 2014-2015 to support astronomical research with GBT. The Green Bank facility also has a long history of science, technology, engineering, and mathematics education, including student training and mentorships through the outreach and training opportunities offered at the NRAO Center for Science Education, which is based at the Green Bank site. In all, more than 40,000 visitors each year pass through the Green Bank Science Center, including thousands of students, educators, and the general public who stay on site to take advantage of the educational facilities. The Green Bank facility holds numerous educational workshops and programs each year aimed at middle school- through post-graduate-age training, and the site mentors on average 10-15 undergraduate and graduate students each year (O'Neil, 2014).

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Proposed Project

2.1 Project Description

NSF is looking for innovative and viable divestment options for GBO. This report provides NSF with the detailed information needed to assist with decision-making regarding appropriate divestment of the facilities. In order to characterize future needs with regard to cultural resource management and the effects of any divestment alternatives on historic properties, an evaluation was conducted of historic built environment resources at GBO for use in determining their potential eligibility for listing in the National Register of Historic Places (NRHP). The evaluation included all facilities that are more than 45 years old and have not yet been assessed for eligibility.

2.2 Area of Potential Effects

The Area of Potential Effects (APE) for this project is defined as the property boundary of GBO (Figure 2-1). The total geographic area of the observatory was determined as the APE to encompass all buildings and structures on the property that are 45 years old or older (at the time of this report) in order to determine if the GBO constituted a potential historic district that could be affected by the activities associated with the potential divestment of the site.

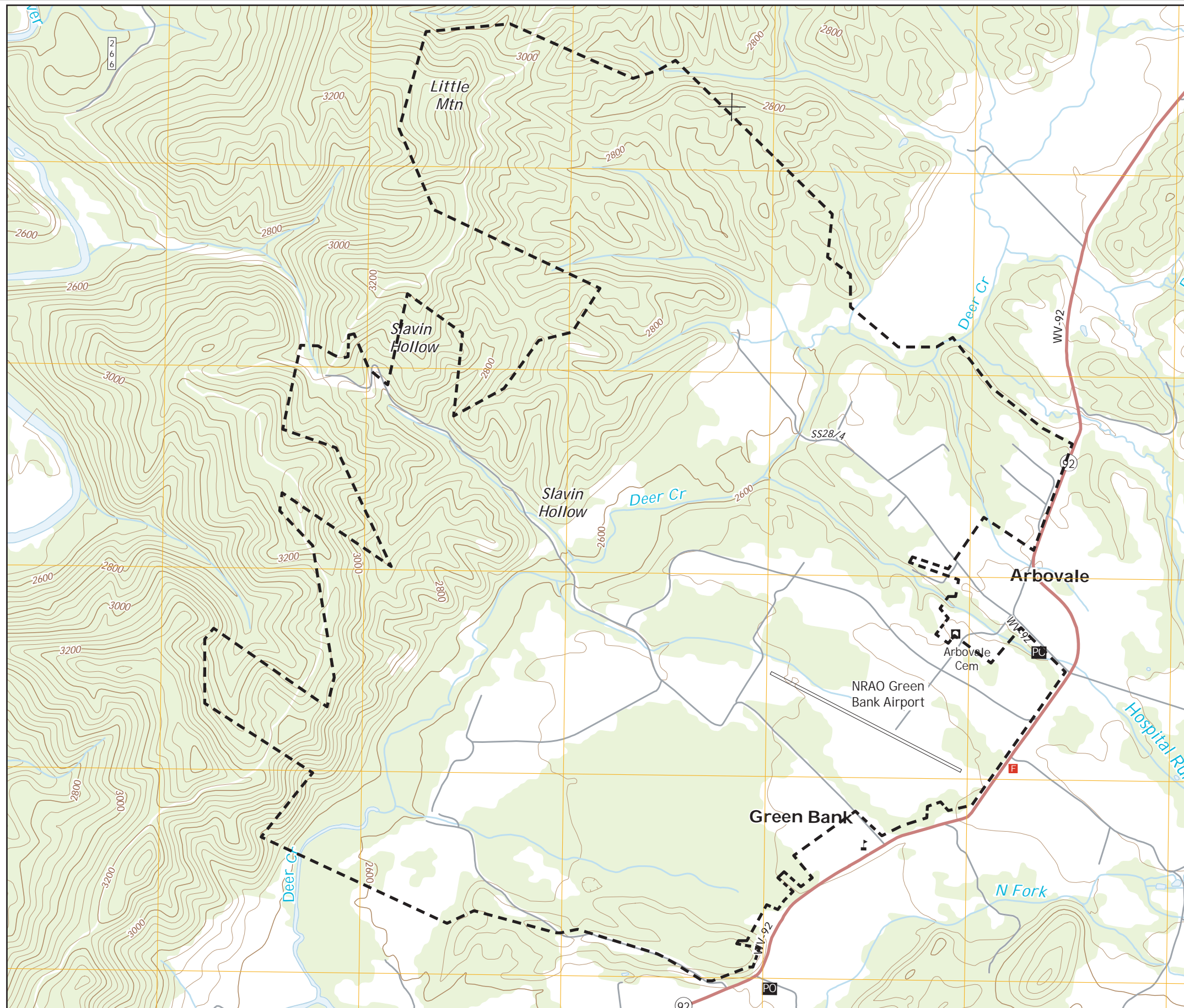
2.3 Property Setting

GBO is located on approximately 2,200 acres in Pocahontas County, West Virginia on federal land adjacent to the Monongahela National Forest. This land is owned by NSF and includes multiple parcels that were acquired by the U.S. Army Corps of Engineers in the 1950s, when GBO was formed as the first (and then, only) site of the National Radio Astronomy Observatory. GBO is located in the National Radio Quiet Zone, where all radio transmissions are limited. Having telescopes within the Radio Quiet Zone allows for the detection of faint scientific signals that otherwise would be drowned-out by man-made signals.


Pocahontas County has a population of approximately 9,000; the total population of Green Bank is 143, but a few hundred to several thousand more people live nearby in unincorporated areas, such as Arbovale. With approximately 120 people employed at NRAO-Green Bank, GBO is a significant employer and driver of the local economy, both through the local employees and a significant program of tourism and education. Approximately 40,000 visitors per year are served by the Green Bank Science Center, located on the grounds of GBO.

Green Bank is the anchor and administrative site of the 13,000-square-mile National Radio Quiet Zone (NRQZ). The Sugar Grove Research Facility of the Department of Defense is also located within the NRQZ; GBO personnel administer the NRQZ on behalf of Sugar Grove. In addition, there are individuals seeking to avoid health effects that they perceive from electromagnetic radiation who have chosen to live in the NRQZ as a “safe haven” from that radiation.

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LEGEND

 Area of Potential Effects (APE)



0 1,700
Approximate scale in feet

FIGURE 2-1
Area of Potential Effects (APE)
Green Bank Observatory
Green Bank, West Virginia

Source: USGS, Green Bank Quadrangle
ES111914104429SAC_area_potential_effects_greenbank.ai 12-08-14 dash



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Research and Field Methodology

MaryNell Nolan-Wheatley, a Secretary of the Interior-qualified architectural historian with CH2M HILL, checked the federal historic properties database in October 2014. A search in the NRHP online database, known as the National Register Information System, showed that the Reber Radio Telescope is the only structure or building located within GBO that is listed in the NRHP.

Field investigations were conducted at GBO October 6-9, 2014. The site visit to GBO was also used to engage GBO staff in informal interviews and to conduct archival research, including the review of historic photographs and narratives, newspaper articles, construction records, and architectural drawings.

Using aerial photographs of GBO and information provided by GBO staff, 47 built environment resources that had been constructed in or before 1969 were identified as extant within the APE. These include: Five telescope structures (one of which contains three large telescopes), 2 horn instruments, 1 antenna, 1 airstrip, 1 water tower, 1 recreation area, 24 residential buildings, and 12 operational and administrative buildings. As noted above, one of these telescopes, the Reber Radio Telescope, was previously evaluated; the Reber Radio Telescope was listed in the NRHP in 1972 and designated a National Historic Landmark in 1986. The remaining 46 built environment resources in the APE built in or before 1969 were photographed and evaluated for NRHP eligibility. The year 1969 was chosen as it is 45 years from the year of the site visit (2014). The standard NRHP age threshold is 50 years; however, using 45 years as the cutoff allows a 5-year buffer for the execution of the Divestment Options Study. Data collected through the background research and field investigations were analyzed to determine NRHP eligibility of the 46 surveyed built environment resources individually. In addition, the GBT, which was constructed after 1969, was evaluated individually due to the exceptional importance to radio astronomy over the last 50 years. All 47 historic-era properties (constructed in or before 1969, including the Reber Radio Telescope) and the GBT were also evaluated as a potential historic district. Properties surveyed in 2014 are listed in Attachment A. The results of the survey are presented in Section 5 and Figure 5-1 shows the locations of all previously evaluated and surveyed built environment resources.

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Historic Context

4.1 West Virginia and Pocahontas County

The first European Americans to settle west of the Allegheny Mountains, in what would become Pocahontas County, West Virginia, were Jacob Marlin and Stephen Sewell. The two settlers were living in what is today Marlinton, West Virginia, when Andrew Lewis, a surveyor hired by the Greenbrier Company, arrived in 1751 to conduct a land grant survey. According to legend, Sewell was living in a hollow sycamore tree when Lewis arrived. The early Euro American settlers in the area were met with significant opposition from the native population who had historically used the region for hunting. Numerous violent encounters ensued as Euro Americans continued to intrude into Native American territory well into the nineteenth century (Pocahontas County, 2013).

Originally, West Virginia was part of Virginia. During the Civil War, the eastern section of the state, which relied more heavily on a slave-based economy, seceded with the Confederacy while 50 counties in the northwestern part of the state, including Pocahontas County, joined the Union and were subsequently granted statehood in 1863 as West Virginia (Pocahontas County, 2013). The arrival of the railroad at the turn of the twentieth century allowed for a booming commercial timber and coal industry in West Virginia. Small railroad towns emerged throughout the region. Today, Pocahontas County is known for its natural beauty; the “Land is rich, forests are thick, and waters are abundant and clean” (Pocahontas County, 2013).

4.2 The Origins of Radio Astronomy (Karl G. Jansky and Grote Reber)

Until the twentieth century, astronomers were limited to what they could see or photograph in the visible spectrum of light – a relatively narrow band of wavelengths. This all changed in 1932, when Karl Jansky, a radio engineer at Bell Laboratories in Holmdel, New Jersey, was the first to establish that radiation at radio wavelengths was reaching the earth from interstellar space (Butowsky, 1989).

Karl G. Jansky started working for Bell Laboratories in New Jersey in 1928. While there, he became interested in static and other types of noise interference that were detectable in the Bell System transoceanic radio-telephone circuits. In order to explore his interest in static radio noise, Jansky constructed a rotating, 14.6-meter directional antenna system. Research he conducted using his antenna allowed him to detect three distinct categories of noise: Noise from local thunderstorms, noise from faraway thunderstorms, and a “steady hiss of static, the origin of which was unknown” (Butowsky, 1989). This mysterious third category of noise, the derivation of which was neither earth nor the solar system, spurred Jansky to continue his research in 1932. Jansky noted that changes in the hissing noise occurred every 23 hours and 56 minutes rather than every 24 hours. This time interval marks one rotation of the earth, or one day, when measured by the location of the stars instead of the sun. Jansky deduced from this information that the noise traveled from beyond our solar system, and instead originated in the center of the Milky Way galaxy. With this finding, Jansky had discovered “the existence of interstellar radio waves... [and] liberated astronomers from the confines of optical astronomy” (Butowsky, 1989). Despite the importance of Jansky’s research, his discovery did not garner much initial interest from the science community.

Grote Reber was born in Chicago, Illinois in 1911. Electronics piqued Reber's interest throughout his childhood and when he was 16, he was awarded an amateur radio license that was signed by Secretary of the Interior Herbert Hoover. He studied electrical engineering and graduated in 1933 from the Illinois Institute of Technology, formerly known as the Armour Institute of Technology (Kellermann, 2002). Post-graduation, Reber worked at several Chicago-based companies, such as Stewart-Warner and Belmont Radio Corporation. Reber read about Jansky's discovery of interstellar radio waves in 1933 and set to work trying to further Jansky's research. Reber approached other astronomers to aid in his endeavor, but received little encouragement. However, Reber was undeterred. Later, when discussing this pivotal moment in his career, Reber stated: "In my estimation it was obvious that Jansky had made a fundamental and very important discovery. Furthermore, he had exploited it to the limit of his equipment facilities. If great progress were to be made it would be necessary to construct new and different equipment especially designed to measure the cosmic static" (Butowsky, 1989).

To continue Jansky's studies, Reber needed a new type of technology: a radio telescope. With no financial support from other astronomers or research institutions, Reber was left to construct this new equipment on his own. In preparation, he enrolled in several astronomy courses at the University of Chicago and took a hiatus from his job during the summer of 1937. He constructed the telescope himself by hand in his backyard in Wheaton, Illinois, the town where he had grown up. Four months and \$4,000 later, Reber had constructed the first radio telescope for radio astronomical observations (Butowsky, 1989).

For 10 years after the completion of his telescope, Reber "worked practically alone in the field of radio astronomy" (Butowsky, 1989). His research established that Jansky's deductions were accurate and that the Milky Way indeed emits radio radiation. Reber published his findings and the first contour maps that showed the radio brightness of the Milky Way in the *Astrophysical Journal* in 1944. The telescope remained in use by Reber until 1948, when the National Bureau of Standards relocated the structure to a site in Sterling, Virginia and mounted it on a turntable. The telescope was moved again in 1952 to an observatory in Boulder, Colorado before it was purchased in 1957 by the NRAO and re-erected in Green Bank between 1959 and 1960. Reber oversaw the re-assembly of the historic structure in Green Bank. The Reber Radio Telescope was listed in the NRHP under Criteria A and C in 1972 and in 1989 it was designated a National Historic Landmark. The telescope's nomination form for designation as a National Historic Landmark states that the Reber Radio Telescope "demonstrated the importance of Jansky's discovery, and forever changed the science of astronomy" (Butowsky, 1989). An exact replica of the Jansky antenna (the Karl Guthe Jansky Replica Antenna) that was made in 1964 is also currently located in Green Bank, very near to the Reber Radio Telescope.

In addition to the Karl Guthe Jansky Replica Antenna and the Reber Radio Telescope, the GBO is also home to the Ewen-Purcell horn. The significantly smaller structure was the instrument used by Harold I. Ewen and Edward M. Purcell at the Lyman Laboratory of Physics at Harvard University to discover free hydrogen gas in the Milky Way at a wavelength of 21 centimeters (in situ plaque). The structure was constructed in 1957 and relocated to GBO in 1963 (Lockman et al., 2007).

4.3 National Radio Astronomy Observatory

The radio receiver technology that became available during World War II was more complex and stable than any previous equipment used by Jansky or Reber. After the war, furthering the field of radio astronomy became an important scientific mission for countries around the world. The United States, however, lagged behind other nations, many of which had quickly established competitive radio astronomy programs. During an international radio astronomy conference that occurred in Washington, D.C. in January 1954, participants debated ways to spur progress in radio astronomy within the United States. Although universities and other research institutions were keen to participate in radio astronomy studies, the associated tools and equipment were often prohibitively expensive. Out of discussions

regarding this financial quagmire, the idea for the NRAO was formed, “The suggestion was made that a National Radio Astronomy Observatory [NRAO] be established, equipped with the expensive research tools not obtainable by other institutions, which would be available to all qualified scientists” (NSF, 1959). By May of that same year, the NSF agreed to fund a study done by the Associated Universities, Inc. on the feasibility of establishing the NRAO.

The feasibility study resulted in a report produced in 1956 entitled “Plan for a Radio Astronomy Observatory” in which various topics were discussed, including potential sites for the observatory, types of required equipment, and organizational and operational plans. As a result of the study, “The National Science Board decided that special Federal support of radio astronomy was required and that part of this support would be in the form of a national observatory” (NSF, 1959). The Associated Universities, Inc., which was contracted by the NSF, moved forward with the construction of the NRAO on November 17, 1956 (NSF, 1959). Also in 1956, the West Virginia Radio Astronomy Zone was established by state legislation that was the “first legislation in the world intended specifically to protect basic research” (Bouton, 2013). This was just 2 years before the Federal Communications Commission established the 13,000-square-mile NRQZ, which overlapped with the West Virginia Radio Astronomy Zone, in order to protect the radio receiving facilities in Green Bank and in Sugar Grove on a federal level (Bouton, 2013).

4.4 Green Bank Observatory: Origins and Development (NRHP-Eligible Historic District Facilities)

The sensitive nature of radio telescopes limits the number of potential locations to establish an observatory. Man-made radio noise from earth can interfere with signals from space, making it difficult to distinguish between various types of data collected. Additionally, severe weather can interfere with the functionality of radio telescopes. Geographic barriers, such as mountains, help isolate radio signals from space, making valleys an ideal location for the placement of radio telescopes. Green Bank in the Deer Creek Valley had several other appealing characteristics, in addition to its geographic location encircled by mountains, such as its rural surroundings, small population, and mild climate. A book produced by the NSF in 1959 titled *The National Radio Astronomy Observatory*, which provides a historical narrative of the early years of the NRAO site, states: “The large site was selected so that a number of telescopes could be installed and operated without mutual interference” (NSF, 1959). The decision to locate the observatory in Green Bank brought a great sense of pride to the region. A special dispatch in the *Pocahontas Times* dated July 26, 1956 is titled “Green Bank Assured of Great Astronomy Center: And How Truly Thankful We All Are!” and states that “West Virginia will become the world centre of research in radio-astronomy; when the National Science Foundation [NSF] constructs its new ‘window to the Universe’ at the site Green Bank” (*Pocahontas Times*, 1956).

The land for the “window to the Universe” was purchased by the U.S. Army Corps of Engineers on behalf of the NSF (NSF, 1959). Most of the land was purchased from families that had multi-generational farms established in the mid- to late-nineteenth century. The earliest pioneer in the area was Adam Arbogast who had settled most of the NRAO land in 1796 (Lockman et al., 2007). A field office was established in May 1957 and construction on an access road soon proceeded. On October 17, 1957, groundbreaking ceremonies were held and one year later, on October 16, 1958, the site’s first telescope, the 85-foot Howard E. Tatel Telescope, was dedicated. The rotating Howard E. Tatel Telescope was erected on a polar mount by the Radio Construction Corporation under sub-contract with the Blaw-Knox Company (NSF, 1959; Lockman et al., 2007). The telescope’s control building was constructed at the same time. Dr. Frank Drake used the Tatel Telescope to search for extra-terrestrial intelligence and subsequently, the “Tatel became famous in 1960 for performing the world’s first SETI (Search for Extra-Terrestrial Intelligence) observations (Project Ozma)” (Stoke, 2014).

Following the dedication of the Tatel Telescope in 1958, construction on several buildings and structures on the site was initiated, including the 43-meter Telescope (also referred to as the 140-foot Telescope), the Calibration Horn, the Karl G. Jansky Laboratory, the residence hall, the works area building, the airstrip, and the renovations of pre-existing farm houses. The 43-meter Telescope was designed by Ned L. Ashton and the E.W. Bliss Company was the prime contractor. The drive and control system of the 210-foot-tall concrete telescope was constructed by the Electric Boat Division of General Dynamics Corporation. The telescope was described as “a steerable paraboloid more than one-third of an acre in area, capable of being pointed with a precision of a small fraction of a minute of arc” (NSF, 1959). The telescope operates through a hydraulic power system and the structure rotates on a massive, 17.5-foot diameter, steel ball-bearing that was designed by Stone and Webster. General Steel Industries poured the steel for the ball-bearing (Lockman et al., 2007). Although the foundation for the 43-meter Telescope was poured in 1958, the last surface panel was not secured on the dish until 1964 and dedication occurred in 1965. With its smooth, curving concrete exterior walls and tubular shaft, the structure has a ship-like, vaguely Streamline Moderne appearance. The construction of the telescope was an engineering feat with its massive parts fabricated off site and brought to rural Green Bank by truck for assembly. According to GBO staff, bridges over creeks and rivers in the area were reinforced to allow for the arrival of these massive parts. An elevated service tower that operates on tracks was constructed adjacent to the structure for maintenance purposes in 1970. Today, the telescope stands as both an engineering and scientific achievement – the “largest [telescope] in the world of any kind to use an equatorial (for polar-aligned) mount, so that it can follow objects in the sky by rotating on one axis, rather than a minute series of up-down, left-right movements, which is much easier to build” (Stoke, 2014).

The Calibration Horn, designed by Dr. John Findlay and known as “Little Big Horn,” was also constructed in this early phase of site development by the Plant Maintenance Division (Lockman et al., 2007). Positioned at a 30-degree angle, the NSF historical narrative of the NRAO published in 1959 describes it as “a radio telescope of somewhat unusual design. It is technically known as a horn antenna...[that] is fixed in such a position that it can observe the strong radio source in Cassiopeia once each day, and will be used to measure accurately the energy of the incoming radio waves” (NSF, 1959). In this way, the horn’s measurements were used for comparative purposes, to calibrate and standardize the other telescopes.

The Jansky Laboratory, completed in 1959, provided 5,000 square feet of electronic laboratory space. Scientists working in the Jansky Laboratory Building had access to electronic test and repair equipment; office, conference, and seminar rooms; and technical and computing assistance, “both human and mechanical” (NSF, 1959). A large addition was added to the laboratory in 1994-1996, although the original building is still visible and retains much of its original fabric. The works area building was also completed between 1958 and 1959, with an adjacent 100,000-gallon, elevated water tank (Bouton, 2013). The original drawings for the building were completed by Irving Bowman and Associates. Soon after the building was occupied in 1959, alterations were made in 1963 including the removal of two windows, replacement of other windows, and the addition of a concrete apron (Tippetts et al., 1963). The building has historically functioned as a machine shop, auto shop, and general maintenance facility.

The residence hall, completed in 1959, included a cafeteria, 16 dormitory rooms, a lounge, and four apartments. When the NRAO property was purchased in 1957, seven residential homes, including the Nut Bin, Hannah House, Beard House, Shinnaberry House, Tracy House, Hill House, and Riley House were located within the property boundary. Most of these had been constructed in the early twentieth century, with the exception of Hill House, which was constructed circa 1896. These properties were renovated and turned into residences for the onsite staff. The 1959 history of the NRAO notes that the renovated houses “are available to visiting scientists, and also newly arrived staff members until such time as permanent housing can be found in the neighboring communities” (NSF, 1959). The Nut Bin was used for administrative purposes and as an electronics lab from 1958 to 1960. Originally constructed in

1901-1902 by Irbe Beard, a descendent of early settlers in the area, the Nut Bin was moved to its current location south of the Presbyterian Church on Route 92 in 1969, at which point it also became a staff residence (Lockman et al., 2007). An addition was constructed on to Beard House and was used briefly in the 1960s as an experiment station, although currently the building is vacant.

Construction on the NRAO site continued during the early 1960s. The 300-foot telescope and its associated control building (now called the Laser Lab), which was shielded by steel mesh so as to not interfere with the massive instrument, were constructed in 1961-1962 (Ralston, 1961). In 1971, a 1,000-square foot addition to the control building was constructed. In 1988, the 300-foot telescope collapsed, crushing part of the control building. Although the telescope was completely destroyed, the control building was repaired and its use was changed to the Laser Lab for the range finder. In 1962, more telescopes, administration facilities, and residential buildings were added to the site. The 40-foot Telescope was constructed in 1962 and was the first fully automated radio telescope in the world (Lockman et al., 2007). The bermed, underground control room was constructed at the same time, along with several small pump houses, and the Radio Frequency Interference trailer. The warehouse (now used as a daycare facility) adjacent to the works area building, was constructed in 1963 (Hahn, 1963).

Two more 85-foot telescopes (85'-2 and 85'-3) were constructed in 1963-1964 and 1965-1968, respectively. Together with the original 85-foot telescope (hereafter referred to as 85'-1), the three structures formed the Interferometer: "Beginning in the late 1960s these [three] telescopes operated in unison as one single instrument serving to prove that the technique called 'interferometry' could be used to combine dishes to form immense telescopes" (Stoke, 2014). The 85'-2 and 85'-3 telescopes were identical to the 85'-1 telescope, except that they were on wheels. This design feature allowed the two structures to move along a linear axis. The Interferometer control building was constructed in 1967-1968 (HDMK, 1966). From the late 1960s, the Interferometer allowed NRAO scientists to perform aperture synthesis observations until 1978 when management of its operation was reassigned to the United States Naval Observatory (USNO). The three-telescope instrument's new task was to monitor the earth's rotation and polar motion (Bouton, 2013). The USNO used the equipment for this task until 1987, at which point the 85'-1 and 85'-2 telescopes were used to monitor extragalactic and galactic variable sources. The Interferometer was shut down in 1996 for a few months, before a cooperative agreement was established between several institutions, including the NRAO and USNO, to observe galactic variable sources. In 2000, the Interferometer Range was closed (Bouton, 2013).

Construction of a collection of new houses was initiated in 1962 and completed by 1963. Seventeen of these remain extant. Of the existing residential buildings constructed circa 1962, 13 are nearly identical ranch houses with only slight variations in cladding or floor plan. The remaining four are nearly identical two-story, Colonial Revival houses that employ similar materials and design elements as the neighboring ranch houses. These ranch and Colonial Revival houses are mainly concentrated along the northeastern boundary of the NRAO site. The ranch style Redwood House (House #1) is located near the entrance to the NRAO site and historically served as the director's house. The house was added on to in 1975 and remodeled in 1977. Ten houses (Houses #2-11) are located in an area known as the Rabbit Patch just off of Route 92. The remaining houses (Houses # 14, 16, 19, 21, 23, and 24) are located on Hannah Run Road. Drawings for some of the houses were located in the Green Bank Archives and are signed by P. Hahn.

A recreation area was also constructed in the early 1960s and eventually included a basketball court (1963), swimming pool (circa 1964), picnic area (1964), shooting range (circa 1963), golf driving range, and small ski slope with ski lift (the driving range and ski slope with lift have since been removed). The recreation area was designed as a draw for scientists and their spouses and children. Family photos taken between 1960 and 1964 by scientist Bertil Høglund and archived at GBO depict daily life for his wife and children at the NRAO site in Green Bank during the early years of the site's operation. According to the photos, it appears the Høglund Family spent some time living in the Riley House and

participated in many jovial occasions in the recreation area, enjoying picnics, three-legged races for the children, and athletic competitions for the adults.

As described above, the 300-foot telescope collapsed in 1988. The Green Bank Telescope, later named as the Robert C. Byrd Green Bank Telescope, was conceived to replace the 300-foot Telescope and was funded via an appropriation from the U.S. Congress. Construction on the GBT started in 1991. The structure was dedicated in 2000. The GBT is the largest fully-steerable single-reflector telescope in the world and was a groundbreaking innovation in the world of radio astronomy (Stoke, 2013).

4.5 Green Bank Observatory: Today

By explaining the nature of the universe around him, the study of astronomy helped to dispel man's dependence on magic and superstition, to unfetter his mind, and to direct his imagination into useful and creative channels (NSF, 1959).

Hoglund's photographs capture life in the early years of the NRAO site and illustrate the strong sense of place that was established following its construction in 1958. The observatory was a small-scale yet fully functioning community, complete with scientific equipment, administrative buildings, laboratories, residences, and recreation facilities. Today, the collection of telescopes demonstrates a comprehensive, linear history of radio astronomical observation starting with Jansky's antenna and ending with the GBT. The 1959 historical narrative of the NRAO notes that "it is anticipated that the National Radio Astronomy Observatory [NRAO], in the heart of the populous eastern states, will attract fully as many" visitors, as other well-known observatories such as Mount Wilson and Palomar Observatories have, and predicts that "as the number of visitors grows, [the public education program] will be expanded" (NSF, 1959). This vision has indeed been fulfilled. Today, the GBO's operations include scientific operation in addition to development programs, observer community programming, and publications. There are five large, functioning telescopes in use and the site hosts 40,000 visitors per year, including students, educators, and the general public who generally stay on site for more than one night to take advantage of the educational facilities. The GBO facility is host to multiple educational workshops and programs each year for middle school through post-graduate student training, and an average of 10 to 15 undergraduate and graduate students are mentored at the facility each year.

Results

5.1 Previously Identified Cultural Resources

One previously evaluated built environment resource is located within the APE. The Reber Radio Telescope was listed in the NRHP in 1972 and designated a National Historic Landmark in 1986 (Table 5-1). The telescope was listed under Criteria A and B for its nationally significant association with the origins of radio astronomy and for its association with Grote Reber.

TABLE 5-1. Previously Evaluated Built Environment Properties within the APE
Cultural Resources Evaluation, GBO, West Virginia

Building/Structure Name	Year Built	Location	Status
Reber Radio Telescope	1937	Entrance to GBO	NRHP listed 1972; National Historic Landmark 1986

5.2 Survey

To be eligible for inclusion in the NRHP, a property must meet the requirements of at least one of the four primary NRHP criteria (National Park Service, 1997). Historic properties are those:

- a) That are associated with events that have made a significant contribution to the broad patterns of our history; or
- b) That are associated with the lives of persons significant in our past; or
- c) That embody the distinctive characteristics of a type, period, or method of construction, or that represent the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinction; or
- d) That have yielded or may be likely to yield, information important in prehistory or history.

In addition, properties must retain enough integrity to demonstrate their significance under the criteria. The NRHP recognizes seven aspects of integrity: setting, feeling, association, location, materials, design, and workmanship. Even if a property meets the criteria, it must retain sufficient integrity to convey that significance in order to be eligible for listing in the NRHP. Generally, properties must be at least 50 years of age to be eligible for the NRHP, unless they are proven to have exceptional importance. Criterion Consideration G applies to buildings that have achieved significance within the past 50 years.

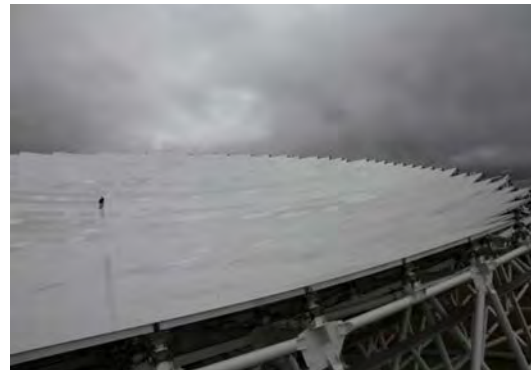
Background research determined that one historic built environment resource, the Reber Radio Telescope, is listed in the NRHP (1972) and is a National Historic Landmark (1986) (Photograph 1).

5.2.1 Individual Resource Eligibility Determinations

Within the historical context of NRAO/GBO, there are four telescope instruments that are individually eligible for listing in the NRHP: The Interferometer Range, the 40-foot Telescope, the 43-meter Telescope, and the GBT (Photographs 2-5 and Table 5-2).



Photo 1: NRHP-listed and National Historic Landmark Reber Radio Telescope, entrance of GBO.



Photos 2-5 (clockwise from top left): The Green Bank Interferometer with the 85'-2 and 85'-3 Telescopes visible; 40-foot Telescope; a section of the 2.3-acre collecting dish of the GBT; and 43-meter Telescope.

TABLE 5-2. NRHP-Eligible Built Environment Resources within the APE
Cultural Resources Evaluation, GBO, West Virginia

Resource Name	Year Constructed	Description/Significance	NRHP Eligibility Recommendation
GBO Historic District	1958-2000	Collection of administrative/operational structures, residential buildings, and radio astronomy equipment associated with the NRAO/GBO.	Eligible (Historic District); 44 contributing resources (Attachment A)
Interferometer Range: Howard E. Tatel Telescope (85'-1) and 85'-1 control building; 85'-2 Telescope; 85'-3 Telescope; and the Interferometer control building	1958-1959 1963-1964 1965-1968	The Tatel Telescope (85'-1) was the first telescope constructed by the NRAO and performed the world's first SETI observations. The Interferometer Range connected two nearly identical telescopes to the Tatel Telescope in a linear formation. The three telescopes operated in unison and proved that dishes could be combined to form very large telescopes. This information spurred the construction of the Very Large Array telescope in New Mexico in the 1970s.	Individually eligible and contributing to GBO Historic District
40-foot Telescope and control building	1962	First fully automated radio telescope in the world. Currently operates as an educational telescope for visiting students.	Individually eligible and contributing to GBO Historic District
43-meter Telescope	1958-1965	Largest telescope in the world to use an equatorial (for polar aligned) mount. Currently used as part of the Russian Radioastron project.	Individually eligible and contributing to GBO Historic District
Robert C. Byrd Green Bank Telescope (GBT)	1991-2000	Largest moving structure on land in the world; tilt and point design that can rotate a full 360 degrees; highly sensitive data collection is "unmatched" by any other telescope in the world (Stoke, 2014).	Individually eligible and contributing to GBO Historic District

The Interferometer Range (including the Tatel [85'-1] Telescope, 85'-2 Telescope, and 85'-3 Telescope), the 40-foot Telescope, and the 43-meter Telescope are all eligible under Criterion A for their important association with events that have made a significant contribution to radio astronomy. The 43-meter Telescope is also eligible under Criterion C for its design and engineering. These telescopes maintain all seven aspects of integrity, including materials, design, workmanship, feeling, association, location, and setting. The GBT is eligible under Criteria A and C, Consideration G for achieving exceptional importance within the last 50 years thanks to its remarkable design and function. The GBT is eligible under Criterion A for its important association with recent scientific developments in radio astronomy. The result of years of radio astronomy innovation at GBO, the GBT has realized unparalleled capabilities, including "unmatched sensitivity to diffuse clouds of gas and dust that feed star and galaxy formation" (Stoke, 2014). The massive instrument is able to collect data a total of 6,500 hours each year and interact with other, distant astronomy instruments to amass unprecedented amounts of information used by scientists around the world (NRAO, 2014b). A slideshow presentation prepared by the NRAO called "NRAO's Green Bank WV Site: The History of Radio Astronomy on Display" states that the GBT is "'historic' in that it represents the likely culmination of the era of enormous single dishes in radio astronomy" (Stoke, 2014). It is able to fulfill its function thanks to the structure's innovative and noteworthy design including its massive collecting dish with 2,200 aluminum panels that can rise and fall by 1 inch, its complex welded steel shaft structure, its ability to fully rotate 360 degrees, its unblocked

aperture, and its single focal plane. All of these design features combine to form a highly sensitive instrument that can retrieve data from 85 percent of the “celestial sphere” (NRAO, 2014b). Therefore, the GBT is eligible for the NRHP under Criteria A and C.

Three radio astronomy instruments and one telescope located within the boundaries of GBO are significant for their association with important events or people related to radio astronomy or for their design, but are not individually eligible for listing in the NRHP due to a lack of integrity. These include: the Calibration Horn, the Jansky Replica Antenna, the Ewen-Purcell Horn, and the 45-foot Telescope (Photographs 6-9).



Photographs 6-9 (clockwise from top left): Calibration Horn; Karl Guthe Jansky Replica Antenna; 45-foot Telescope; and Ewen-Purcell Horn. These structures have significant historic associations but are not individually NRHP-eligible.

The Calibration Horn (1958) is a significant instrument within the history of the NRAO, as it was the standard by which all other measurements at the observatory were made. However, the horn is currently unused and is heavily obscured by vegetation. As a non-functioning instrument in an overgrown condition, the horn has lost integrity of setting and feeling, and due to a lack of maintenance the structure has lost some integrity of materials and workmanship. The horn remains a significant element in the history of radio astronomy and an important educational tool for the observatory but does not retain sufficient integrity to be individually eligible for the NRHP. The Jansky Replica Antenna (1964) is an important educational tool at GBO; it represents the discovery of radio astronomy and has a significant association with Karl Jansky. However, the antenna was built at GBO as a replica for display. The structure does incorporate some parts from Jansky’s original antenna, but most of the materials are not from the original 1933 instrument. Additionally, it is not located in the same site as the 1933 original, nor does it have the same setting. The replica is now more than 50 years old; however, the replica has not achieved individual significance apart from its connection to the original 1933 structure. The replica is used as an educational display to demonstrate Jansky’s work in the 1930s, but it does not reveal significant information about the period when it was reconstructed (1964). Therefore, the replica antenna is not individually eligible for listing in the NRHP. The Ewen-Purcell Horn (1957) was used to make an important scientific discovery and is associated with two significant astronomers. However, the

horn was relocated to GBO from its original location in the Boston-Cambridge area. The relatively small horn is currently used as a display piece, mounted on stone piers; while it serves as an important educational tool within the GBO site, it is a piece of equipment that has lost integrity of location, feeling, and setting due to its relocation. Therefore, it does not retain sufficient integrity to be individually eligible for listing in the NRHP. Lastly, the 45-foot Telescope (circa 1965), which was relocated to GBO in 1972, was part of a pair of telescopes that functioned together as a larger Interferometer instrument. The 45-foot Telescope was separated from its pair and no longer functions as part of an Interferometer. Therefore, it lacks integrity of location, feeling, setting, and association and is not individually eligible for listing in the NRHP.

The 39 remaining surveyed buildings and structures are not individually eligible for listing in the NRHP. They include: 12 administrative/operational facilities, 1 water tower, 1 airstrip, 1 recreational area, and 24 residential buildings. The buildings and structures are not eligible for listing in the NRHP because they are not individually significant in terms of the historical development of the observatory nor the field of radio astronomy. No particular events are known to directly link the buildings and structures to any important historic events; therefore, the 39 remaining buildings and structures are not individually eligible for listing in the NRHP under Criterion A.

To be eligible for the NRHP under Criterion B, a property must be directly associated with a person considered significant within a historic context, whose specific contributions to history have been both identified and documented. There is no evidence to indicate that these 39 buildings and structures have important associations with historically significant individuals. While many important scientists used these buildings, there are other structures on the site (such as the scientific instruments) that better convey the significant work accomplished or associated with such individuals. Therefore, they are not individually eligible under Criterion B.

In terms of design, the 39 remaining surveyed buildings and structures are primarily unremarkable residential buildings or simple utilitarian structures that resemble designs for other administrative, operational, or maintenance facilities around the world (Photographs 10-11). The late-nineteenth century and early twentieth century farm houses are modest, unexceptional, wood frame residences. The residences that were constructed 1962-1963 are undistinguished, ranch style buildings that were widely replicated around the country. In addition, the majority of the buildings within GBO have been altered, including small additions and the replacement of original windows and siding. None of the administrative or residential properties embody the distinctive characteristics of a type, period, or method of construction; they do not represent the work of a master nor do they possess high artistic value. Therefore, these 39 buildings and structures are not individually eligible under Criterion C.

Due to the standard construction and design of these 39 built environment resources, the ordinariness of the materials used and their lack of a direct, significant association to important historic people or events, the properties are unlikely to individually provide further information significant to prehistory or history. Therefore, these 39 surveyed resources are not individually eligible under Criterion D, which requires that structures have yielded or may be likely to yield information important in prehistory or history.



Photos 10-11 (left to right): Typical GBO support buildings - a residential property (House #4) and the works administration building.

In summary, out of the 47 surveyed resources, four telescope instruments (one of which is composed of three telescopes) are individually eligible for listing in the NRHP for their significant association with scientific events and developments in radio astronomy or for their design. An additional four structures are considered historically significant, but do not retain sufficient integrity to convey that significance and are not individually eligible for listing in the NRHP. The 39 remaining resources are not associated with events that have made significant contributions to the broad patterns of local, regional, or national history; are not directly associated with any persons considered important in local, state, or national history; are all unremarkable or utilitarian designs that do not represent a unique style; and are not likely to yield information important in prehistory or history. In total, 43 of the 47 surveyed resources either do not meet the NRHP criteria or do not retain sufficient integrity to convey that significance and for this reason are not individually eligible for listing in the NRHP.

5.2.2 District Eligibility Determination

All of the evaluated resources are located within Green Bank in Pocahontas County and within the NRQZ. With several exceptions, including the farm houses and barns that predate the NRAO, the Reber Radio Telescope (1937), and the GBT (2000), the vast majority (34 resources) of the buildings and structures located within the GBO boundaries were constructed during the first decade of the NRAO between 1958 and 1968.

The National Park Service (NPS) Bulletin entitled *How to Complete the National Register Registration Form* defines a historic district as “possess[ing] a significant concentration, linkage, or continuity of sites, buildings, structures, or objects united historically or aesthetically by plan or physical development.” The bulletin also clarifies that “a district may contain noncontiguous elements only where the historic interrelationship of a group of resources does not depend on visual continuity and physical proximity” (NPS, 1997). The built environment resources that are 45 years of age or older on GBO have significant commonalities: They were all used to further the field of radio astronomy and for the most part have functioned continuously as part of an observatory for over five decades (Photograph 12). In addition, many of the buildings employ similar materials and construction techniques. These similarities link them in a significant way and unite them both historically and in some instances, aesthetically. Although many of the resources have undergone additions and alterations to accommodate changes in radio astronomy technology, as well as other developments within the NRAO/GBO, these changes have not resulted in a significant loss of physical integrity; as a result, the buildings and structures are still able to convey their historical association and significance as a district.



Photo 12: GBO administrative area and airstrip, view from the top of the GBT.

There are 44 resources within the APE that are recommended as contributing to the proposed GBO historic district, the boundaries of which coincide with the site's property boundaries (and the APE) (Table 5-2, Figure 5-1, and Attachment A). Contributing elements include eight administrative/operational buildings, one airstrip, one water tower, one recreational area, 24 residential buildings, two horns, one antenna, and six telescopes (the Interferometer includes three large telescopes). The scientific instruments within the APE are a collection of telescopes, horns, and antenna that are significant for their role in the development of radio astronomy and in several instances as remarkable feats of engineering. Four of these historic telescopes remain in operation and retain excellent integrity of materials, workmanship, design, feeling, association, setting, and location. The Interferometer has been closed for several years and has suffered some deterioration from rust, but the three associated telescopes retain most of their physical integrity and their setting. As a whole, the majority of the components that make up the potential district's historic character possess integrity, even though many of the buildings are individually undistinguished.

Four buildings within the APE were identified as non-contributing resources. These include: three barns and one cellar building, all of which date from the early twentieth century. The four non-contributing buildings pre-date the establishment of the NRAO and have been primarily left vacant or used as miscellaneous storage facilities. No records indicate a direct involvement between these buildings and the function of the observatory, historically or presently.

The administrative and operations buildings and structures within the GBO are primarily utilitarian buildings or structures with simple designs executed using practical and standard materials, such as metal and concrete, often with brick or permastone veneer. These elements create an unassuming, though cohesive, visual unit that emphasizes their historically linked function as support for the observatory. The resources were built rapidly during the first decade of NRAO's operation often with a common plan and common design theme.

As a group, the 44 contributing built environment resources are a distinct and well-preserved representation of the early years of the NRAO, complete with scientific instruments, administration/operational facilities, recreation area, and residential buildings. Additionally, the scientific instruments present on site illustrate a linear, historical narrative of the history of radio astronomy from the Jansky Replica Antenna and Reber Radio Telescope to the monumental GBT. The resources share a distinct and significant history that is unique in both time and place. Individually, many of the resources are not representative examples of a type, period, or method of construction. However, together, the buildings and structures form a singular community and history that could never be replicated. The resources possess a significant linkage or continuity that is united historically by function, plan, and physical development.

The GBO is a collection of buildings and structures mostly built between 1958 and 1968, and most of which are still functioning, that captures the early history of radio astronomy in the United States and illustrates the subsequent development of the field. Therefore, the GBO is eligible as a historic district for representing an important time in science history and for its significant contribution to the advancement of radio astronomy.

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Building / Structure Name

Administrative / Operational

- ▲ 1. Karl Guthe Jansky Laboratory
- ▲ 2. Cafeteria Building and Residence
- ▲ 3. Warehouse
- ▲ 4. Water Tower
- ▲ 5. Works Area Building
- ▲ 6. Telescope Mechanics Office (formerly Cable Storage Warehouse)
- ▲ 7. Millimeter Array Experiment Building
- ▲ 8. Outdoor Test Building
- ▲ 9. Laser Lab (formerly 300" Telescope Control Building)
- ▲ 10. Airstrip
- ▲ 11. Recreation Area
- ▲ 12. Barn
- ▲ 13. Barn
- ▲ 14. Barn
- ▲ 15. Slaven Hollow Orchard Cellar Building

Residential Buildings

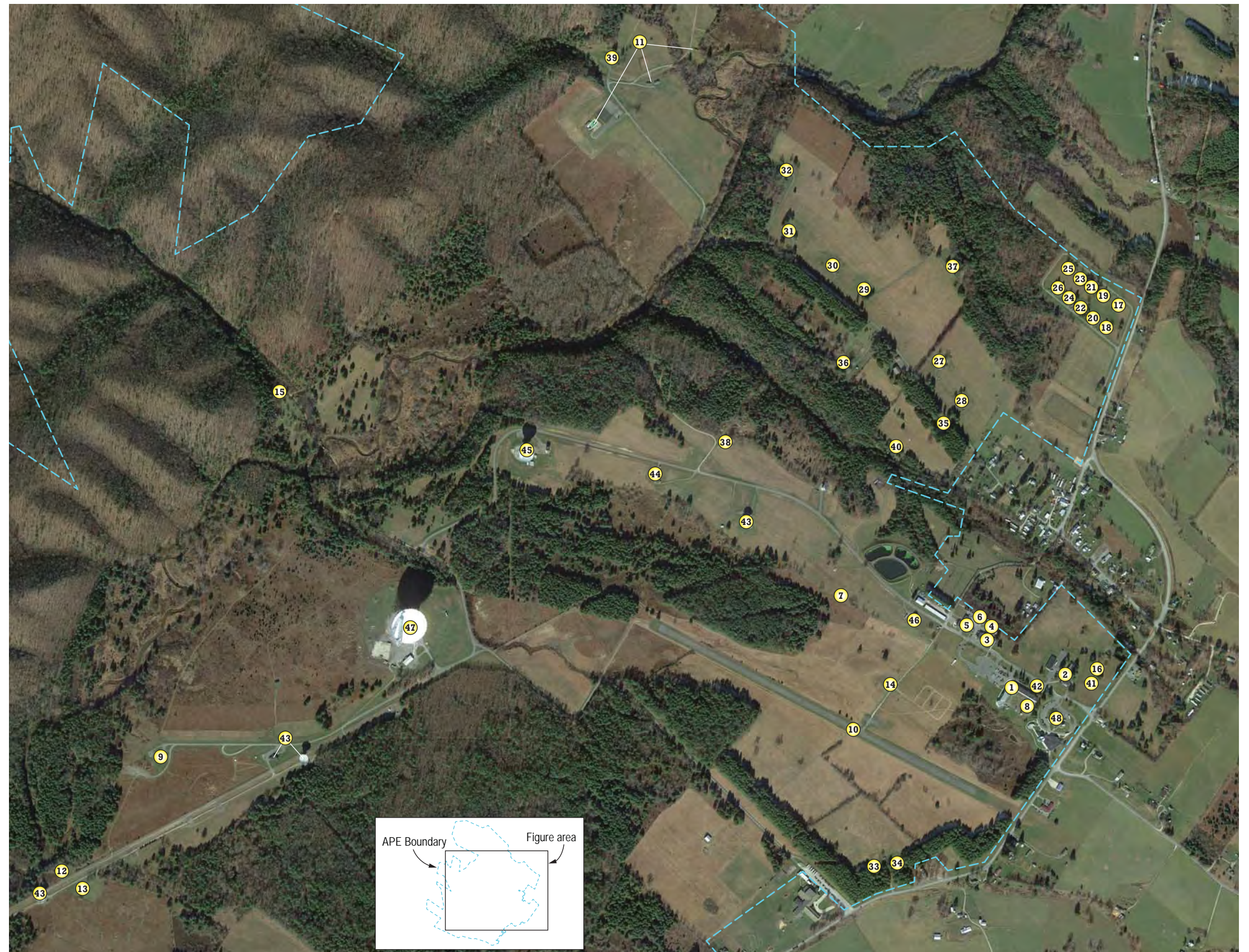
- ▲ 16. Redwood House (House #1; Director's House)
- ▲ 17. House #2 (Rabbit Patch)
- ▲ 18. House #3 (Rabbit Patch)
- ▲ 19. House #4 (Rabbit Patch)
- ▲ 20. House #5 (Rabbit Patch)
- ▲ 21. House #6 (Rabbit Patch)
- ▲ 22. House #7 (Rabbit Patch)
- ▲ 23. House #8 (Rabbit Patch)
- ▲ 24. House #9 (Rabbit Patch)
- ▲ 25. House #10 (Rabbit Patch)
- ▲ 26. House #11 (Rabbit Patch)
- ▲ 27. House #16
- ▲ 28. House #14
- ▲ 29. House #19
- ▲ 30. House #21
- ▲ 31. House #23
- ▲ 32. House #24
- ▲ 33. Shinnaberry House
- ▲ 34. Nut Bin
- ▲ 35. Riley House (#15)
- ▲ 36. Hill House (#17)
- ▲ 37. Tracy House (#18)
- ▲ 38. Beard House
- ▲ 39. Hannah House

Structures / Telescopes

- ▲ 40. Calibration Horn
- ▲ 41. Karl Guthe Jansky Replica Antenna
- ▲ 42. Ewen-Purcell Horn
- ▲ 43. Green Bank Interferometer: Includes Howard E. Tatel (85'-1) Telescope & 85'-1 control building; 85'-2 Telescope; 85'-3 Telescope; and the Interferometer Control Building
- ▲ 44. 40' Telescope & 40' Telescope Control Building
- ▲ 45. 140' Telescope (43m Telescope) & maintenance structure
- ▲ 46. 45' Telescope
- ▲ 47. Robert C. Byrd Green Bank Telescope (GBT)
- ▲ 48. Reber Radio Telescope

LEGEND

- ▲ NRHP Contributing
- Surveyed Property
- ▲ NRHP Non-Contributing
- - - Area of Potential Effects (APE)
- NRHP Individually Eligible
- NRHP Individually Listed



Aerial photo source: Google ©2014, modified by CH2M HILL

FIGURE 5-1
Built Environment Resources
 Green Bank Observatory
 Green Bank, West Virginia

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Conclusion

There are 47 built environment resources within the APE that are 45 years of age or older at the time of this report. One of these, the Reber Radio Telescope, was previously listed in the NRHP and determined a National Historic Landmark. The remaining 46 historic-era built environment properties were surveyed for this technical report. Despite the fact that the GBT is less than 50 years old, the telescope was surveyed and evaluated due to its exceptional significance. Four telescopes were identified within the APE as individually eligible for listing in the NRHP. One of these is the Interferometer which encompasses three large telescopes. The remaining built environment properties do not meet the NRHP criteria or do not retain sufficient integrity to be individually eligible for listing. The GBO was also surveyed as a potential historic district and was found to be eligible for listing in the NRHP. Forty-four resources within the APE were identified as contributing to the historic district.

These findings indicate that there are historic properties (44 NRHP-listed, NRHP-eligible, or contributing buildings and structures and one historic district) located within the APE, and therefore, any alterations or demolitions that may occur as part of the site's divestment could result in an adverse effect on historic properties. If any activities associated with the divestment are determined to affect identified historic properties, consultation with the West Virginia Division of Culture and History (SHPO) would be required under Section 106 of the NHPA.

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Attachment A
Surveyed Built Environment Resources

Building/ Structure Name	Year Built	Description	Function	Alterations	NRHP Status	Contributing to Historic District?
ADMINISTRATIVE/ OPERATIONAL						
Karl Guthe Jansky Laboratory	1959	Steel-column frame, administration building	Supports the telescopes: electronics lab, administrative offices, astronomer's controls	Addition (1994-1996)	Not individually eligible	Yes
Cafeteria Building and Residence	1959	Concrete block, residence hall	Temporary residence and administrative functions	Addition (2003)	Not individually eligible	Yes
Warehouse	1963	Utilitarian: Flat roof, brick veneer	Currently day care facility; historically warehouse and cryogenics lab	N/A	Not individually eligible	Yes
Water Tower	1958	Steel, elevated water tank	Water storage	N/A	Not individually eligible	Yes
Works Area Building	1959	Utilitarian: Flat roof, brick and permastone veneer	Machine shop, auto shop, general maintenance	Alterations (1963); Addition (date unknown)	Not individually eligible	Yes
Telescope Mechanics Office (formerly Cable Storage Warehouse)	Circa 1960	Utilitarian: corrugated metal	Maintenance	Addition (2002)	Not individually eligible	Yes
Millimeter Array Experiment Building	1962-1963	Small, concrete block and permastone veneer	Vacant	N/A	Not individually eligible	Yes
Outdoor Test Building	Circa 1960	Utilitarian: concrete block and face brick, flat roof	Equipment building	N/A	Not individually eligible	Yes
Laser Lab (formerly 300' Telescope Control Building)	1961-1962	Concrete block and face brick, side gabled roof	Laser Lab for range finder	Addition (1971); Repairs and renovation (circa 1988)	Not individually eligible	Yes
Airstrip	1958-1960	Paved airstrip	Closed	N/A	Not individually eligible	Yes
Recreation Area	1963-1964	Picnic area, swimming pool, basketball court, shooting range	Recreation	Addition to Picnic Area (circa 1998); Shooting range buildings demolished and recently rebuilt; Ski lift and golf driving range removed.	Not individually eligible	Yes
Barn	Early twentieth century	Wood frame barn with gambrel roof	Vacant/Storage	N/A	Not individually eligible	No
Barn	Early twentieth century	Wood frame barn with gable roof	Vacant/Storage	N/A	Not individually eligible	No
Barn	Early twentieth century	Wood frame barn, concrete foundation, painted white	Vacant/Storage	N/A	Not individually eligible	No
Slaven Hollow Orchard Cellar Building	Early twentieth century	Wood frame, cellar building	Vacant	N/A	Not individually eligible	No

Building/ Structure Name	Year Built	Description	Function	Alterations	NRHP Status	Contributing to Historic District?
RESIDENTIAL BUILDINGS						
Redwood House (House #1; Director's House)	1962	Wood frame ranch house	Residential	Addition (1975); Remodel (1977)	Not individually eligible	Yes
House #2 (Rabbit Patch)	1962	Wood frame ranch house	Residential	Alterations (cladding, windows)	Not individually eligible	Yes
House #3 (Rabbit Patch)	1962	Wood frame ranch house	Residential	Alterations (windows)	Not individually eligible	Yes
House #4 (Rabbit Patch)	1962	Wood frame ranch house	Residential	Alterations (cladding, windows)	Not individually eligible	Yes
House #5 (Rabbit Patch)	1962	Wood frame ranch house	Residential	Alterations (cladding, windows)	Not individually eligible	Yes
House #6 (Rabbit Patch)	1962	Wood frame, two-story Colonial Revival house	Residential	Alterations (cladding, windows)	Not individually eligible	Yes
House #7 (Rabbit Patch)	1962	Wood frame, two-story Colonial Revival house	Residential	Alterations (windows)	Not individually eligible	Yes
House #8 (Rabbit Patch)	1962	Wood frame ranch house	Residential	Alterations (cladding, windows)	Not individually eligible	Yes
House #9 (Rabbit Patch)	1962	Wood frame ranch house	Residential	Alterations (cladding, windows)	Not individually eligible	Yes
House #10 (Rabbit Patch)	1962	Wood frame ranch house	Residential	Alterations (cladding, windows)	Not individually eligible	Yes
House #11 (Rabbit Patch)	1962	Wood frame ranch house	Residential	Alterations (cladding, windows)	Not individually eligible	Yes
House #14	1962	Wood frame ranch house	Vacant	Alterations (cladding, windows)	Not individually eligible	Yes
House #16	1962	Wood frame ranch house	Residential	Alterations (cladding, windows)	Not individually eligible	Yes
House #19	1963	Wood frame, two-story Colonial Revival house	Residential	Alterations (cladding, windows)	Not individually eligible	Yes
House #21	1963	Wood frame ranch house	Residential	Alterations (cladding, windows)	Not individually eligible	Yes
House #23	1963	Wood frame ranch house	Residential	Alterations (cladding, windows)	Not individually eligible	Yes
House #24	1963	Wood frame, two-story Colonial Revival house	Residential	Alterations (cladding, windows)	Not individually eligible	Yes
Shinnaberry House	Circa 1940	Wood frame farm house	Residential	Alterations (cladding, windows)	Not individually eligible	Yes
Nut Bin	1901-1902	Wood frame farm house with vinyl siding	Residential	Alterations (cladding, windows)	Not individually eligible	Yes
Riley House (#15)	Early twentieth century	Wood frame farm house	Residential	Alterations (cladding, windows)	Not individually eligible	Yes
Hill House (#17)	Circa 1896	Wood frame farm house	Residential	Alterations (cladding, windows)	Not individually eligible	Yes
Tracy House (#18)	Early twentieth century	Wood frame farm house	Residential	Alterations (cladding, windows)	Not individually eligible	Yes
Beard House	Early twentieth century	Wood frame farm house	Vacant (used as an experiment station in the 1960s)	Addition (circa 1960s)	Not individually eligible	Yes
Hannah House	Early twentieth century	Wood frame farm house	Residence for summer school students	Heavily altered, Renovation (2000-2003)	Not individually eligible	Yes

Building/ Structure Name	Year Built	Description	Function	Alterations	NRHP Status	Contributing to Historic District?
STRUCTURES/TELESCOPES						
Calibration Horn	1958-1959	Aluminum with welded seams horn with a concrete shed and a wood frame support structure	Display	N/A	Not individually eligible	Yes
Karl Guthe Jansky Replica Antenna	1964	Antenna replica	Display	N/A	Not individually eligible	Yes
Ewen-Purcell Horn	1957	Horn for collecting radio waves	Display	Relocated to GBO in 1963	Not individually eligible	Yes
Green Bank Interferometer: Includes Howard E. Tatel (85'-1) Telescope & 85'-1 control building; 85'-2 Telescope; 85'-3 Telescope; and the Interferometer Control Building	1958-1959 [85'-1 and control building]; 1963-1964 [85'-2]; 1965-1968 [85'-3]; 1967-1968 [Interferometer control bldg]	Telescopes	Closed	N/A	Individually eligible	Yes
40' Telescope & 40' Telescope Control Building	1962	Telescope	In operation - Education Telescope	N/A	Individually eligible	Yes
140' Telescope (43m Telescope) & maintenance structure	1958-1965/1970	Telescope	In operation	N/A	Individually eligible	Yes
45' Telescope	Circa 1965	Telescope	In operation	Moved to GBO in 1972	Not individually eligible	Yes
Robert C. Byrd Green Bank Telescope (GBT)	1991-2000	Telescope	In operation	N/A	Individually eligible	Yes

1
2

Appendix 3.6A
Environmental Baseline Study

FINAL

Environmental Baseline Study

Green Bank Observatory
Green Bank, West Virginia

Prepared for

National Science Foundation

May 2016



Executive Summary

This Environmental Baseline Study (EBS) has been prepared to document the current environmental conditions on the approximately 2,200-acre contiguous parcel (herein referred to as the subject property) located near Green Bank, West Virginia. The National Science Foundation requested an EBS be completed to determine the environmental condition of the property prior to any future divestment activities or alternate operational agreements are evaluated. This EBS report has been prepared in accordance with the ASTM International (ASTM) provisional standards practice for *Environmental Site Assessments: Phase I Environmental Site Assessment Process* (ASTM, 2013).

This EBS report is based on information obtained through a records search, visual site inspections, physical site inspections, and interviews. The records search included a review of available records, including environmental restoration reports, previous surveys, building drawings, and inspection reports. Visual surveys of the subject property and interviews with current employees were conducted. The EBS assessment also included an evaluation of environmental conditions at offsite properties that could pose environmental concerns or affect the subject property. For adjacent properties, visual surveys consisted of pedestrian surveys.

The following Recognized Environmental Conditions (RECs) were found on the subject property:

- A 1,000-gallon gasoline underground storage tank was abandoned in place (emptied and filled with a cement slurry) in 1991 after water was found in the gasoline. Soil samples were not collected to determine if there was a release.
- The shooting range may have lead in soil at the target areas and gunpowder residues, including polycyclicaromatic hydrocarbons, may have reached the soil at the firing line.

The following Historical RECs were found on the subject property:

- The 300-foot telescope oil pond closure. Soil at the bottom and walls of the oil pond were bio-remediated. A closure letter was issued on December 23, 1999.
- Fuel oil was found leaking from a newly installed underground storage tank at the Jansky Laboratory Building. The tank and contaminated soil were excavated. Soil sample analysis showed that the contaminated soil was removed.

The following de minimis conditions were identified on the subject property:

- 20-gallon drum of lubricant leaked on an absorbent pad in the 43-meter Telescope (also referred to as the 140-foot Telescope).
- Staining on the concrete floor of the Green Bank Telescope Warehouse.
- Staining on the concrete floor in the Works Area garage.
- Staining on the tile floor in the shed southwest of 85-1.

The following are other conditions on the subject property that are not considered RECs, but are worth disclosing:

- According to the 1989 Asbestos Management Plan, 9 buildings were surveyed for asbestos-containing materials (ACM). Other buildings including residential homes were not surveyed. ACM was found at the following buildings: 43-meter Telescope, 85-1 Control Building, Works Area Building, Jansky Laboratory Building, Residence Hall, Interferometer Building, Warehouse Building, and the Cable Building.

EXECUTIVE SUMMARY

- A burn pile of scrap wood, brush, and furniture is located at the junkyard. The West Virginia Department of Natural Resources recommended removing the wastes, disposing of the wastes in the county landfill, and returning the land to its natural slope and drainage. The Environmental Log states this was done; however, there is a burn pile with scrap material at the location of the former junkyard.
- A military-style fuel truck was staged north of the telescope area off of Slavin Hollow Road. The truck is permanently parked on a hillside and is used as a diesel aboveground storage tank. No secondary containment was observed under the filling port behind the truck. Spills from the truck would immediately impact the soil.

To assess the potential for adjacent properties to affect the property, a records search and database search of RECs within 1 mile of the subject property was performed for this EBS assessment (see Attachment B). No other neighboring properties appear to have the potential to environmentally affect the subject property.

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Acronyms and Abbreviations

ACM	asbestos-containing material
AST	aboveground storage tank
ASTM	ASTM International
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CERCLIS	Comprehensive Environmental Response, Compensation, and Liability Information System
DOT	department of transportation
EBS	Environmental Baseline Study
EDR	Environmental Data Resources, Inc.
GBT	Robert C. Byrd Green Bank Telescope
HREC	Historical Recognized Environmental Condition
LBP	lead-based paint
LUST	leaking underground storage tank
NOV	Notice of Violation
NPL	National Priorities List
NSF	National Science Foundation
PCB	polychlorinated biphenyl
pCi/L	picocurie per liter
REC	recognized environmental condition
RTE	rare, threatened, or endangered
TSCA	Toxic Substances Control Act
USEPA	U.S. Environmental Protection Agency
USGS	U.S. Geological Survey
UST	underground storage tank
VSI	visual site inspection
WVDEP	West Virginia Department of Environmental Protection
WVDNR	West Virginia Division of Natural Resources

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Introduction

The National Science Foundation (NSF) issued a Statement of Work for the Divestment Options Studies for the NSF-funded Telescopes and Observatories Project Task Order on July 29, 2014 and a scope revision on August 5, 2014 under Blanket Purchase Agreement (BPA) NSFDACS14B1186. This document describes the Environmental Baseline Study (EBS) assessment portion of the task order for the approximately 2,200-acre property of the Green Bank Observatory, hereinafter referred to as the subject property, located near Green Bank, West Virginia. Figure 1-1 depicts the location of the subject property.

This EBS report is organized as follows:

- Section 1 presents the purpose and scope of the EBS.
- Section 2 describes the site and the current uses.
- Section 3 provides historical uses of the property.
- Section 4 presents the environmental setting information and findings on the property.
- Section 5 presents results of the adjacent property assessment for the EBS.
- Section 6 presents information provided from interviews.
- Section 7 provides findings and conclusions.
- Section 8 provides the certification page.
- Section 9 provides the references consulted in preparing this document.

The appendices to this document include the following:

- Attachment A contains photographs taken during the October 6-9, 2014 site visit.
- Attachment B contains the Environmental Data Resources, Inc. (EDR) reports for the subject properties and adjacent properties.
- Attachment C contains copies of historical aerial photographs and historical topographic maps for the subject property.

This EBS report has been prepared in accordance with the ASTM International (ASTM) provisional standards practice for *Environmental Site Assessments: Phase I Environmental Site Assessment Process* (ASTM, 2013).

1.1 Purpose of Environmental Baseline Study

The purpose of this EBS report is to document the environmental condition of the subject property prior to any divestment activities or changes in operational strategy.

The purpose of the EBS assessment is to identify, to the extent feasible, the presence or likely presence of any hazardous substances or petroleum products on the subject property under conditions that indicate an existing release, a past release, or a material threat of release of any hazardous substances or petroleum products into structures on the subject property. This does not include de minimis conditions that do not present a threat to human health or the environment and that generally would not be the subject of an enforcement action if brought to the attention of appropriate government agencies.

This EBS report is intended to help NSF conduct the following tasks:

- Develop sufficient information to identify what actions are necessary to protect human health and the environment prior to a real property transaction.
- Aid in establishing lease or deed restrictions.
- Support notice, when required under Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) § 120(h)(3), of the type, quantity, and timeframe of any storage, release, or disposal of hazardous materials or petroleum products and their wastes on the properties.
- Define potential liabilities associated with real property transactions.
- Evaluate possible effects on property valuation caused by contamination or other identified concerns.

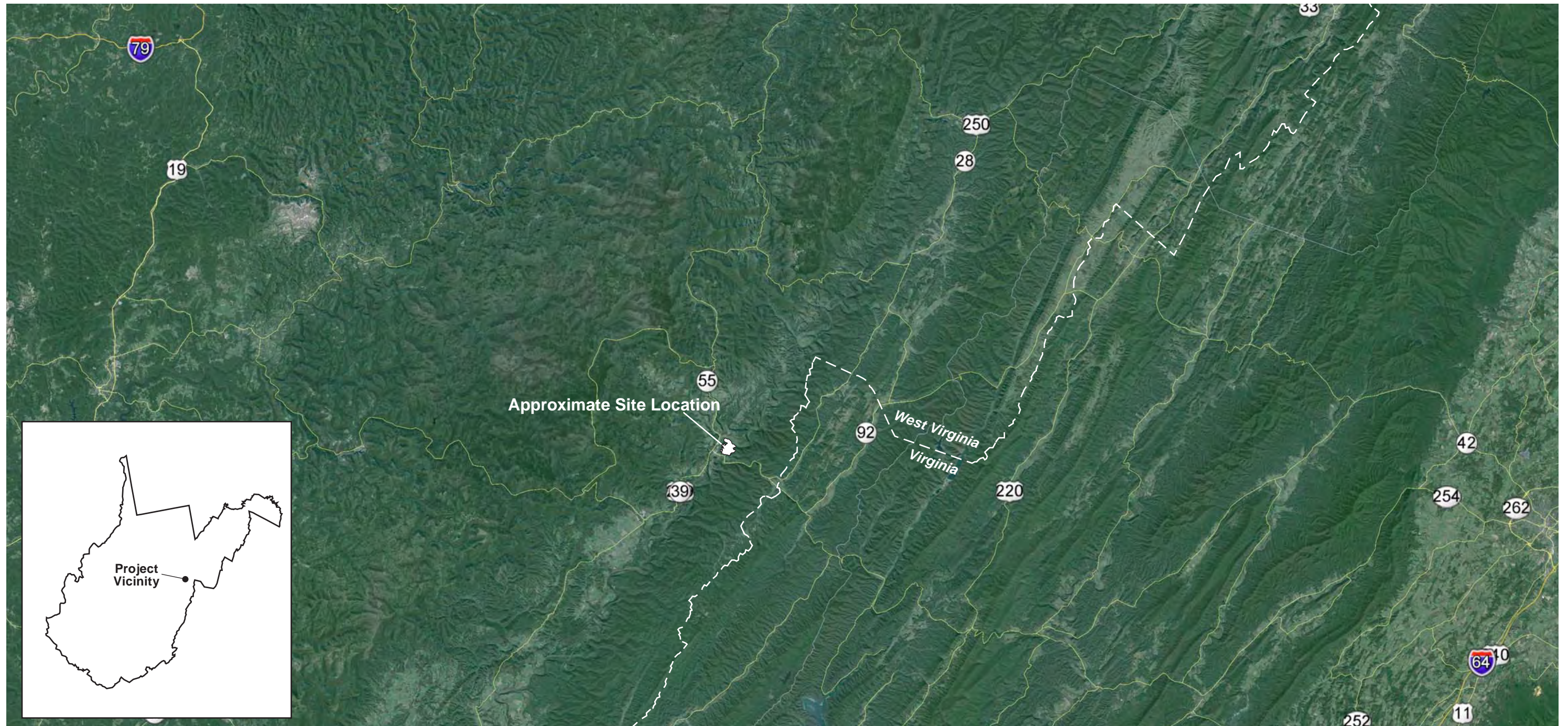
1.1.1 Content of Environmental Baseline Study Report

The information contained in this EBS report was obtained through a records search, visual site inspections (VSIs), physical site inspections, and interviews. The records search included an analysis of historical aerial photographs (Attachment A) and a review of available regulatory agency records.

VSIs were performed in accordance with ASTM E1527-13 *Standard Practice for Environmental Site Assessments: Phase I Environmental Site Assessment Process* (ASTM, 2013). The inspection consisted of a visual examination of the subject properties.

The EBS assessment also included an assessment of environmental conditions on properties within the ASTM standard radius search distance of the subject properties that could pose an environmental concern. As part of this assessment, reasonably ascertainable environmental databases were identified. Search radii were used to identify sites located in the general area of the subject properties. Adjacent properties were visually surveyed from accessible public areas as part of the EBS activities.

This EBS report specifically addresses the approximately 2,200-acre subject property, which is located near Green Bank, West Virginia. The general location and the subject property are illustrated in Figures 1-1 and 1-2.



Aerial photo source: Google ©2014, modified by CH2M HILL

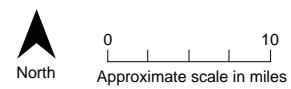
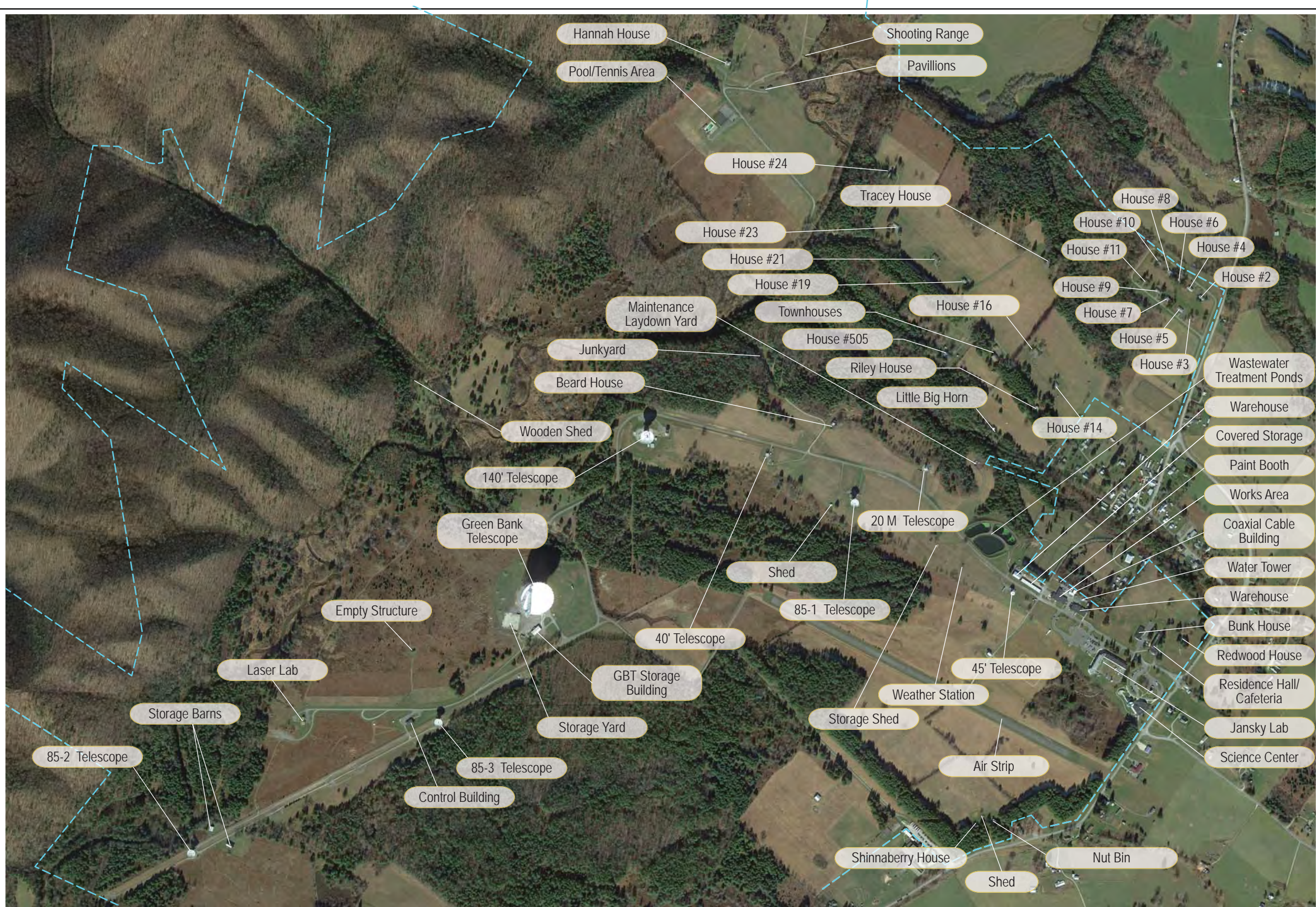


FIGURE 1-1
Project Location Map
 Green Bank Observatory
 Green Bank, West Virginia



Aerial photo source: Google ©2014, modified by CH2M HILL

----- Green Bank Observatory Boundary



0 1,000
Approximate scale in feet

FIGURE 1-2
Subject Property
Green Bank Observatory
Green Bank, West Virginia

Database and pedestrian surveys were conducted for several properties adjacent to the subject properties. In addition, a records search was performed for properties within 1 mile of the subject property. The records and surrounding property evaluations are described in Sections 3 and 4, respectively.

1.2 Survey Methodology

1.2.1 Site Reconnaissance

VSI s were conducted on October 6-9, 2014. The VSIs included an escorted walk-through of accessible areas of buildings and facilities and open areas. One of the primary objectives of the VSIs was to note visual evidence of contamination or potential sources of contamination, including leaks, spills, and any other evidence of past or current releases. Each of the existing buildings was visually inspected; however, the interiors of some buildings were not visually inspected during the site reconnaissance (see Section 1.4.1)

1.2.2 Records Search and Review

The onsite records search was performed October 6-9, 2014, and was facilitated by Mr. Johnny Samples. Mr. Samples provided environmental documentation including asbestos records and the 300-foot telescope oil pond release.

1.2.3 Interviews

Interviews were conducted on October 6-9, 2014, with the site personnel who were knowledgeable of the environmental issues with the subject property. Section 6 lists the individuals who interviewed.

1.2.4 Review of Special Resources

No special resources were reviewed

1.3 Significant Assumptions

There were no significant assumptions.

1.4 Limitations, Exceptions, and Data Gaps

1.4.1 Limitations

The interior of all residential housing, the storage shed between the 45-foot telescope and the 85-1 telescope, the two small storage sheds near the wastewater treatment pond, the Beard House, the shed behind the Shinnaberry House, and the wooden shed on Slavin Hollow Road were inaccessible and not surveyed. The property lines along the northern and western portions of the property were not viewed as there were no access roads and dense vegetation limited line of sight.

No test pits were installed to inspect subsurface soil conditions. No sampling or analysis of any media was conducted during this survey.

This report has been prepared in compliance with ASTM E1527-13. In preparing this report, CH2M has relied on certain information provided by federal, state, and local officials and other parties referenced herein, and on information contained in the files of governmental agencies that was reasonably

ascertainable at the time of this assessment. Although there may have been some degree of overlap in the information provided by these various sources, an independent verification of the accuracy or completeness of all information reviewed or received during the course of this site assessment was not conducted.

1.4.2 Exceptions

There are no identified exceptions.

1.4.3 Data Gaps

According to § 3.2.20 of ASTM E1527-13, a data gap is a lack of or inability to obtain information required by the ASTM standard despite good faith efforts to gather the data. Data gaps may result from incompleteness in any of the activities required by the ASTM standard. A data gap is considered significant only if it affects the ability to identify recognized environmental conditions (RECs). Data gaps that were identified are listed in Table 1-1.

Table 1-1. Data Gaps

Environmental Baseline Study, Green Bank Observatory, West Virginia

Data Gap	Explanation	Significance of Gap
Site History	Site history not available in 5-year intervals.	Low – Standard historical sources of information include aerial photographs, historical topographic maps, city directory abstracts, and Sanborn Fire Insurance Maps. Additional maps would not likely provide additional relevant information.
Interiors of Residential buildings and multiple storage sheds (see Section 1.4.1)	The interior of residential houses and multiple sheds were not surveyed due to inaccessibility	Low – Historic use of the facilities for residential and storage purposes is unlikely to have had a significant environmental impact on the subject property.

Site Description

This section describes the methodology used to assess the EBS. The process included a records search, VSIs, physical site inspections, and interviews.

2.1 Location and Legal Description

The subject property is 2,200 acres located in Pocahontas County near Green Bank, West Virginia (Figure 1-1 and 1-2). It lies approximately 200 miles west of Washington, D.C. adjacent to the Monongahela National Forest. The property is owned by NSF and is home to the Green Bank Observatory component of the National Radio Astronomy Observatory.

2.2 Current Use of the Subject Property

The subject property is currently used for radio astronomy observations, research, and support activities including, administrative, maintenance, and housing. The current use of each building is presented in Table 2-1.

Table 2-1. Uses of Buildings and Structures

Environmental Baseline Study, Green Bank Observatory, West Virginia

Building/Structure	Current Use	Photograph Number
GBT	Radio Astronomy Research	1
43-meter Telescope	Occasionally used	2
Storage Shed near 43-meter Telescope	Storage	3
20-meter telescope	Not currently being used	4
45-foot telescope	Occasionally used	5
40-foot telescope	Education in Radio Astronomy	6
Interferometer 85-1 telescope	Not currently being used	7
Interferometer 85-2 telescope	Not currently being used	8
Interferometer 85-3 telescope	Not currently being used	9
Laser Lab (Formerly the 300-foot telescope control building)	Not currently being used	10
Former Interferometer Control Building	Currently used or records/drawings storage	11
Gabel Barn	Storage of large wire spools	12
Gambrel Barn	Storage of large wire spools	13
Old experiment structure	Not currently being used	14
Slavin Barn	Not currently being used	15
GBT storage building	Equipment storage for the GBT	16-17

Table 2-1. Uses of Buildings and Structures*Environmental Baseline Study, Green Bank Observatory, West Virginia*

Building/Structure	Current Use	Photograph Number
GBT storage yard	Equipment/material storage for the GBT	18-19
Beard House	Not currently being used	20-21
Wooden shed near 85-1	Storage	22
Metal shed near 85-1	Storage	22
Junkyard	Storage of scrap material to be recycled	23-25
Science Center	Exhibit hall and educational use, café, administration offices.	26
Jansky Laboratory	Administration offices, telescope controls, and instrumentation.	27
Storage building in storage yard near works area.	Storage	28-29
Covered storage in works area.	Storage	30
Warehouse	Storage	31
Works	Storage and maintenance shops	32
Paint booth	Painting	33
Bunk house	Guest housing	34
Residence hall/cafeteria	Guest housing and cafeteria	35
Redwood House	Guest housing	36
House #2	Employee housing	37
House #3	Employee housing	38
House #4	Employee housing	39
House #5	Employee housing	40
House #6	Employee housing	41
House #7	Employee housing	42
House #8	Employee housing	43
House #9	Employee housing	44
House #10	Employee housing	45
House #11	Employee housing	46
House #14	Employee housing	47
House #16	Employee housing	48
House #19	Employee housing	49
House #21	Employee housing	50
House #23	Employee housing	51
House #24	Employee housing	52

Table 2-1. Uses of Buildings and Structures*Environmental Baseline Study, Green Bank Observatory, West Virginia*

Building/Structure	Current Use	Photograph Number
Hill House	Employee housing	53
Tracey House	Employee housing	54
Riley House	Employee housing	55
Nut Bin House	Employee housing	56
Shinnaberry House	Employee housing	57
Townhouses	Employee housing	58
Hannah House	Guest housing	59
Recreation area	Showers/restrooms/pavilion/tennis	60-62
Shooting range shed	Not currently being used	63
Barn near airstrip	Storage	64
Shed East of 85-1 telescope	Storage	65
Shed Southwest of 85-1	Storage including oil/lubricants	66
Weather Station	Weather instrumentation	67
43-meter Telescope sheds	Storage	68-69
Little Big Horn Calibration Antenna	Not currently being used	70-71

GBT = Robert C. Byrd Green Bank Telescope

2.3 Description of Structures, Roads, and Other Improvements

The subject property consists of radio telescopes, control buildings, storage and maintenance facilities, and residential facilities for onsite workers. Table 2-1 describes the uses of each of the buildings and structures on the property.

The subject property is divided into three main areas: The telescope area, the upper area, and the employee housing area. The telescope area consists of eight telescopes: The Robert C. Byrd Green Bank Telescope (GBT), 43-meter Telescope, 20-meter telescope, 40-foot telescope, 45-foot telescope, and the interferometer telescopes (85-1, 85-2, and 85-3). Buildings in the telescope area include the laser lab, the interferometer control building, two storage barns, the GBT warehouse, the GBT storage yard, Beard House, an empty structure from a former experiment, and a junkyard.

The upper area consist of the Jansky Laboratory, the works building, warehouses, storage yards and sheds, a residence hall, a cafeteria, and a science center. The water supply wells and water tower for the facilities is located in this area (Photographs 72 and 73). Wastewater treatment ponds (Photograph 74) are located just north of the upper area.

The employee housing area consists of 10 houses on Rabbit Patch Road and 9 houses and a townhouse building on Hannah Run Road. Two additional employee houses, the Nut Bin House and the Shinnaberry House, are located off Potomac-Highland Trail. The employee recreation area is located at the northeast portion of the property and includes a swimming pool, tennis courts, pavilion, and a shooting range (Photograph 75).

A paved road runs from the southern boundary at Potomac-Highland Trail through the upper area and through the telescope areas. Slavin Run Road is an unpaved road that runs northwest-southeast through the property. An airstrip (Photograph 76) is located in the middle of the subject property running northwest-southeast.

Further descriptions of the buildings are presented in the Divestment Options Study Report.

2.4 Site Utilities

The water service, sanitary sewer system, and electricity utility providers and the general stormwater flow for the subject property are discussed in this section.

2.4.1 Water Service

Two onsite drinking water wells provide water to the facilities on the subject property. Water is stored in a 100,000-gallon elevated water storage tank. The two water wells are tested daily per West Virginia Health and Human Services Department.

2.4.2 Wastewater

Wastewater treatment and disposal for the subject property is provided by an onsite sewer lagoon system. The upper site sewer/lagoon system is in compliance with the West Virginia Department of Environmental Quality. The site has a discharge permit and quarterly testing is submitted to the state. No Notice of Violations (NOVs) were found. Treated water is discharged at an outfall (Photograph 77) that leads to Hospital Run which flows into Deer Creek.

The Laser Lab, interferometer control building, GBT Warehouse, and 43-meter Telescope are not connected to the upper site sewer system and have their own septic systems. All of the houses except for Houses #7, #9, and #11 have their own septic systems. Houses #7, #9, and #11 are connected to one septic system that services the three houses.

2.4.3 Stormwater

Stormwater runoff on the subject property generally flows to ditches and swales, which then flows to Deer Creek along the northern part of the property or to Hospital Run along the eastern part of the property.

2.4.4 Electric

Electric service is provided by Monongahela Power. The power lines enter the property along Slavin Hollow Road to a substation located on the property (Photograph 78).

2.5 Current Use of the Adjoining Subject Property

The majority of the northern and western boundaries are vacant forested land.

Site History

The site was purchased in 1957. The subject property is owned by NSF.

3.1 Previous Environmental Baseline Surveys

No previous EBSs were available for review.

3.2 Historical Use Information of the Subject Property

3.2.1 Aerial Photographs

Available historical aerial photographs from 1958 through 2011 were reviewed. Table 3-1 summarizes the aerial photographs reviewed for the property and surrounding area.

Table 3-1. Historical Aerial Photograph Findings
Environmental Baseline Study, Green Bank Observatory, West Virginia

Year	Subject Property	Adjacent and Surrounding Properties
1958	The central part of the property appears to be farm fields. Slavin Hollow Road runs through the central part of the property north-south.	A farm house is located near the western edge of the subject property. The town of Arbovale is visible at the eastern boundary. A building is visible near the southern boundary.
1973	Road to the telescopes is visible. Each of the telescopes are visible except the GBT and 300-foot telescope. The laboratory, residence hall, works building, warehouse building, airstrip, and each of the residential homes are visible.	Additional homes are visible to the south and east of the subject property.
1991	Image is not clear, but appears to be similar to the 1973 photograph.	Image is not clear, but appears to be similar to the 1973 photograph.
1997	The 300-foot telescope is no longer visible. The GBT appears to be under construction. The Jansky Lab has an additional wing and a new parking area.	No significant changes are observed from the 1991 aerial photograph.
1998	Similar to the 1997 photograph.	No significant changes are observed from the 1997 aerial photograph.
2001	Only the western portion of the subject property is shown on this photograph and it is similar to the previous photographs.	No significant changes are observed from the 1998 aerial photograph.
2006	The wastewater treatment ponds, Bunk House, and the Science Center are now visible.	No significant changes are observed from the 2001 aerial photograph.
2007	No significant changes are observed from the 2006 aerial photograph.	No significant changes are observed from the 2006 aerial photograph.
2009	No significant changes are observed from the 2007 aerial photograph.	No significant changes are observed from the 2007 aerial photograph.
2011	No significant changes are observed from the 2009 aerial photograph.	No significant changes are observed from the 2009 aerial photograph.

3.2.2 Topographic Maps

Available topographic maps from 1898 through 1995 were reviewed. Table 3-2 summarizes the topographic maps reviewed for the property and surrounding area.

Table 3-2. Historical Topographical Map Findings

Environmental Baseline Study, Green Bank Observatory, West Virginia

Year	Subject Property	Adjacent and Surrounding Properties
1898	10 structures are visible on the subject property. A few roads and creeks are present.	A few roads and creeks are present along with several structures (most likely homesteads) scattered around the subject property.
1901	Similar to 1898 maps.	Similar to 1898 maps.
1924	12 structures are present along Deer Creek. Several structures are now visible on Hannah Run and Slavin Hollow Roads.	Many structures are now visible in Arbovale.
1960	4 telescopes and the calibration antenna are visible. The works building, Jansky Lab, residence hall, and the water tower are visible.	The high school, church, and bank are visible south of the property. A cemetery is shown east of the works building.
1979	10 homes at Rabbit Patch at the east end are visible. The landing strip is visible.	Similar to 1960 map.
1995	The interferometer range and 300-foot telescopes are now shown.	Similar to 1979 map.

3.2.3 City Directories

No properties were identified on the city directories.

3.3 Environmental Records

3.3.1 Federal Records

No environmental database listings were found to be on the subject property.

3.3.2 State and Tribal Records

No environmental database listings were found to be on the subject property.

3.3.3 Discussion EDR Database Search Results

No environmental database listings were found to be on the subject property.

Findings: Subject Property

4.1 Environmental Setting

The entrance to the subject property is located at Potomac Highland Trail and Slavin Hollow Road, Cass, in Pocahontas County, West Virginia 24927. It is located at the following coordinates: Latitude 38° 26' 8.52"N and Longitude 79° 50' 16.80"W. The approximate elevation of the property is 2,645 feet above mean sea level. The subject property sits on approximately 2,200 acres.

4.1.1 Climate

According to National Oceanic and Atmospheric Administration, the average monthly temperature ranges from 28 degrees Fahrenheit in January to 68 degrees Fahrenheit in July. The annual average precipitation is about 60 inches (Northeastern Regional Climate Center, 2014).

4.1.2 Land Use

The land surrounding the subject property is rural countryside in eastern Western Virginia. The main industries for Pocahontas County are health care, retail/trade, manufacturing, and transportation. The county is home to the headwaters of eight rivers. Deer Creek, a tributary of the North Fork River, runs through the center of the subject property. The Monongahela National Forest protects much of the river headwaters.

The subject property facilities are divided into three areas: telescope area, administration area, and residential/housing area. The facilities layout is shown on Figure 1-2.

4.1.3 Regional Physiography and Topography

The subject property is located in the North Fork Drainage Basin in Pocahontas County. The North Fork Area lies in the Allegheny Mountains section of the Appalachian Plateau Province. The North Fork comprises a headwater of the Deer Creek watershed, which in turn forms a tributary to the Greenbrier River. Regional topography is characterized by dissected uplands and V-shaped valleys.

The general topography gradient across the subject property is from the northwest to the southeast. The approximate elevation of the property is 2,645 feet above mean sea level

4.1.4 Geology

According to the Soil Survey of Pocahontas County, West Virginia, the geology of the Green Bank area containing the oldest rock in the county starts at Green Bank and extends southwestward, generally staying between West Virginia Routes 28 and 92 and extending south to Greenbrier County. This area is highly folded and is comprised of lower Devonian-, Silurian-, and Ordovician-aged rocks (National Resource Conservation Service [NRCS], 1992).

The observatory is located to the east of the Greenbrier River and, except for the area that extends from Green Bank southwestward into Greenbrier County, the material here is of upper and middle Devonian age. It includes the Chemung Group, the Brallier Formation, and the Millboro Shales (NRCS, 1992).

The highly karstified Greenbrier Limestone is located to the west of the subject property along the US 219 corridor, but extends throughout the county. Sinkholes and caves provide a conduit for water and contaminants into the subsurface with little opportunity for filtration (Pocahontas County Water Resources Management Plan, 2012).

4.1.5 Soils and Groundwater

According to the National Cooperative Soil Survey, the subject property is underlain by Allegheny, Weikert, Purdy, and Atkins soil types. These soils are loam to silty loam. Allegheny and Weikert are well to moderately drained, while Purdy and Atkins are poorly drained.

The Chemung Group is the largest expanse of geologic material exposed in the county. It consists of yellowish brown interbedded sandstone and shale. The sandstone ranges from lenses to massive ledges. Berks, Weikert, and Macove soils are on this formation. Mandy, Snowdog, and Trussel soils are at the higher elevations in the northeastern section of the county where the Chemung Group outcrops.

The Brallier Formation is comprised mainly of gray shale, but it includes some siltstone and fine grained sandstone. This formation weathers to form low, rounded hills that parallel the major drains. Weikert soils are on the residual portions of this geologic formation, and Macove and Allegheny soils are on foot slopes and stream terraces, respectively.

The Millboro Shales are comprised of black and greenish gray fissile shales, some of which are the most erodible rocks in the county. These areas are frequently covered by alluvial soils, such as Orrville, Lobdell, Tioga, and Potomac soils, and terrace soils, such as Allegheny and Chavies soils. They are in the main valleys east of the Greenbrier River, along creeks such as Knapps Creek, North Fork of Anthony Creek, Browns Creek, and Deer Creek, which flows through the subject property. Weikert soils are in the residual areas, which are usually low and rolling hills.

The regional groundwater flow direction is to the southwest (Pocahontas County Water Resources Management Plan, 2012). Locally, groundwater flow direction is impacted by topography, hydrogeology, soil characteristics, and nearby waterbodies. Groundwater flow in areas of the subject property adjacent to Deer Creek flow locally towards the creek and other surface water bodies. The subject property is not located in the 100-year or 500-year flood zones, as defined by the Federal Emergency Management Agency.

According to EDR, four groundwater wells are listed as being located on the subject property. All four wells are public water supply wells. No well construction information was available. Eleven wells registered to U.S. Geological Survey (USGS) are located within a 1-mile radius. The depths of these wells ranged from 35 feet below ground surface to 160 feet below ground surface.

4.1.6 Surface Water and Wetlands

A wetland and stream delineation and jurisdictional determination of Waters of the U.S. were not included in this effort. A desktop analysis was completed using the U.S. Fish and Wildlife Service (USFWS) National Wetland Inventory (USFWS, 2014), USGS quadrangle maps (USGS; Green Bank, West Virginia), Natural Resources Conservation Service Web Soil Survey (NRCS, 1992), and available aerial photography to identify potential wetlands and waterbodies.

Deer Creek is a perennial waterbody located at the base of Deer Creek Valley that extends along the northern portion of the subject property. Several ephemeral tributaries to Deer Creek extend through the subject property based on review of USGS quadrangle maps and available aerial photography.

A freshwater forested wetland system is located within the forested area south of the subject property and freshwater emergent wetlands are present along Deer Creek north of the subject property based on USFWS National Wetland Inventory mapping and available aerial photography.

4.1.7 Threatened and Endangered Species

Habitat assessments and species-specific surveys to determine the presence or absence of rare, threatened, or endangered (RTE) species were not included in this effort. Publically available sources of information regarding federal and state-listed RTE species that may be found on or in the vicinity of the subject property were evaluated as part of a desktop review. Sources included the USFWS Threatened and Endangered Species System internet database and the West Virginia Division of Natural Resources (WVDNR) Natural Heritage Database. State legislation for RTE species has not been established in West Virginia, therefore, RTE species management and regulatory protections are generally limited to those listed by the USFWS.

Six RTE species are listed by the USFWS as potentially occurring in Pocahontas County, West Virginia. A general habitat description and desktop evaluation of the potential utilization of the subject property by RTE species are summarized for each of the 5 species in **Table 4-1**. Impacts to RTE species is not anticipated because activities would be generally limited to previously disturbed areas within the subject property.

Table 4-1. Federally Protected Species

Environmental Baseline Study, Green Bank Observatory, West Virginia

Group	Name	Federal Status ^a	Habitat Description	Desktop Assessment
Amphibians	Cheat Mountain salamander (<i>Plethodon nettingi</i>)	Threatened	Red spruce-yellow birch or spruce-dominated forests; occasionally collected in mixed deciduous hardwoods	Unlikely; no activity proposed in forested areas.
Birds	Red knot (<i>Calidris canutus rufa</i>)	Proposed Threatened	Intertidal, marine habitats during non-breeding seasons. Breeds in the middle and high-Arctic areas of northern Canada.	Unlikely; potential stopover habitat only; marine and intertidal habitat not present.
Flowering Plants	Running buffalo clover (<i>Trifolium stoloniferum</i>)	Endangered	Mesic woodlands in partial to filtered sunlight with frequent ground disturbance. Often underlain with limestone or other calcareous bedrock.	Unlikely; no activity proposed in forested areas.
Mammals	Indiana bat (<i>Myotis sodalis</i>)	Endangered	Hibernates in caves; maternity sites generally behind loose bark of dead or dying trees or in tree cavities. Foraging habitats include riparian areas, upland forests, ponds, and fields	Unlikely; no caves are known to be present; no activity proposed in forested areas.
Mammals	Northern Long-Eared Bat (<i>Myotis septentrionalis</i>)	Threatened	Roosts during summer in colonies underneath bark, in cavities, or in crevices of both live and dead trees, caves and mines, or structures. Winter hibernacula includes caves and mines. Foraging habitat includes the understory of forested hillsides and ridges.	Unlikely; no caves are known to be present; no activity proposed in forested areas.
Mammals	Virginia northern flying Squirrel (<i>Glaucomys sabrinus fuscus</i>)	Recovery	Spruce, fir, spruce-hardwood, and northern hardwood forests, with well-developed understory.	Unlikely; no activity proposed in forested areas.

Sources:

USFWS Threatened and Endangered Species System (http://ecos.fws.gov/tess_public/)

West Virginia Division of Natural Resources Natural Heritage Database (<http://www.wvdnr.gov/Wildlife/Endangered.shtm>)

NatureServe (<http://explorer.natureserve.org/index.htm>)

^a State legislation for RTE species has not been established in West Virginia; RTE species management and regulatory protections are generally limited to those listed by the USFWS.

4.2 Environmental Factors

The following sections discuss environmental factors that may affect the subject property.

4.2.1 Hazardous Material/Petroleum Product Management

There is no single storage area for hazardous materials and petroleum products. The products were stored at a building where they intend to be used. Hazardous material/petroleum product inventory lists were not available. However, the following materials were observed:

- 20-meter telescope: One 55-gallon drum of synthetic gear oil and one drum of automatic transmission fluid. (Photograph 80)
- 85-1: Flammable locker with three 1-gallon cans of paint thinner, one 100-pound container of copper polish. (Photograph 81)
- Shed southwest of 85-1: One 55-gallon drum of automatic transmission fluid, one 55-gallon drum of motor oil, two 55-gallon drums of gear oil, five 5-gallon cans of oil. (Photograph 82)
- Inside 43-meter Telescope: Flammable locker with oils and lubricants, seven 55-gallon drums of hydraulic oil, one 5-gallon can of mineral spirits, one 55-gallon drum of antifreeze, two 55-gallon drums of automatic transmission fluid. (Photograph 83)
- Shed outside 43-meter Telescope: Twenty four 55-gallon drums of transmission fluid, eight 55-gallon drums of gear oil, and 15 5-gallon cans of lubricants. (Photographs 84-85)
- Warehouse outside storage shed: One 55-gallon drum label petroleum distillates, three 55-gallon drums of lubricant. (Photograph 86)
- Works Building: Four flammable lockers with spray paints, lubricants, cleaners, and solvents. (Photograph 87-90)
- Works Area garage: Small containers of spray paint, lubricants, cleaners, and solvents. Three 55-gallon drums of motor oil. (Photograph 91)
- Warehouse at works area: Six 55-gallon drums of lubricant. (Photograph 92)
- Paint Booth: Over 100 1-gallon cans of paint, flammable locker with paint and thinner. (Photograph 93)
- GBT warehouse: Twelve 55-gallon drums of synthetic lubricant, flammable locker with cleaners and lubricants. (Photograph 94)
- GBT storage yard: Thirty five 55-gallon drums of synthetic lubricant. (Photograph 95)

Fuel oil is also stored in aboveground storage tanks (ASTs) and underground storage tanks (USTs) as listed in Section 4.2.2 and 4.2.3, respectively.

No significant spills of hazardous materials or petroleum products were observed; however, the following staining was observed:

- 20-gallon drum of lubricant leaked on an absorbent pad in the 43-meter Telescope. (Photograph 96)
- Staining on the concrete floor of the GBT warehouse. (Photograph 97)
- Staining on the concrete floor in the Works Area garage (Photograph 91)
- Staining on the tile floor in the shed west of 85-1. (Photograph 81)

4.2.2 Aboveground Storage Tanks

There are four ASTs on the subject property (Photographs 98-101) and are described on Table 4-2.

Table 4-2. ASTs Located on the Subject Property
Environmental Baseline Study, Green Bank Observatory, West Virginia

AST Location	Capacity	Contents	Photograph
Elevated Water Tank	100,000 gallons	Water	73
Warehouse	500 gallons	Diesel	98
Works Area	2-350 gallons	Used oil	99-100
Fuel truck ^a	~1000 gallons	Diesel	101

^a A fuel truck was staged on a hill near Slavin Hollow Road.

A military-style fuel truck was staged north of the telescope area off of Slavin Hollow Road. The truck is permanently parked on a hillside and is used as a diesel AST. No secondary containment was observed under the filling ports behind the truck.

4.2.3 Underground Storage Tanks

A former fill station was located in front of the warehouse building. In 1991, water was found in the 1,000-gallon gasoline UST. Supply records showed that no gasoline was lost. The gasoline UST was emptied and filled with a cement slurry in 1991. The 3,000-gallon diesel UST was closed and filled with sand in 1994 when it was determined that regulation required the separation of over-the-road fuel from heating oil. Seven active heating oil USTs are located on the subject property. (NRAO, 2000). Table 4-3 summarizes the USTs on the subject property.

Table 4-3. USTs Located on the Subject Property
Environmental Baseline Study, Green Bank Observatory, West Virginia

Building	Capacity	Contents	Status
Warehouse	3,000 gallons	Diesel	Closed in place in 1994 and filled with sand.
Warehouse	1,000 gallons	Gasoline	Closed in place in 1991 and filled with a cement slurry.
Warehouse	2,000 gallons	Heating Oil	Active
Jansky Laboratory	10,000 gallons	Heating Oil	Active
Residence Hall	6,000 gallons	Heating Oil	Active
Works Area	5,000 gallons	Heating Oil	Active
Riley House	350 gallons	Heating Oil	Active
Nut Bin House	350 gallons	Heating Oil	Active
Shinnaberry House	350 gallons	Heating Oil	Active

4.2.4 Environmental Investigations

Soil contamination was discovered at the oil pond for the former 300-foot telescope after the telescope's collapse in 1989. The pond was drained and soil from the pond's bottom and sides were bio-

remediated. The West Virginia Department of Environmental Protection (WVDEP) issued a closure letter dated December 23, 1999 (NRAO, 2000).

In 1996, a fuel oil spill was found in the interstitial space between the newly installed UST at the Jansky Laboratory addition. The tank was improperly installed and the contractor replaced it and excavated the contaminated soil. Soil sample analysis confirmed that the contaminated soil was removed (NRAO, 2000). Photograph 102 shows the vent pipes of the UST at the Jansky Laboratory building.

A burn pile of scrap wood, brush, and furniture is located at the junkyard (Photograph 25). The WVDNR recommended removing the wastes, disposing of the wastes in the county landfill, and returning the land to its natural slope and drainage. The Environmental Log states this was done; however, there is a burn pile with scrap material at the location of the former junkyard.

4.3 Disclosure Factors

Disclosure factors are not regulated under CERCLA and, if properly managed, do not have an environmental impact on the property and do not affect the property categorization. However, their presence may result in an environmental concern if a release to the environment has occurred. Each of the disclosure factors are discussed in the following sections.

4.3.1 Asbestos-containing Materials

Renovation and demolition of buildings with asbestos-containing materials (ACMs) have the potential for releasing asbestos fiber into the air. Asbestos fibers could be released because of disturbance or damage to various building materials, such as pipe lagging, ceilings, floor tile, sheetrock, waterlines, and gasket material.

According to records, ACM surveys were performed in 1989 at the following buildings: 43-meter Telescope, 85-1 Control Building, Works Area Building, Jansky Laboratory Building, Residence Hall, Interferometer building, Warehouse Building, former 300-foot Telescope control building (now the Laser Lab in Table 2-1), and the Cable Building. Table 4-4 presents the ACM at the subject property. (Brackenrich & Associates, Inc., 1989)

Table 4-4. Confirmed ACM

Environmental Baseline Study, Green Bank Observatory, West Virginia

Building	ACM	Friable/Non-friable
43-meter Telescope	Ceiling plaster	Friable
	Air duct splicing	Non-friable
	Pipe insulation	Friable
85-1 Control Building	9"x9" floor tiles	Non-friable
	Dry wall	Friable
	Pipe insulation	Friable
Works Area Building	9"x9" floor tiles	Non-friable
	1' x 1' floor tiles	Non-friable
	Transite wall panels	Non-friable
	Pipe insulation	Friable
	Pipe elbow insulation	Friable

Table 4-4. Confirmed ACM*Environmental Baseline Study, Green Bank Observatory, West Virginia*

Building	ACM	Friable/Non-friable
	Drain pipe insulation	Friable
	Drain pipe elbow insulation	Friable
Jansky Laboratory Building	9"x9" floor tiles	Non-friable
	Pipe insulation	Friable
	Pipe elbow insulation	Friable
Residence Hall	9"x9" floor tiles	Non-friable
	1' x 1' floor tiles	Non-friable
	Pipe insulation	Friable
	Pipe elbow insulation	Friable
Interferometer Control Building	9"x9" floor tiles	Non-friable
	Pipe insulation	Friable
	Air unit jacket	Friable
	Air duct splice	Non-friable
Warehouse Building	9"x9" floor tiles	Non-friable
	1' x 1' floor tiles	Non-friable
Cable Building	9"x9" floor tiles	Non-friable

Source: Brackenrich & Associates, Inc., 1989

No records of ACM surveys of other structures including the residential homes were found or known to exist. Asbestos encapsulation was performed on friable asbestos pipe insulation at the pool room, the Jansky Laboratory Building (Photograph 103), and the cafeteria basement in 1991. ACM was removed from the Jansky Laboratory crawl space, portico roof, and the west end first floor corridor air lock in 1995 (NRAO, 2000).

4.3.2 Lead-based Paint

Lead is a heavy, ductile metal commonly found in association with organic compounds, oxides, salts, and metallic lead. Human exposure to lead has been classified as an adverse health risk by agencies such as the Occupational Safety and Health Administration and U.S. Environmental Protection Agency (USEPA). Sources of exposure to lead include paint, dust, and soil.

Exposure to lead-based paint (LBP) primarily presents a health concern to children, and its use was generally discontinued in 1978. The routine application of LBP in the past, and the associated peeling or degradation of paint over time, have created the potential for localized lead contamination in soils around buildings that were constructed before or during 1978.

No LBP surveys were available for review. Significant peeling paint was not observed during the site reconnaissance and no paint chips were observed on the ground surfaces.

4.3.3 Polychlorinated Biphenyls

Electrical transformers, electrical equipment, light ballasts, and machinery with hydraulic systems are potential sources of polychlorinated biphenyl (PCB)-containing oil. A PCB survey was completed in October 1988. As a result of the survey, all transformers, capacitors, and switches containing PCBs were replaced with non-PCB oil.

Pole-mounted and pad-mounted transformers were located throughout the subject property and are associated with the buildings currently being used. These transformers were not labeled to indicate the presence or absence of PCBs. They appeared to be in good condition and no leaks, soil staining, or stressed vegetation was observed around the poles or pads.

Light ballasts in the buildings were not checked to determine if they contain PCBs.

4.3.4 Radon

In July 1994, a radon survey was conducted at basements of the main buildings. Only the Laser Lab had radon levels above 4 picoCuries per liter (pCi/L). The remedy was to keep the heating, ventilation, and air conditioning system on and keep the doors between the areas open. Subsequent tests resulted in radon levels below 4 pCi/L. In 1997, residential houses with basements were tested for radon. The Shinnaberry House, Nut Bin House, and the Tracy House were above 4 pCi/L and were outfitted with sub-slab ventilation systems.

4.3.5 Medical/Biohazardous Waste

From the records search and interviews, no medical or biohazardous waste was found to be stored on the subject property.

4.3.6 Munitions and Explosives of Concern

A shooting range is located at the northeast corner of the property for employee recreational use. The range is still active (Photograph 104). Casings from small caliber bullets were found at the firing points (Photograph 105). The shooting range may have lead in soil at the target areas and gunpowder residues, including polycyclic aromatic hydrocarbons, may have reached the soil at the firing line.

Findings: Adjacent Properties

5.1 Land Use

More than half of the land in Pocahontas County is managed by the U.S. Forest Service and owned by the federal government, with another 6 percent in state park land. The primary land uses in the county are forest and agriculture. The land use adjacent to the subject property is low density, rural residential/agricultural with commercial/retail strip development along Route 28 and 92. Employment is tied to agriculture, forestry, and tourism. Nearby Snowshoe Mountain attracts visitors for winter sports.

5.2 Surveyed Properties

CH2M contracted with EDR of Milford, Connecticut, to review available regulatory agency databases for sites within the various ASTM-prescribed radii of the property. The specific radii are identified according to source in the complete database search, provided in Attachment B. Additional sources of information include:

- GoogleEarth
- Pocahontas County Water Resources Management Plan. 2012
- WVDEP Agency Geospatial Technologies. Open Dump Website. <http://www.dep.wv.gov/gis-and-maps/Pages/default.aspx>. Accessed November 24, 2014.
- WVDEP Database of all Leaking Underground Storage Tank sites. Accessed November 24, 2014.

The following databases were searched and provided in EDR report to identify generators and transporters of hazardous wastes; hazardous waste treatment, storage, and disposal facilities; and sites where releases of hazardous materials have been reported:

5.2.1 Federal Databases

- USEPA National Priorities List (NPL) of uncontrolled or abandoned hazardous waste sites identified for priority remedial action (last updated 10/25/13)
- USEPA Delisted NPL site list (last updated 10/25/13)
- USEPA Proposed NPL site list (last updated 10/25/13)
- USEPA Comprehensive Environmental Response, Compensation, and Liability Information System (CERCLIS) list of sites that either are proposed for or are on the NPL and sites that are in the screening and assessment phase for possible inclusion on the NPL (last updated 10/25/13)
- Federal Facility site listing of NPL and Base Realignment and Closure (BRAC) sites found in CERCLIS database (last updated 07/21/14)
- CERCLIS No Further Remedial Action Planned sites where, following an initial investigation, no contamination was found, contamination was removed quickly, or the contamination was not serious enough to require federal Superfund action or NPL consideration (last updated 10/25/13)

- EPA database of Resource Conservation and Recovery Act (RCRA) facilities that are undergoing corrective action(CORRACTS)because there has been a release of hazardous waste or constituents into the environment from a RCRA facility (last updated 06/10/14)
- Treatment, storage, and disposal facilities (RCRA-TSDF) (last updated 06/10/2014)
- USEPA RCRA large-quantity, small-quantity, and conditionally exempt small-quantity generators (last updated 06/10/2014)
- U.S. Engineering Controls: Federal institutional control and engineering control registries (last updated 09/18/2014)
- Land Use Control Information System (LUCIS) records pertaining to former Navy Base Realignment and Closure sites (last updated 08/29/2014)
- Federal Emergency Response Notification System (ERNS) list of reported accidental releases of oil and hazardous substances (last updated 9/30/13)
- Federal Emergency Management Agency UST locations (last updated 01/01/10)
- U.S. Brownfields (last updated 09/22/14)
- Open Dump Inventory(ODI) (last updated 06/30/1985)
- U.S. Clandestine Drug Labs (US CDL) Drug Enforcement Administration (last updated 07/25/14)
- LIENS2 is the CERCLA Lien Information database (last updated 02/18/14)
- USEPA database of Superfund Consent Decrees (last updated 12/31/13)
- Records of Decision that document permanent remedies at an NPL site (last updated 11/25/13)
- USEPA Toxic Substances Control Act (TSCA) database, which identifies manufacturers and importers of chemical substances (last updated 12/31/2006)
- USEPA Office of Prevention, Pesticides and Toxic Substances Federal Insecticide, Fungicide, & Rodenticide Act (FIFRA)/Federal TSCA Tracking System (FTTS), which tracks administrative cases and pesticide enforcement actions and compliance activities related to FIFRA, TSCA, and the Emergency Planning and Community Right-to-Know Act (last updated 04/09/2009)
- U.S. Mines Master Index File Department of Labor (last updated 01/30/2014)
- Section 7 Tracking Systems reports types and amounts of pesticides, active ingredients, and devices produced (last updated 12/31/2009)
- National Clandestine Laboratory Registry (US HIST CDL) for either clandestine drug laboratories or dump sites (last updated 07/25/2014)
- U.S. Department of Transportation (DOT) Hazardous Materials Information Reporting System (HMIRS), which contains hazardous material spill incidents reported to DOT (last updated 06/30/14)
- USEPA database of RCRA facilities that currently do not generate hazardous waste (RCRA-NonGen) (last updated 06/10/14)
- USEPA Records of Decision (ROD) database (last updated 11/25/13)
- U.S. DOT Office of Pipeline Safety (OPS) Incident and Accident Data (last updated 07/31/12)
- U.S. Department of Defense Sites (DOD) (last updated 12/31/2005)
- U.S. Army Corps of Engineers Former Used Defense Sites (FUDS) (last updated 06/06/2014)

- USEPA database of Superfund Consent Decrees (CONSENT) (last updated 12/31/13)
- Uranium Mill Tailings Sites (UMTRA) locations (last updated 09/14/2010)
- Emergency Planning and Community Right-to-Know Act inventory of toxic chemical emissions (Toxic Release Inventory System [TRIS]) (last updated 12/31/2011)
- Integrated Compliance Information System (ICIS) national enforcement and compliance program for the National Pollutant Discharge Elimination System (NPDES) (last updated 05/06/2014)
- USEPA PCB Activity Data Systems (PADS), which identifies transporters, commercial stores, and/or brokers, and disposers of PCBs who are required to notify EPA (last updated 06/01/13)
- EPA Material Licensing Tracking System (MLTS), maintained by the Nuclear Regulatory Commission, maintains list of sites that possess or use radioactive materials (last updated 07/22/13)
- Radiation Information Database (RADINFO) facilities regulated by USEPA for radiation and radioactivity (last updated 07/07/14)
- USEPA Facility Index System (FINDS) that contains information and “pointers” to other sources that contain more detail, including permit compliance system (PCS), Aerometric Information Retrieval System (AIRS), Enforcement Docket (DOCKET), Federal Underground Injection Control (FURS), Criminal Docket (C-DOCKET), Federal Facilities Information System (FFIS), state environmental laws and statutes (STATE), and PCB activity data system (PADS) (last updated 08/16/14)
- RCRA Administrative Action Tracking System (RAATS) contains records based on enforcement actions (last updated 04/17/1995)
- EPA Risk Management Plans (RMP) chemical accident prevention at facilities using extremely hazardous substances (last updated 04/01/2014)
- EPA Biennial Reporting System (BRS) database, which collects detailed data regarding large-quantity generators and treatment, storage, and disposal facilities (last updated 12/31/2011)
- State Underground Injection Wells (UIC) (last updated 07/15/2014)
- EPA 2020 Corrective Action List, (COR ACTION) a RCRA cleanup baseline includes facilities expected to need corrective action (last updated 11/11/2011)
- EPA Lead Smelter Sites a listing of former lead smelter locations (last updated 06/04/14)
- EPA Potentially Responsible Parties (PRP) a listing of verified potential responsible parties (last updated 10/25/13)
- EPA Financial Assurance Information (US FIN ASSUR) facilities that treat, store, or dispose of hazardous waste are required to provide proof that they will have sufficient funds to pay for the cleanup, closure, and post-closure care (last updated 09/04/14)
- Steam-Electric Plant Operation Data (COAL ASH DOE) listing of power plants that store ash in surface ponds (last updated 12/31/2005)
- US AIRS (AFS) Aerometric Information Retrieval System Facility Subsystem contains compliance data on air pollution sources (last updated 10/23/2013)
- US AIRS MINOR Air Facility Systems Data is a listing of minor source facilities (last updated 10/23/2013)
- Coal combustion residues surface impoundments (COAL ASH EPA) list (last updated 07/01/2014)
- PCB Transformer Database (PCB TRANSFORMER) registration database (last updated 02/01/2011)

- EPA Watch List on enforcement matters (last updated 08/30/2013)
- Uranium Mill Tailings Sites locations (last updated 09/14/2010)

5.2.2 State and Tribal Databases

- Indian Reservation Locations (INDIAN RESERV) (last updated 12/31/2005)
- Federally and Indian administrated lands (FEDLAND) (last updated 12/31/2005)
- Indian Report on the Status of Open Dumps on Indian Land (INDIAN ODI) (last updated 12/31/1998)
- Solid Waste Facilities/Landfill Sites (SWF/LF) contains an inventory of solid waste disposal facilities or landfills in West Virginia (last updated 01/16/2014)
- Landfill Closure Program (LCP) database on non-lined landfills required to close (last updated 12/31/2013)
- Leaking Underground Storage Tank (LUST) database contains an inventory of reported LUST incidents (last updated 05/07/2014)
- UST database contains data regarding registered USTs (last updated 06/04/2014)
- State institutional control (INST CONTROL) registries (last updated 05/01/2014)
- Voluntary Cleanup, Oversight, and Assistance Program (VCP) allows the opportunity to work proactively with state government to address necessary cleanup of a property to return it to productive use (last updated 05/01/2014)
- Brownfields listings in West Virginia (last updated 05/14/2013)
- State Clandestine Drug Labs (CDL) WVDEP (last updated 11/26/12)
- State Dry Cleaners Listing (DRYCLEANERS) of locations that use perchloroethylene (last updated 05/19/2014)
- Coal ash (COAL ASH) landfill sites list (last updated 04/07/2011)
- State Spills (SPILLS) listing of spills locations (last updated 07/28/2014)
- State Coalition for remediation of drycleaners (SCRD DRYCLEANERS) (last updated 03/07/2011)
- National Pollutant Discharge Elimination System (NPDES) permitted wastewater discharges (last updated 01/19/2010)
- AIRS contains a list of permitted sources by the WVDEP (last updated 01/29/2014)
- State Financial Assurance List (last updated 03/05/2013)

5.2.3 Additional Environmental Site Information

Although the subject property was not listed in any of the databases searched by EDR, adjacent properties were listed in the LUST, UST, FTTS, Historical Federal TSCA Tracking System (HIST FTTS), Underground Injection Control (UIC), and Financial Assistance databases in the EDR report as shown in Table 5-1. Distances of the sites ranged from the boundary of the subject property to 1 mile from the subject property boundary.

The LUST site had soil contamination only and remediation was completed in July 2007. No information was available for the UIC at the Green Bank Elementary-Middle School.

Table 5-1. EDR Database Listings*Environmental Baseline Study, Green Bank Observatory, West Virginia*

Site Name	Database(s)	Site Address	Location Relative to Site
Ryder's Chevron - Arbovale	LUST, UST, Financial Assistance	16811 Potomac Highlands Trail, Arbovale, WV 24915	Approximately 0.4 miles east of the nearest property line of the property
Green Bank Elementary-Middle School	UIC	5917 Potomac Highlands Trail, Green Bank, WV 24944	Approximately 0.4 miles east of the nearest property line of the property
Lamp of Youth Christian - Green Bank	FTTS, HIST FTTS	Route 28, Green Bank, WV 24944	Approximately 0.6 miles east of the nearest property line of the property

Although, the EDR Report did not identify any orphan properties (unknown locations), a review of the WVDEP petroleum cleanup database identified the locations listed in Table 5-2 in addition to Ryder's Chevron in Arbovale.

Table 5-2. WVDEP Petroleum Database Listings*Environmental Baseline Study, Green Bank Observatory, West Virginia*

Site Name	Database(s)	Site Address
Green Bank Sub Station 08382 - Green Bank	WVDEP LUST – Cleanup completed 09/10/2014	Route 28 and 92, Green Bank, WV 24944
Green Bank Sub Station 08382 - Green Bank	WVDEP LUST – Cleanup completed 06/30/2008	Route 28 and 92, Green Bank, WV 24944
Moore's Ready Mix - Green Bank	WVDEP LUST – Cleanup completed 06/09/2008	Unknown, Green Bank, WV 24944
Cass Scenic Railroad - Cass	WVDEP LUST – release 03/19/2004	Unknown, Cass, WV 24927
Old General Store	WVDEP LUST – Cleanup completed 06/28/1994	Unknown, Cass, WV 24927
Moore's Store	WVDEP LUST – Cleanup completed 08/03/1995	Unknown, Cass, WV 24927
Mountain State Telephone	WVDEP LUST – Cleanup completed 06/16/1995	Route 92, Arbovale, WV 24944

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SECTION 6

Interviews

Interviews were conducted on October 6-9, 2014 with the personnel listed in Table 6-1.

Table 6-1. Personnel Interviewed during the Site Visit
Environmental Baseline Study, Green Bank Observatory, West Virginia

Personnel	Title or Department	Information or Services Provided
Mr. Johnny Samples	Safety and Environmental Manager/NRAO	Provided historical documentation related to the subject property, particularly asbestos reports and the 300-foot telescope oil pond release. He is unaware of any environmental issues that could affect the environmental condition of property.
Mr. Michael Holstine	Green Bank Observatory Business Manager	Provided UST information.
Mr. Jody Bolyard	NRAO Environmental Safety and Security (ES&S) Manager	Point of contact for the site reconnaissance. Provided the environmental log.

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Findings and Conclusions

This section consolidates the findings presented in Sections 4 and 5 in accordance with ASTM E1527-13, *Standard Practice for Environmental Site Assessments: Phase I Environmental Site Assessment Process*. The subject property has been classified into property category types.

7.1 Environmental Condition Factors

The findings of this EBS report were based on reasonably available environmental information; interviews with site, state, and local personnel; a review of previous environmental studies; and federal and state database and file information related to the storage, release, treatment, or disposal of hazardous substances or petroleum products. Results were also based on visual observations of the subject property and adjacent properties.

7.1.1 Recognized Environmental Conditions

RECs are defined as the presence or likely presence of a hazardous substance or petroleum product on the property under conditions that indicate an existing release, a past release, or material threat of a release of hazardous substances or petroleum products into the structures of the property or into the ground, groundwater, or surface water of the property. The term includes hazardous substances or petroleum products even under conditions in compliance with applicable laws. The term is not intended to include de minimis conditions that generally do not present a material risk of harm to public health or the environment and that generally would not be subject to enforcement action if brought to the attention of the appropriate government agencies.

The following RECs were found on the subject property:

- A 1,000-gallon gasoline underground storage tank was abandoned in place (emptied and filled with a cement slurry) in 1991 after water was found in the gasoline. Soil samples were not collected to determine if there was a release.
- The shooting range may have lead in soil at the target areas and gunpowder residues including polycyclicaromatic hydrocarbons may have reached the soil at the firing line.

7.1.2 Historical Recognized Environmental Conditions

A Historical Recognized Environmental Condition (HREC) is one that in the past would have been considered a REC, but is not currently considered a REC. If a past release of a hazardous substance or petroleum product has occurred in connection with the subject property and has been remediated, with such remediation accepted by a responsible regulatory agency, that condition is considered an HREC. The following HRECs were found on the subject property:

- The 300-foot telescope oil pond closure. Soil at the bottom and walls of the oil pond were bio-remediated. A closure letter was issued on December 23, 1999.
- Fuel oil was found leaking from a newly installed UST at the Jansky Laboratory building. The tank and contaminated soil was excavated. Soil sample analysis showed that the contaminated soil was removed.

7.1.3 De Minimis Conditions

De minimis conditions are conditions that generally do not present a material risk of harm to public health or the environment and that generally would not be subject to an enforcement action if brought to the attention of the appropriate government agencies. Conditions determined to be de minimis are not RECs. The following de minimis conditions were identified on the subject property:

- 20-gallon drum of lubricant leaked on an absorbent pad in the 43-meter Telescope
- Staining on the concrete floor of the GBT warehouse
- Staining on the concrete floor in the Works Area garage
- Staining on the tile floor in the shed southwest of 85-1

7.1.4 Other Conditions of Note

The following are other conditions on the subject property that are not considered RECs, but are worth disclosing:

- According to the 1989 Asbestos Management Plan, 9 buildings were surveyed for asbestos-containing materials (ACM). Other buildings including residential homes were not surveyed. ACM was found at the following buildings: 43-meter Telescope, 85-1 Control Building, Works Area Building, Jansky Laboratory Building, Residence Hall, Interferometer Control Building, Warehouse Building, and the Cable Building.
- A burn pile of scrap wood, brush, and furniture is located at the junkyard. The WVDNR recommended removing the wastes, disposing of the wastes in the county landfill, and returning the land to its natural slope and drainage. The Environmental Log states this was done; however, there is a burn pile with scrap material at the location of the former junkyard.
- A military-style fuel truck was staged north of the telescope area off of Slavin Hollow Road. The truck is permanently parked on a hillside and is used as a diesel AST. No secondary containment was observed under the filling port behind the truck. Spills from the truck would immediately impact the soil.

To assess the potential for adjacent properties to affect the property, a records search and database search of RECs within 1 mile of the subject property was performed for this EBS assessment (see Attachment B). No other neighboring properties appear to have the potential to environmentally affect the subject property.

SECTION 8

Certification for the Green Bank EBS

CH2M has performed an EBS for the approximately 2,200-acre subject property located in Pocahontas County, West Virginia. We reviewed all of the appropriate records that were made available and conducted site inspections of the facility. The information in this EBS report is based on records made available and, to the best of CH2M's knowledge, is correct and current as of October 2014.

We declare that, to the best of our professional knowledge and belief, we meet the definition of environmental professional as defined in §312.10 of 40 *Code of Federal Regulations* Part 312, and we have the specific qualifications based on education, training, and experience to assess a property of the nature, history, and setting of the subject properties. We have developed and performed all of the appropriate inquiries in conformance with the standards and practices set forth in 40 *Code of Federal Regulations* Part 312.

Michael Brose
Environmental Scientist
CH2M

Date

David Stieb
Senior Technical Reviewer
CH2M

Date

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SECTION 9

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Attachment A
Site Reconnaissance Photographs



Photo 1: Green Bank Telescope facing north.



Photo 2: 43-meter Telescope facing east.



Photo 3: Sheds next to 43-meter Telescope



Photo 4: 20-meter telescope facing north.



Photo 5: 45-foot telescope south.



Photo 6: 40-foot telescope facing south.



Photo 7: 85-1 interferometer facing south.



Photo 8: 85-2 interferometer facing northeast.



Photo 9: 85-3 interferometer facing south.



Photo 10: Laser lab facing west.



Photo 11: Former interferometer control building facing north.



Photo 12: Gabel Barn



Photo 13: Gambrel barn



Photo 14: Old experiment building facing northwest.



Photo 15: Slavin Barn facing north.



Photo 16: GBT storage building facing west.



Photo 17: Inside GBT storage building facing west.



Photo 18: GBT storage yard facing west.



Photo 19: GBT storage yard shed facing east.



Photo 20: Beard House facing north.



Photo 21: Beard House facing south.



Photo 22: Shed at 85-1 facing northeast.



Photo 23: Scrap metal at junkyard facing north.



Photo 24: Waste tires facing northeast.



Photo 25: Burn pile facing west.



Photo 26: Science Center building facing north.



Photo 27: Jansky Laboratory facing northeast.



Photo 28: Storage warehouse at works area facing west.



Photo 29: Inside storage warehouse at works area facing northwest.



Photo 30: Covered storage at works area facing west.



Photo 31: Warehouse building facing north.



Photo 32: Works building facing northeast.



Photo 33: Paint booth facing north.



Photo 34: Bunk house facing north.



Photo 35: Residence hall/cafeteria facing northeast.



Photo 36: Redwood house facing north.



Photo 37: House #2 facing southwest.



Photo 38: House #3 facing northeast.



Photo 39: House # 4 facing southwest.



Photo 40: House #5 facing northeast.



Photo 41: House #6 facing southwest.



Photo 42: House #7 facing northeast.



Photo 43: House #8 facing southwest.



Photo 44: House #9 facing northeast.



Photo 45: House #10 facing southwest.



Photo 46: House #11 facing northeast.



Photo 47: House #14 facing northeast.



Photo 48: House #16 facing northeast.



Photo 49: House #19 facing northeast.



Photo 50: House #21 facing northeast.



Photo 51: House #23 facing northeast.



Photo 52: House #24 facing northeast.



Photo 53: Hill House facing west.



Photo 54: Tracey House facing northeast.



Photo 55: Riley House facing south.



Photo 56: Nut Bin facing north.



Photo 57: Shinnaberry House facing northwest.



Photo 58: Townhouses facing southwest.



Photo 59: Hannah House facing north.



Photo 60: Swimming pool facing south.



Photo 61: Pavilion facing north.



Photo 62: Tennis courts facing southeast.



Photo 63: Shooting range facing north.



Photo 64: Barn near airstrip facing northwest.



Photo 65: Sheds east of 85-1.



Photo 66: Sheds southwest of 85-1.



Photo 67: Weather station facing north.



Photo 68: 140-telescope sheds facing east.



Photo 69: 140-telescope sheds facing east.



Photo 70: Top of Little Big Horn antenna facing southwest.



Photo 71: Base of Little Big Horn antenna facing north.



Photo 72: Drinking water wells facing north.



Photo 73: 100,000-gallon water tower facing northwest.



Photo 74: Wastewater treatment ponds facing west.



Photo 75: Shooting range shed facing northeast.



Photo 76: Airstrip facing northwest.



Photo 77: Outfall at wastewater treatment ponds facing south.



Photo 78: Electrical substation facing north.



Photo 79: Deer Creek at Hannah Run Road facing east.



Photo 80: Drums at 20-meter telescope facing southwest.



Photo 81: Flammable locker at 85-1.



Photo 82: Inside shed southwest of 85-1.



Photo 83: Inside 43-meter Telescope.



Photo 84: Shed outside 43-meter Telescope.



Photo 85: Inside garage at 43-meter Telescope.



Photo 86: Inside shed behind warehouse building facing north.



Photo 87: Flammable locker in Works building.



Photo 88: Flammable locker in Works building.



Photo 89: Flammable locker in Works building.



Photo 90: Flammable locker in Works building.



Photo 91: Inside Works Area garage.



Photo 92: Inside warehouse north of Works building.



Photo 93: Inside Paint booth storage room.



Photo 94: Inside GBT Warehouse.



Photo 95: Drums at GBT storage yard.



Photo 96: Drum leak at 43-meter Telescope.



Photo 97: Staining of concrete floor inside GBT warehouse.



Photo 98: Diesel fuel AST behind Warehouse.



Photo 99: Waste oil AST at Work Area outside storage yard.



Photo 100: Waste oil AST at Work Area outside storage yard.



Photo 101: Tanker truck used to store diesel fuel north of 43-meter Telescope facing north.



Photo 102: UST at Jansky Laboratory.



Photo 103: Encapsulated ACM at Jansky Laboratory.



Photo 104: Shooting range facing north.



Photo 105: Bullet casings at shooting range.

Attachment B
Environmental Data Resources, Inc.,
Radius Map Reports with Geocheck

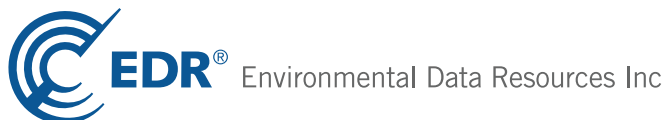
Green Bank

Potomac Highland Trail and Slavin Hollow Rd
Cass, WV 24927

Inquiry Number: 4103240.2s
October 29, 2014

The EDR Radius Map™ Report with GeoCheck®

Prepared using the EDR FieldCheck® System



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Shelton, CT 06484
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www.edrnet.com

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Thank you for your business.
Please contact EDR at 1-800-352-0050
with any questions or comments.

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EXECUTIVE SUMMARY

A search of the environmental records was conducted by Environmental Data Resources, Inc. (EDR). CH2M HILL, INC. used the EDR FieldCheck System to review and/or revise the results of this search, based on independent data verification by CH2M HILL, INC.. The report was designed to assist parties seeking to meet the search requirements of EPA's Standards and Practices for All Appropriate Inquiries (40 CFR Part 312), the ASTM Standard Practice for Environmental Site Assessments (E 1527-13) or custom requirements developed for the evaluation of environmental risk associated with a parcel of real estate.

TARGET PROPERTY INFORMATION

ADDRESS

POTOMAC HIGHLAND TRAIL AND SLAVIN HOLLOW RD
CASS, WV 24927

COORDINATES

Latitude (North): 38.4357000 - 38° 26' 8.52"
Longitude (West): 79.8380000 - 79° 50' 16.80"
Universal Transverse Mercator: Zone 17
UTM X (Meters): 601418.1
UTM Y (Meters): 4254591.5
Elevation: 2645 ft. above sea level

USGS TOPOGRAPHIC MAP ASSOCIATED WITH TARGET PROPERTY

Target Property Map: 38079-D7 GREEN BANK, WV
Most Recent Revision: 1998

AERIAL PHOTOGRAPHY IN THIS REPORT

Portions of Photo from: 20111006
Source: USDA

TARGET PROPERTY SEARCH RESULTS

The target property was not listed in any of the databases searched by EDR.

DATABASES WITH NO MAPPED SITES

No sites were identified in following databases.

STANDARD ENVIRONMENTAL RECORDS

Federal NPL site list

NPL..... National Priority List

EXECUTIVE SUMMARY

Proposed NPL..... Proposed National Priority List Sites
NPL LIENS..... Federal Superfund Liens

Federal Delisted NPL site list

Delisted NPL..... National Priority List Deletions

Federal CERCLIS list

CERCLIS..... Comprehensive Environmental Response, Compensation, and Liability Information System
FEDERAL FACILITY..... Federal Facility Site Information listing

Federal CERCLIS NFRAP site List

CERC-NFRAP..... CERCLIS No Further Remedial Action Planned

Federal RCRA CORRACTS facilities list

CORRACTS..... Corrective Action Report

Federal RCRA non-CORRACTS TSD facilities list

RCRA-TSDF..... RCRA - Treatment, Storage and Disposal

Federal RCRA generators list

RCRA-LQG..... RCRA - Large Quantity Generators
RCRA-SQG..... RCRA - Small Quantity Generators
RCRA-CESQG..... RCRA - Conditionally Exempt Small Quantity Generator

Federal institutional controls / engineering controls registries

US ENG CONTROLS..... Engineering Controls Sites List
US INST CONTROL..... Sites with Institutional Controls
LUCIS..... Land Use Control Information System

Federal ERNS list

ERNS..... Emergency Response Notification System

State- and tribal - equivalent CERCLIS

SHWS..... This state does not maintain a SHWS list. See the Federal CERCLIS list and Federal NPL list.

State and tribal landfill and/or solid waste disposal site lists

SWF/LF..... List of M.S.W. Landfills/Transfer Station Listing
LCP..... Landfill Closure Program

State and tribal leaking storage tank lists

INDIAN LUST..... Leaking Underground Storage Tanks on Indian Land

State and tribal registered storage tank lists

INDIAN UST..... Underground Storage Tanks on Indian Land

EXECUTIVE SUMMARY

FEMA UST..... Underground Storage Tank Listing

State and tribal institutional control / engineering control registries

INST CONTROL..... Sites with Institutional Controls

State and tribal voluntary cleanup sites

INDIAN VCP..... Voluntary Cleanup Priority Listing

VCP..... Voluntary Remediation Sites

State and tribal Brownfields sites

BROWNFIELDS..... Brownfields Sites Listing

ADDITIONAL ENVIRONMENTAL RECORDS

Local Brownfield lists

US BROWNFIELDS..... A Listing of Brownfields Sites

Local Lists of Landfill / Solid Waste Disposal Sites

DEBRIS REGION 9..... Torres Martinez Reservation Illegal Dump Site Locations

ODI..... Open Dump Inventory

INDIAN ODI..... Report on the Status of Open Dumps on Indian Lands

Local Lists of Hazardous waste / Contaminated Sites

US CDL..... Clandestine Drug Labs

CDL..... Drug Lab Site Locations

US HIST CDL..... National Clandestine Laboratory Register

Local Land Records

LIENS 2..... CERCLA Lien Information

Records of Emergency Release Reports

HMIRS..... Hazardous Materials Information Reporting System

SPILLS..... Spills Listing

Other Ascertainable Records

RCRA NonGen / NLR..... RCRA - Non Generators / No Longer Regulated

DOT OPS..... Incident and Accident Data

DOD..... Department of Defense Sites

FUDS..... Formerly Used Defense Sites

CONSENT..... Superfund (CERCLA) Consent Decrees

ROD..... Records Of Decision

UMTRA..... Uranium Mill Tailings Sites

US MINES..... Mines Master Index File

TRIS..... Toxic Chemical Release Inventory System

TSCA..... Toxic Substances Control Act

EXECUTIVE SUMMARY

SSTS.....	Section 7 Tracking Systems
ICIS.....	Integrated Compliance Information System
PADS.....	PCB Activity Database System
MLTS.....	Material Licensing Tracking System
RADINFO.....	Radiation Information Database
FINDS.....	Facility Index System/Facility Registry System
RAATS.....	RCRA Administrative Action Tracking System
RMP.....	Risk Management Plans
DRYCLEANERS.....	Listing of Drycleaner Locations
NPDES.....	Wastewater Discharge Permits Listing
AIRS.....	Permitted Facility and Emissions Listing
INDIAN RESERV.....	Indian Reservations
SCRD DRYCLEANERS.....	State Coalition for Remediation of Drycleaners Listing
US FIN ASSUR.....	Financial Assurance Information
COAL ASH EPA.....	Coal Combustion Residues Surface Impoundments List
PCB TRANSFORMER.....	PCB Transformer Registration Database
COAL ASH.....	Coal Ash Landfills
EPA WATCH LIST.....	EPA WATCH LIST
LEAD SMELTERS.....	Lead Smelter Sites
2020 COR ACTION.....	2020 Corrective Action Program List
US AIRS.....	Aerometric Information Retrieval System Facility Subsystem
PRP.....	Potentially Responsible Parties
COAL ASH DOE.....	Steam-Electric Plant Operation Data

EDR HIGH RISK HISTORICAL RECORDS

EDR Exclusive Records

EDR MGP.....	EDR Proprietary Manufactured Gas Plants
EDR US Hist Auto Stat.....	EDR Exclusive Historic Gas Stations
EDR US Hist Cleaners.....	EDR Exclusive Historic Dry Cleaners

EDR RECOVERED GOVERNMENT ARCHIVES

Exclusive Recovered Govt. Archives

RGA LF.....	Recovered Government Archive Solid Waste Facilities List
RGA LUST.....	Recovered Government Archive Leaking Underground Storage Tank

SURROUNDING SITES: SEARCH RESULTS

Surrounding sites were identified in the following databases.

Elevations have been determined from the USGS Digital Elevation Model and should be evaluated on a relative (not an absolute) basis. Relative elevation information between sites of close proximity should be field verified. Sites with an elevation equal to or higher than the target property have been differentiated below from sites with an elevation lower than the target property.

Page numbers and map identification numbers refer to the EDR Radius Map report where detailed data on individual sites can be reviewed.

Sites listed in ***bold italics*** are in multiple databases.

Unmappable (orphan) sites are not considered in the foregoing analysis.

EXECUTIVE SUMMARY

STANDARD ENVIRONMENTAL RECORDS

State and tribal leaking storage tank lists

LUST: The Leaking Underground Storage Tank Incident Reports contain an inventory of reported leaking underground storage tank incidents. The data come from the Department of Commerce, Labor & Environmental Resources' Leaking Underground Storage Tanks database.

An online review and analysis by CH2M HILL, INC. of the LUST list, as provided by EDR, and dated 05/07/2014 has revealed that there is 1 LUST site within approximately 1.5 miles of the target property.

<u>Equal/Higher Elevation</u>	<u>Address</u>	<u>Direction / Distance</u>	<u>Map ID</u>	<u>Page</u>
<i>RYDERS CHEVRON</i>	<i>16811 POTOMAC HIGHLANDSE</i>	<i>1/4 - 1/2 (0.350 mi.)</i>	<i>1</i>	<i>7</i>

State and tribal registered storage tank lists

UST: The Underground Storage Tank database contains registered USTs. USTs are regulated under Subtitle I of the Resource Conservation and Recovery Act (RCRA). The data come from the Department of Commerce, Labor & Environmental Resources.

An online review and analysis by CH2M HILL, INC. of the UST list, as provided by EDR, and dated 06/04/2014 has revealed that there is 1 UST site within approximately 1.25 miles of the target property.

<u>Equal/Higher Elevation</u>	<u>Address</u>	<u>Direction / Distance</u>	<u>Map ID</u>	<u>Page</u>
<i>RYDERS CHEVRON</i>	<i>16811 POTOMAC HIGHLANDSE</i>	<i>1/4 - 1/2 (0.350 mi.)</i>	<i>1</i>	<i>7</i>

ADDITIONAL ENVIRONMENTAL RECORDS

Other Ascertainable Records

FTTS: FTTS tracks administrative cases and pesticide enforcement actions and compliance activities related to FIFRA, TSCA and EPCRA (Emergency Planning and Community Right-to-Know Act) over the previous five years. To maintain currency, EDR contacts the Agency on a quarterly basis.

An online review and analysis by CH2M HILL, INC. of the FTTS list, as provided by EDR, and dated 04/09/2009 has revealed that there is 1 FTTS site within approximately 1 mile of the target property.

<u>Lower Elevation</u>	<u>Address</u>	<u>Direction / Distance</u>	<u>Map ID</u>	<u>Page</u>
<i>LAMP OF YOUTH CHRISTIAN</i>	<i>RTE 28</i>	<i>S 1/2 - 1 (0.628 mi.)</i>	<i>3</i>	<i>17</i>

EXECUTIVE SUMMARY

HIST FTTS: A complete administrative case listing from the FIFRA/TSCA Tracking System (FTTS) for all ten EPA regions. The information was obtained from the National Compliance Database (NCDB). NCDB supports the implementation of FIFRA (Federal Insecticide, Fungicide, and Rodenticide Act) and TSCA (Toxic Substances Control Act). Some EPA regions are now closing out records. Because of that, and the fact that some EPA regions are not providing EPA Headquarters with updated records, it was decided to create a HIST FTTS database. It included records that may not be included in the newer FTTS database updates. This database is no longer updated.

An online review and analysis by CH2M HILL, INC. of the HIST FTTS list, as provided by EDR, and dated 10/19/2006 has revealed that there is 1 HIST FTTS site within approximately 1 mile of the target property.

<u>Lower Elevation</u>	<u>Address</u>	<u>Direction / Distance</u>	<u>Map ID</u>	<u>Page</u>
<i>LAMP OF YOUTH CHRISTIAN</i>	<i>RTE 28</i>	<i>S 1/2 - 1 (0.628 mi.)</i>	<i>3</i>	<i>17</i>

UIC: A listing of underground injection well locations.

An online review and analysis by CH2M HILL, INC. of the UIC list, as provided by EDR, and dated 07/15/2014 has revealed that there is 1 UIC site within approximately 1 mile of the target property.

<u>Equal/Higher Elevation</u>	<u>Address</u>	<u>Direction / Distance</u>	<u>Map ID</u>	<u>Page</u>
GREEN BANK ELEMENTARY-MIDDLE S		SE 1/4 - 1/2 (0.446 mi.)	2	16

Financial Assurance: A listing of financial assurance information for underground storage tank facilities. Financial assurance is intended to ensure that resources are available to pay for the cost of closure, post-closure care, and corrective measures if the owner or operator of a regulated facility is unable or unwilling to pay.

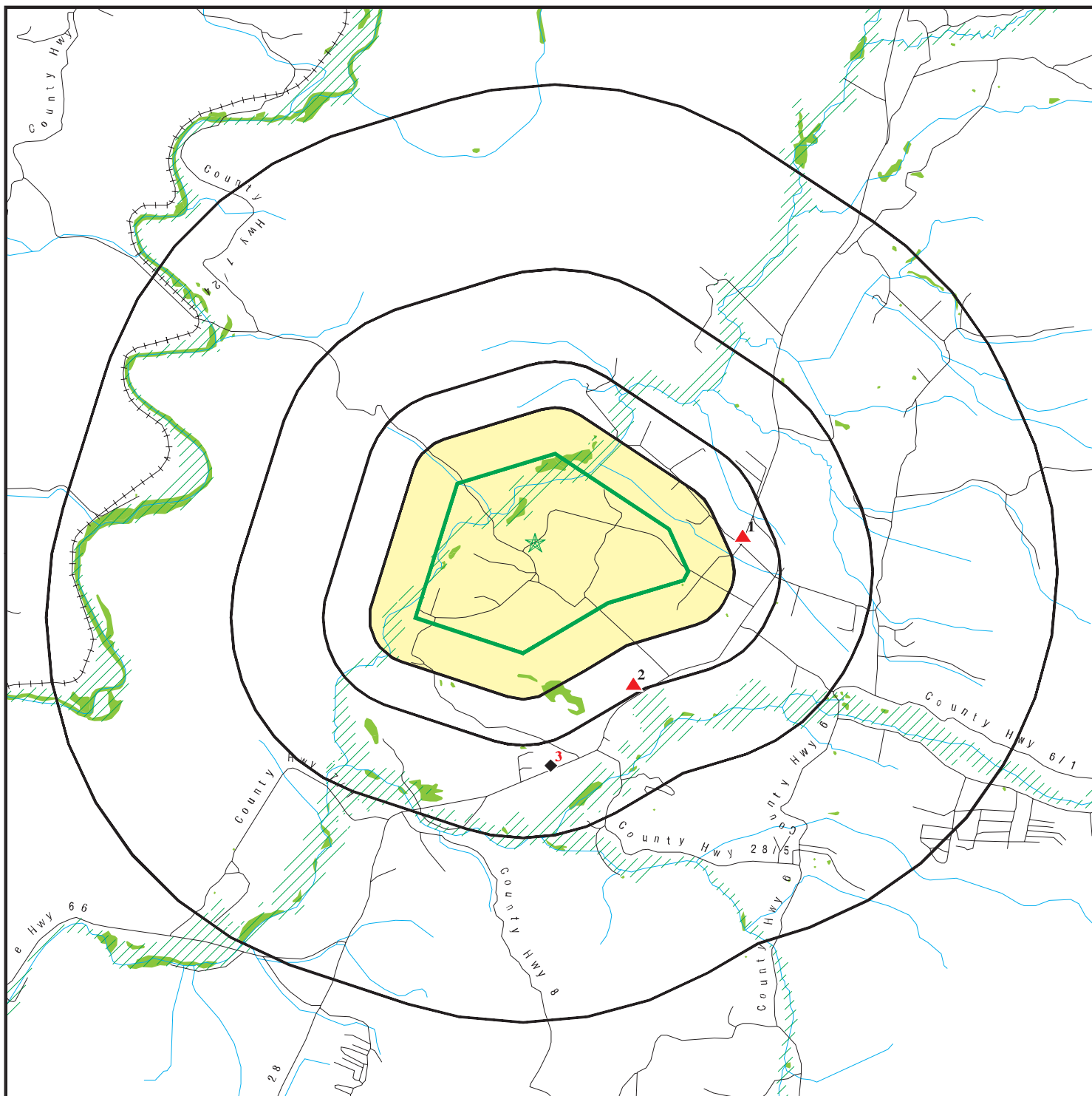
An online review and analysis by CH2M HILL, INC. of the Financial Assurance list, as provided by EDR, and dated 03/05/2013 has revealed that there is 1 Financial Assurance site within approximately 1 mile of the target property.

<u>Equal/Higher Elevation</u>	<u>Address</u>	<u>Direction / Distance</u>	<u>Map ID</u>	<u>Page</u>
<i>RYDERS CHEVRON</i>	<i>16811 POTOMAC HIGHLAND</i>	<i>SE 1/4 - 1/2 (0.350 mi.)</i>	<i>1</i>	<i>7</i>


EXECUTIVE SUMMARY


There were no unmapped sites in this report.

OVERVIEW MAP - 4103240.2S



 Target Property

 Sites at elevations higher than or equal to the target property

 Sites at elevations lower than the target property

 Manufactured Gas Plants

 National Priority List Sites

 Dept. Defense Sites

 Indian Reservations BIA

 Oil & Gas pipelines from USGS

 100-year flood zone

 500-year flood zone

 National Wetland Inventory

0 3/4 1 1/2 3 Miles

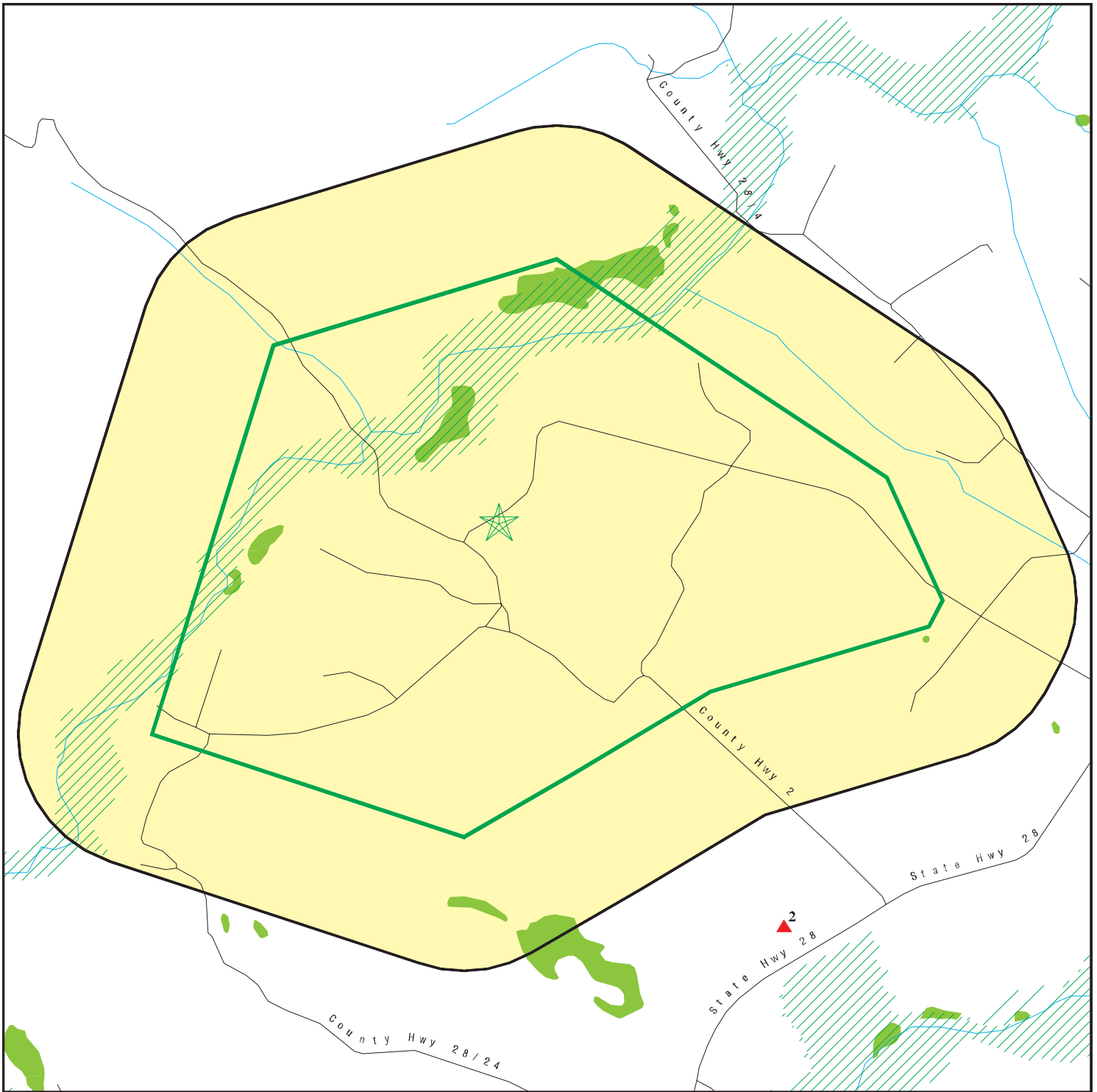









This report includes Interactive Map Layers to display and/or hide map information. The legend includes only those icons for the default map view.

SITE NAME: Green Bank
 ADDRESS: Potomac Highland Trail and Slavin Hollow Rd
 Cass WV 24927
 LAT/LONG: 38.4357 / -79.838

CLIENT: CH2M Hill, Inc.
 CONTACT: Mike Brose
 INQUIRY #: 4103240.2s
 DATE: October 29, 2014 1:09 pm

DETAIL MAP - 4103240.2S



-  Target Property
-  Sites at elevations higher than or equal to the target property
-  Sites at elevations lower than the target property
-  Manufactured Gas Plants
-  Sensitive Receptors
-  National Priority List Sites
-  Dept. Defense Sites

-  Indian Reservations BIA
-  Oil & Gas pipelines from USGS
-  100-year flood zone
-  500-year flood zone
-  National Wetland Inventory

This report includes Interactive Map Layers to display and/or hide map information. The legend includes only those icons for the default map view.

SITE NAME: Green Bank
 ADDRESS: Potomac Highland Trail and Slavin Hollow Rd
 Cass WV 24927
 LAT/LONG: 38.4357 / -79.838

CLIENT: CH2M Hill, Inc.
 CONTACT: Mike Brose
 INQUIRY #: 4103240.2s
 DATE: October 29, 2014 1:10 pm

MAP FINDINGS SUMMARY

Database	Search Distance (Miles)	Target Property	< 1/8	1/8 - 1/4	1/4 - 1/2	1/2 - 1	> 1	Total Plotted
STANDARD ENVIRONMENTAL RECORDS								
<i>Federal NPL site list</i>								
NPL	2.000		0	0	0	0	0	0
Proposed NPL	2.000		0	0	0	0	0	0
NPL LIENS	1.000		0	0	0	0	NR	0
<i>Federal Delisted NPL site list</i>								
Delisted NPL	2.000		0	0	0	0	0	0
<i>Federal CERCLIS list</i>								
CERCLIS	1.500		0	0	0	0	0	0
FEDERAL FACILITY	1.500		0	0	0	0	0	0
<i>Federal CERCLIS NFRAP site List</i>								
CERC-NFRAP	1.500		0	0	0	0	0	0
<i>Federal RCRA CORRACTS facilities list</i>								
CORRACTS	2.000		0	0	0	0	0	0
<i>Federal RCRA non-CORRACTS TSD facilities list</i>								
RCRA-TSDF	1.500		0	0	0	0	0	0
<i>Federal RCRA generators list</i>								
RCRA-LQG	1.250		0	0	0	0	0	0
RCRA-SQG	1.250		0	0	0	0	0	0
RCRA-CESQG	1.250		0	0	0	0	0	0
<i>Federal institutional controls / engineering controls registries</i>								
US ENG CONTROLS	1.500		0	0	0	0	0	0
US INST CONTROL	1.500		0	0	0	0	0	0
LUCIS	1.500		0	0	0	0	0	0
<i>Federal ERNS list</i>								
ERNS	1.000		0	0	0	0	NR	0
<i>State- and tribal - equivalent CERCLIS</i>								
SHWS	N/A		N/A	N/A	N/A	N/A	N/A	N/A
<i>State and tribal landfill and/or solid waste disposal site lists</i>								
SWF/LF	1.500		0	0	0	0	0	0
LCP	2.000		0	0	0	0	0	0
<i>State and tribal leaking storage tank lists</i>								
LUST	1.500		0	0	1	0	0	1
INDIAN LUST	1.500		0	0	0	0	0	0
<i>State and tribal registered storage tank lists</i>								
UST	1.250		0	0	1	0	0	1

MAP FINDINGS SUMMARY

Database	Search Distance (Miles)	Target Property	< 1/8	1/8 - 1/4	1/4 - 1/2	1/2 - 1	> 1	Total Plotted
INDIAN UST	1.250		0	0	0	0	0	0
FEMA UST	1.250		0	0	0	0	0	0
State and tribal institutional control / engineering control registries								
INST CONTROL	1.500		0	0	0	0	0	0
State and tribal voluntary cleanup sites								
INDIAN VCP	1.500		0	0	0	0	0	0
VCP	1.500		0	0	0	0	0	0
State and tribal Brownfields sites								
BROWNFIELDS	1.250		0	0	0	0	0	0
ADDITIONAL ENVIRONMENTAL RECORDS								
Local Brownfield lists								
US BROWNFIELDS	1.500		0	0	0	0	0	0
Local Lists of Landfill / Solid Waste Disposal Sites								
DEBRIS REGION 9	1.500		0	0	0	0	0	0
ODI	1.500		0	0	0	0	0	0
INDIAN ODI	1.500		0	0	0	0	0	0
Local Lists of Hazardous waste / Contaminated Sites								
US CDL	1.000		0	0	0	0	NR	0
CDL	1.000		0	0	0	0	NR	0
US HIST CDL	1.000		0	0	0	0	NR	0
Local Land Records								
LIENS 2	1.000		0	0	0	0	NR	0
Records of Emergency Release Reports								
HMIRS	1.000		0	0	0	0	NR	0
SPILLS	1.000		0	0	0	0	NR	0
Other Ascertainable Records								
RCRA NonGen / NLR	1.250		0	0	0	0	0	0
DOT OPS	1.000		0	0	0	0	NR	0
DOD	2.000		0	0	0	0	0	0
FUDS	2.000		0	0	0	0	0	0
CONSENT	2.000		0	0	0	0	0	0
ROD	2.000		0	0	0	0	0	0
UMTRA	1.500		0	0	0	0	0	0
US MINES	1.250		0	0	0	0	0	0
TRIS	1.000		0	0	0	0	NR	0
TSCA	1.000		0	0	0	0	NR	0
FTTS	1.000		0	0	0	1	NR	1

MAP FINDINGS SUMMARY

Database	Search Distance (Miles)	Target Property	< 1/8	1/8 - 1/4	1/4 - 1/2	1/2 - 1	> 1	Total Plotted
HIST FTTS	1.000		0	0	0	1	NR	1
SSTS	1.000		0	0	0	0	NR	0
ICIS	1.000		0	0	0	0	NR	0
PADS	1.000		0	0	0	0	NR	0
MLTS	1.000		0	0	0	0	NR	0
RADINFO	1.000		0	0	0	0	NR	0
FINDS	1.000		0	0	0	0	NR	0
RAATS	1.000		0	0	0	0	NR	0
RMP	1.000		0	0	0	0	NR	0
UIC	1.000		0	0	1	0	NR	1
DRYCLEANERS	1.250		0	0	0	0	0	0
NPDES	1.000		0	0	0	0	NR	0
AIRS	1.000		0	0	0	0	NR	0
INDIAN RESERV	2.000		0	0	0	0	0	0
SCRD DRYCLEANERS	1.500		0	0	0	0	0	0
US FIN ASSUR	1.000		0	0	0	0	NR	0
COAL ASH EPA	1.500		0	0	0	0	0	0
Financial Assurance	1.000		0	0	1	0	NR	1
PCB TRANSFORMER	1.000		0	0	0	0	NR	0
COAL ASH	1.250		0	0	0	0	0	0
EPA WATCH LIST	1.000		0	0	0	0	NR	0
LEAD SMELTERS	1.000		0	0	0	0	NR	0
2020 COR ACTION	1.250		0	0	0	0	0	0
US AIRS	1.000		0	0	0	0	NR	0
PRP	1.000		0	0	0	0	NR	0
COAL ASH DOE	1.000		0	0	0	0	NR	0

EDR HIGH RISK HISTORICAL RECORDS

EDR Exclusive Records

EDR MGP	2.000		0	0	0	0	0	0
EDR US Hist Auto Stat	1.250		0	0	0	0	0	0
EDR US Hist Cleaners	1.250		0	0	0	0	0	0

EDR RECOVERED GOVERNMENT ARCHIVES

Exclusive Recovered Govt. Archives

RGA LF	1.000		0	0	0	0	NR	0
RGA LUST	1.000		0	0	0	0	NR	0

NOTES:

TP = Target Property

NR = Not Requested at this Search Distance

Sites may be listed in more than one database

N/A = This State does not maintain a SHWS list. See the Federal CERCLIS list.

MAP FINDINGS

Map ID
 Direction
 Distance
 Elevation

Site

Database(s)

EDR ID Number
 EPA ID Number

1
East
1/4-1/2
0.350 mi.
1850 ft.

RYDERS CHEVRON
16811 POTOMAC HIGHLANDS TRAIL
ARBOVALE, WV 24915

LUST **U004135518**
UST **N/A**
Financial Assurance

Relative:
Higher

LUST:

Facility ID: 3-804534
 Leak Number: 99-044
 Priority: Soil contamination only
 Project Manager: Sutphin Mike
 Confirmed Release Date: 03/05/1999
 Cleanup Initiated Date: 03/05/1999
 Cleanup Complete Date: 07/11/2007
 EDR Link ID: 3-804534

Actual:
2733 ft.

UST:

Facility ID: 3804534
 Owner: FISHER, ANGELA
 Owner Address: 14245 STAUTON PARKERSBURG TPK
 Owner Address 2: Not reported
 Owner City,St,Zip: BARTOW, WV 24920
 Owner Telephone: (304) 456-4308

Tank ID: 3
Tank Status: Currently in Use
 Tank Substance: Gasoline
 Tank Capacity: 6000
 Date Last Used: Not reported
 Date Closed: Not reported
 Closure Status: Not listed
 Tank Material: Fiberglass Reinforced Plastic
 Piping Material: Fiberglass Reinforced Plastic
 Overfill Installed: Yes
 Installed Spill Protection: Yes
 Cathodic Protection Method: Yes

Tank ID: 4
Tank Status: Currently in Use
 Tank Substance: Gasoline
 Tank Capacity: 6000
 Date Last Used: Not reported
 Date Closed: Not reported
 Closure Status: Not listed
 Tank Material: Fiberglass Reinforced Plastic
 Piping Material: Fiberglass Reinforced Plastic
 Overfill Installed: Yes
 Installed Spill Protection: Yes
 Cathodic Protection Method: Yes

Tank ID: D1
Tank Status: Permanently Out of Service
 Tank Substance: Gasoline
 Tank Capacity: 2000
 Date Last Used: 02/20/1999
 Date Closed: 03/05/1999
 Closure Status: Tank removed from ground

Map ID
Direction
Distance
Elevation

MAP FINDINGS

Site

Database(s)

EDR ID Number
EPA ID Number

RYDERS CHEVRON (Continued)

U004135518

Tank Material: Asphalt Coated or Bare Steel
Piping Material: Unprotected Steel
Overfill Installed: No
Installed Spill Protection: No
Cathodic Protection Method: No

Tank ID: D2
Tank Status: Permanently Out of Service
Tank Substance: Gasoline
Tank Capacity: 3000
Date Last Used: 02/20/1999
Date Closed: 03/05/1999
Closure Status: Tank removed from ground
Tank Material: Asphalt Coated or Bare Steel
Piping Material: Unprotected Steel
Overfill Installed: No
Installed Spill Protection: No
Cathodic Protection Method: No

WV Financial Assurance:

Policy: USC 5863703
Id #: 3-804534
Owner Name: RYDER, VIOLET L
Owner Address: HC 63 BOX 50
Owner Address: Not reported
Owner City: ARBOVALE
Owner State: WV
Owner Zip: 24915
Owner Phone: 304-456-4308
Tank Id #: 3
Tank Capacity: 6000
Begin Date: 10/21/2008
End Date: 10/21/2009
Cancel Date: Not reported
Policy Name: ZURICH INSURANCE COMPANY
Tank Material: Fiberglass Reinforced Plastic
Tank Option: None
Pipe Material: Fiberglass Reinforced Plastic
Pipe Option: Double-Walled

Policy: USC 5863703 06
Id #: 3-804534
Owner Name: RYDER, VIOLET L
Owner Address: HC 63 BOX 50
Owner Address: Not reported
Owner City: ARBOVALE
Owner State: WV
Owner Zip: 24915
Owner Phone: (304) 456-4308
Tank Id #: 4
Tank Capacity: 6000
Begin Date: 10/21/2010
End Date: 10/21/2011
Cancel Date: Not reported
Policy Name: ZURICH INSURANCE COMPANY
Tank Material: Fiberglass Reinforced Plastic

Map ID
Direction
Distance
Elevation

MAP FINDINGS

Site

Database(s)

EDR ID Number
EPA ID Number

RYDERS CHEVRON (Continued)

U004135518

Tank Option: None
Pipe Material: Fiberglass Reinforced Plastic
Pipe Option: Double-Walled

Policy: USC 5863703
Id #: 3-804534
Owner Name: RYDER, VIOLET L
Owner Address: HC 63 BOX 50
Owner Address: Not reported
Owner City: ARBOVALE
Owner State: WV
Owner Zip: 24915
Owner Phone: 304-456-4308
Tank Id #: 4
Tank Capacity: 6000
Begin Date: 10/21/2008
End Date: 10/21/2009
Cancel Date: Not reported
Policy Name: ZURICH INSURANCE COMPANY
Tank Material: Fiberglass Reinforced Plastic
Tank Option: None
Pipe Material: Fiberglass Reinforced Plastic
Pipe Option: Double-Walled

Policy: USC 5863703
Id #: 3-804534
Owner Name: RYDER, VIOLET L
Owner Address: HC 63 BOX 50
Owner Address: Not reported
Owner City: ARBOVALE
Owner State: WV
Owner Zip: 24915
Owner Phone: (304) 456-4308
Tank Id #: 4
Tank Capacity: 6000
Begin Date: 10/21/2008
End Date: 10/21/2009
Cancel Date: Not reported
Policy Name: ZURICH INSURANCE COMPANY
Tank Material: Fiberglass Reinforced Plastic
Tank Option: None
Pipe Material: Fiberglass Reinforced Plastic
Pipe Option: Double-Walled

Policy: USC 5863703 05
Id #: 3-804534
Owner Name: RYDER, VIOLET L
Owner Address: HC 63 BOX 50
Owner Address: Not reported
Owner City: ARBOVALE
Owner State: WV
Owner Zip: 24915
Owner Phone: 304-456-4308
Tank Id #: 3
Tank Capacity: 6000
Begin Date: 10/21/2009
End Date: 10/21/2010

Map ID
Direction
Distance
Elevation

MAP FINDINGS

Site

Database(s)

EDR ID Number
EPA ID Number

RYDERS CHEVRON (Continued)

U004135518

Cancel Date: Not reported
Policy Name: ZURICH INSURANCE COMPANY
Tank Material: Fiberglass Reinforced Plastic
Tank Option: None
Pipe Material: Fiberglass Reinforced Plastic
Pipe Option: Double-Walled

Policy: USC 5863703 05
Id #: 3-804534
Owner Name: RYDER, VIOLET L
Owner Address: HC 63 BOX 50
Owner Address: Not reported
Owner City: ARBOVALE
Owner State: WV
Owner Zip: 24915
Owner Phone: (304) 456-4308
Tank Id #: 3
Tank Capacity: 6000
Begin Date: 10/21/2009
End Date: 10/21/2010
Cancel Date: Not reported
Policy Name: ZURICH INSURANCE COMPANY
Tank Material: Fiberglass Reinforced Plastic
Tank Option: None
Pipe Material: Fiberglass Reinforced Plastic
Pipe Option: Double-Walled

Policy: USC 5863703 05
Id #: 3-804534
Owner Name: RYDER, VIOLET L
Owner Address: HC 63 BOX 50
Owner Address: Not reported
Owner City: ARBOVALE
Owner State: WV
Owner Zip: 24915
Owner Phone: 304-456-4308
Tank Id #: 4
Tank Capacity: 6000
Begin Date: 10/21/2009
End Date: 10/21/2010
Cancel Date: Not reported
Policy Name: ZURICH INSURANCE COMPANY
Tank Material: Fiberglass Reinforced Plastic
Tank Option: None
Pipe Material: Fiberglass Reinforced Plastic
Pipe Option: Double-Walled

Policy: USC 5863703 05
Id #: 3-804534
Owner Name: RYDER, VIOLET L
Owner Address: HC 63 BOX 50
Owner Address: Not reported
Owner City: ARBOVALE
Owner State: WV
Owner Zip: 24915
Owner Phone: (304) 456-4308
Tank Id #: 4

Map ID
Direction
Distance
Elevation

MAP FINDINGS

Site

Database(s)

EDR ID Number
EPA ID Number

RYDERS CHEVRON (Continued)

U004135518

Tank Capacity: 6000
Begin Date: 10/21/2009
End Date: 10/21/2010
Cancel Date: Not reported
Policy Name: ZURICH INSURANCE COMPANY
Tank Material: Fiberglass Reinforced Plastic
Tank Option: None
Pipe Material: Fiberglass Reinforced Plastic
Pipe Option: Double-Walled

Policy: USC 5863703
Id #: 3-804534
Owner Name: RYDER, VIOLET L
Owner Address: HC 63 BOX 50
Owner Address: Not reported
Owner City: ARBOVALE
Owner State: WV
Owner Zip: 24915
Owner Phone: 304-456-4308
Tank Id #: 3
Tank Capacity: 6000
Begin Date: 10/21/2007
End Date: 10/21/2008
Cancel Date: Not reported
Policy Name: ZURICH INSURANCE COMPANY
Tank Material: Fiberglass Reinforced Plastic
Tank Option: None
Pipe Material: Fiberglass Reinforced Plastic
Pipe Option: Double-Walled

Policy: USC 5863703
Id #: 3-804534
Owner Name: RYDER, VIOLET L
Owner Address: HC 63 BOX 50
Owner Address: Not reported
Owner City: ARBOVALE
Owner State: WV
Owner Zip: 24915
Owner Phone: (304) 456-4308
Tank Id #: 3
Tank Capacity: 6000
Begin Date: 10/21/2007
End Date: 10/21/2008
Cancel Date: Not reported
Policy Name: ZURICH INSURANCE COMPANY
Tank Material: Fiberglass Reinforced Plastic
Tank Option: None
Pipe Material: Fiberglass Reinforced Plastic
Pipe Option: Double-Walled

Policy: USC 5863703
Id #: 3-804534
Owner Name: RYDER, VIOLET L
Owner Address: HC 63 BOX 50
Owner Address: Not reported
Owner City: ARBOVALE
Owner State: WV

Map ID
Direction
Distance
Elevation

MAP FINDINGS

Site

Database(s)

EDR ID Number
EPA ID Number

RYDERS CHEVRON (Continued)

U004135518

Owner Zip: 24915
Owner Phone: 304-456-4308
Tank Id #: 4
Tank Capacity: 6000
Begin Date: 10/21/2007
End Date: 10/21/2008
Cancel Date: Not reported
Policy Name: ZURICH INSURANCE COMPANY
Tank Material: Fiberglass Reinforced Plastic
Tank Option: None
Pipe Material: Fiberglass Reinforced Plastic
Pipe Option: Double-Walled

Policy: USC 5863703
Id #: 3-804534
Owner Name: RYDER, VIOLET L
Owner Address: HC 63 BOX 50
Owner Address: Not reported
Owner City: ARBOVALE
Owner State: WV
Owner Zip: 24915
Owner Phone: (304) 456-4308
Tank Id #: 4
Tank Capacity: 6000
Begin Date: 10/21/2007
End Date: 10/21/2008
Cancel Date: Not reported
Policy Name: ZURICH INSURANCE COMPANY
Tank Material: Fiberglass Reinforced Plastic
Tank Option: None
Pipe Material: Fiberglass Reinforced Plastic
Pipe Option: Double-Walled

Policy: 12345
Id #: 3-804534
Owner Name: RYDER, VIOLET L
Owner Address: HC 63 BOX 50
Owner Address: Not reported
Owner City: ARBOVALE
Owner State: WV
Owner Zip: 24915
Owner Phone: 304-456-4308
Tank Id #: 3
Tank Capacity: 6000
Begin Date: 10/01/1995
End Date: 10/01/1998
Cancel Date: Not reported
Policy Name: STATE INSURANCE FUND
Tank Material: Fiberglass Reinforced Plastic
Tank Option: None
Pipe Material: Fiberglass Reinforced Plastic
Pipe Option: Double-Walled

Policy: 12345
Id #: 3-804534
Owner Name: RYDER, VIOLET L
Owner Address: HC 63 BOX 50

Map ID
Direction
Distance
Elevation

MAP FINDINGS

Site

Database(s)

EDR ID Number
EPA ID Number

RYDERS CHEVRON (Continued)

U004135518

Owner Address: Not reported
Owner City: ARBOVALE
Owner State: WV
Owner Zip: 24915
Owner Phone: (304) 456-4308
Tank Id #: 3
Tank Capacity: 6000
Begin Date: 10/01/1995
End Date: 10/01/1998
Cancel Date: Not reported
Policy Name: STATE INSURANCE FUND
Tank Material: Fiberglass Reinforced Plastic
Tank Option: None
Pipe Material: Fiberglass Reinforced Plastic
Pipe Option: Double-Walled

Policy: 12345
Id #: 3-804534
Owner Name: RYDER, VIOLET L
Owner Address: HC 63 BOX 50
Owner Address: Not reported
Owner City: ARBOVALE
Owner State: WV
Owner Zip: 24915
Owner Phone: 304-456-4308
Tank Id #: 4
Tank Capacity: 6000
Begin Date: 10/01/1995
End Date: 10/01/1998
Cancel Date: Not reported
Policy Name: STATE INSURANCE FUND
Tank Material: Fiberglass Reinforced Plastic
Tank Option: None
Pipe Material: Fiberglass Reinforced Plastic
Pipe Option: Double-Walled

Policy: 12345
Id #: 3-804534
Owner Name: RYDER, VIOLET L
Owner Address: HC 63 BOX 50
Owner Address: Not reported
Owner City: ARBOVALE
Owner State: WV
Owner Zip: 24915
Owner Phone: (304) 456-4308
Tank Id #: 4
Tank Capacity: 6000
Begin Date: 10/01/1995
End Date: 10/01/1998
Cancel Date: Not reported
Policy Name: STATE INSURANCE FUND
Tank Material: Fiberglass Reinforced Plastic
Tank Option: None
Pipe Material: Fiberglass Reinforced Plastic
Pipe Option: Double-Walled

Policy: 12345

Map ID
Direction
Distance
Elevation

MAP FINDINGS

Site

Database(s)

EDR ID Number
EPA ID Number

RYDERS CHEVRON (Continued)

U004135518

Id #: 3-804534
Owner Name: RYDER, VIOLET L
Owner Address: HC 63 BOX 50
Owner Address: Not reported
Owner City: ARBOVALE
Owner State: WV
Owner Zip: 24915
Owner Phone: 304-456-4308
Tank Id #: 3
Tank Capacity: 6000
Begin Date: 01/01/1901
End Date: Not reported
Cancel Date: 07/22/1999
Policy Name: STATE INSURANCE FUND
Tank Material: Fiberglass Reinforced Plastic
Tank Option: None
Pipe Material: Fiberglass Reinforced Plastic
Pipe Option: Double-Walled

Policy: 12345
Id #: 3-804534
Owner Name: RYDER, VIOLET L
Owner Address: HC 63 BOX 50
Owner Address: Not reported
Owner City: ARBOVALE
Owner State: WV
Owner Zip: 24915
Owner Phone: (304) 456-4308
Tank Id #: 3
Tank Capacity: 6000
Begin Date: 01/01/1901
End Date: Not reported
Cancel Date: 07/22/1999
Policy Name: STATE INSURANCE FUND
Tank Material: Fiberglass Reinforced Plastic
Tank Option: None
Pipe Material: Fiberglass Reinforced Plastic
Pipe Option: Double-Walled

Policy: 12345
Id #: 3-804534
Owner Name: RYDER, VIOLET L
Owner Address: HC 63 BOX 50
Owner Address: Not reported
Owner City: ARBOVALE
Owner State: WV
Owner Zip: 24915
Owner Phone: 304-456-4308
Tank Id #: 4
Tank Capacity: 6000
Begin Date: 01/01/1901
End Date: Not reported
Cancel Date: 07/22/1999
Policy Name: STATE INSURANCE FUND
Tank Material: Fiberglass Reinforced Plastic
Tank Option: None
Pipe Material: Fiberglass Reinforced Plastic

Map ID
Direction
Distance
Elevation

MAP FINDINGS

Site

Database(s)

EDR ID Number
EPA ID Number

RYDERS CHEVRON (Continued)

U004135518

Pipe Option: Double-Walled

Policy: 12345
Id #: 3-804534
Owner Name: RYDER, VIOLET L
Owner Address: HC 63 BOX 50
Owner Address: Not reported
Owner City: ARBOVALE
Owner State: WV
Owner Zip: 24915
Owner Phone: (304) 456-4308
Tank Id #: 4
Tank Capacity: 6000
Begin Date: 01/01/1901
End Date: Not reported
Cancel Date: 07/22/1999
Policy Name: STATE INSURANCE FUND
Tank Material: Fiberglass Reinforced Plastic
Tank Option: None
Pipe Material: Fiberglass Reinforced Plastic
Pipe Option: Double-Walled

Policy: USC 5863703 06
Id #: 3-804534
Owner Name: RYDER, VIOLET L
Owner Address: HC 63 BOX 50
Owner Address: Not reported
Owner City: ARBOVALE
Owner State: WV
Owner Zip: 24915
Owner Phone: 304-456-4308
Tank Id #: 3
Tank Capacity: 6000
Begin Date: 10/21/2010
End Date: 10/21/2011
Cancel Date: Not reported
Policy Name: ZURICH INSURANCE COMPANY
Tank Material: Fiberglass Reinforced Plastic
Tank Option: None
Pipe Material: Fiberglass Reinforced Plastic
Pipe Option: Double-Walled

Policy: USC 5863703 06
Id #: 3-804534
Owner Name: RYDER, VIOLET L
Owner Address: HC 63 BOX 50
Owner Address: Not reported
Owner City: ARBOVALE
Owner State: WV
Owner Zip: 24915
Owner Phone: (304) 456-4308
Tank Id #: 3
Tank Capacity: 6000
Begin Date: 10/21/2010
End Date: 10/21/2011
Cancel Date: Not reported
Policy Name: ZURICH INSURANCE COMPANY

Map ID
Direction
Distance
Elevation

MAP FINDINGS

Site

Database(s)

EDR ID Number
EPA ID Number

RYDERS CHEVRON (Continued)

U004135518

Tank Material: Fiberglass Reinforced Plastic
 Tank Option: None
 Pipe Material: Fiberglass Reinforced Plastic
 Pipe Option: Double-Walled

Policy: USC 5863703 06
 Id #: 3-804534
 Owner Name: RYDER, VIOLET L
 Owner Address: HC 63 BOX 50
 Owner Address: Not reported
 Owner City: ARBOVALE
 Owner State: WV
 Owner Zip: 24915
 Owner Phone: 304-456-4308
 Tank Id #: 4
 Tank Capacity: 6000
 Begin Date: 10/21/2010
 End Date: 10/21/2011
 Cancel Date: Not reported
 Policy Name: ZURICH INSURANCE COMPANY
 Tank Material: Fiberglass Reinforced Plastic
 Tank Option: None
 Pipe Material: Fiberglass Reinforced Plastic
 Pipe Option: Double-Walled

Policy: USC 5863703
 Id #: 3-804534
 Owner Name: RYDER, VIOLET L
 Owner Address: HC 63 BOX 50
 Owner Address: Not reported
 Owner City: ARBOVALE
 Owner State: WV
 Owner Zip: 24915
 Owner Phone: (304) 456-4308
 Tank Id #: 3
 Tank Capacity: 6000
 Begin Date: 10/21/2008
 End Date: 10/21/2009
 Cancel Date: Not reported
 Policy Name: ZURICH INSURANCE COMPANY
 Tank Material: Fiberglass Reinforced Plastic
 Tank Option: None
 Pipe Material: Fiberglass Reinforced Plastic
 Pipe Option: Double-Walled

2
SE
1/4-1/2
0.446 mi.
2355 ft.

GREEN BANK ELEMENTARY-MIDDLE SCHOOL
POCAHONTAS (County), WV

UIC S110133327
N/A

Relative:
Higher

UIC:
 Permit Id: 0840-04-075
 Responsible Party Name: POCAHONTAS COUNTY SCHOOLS
 Latitude Degrees: 38
 Latitude Minutes: 25
 Latitude Seconds: 29.039999999999999
 Longitude Degrees: 79

Actual:
2686 ft.

Map ID
Direction
Distance
Elevation

MAP FINDINGS

Site

Database(s)

EDR ID Number
EPA ID Number

GREEN BANK ELEMENTARY-MIDDLE SCHOOL (Continued)

S110133327

Longitude Minutes: 49
Longitude Seconds: 41.39999999999999
Expiration Date: 1/10/2011 00:00:00
SIC Code: 4952
Priority Flag: Y
Design Flow Quantity: Not reported
Average Flow Quantity: 0.0028
Disturbed Acres: Not reported
Extension Date: Not reported
Number of Customers: Not reported
Number Injection Points: 2
Permit Type: UICS
Attention: Dr. J. Patrick Law, Supt.
Address Street 1: 926 5TH AVE.
Address Street 2: Not reported
Address City/State/Zip: MARLINTON, WV 24954
Address Phone Number: 3047994505
API: Not reported
Last Permit Issue Date for Well: Not reported
Completion Date: Not reported
Surface Owner: Not reported
Well Number: Not reported
Current Operator: Not reported
Well Status: Not reported
Well Type: Not reported
Latitude: Not reported
Longitude: Not reported

3
South
1/2-1
0.628 mi.
3315 ft.

LAMP OF YOUTH CHRISTIAN
RTE 28
GREENBANK, WV 24944

FTTS 1009517205
HIST FTTS N/A

Relative:
Lower

FTTS INSP:
Inspection Number: 19950330WV014 1
Region: 03
Inspection Date: 03/30/95
Inspector: PARKER
Violation occurred: No
Investigation Type: AHERA, Enforcement, State Conducted
Investigation Reason: Neutral Scheme, State
Legislation Code: TSCA
Facility Function: User

Actual:
2631 ft.

HIST FTTS INSP:
Inspection Number: 19950330WV014 1
Region: 03
Inspection Date: Not reported
Inspector: PARKER
Violation occurred: No
Investigation Type: AHERA, Enforcement, State Conducted
Investigation Reason: Neutral Scheme, State
Legislation Code: TSCA
Facility Function: User

Count: 0 records.

ORPHAN SUMMARY

City	EDR ID	Site Name	Site Address	Zip	Database(s)
NO SITES FOUND					

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

To maintain currency of the following federal and state databases, EDR contacts the appropriate governmental agency on a monthly or quarterly basis, as required.

Number of Days to Update: Provides confirmation that EDR is reporting records that have been updated within 90 days from the date the government agency made the information available to the public.

STANDARD ENVIRONMENTAL RECORDS

Federal NPL site list

NPL: National Priority List

National Priorities List (Superfund). The NPL is a subset of CERCLIS and identifies over 1,200 sites for priority cleanup under the Superfund Program. NPL sites may encompass relatively large areas. As such, EDR provides polygon coverage for over 1,000 NPL site boundaries produced by EPA's Environmental Photographic Interpretation Center (EPIC) and regional EPA offices.

Date of Government Version: 10/25/2013	Source: EPA
Date Data Arrived at EDR: 11/11/2013	Telephone: N/A
Date Made Active in Reports: 01/28/2014	Last EDR Contact: 10/08/2014
Number of Days to Update: 78	Next Scheduled EDR Contact: 01/19/2015
	Data Release Frequency: Quarterly

NPL Site Boundaries

Sources:

EPA's Environmental Photographic Interpretation Center (EPIC)
Telephone: 202-564-7333

EPA Region 1
Telephone 617-918-1143

EPA Region 6
Telephone: 214-655-6659

EPA Region 3
Telephone 215-814-5418

EPA Region 7
Telephone: 913-551-7247

EPA Region 4
Telephone 404-562-8033

EPA Region 8
Telephone: 303-312-6774

EPA Region 5
Telephone 312-886-6686

EPA Region 9
Telephone: 415-947-4246

EPA Region 10
Telephone 206-553-8665

Proposed NPL: Proposed National Priority List Sites

A site that has been proposed for listing on the National Priorities List through the issuance of a proposed rule in the Federal Register. EPA then accepts public comments on the site, responds to the comments, and places on the NPL those sites that continue to meet the requirements for listing.

Date of Government Version: 10/25/2013	Source: EPA
Date Data Arrived at EDR: 11/11/2013	Telephone: N/A
Date Made Active in Reports: 01/28/2014	Last EDR Contact: 10/08/2014
Number of Days to Update: 78	Next Scheduled EDR Contact: 01/19/2015
	Data Release Frequency: Quarterly

NPL LIENS: Federal Superfund Liens

Federal Superfund Liens. Under the authority granted the USEPA by CERCLA of 1980, the USEPA has the authority to file liens against real property in order to recover remedial action expenditures or when the property owner received notification of potential liability. USEPA compiles a listing of filed notices of Superfund Liens.

Date of Government Version: 10/15/1991	Source: EPA
Date Data Arrived at EDR: 02/02/1994	Telephone: 202-564-4267
Date Made Active in Reports: 03/30/1994	Last EDR Contact: 08/15/2011
Number of Days to Update: 56	Next Scheduled EDR Contact: 11/28/2011
	Data Release Frequency: No Update Planned

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

Federal Delisted NPL site list

DELISTED NPL: National Priority List Deletions

The National Oil and Hazardous Substances Pollution Contingency Plan (NCP) establishes the criteria that the EPA uses to delete sites from the NPL. In accordance with 40 CFR 300.425.(e), sites may be deleted from the NPL where no further response is appropriate.

Date of Government Version: 10/25/2013	Source: EPA
Date Data Arrived at EDR: 11/11/2013	Telephone: N/A
Date Made Active in Reports: 01/28/2014	Last EDR Contact: 10/08/2014
Number of Days to Update: 78	Next Scheduled EDR Contact: 01/19/2015
	Data Release Frequency: Quarterly

Federal CERCLIS list

CERCLIS: Comprehensive Environmental Response, Compensation, and Liability Information System

CERCLIS contains data on potentially hazardous waste sites that have been reported to the USEPA by states, municipalities, private companies and private persons, pursuant to Section 103 of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). CERCLIS contains sites which are either proposed to or on the National Priorities List (NPL) and sites which are in the screening and assessment phase for possible inclusion on the NPL.

Date of Government Version: 10/25/2013	Source: EPA
Date Data Arrived at EDR: 11/11/2013	Telephone: 703-412-9810
Date Made Active in Reports: 02/13/2014	Last EDR Contact: 08/28/2014
Number of Days to Update: 94	Next Scheduled EDR Contact: 12/08/2014
	Data Release Frequency: Quarterly

FEDERAL FACILITY: Federal Facility Site Information listing

A listing of National Priority List (NPL) and Base Realignment and Closure (BRAC) sites found in the Comprehensive Environmental Response, Compensation and Liability Information System (CERCLIS) Database where EPA Federal Facilities Restoration and Reuse Office is involved in cleanup activities.

Date of Government Version: 07/21/2014	Source: Environmental Protection Agency
Date Data Arrived at EDR: 10/07/2014	Telephone: 703-603-8704
Date Made Active in Reports: 10/20/2014	Last EDR Contact: 10/07/2014
Number of Days to Update: 13	Next Scheduled EDR Contact: 01/19/2015
	Data Release Frequency: Varies

Federal CERCLIS NFRAP site List

CERCLIS-NFRAP: CERCLIS No Further Remedial Action Planned

Archived sites are sites that have been removed and archived from the inventory of CERCLIS sites. Archived status indicates that, to the best of EPA's knowledge, assessment at a site has been completed and that EPA has determined no further steps will be taken to list this site on the National Priorities List (NPL), unless information indicates this decision was not appropriate or other considerations require a recommendation for listing at a later time. This decision does not necessarily mean that there is no hazard associated with a given site; it only means that, based upon available information, the location is not judged to be a potential NPL site.

Date of Government Version: 10/25/2013	Source: EPA
Date Data Arrived at EDR: 11/11/2013	Telephone: 703-412-9810
Date Made Active in Reports: 02/13/2014	Last EDR Contact: 08/28/2014
Number of Days to Update: 94	Next Scheduled EDR Contact: 12/08/2014
	Data Release Frequency: Quarterly

Federal RCRA CORRACTS facilities list

CORRACTS: Corrective Action Report

CORRACTS identifies hazardous waste handlers with RCRA corrective action activity.

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

Date of Government Version: 06/10/2014
Date Data Arrived at EDR: 07/02/2014
Date Made Active in Reports: 09/18/2014
Number of Days to Update: 78

Source: EPA
Telephone: 800-424-9346
Last EDR Contact: 10/01/2014
Next Scheduled EDR Contact: 01/12/2015
Data Release Frequency: Quarterly

Federal RCRA non-CORRACTS TSD facilities list

RCRA-TSDF: RCRA - Treatment, Storage and Disposal

RCRAInfo is EPA's comprehensive information system, providing access to data supporting the Resource Conservation and Recovery Act (RCRA) of 1976 and the Hazardous and Solid Waste Amendments (HSWA) of 1984. The database includes selective information on sites which generate, transport, store, treat and/or dispose of hazardous waste as defined by the Resource Conservation and Recovery Act (RCRA). Transporters are individuals or entities that move hazardous waste from the generator offsite to a facility that can recycle, treat, store, or dispose of the waste. TSDFs treat, store, or dispose of the waste.

Date of Government Version: 06/10/2014
Date Data Arrived at EDR: 07/02/2014
Date Made Active in Reports: 09/18/2014
Number of Days to Update: 78

Source: Environmental Protection Agency
Telephone: 800-438-2474
Last EDR Contact: 10/01/2014
Next Scheduled EDR Contact: 01/12/2015
Data Release Frequency: Quarterly

Federal RCRA generators list

RCRA-LQG: RCRA - Large Quantity Generators

RCRAInfo is EPA's comprehensive information system, providing access to data supporting the Resource Conservation and Recovery Act (RCRA) of 1976 and the Hazardous and Solid Waste Amendments (HSWA) of 1984. The database includes selective information on sites which generate, transport, store, treat and/or dispose of hazardous waste as defined by the Resource Conservation and Recovery Act (RCRA). Large quantity generators (LQGs) generate over 1,000 kilograms (kg) of hazardous waste, or over 1 kg of acutely hazardous waste per month.

Date of Government Version: 06/10/2014
Date Data Arrived at EDR: 07/02/2014
Date Made Active in Reports: 09/18/2014
Number of Days to Update: 78

Source: Environmental Protection Agency
Telephone: 800-438-2474
Last EDR Contact: 10/01/2014
Next Scheduled EDR Contact: 01/12/2015
Data Release Frequency: Quarterly

RCRA-SQG: RCRA - Small Quantity Generators

RCRAInfo is EPA's comprehensive information system, providing access to data supporting the Resource Conservation and Recovery Act (RCRA) of 1976 and the Hazardous and Solid Waste Amendments (HSWA) of 1984. The database includes selective information on sites which generate, transport, store, treat and/or dispose of hazardous waste as defined by the Resource Conservation and Recovery Act (RCRA). Small quantity generators (SQGs) generate between 100 kg and 1,000 kg of hazardous waste per month.

Date of Government Version: 06/10/2014
Date Data Arrived at EDR: 07/02/2014
Date Made Active in Reports: 09/18/2014
Number of Days to Update: 78

Source: Environmental Protection Agency
Telephone: 800-438-2474
Last EDR Contact: 10/01/2014
Next Scheduled EDR Contact: 01/12/2015
Data Release Frequency: Quarterly

RCRA-CESQG: RCRA - Conditionally Exempt Small Quantity Generators

RCRAInfo is EPA's comprehensive information system, providing access to data supporting the Resource Conservation and Recovery Act (RCRA) of 1976 and the Hazardous and Solid Waste Amendments (HSWA) of 1984. The database includes selective information on sites which generate, transport, store, treat and/or dispose of hazardous waste as defined by the Resource Conservation and Recovery Act (RCRA). Conditionally exempt small quantity generators (CESQGs) generate less than 100 kg of hazardous waste, or less than 1 kg of acutely hazardous waste per month.

Date of Government Version: 06/10/2014
Date Data Arrived at EDR: 07/02/2014
Date Made Active in Reports: 09/18/2014
Number of Days to Update: 78

Source: Environmental Protection Agency
Telephone: 800-438-2474
Last EDR Contact: 10/01/2014
Next Scheduled EDR Contact: 01/12/2015
Data Release Frequency: Varies

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

Federal institutional controls / engineering controls registries

US ENG CONTROLS: Engineering Controls Sites List

A listing of sites with engineering controls in place. Engineering controls include various forms of caps, building foundations, liners, and treatment methods to create pathway elimination for regulated substances to enter environmental media or effect human health.

Date of Government Version: 09/18/2014	Source: Environmental Protection Agency
Date Data Arrived at EDR: 09/19/2014	Telephone: 703-603-0695
Date Made Active in Reports: 10/20/2014	Last EDR Contact: 09/08/2014
Number of Days to Update: 31	Next Scheduled EDR Contact: 12/22/2014
	Data Release Frequency: Varies

US INST CONTROL: Sites with Institutional Controls

A listing of sites with institutional controls in place. Institutional controls include administrative measures, such as groundwater use restrictions, construction restrictions, property use restrictions, and post remediation care requirements intended to prevent exposure to contaminants remaining on site. Deed restrictions are generally required as part of the institutional controls.

Date of Government Version: 09/18/2014	Source: Environmental Protection Agency
Date Data Arrived at EDR: 09/19/2014	Telephone: 703-603-0695
Date Made Active in Reports: 10/20/2014	Last EDR Contact: 09/08/2014
Number of Days to Update: 31	Next Scheduled EDR Contact: 12/22/2014
	Data Release Frequency: Varies

LUCIS: Land Use Control Information System

LUCIS contains records of land use control information pertaining to the former Navy Base Realignment and Closure properties.

Date of Government Version: 08/29/2014	Source: Department of the Navy
Date Data Arrived at EDR: 10/09/2014	Telephone: 843-820-7326
Date Made Active in Reports: 10/20/2014	Last EDR Contact: 08/14/2014
Number of Days to Update: 11	Next Scheduled EDR Contact: 12/01/2014
	Data Release Frequency: Varies

Federal ERNS list

ERNS: Emergency Response Notification System

Emergency Response Notification System. ERNS records and stores information on reported releases of oil and hazardous substances.

Date of Government Version: 09/30/2013	Source: National Response Center, United States Coast Guard
Date Data Arrived at EDR: 10/01/2013	Telephone: 202-267-2180
Date Made Active in Reports: 12/06/2013	Last EDR Contact: 09/30/2014
Number of Days to Update: 66	Next Scheduled EDR Contact: 01/12/2015
	Data Release Frequency: Annually

State- and tribal - equivalent CERCLIS

SHWS: This state does not maintain a SHWS list. See the Federal CERCLIS list and Federal NPL list.

State Hazardous Waste Sites. State hazardous waste site records are the states' equivalent to CERCLIS. These sites may or may not already be listed on the federal CERCLIS list. Priority sites planned for cleanup using state funds (state equivalent of Superfund) are identified along with sites where cleanup will be paid for by potentially responsible parties. Available information varies by state.

Date of Government Version: N/A	Source: Department of Environmental Protection
Date Data Arrived at EDR: N/A	Telephone: 304-926-0455
Date Made Active in Reports: N/A	Last EDR Contact: 09/22/2014
Number of Days to Update: N/A	Next Scheduled EDR Contact: 12/08/2014
	Data Release Frequency: N/A

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

State and tribal landfill and/or solid waste disposal site lists

SWF/LF: List of M.S.W. Landfills/Transfer Station Listing

Solid Waste Facilities/Landfill Sites. SWF/LF type records typically contain an inventory of solid waste disposal facilities or landfills in a particular state. Depending on the state, these may be active or inactive facilities or open dumps that failed to meet RCRA Subtitle D Section 4004 criteria for solid waste landfills or disposal sites.

Date of Government Version: 01/16/2014	Source: Division of Environmental Protection
Date Data Arrived at EDR: 07/10/2014	Telephone: 304-926-0499
Date Made Active in Reports: 09/08/2014	Last EDR Contact: 09/29/2014
Number of Days to Update: 60	Next Scheduled EDR Contact: 01/12/2015
	Data Release Frequency: Varies

LCP: Landfill Closure Program

The WV DEP's LCAP aids the owners/permittees of landfills that were required to cease operations because of certain statutory closure deadlines for non-composite lined facilities

Date of Government Version: 12/31/2013	Source: Department of Environmental Protection
Date Data Arrived at EDR: 03/21/2014	Telephone: 304-926-0499
Date Made Active in Reports: 04/08/2014	Last EDR Contact: 09/08/2014
Number of Days to Update: 18	Next Scheduled EDR Contact: 12/22/2014
	Data Release Frequency: Annually

State and tribal leaking storage tank lists

LUST: Leaking Underground Storage Tanks

Leaking Underground Storage Tank Incident Reports. LUST records contain an inventory of reported leaking underground storage tank incidents. Not all states maintain these records, and the information stored varies by state.

Date of Government Version: 05/07/2014	Source: Division of Environmental Protection
Date Data Arrived at EDR: 06/05/2014	Telephone: 304-926-0455
Date Made Active in Reports: 06/09/2014	Last EDR Contact: 09/04/2014
Number of Days to Update: 4	Next Scheduled EDR Contact: 12/15/2014
	Data Release Frequency: Semi-Annually

INDIAN LUST R5: Leaking Underground Storage Tanks on Indian Land

Leaking underground storage tanks located on Indian Land in Michigan, Minnesota and Wisconsin.

Date of Government Version: 08/04/2014	Source: EPA, Region 5
Date Data Arrived at EDR: 08/05/2014	Telephone: 312-886-7439
Date Made Active in Reports: 08/22/2014	Last EDR Contact: 10/27/2014
Number of Days to Update: 17	Next Scheduled EDR Contact: 02/09/2015
	Data Release Frequency: Varies

INDIAN LUST R9: Leaking Underground Storage Tanks on Indian Land

LUSTs on Indian land in Arizona, California, New Mexico and Nevada

Date of Government Version: 03/01/2013	Source: Environmental Protection Agency
Date Data Arrived at EDR: 03/01/2013	Telephone: 415-972-3372
Date Made Active in Reports: 04/12/2013	Last EDR Contact: 10/27/2014
Number of Days to Update: 42	Next Scheduled EDR Contact: 02/09/2015
	Data Release Frequency: Quarterly

INDIAN LUST R8: Leaking Underground Storage Tanks on Indian Land

LUSTs on Indian land in Colorado, Montana, North Dakota, South Dakota, Utah and Wyoming.

Date of Government Version: 08/13/2014	Source: EPA Region 8
Date Data Arrived at EDR: 08/15/2014	Telephone: 303-312-6271
Date Made Active in Reports: 08/22/2014	Last EDR Contact: 10/27/2014
Number of Days to Update: 7	Next Scheduled EDR Contact: 02/09/2015
	Data Release Frequency: Quarterly

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

INDIAN LUST R7: Leaking Underground Storage Tanks on Indian Land
LUSTs on Indian land in Iowa, Kansas, and Nebraska

Date of Government Version: 05/22/2014	Source: EPA Region 7
Date Data Arrived at EDR: 08/22/2014	Telephone: 913-551-7003
Date Made Active in Reports: 09/18/2014	Last EDR Contact: 10/27/2014
Number of Days to Update: 27	Next Scheduled EDR Contact: 02/09/2015
	Data Release Frequency: Varies

INDIAN LUST R6: Leaking Underground Storage Tanks on Indian Land
LUSTs on Indian land in New Mexico and Oklahoma.

Date of Government Version: 05/14/2014	Source: EPA Region 6
Date Data Arrived at EDR: 05/15/2014	Telephone: 214-665-6597
Date Made Active in Reports: 07/15/2014	Last EDR Contact: 10/27/2014
Number of Days to Update: 61	Next Scheduled EDR Contact: 02/09/2015
	Data Release Frequency: Varies

INDIAN LUST R4: Leaking Underground Storage Tanks on Indian Land
LUSTs on Indian land in Florida, Mississippi and North Carolina.

Date of Government Version: 07/30/2014	Source: EPA Region 4
Date Data Arrived at EDR: 08/12/2014	Telephone: 404-562-8677
Date Made Active in Reports: 08/22/2014	Last EDR Contact: 10/27/2014
Number of Days to Update: 10	Next Scheduled EDR Contact: 02/09/2015
	Data Release Frequency: Semi-Annually

INDIAN LUST R1: Leaking Underground Storage Tanks on Indian Land
A listing of leaking underground storage tank locations on Indian Land.

Date of Government Version: 02/01/2013	Source: EPA Region 1
Date Data Arrived at EDR: 05/01/2013	Telephone: 617-918-1313
Date Made Active in Reports: 11/01/2013	Last EDR Contact: 08/01/2014
Number of Days to Update: 184	Next Scheduled EDR Contact: 11/10/2014
	Data Release Frequency: Varies

INDIAN LUST R10: Leaking Underground Storage Tanks on Indian Land
LUSTs on Indian land in Alaska, Idaho, Oregon and Washington.

Date of Government Version: 05/20/2014	Source: EPA Region 10
Date Data Arrived at EDR: 06/10/2014	Telephone: 206-553-2857
Date Made Active in Reports: 08/22/2014	Last EDR Contact: 10/27/2014
Number of Days to Update: 73	Next Scheduled EDR Contact: 02/09/2015
	Data Release Frequency: Quarterly

State and tribal registered storage tank lists

UST: Underground Storage Tank Database
Registered Underground Storage Tanks. UST's are regulated under Subtitle I of the Resource Conservation and Recovery Act (RCRA) and must be registered with the state department responsible for administering the UST program. Available information varies by state program.

Date of Government Version: 06/04/2014	Source: Division of Environmental Protection
Date Data Arrived at EDR: 06/05/2014	Telephone: 304-926-0495
Date Made Active in Reports: 06/09/2014	Last EDR Contact: 09/02/2014
Number of Days to Update: 4	Next Scheduled EDR Contact: 12/15/2014
	Data Release Frequency: Annually

INDIAN UST R4: Underground Storage Tanks on Indian Land
The Indian Underground Storage Tank (UST) database provides information about underground storage tanks on Indian land in EPA Region 4 (Alabama, Florida, Georgia, Kentucky, Mississippi, North Carolina, South Carolina, Tennessee and Tribal Nations)

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

Date of Government Version: 07/30/2014
Date Data Arrived at EDR: 08/12/2014
Date Made Active in Reports: 08/22/2014
Number of Days to Update: 10

Source: EPA Region 4
Telephone: 404-562-9424
Last EDR Contact: 10/27/2014
Next Scheduled EDR Contact: 02/09/2015
Data Release Frequency: Semi-Annually

INDIAN UST R5: Underground Storage Tanks on Indian Land

The Indian Underground Storage Tank (UST) database provides information about underground storage tanks on Indian land in EPA Region 5 (Michigan, Minnesota and Wisconsin and Tribal Nations).

Date of Government Version: 08/04/2014
Date Data Arrived at EDR: 08/05/2014
Date Made Active in Reports: 08/22/2014
Number of Days to Update: 17

Source: EPA Region 5
Telephone: 312-886-6136
Last EDR Contact: 10/27/2014
Next Scheduled EDR Contact: 02/09/2015
Data Release Frequency: Varies

INDIAN UST R6: Underground Storage Tanks on Indian Land

The Indian Underground Storage Tank (UST) database provides information about underground storage tanks on Indian land in EPA Region 6 (Louisiana, Arkansas, Oklahoma, New Mexico, Texas and 65 Tribes).

Date of Government Version: 07/25/2014
Date Data Arrived at EDR: 07/28/2014
Date Made Active in Reports: 08/22/2014
Number of Days to Update: 25

Source: EPA Region 6
Telephone: 214-665-7591
Last EDR Contact: 10/27/2014
Next Scheduled EDR Contact: 02/09/2015
Data Release Frequency: Semi-Annually

INDIAN UST R1: Underground Storage Tanks on Indian Land

The Indian Underground Storage Tank (UST) database provides information about underground storage tanks on Indian land in EPA Region 1 (Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, Vermont and ten Tribal Nations).

Date of Government Version: 02/01/2013
Date Data Arrived at EDR: 05/01/2013
Date Made Active in Reports: 01/27/2014
Number of Days to Update: 271

Source: EPA, Region 1
Telephone: 617-918-1313
Last EDR Contact: 08/01/2014
Next Scheduled EDR Contact: 11/10/2014
Data Release Frequency: Varies

INDIAN UST R7: Underground Storage Tanks on Indian Land

The Indian Underground Storage Tank (UST) database provides information about underground storage tanks on Indian land in EPA Region 7 (Iowa, Kansas, Missouri, Nebraska, and 9 Tribal Nations).

Date of Government Version: 08/20/2014
Date Data Arrived at EDR: 08/22/2014
Date Made Active in Reports: 09/18/2014
Number of Days to Update: 27

Source: EPA Region 7
Telephone: 913-551-7003
Last EDR Contact: 10/27/2014
Next Scheduled EDR Contact: 02/09/2015
Data Release Frequency: Varies

INDIAN UST R10: Underground Storage Tanks on Indian Land

The Indian Underground Storage Tank (UST) database provides information about underground storage tanks on Indian land in EPA Region 10 (Alaska, Idaho, Oregon, Washington, and Tribal Nations).

Date of Government Version: 05/20/2014
Date Data Arrived at EDR: 06/10/2014
Date Made Active in Reports: 08/15/2014
Number of Days to Update: 66

Source: EPA Region 10
Telephone: 206-553-2857
Last EDR Contact: 10/27/2014
Next Scheduled EDR Contact: 02/09/2015
Data Release Frequency: Quarterly

INDIAN UST R8: Underground Storage Tanks on Indian Land

The Indian Underground Storage Tank (UST) database provides information about underground storage tanks on Indian land in EPA Region 8 (Colorado, Montana, North Dakota, South Dakota, Utah, Wyoming and 27 Tribal Nations).

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

Date of Government Version: 08/13/2014
Date Data Arrived at EDR: 08/15/2014
Date Made Active in Reports: 08/22/2014
Number of Days to Update: 7

Source: EPA Region 8
Telephone: 303-312-6137
Last EDR Contact: 10/27/2014
Next Scheduled EDR Contact: 02/09/2015
Data Release Frequency: Quarterly

INDIAN UST R9: Underground Storage Tanks on Indian Land

The Indian Underground Storage Tank (UST) database provides information about underground storage tanks on Indian land in EPA Region 9 (Arizona, California, Hawaii, Nevada, the Pacific Islands, and Tribal Nations).

Date of Government Version: 08/14/2014
Date Data Arrived at EDR: 08/15/2014
Date Made Active in Reports: 08/22/2014
Number of Days to Update: 7

Source: EPA Region 9
Telephone: 415-972-3368
Last EDR Contact: 10/27/2014
Next Scheduled EDR Contact: 02/09/2015
Data Release Frequency: Quarterly

FEMA UST: Underground Storage Tank Listing

A listing of all FEMA owned underground storage tanks.

Date of Government Version: 01/01/2010
Date Data Arrived at EDR: 02/16/2010
Date Made Active in Reports: 04/12/2010
Number of Days to Update: 55

Source: FEMA
Telephone: 202-646-5797
Last EDR Contact: 10/10/2014
Next Scheduled EDR Contact: 01/26/2015
Data Release Frequency: Varies

State and tribal institutional control / engineering control registries

INST CONTROL: Sites with Institutional Controls Sites that have institutional controls in place.

Date of Government Version: 05/01/2014
Date Data Arrived at EDR: 05/28/2014
Date Made Active in Reports: 06/09/2014
Number of Days to Update: 12

Source: Department of Environmental Protection
Telephone: 304-558-2508
Last EDR Contact: 08/20/2014
Next Scheduled EDR Contact: 12/08/2014
Data Release Frequency: Varies

State and tribal voluntary cleanup sites

INDIAN VCP R7: Voluntary Cleanup Priority Listing

A listing of voluntary cleanup priority sites located on Indian Land located in Region 7.

Date of Government Version: 03/20/2008
Date Data Arrived at EDR: 04/22/2008
Date Made Active in Reports: 05/19/2008
Number of Days to Update: 27

Source: EPA, Region 7
Telephone: 913-551-7365
Last EDR Contact: 04/20/2009
Next Scheduled EDR Contact: 07/20/2009
Data Release Frequency: Varies

VCP: Voluntary Remediation Sites

Sites involved in the Voluntary Remediation Program.

Date of Government Version: 05/01/2014
Date Data Arrived at EDR: 05/28/2014
Date Made Active in Reports: 06/09/2014
Number of Days to Update: 12

Source: Department of Environmental Protection
Telephone: 304-558-2745
Last EDR Contact: 08/20/2014
Next Scheduled EDR Contact: 12/08/2014
Data Release Frequency: Semi-Annually

INDIAN VCP R1: Voluntary Cleanup Priority Listing

A listing of voluntary cleanup priority sites located on Indian Land located in Region 1.

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

Date of Government Version: 05/30/2014
Date Data Arrived at EDR: 07/01/2014
Date Made Active in Reports: 08/15/2014
Number of Days to Update: 45

Source: EPA, Region 1
Telephone: 617-918-1102
Last EDR Contact: 10/01/2014
Next Scheduled EDR Contact: 01/12/2015
Data Release Frequency: Varies

State and tribal Brownfields sites

BROWNFIELDS: Brownfields Sites Listing

Brownfields are abandoned, idle or underused commercial or industrial properties, where the expansion or redevelopment is hindered by real or perceived contamination. Brownfields vary in size, location, age, and past use -- they can be anything from a five-hundred acre automobile assembly plant to a small, abandoned corner gas station.

Date of Government Version: 05/14/2013
Date Data Arrived at EDR: 07/05/2013
Date Made Active in Reports: 08/15/2013
Number of Days to Update: 41

Source: Department of Environmental Protection
Telephone: 304-926-0455
Last EDR Contact: 10/03/2014
Next Scheduled EDR Contact: 01/12/2015
Data Release Frequency: Varies

ADDITIONAL ENVIRONMENTAL RECORDS

Local Brownfield lists

US BROWNFIELDS: A Listing of Brownfields Sites

Brownfields are real property, the expansion, redevelopment, or reuse of which may be complicated by the presence or potential presence of a hazardous substance, pollutant, or contaminant. Cleaning up and reinvesting in these properties takes development pressures off of undeveloped, open land, and both improves and protects the environment. Assessment, Cleanup and Redevelopment Exchange System (ACRES) stores information reported by EPA Brownfields grant recipients on brownfields properties assessed or cleaned up with grant funding as well as information on Targeted Brownfields Assessments performed by EPA Regions. A listing of ACRES Brownfield sites is obtained from Cleanups in My Community. Cleanups in My Community provides information on Brownfields properties for which information is reported back to EPA, as well as areas served by Brownfields grant programs.

Date of Government Version: 09/22/2014
Date Data Arrived at EDR: 09/23/2014
Date Made Active in Reports: 10/20/2014
Number of Days to Update: 27

Source: Environmental Protection Agency
Telephone: 202-566-2777
Last EDR Contact: 09/23/2014
Next Scheduled EDR Contact: 01/05/2015
Data Release Frequency: Semi-Annually

Local Lists of Landfill / Solid Waste Disposal Sites

DEBRIS REGION 9: Torres Martinez Reservation Illegal Dump Site Locations

A listing of illegal dump sites location on the Torres Martinez Indian Reservation located in eastern Riverside County and northern Imperial County, California.

Date of Government Version: 01/12/2009
Date Data Arrived at EDR: 05/07/2009
Date Made Active in Reports: 09/21/2009
Number of Days to Update: 137

Source: EPA, Region 9
Telephone: 415-947-4219
Last EDR Contact: 10/24/2014
Next Scheduled EDR Contact: 02/09/2015
Data Release Frequency: No Update Planned

ODI: Open Dump Inventory

An open dump is defined as a disposal facility that does not comply with one or more of the Part 257 or Part 258 Subtitle D Criteria.

Date of Government Version: 06/30/1985
Date Data Arrived at EDR: 08/09/2004
Date Made Active in Reports: 09/17/2004
Number of Days to Update: 39

Source: Environmental Protection Agency
Telephone: 800-424-9346
Last EDR Contact: 06/09/2004
Next Scheduled EDR Contact: N/A
Data Release Frequency: No Update Planned

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

INDIAN ODI: Report on the Status of Open Dumps on Indian Lands
Location of open dumps on Indian land.

Date of Government Version: 12/31/1998	Source: Environmental Protection Agency
Date Data Arrived at EDR: 12/03/2007	Telephone: 703-308-8245
Date Made Active in Reports: 01/24/2008	Last EDR Contact: 08/01/2014
Number of Days to Update: 52	Next Scheduled EDR Contact: 11/17/2014
	Data Release Frequency: Varies

Local Lists of Hazardous waste / Contaminated Sites

US CDL: Clandestine Drug Labs

A listing of clandestine drug lab locations. The U.S. Department of Justice ("the Department") provides this web site as a public service. It contains addresses of some locations where law enforcement agencies reported they found chemicals or other items that indicated the presence of either clandestine drug laboratories or dumpsites. In most cases, the source of the entries is not the Department, and the Department has not verified the entry and does not guarantee its accuracy. Members of the public must verify the accuracy of all entries by, for example, contacting local law enforcement and local health departments.

Date of Government Version: 07/25/2014	Source: Drug Enforcement Administration
Date Data Arrived at EDR: 09/09/2014	Telephone: 202-307-1000
Date Made Active in Reports: 10/20/2014	Last EDR Contact: 09/03/2014
Number of Days to Update: 41	Next Scheduled EDR Contact: 12/15/2014
	Data Release Frequency: Quarterly

CDL: Drug Lab Site Locations

A listing of clandestine drug lab site locations.

Date of Government Version: 11/26/2012	Source: Department of Environmental Protection
Date Data Arrived at EDR: 11/29/2012	Telephone: 304-926-0499
Date Made Active in Reports: 12/18/2012	Last EDR Contact: 09/17/2014
Number of Days to Update: 19	Next Scheduled EDR Contact: 12/01/2014
	Data Release Frequency: Varies

US HIST CDL: National Clandestine Laboratory Register

A listing of clandestine drug lab locations. The U.S. Department of Justice ("the Department") provides this web site as a public service. It contains addresses of some locations where law enforcement agencies reported they found chemicals or other items that indicated the presence of either clandestine drug laboratories or dumpsites. In most cases, the source of the entries is not the Department, and the Department has not verified the entry and does not guarantee its accuracy. Members of the public must verify the accuracy of all entries by, for example, contacting local law enforcement and local health departments.

Date of Government Version: 07/25/2014	Source: Drug Enforcement Administration
Date Data Arrived at EDR: 09/09/2014	Telephone: 202-307-1000
Date Made Active in Reports: 10/20/2014	Last EDR Contact: 09/03/2014
Number of Days to Update: 41	Next Scheduled EDR Contact: 12/15/2014
	Data Release Frequency: No Update Planned

Local Land Records

LIENS 2: CERCLA Lien Information

A Federal CERCLA ('Superfund') lien can exist by operation of law at any site or property at which EPA has spent Superfund monies. These monies are spent to investigate and address releases and threatened releases of contamination. CERCLIS provides information as to the identity of these sites and properties.

Date of Government Version: 02/18/2014	Source: Environmental Protection Agency
Date Data Arrived at EDR: 03/18/2014	Telephone: 202-564-6023
Date Made Active in Reports: 04/24/2014	Last EDR Contact: 10/27/2014
Number of Days to Update: 37	Next Scheduled EDR Contact: 02/09/2015
	Data Release Frequency: Varies

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

Records of Emergency Release Reports

HMIRS: Hazardous Materials Information Reporting System

Hazardous Materials Incident Report System. HMIRS contains hazardous material spill incidents reported to DOT.

Date of Government Version: 06/30/2014	Source: U.S. Department of Transportation
Date Data Arrived at EDR: 07/01/2014	Telephone: 202-366-4555
Date Made Active in Reports: 09/18/2014	Last EDR Contact: 10/01/2014
Number of Days to Update: 79	Next Scheduled EDR Contact: 01/12/2015
	Data Release Frequency: Annually

SPILLS: Spills Listing

A listing of spills and releases reported to the Office of Emergency Services, they do not include any TRI information.

Date of Government Version: 07/28/2014	Source: Office of Emergency Services
Date Data Arrived at EDR: 07/28/2014	Telephone: 304-558-5380
Date Made Active in Reports: 09/17/2014	Last EDR Contact: 10/27/2014
Number of Days to Update: 51	Next Scheduled EDR Contact: 02/09/2015
	Data Release Frequency: Varies

Other Ascertainable Records

RCRA NonGen / NLR: RCRA - Non Generators

RCRAInfo is EPA's comprehensive information system, providing access to data supporting the Resource Conservation and Recovery Act (RCRA) of 1976 and the Hazardous and Solid Waste Amendments (HSWA) of 1984. The database includes selective information on sites which generate, transport, store, treat and/or dispose of hazardous waste as defined by the Resource Conservation and Recovery Act (RCRA). Non-Generators do not presently generate hazardous waste.

Date of Government Version: 06/10/2014	Source: Environmental Protection Agency
Date Data Arrived at EDR: 07/02/2014	Telephone: 800-438-2474
Date Made Active in Reports: 09/18/2014	Last EDR Contact: 10/01/2014
Number of Days to Update: 78	Next Scheduled EDR Contact: 01/12/2015
	Data Release Frequency: Varies

DOT OPS: Incident and Accident Data

Department of Transportation, Office of Pipeline Safety Incident and Accident data.

Date of Government Version: 07/31/2012	Source: Department of Transportation, Office of Pipeline Safety
Date Data Arrived at EDR: 08/07/2012	Telephone: 202-366-4595
Date Made Active in Reports: 09/18/2012	Last EDR Contact: 08/06/2014
Number of Days to Update: 42	Next Scheduled EDR Contact: 11/17/2014
	Data Release Frequency: Varies

DOD: Department of Defense Sites

This data set consists of federally owned or administered lands, administered by the Department of Defense, that have any area equal to or greater than 640 acres of the United States, Puerto Rico, and the U.S. Virgin Islands.

Date of Government Version: 12/31/2005	Source: USGS
Date Data Arrived at EDR: 11/10/2006	Telephone: 888-275-8747
Date Made Active in Reports: 01/11/2007	Last EDR Contact: 10/24/2014
Number of Days to Update: 62	Next Scheduled EDR Contact: 01/26/2015
	Data Release Frequency: Semi-Annually

FUDS: Formerly Used Defense Sites

The listing includes locations of Formerly Used Defense Sites properties where the US Army Corps of Engineers is actively working or will take necessary cleanup actions.

Date of Government Version: 06/06/2014	Source: U.S. Army Corps of Engineers
Date Data Arrived at EDR: 09/10/2014	Telephone: 202-528-4285
Date Made Active in Reports: 09/18/2014	Last EDR Contact: 09/10/2014
Number of Days to Update: 8	Next Scheduled EDR Contact: 12/22/2014
	Data Release Frequency: Varies

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

CONSENT: Superfund (CERCLA) Consent Decrees

Major legal settlements that establish responsibility and standards for cleanup at NPL (Superfund) sites. Released periodically by United States District Courts after settlement by parties to litigation matters.

Date of Government Version: 12/31/2013	Source: Department of Justice, Consent Decree Library
Date Data Arrived at EDR: 01/24/2014	Telephone: Varies
Date Made Active in Reports: 02/24/2014	Last EDR Contact: 09/30/2014
Number of Days to Update: 31	Next Scheduled EDR Contact: 01/12/2015
	Data Release Frequency: Varies

ROD: Records Of Decision

Record of Decision. ROD documents mandate a permanent remedy at an NPL (Superfund) site containing technical and health information to aid in the cleanup.

Date of Government Version: 11/25/2013	Source: EPA
Date Data Arrived at EDR: 12/12/2013	Telephone: 703-416-0223
Date Made Active in Reports: 02/24/2014	Last EDR Contact: 09/09/2014
Number of Days to Update: 74	Next Scheduled EDR Contact: 12/22/2014
	Data Release Frequency: Annually

UMTRA: Uranium Mill Tailings Sites

Uranium ore was mined by private companies for federal government use in national defense programs. When the mills shut down, large piles of the sand-like material (mill tailings) remain after uranium has been extracted from the ore. Levels of human exposure to radioactive materials from the piles are low; however, in some cases tailings were used as construction materials before the potential health hazards of the tailings were recognized.

Date of Government Version: 09/14/2010	Source: Department of Energy
Date Data Arrived at EDR: 10/07/2011	Telephone: 505-845-0011
Date Made Active in Reports: 03/01/2012	Last EDR Contact: 08/20/2014
Number of Days to Update: 146	Next Scheduled EDR Contact: 12/08/2014
	Data Release Frequency: Varies

US MINES: Mines Master Index File

Contains all mine identification numbers issued for mines active or opened since 1971. The data also includes violation information.

Date of Government Version: 01/30/2014	Source: Department of Labor, Mine Safety and Health Administration
Date Data Arrived at EDR: 03/05/2014	Telephone: 303-231-5959
Date Made Active in Reports: 07/15/2014	Last EDR Contact: 09/04/2014
Number of Days to Update: 132	Next Scheduled EDR Contact: 12/15/2014
	Data Release Frequency: Semi-Annually

TRIS: Toxic Chemical Release Inventory System

Toxic Release Inventory System. TRIS identifies facilities which release toxic chemicals to the air, water and land in reportable quantities under SARA Title III Section 313.

Date of Government Version: 12/31/2011	Source: EPA
Date Data Arrived at EDR: 07/31/2013	Telephone: 202-566-0250
Date Made Active in Reports: 09/13/2013	Last EDR Contact: 08/29/2014
Number of Days to Update: 44	Next Scheduled EDR Contact: 12/08/2014
	Data Release Frequency: Annually

TSCA: Toxic Substances Control Act

Toxic Substances Control Act. TSCA identifies manufacturers and importers of chemical substances included on the TSCA Chemical Substance Inventory list. It includes data on the production volume of these substances by plant site.

Date of Government Version: 12/31/2006	Source: EPA
Date Data Arrived at EDR: 09/29/2010	Telephone: 202-260-5521
Date Made Active in Reports: 12/02/2010	Last EDR Contact: 09/26/2014
Number of Days to Update: 64	Next Scheduled EDR Contact: 01/05/2015
	Data Release Frequency: Every 4 Years

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

FTTS: FIFRA/ TSCA Tracking System - FIFRA (Federal Insecticide, Fungicide, & Rodenticide Act)/TSCA (Toxic Substances Control Act)

FTTS tracks administrative cases and pesticide enforcement actions and compliance activities related to FIFRA, TSCA and EPCRA (Emergency Planning and Community Right-to-Know Act). To maintain currency, EDR contacts the Agency on a quarterly basis.

Date of Government Version: 04/09/2009	Source: EPA/Office of Prevention, Pesticides and Toxic Substances
Date Data Arrived at EDR: 04/16/2009	Telephone: 202-566-1667
Date Made Active in Reports: 05/11/2009	Last EDR Contact: 08/19/2014
Number of Days to Update: 25	Next Scheduled EDR Contact: 12/08/2014
	Data Release Frequency: Quarterly

FTTS INSP: FIFRA/ TSCA Tracking System - FIFRA (Federal Insecticide, Fungicide, & Rodenticide Act)/TSCA (Toxic Substances Control Act)

A listing of FIFRA/TSCA Tracking System (FTTS) inspections and enforcements.

Date of Government Version: 04/09/2009	Source: EPA
Date Data Arrived at EDR: 04/16/2009	Telephone: 202-566-1667
Date Made Active in Reports: 05/11/2009	Last EDR Contact: 08/19/2014
Number of Days to Update: 25	Next Scheduled EDR Contact: 12/08/2014
	Data Release Frequency: Quarterly

HIST FTTS: FIFRA/TSCA Tracking System Administrative Case Listing

A complete administrative case listing from the FIFRA/TSCA Tracking System (FTTS) for all ten EPA regions. The information was obtained from the National Compliance Database (NCDB). NCDB supports the implementation of FIFRA (Federal Insecticide, Fungicide, and Rodenticide Act) and TSCA (Toxic Substances Control Act). Some EPA regions are now closing out records. Because of that, and the fact that some EPA regions are not providing EPA Headquarters with updated records, it was decided to create a HIST FTTS database. It included records that may not be included in the newer FTTS database updates. This database is no longer updated.

Date of Government Version: 10/19/2006	Source: Environmental Protection Agency
Date Data Arrived at EDR: 03/01/2007	Telephone: 202-564-2501
Date Made Active in Reports: 04/10/2007	Last EDR Contact: 12/17/2007
Number of Days to Update: 40	Next Scheduled EDR Contact: 03/17/2008
	Data Release Frequency: No Update Planned

HIST FTTS INSP: FIFRA/TSCA Tracking System Inspection & Enforcement Case Listing

A complete inspection and enforcement case listing from the FIFRA/TSCA Tracking System (FTTS) for all ten EPA regions. The information was obtained from the National Compliance Database (NCDB). NCDB supports the implementation of FIFRA (Federal Insecticide, Fungicide, and Rodenticide Act) and TSCA (Toxic Substances Control Act). Some EPA regions are now closing out records. Because of that, and the fact that some EPA regions are not providing EPA Headquarters with updated records, it was decided to create a HIST FTTS database. It included records that may not be included in the newer FTTS database updates. This database is no longer updated.

Date of Government Version: 10/19/2006	Source: Environmental Protection Agency
Date Data Arrived at EDR: 03/01/2007	Telephone: 202-564-2501
Date Made Active in Reports: 04/10/2007	Last EDR Contact: 12/17/2008
Number of Days to Update: 40	Next Scheduled EDR Contact: 03/17/2008
	Data Release Frequency: No Update Planned

SSTS: Section 7 Tracking Systems

Section 7 of the Federal Insecticide, Fungicide and Rodenticide Act, as amended (92 Stat. 829) requires all registered pesticide-producing establishments to submit a report to the Environmental Protection Agency by March 1st each year. Each establishment must report the types and amounts of pesticides, active ingredients and devices being produced, and those having been produced and sold or distributed in the past year.

Date of Government Version: 12/31/2009	Source: EPA
Date Data Arrived at EDR: 12/10/2010	Telephone: 202-564-4203
Date Made Active in Reports: 02/25/2011	Last EDR Contact: 10/27/2014
Number of Days to Update: 77	Next Scheduled EDR Contact: 02/09/2015
	Data Release Frequency: Annually

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

ICIS: Integrated Compliance Information System

The Integrated Compliance Information System (ICIS) supports the information needs of the national enforcement and compliance program as well as the unique needs of the National Pollutant Discharge Elimination System (NPDES) program.

Date of Government Version: 05/06/2014	Source: Environmental Protection Agency
Date Data Arrived at EDR: 05/16/2014	Telephone: 202-564-5088
Date Made Active in Reports: 06/17/2014	Last EDR Contact: 10/10/2014
Number of Days to Update: 32	Next Scheduled EDR Contact: 01/26/2015
	Data Release Frequency: Quarterly

PADS: PCB Activity Database System

PCB Activity Database. PADS Identifies generators, transporters, commercial storers and/or brokers and disposers of PCB's who are required to notify the EPA of such activities.

Date of Government Version: 06/01/2013	Source: EPA
Date Data Arrived at EDR: 07/17/2013	Telephone: 202-566-0500
Date Made Active in Reports: 11/01/2013	Last EDR Contact: 10/15/2014
Number of Days to Update: 107	Next Scheduled EDR Contact: 01/26/2015
	Data Release Frequency: Annually

MLTS: Material Licensing Tracking System

MLTS is maintained by the Nuclear Regulatory Commission and contains a list of approximately 8,100 sites which possess or use radioactive materials and which are subject to NRC licensing requirements. To maintain currency, EDR contacts the Agency on a quarterly basis.

Date of Government Version: 07/22/2013	Source: Nuclear Regulatory Commission
Date Data Arrived at EDR: 08/02/2013	Telephone: 301-415-7169
Date Made Active in Reports: 11/01/2013	Last EDR Contact: 09/08/2014
Number of Days to Update: 91	Next Scheduled EDR Contact: 12/22/2014
	Data Release Frequency: Quarterly

RADINFO: Radiation Information Database

The Radiation Information Database (RADINFO) contains information about facilities that are regulated by U.S. Environmental Protection Agency (EPA) regulations for radiation and radioactivity.

Date of Government Version: 10/07/2014	Source: Environmental Protection Agency
Date Data Arrived at EDR: 10/08/2014	Telephone: 202-343-9775
Date Made Active in Reports: 10/20/2014	Last EDR Contact: 10/08/2014
Number of Days to Update: 12	Next Scheduled EDR Contact: 01/19/2015
	Data Release Frequency: Quarterly

FINDS: Facility Index System/Facility Registry System

Facility Index System. FINDS contains both facility information and 'pointers' to other sources that contain more detail. EDR includes the following FINDS databases in this report: PCS (Permit Compliance System), AIRS (Aerometric Information Retrieval System), DOCKET (Enforcement Docket used to manage and track information on civil judicial enforcement cases for all environmental statutes), FURS (Federal Underground Injection Control), C-DOCKET (Criminal Docket System used to track criminal enforcement actions for all environmental statutes), FFIS (Federal Facilities Information System), STATE (State Environmental Laws and Statutes), and PADS (PCB Activity Data System).

Date of Government Version: 08/16/2014	Source: EPA
Date Data Arrived at EDR: 09/10/2014	Telephone: (215) 814-5000
Date Made Active in Reports: 10/20/2014	Last EDR Contact: 09/10/2014
Number of Days to Update: 40	Next Scheduled EDR Contact: 12/22/2014
	Data Release Frequency: Quarterly

RAATS: RCRA Administrative Action Tracking System

RCRA Administration Action Tracking System. RAATS contains records based on enforcement actions issued under RCRA pertaining to major violators and includes administrative and civil actions brought by the EPA. For administration actions after September 30, 1995, data entry in the RAATS database was discontinued. EPA will retain a copy of the database for historical records. It was necessary to terminate RAATS because a decrease in agency resources made it impossible to continue to update the information contained in the database.

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

Date of Government Version: 04/17/1995
Date Data Arrived at EDR: 07/03/1995
Date Made Active in Reports: 08/07/1995
Number of Days to Update: 35

Source: EPA
Telephone: 202-564-4104
Last EDR Contact: 06/02/2008
Next Scheduled EDR Contact: 09/01/2008
Data Release Frequency: No Update Planned

RMP: Risk Management Plans

When Congress passed the Clean Air Act Amendments of 1990, it required EPA to publish regulations and guidance for chemical accident prevention at facilities using extremely hazardous substances. The Risk Management Program Rule (RMP Rule) was written to implement Section 112(r) of these amendments. The rule, which built upon existing industry codes and standards, requires companies of all sizes that use certain flammable and toxic substances to develop a Risk Management Program, which includes a(n): Hazard assessment that details the potential effects of an accidental release, an accident history of the last five years, and an evaluation of worst-case and alternative accidental releases; Prevention program that includes safety precautions and maintenance, monitoring, and employee training measures; and Emergency response program that spells out emergency health care, employee training measures and procedures for informing the public and response agencies (e.g the fire department) should an accident occur.

Date of Government Version: 04/01/2014
Date Data Arrived at EDR: 05/23/2014
Date Made Active in Reports: 07/28/2014
Number of Days to Update: 66

Source: Environmental Protection Agency
Telephone: 202-564-8600
Last EDR Contact: 10/27/2014
Next Scheduled EDR Contact: 02/09/2015
Data Release Frequency: Varies

BRS: Biennial Reporting System

The Biennial Reporting System is a national system administered by the EPA that collects data on the generation and management of hazardous waste. BRS captures detailed data from two groups: Large Quantity Generators (LQG) and Treatment, Storage, and Disposal Facilities.

Date of Government Version: 12/31/2011
Date Data Arrived at EDR: 02/26/2013
Date Made Active in Reports: 04/19/2013
Number of Days to Update: 52

Source: EPA/NTIS
Telephone: 800-424-9346
Last EDR Contact: 08/29/2014
Next Scheduled EDR Contact: 12/08/2014
Data Release Frequency: Biennially

UIC: Underground Injection Wells

A listing of underground injection well locations.

Date of Government Version: 07/15/2014
Date Data Arrived at EDR: 07/16/2014
Date Made Active in Reports: 09/08/2014
Number of Days to Update: 54

Source: Department of Environmental Protection
Telephone: 304-926-0499
Last EDR Contact: 10/16/2014
Next Scheduled EDR Contact: 01/26/2015
Data Release Frequency: Varies

DRYCLEANERS: Listing of Drycleaner Locations

A listing of drycleaners which use perchloroethylene.

Date of Government Version: 05/19/2014
Date Data Arrived at EDR: 05/20/2014
Date Made Active in Reports: 06/09/2014
Number of Days to Update: 20

Source: Department of Environmental Protection
Telephone: 304-926-0475
Last EDR Contact: 08/15/2014
Next Scheduled EDR Contact: 12/01/2014
Data Release Frequency: Varies

NPDES: Wastewater Discharge Permits Listing

A listing of wastewater discharge permits.

Date of Government Version: 01/19/2010
Date Data Arrived at EDR: 01/21/2010
Date Made Active in Reports: 02/25/2010
Number of Days to Update: 35

Source: Department of Environmental Protection
Telephone: 304-926-0495
Last EDR Contact: 10/20/2014
Next Scheduled EDR Contact: 02/02/2015
Data Release Frequency: Varies

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

AIRS: Permitted Facility and Emissions Listing

Permitted facility and emissions information listing.

Date of Government Version: 01/29/2014
Date Data Arrived at EDR: 01/29/2014
Date Made Active in Reports: 04/08/2014
Number of Days to Update: 69

Source: Department of Environmental Protection
Telephone: 304-926-0499
Last EDR Contact: 10/27/2014
Next Scheduled EDR Contact: 02/09/2015
Data Release Frequency: Varies

INDIAN RESERV: Indian Reservations

This map layer portrays Indian administered lands of the United States that have any area equal to or greater than 640 acres.

Date of Government Version: 12/31/2005
Date Data Arrived at EDR: 12/08/2006
Date Made Active in Reports: 01/11/2007
Number of Days to Update: 34

Source: USGS
Telephone: 202-208-3710
Last EDR Contact: 10/24/2014
Next Scheduled EDR Contact: 01/26/2015
Data Release Frequency: Semi-Annually

SCRD DRYCLEANERS: State Coalition for Remediation of Drycleaners Listing

The State Coalition for Remediation of Drycleaners was established in 1998, with support from the U.S. EPA Office of Superfund Remediation and Technology Innovation. It is comprised of representatives of states with established drycleaner remediation programs. Currently the member states are Alabama, Connecticut, Florida, Illinois, Kansas, Minnesota, Missouri, North Carolina, Oregon, South Carolina, Tennessee, Texas, and Wisconsin.

Date of Government Version: 03/07/2011
Date Data Arrived at EDR: 03/09/2011
Date Made Active in Reports: 05/02/2011
Number of Days to Update: 54

Source: Environmental Protection Agency
Telephone: 615-532-8599
Last EDR Contact: 10/20/2014
Next Scheduled EDR Contact: 02/02/2015
Data Release Frequency: Varies

FEDLAND: Federal and Indian Lands

Federally and Indian administrated lands of the United States. Lands included are administrated by: Army Corps of Engineers, Bureau of Reclamation, National Wild and Scenic River, National Wildlife Refuge, Public Domain Land, Wilderness, Wilderness Study Area, Wildlife Management Area, Bureau of Indian Affairs, Bureau of Land Management, Department of Justice, Forest Service, Fish and Wildlife Service, National Park Service.

Date of Government Version: 12/31/2005
Date Data Arrived at EDR: 02/06/2006
Date Made Active in Reports: 01/11/2007
Number of Days to Update: 339

Source: U.S. Geological Survey
Telephone: 888-275-8747
Last EDR Contact: 10/24/2014
Next Scheduled EDR Contact: 01/26/2015
Data Release Frequency: N/A

2020 COR ACTION: 2020 Corrective Action Program List

The EPA has set ambitious goals for the RCRA Corrective Action program by creating the 2020 Corrective Action Universe. This RCRA cleanup baseline includes facilities expected to need corrective action. The 2020 universe contains a wide variety of sites. Some properties are heavily contaminated while others were contaminated but have since been cleaned up. Still others have not been fully investigated yet, and may require little or no remediation. Inclusion in the 2020 Universe does not necessarily imply failure on the part of a facility to meet its RCRA obligations.

Date of Government Version: 11/11/2011
Date Data Arrived at EDR: 05/18/2012
Date Made Active in Reports: 05/25/2012
Number of Days to Update: 7

Source: Environmental Protection Agency
Telephone: 703-308-4044
Last EDR Contact: 08/15/2014
Next Scheduled EDR Contact: 11/24/2014
Data Release Frequency: Varies

PRP: Potentially Responsible Parties

A listing of verified Potentially Responsible Parties

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

Date of Government Version: 10/25/2013
Date Data Arrived at EDR: 10/17/2014
Date Made Active in Reports: 10/20/2014
Number of Days to Update: 3

Source: EPA
Telephone: 202-564-6023
Last EDR Contact: 09/30/2014
Next Scheduled EDR Contact: 01/12/2015
Data Release Frequency: Quarterly

LEAD SMELTER 2: Lead Smelter Sites

A list of several hundred sites in the U.S. where secondary lead smelting was done from 1931 and 1964. These sites may pose a threat to public health through ingestion or inhalation of contaminated soil or dust

Date of Government Version: 04/05/2001
Date Data Arrived at EDR: 10/27/2010
Date Made Active in Reports: 12/02/2010
Number of Days to Update: 36

Source: American Journal of Public Health
Telephone: 703-305-6451
Last EDR Contact: 12/02/2009
Next Scheduled EDR Contact: N/A
Data Release Frequency: No Update Planned

LEAD SMELTER 1: Lead Smelter Sites

A listing of former lead smelter site locations.

Date of Government Version: 06/04/2014
Date Data Arrived at EDR: 06/12/2014
Date Made Active in Reports: 07/28/2014
Number of Days to Update: 46

Source: Environmental Protection Agency
Telephone: 703-603-8787
Last EDR Contact: 10/06/2014
Next Scheduled EDR Contact: 01/19/2015
Data Release Frequency: Varies

EPA WATCH LIST: EPA WATCH LIST

EPA maintains a "Watch List" to facilitate dialogue between EPA, state and local environmental agencies on enforcement matters relating to facilities with alleged violations identified as either significant or high priority. Being on the Watch List does not mean that the facility has actually violated the law only that an investigation by EPA or a state or local environmental agency has led those organizations to allege that an unproven violation has in fact occurred. Being on the Watch List does not represent a higher level of concern regarding the alleged violations that were detected, but instead indicates cases requiring additional dialogue between EPA, state and local agencies - primarily because of the length of time the alleged violation has gone unaddressed or unresolved.

Date of Government Version: 08/30/2013
Date Data Arrived at EDR: 03/21/2014
Date Made Active in Reports: 06/17/2014
Number of Days to Update: 88

Source: Environmental Protection Agency
Telephone: 617-520-3000
Last EDR Contact: 08/15/2014
Next Scheduled EDR Contact: 11/24/2014
Data Release Frequency: Quarterly

COAL ASH: Coal Ash Landfills

A listing of coal ash landfill site locations.

Date of Government Version: 04/07/2011
Date Data Arrived at EDR: 04/27/2011
Date Made Active in Reports: 06/02/2011
Number of Days to Update: 36

Source: Department of Environmental Protection
Telephone: 304-926-0499
Last EDR Contact: 10/14/2014
Next Scheduled EDR Contact: 01/26/2015
Data Release Frequency: Varies

PCB TRANSFORMER: PCB Transformer Registration Database

The database of PCB transformer registrations that includes all PCB registration submittals.

Date of Government Version: 02/01/2011
Date Data Arrived at EDR: 10/19/2011
Date Made Active in Reports: 01/10/2012
Number of Days to Update: 83

Source: Environmental Protection Agency
Telephone: 202-566-0517
Last EDR Contact: 08/01/2014
Next Scheduled EDR Contact: 11/10/2014
Data Release Frequency: Varies

Financial Assurance: Financial Assurance Information Listing

A listing of financial assurance information for underground storage tank facilities. Financial assurance is intended to ensure that resources are available to pay for the cost of closure, post-closure care, and corrective measures if the owner or operator of a regulated facility is unable or unwilling to pay.

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

Date of Government Version: 03/05/2013
Date Data Arrived at EDR: 03/07/2013
Date Made Active in Reports: 04/05/2013
Number of Days to Update: 29

Source: Department of Environmental Protection
Telephone: 304-926-0499
Last EDR Contact: 09/02/2014
Next Scheduled EDR Contact: 12/15/2014
Data Release Frequency: Varies

US FIN ASSUR: Financial Assurance Information

All owners and operators of facilities that treat, store, or dispose of hazardous waste are required to provide proof that they will have sufficient funds to pay for the clean up, closure, and post-closure care of their facilities.

Date of Government Version: 09/04/2014
Date Data Arrived at EDR: 09/04/2014
Date Made Active in Reports: 10/20/2014
Number of Days to Update: 46

Source: Environmental Protection Agency
Telephone: 202-566-1917
Last EDR Contact: 08/14/2014
Next Scheduled EDR Contact: 12/01/2014
Data Release Frequency: Quarterly

COAL ASH EPA: Coal Combustion Residues Surface Impoundments List

A listing of coal combustion residues surface impoundments with high hazard potential ratings.

Date of Government Version: 07/01/2014
Date Data Arrived at EDR: 09/10/2014
Date Made Active in Reports: 10/20/2014
Number of Days to Update: 40

Source: Environmental Protection Agency
Telephone: N/A
Last EDR Contact: 09/10/2014
Next Scheduled EDR Contact: 12/22/2014
Data Release Frequency: Varies

US AIRS MINOR: Air Facility System Data

A listing of minor source facilities.

Date of Government Version: 10/23/2013
Date Data Arrived at EDR: 11/06/2013
Date Made Active in Reports: 12/06/2013
Number of Days to Update: 30

Source: EPA
Telephone: 202-564-2496
Last EDR Contact: 09/29/2014
Next Scheduled EDR Contact: 01/12/2015
Data Release Frequency: Annually

US AIRS (AFS): Aerometric Information Retrieval System Facility Subsystem (AFS)

The database is a sub-system of Aerometric Information Retrieval System (AIRS). AFS contains compliance data on air pollution point sources regulated by the U.S. EPA and/or state and local air regulatory agencies. This information comes from source reports by various stationary sources of air pollution, such as electric power plants, steel mills, factories, and universities, and provides information about the air pollutants they produce. Action, air program, air program pollutant, and general level plant data. It is used to track emissions and compliance data from industrial plants.

Date of Government Version: 10/23/2013
Date Data Arrived at EDR: 11/06/2013
Date Made Active in Reports: 12/06/2013
Number of Days to Update: 30

Source: EPA
Telephone: 202-564-2496
Last EDR Contact: 09/29/2014
Next Scheduled EDR Contact: 01/12/2015
Data Release Frequency: Annually

COAL ASH DOE: Sleam-Electric Plan Operation Data

A listing of power plants that store ash in surface ponds.

Date of Government Version: 12/31/2005
Date Data Arrived at EDR: 08/07/2009
Date Made Active in Reports: 10/22/2009
Number of Days to Update: 76

Source: Department of Energy
Telephone: 202-586-8719
Last EDR Contact: 10/17/2014
Next Scheduled EDR Contact: 01/26/2015
Data Release Frequency: Varies

EDR HIGH RISK HISTORICAL RECORDS

EDR Exclusive Records

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

EDR MGP: EDR Proprietary Manufactured Gas Plants

The EDR Proprietary Manufactured Gas Plant Database includes records of coal gas plants (manufactured gas plants) compiled by EDR's researchers. Manufactured gas sites were used in the United States from the 1800's to 1950's to produce a gas that could be distributed and used as fuel. These plants used whale oil, rosin, coal, or a mixture of coal, oil, and water that also produced a significant amount of waste. Many of the byproducts of the gas production, such as coal tar (oily waste containing volatile and non-volatile chemicals), sludges, oils and other compounds are potentially hazardous to human health and the environment. The byproduct from this process was frequently disposed of directly at the plant site and can remain or spread slowly, serving as a continuous source of soil and groundwater contamination.

Date of Government Version: N/A
Date Data Arrived at EDR: N/A
Date Made Active in Reports: N/A
Number of Days to Update: N/A

Source: EDR, Inc.
Telephone: N/A
Last EDR Contact: N/A
Next Scheduled EDR Contact: N/A
Data Release Frequency: No Update Planned

EDR US Hist Auto Stat: EDR Exclusive Historic Gas Stations

EDR has searched selected national collections of business directories and has collected listings of potential gas station/filling station/service station sites that were available to EDR researchers. EDR's review was limited to those categories of sources that might, in EDR's opinion, include gas station/filling station/service station establishments. The categories reviewed included, but were not limited to gas, gas station, gasoline station, filling station, auto, automobile repair, auto service station, service station, etc. This database falls within a category of information EDR classifies as "High Risk Historical Records", or HRHR. EDR's HRHR effort presents unique and sometimes proprietary data about past sites and operations that typically create environmental concerns, but may not show up in current government records searches.

Date of Government Version: N/A
Date Data Arrived at EDR: N/A
Date Made Active in Reports: N/A
Number of Days to Update: N/A

Source: EDR, Inc.
Telephone: N/A
Last EDR Contact: N/A
Next Scheduled EDR Contact: N/A
Data Release Frequency: Varies

EDR US Hist Cleaners: EDR Exclusive Historic Dry Cleaners

EDR has searched selected national collections of business directories and has collected listings of potential dry cleaner sites that were available to EDR researchers. EDR's review was limited to those categories of sources that might, in EDR's opinion, include dry cleaning establishments. The categories reviewed included, but were not limited to dry cleaners, cleaners, laundry, laundromat, cleaning/laundry, wash & dry etc. This database falls within a category of information EDR classifies as "High Risk Historical Records", or HRHR. EDR's HRHR effort presents unique and sometimes proprietary data about past sites and operations that typically create environmental concerns, but may not show up in current government records searches.

Date of Government Version: N/A
Date Data Arrived at EDR: N/A
Date Made Active in Reports: N/A
Number of Days to Update: N/A

Source: EDR, Inc.
Telephone: N/A
Last EDR Contact: N/A
Next Scheduled EDR Contact: N/A
Data Release Frequency: Varies

EDR RECOVERED GOVERNMENT ARCHIVES

Exclusive Recovered Govt. Archives

RGA LF: Recovered Government Archive Solid Waste Facilities List

The EDR Recovered Government Archive Landfill database provides a list of landfills derived from historical databases and includes many records that no longer appear in current government lists. Compiled from Records formerly available from the Division of Environmental Protection in West Virginia.

Date of Government Version: N/A
Date Data Arrived at EDR: 07/01/2013
Date Made Active in Reports: 01/20/2014
Number of Days to Update: 203

Source: Division of Environmental Protection
Telephone: N/A
Last EDR Contact: 06/01/2012
Next Scheduled EDR Contact: N/A
Data Release Frequency: Varies

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

RGA LUST: Recovered Government Archive Leaking Underground Storage Tank

The EDR Recovered Government Archive Leaking Underground Storage Tank database provides a list of LUST incidents derived from historical databases and includes many records that no longer appear in current government lists. Compiled from Records formerly available from the Division of Environmental Protection in West Virginia.

Date of Government Version: N/A
Date Data Arrived at EDR: 07/01/2013
Date Made Active in Reports: 12/30/2013
Number of Days to Update: 182

Source: Division of Environmental Protection
Telephone: N/A
Last EDR Contact: 06/01/2012
Next Scheduled EDR Contact: N/A
Data Release Frequency: Varies

OTHER DATABASE(S)

Depending on the geographic area covered by this report, the data provided in these specialty databases may or may not be complete. For example, the existence of wetlands information data in a specific report does not mean that all wetlands in the area covered by the report are included. Moreover, the absence of any reported wetlands information does not necessarily mean that wetlands do not exist in the area covered by the report.

NJ MANIFEST: Manifest Information

Hazardous waste manifest information.

Date of Government Version: 12/31/2011
Date Data Arrived at EDR: 07/19/2012
Date Made Active in Reports: 08/28/2012
Number of Days to Update: 40

Source: Department of Environmental Protection
Telephone: N/A
Last EDR Contact: 10/10/2014
Next Scheduled EDR Contact: 01/26/2015
Data Release Frequency: Annually

NY MANIFEST: Facility and Manifest Data

Manifest is a document that lists and tracks hazardous waste from the generator through transporters to a TSD facility.

Date of Government Version: 08/01/2014
Date Data Arrived at EDR: 08/07/2014
Date Made Active in Reports: 10/17/2014
Number of Days to Update: 71

Source: Department of Environmental Conservation
Telephone: 518-402-8651
Last EDR Contact: 08/07/2014
Next Scheduled EDR Contact: 11/17/2014
Data Release Frequency: Annually

PA MANIFEST: Manifest Information

Hazardous waste manifest information.

Date of Government Version: 12/31/2013
Date Data Arrived at EDR: 07/21/2014
Date Made Active in Reports: 08/25/2014
Number of Days to Update: 35

Source: Department of Environmental Protection
Telephone: 717-783-8990
Last EDR Contact: 10/20/2014
Next Scheduled EDR Contact: 02/02/2015
Data Release Frequency: Annually

RI MANIFEST: Manifest information

Hazardous waste manifest information

Date of Government Version: 12/31/2013
Date Data Arrived at EDR: 07/15/2014
Date Made Active in Reports: 08/13/2014
Number of Days to Update: 29

Source: Department of Environmental Management
Telephone: 401-222-2797
Last EDR Contact: 08/26/2014
Next Scheduled EDR Contact: 12/08/2014
Data Release Frequency: Annually

WI MANIFEST: Manifest Information

Hazardous waste manifest information.

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

Date of Government Version: 12/31/2013
Date Data Arrived at EDR: 06/20/2014
Date Made Active in Reports: 08/07/2014
Number of Days to Update: 48

Source: Department of Natural Resources
Telephone: N/A
Last EDR Contact: 09/15/2014
Next Scheduled EDR Contact: 12/29/2014
Data Release Frequency: Annually

Oil/Gas Pipelines: This data was obtained by EDR from the USGS in 1994. It is referred to by USGS as GeoData Digital Line Graphs from 1:100,000-Scale Maps. It was extracted from the transportation category including some oil, but primarily gas pipelines.

Sensitive Receptors: There are individuals deemed sensitive receptors due to their fragile immune systems and special sensitivity to environmental discharges. These sensitive receptors typically include the elderly, the sick, and children. While the location of all sensitive receptors cannot be determined, EDR indicates those buildings and facilities - schools, daycares, hospitals, medical centers, and nursing homes - where individuals who are sensitive receptors are likely to be located.

AHA Hospitals:

Source: American Hospital Association, Inc.
Telephone: 312-280-5991

The database includes a listing of hospitals based on the American Hospital Association's annual survey of hospitals.

Medical Centers: Provider of Services Listing

Source: Centers for Medicare & Medicaid Services
Telephone: 410-786-3000

A listing of hospitals with Medicare provider number, produced by Centers of Medicare & Medicaid Services, a federal agency within the U.S. Department of Health and Human Services.

Nursing Homes

Source: National Institutes of Health
Telephone: 301-594-6248

Information on Medicare and Medicaid certified nursing homes in the United States.

Public Schools

Source: National Center for Education Statistics
Telephone: 202-502-7300

The National Center for Education Statistics' primary database on elementary and secondary public education in the United States. It is a comprehensive, annual, national statistical database of all public elementary and secondary schools and school districts, which contains data that are comparable across all states.

Private Schools

Source: National Center for Education Statistics
Telephone: 202-502-7300

The National Center for Education Statistics' primary database on private school locations in the United States.

Daycare Centers: Day Care Center List

Source: Office of Social Services
Telephone: 304-558-7980

Flood Zone Data: This data, available in select counties across the country, was obtained by EDR in 2003 & 2011 from the Federal Emergency Management Agency (FEMA). Data depicts 100-year and 500-year flood zones as defined by FEMA.

NWI: National Wetlands Inventory. This data, available in select counties across the country, was obtained by EDR in 2002, 2005 and 2010 from the U.S. Fish and Wildlife Service.

Scanned Digital USGS 7.5' Topographic Map (DRG)

Source: United States Geologic Survey

A digital raster graphic (DRG) is a scanned image of a U.S. Geological Survey topographic map. The map images are made by scanning published paper maps on high-resolution scanners. The raster image is georeferenced and fit to the Universal Transverse Mercator (UTM) projection.

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

STREET AND ADDRESS INFORMATION

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GEOCHECK[®] - PHYSICAL SETTING SOURCE ADDENDUM

TARGET PROPERTY ADDRESS

GREEN BANK
POTOMAC HIGHLAND TRAIL AND SLAVIN HOLLOW RD
CASS, WV 24927

TARGET PROPERTY COORDINATES

Latitude (North):	38.4357 - 38° 26' 8.52"
Longitude (West):	79.838 - 79° 50' 16.80"
Universal Tranverse Mercator:	Zone 17
UTM X (Meters):	601418.1
UTM Y (Meters):	4254591.5
Elevation:	2645 ft. above sea level

USGS TOPOGRAPHIC MAP

Target Property Map:	38079-D7 GREEN BANK, WV
Most Recent Revision:	1998

EDR's GeoCheck Physical Setting Source Addendum is provided to assist the environmental professional in forming an opinion about the impact of potential contaminant migration.

Assessment of the impact of contaminant migration generally has two principal investigative components:

1. Groundwater flow direction, and
2. Groundwater flow velocity.

Groundwater flow direction may be impacted by surface topography, hydrology, hydrogeology, characteristics of the soil, and nearby wells. Groundwater flow velocity is generally impacted by the nature of the geologic strata.

GEOCHECK® - PHYSICAL SETTING SOURCE SUMMARY

GROUNDWATER FLOW DIRECTION INFORMATION

Groundwater flow direction for a particular site is best determined by a qualified environmental professional using site-specific well data. If such data is not reasonably ascertainable, it may be necessary to rely on other sources of information, such as surface topographic information, hydrologic information, hydrogeologic data collected on nearby properties, and regional groundwater flow information (from deep aquifers).

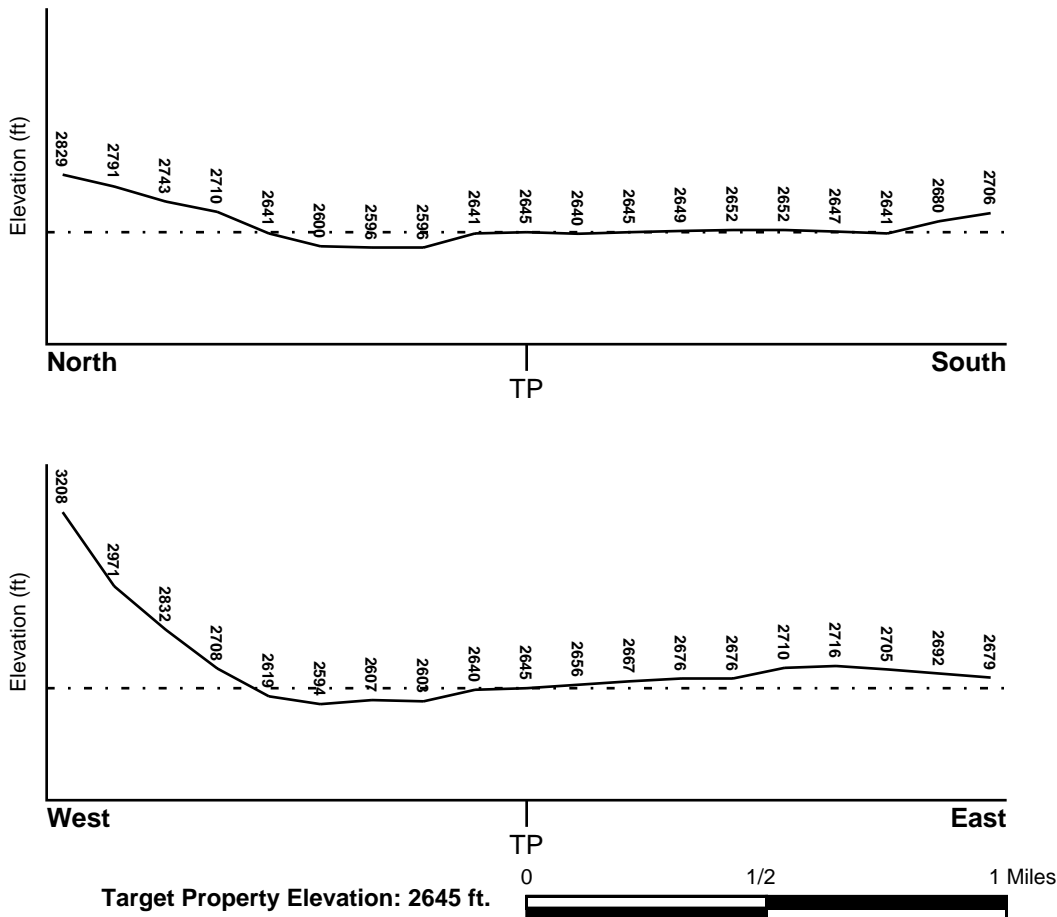
TOPOGRAPHIC INFORMATION

Surface topography may be indicative of the direction of surficial groundwater flow. This information can be used to assist the environmental professional in forming an opinion about the impact of nearby contaminated properties or, should contamination exist on the target property, what downgradient sites might be impacted.

TARGET PROPERTY TOPOGRAPHY

General Topographic Gradient: General NW

SURROUNDING TOPOGRAPHY: ELEVATION PROFILES



Source: Topography has been determined from the USGS 7.5' Digital Elevation Model and should be evaluated on a relative (not an absolute) basis. Relative elevation information between sites of close proximity should be field verified.

GEOCHECK® - PHYSICAL SETTING SOURCE SUMMARY

HYDROLOGIC INFORMATION

Surface water can act as a hydrologic barrier to groundwater flow. Such hydrologic information can be used to assist the environmental professional in forming an opinion about the impact of nearby contaminated properties or, should contamination exist on the target property, what downgradient sites might be impacted.

Refer to the Physical Setting Source Map following this summary for hydrologic information (major waterways and bodies of water).

FEMA FLOOD ZONE

<u>Target Property County</u> POCAHONTAS, WV	<u>FEMA Flood Electronic Data</u> YES - refer to the Overview Map and Detail Map
-------------------------------------------------	-------------------------------------------------------------------------------------

Flood Plain Panel at Target Property: 54075C - FEMA DFIRM Flood data

Additional Panels in search area: Not Reported

NATIONAL WETLAND INVENTORY

<u>NWI Quad at Target Property</u> GREEN BANK	<u>NWI Electronic Data Coverage</u> YES - refer to the Overview Map and Detail Map
--------------------------------------------------	---------------------------------------------------------------------------------------

HYDROGEOLOGIC INFORMATION

Hydrogeologic information obtained by installation of wells on a specific site can often be an indicator of groundwater flow direction in the immediate area. Such hydrogeologic information can be used to assist the environmental professional in forming an opinion about the impact of nearby contaminated properties or, should contamination exist on the target property, what downgradient sites might be impacted.

AQUIFLOW®

Search Radius: 1.000 Mile.

EDR has developed the AQUIFLOW Information System to provide data on the general direction of groundwater flow at specific points. EDR has reviewed reports submitted by environmental professionals to regulatory authorities at select sites and has extracted the date of the report, groundwater flow direction as determined hydrogeologically, and the depth to water table.

<u>MAP ID</u>	<u>LOCATION FROM TP</u>	<u>GENERAL DIRECTION GROUNDWATER FLOW</u>
Not Reported		

GEOCHECK® - PHYSICAL SETTING SOURCE SUMMARY

GROUNDWATER FLOW VELOCITY INFORMATION

Groundwater flow velocity information for a particular site is best determined by a qualified environmental professional using site specific geologic and soil strata data. If such data are not reasonably ascertainable, it may be necessary to rely on other sources of information, including geologic age identification, rock stratigraphic unit and soil characteristics data collected on nearby properties and regional soil information. In general, contaminant plumes move more quickly through sandy-gravelly types of soils than silty-clayey types of soils.

GEOLOGIC INFORMATION IN GENERAL AREA OF TARGET PROPERTY

Geologic information can be used by the environmental professional in forming an opinion about the relative speed at which contaminant migration may be occurring.

ROCK STRATIGRAPHIC UNIT

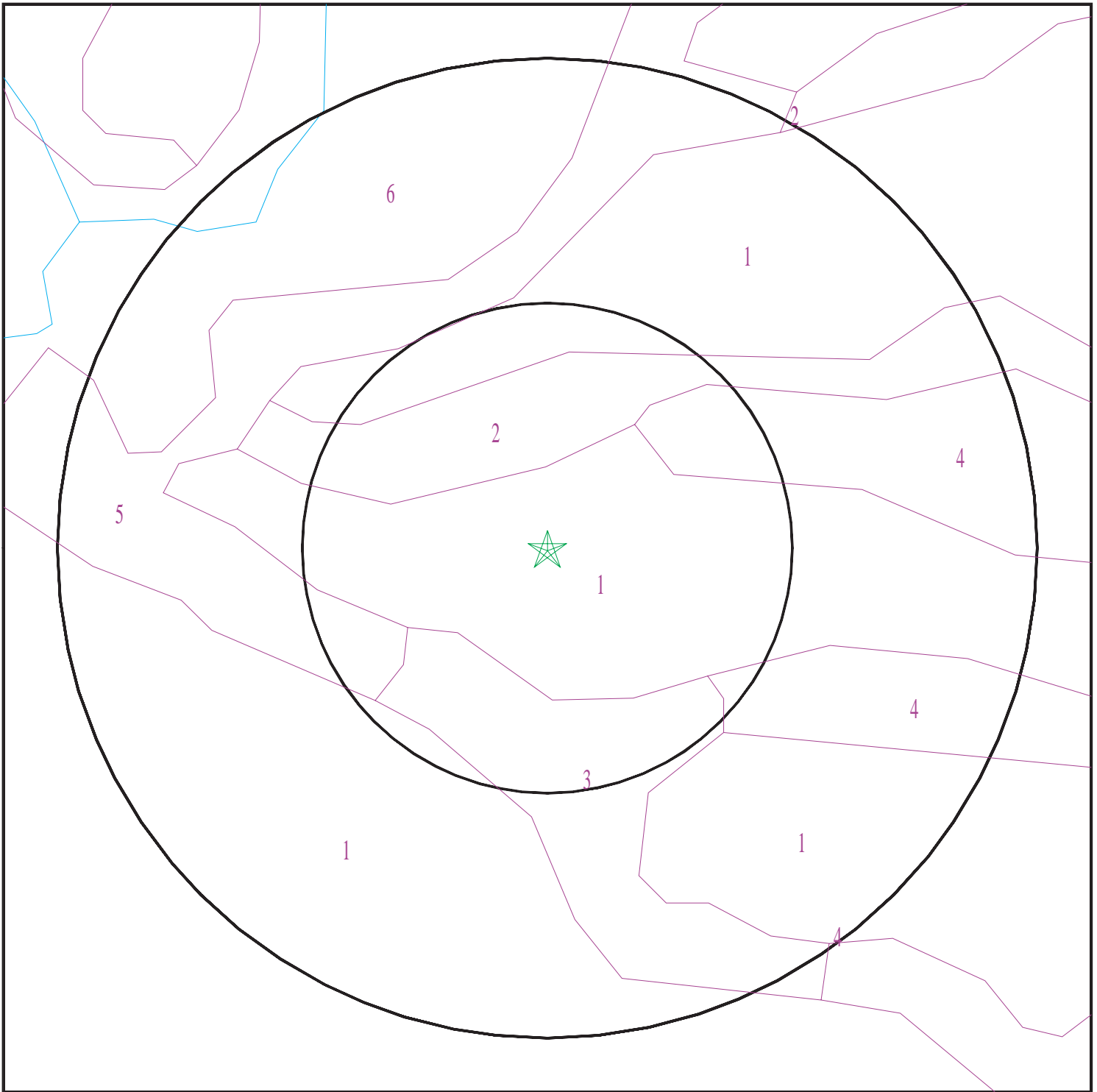
Era:	Paleozoic
System:	Devonian
Series:	Devonian
Code:	D <i>(decoded above as Era, System & Series)</i>

GEOLOGIC AGE IDENTIFICATION

Category: Stratified Sequence

Geologic Age and Rock Stratigraphic Unit Source: P.G. Schruben, R.E. Arndt and W.J. Bawiec, Geology of the Conterminous U.S. at 1:2,500,000 Scale - a digital representation of the 1974 P.B. King and H.M. Beikman Map, USGS Digital Data Series DDS - 11 (1994).

SSURGO SOIL MAP - 4103240.2s



- ★ Target Property
- ∩ SSURGO Soil
- ∩ Water



SITE NAME: Green Bank
ADDRESS: Potomac Highland Trail and Slavin Hollow Rd
Cass WV 24927
LAT/LONG: 38.4357 / -79.838

CLIENT: CH2M Hill, Inc.
CONTACT: Mike Brose
INQUIRY #: 4103240.2s
DATE: October 29, 2014 1:10 pm

GEOCHECK® - PHYSICAL SETTING SOURCE SUMMARY

DOMINANT SOIL COMPOSITION IN GENERAL AREA OF TARGET PROPERTY

The U.S. Department of Agriculture's (USDA) Soil Conservation Service (SCS) leads the National Cooperative Soil Survey (NCSS) and is responsible for collecting, storing, maintaining and distributing soil survey information for privately owned lands in the United States. A soil map in a soil survey is a representation of soil patterns in a landscape. The following information is based on Soil Conservation Service SSURGO data.

Soil Map ID: 1

Soil Component Name: Allegheny

Soil Surface Texture: loam

Hydrologic Group: Class B - Moderate infiltration rates. Deep and moderately deep, moderately well and well drained soils with moderately coarse textures.

Soil Drainage Class: Well drained

Hydric Status: Unknown

Corrosion Potential - Uncoated Steel: Low

Depth to Bedrock Min: > 0 inches

Depth to Watertable Min: > 0 inches

Soil Layer Information							
Layer	Boundary		Soil Texture Class	Classification		Saturated hydraulic conductivity micro m/sec	Soil Reaction (pH)
	Upper	Lower		AASHTO Group	Unified Soil		
1	0 inches	7 inches	loam	Not reported	Not reported	Max: 14 Min: 4	Max: 5.5 Min: 3.6
2	7 inches	40 inches	loam	Not reported	Not reported	Max: 14 Min: 4	Max: 5.5 Min: 3.6
3	40 inches	64 inches	extremely gravelly fine sandy loam	Not reported	Not reported	Max: 14 Min: 4	Max: 5.5 Min: 3.6

Soil Map ID: 2

Soil Component Name: Allegheny

Soil Surface Texture: loam

Hydrologic Group: Class B - Moderate infiltration rates. Deep and moderately deep, moderately well and well drained soils with moderately coarse textures.

Soil Drainage Class: Well drained

GEOCHECK® - PHYSICAL SETTING SOURCE SUMMARY

Hydric Status: Unknown

Corrosion Potential - Uncoated Steel: Low

Depth to Bedrock Min: > 0 inches

Depth to Watertable Min: > 0 inches

Soil Layer Information							
Layer	Boundary		Soil Texture Class	Classification		Saturated hydraulic conductivity micro m/sec	Soil Reaction (pH)
	Upper	Lower		AASHTO Group	Unified Soil		
1	0 inches	7 inches	loam	Not reported	Not reported	Max: 14 Min: 4	Max: 5.5 Min: 3.6
2	7 inches	40 inches	loam	Not reported	Not reported	Max: 14 Min: 4	Max: 5.5 Min: 3.6
3	40 inches	64 inches	extremely gravelly fine sandy loam	Not reported	Not reported	Max: 14 Min: 4	Max: 5.5 Min: 3.6

Soil Map ID: 3

Soil Component Name: Weikert

Soil Surface Texture: very channery silt loam

Hydrologic Group: Class B/D - Drained/undrained hydrology class of soils that can be drained and are classified.

Soil Drainage Class: Somewhat excessively drained

Hydric Status: Unknown

Corrosion Potential - Uncoated Steel: Moderate

Depth to Bedrock Min: > 0 inches

Depth to Watertable Min: > 0 inches

Soil Layer Information							
Layer	Boundary		Soil Texture Class	Classification		Saturated hydraulic conductivity micro m/sec	Soil Reaction (pH)
	Upper	Lower		AASHTO Group	Unified Soil		
1	0 inches	5 inches	very channery silt loam	Not reported	Not reported	Max: 42 Min: 14	Max: 5.5 Min: 4.5

GEOCHECK® - PHYSICAL SETTING SOURCE SUMMARY

Soil Layer Information							
Layer	Boundary		Soil Texture Class	Classification		Saturated hydraulic conductivity micro m/sec	Soil Reaction (pH)
	Upper	Lower		AASHTO Group	Unified Soil		
2	5 inches	14 inches	very channery silt loam	Not reported	Not reported	Max: 42 Min: 14	Max: 5.5 Min: 3.6
3	14 inches	18 inches	unweathered bedrock	Not reported	Not reported	Max: 141 Min: 4	Max: Min:

Soil Map ID: 4

Soil Component Name: Purdy

Soil Surface Texture: silt loam

Hydrologic Group: Class D - Very slow infiltration rates. Soils are clayey, have a high water table, or are shallow to an impervious layer.

Soil Drainage Class: Poorly drained

Hydric Status: Partially hydric

Corrosion Potential - Uncoated Steel: High

Depth to Bedrock Min: > 0 inches

Depth to Watertable Min: > 30 inches

Soil Layer Information							
Layer	Boundary		Soil Texture Class	Classification		Saturated hydraulic conductivity micro m/sec	Soil Reaction (pH)
	Upper	Lower		AASHTO Group	Unified Soil		
1	0 inches	5 inches	silt loam	Not reported	Not reported	Max: 4 Min: 1.4	Max: 5.5 Min: 3.6
2	5 inches	37 inches	silty clay	Not reported	Not reported	Max: 1.4 Min: 0.42	Max: 5.5 Min: 3.6
3	37 inches	64 inches	very gravelly silty clay loam	Not reported	Not reported	Max: 1.4 Min: 0.42	Max: 5.5 Min: 3.6

Soil Map ID: 5

Soil Component Name: Weikert

Soil Surface Texture: very channery silt loam

Hydrologic Group: Class B/D - Drained/undrained hydrology class of soils that can be drained and are classified.

Soil Drainage Class: Somewhat excessively drained

GEOCHECK® - PHYSICAL SETTING SOURCE SUMMARY

Hydric Status: Unknown

Corrosion Potential - Uncoated Steel: Moderate

Depth to Bedrock Min: > 0 inches

Depth to Watertable Min: > 0 inches

Soil Layer Information							
Layer	Boundary		Soil Texture Class	Classification		Saturated hydraulic conductivity micro m/sec	Soil Reaction (pH)
	Upper	Lower		AASHTO Group	Unified Soil		
1	0 inches	5 inches	very channery silt loam	Not reported	Not reported	Max: 42 Min: 14	Max: 5.5 Min: 4.5
2	5 inches	14 inches	very channery silt loam	Not reported	Not reported	Max: 42 Min: 14	Max: 5.5 Min: 3.6
3	14 inches	18 inches	unweathered bedrock	Not reported	Not reported	Max: 141 Min: 4	Max: Min:

Soil Map ID: 6

Soil Component Name: Atkins

Soil Surface Texture: silt loam

Hydrologic Group: Class D - Very slow infiltration rates. Soils are clayey, have a high water table, or are shallow to an impervious layer.

Soil Drainage Class: Poorly drained

Hydric Status: Partially hydric

Corrosion Potential - Uncoated Steel: High

Depth to Bedrock Min: > 0 inches

Depth to Watertable Min: > 15 inches

Soil Layer Information							
Layer	Boundary		Soil Texture Class	Classification		Saturated hydraulic conductivity micro m/sec	Soil Reaction (pH)
	Upper	Lower		AASHTO Group	Unified Soil		
1	0 inches	3 inches	silt loam	Not reported	Not reported	Max: 14 Min: 4	Max: 5.5 Min: 4.5
2	3 inches	25 inches	silt loam	Not reported	Not reported	Max: 14 Min: 0.42	Max: 5.5 Min: 4.5

GEOCHECK® - PHYSICAL SETTING SOURCE SUMMARY

Soil Layer Information							
Layer	Boundary		Soil Texture Class	Classification		Saturated hydraulic conductivity micro m/sec	Soil Reaction (pH)
	Upper	Lower		AASHTO Group	Unified Soil		
3	25 inches	64 inches	gravelly silt loam	Not reported	Not reported	Max: 42 Min: 1.4	Max: 5.5 Min: 4.5

LOCAL / REGIONAL WATER AGENCY RECORDS

EDR Local/Regional Water Agency records provide water well information to assist the environmental professional in assessing sources that may impact ground water flow direction, and in forming an opinion about the impact of contaminant migration on nearby drinking water wells.

WELL SEARCH DISTANCE INFORMATION

<u>DATABASE</u>	<u>SEARCH DISTANCE (miles)</u>
Federal USGS	1.000
Federal FRDS PWS	Nearest PWS within 1.000 miles
State Database	1.000

FEDERAL USGS WELL INFORMATION

<u>MAP ID</u>	<u>WELL ID</u>	<u>LOCATION FROM TP</u>
1	USGS40001297503	1/8 - 1/4 Mile SSW
2	USGS40001297531	1/4 - 1/2 Mile East
3	USGS40001297498	1/2 - 1 Mile WSW
4	USGS40001297529	1/2 - 1 Mile East
5	USGS40001297502	1/2 - 1 Mile ESE
B8	USGS40001297451	1/2 - 1 Mile SE
C10	USGS40001297453	1/2 - 1 Mile SE
B11	USGS40001297449	1/2 - 1 Mile SE
B12	USGS40001297450	1/2 - 1 Mile SE
D14	USGS40001297501	1/2 - 1 Mile East
C15	USGS40001297448	1/2 - 1 Mile SE

FEDERAL FRDS PUBLIC WATER SUPPLY SYSTEM INFORMATION

<u>MAP ID</u>	<u>WELL ID</u>	<u>LOCATION FROM TP</u>
No PWS System Found		

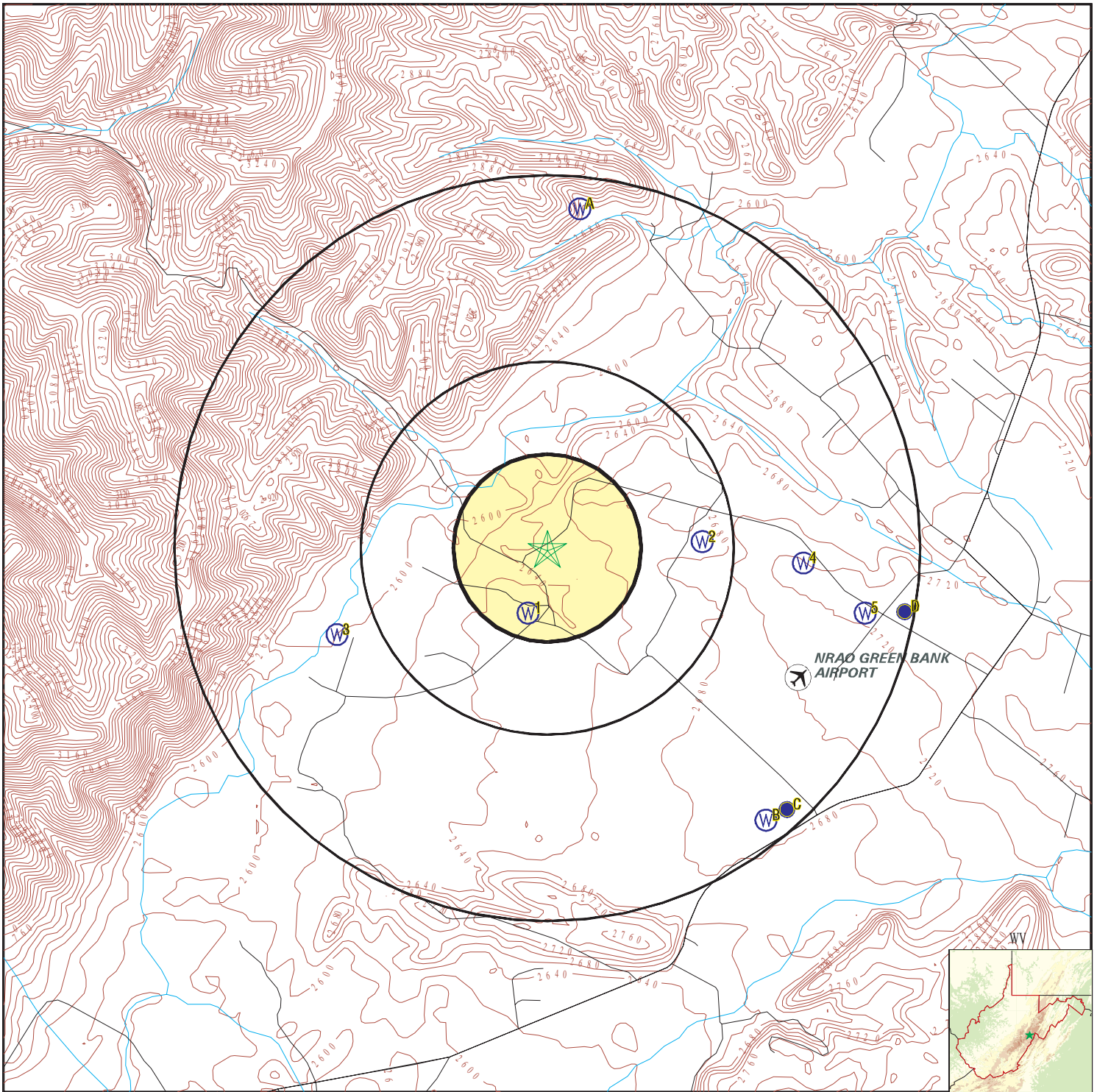
Note: PWS System location is not always the same as well location.

GEOCHECK® - PHYSICAL SETTING SOURCE SUMMARY

STATE DATABASE WELL INFORMATION

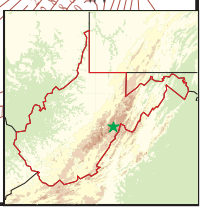
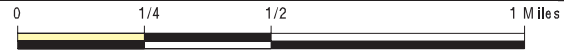
<u>MAP ID</u>	<u>WELL ID</u>	<u>LOCATION FROM TP</u>
A6	WVWELL0874	1/2 - 1 Mile North
A7	WVWELL0087	1/2 - 1 Mile North
C9	WVWELL0082	1/2 - 1 Mile SE
D13	WVWELL1255	1/2 - 1 Mile East

PHYSICAL SETTING SOURCE MAP - 4103240.2s



- County Boundary
- Major Roads
- Contour Lines
- Airports
- Earthquake epicenter, Richter 5 or greater
- Water Wells
- Public Water Supply Wells
- Cluster of Multiple Icons

- Groundwater Flow Direction
- Indeterminate Groundwater Flow at Location
- Groundwater Flow Varies at Location
- Oil, gas or related wells



SITE NAME: Green Bank
 ADDRESS: Potomac Highland Trail and Slavin Hollow Rd
 Cass WV 24927
 LAT/LONG: 38.4357 / -79.838

CLIENT: CH2M Hill, Inc.
 CONTACT: Mike Brose
 INQUIRY #: 4103240.2s
 DATE: October 29, 2014 1:10 pm

GEOCHECK® - PHYSICAL SETTING SOURCE MAP FINDINGS

Map ID
Direction
Distance
Elevation

Database EDR ID Number

1
SSW
1/8 - 1/4 Mile
Higher

FED USGS USGS40001297503

Org. Identifier:	USGS-WV		
Formal name:	USGS West Virginia Water Science Center		
Monloc Identifier:	USGS-382559079502101		
Monloc name:	Poc-0107		
Monloc type:	Well		
Monloc desc:	Orig staname was 4401006/E P SHINABERRY		
Huc code:	05050003	Drainagearea value:	Not Reported
Drainagearea Units:	Not Reported	Contrib drainagearea:	Not Reported
Contrib drainagearea units:	Not Reported	Latitude:	38.4331738
Longitude:	-79.8389466	Sourcemap scale:	Not Reported
Horiz Acc measure:	1	Horiz Acc measure units:	seconds
Horiz Collection method:	Interpolated from map		
Horiz coord refsys:	NAD83	Vert measure val:	2640.00
Vert measure units:	feet	Vertacc measure val:	50
Vert accmeasure units:	feet		
Vertcollection method:	Interpolated from topographic map		
Vert coord refsys:	NGVD29	Countrycode:	US
Aquifername:	Valley and Ridge aquifers		
Formation type:	Not Reported		
Aquifer type:	Not Reported		
Construction date:	19510101	Welldepth:	65
Welldepth units:	ft	Wellholedepth:	Not Reported
Wellholedepth units:	Not Reported		

Ground-water levels, Number of Measurements: 0

2
East
1/4 - 1/2 Mile
Higher

FED USGS USGS40001297531

Org. Identifier:	USGS-WV		
Formal name:	USGS West Virginia Water Science Center		
Monloc Identifier:	USGS-382609079495001		
Monloc name:	Poc-0110		
Monloc type:	Well		
Monloc desc:	Original station name was 4401008/MARY BEARD		
Huc code:	05050003	Drainagearea value:	Not Reported
Drainagearea Units:	Not Reported	Contrib drainagearea:	Not Reported
Contrib drainagearea units:	Not Reported	Latitude:	38.4359515
Longitude:	-79.8303351	Sourcemap scale:	Not Reported
Horiz Acc measure:	1	Horiz Acc measure units:	seconds
Horiz Collection method:	Interpolated from map		
Horiz coord refsys:	NAD83	Vert measure val:	2700.00
Vert measure units:	feet	Vertacc measure val:	50
Vert accmeasure units:	feet		
Vertcollection method:	Interpolated from topographic map		
Vert coord refsys:	NGVD29	Countrycode:	US
Aquifername:	Valley and Ridge aquifers		
Formation type:	Not Reported		

GEOCHECK® - PHYSICAL SETTING SOURCE MAP FINDINGS

Aquifer type:	Not Reported	Welldepth:	35
Construction date:	Not Reported	Wellholedepth:	Not Reported
Welldepth units:	ft		
Wellholedepth units:	Not Reported		

Ground-water levels, Number of Measurements: 0

3
WSW
1/2 - 1 Mile
Lower

FED USGS USGS40001297498

Org. Identifier:	USGS-WV		
Formal name:	USGS West Virginia Water Science Center		
Monloc Identifier:	USGS-382556079505501		
Monloc name:	Poc-0105		
Monloc type:	Well		
Monloc desc:	Original staname was 4401007/LUCY CLOWE		
Huc code:	05050003	Drainagearea value:	Not Reported
Drainagearea Units:	Not Reported	Contrib drainagearea:	Not Reported
Contrib drainagearea units:	Not Reported	Latitude:	38.4323403
Longitude:	-79.8483914	Sourcemap scale:	Not Reported
Horiz Acc measure:	1	Horiz Acc measure units:	seconds
Horiz Collection method:	Interpolated from map		
Horiz coord refsys:	NAD83	Vert measure val:	2630.00
Vert measure units:	feet	Vertacc measure val:	50
Vert accmeasure units:	feet		
Vertcollection method:	Interpolated from topographic map		
Vert coord refsys:	NGVD29	Countrycode:	US
Aquifername:	Not Reported		
Formation type:	Not Reported		
Aquifer type:	Not Reported		
Construction date:	19510101	Welldepth:	60
Welldepth units:	ft	Wellholedepth:	Not Reported
Wellholedepth units:	Not Reported		

Ground-water levels, Number of Measurements: 0

4
East
1/2 - 1 Mile
Higher

FED USGS USGS40001297529

Org. Identifier:	USGS-WV		
Formal name:	USGS West Virginia Water Science Center		
Monloc Identifier:	USGS-382606079493201		
Monloc name:	Poc-0109		
Monloc type:	Well		
Monloc desc:	Orig staname 4401015/AMERICAN ASSOC UNIVERSITY		
Huc code:	05050003	Drainagearea value:	Not Reported
Drainagearea Units:	Not Reported	Contrib drainagearea:	Not Reported
Contrib drainagearea units:	Not Reported	Latitude:	38.4351183
Longitude:	-79.8253349	Sourcemap scale:	Not Reported
Horiz Acc measure:	1	Horiz Acc measure units:	seconds
Horiz Collection method:	Interpolated from map		
Horiz coord refsys:	NAD83	Vert measure val:	2725.00
Vert measure units:	feet	Vertacc measure val:	50
Vert accmeasure units:	feet		
Vertcollection method:	Interpolated from topographic map		
Vert coord refsys:	NGVD29	Countrycode:	US
Aquifername:	Valley and Ridge aquifers		
Formation type:	Upper-Middle Devonian Series		

GEOCHECK® - PHYSICAL SETTING SOURCE MAP FINDINGS

Aquifer type:	Not Reported	Welldepth:	100
Construction date:	19590101	Wellholedepth:	Not Reported
Welldepth units:	ft		
Wellholedepth units:	Not Reported		

Ground-water levels, Number of Measurements: 1

Date	Feet below Surface	Feet to Sealevel

1964-06-01	20.00	

5
ESE
1/2 - 1 Mile
Higher

FED USGS USGS40001297502

Org. Identifier:	USGS-WV		
Formal name:	USGS West Virginia Water Science Center		
Monloc Identifier:	USGS-382559079492101		
Monloc name:	Poc-0106		
Monloc type:	Well		
Monloc desc:	Orig staname was 4401010/AMER ASSOC UNIV		
Huc code:	05050003	Drainagearea value:	Not Reported
Drainagearea Units:	Not Reported	Contrib drainagearea:	Not Reported
Contrib drainagearea units:	Not Reported	Latitude:	38.4331739
Longitude:	-79.8222792	Sourcemap scale:	Not Reported
Horiz Acc measure:	1	Horiz Acc measure units:	seconds
Horiz Collection method:	Interpolated from map		
Horiz coord refsys:	NAD83	Vert measure val:	2700.00
Vert measure units:	feet	Vertacc measure val:	50
Vert accmeasure units:	feet		
Vertcollection method:	Interpolated from topographic map		
Vert coord refsys:	NGVD29	Countrycode:	US
Aquifername:	Valley and Ridge aquifers		
Formation type:	Not Reported		
Aquifer type:	Not Reported		
Construction date:	19570101	Welldepth:	100
Welldepth units:	ft	Wellholedepth:	Not Reported
Wellholedepth units:	Not Reported		

Ground-water levels, Number of Measurements: 0

A6
North
1/2 - 1 Mile
Higher

WV WELLS WWWELL0874

Id number:	2182	Pwsid:	WV9938030
Sys name:	NATIONAL RADIO AST. OBSERVATORY		
Facility id:	566620		
Fac name:	WELL #2		
City:	GREEN BANK	County:	POCAHONTAS
Act status:	A	Water type:	Groundwater
Owner type:	Local	Daily prod:	0
Sys popula:	25	Sys type:	Non Community
Latitude:	38.448889	Longitude:	-79.836389
Elevation:	0	Updated:	Not Reported
Wdate:	Not Reported		
Descriptio:	Not Reported		
User initi:	Not Reported	Gudi statu:	No
Sourcetype:	Not Reported	Whp radius:	500
Prod gpd:	1250	Conv facto:	50
Calc pop:	25	Seasonbegi:	4/1/00
Season end:	9/30/00	Facility type:	Well

GEOCHECK® - PHYSICAL SETTING SOURCE MAP FINDINGS

Map ID
 Direction
 Distance
 Elevation

Database EDR ID Number

A7
North
1/2 - 1 Mile
Higher

WV WELLS WWWELL0087

Id number:	1136	Pwsid:	WV9938030
Sys name:	NATIONAL RADIO AST. OBSERVATORY		
Facility id:	566620		
Fac name:	WELL #1		
City:	GREEN BANK	County:	POCAHONTAS
Act status:	A	Water type:	Groundwater
Owner type:	Local	Daily prod:	0
Sys popula:	25	Sys type:	Non Community
Latitude:	38.448889	Longitude:	-79.836389
Elevation:	0	Updated:	Not Reported
Wdate:	Not Reported		
Descriptio:	Not Reported		
User initi:	Not Reported	Gudi statu:	No
Sourcetype:	Not Reported	Whp radius:	500
Prod gpd:	1250	Conv facto:	50
Calc pop:	25	Seasonbegi:	4/1/00
Season end:	9/30/00	Facility type:	Well

B8
SE
1/2 - 1 Mile
Higher

FED USGS USGS40001297451

Org. Identifier:	USGS-WV		
Formal name:	USGS West Virginia Water Science Center		
Monloc Identifier:	USGS-382530079494001		
Monloc name:	Poc-0102		
Monloc type:	Well		
Monloc desc:	Original station name was GREEN BANK SCH3		
Huc code:	05050003	Drainagearea value:	Not Reported
Drainagearea Units:	Not Reported	Contrib drainagearea:	Not Reported
Contrib drainagearea units:	Not Reported	Latitude:	38.4251185
Longitude:	-79.8275571	Sourcemap scale:	Not Reported
Horiz Acc measure:	10	Horiz Acc measure units:	seconds
Horiz Collection method:	Interpolated from map		
Horiz coord refsys:	NAD83	Vert measure val:	2700.00
Vert measure units:	feet	Vertacc measure val:	50
Vert accmeasure units:	feet		
Vertcollection method:	Interpolated from topographic map		
Vert coord refsys:	NGVD29	Countrycode:	US
Aquifername:	Valley and Ridge aquifers		
Formation type:	Not Reported		
Aquifer type:	Not Reported		
Construction date:	19400101	Welldepth:	160
Welldepth units:	ft	Wellholedepth:	Not Reported
Wellholedepth units:	Not Reported		

Ground-water levels, Number of Measurements: 0

GEOCHECK® - PHYSICAL SETTING SOURCE MAP FINDINGS

Map ID
Direction
Distance
Elevation

Database EDR ID Number

C9
SE
1/2 - 1 Mile
Higher

WV WELLS WWELL0082

Id number:	1129	Pwsid:	WV9938019
Sys name:	GREEN BANK SCHOOL		
Facility id:	566609		
Fac name:	WELL #1		
City:	MARLINTON	County:	POCAHONTAS
Act status:	A	Water type:	Groundwater
Owner type:	Local	Daily prod:	0
Sys popula:	431	Sys type:	Non Transient Non Community
Latitude:	38.425833	Longitude:	-79.826389
Elevation:	0	Updated:	Not Reported
Wdate:	Not Reported		
Descriptio:	Not Reported		
User initi:	Not Reported	Gudi statu:	No
Sourcetype:	Not Reported	Whp radius:	1500
Prod gpd:	10775	Conv facto:	25
Calc pop:	431	Seasonbegi:	Not Reported
Season end:	Not Reported	Facility type:	Well

C10
SE
1/2 - 1 Mile
Higher

FED USGS USGS40001297453

Org. Identifier:	USGS-WV		
Formal name:	USGS West Virginia Water Science Center		
Monloc Identifier:	USGS-382533079493401		
Monloc name:	Poc-0193		
Monloc type:	Well		
Monloc desc:	Original station name was JB048		
Huc code:	05050003	Drainagearea value:	Not Reported
Drainagearea Units:	Not Reported	Contrib drainagearea:	Not Reported
Contrib drainagearea units:	Not Reported	Latitude:	38.4259518
Longitude:	-79.8258904	Sourcemap scale:	24000
Horiz Acc measure:	1	Horiz Acc measure units:	seconds
Horiz Collection method:	Interpolated from map		
Horiz coord refsys:	NAD83	Vert measure val:	2700.
Vert measure units:	feet	Vertacc measure val:	20
Vert accmeasure units:	feet		
Vertcollection method:	Interpolated from topographic map		
Vert coord refsys:	NGVD29	Countrycode:	US
Aquifername:	Valley and Ridge aquifers		
Formation type:	Marcellus Shale		
Aquifer type:	Not Reported		
Construction date:	Not Reported	Welldepth:	144
Welldepth units:	ft	Wellholedepth:	144
Wellholedepth units:	ft		

Ground-water levels, Number of Measurements: 0

GEOCHECK® - PHYSICAL SETTING SOURCE MAP FINDINGS

Map ID
 Direction
 Distance
 Elevation

Database EDR ID Number

B11
SE
1/2 - 1 Mile
Higher

FED USGS USGS40001297449

Org. Identifier:	USGS-WV		
Formal name:	USGS West Virginia Water Science Center		
Monloc Identifier:	USGS-382530079493801		
Monloc name:	Poc-0007		
Monloc type:	Well		
Monloc desc:	Original station name was 4401004		
Huc code:	05050003	Drainagearea value:	Not Reported
Drainagearea Units:	Not Reported	Contrib drainagearea:	Not Reported
Contrib drainagearea units:	Not Reported	Latitude:	38.4251185
Longitude:	-79.8270015	Sourcemap scale:	Not Reported
Horiz Acc measure:	1	Horiz Acc measure units:	seconds
Horiz Collection method:	Interpolated from map		
Horiz coord refsys:	NAD83	Vert measure val:	2700.00
Vert measure units:	feet	Vertacc measure val:	20
Vert accmeasure units:	feet		
Vertcollection method:	Interpolated from topographic map		
Vert coord refsys:	NGVD29	Countrycode:	US
Aquifername:	Valley and Ridge aquifers		
Formation type:	Not Reported		
Aquifer type:	Not Reported		
Construction date:	19530101	Welldepth:	160
Welldepth units:	ft	Wellholedepth:	Not Reported
Wellholedepth units:	Not Reported		

Ground-water levels, Number of Measurements: 0

B12
SE
1/2 - 1 Mile
Higher

FED USGS USGS40001297450

Org. Identifier:	USGS-WV		
Formal name:	USGS West Virginia Water Science Center		
Monloc Identifier:	USGS-382530079493802		
Monloc name:	Poc-0008		
Monloc type:	Well		
Monloc desc:	Original station name was 4401005		
Huc code:	05050003	Drainagearea value:	Not Reported
Drainagearea Units:	Not Reported	Contrib drainagearea:	Not Reported
Contrib drainagearea units:	Not Reported	Latitude:	38.4251185
Longitude:	-79.8270015	Sourcemap scale:	Not Reported
Horiz Acc measure:	1	Horiz Acc measure units:	seconds
Horiz Collection method:	Interpolated from map		
Horiz coord refsys:	NAD83	Vert measure val:	2100.00
Vert measure units:	feet	Vertacc measure val:	20
Vert accmeasure units:	feet		
Vertcollection method:	Interpolated from topographic map		
Vert coord refsys:	NGVD29	Countrycode:	US
Aquifername:	Valley and Ridge aquifers		
Formation type:	Not Reported		

GEOCHECK® - PHYSICAL SETTING SOURCE MAP FINDINGS

Aquifer type:	Not Reported	Welldepth:	120
Construction date:	19180101	Wellholeddepth:	Not Reported
Welldepth units:	ft		
Wellholeddepth units:	Not Reported		

Ground-water levels, Number of Measurements: 0

D13
East
1/2 - 1 Mile
Higher

WV WELLS VVWELL1255

Id number:	2562	Pwsid:	WV9938029
Sys name:	NTNL RADIO ASTRONOMY		
Facility id:	566619		
Fac name:	WORK AREA WELL (SDWIS #5)		
City:	GREEN BANK	County:	POCAHONTAS
Act status:	A	Water type:	Groundwater
Owner type:	Local	Daily prod:	0
Sys popula:	100	Sys type:	Non Transient Non Community
Latitude:	38.433286	Longitude:	-79.820317
Elevation:	0	Updated:	Y
Wdate:	4/6/01		
Descriptio:	SDWIS Well names included		
User initi:	RWW	Gudi statu:	No
Sourcetype:	Not Reported	Whp radius:	750
Prod gpd:	5000	Conv facto:	50
Calc pop:	100	Seasonbegi:	Not Reported
Season end:	Not Reported	Facility type:	Well

D14
East
1/2 - 1 Mile
Higher

FED USGS USGS40001297501

Org. Identifier:	USGS-WV		
Formal name:	USGS West Virginia Water Science Center		
Monloc Identifier:	USGS-382559079491401		
Monloc name:	Poc-0197		
Monloc type:	Well		
Monloc desc:	Original station name was JB044		
Huc code:	05050003	Drainagearea value:	Not Reported
Drainagearea Units:	Not Reported	Contrib drainagearea:	Not Reported
Contrib drainagearea units:	Not Reported	Latitude:	38.4331739
Longitude:	-79.8203347	Sourcemap scale:	24000
Horiz Acc measure:	1	Horiz Acc measure units:	seconds
Horiz Collection method:	Interpolated from map		
Horiz coord refsys:	NAD83	Vert measure val:	2730.
Vert measure units:	feet	Vertacc measure val:	20
Vert accmeasure units:	feet		
Vertcollection method:	Interpolated from topographic map		
Vert coord refsys:	NGVD29	Countrycode:	US
Aquifername:	Valley and Ridge aquifers		
Formation type:	Marcellus Shale		

GEOCHECK® - PHYSICAL SETTING SOURCE MAP FINDINGS

Aquifer type:	Not Reported	Welldepth:	100
Construction date:	19590000	Wellholeddepth:	100
Welldepth units:	ft		
Wellholeddepth units:	ft		

Ground-water levels, Number of Measurements: 0

**C15
SE
1/2 - 1 Mile
Higher**

FED USGS

USGS40001297448

Org. Identifier:	USGS-WV		
Formal name:	USGS West Virginia Water Science Center		
Monloc Identifier:	USGS-382529079493501		
Monloc name:	Poc-0101		
Monloc type:	Well		
Monloc desc:	Original station name was GREEN BANK SCH2		
Huc code:	05050003	Drainagearea value:	Not Reported
Drainagearea Units:	Not Reported	Contrib drainagearea:	Not Reported
Contrib drainagearea units:	Not Reported	Latitude:	38.4248408
Longitude:	-79.8261681	Sourcemap scale:	Not Reported
Horiz Acc measure:	10	Horiz Acc measure units:	seconds
Horiz Collection method:	Interpolated from map		
Horiz coord refsys:	NAD83	Vert measure val:	2700.00
Vert measure units:	feet	Vertacc measure val:	50
Vert accmeasure units:	feet		
Vertcollection method:	Interpolated from topographic map		
Vert coord refsys:	NGVD29	Countrycode:	US
Aquifername:	Valley and Ridge aquifers		
Formation type:	Not Reported		
Aquifer type:	Not Reported		
Construction date:	Not Reported	Welldepth:	20
Welldepth units:	ft	Wellholeddepth:	Not Reported
Wellholeddepth units:	Not Reported		

Ground-water levels, Number of Measurements: 0

GEOCHECK® - PHYSICAL SETTING SOURCE MAP FINDINGS RADON

AREA RADON INFORMATION

EPA Region 3 Statistical Summary Readings for Zip Code: 24927

Number of sites tested: 1.

Maximum Radon Level: 0.3 pCi/L.

Minimum Radon Level: 0.3 pCi/L.

<u>pCi/L</u> <u><4</u>	<u>pCi/L</u> <u>4-10</u>	<u>pCi/L</u> <u>10-20</u>	<u>pCi/L</u> <u>20-50</u>	<u>pCi/L</u> <u>50-100</u>	<u>pCi/L</u> <u>>100</u>
1 (100.00%)	0 (0.00%)	0 (0.00%)	0 (0.00%)	0 (0.00%)	0 (0.00%)

PHYSICAL SETTING SOURCE RECORDS SEARCHED

TOPOGRAPHIC INFORMATION

USGS 7.5' Digital Elevation Model (DEM)

Source: United States Geologic Survey

EDR acquired the USGS 7.5' Digital Elevation Model in 2002 and updated it in 2006. The 7.5 minute DEM corresponds to the USGS 1:24,000- and 1:25,000-scale topographic quadrangle maps. The DEM provides elevation data with consistent elevation units and projection.

Scanned Digital USGS 7.5' Topographic Map (DRG)

Source: United States Geologic Survey

A digital raster graphic (DRG) is a scanned image of a U.S. Geological Survey topographic map. The map images are made by scanning published paper maps on high-resolution scanners. The raster image is georeferenced and fit to the Universal Transverse Mercator (UTM) projection.

HYDROLOGIC INFORMATION

Flood Zone Data: This data, available in select counties across the country, was obtained by EDR in 2003 & 2011 from the Federal Emergency Management Agency (FEMA). Data depicts 100-year and 500-year flood zones as defined by FEMA.

NWI: National Wetlands Inventory. This data, available in select counties across the country, was obtained by EDR in 2002, 2005 and 2010 from the U.S. Fish and Wildlife Service.

HYDROGEOLOGIC INFORMATION

AQUIFLOW^R Information System

Source: EDR proprietary database of groundwater flow information

EDR has developed the AQUIFLOW Information System (AIS) to provide data on the general direction of groundwater flow at specific points. EDR has reviewed reports submitted to regulatory authorities at select sites and has extracted the date of the report, hydrogeologically determined groundwater flow direction and depth to water table information.

GEOLOGIC INFORMATION

Geologic Age and Rock Stratigraphic Unit

Source: P.G. Schruben, R.E. Arndt and W.J. Bawiec, Geology of the Conterminous U.S. at 1:2,500,000 Scale - A digital representation of the 1974 P.B. King and H.M. Beikman Map, USGS Digital Data Series DDS - 11 (1994).

STATSGO: State Soil Geographic Database

Source: Department of Agriculture, Natural Resources Conservation Services

The U.S. Department of Agriculture's (USDA) Natural Resources Conservation Service (NRCS) leads the national Conservation Soil Survey (NCSS) and is responsible for collecting, storing, maintaining and distributing soil survey information for privately owned lands in the United States. A soil map in a soil survey is a representation of soil patterns in a landscape. Soil maps for STATSGO are compiled by generalizing more detailed (SSURGO) soil survey maps.

SSURGO: Soil Survey Geographic Database

Source: Department of Agriculture, Natural Resources Conservation Services (NRCS)

Telephone: 800-672-5559

SSURGO is the most detailed level of mapping done by the Natural Resources Conservation Services, mapping scales generally range from 1:12,000 to 1:63,360. Field mapping methods using national standards are used to construct the soil maps in the Soil Survey Geographic (SSURGO) database. SSURGO digitizing duplicates the original soil survey maps. This level of mapping is designed for use by landowners, townships and county natural resource planning and management.

PHYSICAL SETTING SOURCE RECORDS SEARCHED

LOCAL / REGIONAL WATER AGENCY RECORDS

FEDERAL WATER WELLS

PWS: Public Water Systems

Source: EPA/Office of Drinking Water

Telephone: 202-564-3750

Public Water System data from the Federal Reporting Data System. A PWS is any water system which provides water to at least 25 people for at least 60 days annually. PWSs provide water from wells, rivers and other sources.

PWS ENF: Public Water Systems Violation and Enforcement Data

Source: EPA/Office of Drinking Water

Telephone: 202-564-3750

Violation and Enforcement data for Public Water Systems from the Safe Drinking Water Information System (SDWIS) after August 1995. Prior to August 1995, the data came from the Federal Reporting Data System (FRDS).

USGS Water Wells: USGS National Water Inventory System (NWIS)

This database contains descriptive information on sites where the USGS collects or has collected data on surface water and/or groundwater. The groundwater data includes information on wells, springs, and other sources of groundwater.

STATE RECORDS

West Virginia Water Well Information

Source: Bureau of Public Health

Telephone: 304-558-6765

OTHER STATE DATABASE INFORMATION

West Virginia Oil and Gas Well Database

Source: Department of Environmental Protection

Telephone: 304-926-0450

Oil and Gas well locations in the state.

RADON

Area Radon Information

Source: USGS

Telephone: 703-356-4020

The National Radon Database has been developed by the U.S. Environmental Protection Agency (USEPA) and is a compilation of the EPA/State Residential Radon Survey and the National Residential Radon Survey. The study covers the years 1986 - 1992. Where necessary data has been supplemented by information collected at private sources such as universities and research institutions.

EPA Radon Zones

Source: EPA

Telephone: 703-356-4020

Sections 307 & 309 of IRAA directed EPA to list and identify areas of U.S. with the potential for elevated indoor radon levels.

EPA Region 3 Statistical Summary Readings

Source: Region 3 EPA

Telephone: 215-814-2082

Radon readings for Delaware, D.C., Maryland, Pennsylvania, Virginia and West Virginia.

OTHER

Airport Landing Facilities: Private and public use landing facilities

Source: Federal Aviation Administration, 800-457-6656

Epicenters: World earthquake epicenters, Richter 5 or greater

Source: Department of Commerce, National Oceanic and Atmospheric Administration

Earthquake Fault Lines: The fault lines displayed on EDR's Topographic map are digitized quaternary faultlines, prepared in 1975 by the United State Geological Survey

PHYSICAL SETTING SOURCE RECORDS SEARCHED

STREET AND ADDRESS INFORMATION

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Attachment C
Aerial Photographs and
Topographic Maps



Green Bank

Potomac Highland Trail and Slavin Hollow Rd
Cass, WV 24927

Inquiry Number: 4103240.4

October 13, 2014

EDR Historical Topographic Map Report



6 Armstrong Road, 4th Floor
Shelton, Connecticut 06484
Toll Free: 800.352.0050
www.edrnet.com

EDR Historical Topographic Map Report

Environmental Data Resources, Inc.s (EDR) Historical Topographic Map Report is designed to assist professionals in evaluating potential liability on a target property resulting from past activities. EDRs Historical Topographic Map Report includes a search of a collection of public and private color historical topographic maps, dating back to the early 1900s.

Thank you for your business.
Please contact EDR at 1-800-352-0050
with any questions or comments.

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Historical Topographic Map



<p>N</p> 	TARGET QUAD	SITE NAME: Green Bank	CLIENT: CH2M Hill, Inc.
	NAME: MONTEREY	ADDRESS: Potomac Highland Trail and Slavin	CONTACT: Mike Brose
	MAP YEAR: 1898	Hollow Rd	INQUIRY#: 4103240.4
	SERIES: 30	Cass, WV 24927	RESEARCH DATE: 10/13/2014
	SCALE: 1:125000	LAT/LONG: 38.4357 / -79.838	


Historical Topographic Map



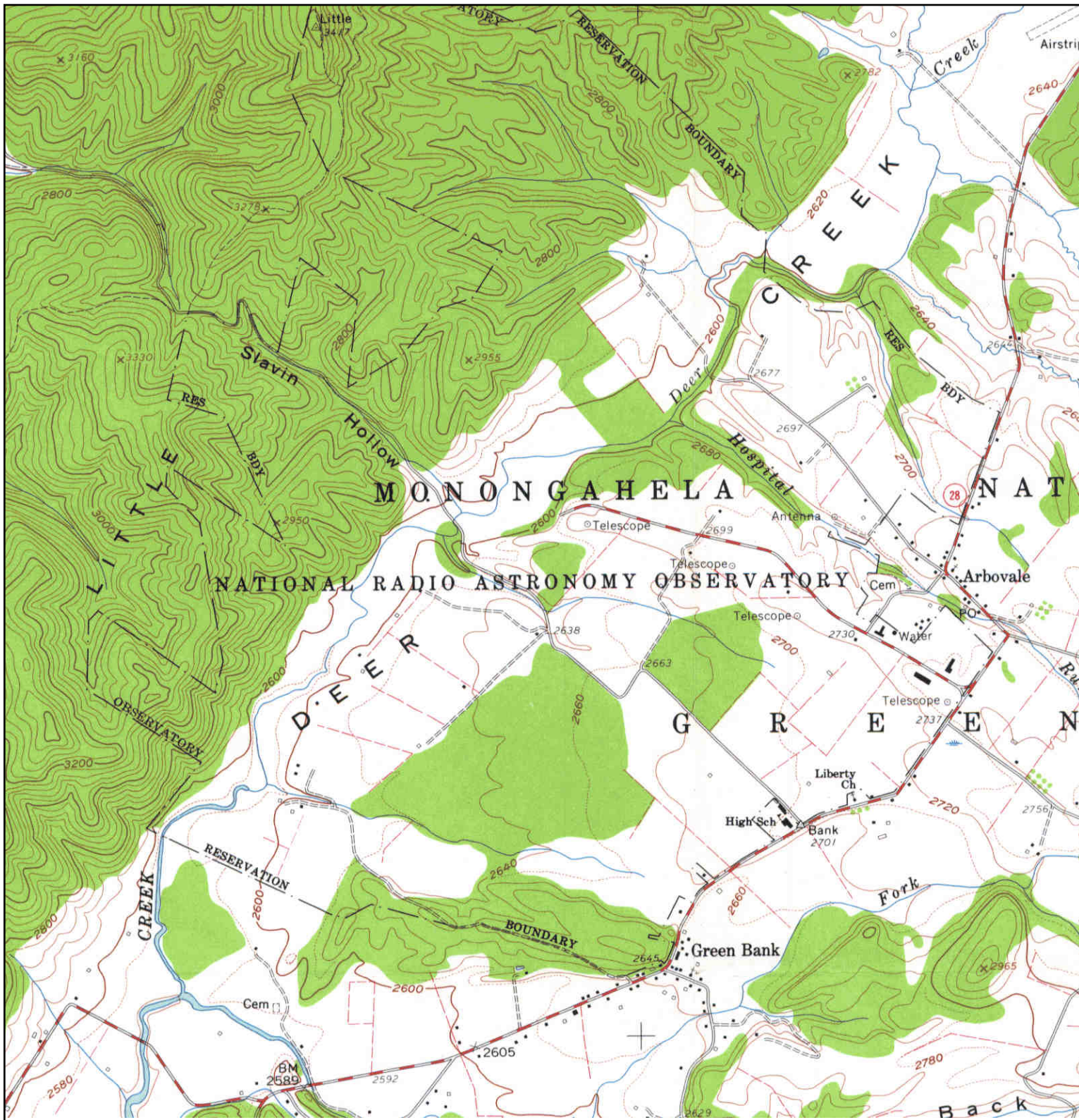
<p>N</p>	<p>TARGET QUAD</p> <p>NAME: MONTEREY</p> <p>MAP YEAR: 1901</p>	<p>SITE NAME: Green Bank</p> <p>ADDRESS: Potomac Highland Trail and Slavin Hollow Rd</p> <p>Cass, WV 24927</p>	<p>CLIENT: CH2M Hill, Inc.</p> <p>CONTACT: Mike Brose</p> <p>INQUIRY#: 4103240.4</p> <p>RESEARCH DATE: 10/13/2014</p>
	<p>SERIES: 30</p> <p>SCALE: 1:125000</p>	<p>LAT/LONG: 38.4357 / -79.838</p>	


Historical Topographic Map



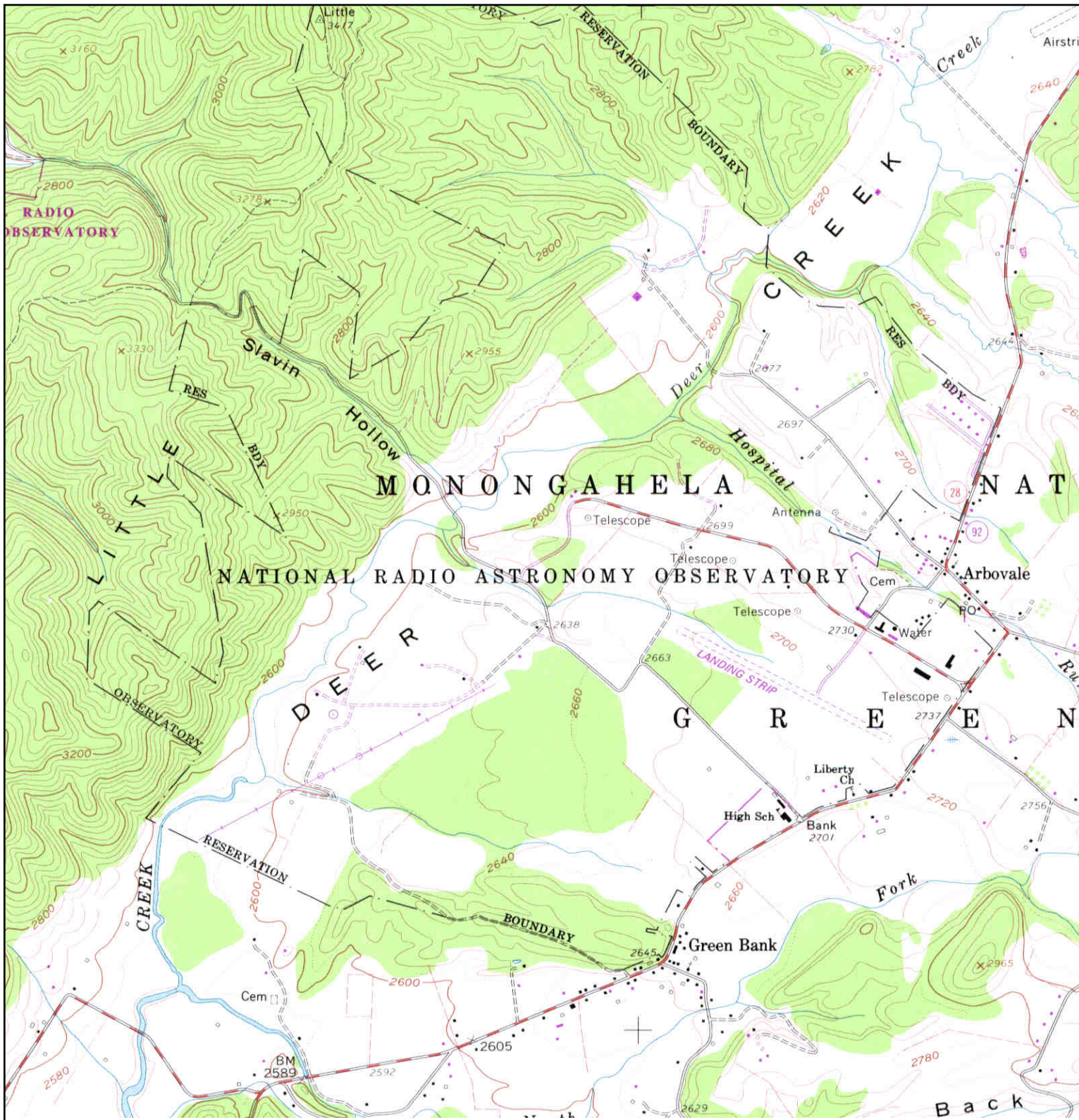
 N	TARGET QUAD	SITE NAME: Green Bank	CLIENT: CH2M Hill, Inc.
	NAME: CASS	ADDRESS: Potomac Highland Trail and Slavin Hollow Rd	CONTACT: Mike Brose
	MAP YEAR: 1924	Cass, WV 24927	INQUIRY#: 4103240.4
	SERIES: 15	LAT/LONG: 38.4357 / -79.838	RESEARCH DATE: 10/13/2014
	SCALE: 1:62500		

Historical Topographic Map



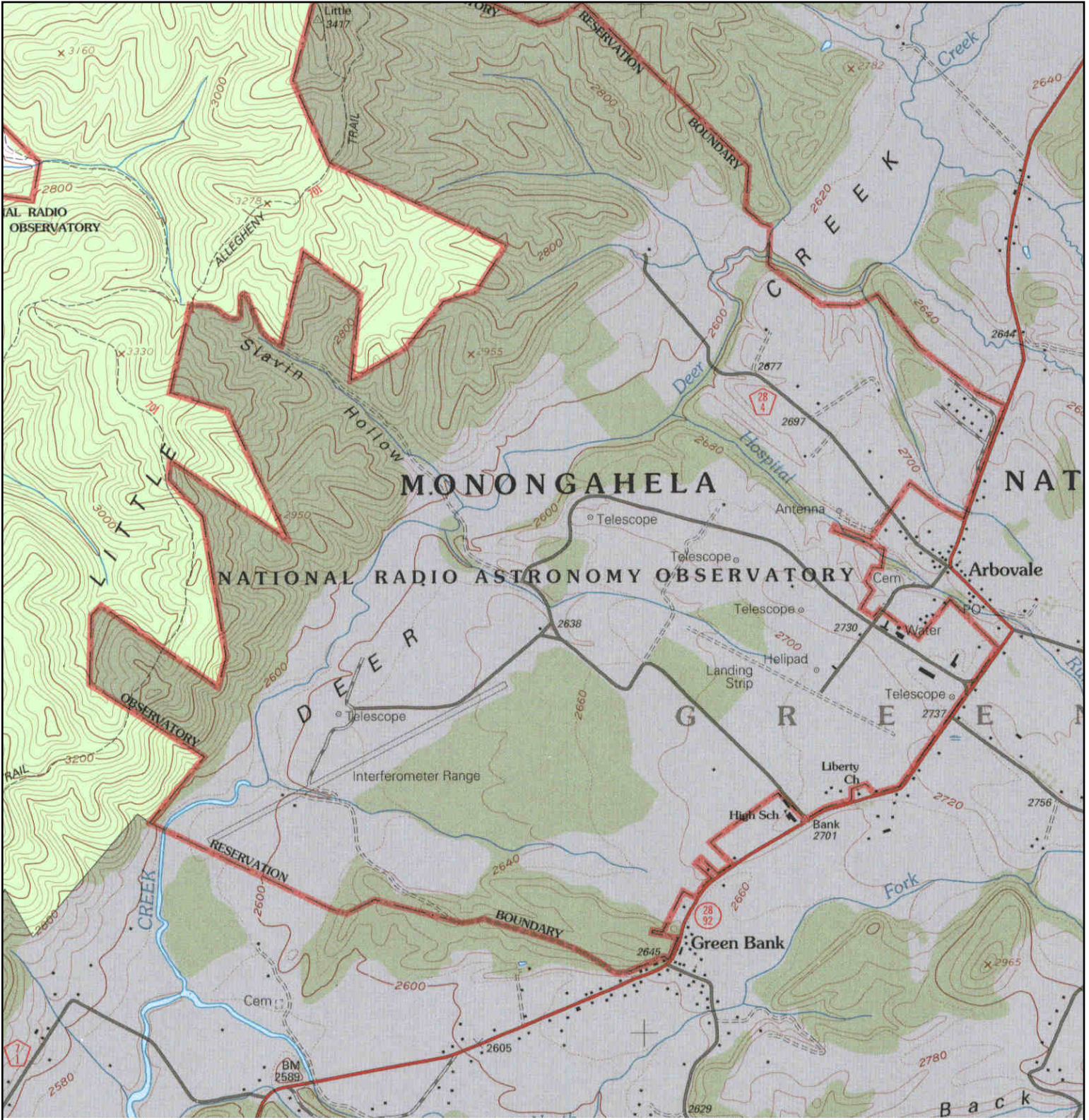
	TARGET QUAD	SITE NAME: Green Bank	CLIENT: CH2M Hill, Inc.
	NAME: GREEN BANK	ADDRESS: Potomac Highland Trail and Slavin Hollow Rd	CONTACT: Mike Brose
	MAP YEAR: 1960	Cass, WV 24927	INQUIRY#: 4103240.4
	SERIES: 7.5	LAT/LONG: 38.4357 / -79.838	RESEARCH DATE: 10/13/2014
	SCALE: 1:24000		


Historical Topographic Map



<p>N</p>	TARGET QUAD	SITE NAME: Green Bank	CLIENT: CH2M Hill, Inc.
	NAME: GREEN BANK	ADDRESS: Potomac Highland Trail and Slavin Hollow Rd	CONTACT: Mike Brose
	MAP YEAR: 1979	Cass, WV 24927	INQUIRY#: 4103240.4
	PHOTOREVISED FROM :1960	LAT/LONG: 38.4357 / -79.838	RESEARCH DATE: 10/13/2014
	SERIES: 7.5		
	SCALE: 1:24000		

Historical Topographic Map



	TARGET QUAD NAME: GREEN BANK MAP YEAR: 1995	SITE NAME: Green Bank ADDRESS: Potomac Highland Trail and Slavin Hollow Rd Cass, WV 24927	CLIENT: CH2M Hill, Inc. CONTACT: Mike Brose INQUIRY#: 4103240.4 RESEARCH DATE: 10/13/2014
	SERIES: 7.5 SCALE: 1:24000	LAT/LONG: 38.4357 / -79.838	



Green Bank

Potomac Highland Trail and Slavin Hollow Rd
Cass, WV 24927

Inquiry Number: 4103240.9

October 14, 2014

The EDR Aerial Photo Decade Package



6 Armstrong Road, 4th Floor
Shelton, Connecticut 06484
Toll Free: 800.352.0050
www.edrnet.com

EDR Aerial Photo Decade Package

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Date EDR Searched Historical Sources:

Aerial Photography October 14, 2014

Target Property:

Potomac Highland Trail and Slavin Hollow Rd

Cass, WV 24927

<u>Year</u>	<u>Scale</u>	<u>Details</u>	<u>Source</u>
1958	Aerial Photograph. Scale: 1"=750'	Flight Date: April 09, 1958	EDR
1958	Aerial Photograph. Scale: 1"=750'	Flight Date: April 09, 1958	EDR
1973	Aerial Photograph. Scale: 1"=750'	Flight Date: May 06, 1973	EDR
1973	Aerial Photograph. Scale: 1"=750'	Flight Date: May 06, 1973	EDR
1991	Aerial Photograph. Scale: 1"=750'	Flight Date: April 16, 1991	EDR
1991	Aerial Photograph. Scale: 1"=750'	Flight Date: April 16, 1991	EDR
1997	Aerial Photograph. Scale: 1"=500'	DOQQ - acquisition dates: April 10, 1997	USGS/DOQQ
1997	Aerial Photograph. Scale: 1"=500'	DOQQ - acquisition dates: April 10, 1997	USGS/DOQQ
1997	Aerial Photograph. Scale: 1"=500'	DOQQ - acquisition dates: April 10, 1997	USGS/DOQQ
1997	Aerial Photograph. Scale: 1"=500'	DOQQ - acquisition dates: April 10, 1997	USGS/DOQQ
1997	Aerial Photograph. Scale: 1"=500'	DOQQ - acquisition dates: April 10, 1997	USGS/DOQQ
1997	Aerial Photograph. Scale: 1"=500'	DOQQ - acquisition dates: April 10, 1997	USGS/DOQQ
1997	Aerial Photograph. Scale: 1"=500'	DOQQ - acquisition dates: April 10, 1997	USGS/DOQQ
1998	Aerial Photograph. Scale: 1"=750'	Flight Date: April 06, 1998	EDR
1998	Aerial Photograph. Scale: 1"=750'	Flight Date: April 06, 1998	EDR
2001	Aerial Photograph. Scale: 1"=750'	Flight Date: April 14, 2001	EDR
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2006	Aerial Photograph. Scale: 1"=500'	Flight Year: 2006	USDA/NAIP
2006	Aerial Photograph. Scale: 1"=500'	Flight Year: 2006	USDA/NAIP
2006	Aerial Photograph. Scale: 1"=500'	Flight Year: 2006	USDA/NAIP

<i>Year</i>	<i>Scale</i>	<i>Details</i>	<i>Source</i>
2006	Aerial Photograph. Scale: 1"=500'	Flight Year: 2006	USDA/NAIP
2006	Aerial Photograph. Scale: 1"=500'	Flight Year: 2006	USDA/NAIP
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2007	Aerial Photograph. Scale: 1"=500'	Flight Year: 2007	USDA/NAIP
2007	Aerial Photograph. Scale: 1"=500'	Flight Year: 2007	USDA/NAIP
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2007	Aerial Photograph. Scale: 1"=500'	Flight Year: 2007	USDA/NAIP
2007	Aerial Photograph. Scale: 1"=500'	Flight Year: 2007	USDA/NAIP
2009	Aerial Photograph. Scale: 1"=500'	Flight Year: 2009	USDA/NAIP
2009	Aerial Photograph. Scale: 1"=500'	Flight Year: 2009	USDA/NAIP
2009	Aerial Photograph. Scale: 1"=500'	Flight Year: 2009	USDA/NAIP
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2011	Aerial Photograph. Scale: 1"=500'	Flight Year: 2011	USDA/NAIP
2011	Aerial Photograph. Scale: 1"=500'	Flight Year: 2011	USDA/NAIP
2011	Aerial Photograph. Scale: 1"=500'	Flight Year: 2011	USDA/NAIP



INQUIRY #: 4103240.9

YEAR: 1958

| = 750'







INQUIRY #: 4103240.9

YEAR: 1958

| = 750'

 **N**

 EDR



INQUIRY #: 4103240.9

YEAR: 1973

| = 750'





INQUIRY #: 4103240.9

YEAR: 1973

| = 750'





INQUIRY #: 4103240.9

YEAR: 1991

| = 750'



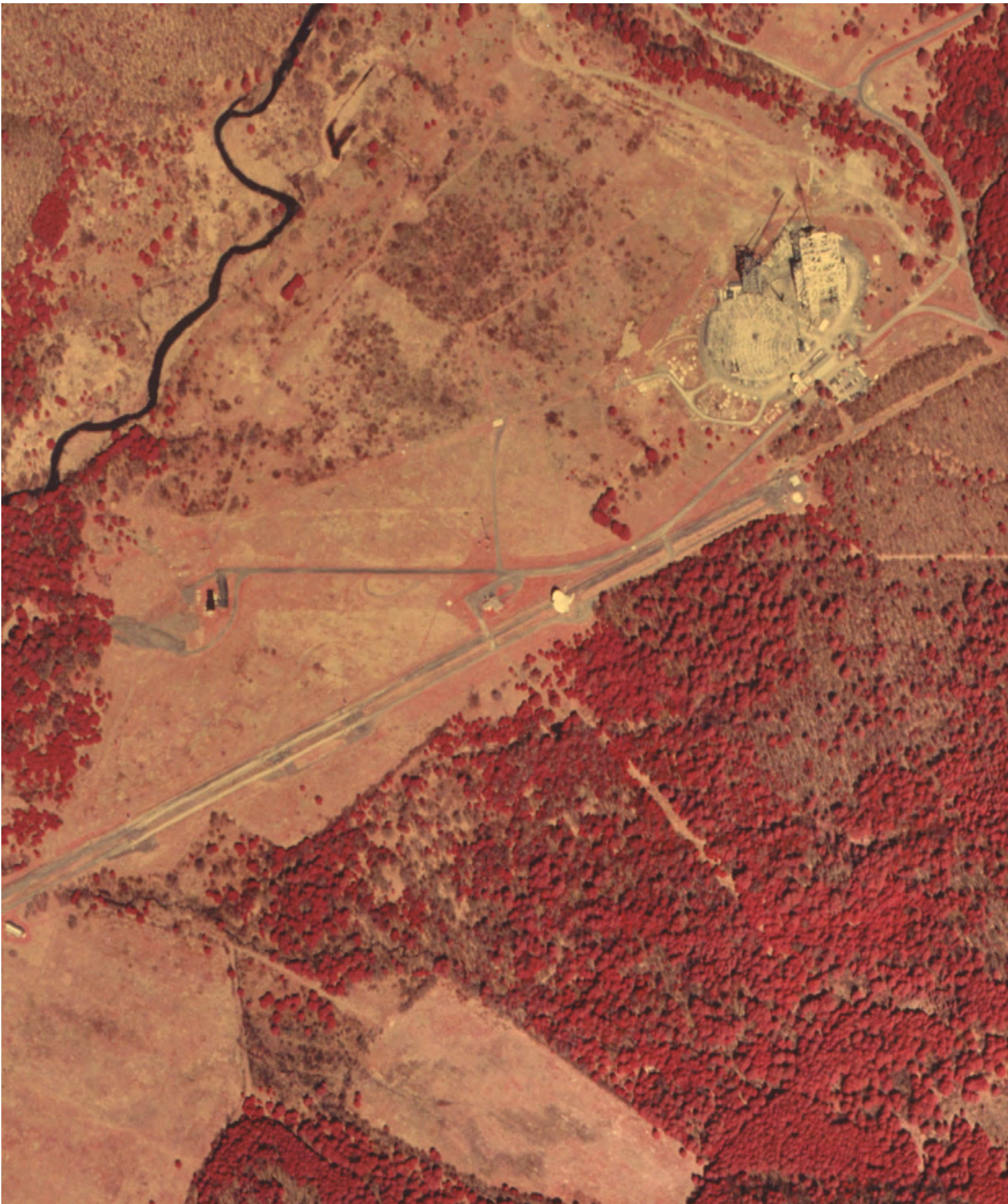


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YEAR: 1991

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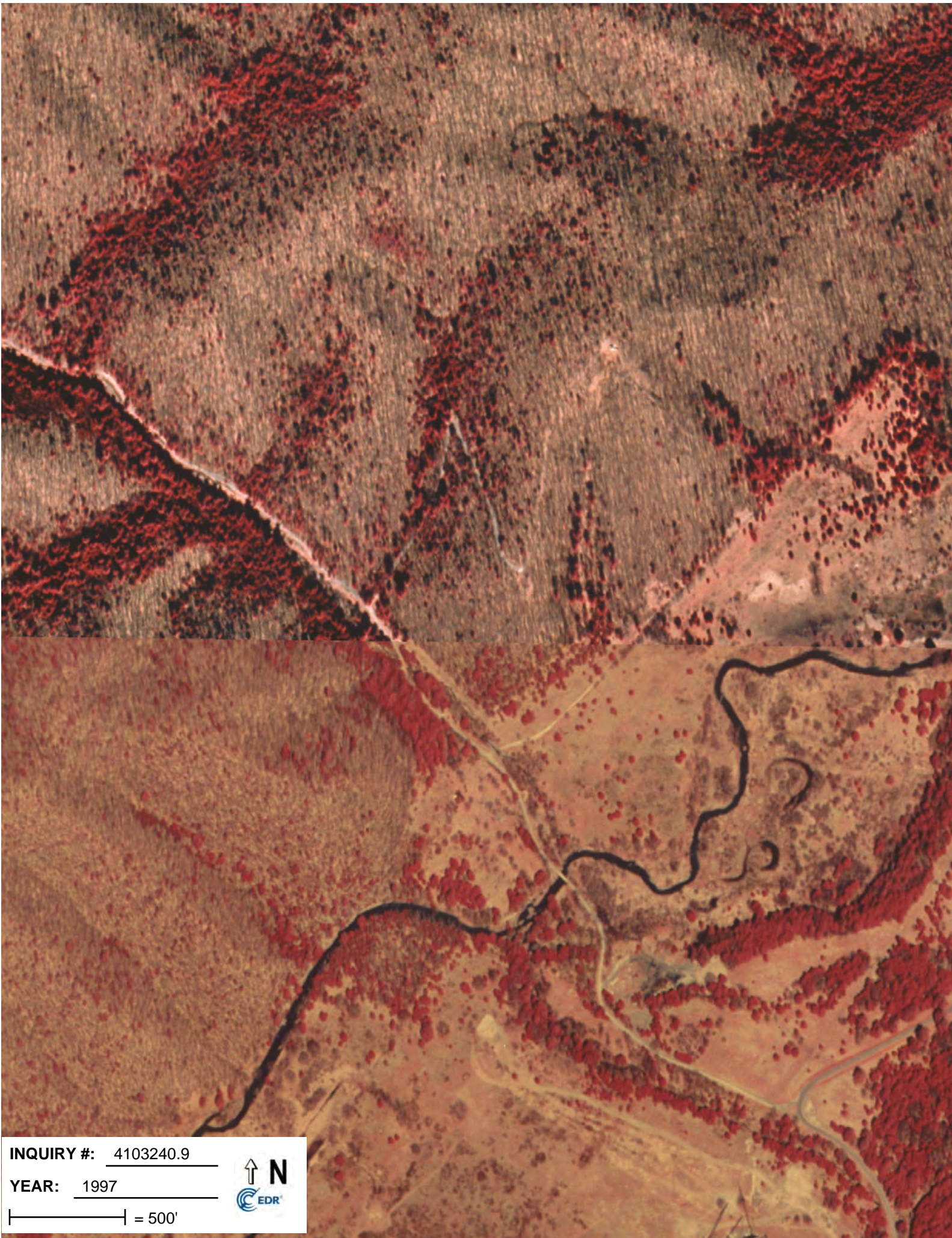


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YEAR: 1997

| = 500'





INQUIRY #: 4103240.9

YEAR: 1997

| = 500'





INQUIRY #: 4103240.9

YEAR: 1997

| = 500'





INQUIRY #: 4103240.9

YEAR: 1997

| = 500'



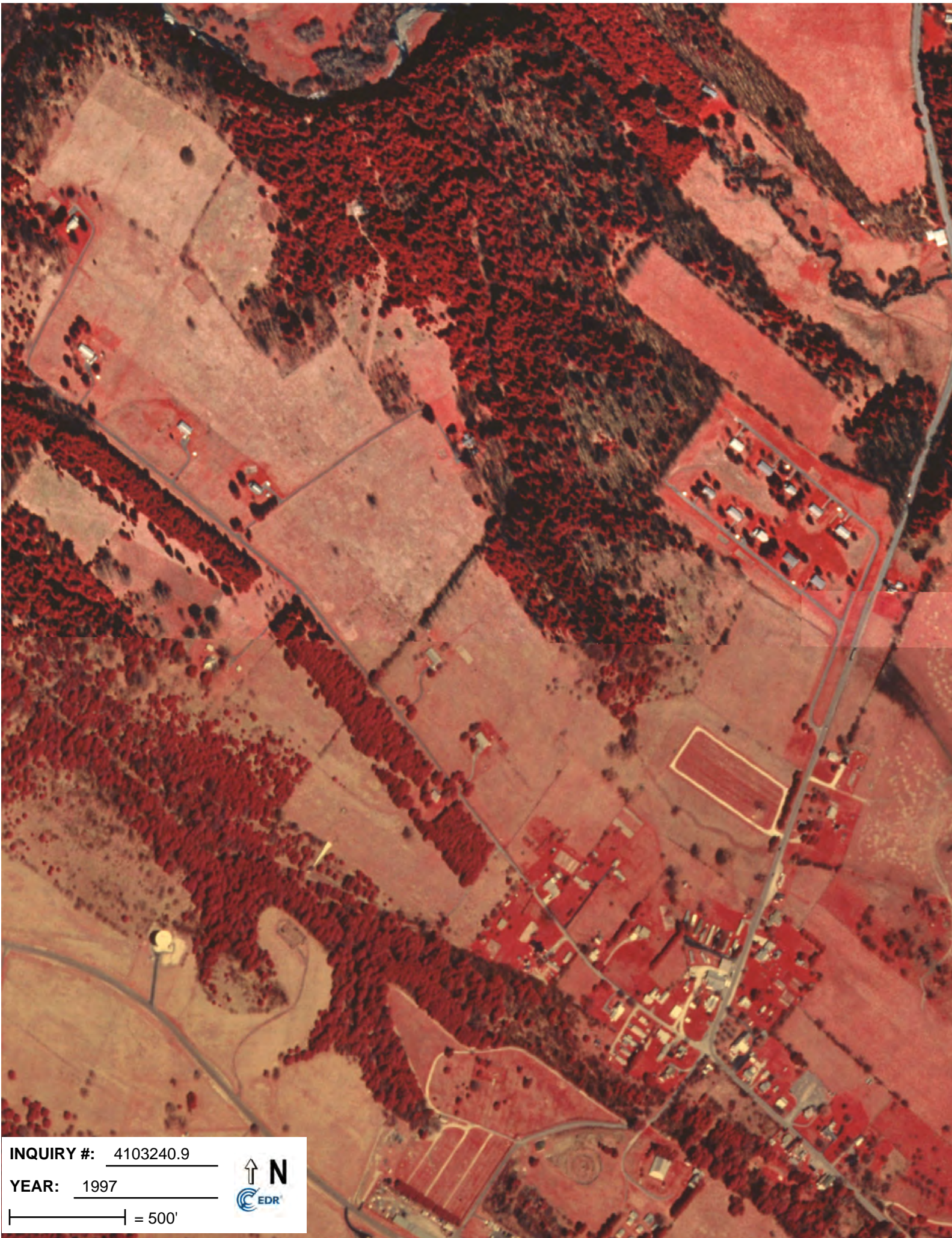


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YEAR: 1997

| = 500'





INQUIRY #: 4103240.9

YEAR: 1997

| = 500'





INQUIRY #: 4103240.9

YEAR: 1998

| = 750'





INQUIRY #: 4103240.9

YEAR: 1998

| = 750'





INQUIRY #: 4103240.9

YEAR: 2001

| = 750'





INQUIRY #: 4103240.9

YEAR: 2006

| = 500'





INQUIRY #: 4103240.9

YEAR: 2006

| = 500'





INQUIRY #: 4103240.9

YEAR: 2006

| = 500'





INQUIRY #: 4103240.9

YEAR: 2006

| = 500'





INQUIRY #: 4103240.9

YEAR: 2006

| = 500'





INQUIRY #: 4103240.9

YEAR: 2006

| = 500'





INQUIRY #: 4103240.9

YEAR: 2007

| = 500'





INQUIRY #: 4103240.9

YEAR: 2007

| = 500'





INQUIRY #: 4103240.9

YEAR: 2007

| = 500'





INQUIRY #: 4103240.9

YEAR: 2007

| = 500'





INQUIRY #: 4103240.9

YEAR: 2007

| = 500'





INQUIRY #: 4103240.9

YEAR: 2007

| = 500'





INQUIRY #: 4103240.9

YEAR: 2009

| = 500'





INQUIRY #: 4103240.9

YEAR: 2009

| = 500'





INQUIRY #: 4103240.9

YEAR: 2009

| = 500'





INQUIRY #: 4103240.9

YEAR: 2009

| = 500'





INQUIRY #: 4103240.9

YEAR: 2009

| = 500'



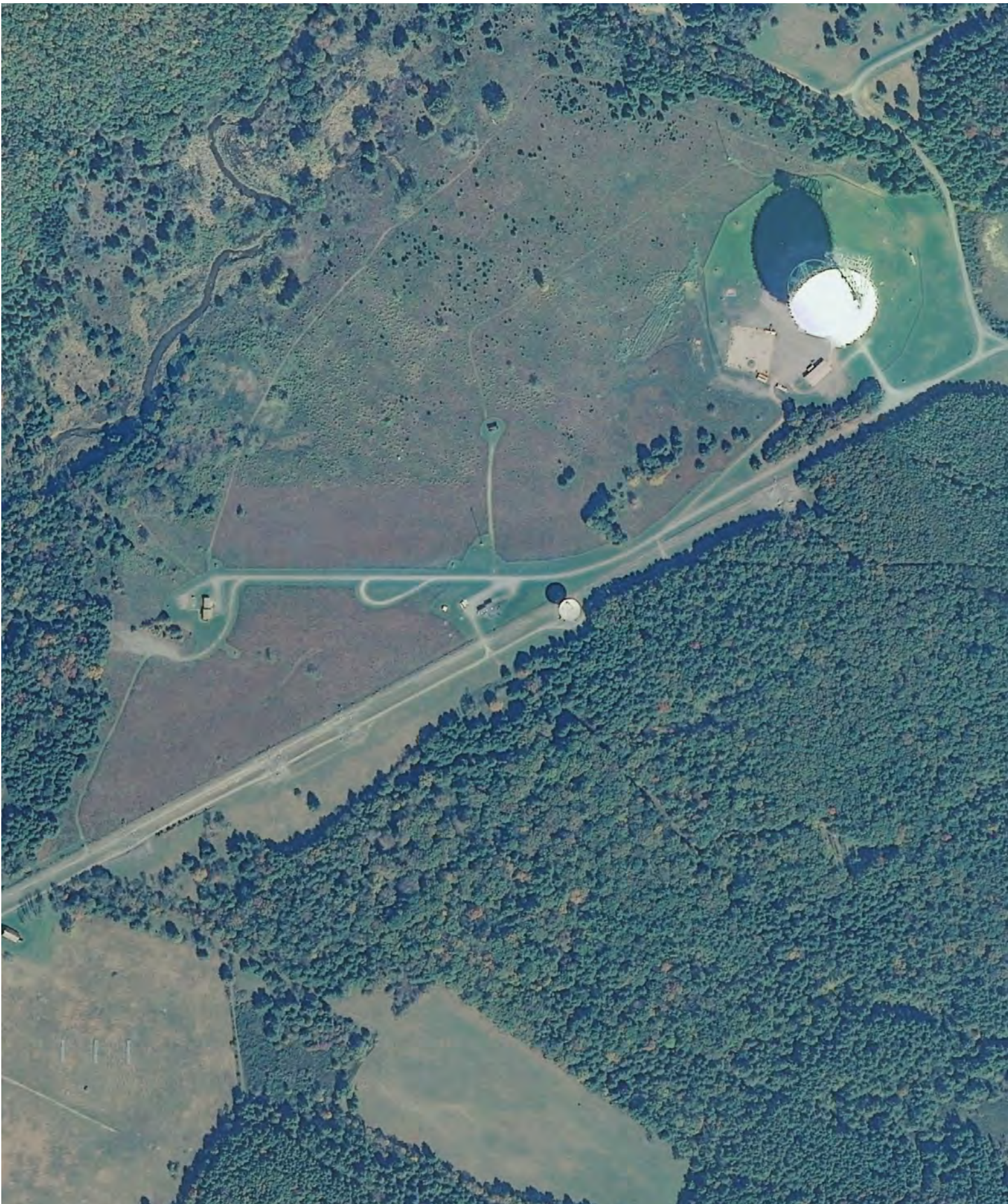


INQUIRY #: 4103240.9

YEAR: 2009

| = 500'





INQUIRY #: 4103240.9

YEAR: 2011

| = 500'





INQUIRY #: 4103240.9

YEAR: 2011

| = 500'





INQUIRY #: 4103240.9

YEAR: 2011

| = 500'





INQUIRY #: 4103240.9

YEAR: 2011

| = 500'





INQUIRY #: 4103240.9

YEAR: 2011

| = 500'





INQUIRY #: 4103240.9

YEAR: 2011

| = 500'



Appendix 3.11A
Temporary Housing Options

Appendix 3.11B Temporary Housing Options

Location	Name	Type	Units
<i>Green Bank</i>	Green Bank Cabins & Country Store	Cabins	3
<i>Boyer</i>	Boyer Station Motel	Motel / RV Campground	20 rooms & 50 hookups
<i>Cass</i>			
	Bear Creek Lodge	Inn	8 rooms
	Cass Scenic Railroad State Park	Cottages and Caboose	Twenty 3, 4, 5 and 6 bedroom vacation cottages plus Caboose rentals
	Whittaker Campground	Campground	40 tent sites / 62 trailer sites
<i>Dunmore</i>			
	Chestnut Ridge Country Inn	Inn	5 rooms
	E.J.'s Cottages and Horse Stables	Cottages / Stables	2 units
	Seneca State Forest Cabins	Cabins / Campground	5 units and 10 campsites
	White Oak Village	Campground	12 camp sites
<i>Town of Marlinton</i>			
	Carriage House Inn	Inn	5 rooms
	Locust Hill Inn	Inn	4 rooms
	Old Clark Inn	Inn	
	Marlinton Motor Inn	Motel	72 rooms
	Eden in the Alleghenies Ambassadors for Christ (AFC)	Lodge	80 – 110 person capacity
	Appalachian Sports Lodge	Lodge	3 condominiums
	Watoga State Park Cabins	Cabins / RV Campground	34 cabins and 88 camp / trailer sites
	Allegheny Lodge and Cabins	Cabins	
	Country River Cabins	Cabins	
	Handley Wildlife Management Area	RV Campground	13 tent / trailer sites
	Riverside RV Park	RV Campground	16 sites
	Tea Creek Campground	RV Campground	20 tent / trailer sites
	Pocahontas Campground	Campground	9 primitive sites
	The Lodge on the Greenbrier River	Lodge	4 rooms
	Jerico B & B and Pre-Civil War Cabins	Cabins	3 cabins
<i>Snowshoe Resort</i>			
	Snowshoe Mountain Resort		1,150 rooms
	Silver Creek Lodge		240 rooms
	Inn at Snowshoe		150 rooms
	Condos East	Condominiums	20 units

Appendix 3.11B Temporary Housing Options

Location	Name	Type	Units
	First Tracts Rentals	Condominiums	110 units
	Mountaintop Condos	Condominiums	14 units
<i>Others</i>			
	The Inn at Mountain Quest in Frost, WV	Inn	12 rooms
	Greenbrier Suites in Durdin		

Cass Scenic RR SP, 2017, PC CVB, 2017b

Appendix 3.11B
Employment and Median Earnings for 2010 and
2015

Employment and Median Earnings for 2010 and 2015 by Occupation for the CDPs of Green Bank and Arbovale, Pocahontas County and the State of West Virginia (in 2015 inflation-adjusted dollars)

	Green Bank CDP					Arbovale CDP (2010 not available)			Pocahontas County					West Virginia				
	2010 Estimate	2015 Estimate	2015 % Distribution	2010 - 2015 % Change	2015 Median earnings (dollars)	2015 Estimate	2015 % Distribution	2015 Median earnings (dollars)	2010 Estimate	2015 Estimate	2015 % Distribution	2010 - 2015 % Change	2015 Median earnings (dollars)	2010 Estimate	2015 Estimate	2015 % Distribution	2010 - 2015 % Change	2015 Median earnings (dollars)
Civilian employed population 16 years and over	38	71		87%	\$32,708.00	60		\$52,692.00	3584	3723		4%	\$22,454	763691	751252		-2%	\$30,618
Management, business, science, and arts occupations:	24	44	62%	83%	\$26,944.00	39	65%	\$54,712.00	893	1119	30%	25%	\$35,080	229188	241587	32%	5%	\$44,320
Management, business, and financial occupations:	0	11	25%	100%	-	8	21%	-	315	528	47%	68%	\$32,315	77354	79703	33%	3%	\$50,613
Management occupations	0	11	100%	100%	-	8	100%	-	263	440	83%	67%	\$38,514	53533	55613	70%	4%	\$52,194
Business and financial operations occupations	0	0	0%	--	-	0	0%	-	52	88	17%	69%	\$21,250	23821	24090	30%	1%	\$46,434
Computer, engineering, and science occupations:	24	0	0%	-100%	-	18	46%	-	131	130	12%	-1%	\$50,833	25304	29555	12%	17%	\$60,171
Computer and mathematical occupations	0	0	0%	--	-	18	100%	-	78	82	63%	5%	\$37,206	9366	12201	41%	30%	\$61,482
Architecture and engineering occupations	0	0	0%	--	-	0	0%	-	0	10	8%	100%	-	9899	11020	37%	11%	\$65,077
Life, physical, and social science occupations	24	0	0%	-100%	-	0	0%	-	53	38	29%	-28%	\$52,000	6039	6334	21%	5%	\$49,620
Education, legal, community service, arts, and media occupations:	0	33	75%	--	\$33,958.00	13	33%	-	362	379	34%	5%	\$30,417	76035	75661	31%	0%	\$36,538
Community and social services occupations	0	9	27%	--	-	0	0%	-	87	104	27%	20%	\$26,778	13872	14104	19%	2%	\$31,879
Legal occupations	0	0	0%	--	-	0	0%	-	0	9	2%	100%	-	8891	8642	11%	-3%	\$53,657
Education, training, and library occupations	0	20	61%	100%	-	13	100%	-	255	237	63%	-7%	\$38,344	44649	44624	59%	0%	\$37,734
Arts, design, entertainment, sports, and media occupations	0	4	12%	--	-	0	0%	-	20	29	8%	45%	\$9,327	8623	8291	11%	-4%	\$26,302
Healthcare practitioner and technical occupations:	0	0	0%	--	-	0	0%	-	85	82	7%	-4%	\$31,250	50495	56668	23%	12%	\$45,320
Health diagnosing and treating practitioners and other technical occupations	0	0	0%	--	-	0	0%	-	39	48	59%	23%	\$52,000	31417	35482	63%	13%	\$54,803
Health technologists and technicians	0	0	0%	--	-	0	0%	-	46	34	41%	-26%	\$23,125	19078	21186	37%	11%	\$31,289
Service occupations:	0	11	15%	--	-	21	35%	-	693	844	23%	22%	\$15,393	139861	141436	19%	1%	\$16,089
Healthcare support occupations	0	0	0%	--	-	0	0%	-	64	67	8%	5%	\$16,688	21323	21973	16%	3%	\$20,184
Protective service occupations:	0	0	0%	--	-	0	0%	-	117	117	14%	0%	\$30,938	17137	17505	12%	2%	\$33,024
Fire fighting and prevention, and other protective service workers including supervisors	0	0	0%	--	-	0	0%	-	4	56	48%	1300%	\$31,167	9262	8921	51%	-4%	\$23,212
Law enforcement workers including supervisors	0	0	0%	--	-	0	0%	-	113	61	52%	-46%	\$30,250	7875	8584	49%	9%	\$41,900
Food preparation and serving related occupations	0	0	0%	--	-	4	19%	-	233	210	25%	-10%	\$17,917	45088	43709	31%	-3%	\$11,734
Building and grounds cleaning and maintenance occupations	0	0	0%	--	-	17	81%	-	178	347	41%	95%	\$10,492	29113	30161	21%	4%	\$17,328
Personal care and service occupations	0	11	100%	--	-	0	0%	-	101	103	12%	2%	\$11,083	27200	28088	20%	3%	\$14,358
Sales and office occupations:	14	0	0%	-100%	-	0	0%	-	711	688	18%	-3%	\$19,899	188558	181570	24%	-4%	\$23,692
Sales and related occupations	0	0	0%	--	-	0	0%	-	383	205	30%	-46%	\$27,545	82147	80531	44%	-2%	\$20,319
Office and administrative support occupations	14	0	0%	-100%	-	0	0%	-	328	483	70%	47%	\$19,184	106411	101039	56%	-5%	\$25,326
Natural resources, construction, and maintenance occupations:	0	0	0%	--	-	0	0%	-	751	599	16%	-20%	\$25,434	99923	89595	12%	-10%	\$41,684
Farming, fishing, and forestry occupations	0	0	0%	--	-	0	0%	-	73	63	11%	-14%	\$25,078	3673	3340	4%	-9%	\$20,434
Construction and extraction occupations	0	0	0%	--	-	0	0%	-	434	363	61%	-16%	\$24,609	64474	56448	63%	-12%	\$44,754
Installation, maintenance, and repair occupations	0	0	0%	--	-	0	0%	-	244	173	29%	-29%	\$29,519	31776	29807	33%	-6%	\$39,767
Production, transportation, and material moving occupations:	0	16	23%	100%	-	0	0%	-	536	473	13%	-12%	\$31,012	106161	97064	13%	-9%	\$32,527
Production occupations	0	16	100%	100%	-	0	0%	-	238	222	47%	-7%	\$36,480	45729	43052	44%	-6%	\$36,378
Transportation occupations	0	0	0%	--	-	0	0%	-	209	151	32%	-28%	\$22,404	35898	32925	34%	-8%	\$35,509
Material moving occupations	0	0	0%	--	-	0	0%	-	89	100	21%	12%	\$23,542	24534	21087	22%	-14%	\$24,731

Appendix 3.11C
Community Resources

APPENDIX 3-11C

Community Resources in the County but outside of the Vicinity

	Name	Type
1.	Advent Church, Hillsboro	Community Gathering Place
2.	Alexander Memorial Presbyterian Church, Clover Lick	Community Gathering Place
3.	Bartow Post Office	Community Services
4.	Bartow-Frank-Durbin Fire & Rescue 2	Community Services
5.	Baxter Presbyterian Church, Clover Lick	Community Gathering Place
6.	Bear Creek Lodge, Cass	Community Commercial
7.	Beaver Creek Church, Lake Sherwood	Community Gathering Place
8.	Bethel United Methodist Church, Durbin	Community Gathering Place
9.	Big Springs Linwood Presbyterian Church, Mingo	Community Gathering Place
10.	Boyer Hill Mennonite Church	Community Gathering Place
11.	Boyer Motel, Restaurant, and Campground	Community Commercial
12.	Browns Creek Church, Minnehaha Springs	Community Gathering Place
13.	Buffalo Run Lodge	Community Commercial
14.	Cass Ambulance Service	Community Services
15.	Cass Depot and Scenic Railroad State Park	Community Gathering Place
16.	Cass Inn	Community Commercial
17.	Cass Post Office	Community Services
18.	Cass United Methodist Church	Community Gathering Place
19.	Central Union Church, Edray	Community Gathering Place
20.	Chestnut Ridge Country Inn, Dunmore	Community Commercial
21.	Cochran Creek Church, Mountain Grove	Community Gathering Place
22.	Cummings Creek Church, Marlinton	Community Gathering Place
23.	Dunmore Post Office	Community Services
24.	Dunmore United Methodist Church, Clover Lick	Community Gathering Place
25.	Durbin & Greenbrier Valley Railroad	Community Gathering Place
26.	Durbin Art Center	Community Gathering Place
27.	Durbin United Methodist Church	Community Gathering Place
28.	East Fork Campground, Durbin	Community Commercial

APPENDIX 3-11C

Community Resources in the County but outside of the Vicinity

29. Edray United Methodist Church, Edray	Community Gathering Place
30. Emmanuel Church, Lobelia	Community Gathering Place
31. Fairview Church, Edray	Community Gathering Place
32. First Baptist Church, Marlinton	Community Gathering Place
33. Frank African Methodist Episcopal Church, Durbin	Community Gathering Place
34. Frost United Methodist Church, Clover Lick	Community Gathering Place
35. Grace Church, Droop	Community Gathering Place
36. Hamlin United Methodist Church, Edray	Community Gathering Place
37. Hills Chapel, Droop	Community Gathering Place
38. Huntersville Presbyterian Church, Marlinton	Community Gathering Place
39. Huntersville United Methodist Church, Marlinton	Community Gathering Place
40. Judi's Flower and Gift Boutique, Bartow	Community Commercial
41. Kinders Market, Durbin	Community Commercial
42. Little Yellow House, Dunmore	Community Gathering Place
43. Mace United Methodist Church, Mingo	Community Gathering Place
44. Marlinton Presbyterian Church	Community Gathering Place
45. Marlinton United Methodist	Community Gathering Place
46. Marvin United Methodist Church, Hillsboro	Community Gathering Place
47. Marys Chapel, Edray	Community Gathering Place
48. Mount Carmel Church, Minnehaha Springs	Community Gathering Place
49. Mount Olivet United Methodist Church, Droop	Community Gathering Place
50. Mount Pleasant Church, Edray	Community Gathering Place
51. Mount Zion Church, Clover Lick	Community Gathering Place
52. Mount Zion United Methodist Church, Droop	Community Gathering Place
53. Murphy's Body & Repair Shop & Wrecker Service, Durbin	Community Commercial
54. NAPA / Wilson Brothers Auto Parts, Bartow	Community Commercial
55. New Hope Church, Paddy Knob	Community Gathering Place
56. Old Droop Church Denmar	Community Gathering Place
57. Pocahontas Center Board of Education	Community Services

APPENDIX 3-11C

Community Resources in the County but outside of the Vicinity

58. Pocahontas Center Nursing Home	Community Services
59. Pocahontas County Career Center, Marlinton	Community Services
60. Pocahontas County Emergency Operations Center	Community Services
61. Pocahontas County Health Department	Community Services
62. Pocahontas County Opera House	Community Gathering Place
63. Pocahontas Memorial Hospital	Community Services
64. Pocahontas Times	Community Commercial
65. Rotary Club of Marlinton	Community Gathering Place
66. Ryder's Chevron Restaurant	Community Commercial
67. St. John Catholic Church, Marlinton	Community Gathering Place
68. St. Johns Episcopal Church, Marlinton	Community Gathering Place
69. St. Mark the Evangelist Catholic Church, Durbin	Community Gathering Place
70. Seebert United Methodist Church, Hillsboro	Community Gathering Place
71. Slatyfork Methodist Church, Mingo	Community Gathering Place
72. Stony Creek Presbyterian Church, Edray	Community Gathering Place
73. Swago Church, Hillsboro	Community Gathering Place
74. The Outhouse, Inc, Cass	Community Commercial
75. Thornwood Community Church, Thornwood	Community Gathering Place
76. Trent's General Store, Bartow	Community Commercial
77. Wanless United Methodist Church, Cass	Community Gathering Place
78. Wesley Chapel, Paddy Knob	Community Gathering Place
79. West Union Church, Woodrow	Community Gathering Place
80. Westminster Presbyterian Church, Minnehaha Springs	Community Gathering Place
81. White Church, Woodrow	Community Gathering Place
82. Wilson Chapel, Edray	Community Gathering Place
83. Woodrow Church of the Nazarene, Woodrow	Community Gathering Place
84. Woods-Poage Chapel, Edray	Community Gathering Place

Sources: PCAC, 2017; WV HometownLocator, 2017b; Region 4 Planning and Development Council, 2016a.

Appendix 4.2A
Cultural Correspondence

**NATIONAL SCIENCE FOUNDATION
4201 WILSON BOULEVARD
ARLINGTON, VIRGINIA 22230**



**DIVISION OF ASTRONOMICAL
SCIENCES**

October 20, 2016

Mr. John M. Fowler
Executive Director
Advisory Council on Historic Preservation
401 F Street NW, Suite 308
Washington, DC 20001-2637

Subject: NEPA Analysis for Proposed Changes to Green Bank Observatory Operations,
Green Bank, West Virginia

Dear Mr. Fowler:

In compliance with the National Environmental Policy Act of 1969 (NEPA), as amended, the National Science Foundation (NSF) intends to prepare an Environmental Impact Statement (EIS) to evaluate potential environmental effects of proposed changes to operations at the Green Bank Observatory, in Green Bank, West Virginia. The Notice of Intent for this EIS was published in the Federal Register on October 19, 2016 to initiate the public scoping for the EIS.

At present, alternatives under consideration for inclusion in the EIS include the following:

- Continued NSF investment for science-focused operations (No-Action Alternative)
- Collaboration with interested parties for science-and education-focused operations with reduced NSF-funded scope
- Collaboration with interested parties for operation as a technology and education park
- Mothballing of facilities (suspension of operations in a manner such that operations could resume efficiently at some future date).
- Deconstruction and site restoration

At this time, NSF is soliciting scoping comments from your agency to determine relevant issues that will influence the scope of the environmental analysis, including identification of viable alternatives, and guide the process for developing the EIS. At present, NSF has identified the following preliminary resource areas for analysis of potential impacts: air quality, biological resources, cultural resources, geological resources, solid waste generation, health and safety, socioeconomics, traffic, and groundwater resources.

NSF will conduct scoping meetings on Wednesday November 9, 2016 at 3:00-5:00pm and at 6:00-8:00pm at the following location:

Green Bank Science Center
155 Observatory Road
Green Bank, WV 24915
304-456-2011

Your agency may provide comments at any time during the development of the EIS. However, if you would like your comments to be considered and included in the Draft EIS that will be provided for public and agency review, please provide your comments by November 19, 2016.

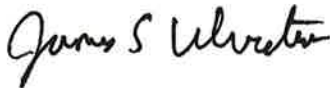
NSF will be conducting consultation under Section 106 of the National Historic Preservation Act concurrent to the NEPA review and will be initiating that process in the near future.

Information about the NEPA and Section 106 processes will be posted at www.nsf.gov/ast under "AST Facilities - Environmental Reviews." If you or your representative(s) would like to be included on emails regarding notices and meetings, please provide the relevant contact information.

The NSF point of contact for the NEPA analysis is Ms. Elizabeth Pentecost, National Science Foundation, Division of Astronomical Sciences, Suite 1045, 4201 Wilson Blvd., Arlington, Virginia 22230; telephone: (703) 292-4907; email: epenteco@nsf.gov.

We appreciate your assistance in this matter and look forward to your response. If you require any additional information or documentation, please contact Ms. Pentecost.

Sincerely,



James S. Ulvestad
Division Director
Division of Astronomical Sciences

Cc: Caroline Blanco, NSF/OGC
Kristin Hamilton, NSF/OGC
Elizabeth Pentecost, NSF/AST
Michelle Rau, CH2M

Enclosure:
Project Location Map

**NATIONAL SCIENCE FOUNDATION
4201 WILSON BOULEVARD
ARLINGTON, VIRGINIA 22230**



**DIVISION OF ASTRONOMICAL
SCIENCES**

October 20, 2016

Ms. Susan Pierce
Director and Deputy State Historic Preservation Officer
WV State Historical Preservation Office
1900 Kanawha Boulevard E
Charleston, WV 25305

Subject: NEPA Analysis for Proposed Changes to Green Bank Observatory Operations,
Green Bank, West Virginia

Dear Ms. Pierce:

In compliance with the National Environmental Policy Act of 1969 (NEPA), as amended, the National Science Foundation (NSF) intends to prepare an Environmental Impact Statement (EIS) to evaluate potential environmental effects of proposed changes to operations at the Green Bank Observatory, in Green Bank, West Virginia. The Notice of Intent for this EIS was published in the Federal Register on October 19, 2016 to initiate the public scoping for the EIS.

At present, alternatives under consideration for inclusion in the EIS include the following:

- Continued NSF investment for science-focused operations (No-Action Alternative)
- Collaboration with interested parties for science-and education-focused operations with reduced NSF-funded scope
- Collaboration with interested parties for operation as a technology and education park
- Mothballing of facilities (suspension of operations in a manner such that operations could resume efficiently at some future date).
- Deconstruction and site restoration

At this time, NSF is soliciting scoping comments from your agency to determine relevant issues that will influence the scope of the environmental analysis, including identification of viable alternatives, and guide the process for developing the EIS. At present, NSF has identified the following preliminary resource areas for analysis of potential impacts: air quality, biological resources, cultural resources, geological resources, solid waste generation, health and safety, socioeconomics, traffic, and groundwater resources.

NSF will conduct scoping meetings on Wednesday November 9, 2016 at 3:00-5:00pm and at 6:00-8:00pm at the following location:

Green Bank Science Center
155 Observatory Road
Green Bank, WV 24915
304-456-2011

Your agency may provide comments at any time during the development of the EIS. However, if you would like your comments to be considered and included in the Draft EIS that will be provided for public and agency review, please provide your comments by November 19, 2016.

NSF will be conducting consultation under Section 106 of the National Historic Preservation Act concurrent to the NEPA review and will initiate consultation with your office in the near future.

Information about the NEPA and Section 106 processes will be posted at www.nsf.gov/ast under "AST Facilities - Environmental Reviews." If you or your representative(s) would like to be included on emails regarding notices and meetings, please provide the relevant contact information.

The NSF point of contact for the NEPA analysis is Ms. Elizabeth Pentecost, National Science Foundation, Division of Astronomical Sciences, Suite 1045, 4201 Wilson Blvd., Arlington, Virginia 22230; telephone: (703) 292-4907; email: epenteco@nsf.gov.

We appreciate your assistance in this matter and look forward to your response. If you require any additional information or documentation, please contact Ms. Pentecost.

Sincerely,



James S. Ulvestad
Division Director
Division of Astronomical Sciences

Cc: Caroline Blanco, NSF/OGC
Kristin Hamilton, NSF/OGC
Elizabeth Pentecost, NSF/AST
Michelle Rau, CH2M

Enclosure:
Project Location Map

Subject: RE: Notice of Intent To Prepare an Environmental Impact Statement and Initiate Consultation for Proposed Changes to Green Bank Observatory Operations, Green Bank, West Virginia; Notice of Public Scoping Meetings and Comment Period

Date: Monday, November 7, 2016 at 12:01:52 PM Eastern Standard Time

From: Lamarre, Lora A

To: Hamilton, Kristen

Hi Kristen,

I put together a list of tribes who have historic ties to WV. I don't know that any of them will be interested in the proposed Green Bank project, especially since, as you said, archaeology isn't likely to be a huge issue. But these are tribes that my agency has invited to consultation for other, non-Section 106 issues. The list does not include the Catawba or the Osage, both of whom have indicated they are not interested in projects in Pocahontas County. Please let me know if you have any questions or if we can be of further assistance. The list is below.

Sincerely,

Lora A Lamarre-DeMott
Senior Archaeologist
WV SHPO
The Cultural Center
1900 Kanawha Blvd., East
Charleston, WV 25305-0300
304-558-0220 x711 (p)
304-558-2779 (f)

Iroquoian Tribes:

Tuscarora Nation
Tonawanda Band of Seneca
Seneca Nation of Indians
St. Regis Mohawk Tribe
Onondaga Indian Nation
Seneca-Cayuga Tribe of Oklahoma
Oneida Nation of New York
Oneida Tribe of Wisconsin
Cayuga Nation

Cherokee Tribes:

Eastern Band of Cherokee Indians
Cherokee Nation
United Keetoowah Band of Cherokee Indians

Algonquian Tribes:

Absentee Shawnee Tribe
Eastern Shawnee Tribe of Oklahoma
Shawnee Tribe
Delaware Nation
Delaware Tribe of Indians

From: Jeffrey M. Mears <jmears@oneidanation.org>
Sent: Wednesday, November 09, 2016 6:06 AM
To: 'epenteco@nsf.gov'
Cc: Patrick J. Pelky
Subject: Notice of Intent To Prepare an Environmental Impact Statement and Initiate Consultation for Proposed Changes to Green Bank Observatory Operations, Green Bank, West Virginia

Hi Elizabeth,

The Oneida Nation, located in Wisconsin, is not interested in participating as a consulting party at this time.

I can serve as the Point of Contact for any questions. Please see my contact information listed below.

From: Pentecost, Elizabeth A. [<mailto:epenteco@nsf.gov>]
Sent: Monday, November 07, 2016 12:00 PM
To: Communications_Department
Subject: Notice of Intent To Prepare an Environmental Impact Statement and Initiate Consultation for Proposed Changes to Green Bank Observatory Operations, Green Bank, West Virginia; Notice of Public Scoping Meetings and Comment Period

To Whom It May Concern,

In compliance with the National Environmental Policy Act of 1969, as amended, the National Science Foundation (NSF) intends to prepare an Environmental Impact Statement (EIS) to evaluate potential environmental effects of proposed operational changes due to funding constraints for Green Bank Observatory, in Green Bank, West Virginia. On October 19, 2016, NSF announced the beginning of the scoping process to solicit public comments and identify issues to be analyzed in the EIS. At this juncture, NSF welcomes public comments on the preliminary proposed alternatives and resource areas identified for analysis. NSF also intends to initiate consultation under Section 106 of the National Historic Preservation Act to evaluate potential effects, if any, on historic properties as a result of the Proposed Action.

NSF invites the Oneida Tribe of Wisconsin to participate in this EIS process. We would appreciate a Point of Contact and email address so that we can provide the Oneida Tribe with additional information and ask if they would like participate as a Consulting Party in the EIS process.

Sincerely,

Elizabeth Pentecost
National Science Foundation
Division of Astronomical Sciences

Room 1045
4201 Wilson Boulevard
Arlington, VA 22230
Tel: 703-292-4907
Fax: 703-292-9034
epenteco@nsf.gov

Yaw^ko (Thank you),

Jeffrey M. Mears, MPA
Environmental Area Manager
Oneida Nation
Environmental Health & Safety Division
P.O. Box 365
Oneida, WI 54155
Office 920/869-4555
Cell 920/639-7457
jmears@oneidanation.org



A good mind. A good heart. A strong fire.



NATIONAL SCIENCE FOUNDATION
4201 Wilson Boulevard
Arlington, Virginia 22230



**OFFICE OF THE
GENERAL COUNSEL**

December 2, 2016

Mr. Randall Reid-Smith
State Historic Preservation Officer
West Virginia Division of Culture and History
Historic Preservation Office
1900 Kanawha Boulevard East
Charleston, West Virginia 25305

RE: Section 106 Consultation for the Proposed Changes to Green Bank
Observatory Operations, Green Bank, West Virginia

Dear Mr. Reid-Smith:

The National Science Foundation (NSF) has identified the need to divest several facilities from its portfolio to retain the balance of capabilities needed to deliver the best performance on the key science of the present decade and beyond. Green Bank Observatory (GBO) in Green Bank, Pocahontas County, West Virginia, is one of the facilities identified for potential divestment. The decision regarding the potential changes to GBO operations is considered a federal undertaking. While engaging in Section 106 consultation under the National Historic Preservation Act (NHPA), NSF will be simultaneously conducting an Environmental Impact Statement (EIS) process under the National Environmental Policy Act (NEPA) to identify potential impacts associated with the proposed operational changes due to funding constraints. With this letter, NSF is formally initiating Section 106 consultation under the NHPA, transmitting the *Cultural Resources Evaluation, Green Bank Observatory, Green Bank, West Virginia* (Enclosure 1) for your review and comment, and requesting concurrence on determinations of eligibility for properties surveyed at GBO.

Project Location and Background

GBO is located on federal lands adjacent to the Monongahela National Forest. This land is owned by NSF and consists of numerous parcels that were acquired/condemned by the U.S. Army Corps of Engineers in the 1950s when GBO was formed as the first (and then, only) site of the National Radio Astronomy Observatory (NRAO). The GBO is the anchor and

administrative site of the 13,000-square-mile National Radio Quiet Zone (NRQZ) and is situated on approximately 2,200 acres in the NRQZ, where all radio transmissions are limited. The GBO facility has a long history of science, technology, engineering, and mathematics education, ranging from student training and mentorships through the outreach and training opportunities offered through the NRAO Center for Science Education, which is based at the GBO site. More than 40,000 visitors each year pass through the Green Bank Science Center, including students, educators, and the general public who generally stay on site for more than one night to take advantage of the educational facilities. The GBO facility is host to multiple educational workshops and programs each year for middle school through post-graduate student training, and an average of 10 to 15 undergraduate and graduate students are mentored at the facility each year.

GBO facilities include the Green Bank Telescope; 43-meter telescope (also referred to as the 140-foot telescope); Green Bank Solar Radio Burst Spectrometer (45-foot telescope); Interferometer Range (includes three 85-foot diameter telescopes); 20-meter Geodetic Telescope; 40-foot telescope; three non-operational historical telescopes (Jansky Replica Antenna, Reber Radio Telescope, and Ewen-Purcell Horn); and other support facilities and infrastructure.

Project Description

NSF's Division of Astronomical Sciences (AST) is the federal steward for ground-based astronomy in the United States, funding research with awards to individual investigators and small research groups, and via cooperative agreements for operation of large telescope facilities. These national and international telescope facilities provide world-leading, one-of-a-kind observational capabilities on a competitive basis to thousands of astronomers per year. These facilities also enable scientific advances by making archived data products available to researchers. Along with funding telescope facilities and research awards, AST supports the development of advanced technologies and instrumentation, and manages the allocation and assignment of specific frequencies in the radio spectrum for scientific use by the entire NSF community. The need for NSF to reduce funding for the GBO has been established through a number of reviews and surveys conducted by the science community.

In 2014, CH2M conducted a Cultural Resources Evaluation for the architectural resources at the GBO. The results of the survey are included below under "Determinations of Eligibility." The associated technical report, entitled *Cultural*

Resources Evaluation, Green Bank Observatory, Green Bank, West Virginia, is attached for reference (Enclosure 1).

A range of preliminary proposed Alternatives is being considered for evaluation. These preliminary proposed Alternatives, which will be refined through public input, include the following:

- Continued NSF investment for science-focused operations (No-Action Alternative).
- Collaboration with interested parties for science- and education-focused operations with reduced NSF-funded scope (Agency-Preferred Alternative).
- Collaboration with interested parties for operation as a technology and education park.
- Mothballing of facilities (suspension of operations in a manner such that operations could resume efficiently at some future date).
- Deconstruction and site restoration.

These alternatives may be further refined during the early phases of the compliance review and will be informed by the public process.

Proposed Area of Potential Effects

The Area of Potential Effects (APE) being proposed for the project is defined as the property boundary of GBO. The total geographic area of the Observatory was chosen as the APE to encompass all buildings and structures on the property. This inclusive APE enables a determination of whether GBO constitutes a potential historic district that could be affected by the activities associated with the proposed changes to operations at the Observatory. Figure 2-1 included in Enclosure 1 shows the boundaries of the APE. We invite your comments on this proposed APE.

Public Involvement

A Notice of Intent (NOI) was published in the Federal Register on October 19, 2016 to initiate the public scoping process for the EIS. A revised NOI was published on November 1, 2016. Two public scoping meetings were conducted on November 9, 2016, at GBO. Section 106 public outreach was addressed as part of the public meeting,

and participants were invited to identify whether they would like to participate in Section 106 as a consulting party. Concurrent to the mailing of this letter, NSF will email these potential consulting parties a description of the role of a consulting party and requesting that they confirm their interest. A separate Section 106 consulting party meeting will be scheduled following the release of the Draft EIS this spring. Follow-up discussions with consulting parties will occur as needed.

Tribal Involvement

Your office provided a list of tribes with historic ties to West Virginia (email correspondence from Ms. Lora Lamarre, November 7, 2016, see Enclosure 2). These tribes were provided email notice of the proposal during NEPA scoping, and we will be providing them with letters inviting them to participate in Section 106 consultation.

Previously Identified Historic Properties

A literature review was conducted through the West Virginia State Historic Preservation Office (SHPO) Interactive Map on November 7, 2016. The literature review focused on the APE and included a 0.5-mile study area.

The Reber Radio Telescope is the only structure or building located within GBO that is listed in the NRHP. It was listed in the NRHP in 1972 and designated a National Historic Landmark in 1986. The telescope was listed under Criteria A and B for its nationally significant association with the origins of radio astronomy and for its association with Grote Reber.

One residence within the APE, the Riley House (House #15), was previously recorded in 2011. The associated survey form states that the early twentieth-century wood-frame farm house does not appear to be significant under NRHP Criterion C. The literature review did not identify any prior cultural resources surveys that have occurred within the APE. Two archaeological sites and nine architectural resources have been recorded outside of the APE, along State Routes 28 and 92, directly adjacent to the eastern boundary of the Observatory. The two previously recorded archaeological resources were not evaluated for the NRHP. One of the architectural resources, the Liberty Presbyterian Church on State Route 92 that was constructed in 1851, is described as significant as an excellent example of Greek Revival architecture, although no formal NRHP evaluation is included with the survey form. The church was recorded on two West Virginia Historic Property Inventory Forms (PH-0002 and PH-0037-0018). Four architectural resources were evaluated as not eligible for the NRHP and three buildings

were recorded, but not evaluated for the NRHP. The cultural resources that have been previously recorded within or directly adjacent to the APE are listed below in Table 1. In addition, two surveys (a bridge survey and a cultural resources survey) have occurred and 34 additional cultural resources have been identified within the 0.5-mile study area.

TABLE 1. Previously Recorded Cultural Resources Within and Directly Adjacent to the APE*

Resource Name	Description	Status	Recorded by
Reber Radio Telescope	1937 telescope located at the entrance to GBO within APE	NRHP listed 1972; National Historic Landmark 1986	National Register of Historic Places Registration Form
Riley House (House #15) PH-0331	Circa 1915 farm house within APE	Not eligible for the NRHP	Justin Greenawalt and Mary Stack (Skelly and Loy, Inc.); 2011
Liberty Presbyterian Church PH-0002 PH-0037-0018	1851 Greek Revival Church adjacent to APE	Not formally evaluated for the NRHP, but described as "significant as an excellent example of Greek Revival architecture in the area"	Michael Gioulis (Historic Preservation Consultant); 1993
George Porter Kerr House – Historic Orlan Shears House PH-0037-0040	Circa 1901 residence adjacent to APE	Not evaluated for the NRHP	Sherron Waybright; 1986
Dr. J.P. Mooumau House PH-0037-0044	1873 residence adjacent to APE	Not evaluated for the NRHP	Jessie B. Powell; 1986

Hamed House PH-0037-0048	1910 residence adjacent to APE	Not evaluated for the NRHP	Jessie B. Powell; 1986
Jack Nelson House PH-0209	Circa 1900 residence adjacent to the APE	Not eligible for the NRHP	Jeff Drobney (Skelly and Loy, Inc.); 1996
Jerry Thortnon House PH-0210	Circa 1880-1890 vernacular residence adjacent to APE	Not eligible for the NRHP	Jeff Drobney (Skelly and Loy, Inc.); 1996
PH-0326	Circa 1920 bungalow residence adjacent to APE	Not eligible for the NRHP	Justin Greenawalt and Mary Stack (Skelly and Loy, Inc.); 2011
PH-0327	Circa 1920 bungalow residence adjacent to APE	Not eligible for the NRHP	Justin Greenawalt and Mary Stack (Skelly and Loy, Inc.); 2011
PH-0332	1949 bungalow residence adjacent to APE	Not eligible for the NRHP	Justin Greenawalt and Mary Stack (Skelly and Loy, Inc.); 2011
Shinaberry's Fifth Grade Site 46-PH-64	Prehistoric open archaeological site adjacent to APE	Not evaluated for the NRHP	Dick Reigel; 1987
Sheets Site 46-PH-27	Prehistoric campsite adjacent to APE	Not evaluated for the NRHP	Stephen Davis; 1977

* Shaded rows indicate previously recorded resources within the APE.

Determination of Eligibility

A Secretary of the Interior-qualified architectural historian with CH2M conducted an intensive architectural survey at the GBO from October 6-9, 2014. The site visit to GBO was also used to engage GBO staff in informal interviews and to conduct archival research, including the review of historic photographs and narratives, newspaper articles, construction records, and architectural drawings.

The field survey encompassed standing structures built in or before 1969, which is 47 years from the present year. The standard NRHP age threshold is 50 years; however, using 47 years as the cutoff allowed a buffer for the execution of the proposed Alternatives. All built environment resources from 1969 or earlier within the GBO boundary were surveyed and assessed, including a determination of eligibility for listing in the NRHP, except for the Reber Radio Telescope. Buildings and structures were evaluated individually as well as part of a potential historic district.

Using aerial photographs of GBO and information provided by GBO staff, 47 built environment resources that had been constructed in or before 1969 were identified as extant within the APE. These include: 5 telescope structures (one of which contains three large telescopes), 2 horn instruments, 1 antenna, 1 airstrip, 1 water tower, 1 recreation area, 24 residential buildings, and 12 operational and administrative buildings. As noted above, one of these telescopes, the Reber Radio Telescope, was previously evaluated. The remaining 46 built environment resources in the APE built in or before 1969 were photographed and evaluated for NRHP eligibility. Data collected through the background research and field investigations were analyzed to determine NRHP eligibility of the 46 surveyed built environment resources individually. In addition, the Green Bank Telescope, which was constructed after 1969, was evaluated individually due to its exceptional importance to radio astronomy over the last 50 years. All 47 historic-era properties (constructed in or before 1969, including the Reber Radio Telescope) and the GBT were also evaluated as a potential historic district. Properties surveyed in 2014 are listed in Attachment A of Enclosure 1. Figure 5-1, included in Enclosure 1, shows the location of each evaluated built environment resource.

NSF has determined that within the historical context of NRAO/GBO, there are four telescope instruments that are individually eligible for listing in the NRHP: the Interferometer Range, the 40-foot Telescope, the 43-meter Telescope, and the Green Bank Telescope. In addition, NSF has determined that GBO is eligible as a historic district for representing an important time in science history and for its significant contribution to the advancement of radio astronomy. There are 44 resources within the APE that are recommended as contributing to the proposed GBO historic district, the boundaries of which coincide with the site's property boundaries (and the APE). Contributing elements include 8 administrative/operational buildings, 1 airstrip, 1 water tower, 1 recreational area, 24 residential buildings, 2 horns, 1 antenna, and 6 telescopes (the Interferometer includes 3 large telescopes) (Table 2).

The scientific instruments within the APE are a collection of telescopes, horns, and antenna that are significant for their role in the development of radio astronomy and, in several instances, as remarkable feats of engineering. As a whole, the majority of the components that make up the potential district's historic character possess integrity, even though many of the buildings are individually undistinguished. The administrative and operations buildings and structures within the GBO are primarily utilitarian buildings or structures with simple designs executed using practical and standard materials. These elements create a cohesive, visual unit that emphasizes their historically linked function as support for the observatory. As a group, the 44 contributing built environment resources are a distinct and well-preserved representation of the early years of the NRAO, complete with scientific instruments, administration/operational facilities, recreation area, and residential buildings. Additionally, the scientific instruments present on site illustrate a linear, historical narrative of the history of radio astronomy from the Jansky Replica Antenna and Reber Radio Telescope to the monumental Green Bank Telescope. Four buildings within the APE were identified as non-contributing resources. These include three barns and one cellar building, all of which pre-date the establishment of the NRAO and have been primarily left vacant or used as miscellaneous storage facilities.

Table 2 lists the properties at the GBO that were identified as individually eligible for the NRHP. Attachment A, included in Enclosure 1, lists the buildings that contribute to the NRHP-eligible historic district.

TABLE 2. NRHP-Eligible Built Environment Resources within the APE

Resource Name	Year Constructed	Description/Significance	NRHP Eligibility Recommendation
GBO Historic District	1958-2000	Collection of administrative/operational structures, residential buildings, and radio astronomy equipment associated with the NRAO/GBO.	Eligible (Historic District); 44 contributing resources (Attachment A in Enclosure 1)
Interferometer Range:	85'-1: 1958-1959	The Tatel Telescope (85'-1) was the first telescope	Individually eligible and contributing to

TABLE 2. NRHP-Eligible Built Environment Resources within the APE

Resource Name	Year Constructed	Description/Significance	NRHP Eligibility Recommendation
Howard E. Tatel Telescope (85'-1) and 85'-1 control building; 85'-2 Telescope; 85'-3 Telescope; and the Interferometer control building	85'-2: 1963-1964 85'-3: 1965-1968 Interferometer control building: 1967-1968	constructed by the NRAO and performed the world's first Search For Extra Terrestrial Intelligence (SETI) observations. The Interferometer Range connected two nearly identical telescopes to the Tatel Telescope in a linear formation. The three telescopes operated in unison and proved that dishes could be combined to form very large telescopes. This information spurred the construction of the Very Large Array telescope in New Mexico in the 1970s.	GBO Historic District
40-foot Telescope and control building	1962	First fully automated radio telescope in the world. Currently operates as an educational telescope for visiting students.	Individually eligible and contributing to GBO Historic District
43-meter Telescope	1958-1965	Largest telescope in the world to use an equatorial (for polar aligned) mount. Currently used as part of the Russian Radioastron project.	Individually eligible and contributing to GBO Historic District

TABLE 2. NRHP-Eligible Built Environment Resources within the APE

Resource Name	Year Constructed	Description/Significance	NRHP Eligibility Recommendation
Robert C. Byrd Green Bank Telescope (Green Bank Telescope)	1991-2000	Largest moving structure on land in the world; tilt and point design that can rotate a full 360 degrees; performs highly sensitive data collection.	Individually eligible and contributing to GBO Historic District

Request for Concurrence

NSF requests your input on the proposed APE and concurrence with the determination that there are four telescopes at the GBO that are individually eligible for listing in the NRHP (one of which is the Interferometer which encompasses three large telescopes) and that the GBO is eligible for the NRHP as a historic district, containing 44 contributing resources.

Initiation of Section 106 Consultation

The GBO is a federally-owned property that contains historic properties. Therefore the Proposed Action has the potential to affect historic properties. In compliance with 36 Code of Federal Regulations (CFR) 800.3(c), NSF is initiating consultation with the West Virginia State Historic Preservation Officer (SHPO) on the proposed changes to GBO operations. Please respond within 30 days from receipt of this letter to:

Ms. Elizabeth Pentecost
National Science Foundation
Division of Astronomical Sciences
4201 Wilson Blvd, Suite 1045
Arlington, Virginia 22230
epenteco@nsf.gov

NSF is also transmitting the *Cultural Resources Evaluation, Green Bank Observatory, Green Bank, West Virginia* (attached as Enclosure 1). If you have any questions, please do not hesitate to contact me by phone at 703-292-4592 or by email at

cblanco@nsf.gov. Information about this proposal will be posted, throughout the NEPA and Section 106 processes, at www.nsf.gov/AST (click on "AST Facilities-Environmental Reviews," the "Green Bank Observatory.") We look forward to further consultation on this proposed undertaking.

Regards,

A handwritten signature in blue ink that reads "Caroline M. Blanco". The signature is written in a cursive style with a large initial 'C'.

Caroline M. Blanco
Federal Preservation Officer
Assistant General Counsel
Office of the General Counsel

Enclosures:

1. *Cultural Resources Evaluation, Green Bank Observatory, Green Bank, West Virginia*
2. Email from SHPO's office with list of tribes with potential interest in West Virginia projects

Nolan-Wheatley, Marynell/NYC

From: Price, Lori/TPA
Sent: Thursday, August 10, 2017 5:32 PM
To: Nolan-Wheatley, Marynell/NYC
Subject: FW: replacement report for our recent letter initiating consultation, Green Bank Observatory, NSF [EXTERNAL]
Attachments: Enclosure 1_NSF_GBO_Cultural Resources TM 050616_FOR SHPO.pdf
Follow Up Flag: Follow up
Flag Status: Flagged

Is this it?

From: Hamilton, Kristen [mailto:KRIHAMIL@nsf.gov]
Sent: Thursday, December 08, 2016 11:27 AM
To: susan.m.pierce@wv.gov
Subject: replacement report for our recent letter initiating consultation, Green Bank Observatory, NSF [EXTERNAL]

Good morning Susan,

We provided your office with a letter (mailed Friday) initiating Section 106 consultation and asking for your concurrence or input on our determinations of eligibility, including Green Bank Observatory as a historic district, along with your thoughts on the APE. We enclosed a report that provides these determinations, but it also contains our effects findings, which is jumping the gun a bit. This report was prepared for us last year as part of a feasibility study, when we asked our contractor to evaluate eligibility and describe potential Section 106 implications/findings, just so we had an idea of what would be involved in environmental and cultural reviews. However, both the alternatives described and the findings themselves are liable to change as a result of both scoping under NEPA and input from your office, consulting parties, and tribes (all of whom are being contacted this week or next) regarding historic properties identification.

So in order to not do things out of order in terms of the basic Section 106 steps and not have you review something that could ultimately change, I'm sending the version of the report that focuses on historic properties identification only for you to review. Sorry for this mix up, and if you prefer that I send this via a formal letter, I'm happy to do so. Once historic properties are properly identified, we will, of course then update our analysis as needed and consult with you on a formal finding of effect. Give me a ring if you'd like to discuss.

Thanks,
Kristen

Kristen Hamilton
Environmental Compliance Officer
Office of the General Counsel
National Science Foundation
4201 Wilson Boulevard, Suite 1265
Arlington, VA 22230
(703)292-4820
krihamil@nsf.gov

**NATIONAL SCIENCE FOUNDATION
4201 WILSON BOULEVARD
ARLINGTON, VIRGINIA 22230**



**DIVISION OF ASTRONOMICAL
SCIENCES**

December 9, 2016

Ms. B. J. Sharp-Gudmundsson
Historic Preservation Officer
Preserving Pocahontas
1200 2nd Avenue
Marlinton, WV 24954

Subject: Identification of Consulting Parties for Section 106 Compliance for Proposed Changes to Green Bank Observatory Operations, Green Bank, West Virginia

Dear Ms. Gudmundsson:

The National Science Foundation (NSF) has identified the need to divest several facilities from its portfolio to retain the balance of capabilities needed to deliver the best performance on the key science of the present decade and beyond. Green Bank Observatory (GBO) in Green Bank, Pocahontas County, West Virginia, is one of the facilities identified for potential divestment. NSF has initiated consultation under Section 106 of the National Historic Preservation Act (NHPA).

The Reber Radio Telescope located within GBO is listed in the NRHP. It was listed in the NRHP in 1972 and designated a National Historic Landmark in 1986. The telescope was listed under Criteria A and B for its nationally significant association with the origins of radio astronomy and for its association with Grote Reber.

NSF will be conducting an Environmental Impact Statement (EIS) under the National Environmental Policy Act (NEPA) to identify potential impacts associated with this potential change in operations while simultaneously engaging in Section 106 consultation under the NHPA.

At present, alternatives under consideration include:

- Continued NSF investment for science-focused operations (No-Action Alternative).
- Collaboration with interested parties for science- and education-focused operations with reduced NSF-funded scope.
- Collaboration with interested parties for operation as a technology and education park.
- Mothballing of facilities (suspension of operations in a manner such that operations could resume efficiently at some future date).
- Deconstruction and site restoration.

NSF is identifying organizations and individuals with an interest in the project's potential to affect historic properties who may qualify as consulting parties. Consulting parties can include individuals and organizations with a demonstrated interest in the project "due to the nature of their legal or economic relation to the undertaking or affected properties, or their concern with the undertaking's effects on historic properties" (30 CFR Part 800.2[5]). The purpose of this letter is to determine if you wish to be a consulting party under Section 106 for this project. The Section 106 process is described at <http://www.achp.gov/citizensguide.html>.

As a consulting party, you will be actively informed of and able to participate in the Section 106 process, including potential consultation meetings, and your views will be actively sought. If you would like to request consulting party status on this project, please respond no later than January 5, 2017 by contacting:

Ms. Elizabeth Pentecost, National Science Foundation, Division of Astronomical Sciences, Suite 1045,
4201 Wilson Blvd., Arlington, Virginia 22230; telephone: (703) 292-4907; email: epenteco@nsf.gov.

If you do not respond within this time frame, you may request consulting party status in the future; however, the project may advance without your input and you won't have an opportunity to comment on the previous steps. If Preserving Pocahontas is interested in participating, we do ask that your organization nominate one representative and an alternate to participate on behalf of the group. There is also an opportunity for individuals to participate in the Section 106 process in a more limited capacity as members of the public.

We look forward to your response to this request and to your role as a consulting party on this project, should you choose to participate. Should you have any questions, or wish to discuss the project or our agency's responsibilities in more detail, please contact me at epenteco@nsf.gov.

Sincerely,

A handwritten signature in black ink that reads "Elizabeth Pentecost". The signature is written in a cursive, flowing style.

Elizabeth Pentecost
Project Management Administrator

**NATIONAL SCIENCE FOUNDATION
4201 WILSON BOULEVARD
ARLINGTON, VIRGINIA 22230**



**DIVISION OF ASTRONOMICAL
SCIENCES**

December 9, 2016

Mr. Wayne Gillispie
Chairman
Pocahontas County Historic Landmarks Commission
900 Tenth Avenue
Marlinton, WV 24954

Subject: Identification of Consulting Parties for Section 106 Compliance for Proposed Changes to Green Bank Observatory Operations, Green Bank, West Virginia

Dear Mr. Gillispie:

The National Science Foundation (NSF) has identified the need to divest several facilities from its portfolio to retain the balance of capabilities needed to deliver the best performance on the key science of the present decade and beyond. Green Bank Observatory (GBO) in Green Bank, Pocahontas County, West Virginia, is one of the facilities identified for potential divestment. NSF has initiated consultation under Section 106 of the National Historic Preservation Act (NHPA).

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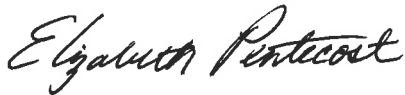
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Ms. Elizabeth Pentecost, National Science Foundation, Division of Astronomical Sciences, Suite 1045,
4201 Wilson Blvd., Arlington, Virginia 22230; telephone: (703) 292-4907; email: epenteco@nsf.gov.

If you do not respond within this time frame, you may request consulting party status in the future; however, the project may advance without your input and you won't have an opportunity to comment on the previous steps. If Pocahontas County Historic Landmarks Commission is interested in participating, we do ask that your organization nominate one representative and an alternate to participate on behalf of the group. There is also an opportunity for individuals to participate in the Section 106 process in a more limited capacity as members of the public. We look forward to your response to this request and to your role as a consulting party on this project, should you choose to participate. Should you have any questions, or wish to discuss the project or our agency's responsibilities in more detail, please contact me at epenteco@nsf.gov.

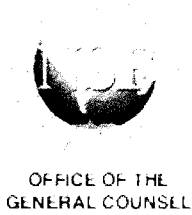
Sincerely,

A handwritten signature in black ink that reads "Elizabeth Pentecost". The signature is written in a cursive, flowing style.

Elizabeth Pentecost
Project Management Administrator

NATIONAL SCIENCE FOUNDATION

4201 Wilson Boulevard
Arlington, Virginia 22230



December 12, 2016

Mr. Eric Oosahwee-voss
Tribal Historic Preservation Office
United Keetoowah Band of Cherokee Indians
PO Box 746
Tahlequah, OK 74465

RE: Section 106 Consultation for the Proposed Changes to Green Bank
Observatory Operations, Green Bank, West Virginia

Dear Mr. Oosahwee-voss:

The National Science Foundation (NSF) has identified the need to divest several facilities from its portfolio to retain the balance of capabilities needed to deliver the best performance on the key science of the present decade and beyond. Green Bank Observatory (GBO) in Green Bank, Pocahontas County, West Virginia, is one of the facilities identified for potential divestment. The decision regarding the potential changes to GBO operations is considered a federal undertaking. While engaging in Section 106 consultation under the National Historic Preservation Act (NHPA), NSF will be simultaneously conducting an Environmental Impact Statement (EIS) process under the National Environmental Policy Act (NEPA) to identify potential impacts associated with the proposed operational changes due to funding constraints. With this letter, NSF is formally initiating Section 106 consultation under the NHPA and transmitting the *Cultural Resources Evaluation, Green Bank Observatory, Green Bank, West Virginia* (Enclosure 1) for your review and comment.

Project Location and Background

GBO is located on federal lands adjacent to the Monongahela National Forest. This land is owned by NSF and consists of numerous parcels that were acquired/condemned by the U.S. Army Corps of Engineers in the 1950s when GBO was formed as the first (and then, only) site of the National Radio Astronomy Observatory (NRAO). The GBO is the anchor and administrative site of the 13,000-square-mile National Radio Quiet Zone (NRQZ) and is situated on approximately 2,200 acres in the NRQZ, where all radio transmissions are limited. The GBO facility has a long history of science, technology, engineering, and mathematics education, ranging from student training and mentorships through the outreach and training opportunities offered through the NRAO Center for

Science Education, which is based at the GBO site. More than 40,000 visitors each year pass through the Green Bank Science Center, including students, educators, and the general public who generally stay on site for more than one night to take advantage of the educational facilities. The GBO facility is host to multiple educational workshops and programs each year for middle school through post-graduate student training, and an average of 10 to 15 undergraduate and graduate students are mentored at the facility each year.

GBO facilities include the Green Bank Telescope; 43-meter telescope (also referred to as the 140-foot telescope); Green Bank Solar Radio Burst Spectrometer (45-foot telescope); Interferometer Range (includes three 85-foot diameter telescopes); 20-meter Geodetic Telescope; 40-foot telescope; three non-operational historical telescopes (Jansky Replica Antenna, Reber Radio Telescope, and Ewen-Purcell Horn); and other support facilities and infrastructure.

Project Description

NSF's Division of Astronomical Sciences (AST) is the federal steward for ground-based astronomy in the United States, funding research with awards to individual investigators and small research groups, and via cooperative agreements for operation of large telescope facilities. These national and international telescope facilities provide world-leading, one-of-a-kind observational capabilities on a competitive basis to thousands of astronomers per year. These facilities also enable scientific advances by making archived data products available to researchers. Along with funding telescope facilities and research awards, AST supports the development of advanced technologies and instrumentation, and manages the allocation and assignment of specific frequencies in the radio spectrum for scientific use by the entire NSF community. The need for NSF to reduce funding for the GBO has been established through a number of reviews and surveys conducted by the science community.

In 2014, CH2M conducted a Cultural Resources Evaluation for the architectural resources at the GBO. The results of the survey are included below under "Determinations of Eligibility." The associated technical report, entitled *Cultural Resources Evaluation, Green Bank Observatory, Green Bank, West Virginia*, is attached for reference (Enclosure 1).

A range of preliminary proposed Alternatives is being considered for evaluation. These preliminary proposed Alternatives, which will be refined through public input, include the following:

- Continued NSF investment for science-focused operations (No-Action Alternative).
- Collaboration with interested parties for science- and education-focused operations with reduced NSF-funded scope.

- Collaboration with interested parties for operation as a technology and education park.
- Mothballing of facilities (suspension of operations in a manner such that operations could resume efficiently at some future date).
- Deconstruction and site restoration.

These alternatives may be further refined during the early phases of the compliance review and will be informed by the public process.

Proposed Area of Potential Effects

The Area of Potential Effects (APE) being proposed for the project is defined as the property boundary of GBO. The total geographic area of the Observatory was chosen as the APE to encompass all buildings and structures on the property. This inclusive APE enables a determination of whether GBO constitutes a potential historic district that could be affected by the activities associated with the proposed changes to operations at the Observatory. Figure 2-1 included in Enclosure 1 shows the boundaries of the APE.

Public Involvement

A Notice of Intent (NOI) was published in the Federal Register on October 19, 2016 to initiate the public scoping process for the EIS. A revised NOI was published on November 1, 2016. Two Public Scoping Meetings were conducted on November 9, 2016, at GBO. Section 106 public outreach was addressed as part of the public meeting, and participants were invited to identify whether they would like to participate in Section 106 as a consulting party. Concurrent to the mailing of this letter, NSF will email these potential consulting parties a description of the role of a consulting party and requesting that they confirm their interest. A separate Section 106 consulting party meeting will be scheduled following the release of the Draft EIS this spring. Follow-up discussions with consulting parties will occur as needed.

Previously Identified Historic Properties

A literature review was conducted through the West Virginia State Historic Preservation Office (SHPO) Interactive Map on November 7, 2016. The literature review focused on the APE and included a 0.5-mile study area.

The Reber Radio Telescope is the only structure or building located within GBO that is listed in the NRHP. It was listed in the NRHP in 1972 and designated a National Historic Landmark in 1986. The telescope was listed under Criteria A and B for its nationally significant association with the origins of radio astronomy and for its association with Grote Reber.

One residence within the APE, the Riley House (House #15), was previously recorded in 2011. The associated survey form states that the early twentieth-century wood-frame farm house does not appear to be significant under NRHP Criterion C. The literature

review did not identify any prior cultural resources surveys that have occurred within the APE. Two archaeological sites and nine architectural resources have been recorded outside of the APE, along State Routes 28 and 92, directly adjacent to the eastern boundary of the Observatory. The two previously recorded archaeological resources were not evaluated for the NRHP. One of the architectural resources, the Liberty Presbyterian Church on State Route 92 that was constructed in 1851, is described as significant as an excellent example of Greek Revival architecture, although no formal NRHP evaluation is included with the survey form. The church was recorded on two West Virginia Historic Property Inventory Forms (PH-0002 and PH-0037-0018). Four architectural resources were evaluated as not eligible for the NRHP and three buildings were recorded, but not evaluated for the NRHP. The cultural resources that have been previously recorded within or directly adjacent to the APE are listed below in Table 1. In addition, two surveys (a bridge survey and a cultural resources survey) have occurred and 34 additional cultural resources have been identified within the 0.5-mile study area.

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A Secretary of the Interior-qualified architectural historian with CH2M conducted an intensive architectural survey at the GBO from October 6-9, 2014. The site visit to GBO was also used to engage GBO staff in informal interviews and to conduct archival research, including the review of historic photographs and narratives, newspaper articles, construction records, and architectural drawings.

The field survey encompassed standing structures built in or before 1969, which is 47 years from the present year. The standard NRHP age threshold is 50 years; however, using 47 years as the cutoff allowed a buffer for the execution of the proposed Alternatives. All built environment resources from 1969 or earlier within the GBO boundary were surveyed and assessed, including a determination of eligibility for listing in the NRHP, except for the Reber Radio Telescope. Buildings and structures were evaluated individually as well as part of a potential historic district.

Using aerial photographs of GBO and information provided by GBO staff, 47 built environment resources that had been constructed in or before 1969 were identified as extant within the APE. These include: 5 telescope structures (one of which contains three large telescopes), 2 horn instruments, 1 antenna, 1 airstrip, 1 water tower, 1 recreation area, 24 residential buildings, and 12 operational and administrative buildings. As noted above, one of these telescopes, the Reber Radio Telescope, was previously evaluated. The remaining 46 built environment resources in the APE built in or before 1969 were photographed and evaluated for NRHP eligibility. Data collected through the background research and field investigations were analyzed to determine NRHP eligibility of the 46 surveyed built environment resources individually. In addition, the Green Bank Telescope, which was constructed after 1969, was evaluated individually due to its exceptional importance to radio astronomy over the last 50 years. All 47 historic-era properties (constructed in or before 1969, including the Reber Radio Telescope) and the GBT were also evaluated as a potential historic district. Properties surveyed in 2014 are listed in Attachment A of Enclosure 1. Figure 5-1, included in Enclosure 1, shows the location of each evaluated built environment resource.

NSF has determined that within the historical context of NRAO/GBO, there are four telescope instruments that are individually eligible for listing in the NRHP: the Interferometer Range, the 40-foot Telescope, the 43-meter Telescope, and the Green Bank Telescope. In addition, NSF has determined that GBO is eligible as a historic district for representing an important time in science history and for its significant contribution to the advancement of radio astronomy. There are 44 resources within the APE that are recommended as contributing to the proposed GBO historic district, the boundaries of which coincide with the site's property boundaries (and the APE). Contributing elements include 8 administrative/operational buildings, 1 airstrip, 1 water tower, 1 recreational area, 24 residential buildings, 2 horns, 1 antenna, and 6 telescopes (the Interferometer includes 3 large telescopes) (Table 2).

The scientific instruments within the APE are a collection of telescopes, horns, and antenna that are significant for their role in the development of radio astronomy and, in several instances, as remarkable feats of engineering. As a whole, the majority of the components that make up the potential district's historic character possess integrity, even though many of the buildings are individually undistinguished. The administrative and operations buildings and structures within the GBO are primarily utilitarian buildings or structures with simple designs executed using practical and standard materials. These elements create a cohesive, visual unit that emphasizes their historically linked function

as support for the observatory. As a group, the 44 contributing built environment resources are a distinct and well-preserved representation of the early years of the NRAO, complete with scientific instruments, administration/operational facilities, recreation area, and residential buildings. Additionally, the scientific instruments present on site illustrate a linear, historical narrative of the history of radio astronomy from the Jansky Replica Antenna and Reber Radio Telescope to the monumental Green Bank Telescope. Four buildings within the APE were identified as non-contributing resources. These include three barns and one cellar building, all of which pre-date the establishment of the NRAO and have been primarily left vacant or used as miscellaneous storage facilities.

Table 2 lists the properties at the GBO that were identified as individually eligible for the NRHP. Attachment A, included in Enclosure 1, lists the buildings that contribute to the NRHP-eligible historic district.

TABLE 2. NRHP-Eligible Built Environment Resources within the APE

Resource Name	Year Constructed	Description/Significance	NRHP Eligibility Recommendation
GBO Historic District	1958-2000	Collection of administrative/operational structures, residential buildings, and radio astronomy equipment associated with the NRAO/GBO.	Eligible (Historic District); 44 contributing resources (Attachment A in Enclosure 1)
Interferometer Range: Howard E. Tatel Telescope (85'-1) and 85'-1 control building; 85'-2 Telescope; 85'-3 Telescope; and the Interferometer control building	85'-1: 1958-1959 85'-2: 1963-1964 85'-3: 1965-1968 Interferometer control building: 1967-1968	The Tatel Telescope (85'-1) was the first telescope constructed by the NRAO and performed the world's first Search For Extra Terrestrial Intelligence (SETI) observations. The Interferometer Range connected two nearly identical telescopes to the Tatel Telescope in a linear formation. The three telescopes operated in unison and proved that dishes could be combined to form very large telescopes. This information spurred the	Individually eligible and contributing to GBO Historic District

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40-foot Telescope and control building	1962	First fully automated radio telescope in the world. Currently operates as an educational telescope for visiting students.	Individually eligible and contributing to GBO Historic District
43-meter Telescope	1958-1965	Largest telescope in the world to use an equatorial (for polar aligned) mount. Currently used as part of the Russian Radioastron project.	Individually eligible and contributing to GBO Historic District
Robert C. Byrd Green Bank Telescope (Green Bank Telescope)	1991-2000	Largest moving structure on land in the world; tilt and point design that can rotate a full 360 degrees; performs highly sensitive data collection.	Individually eligible and contributing to GBO Historic District

Initiation of Section 106 Consultation

The GBO is a federally-owned property that contains historic properties. Therefore the Proposed Action has the potential to affect historic properties. In compliance with 36 Code of Federal Regulations (CFR) 800.2(c)(2)(ii), NSF is initiating consultation with you on the proposed changes to GBO operations. NSF is also seeking your input on any cultural resources in the project area or any cultural resources concerns you may have related to this undertaking.

We respectfully request your response within 30 days from receipt of this letter indicating your interest in participating in consultation for this undertaking. Please respond to:

Ms. Elizabeth Pentecost
National Science Foundation
Division of Astronomical Sciences
4201 Wilson Blvd, Suite 1045
Arlington, Virginia 22230
epenteco@nsf.gov

NSF is also transmitting the *Cultural Resources Evaluation, Green Bank Observatory, Green Bank, West Virginia* (attached as Enclosure 1). If you have any questions, please do not hesitate to contact me by phone at 703-292-4592 or by email at cblanco@nsf.gov. We look forward to further consultation on this proposed undertaking.

Regards,

A handwritten signature in black ink that reads "Caroline M. Blanco". The signature is written in a cursive, flowing style.

Caroline M. Blanco
Federal Preservation Officer
Assistant General Counsel
Office of the General Counsel

Enclosures:

1. *Cultural Resources Evaluation, Green Bank Observatory, Green Bank, West Virginia*

NATIONAL SCIENCE FOUNDATION

4201 Wilson Boulevard
Arlington, Virginia 22230



OFFICE OF THE
GENERAL COUNSEL

December 12, 2016

Chief Leo Henry
Tuscarora Nation
5616 Walmore Road
Lewiston, NY 14092

RE: Section 106 Consultation for the Proposed Changes to Green Bank
Observatory Operations, Green Bank, West Virginia

Dear Chief Henry:

The National Science Foundation (NSF) has identified the need to divest several facilities from its portfolio to retain the balance of capabilities needed to deliver the best performance on the key science of the present decade and beyond. Green Bank Observatory (GBO) in Green Bank, Pocahontas County, West Virginia, is one of the facilities identified for potential divestment. The decision regarding the potential changes to GBO operations is considered a federal undertaking. While engaging in Section 106 consultation under the National Historic Preservation Act (NHPA), NSF will be simultaneously conducting an Environmental Impact Statement (EIS) process under the National Environmental Policy Act (NEPA) to identify potential impacts associated with the proposed operational changes due to funding constraints. With this letter, NSF is formally initiating Section 106 consultation under the NHPA and transmitting the *Cultural Resources Evaluation, Green Bank Observatory, Green Bank, West Virginia* (Enclosure 1) for your review and comment.

Project Location and Background

GBO is located on federal lands adjacent to the Monongahela National Forest. This land is owned by NSF and consists of numerous parcels that were acquired/condemned by the U.S. Army Corps of Engineers in the 1950s when GBO was formed as the first (and then, only) site of the National Radio Astronomy Observatory (NRAO). The GBO is the anchor and administrative site of the 13,000-square-mile National Radio Quiet Zone (NRQZ) and is situated on approximately 2,200 acres in the NRQZ, where all radio transmissions are limited. The GBO facility has a long history of science, technology, engineering, and mathematics education, ranging from student training and mentorships through the outreach and training opportunities offered through the NRAO Center for Science Education, which is based at the GBO site. More than 40,000 visitors each year

pass through the Green Bank Science Center, including students, educators, and the general public who generally stay on site for more than one night to take advantage of the educational facilities. The GBO facility is host to multiple educational workshops and programs each year for middle school through post-graduate student training, and an average of 10 to 15 undergraduate and graduate students are mentored at the facility each year.

GBO facilities include the Green Bank Telescope; 43-meter telescope (also referred to as the 140-foot telescope); Green Bank Solar Radio Burst Spectrometer (45-foot telescope); Interferometer Range (includes three 85-foot diameter telescopes); 20-meter Geodetic Telescope; 40-foot telescope; three non-operational historical telescopes (Jansky Replica Antenna, Reber Radio Telescope, and Ewen-Purcell Horn); and other support facilities and infrastructure.

Project Description

NSF's Division of Astronomical Sciences (AST) is the federal steward for ground-based astronomy in the United States, funding research with awards to individual investigators and small research groups, and via cooperative agreements for operation of large telescope facilities. These national and international telescope facilities provide world-leading, one-of-a-kind observational capabilities on a competitive basis to thousands of astronomers per year. These facilities also enable scientific advances by making archived data products available to researchers. Along with funding telescope facilities and research awards, AST supports the development of advanced technologies and instrumentation, and manages the allocation and assignment of specific frequencies in the radio spectrum for scientific use by the entire NSF community. The need for NSF to reduce funding for the GBO has been established through a number of reviews and surveys conducted by the science community.

In 2014, CH2M conducted a Cultural Resources Evaluation for the architectural resources at the GBO. The results of the survey are included below under "Determinations of Eligibility." The associated technical report, entitled *Cultural Resources Evaluation, Green Bank Observatory, Green Bank, West Virginia*, is attached for reference (Enclosure 1).

A range of preliminary proposed Alternatives is being considered for evaluation. These preliminary proposed Alternatives, which will be refined through public input, include the following:

- Continued NSF investment for science-focused operations (No-Action Alternative).
- Collaboration with interested parties for science- and education-focused operations with reduced NSF-funded scope.
- Collaboration with interested parties for operation as a technology and education park.

- Mothballing of facilities (suspension of operations in a manner such that operations could resume efficiently at some future date).
- Deconstruction and site restoration.

These alternatives may be further refined during the early phases of the compliance review and will be informed by the public process.

Proposed Area of Potential Effects

The Area of Potential Effects (APE) being proposed for the project is defined as the property boundary of GBO. The total geographic area of the Observatory was chosen as the APE to encompass all buildings and structures on the property. This inclusive APE enables a determination of whether GBO constitutes a potential historic district that could be affected by the activities associated with the proposed changes to operations at the Observatory. Figure 2-1 included in Enclosure 1 shows the boundaries of the APE.

Public Involvement

A Notice of Intent (NOI) was published in the Federal Register on October 19, 2016 to initiate the public scoping process for the EIS. A revised NOI was published on November 1, 2016. Two Public Scoping Meetings were conducted on November 9, 2016, at GBO. Section 106 public outreach was addressed as part of the public meeting, and participants were invited to identify whether they would like to participate in Section 106 as a consulting party. Concurrent to the mailing of this letter, NSF will email these potential consulting parties a description of the role of a consulting party and requesting that they confirm their interest. A separate Section 106 consulting party meeting will be scheduled following the release of the Draft EIS this spring. Follow-up discussions with consulting parties will occur as needed.

Previously Identified Historic Properties

A literature review was conducted through the West Virginia State Historic Preservation Office (SHPO) Interactive Map on November 7, 2016. The literature review focused on the APE and included a 0.5-mile study area.

The Reber Radio Telescope is the only structure or building located within GBO that is listed in the NRHP. It was listed in the NRHP in 1972 and designated a National Historic Landmark in 1986. The telescope was listed under Criteria A and B for its nationally significant association with the origins of radio astronomy and for its association with Grote Reber.

One residence within the APE, the Riley House (House #15), was previously recorded in 2011. The associated survey form states that the early twentieth-century wood-frame farm house does not appear to be significant under NRHP Criterion C. The literature review did not identify any prior cultural resources surveys that have occurred within the APE. Two archaeological sites and nine architectural resources have been recorded

outside of the APE, along State Routes 28 and 92, directly adjacent to the eastern boundary of the Observatory. The two previously recorded archaeological resources were not evaluated for the NRHP. One of the architectural resources, the Liberty Presbyterian Church on State Route 92 that was constructed in 1851, is described as significant as an excellent example of Greek Revival architecture, although no formal NRHP evaluation is included with the survey form. The church was recorded on two West Virginia Historic Property Inventory Forms (PH-0002 and PH-0037-0018). Four architectural resources were evaluated as not eligible for the NRHP and three buildings were recorded, but not evaluated for the NRHP. The cultural resources that have been previously recorded within or directly adjacent to the APE are listed below in Table 1. In addition, two surveys (a bridge survey and a cultural resources survey) have occurred and 34 additional cultural resources have been identified within the 0.5-mile study area.

TABLE 1. Previously Recorded Cultural Resources Within and Directly Adjacent to the APE*

Resource Name	Description	Status	Recorded by
Reber Radio Telescope	1937 telescope located at the entrance to GBO within APE	NRHP listed 1972; National Historic Landmark 1986	National Register of Historic Places Registration Form
Riley House (House #15) PH-0331	Circa 1915 farm house within APE	Not eligible for the NRHP	Justin Greenawalt and Mary Stack (Skelly and Loy, Inc.); 2011
Liberty Presbyterian Church PH-0002 PH-0037-0018	1851 Greek Revival Church adjacent to APE	Not formally evaluated for the NRHP, but described as “significant as an excellent example of Greek Revival architecture in the area”	Michael Gioulis (Historic Preservation Consultant); 1993
George Porter Kerr House – Historic Orlan Shears House PH-0037-0040	Circa 1901 residence adjacent to APE	Not evaluated for the NRHP	Sherron Waybright; 1986

Dr. J.P. Mooumau House PH-0037-0044	1873 residence adjacent to APE	Not evaluated for the NRHP	Jessie B. Powell; 1986
Hamed House PH-0037-0048	1910 residence adjacent to APE	Not evaluated for the NRHP	Jessie B. Powell; 1986
Jack Nelson House PH-0209	Circa 1900 residence adjacent to the APE	Not eligible for the NRHP	Jeff Drobney (Skelly and Loy, Inc.); 1996
Jerry Thortnon House PH-0210	Circa 1880-1890 vernacular residence adjacent to APE	Not eligible for the NRHP	Jeff Drobney (Skelly and Loy, Inc.); 1996
PH-0326	Circa 1920 bungalow residence adjacent to APE	Not eligible for the NRHP	Justin Greenawalt and Mary Stack (Skelly and Loy, Inc.); 2011
PH-0327	Circa 1920 bungalow residence adjacent to APE	Not eligible for the NRHP	Justin Greenawalt and Mary Stack (Skelly and Loy, Inc.); 2011
PH-0332	1949 bungalow residence adjacent to APE	Not eligible for the NRHP	Justin Greenawalt and Mary Stack (Skelly and Loy, Inc.); 2011
Shinaberry's Fifth Grade Site 46-PH-64	Prehistoric open archaeological site adjacent to APE	Not evaluated for the NRHP	Dick Reigel; 1987
Sheets Site 46-PH-27	Prehistoric campsite adjacent to APE	Not evaluated for the NRHP	Stephen Davis; 1977

* Shaded rows indicate previously recorded resources within the APE.

Determination of Eligibility

A Secretary of the Interior-qualified architectural historian with CH2M conducted an intensive architectural survey at the GBO from October 6-9, 2014. The site visit to GBO was also used to engage GBO staff in informal interviews and to conduct archival research, including the review of historic photographs and narratives, newspaper articles, construction records, and architectural drawings.

The field survey encompassed standing structures built in or before 1969, which is 47 years from the present year. The standard NRHP age threshold is 50 years; however, using 47 years as the cutoff allowed a buffer for the execution of the proposed Alternatives. All built environment resources from 1969 or earlier within the GBO boundary were surveyed and assessed, including a determination of eligibility for listing in the NRHP, except for the Reber Radio Telescope. Buildings and structures were evaluated individually as well as part of a potential historic district.

Using aerial photographs of GBO and information provided by GBO staff, 47 built environment resources that had been constructed in or before 1969 were identified as extant within the APE. These include: 5 telescope structures (one of which contains three large telescopes), 2 horn instruments, 1 antenna, 1 airstrip, 1 water tower, 1 recreation area, 24 residential buildings, and 12 operational and administrative buildings. As noted above, one of these telescopes, the Reber Radio Telescope, was previously evaluated. The remaining 46 built environment resources in the APE built in or before 1969 were photographed and evaluated for NRHP eligibility. Data collected through the background research and field investigations were analyzed to determine NRHP eligibility of the 46 surveyed built environment resources individually. In addition, the Green Bank Telescope, which was constructed after 1969, was evaluated individually due to its exceptional importance to radio astronomy over the last 50 years. All 47 historic-era properties (constructed in or before 1969, including the Reber Radio Telescope) and the GBT were also evaluated as a potential historic district. Properties surveyed in 2014 are listed in Attachment A of Enclosure 1. Figure 5-1, included in Enclosure 1, shows the location of each evaluated built environment resource.

NSF has determined that within the historical context of NRAO/GBO, there are four telescope instruments that are individually eligible for listing in the NRHP: the Interferometer Range, the 40-foot Telescope, the 43-meter Telescope, and the Green Bank Telescope. In addition, NSF has determined that GBO is eligible as a historic district for representing an important time in science history and for its significant contribution to the advancement of radio astronomy. There are 44 resources within the APE that are recommended as contributing to the proposed GBO historic district, the boundaries of which coincide with the site's property boundaries (and the APE). Contributing elements include 8 administrative/operational buildings, 1 airstrip, 1 water tower, 1 recreational area, 24 residential buildings, 2 horns, 1 antenna, and 6 telescopes (the Interferometer includes 3 large telescopes) (Table 2).

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GBO Historic District	1958-2000	Collection of administrative/operational structures, residential buildings, and radio astronomy equipment associated with the NRAO/GBO.	Eligible (Historic District); 44 contributing resources (Attachment A in Enclosure 1)
Interferometer Range: Howard E. Tatel Telescope (85'-1) and 85'-1 control building; 85'-2 Telescope; 85'-3 Telescope; and the Interferometer control building	85'-1: 1958-1959 85'-2: 1963-1964 85'-3: 1965-1968 Interferometer control building: 1967-1968	The Tatel Telescope (85'-1) was the first telescope constructed by the NRAO and performed the world's first Search For Extra Terrestrial Intelligence (SETI) observations. The Interferometer Range connected two nearly identical telescopes to the Tatel Telescope in a linear formation. The three telescopes operated in unison and proved that dishes could be combined to form very large telescopes. This information spurred the	Individually eligible and contributing to GBO Historic District

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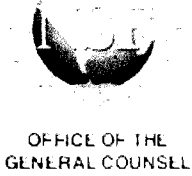
Caroline M. Blanco
Federal Preservation Officer
Assistant General Counsel
Office of the General Counsel

Enclosures:

1. *Cultural Resources Evaluation, Green Bank Observatory, Green Bank, West Virginia*

NATIONAL SCIENCE FOUNDATION

4201 Wilson Boulevard
Arlington, Virginia 22230



December 12, 2016

Ms. Rosanna Sheppard
Director
Environmental & Natural Resources Dept.
Shawnee Tribe
PO Box 189, 29 S Hwy 69A
Miami, OK 74355

RE: Section 106 Consultation for the Proposed Changes to Green Bank
Observatory Operations, Green Bank, West Virginia

Dear Ms. Sheppard:

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review did not identify any prior cultural resources surveys that have occurred within the APE. Two archaeological sites and nine architectural resources have been recorded outside of the APE, along State Routes 28 and 92, directly adjacent to the eastern boundary of the Observatory. The two previously recorded archaeological resources were not evaluated for the NRHP. One of the architectural resources, the Liberty Presbyterian Church on State Route 92 that was constructed in 1851, is described as significant as an excellent example of Greek Revival architecture, although no formal NRHP evaluation is included with the survey form. The church was recorded on two West Virginia Historic Property Inventory Forms (PH-0002 and PH-0037-0018). Four architectural resources were evaluated as not eligible for the NRHP and three buildings were recorded, but not evaluated for the NRHP. The cultural resources that have been previously recorded within or directly adjacent to the APE are listed below in Table 1. In addition, two surveys (a bridge survey and a cultural resources survey) have occurred and 34 additional cultural resources have been identified within the 0.5-mile study area.

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Jerry Thortnon House PH-0210	Circa 1880-1890 vernacular residence adjacent to APE	Not eligible for the NRHP	Jeff Drobney (Skelly and Loy, Inc.); 1996
PH-0326	Circa 1920 bungalow residence adjacent to APE	Not eligible for the NRHP	Justin Greenawalt and Mary Stack (Skelly and Loy, Inc.); 2011
PH-0327	Circa 1920 bungalow residence adjacent to APE	Not eligible for the NRHP	Justin Greenawalt and Mary Stack (Skelly and Loy, Inc.); 2011
PH-0332	1949 bungalow residence adjacent to APE	Not eligible for the NRHP	Justin Greenawalt and Mary Stack (Skelly and Loy, Inc.); 2011
Shinaberry's Fifth Grade Site 46-PH-64	Prehistoric open archaeological site adjacent to APE	Not evaluated for the NRHP	Dick Reigel; 1987
Sheets Site 46-PH-27	Prehistoric campsite adjacent to APE	Not evaluated for the NRHP	Stephen Davis; 1977

* Shaded rows indicate previously recorded resources within the APE.

Determination of Eligibility

A Secretary of the Interior-qualified architectural historian with CH2M conducted an intensive architectural survey at the GBO from October 6-9, 2014. The site visit to GBO was also used to engage GBO staff in informal interviews and to conduct archival research, including the review of historic photographs and narratives, newspaper articles, construction records, and architectural drawings.

The field survey encompassed standing structures built in or before 1969, which is 47 years from the present year. The standard NRHP age threshold is 50 years; however, using 47 years as the cutoff allowed a buffer for the execution of the proposed Alternatives. All built environment resources from 1969 or earlier within the GBO boundary were surveyed and assessed, including a determination of eligibility for listing in the NRHP, except for the Reber Radio Telescope. Buildings and structures were evaluated individually as well as part of a potential historic district.

Using aerial photographs of GBO and information provided by GBO staff, 47 built environment resources that had been constructed in or before 1969 were identified as extant within the APE. These include: 5 telescope structures (one of which contains three large telescopes), 2 horn instruments, 1 antenna, 1 airstrip, 1 water tower, 1 recreation area, 24 residential buildings, and 12 operational and administrative buildings. As noted above, one of these telescopes, the Reber Radio Telescope, was previously evaluated. The remaining 46 built environment resources in the APE built in or before 1969 were photographed and evaluated for NRHP eligibility. Data collected through the background research and field investigations were analyzed to determine NRHP eligibility of the 46 surveyed built environment resources individually. In addition, the Green Bank Telescope, which was constructed after 1969, was evaluated individually due to its exceptional importance to radio astronomy over the last 50 years. All 47 historic-era properties (constructed in or before 1969, including the Reber Radio Telescope) and the GBT were also evaluated as a potential historic district. Properties surveyed in 2014 are listed in Attachment A of Enclosure 1. Figure 5-1, included in Enclosure 1, shows the location of each evaluated built environment resource.

NSF has determined that within the historical context of NRAO/GBO, there are four telescope instruments that are individually eligible for listing in the NRHP: the Interferometer Range, the 40-foot Telescope, the 43-meter Telescope, and the Green Bank Telescope. In addition, NSF has determined that GBO is eligible as a historic district for representing an important time in science history and for its significant contribution to the advancement of radio astronomy. There are 44 resources within the APE that are recommended as contributing to the proposed GBO historic district, the boundaries of which coincide with the site's property boundaries (and the APE). Contributing elements include 8 administrative/operational buildings, 1 airstrip, 1 water tower, 1 recreational area, 24 residential buildings, 2 horns, 1 antenna, and 6 telescopes (the Interferometer includes 3 large telescopes) (Table 2).

The scientific instruments within the APE are a collection of telescopes, horns, and antenna that are significant for their role in the development of radio astronomy and, in several instances, as remarkable feats of engineering. As a whole, the majority of the components that make up the potential district's historic character possess integrity, even though many of the buildings are individually undistinguished. The administrative and operations buildings and structures within the GBO are primarily utilitarian buildings or structures with simple designs executed using practical and standard materials. These elements create a cohesive, visual unit that emphasizes their historically linked function

as support for the observatory. As a group, the 44 contributing built environment resources are a distinct and well-preserved representation of the early years of the NRAO, complete with scientific instruments, administration/operational facilities, recreation area, and residential buildings. Additionally, the scientific instruments present on site illustrate a linear, historical narrative of the history of radio astronomy from the Jansky Replica Antenna and Reber Radio Telescope to the monumental Green Bank Telescope. Four buildings within the APE were identified as non-contributing resources. These include three barns and one cellar building, all of which pre-date the establishment of the NRAO and have been primarily left vacant or used as miscellaneous storage facilities.

Table 2 lists the properties at the GBO that were identified as individually eligible for the NRHP. Attachment A, included in Enclosure 1, lists the buildings that contribute to the NRHP-eligible historic district.

TABLE 2. NRHP-Eligible Built Environment Resources within the APE

Resource Name	Year Constructed	Description/Significance	NRHP Eligibility Recommendation
GBO Historic District	1958-2000	Collection of administrative/operational structures, residential buildings, and radio astronomy equipment associated with the NRAO/GBO.	Eligible (Historic District); 44 contributing resources (Attachment A in Enclosure 1)
Interferometer Range: Howard E. Tatel Telescope (85'-1) and 85'-1 control building; 85'-2 Telescope; 85'-3 Telescope; and the Interferometer control building	85'-1: 1958-1959 85'-2: 1963-1964 85'-3: 1965-1968 Interferometer control building: 1967-1968	The Tatel Telescope (85'-1) was the first telescope constructed by the NRAO and performed the world's first Search For Extra Terrestrial Intelligence (SETI) observations. The Interferometer Range connected two nearly identical telescopes to the Tatel Telescope in a linear formation. The three telescopes operated in unison and proved that dishes could be combined to form very large telescopes. This information spurred the	Individually eligible and contributing to GBO Historic District

TABLE 2. NRHP-Eligible Built Environment Resources within the APE

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		construction of the Very Large Array telescope in New Mexico in the 1970s.	
40-foot Telescope and control building	1962	First fully automated radio telescope in the world. Currently operates as an educational telescope for visiting students.	Individually eligible and contributing to GBO Historic District
43-meter Telescope	1958-1965	Largest telescope in the world to use an equatorial (for polar aligned) mount. Currently used as part of the Russian Radioastron project.	Individually eligible and contributing to GBO Historic District
Robert C. Byrd Green Bank Telescope (Green Bank Telescope)	1991-2000	Largest moving structure on land in the world; tilt and point design that can rotate a full 360 degrees; performs highly sensitive data collection.	Individually eligible and contributing to GBO Historic District

Initiation of Section 106 Consultation

The GBO is a federally-owned property that contains historic properties. Therefore the Proposed Action has the potential to affect historic properties. In compliance with 36 Code of Federal Regulations (CFR) 800.2(c)(2)(ii), NSF is initiating consultation with you on the proposed changes to GBO operations. NSF is also seeking your input on any cultural resources in the project area or any cultural resources concerns you may have related to this undertaking.

We respectfully request your response within 30 days from receipt of this letter indicating your interest in participating in consultation for this undertaking. Please respond to:

Ms. Elizabeth Pentecost
National Science Foundation
Division of Astronomical Sciences
4201 Wilson Blvd, Suite 1045
Arlington, Virginia 22230
epenteco@nsf.gov

NSF is also transmitting the *Cultural Resources Evaluation, Green Bank Observatory, Green Bank, West Virginia* (attached as Enclosure 1). If you have any questions, please do not hesitate to contact me by phone at 703-292-4592 or by email at cblanco@nsf.gov. We look forward to further consultation on this proposed undertaking.

Regards,

A handwritten signature in cursive script that reads "Caroline M. Blanco".

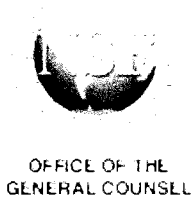
Caroline M. Blanco
Federal Preservation Officer
Assistant General Counsel
Office of the General Counsel

Enclosures:

1. *Cultural Resources Evaluation, Green Bank Observatory, Green Bank, West Virginia*

NATIONAL SCIENCE FOUNDATION

4201 Wilson Boulevard
Arlington, Virginia 22230



December 12, 2016

Mr. Micco Emarthla
Tribal Historic Preservation Officer
Seneca-Cayuga Tribe of Oklahoma
23701 S. 655 Road
Grove, OK 74344

RE: Section 106 Consultation for the Proposed Changes to Green Bank
Observatory Operations, Green Bank, West Virginia

Dear Mr. Emarthla:

The National Science Foundation (NSF) has identified the need to divest several facilities from its portfolio to retain the balance of capabilities needed to deliver the best performance on the key science of the present decade and beyond. Green Bank Observatory (GBO) in Green Bank, Pocahontas County, West Virginia, is one of the facilities identified for potential divestment. The decision regarding the potential changes to GBO operations is considered a federal undertaking. While engaging in Section 106 consultation under the National Historic Preservation Act (NHPA), NSF will be simultaneously conducting an Environmental Impact Statement (EIS) process under the National Environmental Policy Act (NEPA) to identify potential impacts associated with the proposed operational changes due to funding constraints. With this letter, NSF is formally initiating Section 106 consultation under the NHPA and transmitting the *Cultural Resources Evaluation, Green Bank Observatory, Green Bank, West Virginia* (Enclosure 1) for your review and comment.

Project Location and Background

GBO is located on federal lands adjacent to the Monongahela National Forest. This land is owned by NSF and consists of numerous parcels that were acquired/condemned by the U.S. Army Corps of Engineers in the 1950s when GBO was formed as the first (and then, only) site of the National Radio Astronomy Observatory (NRAO). The GBO is the anchor and administrative site of the 13,000-square-mile National Radio Quiet Zone (NRQZ) and is situated on approximately 2,200 acres in the NRQZ, where all radio transmissions are limited. The GBO facility has a long history of science, technology, engineering, and mathematics education, ranging from student training and mentorships through the outreach and training opportunities offered through the NRAO Center for

Science Education, which is based at the GBO site. More than 40,000 visitors each year pass through the Green Bank Science Center, including students, educators, and the general public who generally stay on site for more than one night to take advantage of the educational facilities. The GBO facility is host to multiple educational workshops and programs each year for middle school through post-graduate student training, and an average of 10 to 15 undergraduate and graduate students are mentored at the facility each year.

GBO facilities include the Green Bank Telescope; 43-meter telescope (also referred to as the 140-foot telescope); Green Bank Solar Radio Burst Spectrometer (45-foot telescope); Interferometer Range (includes three 85-foot diameter telescopes); 20-meter Geodetic Telescope; 40-foot telescope; three non-operational historical telescopes (Jansky Replica Antenna, Reber Radio Telescope, and Ewen-Purcell Horn); and other support facilities and infrastructure.

Project Description

NSF's Division of Astronomical Sciences (AST) is the federal steward for ground-based astronomy in the United States, funding research with awards to individual investigators and small research groups, and via cooperative agreements for operation of large telescope facilities. These national and international telescope facilities provide world-leading, one-of-a-kind observational capabilities on a competitive basis to thousands of astronomers per year. These facilities also enable scientific advances by making archived data products available to researchers. Along with funding telescope facilities and research awards, AST supports the development of advanced technologies and instrumentation, and manages the allocation and assignment of specific frequencies in the radio spectrum for scientific use by the entire NSF community. The need for NSF to reduce funding for the GBO has been established through a number of reviews and surveys conducted by the science community.

In 2014, CH2M conducted a Cultural Resources Evaluation for the architectural resources at the GBO. The results of the survey are included below under "Determinations of Eligibility." The associated technical report, entitled *Cultural Resources Evaluation, Green Bank Observatory, Green Bank, West Virginia*, is attached for reference (Enclosure 1).

A range of preliminary proposed Alternatives is being considered for evaluation. These preliminary proposed Alternatives, which will be refined through public input, include the following:

- Continued NSF investment for science-focused operations (No-Action Alternative).
- Collaboration with interested parties for science- and education-focused operations with reduced NSF-funded scope.

- Collaboration with interested parties for operation as a technology and education park.
- Mothballing of facilities (suspension of operations in a manner such that operations could resume efficiently at some future date).
- Deconstruction and site restoration.

These alternatives may be further refined during the early phases of the compliance review and will be informed by the public process.

Proposed Area of Potential Effects

The Area of Potential Effects (APE) being proposed for the project is defined as the property boundary of GBO. The total geographic area of the Observatory was chosen as the APE to encompass all buildings and structures on the property. This inclusive APE enables a determination of whether GBO constitutes a potential historic district that could be affected by the activities associated with the proposed changes to operations at the Observatory. Figure 2-1 included in Enclosure 1 shows the boundaries of the APE.

Public Involvement

A Notice of Intent (NOI) was published in the Federal Register on October 19, 2016 to initiate the public scoping process for the EIS. A revised NOI was published on November 1, 2016. Two Public Scoping Meetings were conducted on November 9, 2016, at GBO. Section 106 public outreach was addressed as part of the public meeting, and participants were invited to identify whether they would like to participate in Section 106 as a consulting party. Concurrent to the mailing of this letter, NSF will email these potential consulting parties a description of the role of a consulting party and requesting that they confirm their interest. A separate Section 106 consulting party meeting will be scheduled following the release of the Draft EIS this spring. Follow-up discussions with consulting parties will occur as needed.

Previously Identified Historic Properties

A literature review was conducted through the West Virginia State Historic Preservation Office (SHPO) Interactive Map on November 7, 2016. The literature review focused on the APE and included a 0.5-mile study area.

The Reber Radio Telescope is the only structure or building located within GBO that is listed in the NRHP. It was listed in the NRHP in 1972 and designated a National Historic Landmark in 1986. The telescope was listed under Criteria A and B for its nationally significant association with the origins of radio astronomy and for its association with Grote Reber.

One residence within the APE, the Riley House (House #15), was previously recorded in 2011. The associated survey form states that the early twentieth-century wood-frame farm house does not appear to be significant under NRHP Criterion C. The literature

review did not identify any prior cultural resources surveys that have occurred within the APE. Two archaeological sites and nine architectural resources have been recorded outside of the APE, along State Routes 28 and 92, directly adjacent to the eastern boundary of the Observatory. The two previously recorded archaeological resources were not evaluated for the NRHP. One of the architectural resources, the Liberty Presbyterian Church on State Route 92 that was constructed in 1851, is described as significant as an excellent example of Greek Revival architecture, although no formal NRHP evaluation is included with the survey form. The church was recorded on two West Virginia Historic Property Inventory Forms (PH-0002 and PH-0037-0018). Four architectural resources were evaluated as not eligible for the NRHP and three buildings were recorded, but not evaluated for the NRHP. The cultural resources that have been previously recorded within or directly adjacent to the APE are listed below in Table 1. In addition, two surveys (a bridge survey and a cultural resources survey) have occurred and 34 additional cultural resources have been identified within the 0.5-mile study area.

TABLE 1. Previously Recorded Cultural Resources Within and Directly Adjacent to the APE*

Resource Name	Description	Status	Recorded by
Reber Radio Telescope	1937 telescope located at the entrance to GBO within APE	NRHP listed 1972; National Historic Landmark 1986	National Register of Historic Places Registration Form
Riley House (House #15) PH-0331	Circa 1915 farm house within APE	Not eligible for the NRHP	Justin Greenawalt and Mary Stack (Skelly and Loy, Inc.); 2011
Liberty Presbyterian Church PH-0002 PH-0037-0018	1851 Greek Revival Church adjacent to APE	Not formally evaluated for the NRHP, but described as “significant as an excellent example of Greek Revival architecture in the area”	Michael Gioulis (Historic Preservation Consultant); 1993
George Porter Kerr House – Historic Orlan Shears House PH-0037-0040	Circa 1901 residence adjacent to APE	Not evaluated for the NRHP	Sherron Waybright; 1986

Dr. J.P. Mooumau House PH-0037-0044	1873 residence adjacent to APE	Not evaluated for the NRHP	Jessie B. Powell; 1986
Hamed House PH-0037-0048	1910 residence adjacent to APE	Not evaluated for the NRHP	Jessie B. Powell; 1986
Jack Nelson House PH-0209	Circa 1900 residence adjacent to the APE	Not eligible for the NRHP	Jeff Drobney (Skelly and Loy, Inc.); 1996
Jerry Thortnon House PH-0210	Circa 1880-1890 vernacular residence adjacent to APE	Not eligible for the NRHP	Jeff Drobney (Skelly and Loy, Inc.); 1996
PH-0326	Circa 1920 bungalow residence adjacent to APE	Not eligible for the NRHP	Justin Greenawalt and Mary Stack (Skelly and Loy, Inc.); 2011
PH-0327	Circa 1920 bungalow residence adjacent to APE	Not eligible for the NRHP	Justin Greenawalt and Mary Stack (Skelly and Loy, Inc.); 2011
PH-0332	1949 bungalow residence adjacent to APE	Not eligible for the NRHP	Justin Greenawalt and Mary Stack (Skelly and Loy, Inc.); 2011
Shinaberry's Fifth Grade Site 46-PH-64	Prehistoric open archaeological site adjacent to APE	Not evaluated for the NRHP	Dick Reigel; 1987
Sheets Site 46-PH-27	Prehistoric campsite adjacent to APE	Not evaluated for the NRHP	Stephen Davis; 1977

* Shaded rows indicate previously recorded resources within the APE.

Determination of Eligibility

A Secretary of the Interior-qualified architectural historian with CH2M conducted an intensive architectural survey at the GBO from October 6-9, 2014. The site visit to GBO was also used to engage GBO staff in informal interviews and to conduct archival research, including the review of historic photographs and narratives, newspaper articles, construction records, and architectural drawings.

The field survey encompassed standing structures built in or before 1969, which is 47 years from the present year. The standard NRHP age threshold is 50 years; however, using 47 years as the cutoff allowed a buffer for the execution of the proposed Alternatives. All built environment resources from 1969 or earlier within the GBO boundary were surveyed and assessed, including a determination of eligibility for listing in the NRHP, except for the Reber Radio Telescope. Buildings and structures were evaluated individually as well as part of a potential historic district.

Using aerial photographs of GBO and information provided by GBO staff, 47 built environment resources that had been constructed in or before 1969 were identified as extant within the APE. These include: 5 telescope structures (one of which contains three large telescopes), 2 horn instruments, 1 antenna, 1 airstrip, 1 water tower, 1 recreation area, 24 residential buildings, and 12 operational and administrative buildings. As noted above, one of these telescopes, the Reber Radio Telescope, was previously evaluated. The remaining 46 built environment resources in the APE built in or before 1969 were photographed and evaluated for NRHP eligibility. Data collected through the background research and field investigations were analyzed to determine NRHP eligibility of the 46 surveyed built environment resources individually. In addition, the Green Bank Telescope, which was constructed after 1969, was evaluated individually due to its exceptional importance to radio astronomy over the last 50 years. All 47 historic-era properties (constructed in or before 1969, including the Reber Radio Telescope) and the GBT were also evaluated as a potential historic district. Properties surveyed in 2014 are listed in Attachment A of Enclosure 1. Figure 5-1, included in Enclosure 1, shows the location of each evaluated built environment resource.

NSF has determined that within the historical context of NRAO/GBO, there are four telescope instruments that are individually eligible for listing in the NRHP: the Interferometer Range, the 40-foot Telescope, the 43-meter Telescope, and the Green Bank Telescope. In addition, NSF has determined that GBO is eligible as a historic district for representing an important time in science history and for its significant contribution to the advancement of radio astronomy. There are 44 resources within the APE that are recommended as contributing to the proposed GBO historic district, the boundaries of which coincide with the site's property boundaries (and the APE). Contributing elements include 8 administrative/operational buildings, 1 airstrip, 1 water tower, 1 recreational area, 24 residential buildings, 2 horns, 1 antenna, and 6 telescopes (the Interferometer includes 3 large telescopes) (Table 2).

The scientific instruments within the APE are a collection of telescopes, horns, and antenna that are significant for their role in the development of radio astronomy and, in several instances, as remarkable feats of engineering. As a whole, the majority of the components that make up the potential district's historic character possess integrity, even though many of the buildings are individually undistinguished. The administrative and operations buildings and structures within the GBO are primarily utilitarian buildings or structures with simple designs executed using practical and standard materials. These elements create a cohesive, visual unit that emphasizes their historically linked function

as support for the observatory. As a group, the 44 contributing built environment resources are a distinct and well-preserved representation of the early years of the NRAO, complete with scientific instruments, administration/operational facilities, recreation area, and residential buildings. Additionally, the scientific instruments present on site illustrate a linear, historical narrative of the history of radio astronomy from the Jansky Replica Antenna and Reber Radio Telescope to the monumental Green Bank Telescope. Four buildings within the APE were identified as non-contributing resources. These include three barns and one cellar building, all of which pre-date the establishment of the NRAO and have been primarily left vacant or used as miscellaneous storage facilities.

Table 2 lists the properties at the GBO that were identified as individually eligible for the NRHP. Attachment A, included in Enclosure 1, lists the buildings that contribute to the NRHP-eligible historic district.

TABLE 2. NRHP-Eligible Built Environment Resources within the APE

Resource Name	Year Constructed	Description/Significance	NRHP Eligibility Recommendation
GBO Historic District	1958-2000	Collection of administrative/operational structures, residential buildings, and radio astronomy equipment associated with the NRAO/GBO.	Eligible (Historic District); 44 contributing resources (Attachment A in Enclosure 1)
Interferometer Range: Howard E. Tatel Telescope (85'-1) and 85'-1 control building; 85'-2 Telescope; 85'-3 Telescope; and the Interferometer control building	85'-1: 1958-1959 85'-2: 1963-1964 85'-3: 1965-1968 Interferometer control building: 1967-1968	The Tatel Telescope (85'-1) was the first telescope constructed by the NRAO and performed the world's first Search For Extra Terrestrial Intelligence (SETI) observations. The Interferometer Range connected two nearly identical telescopes to the Tatel Telescope in a linear formation. The three telescopes operated in unison and proved that dishes could be combined to form very large telescopes. This information spurred the	Individually eligible and contributing to GBO Historic District

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The GBO is a federally-owned property that contains historic properties. Therefore the Proposed Action has the potential to affect historic properties. In compliance with 36 Code of Federal Regulations (CFR) 800.2(c)(2)(ii), NSF is initiating consultation with you on the proposed changes to GBO operations. NSF is also seeking your input on any cultural resources in the project area or any cultural resources concerns you may have related to this undertaking.

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Regards,

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Caroline M. Blanco
Federal Preservation Officer
Assistant General Counsel
Office of the General Counsel

Enclosures:

1. *Cultural Resources Evaluation, Green Bank Observatory, Green Bank, West Virginia*

NATIONAL SCIENCE FOUNDATION

1201 Wilson Boulevard
Arlington, Virginia 22230



OFFICE OF THE
GENERAL COUNSEL

December 12, 2016

Mr. Jay Todd
Tribal Historic Preservation Officer
Seneca Nation of Indians
90 Ohiyo Way
Salamanca, NY 14779

RE: Section 106 Consultation for the Proposed Changes to Green Bank
Observatory Operations, Green Bank, West Virginia

Dear Mr. Todd:

The National Science Foundation (NSF) has identified the need to divest several facilities from its portfolio to retain the balance of capabilities needed to deliver the best performance on the key science of the present decade and beyond. Green Bank Observatory (GBO) in Green Bank, Pocahontas County, West Virginia, is one of the facilities identified for potential divestment. The decision regarding the potential changes to GBO operations is considered a federal undertaking. While engaging in Section 106 consultation under the National Historic Preservation Act (NHPA), NSF will be simultaneously conducting an Environmental Impact Statement (EIS) process under the National Environmental Policy Act (NEPA) to identify potential impacts associated with the proposed operational changes due to funding constraints. With this letter, NSF is formally initiating Section 106 consultation under the NHPA and transmitting the *Cultural Resources Evaluation, Green Bank Observatory, Green Bank, West Virginia* (Enclosure 1) for your review and comment.

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One residence within the APE, the Riley House (House #15), was previously recorded in 2011. The associated survey form states that the early twentieth-century wood-frame farm house does not appear to be significant under NRHP Criterion C. The literature review did not identify any prior cultural resources surveys that have occurred within the APE. Two archaeological sites and nine architectural resources have been recorded

outside of the APE, along State Routes 28 and 92, directly adjacent to the eastern boundary of the Observatory. The two previously recorded archaeological resources were not evaluated for the NRHP. One of the architectural resources, the Liberty Presbyterian Church on State Route 92 that was constructed in 1851, is described as significant as an excellent example of Greek Revival architecture, although no formal NRHP evaluation is included with the survey form. The church was recorded on two West Virginia Historic Property Inventory Forms (PH-0002 and PH-0037-0018). Four architectural resources were evaluated as not eligible for the NRHP and three buildings were recorded, but not evaluated for the NRHP. The cultural resources that have been previously recorded within or directly adjacent to the APE are listed below in Table 1. In addition, two surveys (a bridge survey and a cultural resources survey) have occurred and 34 additional cultural resources have been identified within the 0.5-mile study area.

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Reber Radio Telescope	1937 telescope located at the entrance to GBO within APE	NRHP listed 1972; National Historic Landmark 1986	National Register of Historic Places Registration Form
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Liberty Presbyterian Church PH-0002 PH-0037-0018	1851 Greek Revival Church adjacent to APE	Not formally evaluated for the NRHP, but described as “significant as an excellent example of Greek Revival architecture in the area”	Michael Gioulis (Historic Preservation Consultant); 1993
George Porter Kerr House – Historic Orlan Shears House PH-0037-0040	Circa 1901 residence adjacent to APE	Not evaluated for the NRHP	Sherron Waybright; 1986

Dr. J.P. Mooumau House PH-0037-0044	1873 residence adjacent to APE	Not evaluated for the NRHP	Jessie B. Powell; 1986
Hamed House PH-0037-0048	1910 residence adjacent to APE	Not evaluated for the NRHP	Jessie B. Powell; 1986
Jack Nelson House PH-0209	Circa 1900 residence adjacent to the APE	Not eligible for the NRHP	Jeff Drobney (Skelly and Loy, Inc.); 1996
Jerry Thortnon House PH-0210	Circa 1880-1890 vernacular residence adjacent to APE	Not eligible for the NRHP	Jeff Drobney (Skelly and Loy, Inc.); 1996
PH-0326	Circa 1920 bungalow residence adjacent to APE	Not eligible for the NRHP	Justin Greenawalt and Mary Stack (Skelly and Loy, Inc.); 2011
PH-0327	Circa 1920 bungalow residence adjacent to APE	Not eligible for the NRHP	Justin Greenawalt and Mary Stack (Skelly and Loy, Inc.); 2011
PH-0332	1949 bungalow residence adjacent to APE	Not eligible for the NRHP	Justin Greenawalt and Mary Stack (Skelly and Loy, Inc.); 2011
Shinaberry's Fifth Grade Site 46-PH-64	Prehistoric open archaeological site adjacent to APE	Not evaluated for the NRHP	Dick Reigel; 1987
Sheets Site 46-PH-27	Prehistoric campsite adjacent to APE	Not evaluated for the NRHP	Stephen Davis; 1977

* Shaded rows indicate previously recorded resources within the APE.

Determination of Eligibility

A Secretary of the Interior-qualified architectural historian with CH2M conducted an intensive architectural survey at the GBO from October 6-9, 2014. The site visit to GBO was also used to engage GBO staff in informal interviews and to conduct archival research, including the review of historic photographs and narratives, newspaper articles, construction records, and architectural drawings.

The field survey encompassed standing structures built in or before 1969, which is 47 years from the present year. The standard NRHP age threshold is 50 years; however, using 47 years as the cutoff allowed a buffer for the execution of the proposed Alternatives. All built environment resources from 1969 or earlier within the GBO boundary were surveyed and assessed, including a determination of eligibility for listing in the NRHP, except for the Reber Radio Telescope. Buildings and structures were evaluated individually as well as part of a potential historic district.

Using aerial photographs of GBO and information provided by GBO staff, 47 built environment resources that had been constructed in or before 1969 were identified as extant within the APE. These include: 5 telescope structures (one of which contains three large telescopes), 2 horn instruments, 1 antenna, 1 airstrip, 1 water tower, 1 recreation area, 24 residential buildings, and 12 operational and administrative buildings. As noted above, one of these telescopes, the Reber Radio Telescope, was previously evaluated. The remaining 46 built environment resources in the APE built in or before 1969 were photographed and evaluated for NRHP eligibility. Data collected through the background research and field investigations were analyzed to determine NRHP eligibility of the 46 surveyed built environment resources individually. In addition, the Green Bank Telescope, which was constructed after 1969, was evaluated individually due to its exceptional importance to radio astronomy over the last 50 years. All 47 historic-era properties (constructed in or before 1969, including the Reber Radio Telescope) and the GBT were also evaluated as a potential historic district. Properties surveyed in 2014 are listed in Attachment A of Enclosure 1. Figure 5-1, included in Enclosure 1, shows the location of each evaluated built environment resource.

NSF has determined that within the historical context of NRAO/GBO, there are four telescope instruments that are individually eligible for listing in the NRHP: the Interferometer Range, the 40-foot Telescope, the 43-meter Telescope, and the Green Bank Telescope. In addition, NSF has determined that GBO is eligible as a historic district for representing an important time in science history and for its significant contribution to the advancement of radio astronomy. There are 44 resources within the APE that are recommended as contributing to the proposed GBO historic district, the boundaries of which coincide with the site's property boundaries (and the APE). Contributing elements include 8 administrative/operational buildings, 1 airstrip, 1 water tower, 1 recreational area, 24 residential buildings, 2 horns, 1 antenna, and 6 telescopes (the Interferometer includes 3 large telescopes) (Table 2).

The scientific instruments within the APE are a collection of telescopes, horns, and antenna that are significant for their role in the development of radio astronomy and, in several instances, as remarkable feats of engineering. As a whole, the majority of the components that make up the potential district's historic character possess integrity, even though many of the buildings are individually undistinguished. The administrative and operations buildings and structures within the GBO are primarily utilitarian buildings or structures with simple designs executed using practical and standard materials. These elements create a cohesive, visual unit that emphasizes their historically linked function

as support for the observatory. As a group, the 44 contributing built environment resources are a distinct and well-preserved representation of the early years of the NRAO, complete with scientific instruments, administration/operational facilities, recreation area, and residential buildings. Additionally, the scientific instruments present on site illustrate a linear, historical narrative of the history of radio astronomy from the Jansky Replica Antenna and Reber Radio Telescope to the monumental Green Bank Telescope. Four buildings within the APE were identified as non-contributing resources. These include three barns and one cellar building, all of which pre-date the establishment of the NRAO and have been primarily left vacant or used as miscellaneous storage facilities.

Table 2 lists the properties at the GBO that were identified as individually eligible for the NRHP. Attachment A, included in Enclosure 1, lists the buildings that contribute to the NRHP-eligible historic district.

TABLE 2. NRHP-Eligible Built Environment Resources within the APE

Resource Name	Year Constructed	Description/Significance	NRHP Eligibility Recommendation
GBO Historic District	1958-2000	Collection of administrative/operational structures, residential buildings, and radio astronomy equipment associated with the NRAO/GBO.	Eligible (Historic District); 44 contributing resources (Attachment A in Enclosure 1)
Interferometer Range: Howard E. Tatel Telescope (85'-1) and 85'-1 control building; 85'-2 Telescope; 85'-3 Telescope; and the Interferometer control building	85'-1: 1958-1959 85'-2: 1963-1964 85'-3: 1965-1968 Interferometer control building: 1967-1968	The Tatel Telescope (85'-1) was the first telescope constructed by the NRAO and performed the world's first Search For Extra Terrestrial Intelligence (SETI) observations. The Interferometer Range connected two nearly identical telescopes to the Tatel Telescope in a linear formation. The three telescopes operated in unison and proved that dishes could be combined to form very large telescopes. This information spurred the	Individually eligible and contributing to GBO Historic District

TABLE 2. NRHP-Eligible Built Environment Resources within the APE

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		construction of the Very Large Array telescope in New Mexico in the 1970s.	
40-foot Telescope and control building	1962	First fully automated radio telescope in the world. Currently operates as an educational telescope for visiting students.	Individually eligible and contributing to GBO Historic District
43-meter Telescope	1958-1965	Largest telescope in the world to use an equatorial (for polar aligned) mount. Currently used as part of the Russian Radioastron project.	Individually eligible and contributing to GBO Historic District
Robert C. Byrd Green Bank Telescope (Green Bank Telescope)	1991-2000	Largest moving structure on land in the world; tilt and point design that can rotate a full 360 degrees; performs highly sensitive data collection.	Individually eligible and contributing to GBO Historic District

Initiation of Section 106 Consultation

The GBO is a federally-owned property that contains historic properties. Therefore the Proposed Action has the potential to affect historic properties. In compliance with 36 Code of Federal Regulations (CFR) 800.2(c)(2)(ii), NSF is initiating consultation with you on the proposed changes to GBO operations. NSF is also seeking your input on any cultural resources in the project area or any cultural resources concerns you may have related to this undertaking.

We respectfully request your response within 30 days from receipt of this letter indicating your interest in participating in consultation for this undertaking. Please respond to:

Ms. Elizabeth Pentecost
National Science Foundation
Division of Astronomical Sciences
4201 Wilson Blvd, Suite 1045
Arlington, Virginia 22230
epenteco@nsf.gov

NSF is also transmitting the *Cultural Resources Evaluation, Green Bank Observatory, Green Bank, West Virginia* (attached as Enclosure 1). If you have any questions, please do not hesitate to contact me by phone at 703-292-4592 or by email at cblanco@nsf.gov. We look forward to further consultation on this proposed undertaking.

Regards,

A handwritten signature in black ink that reads "Caroline M. Blanco". The signature is written in a cursive, flowing style.

Caroline M. Blanco
Federal Preservation Officer
Assistant General Counsel
Office of the General Counsel

Enclosures:

1. *Cultural Resources Evaluation, Green Bank Observatory, Green Bank, West Virginia*

NATIONAL SCIENCE FOUNDATION

1201 Wilson Boulevard
Arlington, Virginia 22230



OFFICE OF THE
GENERAL COUNSELL

December 12, 2016

Ms. Christine Abrams
Tonawanda Band of Seneca
7027 Meadville Road
Basom, NY 14013

RE: Section 106 Consultation for the Proposed Changes to Green Bank
Observatory Operations, Green Bank, West Virginia

Dear Ms. Abrams:

The National Science Foundation (NSF) has identified the need to divest several facilities from its portfolio to retain the balance of capabilities needed to deliver the best performance on the key science of the present decade and beyond. Green Bank Observatory (GBO) in Green Bank, Pocahontas County, West Virginia, is one of the facilities identified for potential divestment. The decision regarding the potential changes to GBO operations is considered a federal undertaking. While engaging in Section 106 consultation under the National Historic Preservation Act (NHPA), NSF will be simultaneously conducting an Environmental Impact Statement (EIS) process under the National Environmental Policy Act (NEPA) to identify potential impacts associated with the proposed operational changes due to funding constraints. With this letter, NSF is formally initiating Section 106 consultation under the NHPA and transmitting the *Cultural Resources Evaluation, Green Bank Observatory, Green Bank, West Virginia* (Enclosure 1) for your review and comment.

Project Location and Background

GBO is located on federal lands adjacent to the Monongahela National Forest. This land is owned by NSF and consists of numerous parcels that were acquired/condemned by the U.S. Army Corps of Engineers in the 1950s when GBO was formed as the first (and then, only) site of the National Radio Astronomy Observatory (NRAO). The GBO is the anchor and administrative site of the 13,000-square-mile National Radio Quiet Zone (NRQZ) and is situated on approximately 2,200 acres in the NRQZ, where all radio transmissions are limited. The GBO facility has a long history of science, technology, engineering, and mathematics education, ranging from student training and mentorships through the outreach and training opportunities offered through the NRAO Center for Science Education, which is based at the GBO site. More than 40,000 visitors each year

pass through the Green Bank Science Center, including students, educators, and the general public who generally stay on site for more than one night to take advantage of the educational facilities. The GBO facility is host to multiple educational workshops and programs each year for middle school through post-graduate student training, and an average of 10 to 15 undergraduate and graduate students are mentored at the facility each year.

GBO facilities include the Green Bank Telescope; 43-meter telescope (also referred to as the 140-foot telescope); Green Bank Solar Radio Burst Spectrometer (45-foot telescope); Interferometer Range (includes three 85-foot diameter telescopes); 20-meter Geodetic Telescope; 40-foot telescope; three non-operational historical telescopes (Jansky Replica Antenna, Reber Radio Telescope, and Ewen-Purcell Horn); and other support facilities and infrastructure.

Project Description

NSF's Division of Astronomical Sciences (AST) is the federal steward for ground-based astronomy in the United States, funding research with awards to individual investigators and small research groups, and via cooperative agreements for operation of large telescope facilities. These national and international telescope facilities provide world-leading, one-of-a-kind observational capabilities on a competitive basis to thousands of astronomers per year. These facilities also enable scientific advances by making archived data products available to researchers. Along with funding telescope facilities and research awards, AST supports the development of advanced technologies and instrumentation, and manages the allocation and assignment of specific frequencies in the radio spectrum for scientific use by the entire NSF community. The need for NSF to reduce funding for the GBO has been established through a number of reviews and surveys conducted by the science community.

In 2014, CH2M conducted a Cultural Resources Evaluation for the architectural resources at the GBO. The results of the survey are included below under "Determinations of Eligibility." The associated technical report, entitled *Cultural Resources Evaluation, Green Bank Observatory, Green Bank, West Virginia*, is attached for reference (Enclosure 1).

A range of preliminary proposed Alternatives is being considered for evaluation. These preliminary proposed Alternatives, which will be refined through public input, include the following:

- Continued NSF investment for science-focused operations (No-Action Alternative).
- Collaboration with interested parties for science- and education-focused operations with reduced NSF-funded scope.
- Collaboration with interested parties for operation as a technology and education park.

- Mothballing of facilities (suspension of operations in a manner such that operations could resume efficiently at some future date).
- Deconstruction and site restoration.

These alternatives may be further refined during the early phases of the compliance review and will be informed by the public process.

Proposed Area of Potential Effects

The Area of Potential Effects (APE) being proposed for the project is defined as the property boundary of GBO. The total geographic area of the Observatory was chosen as the APE to encompass all buildings and structures on the property. This inclusive APE enables a determination of whether GBO constitutes a potential historic district that could be affected by the activities associated with the proposed changes to operations at the Observatory. Figure 2-1 included in Enclosure 1 shows the boundaries of the APE.

Public Involvement

A Notice of Intent (NOI) was published in the Federal Register on October 19, 2016 to initiate the public scoping process for the EIS. A revised NOI was published on November 1, 2016. Two Public Scoping Meetings were conducted on November 9, 2016, at GBO. Section 106 public outreach was addressed as part of the public meeting, and participants were invited to identify whether they would like to participate in Section 106 as a consulting party. Concurrent to the mailing of this letter, NSF will email these potential consulting parties a description of the role of a consulting party and requesting that they confirm their interest. A separate Section 106 consulting party meeting will be scheduled following the release of the Draft EIS this spring. Follow-up discussions with consulting parties will occur as needed.

Previously Identified Historic Properties

A literature review was conducted through the West Virginia State Historic Preservation Office (SHPO) Interactive Map on November 7, 2016. The literature review focused on the APE and included a 0.5-mile study area.

The Reber Radio Telescope is the only structure or building located within GBO that is listed in the NRHP. It was listed in the NRHP in 1972 and designated a National Historic Landmark in 1986. The telescope was listed under Criteria A and B for its nationally significant association with the origins of radio astronomy and for its association with Grote Reber.

One residence within the APE, the Riley House (House #15), was previously recorded in 2011. The associated survey form states that the early twentieth-century wood-frame farm house does not appear to be significant under NRHP Criterion C. The literature review did not identify any prior cultural resources surveys that have occurred within the APE. Two archaeological sites and nine architectural resources have been recorded

outside of the APE, along State Routes 28 and 92, directly adjacent to the eastern boundary of the Observatory. The two previously recorded archaeological resources were not evaluated for the NRHP. One of the architectural resources, the Liberty Presbyterian Church on State Route 92 that was constructed in 1851, is described as significant as an excellent example of Greek Revival architecture, although no formal NRHP evaluation is included with the survey form. The church was recorded on two West Virginia Historic Property Inventory Forms (PH-0002 and PH-0037-0018). Four architectural resources were evaluated as not eligible for the NRHP and three buildings were recorded, but not evaluated for the NRHP. The cultural resources that have been previously recorded within or directly adjacent to the APE are listed below in Table 1. In addition, two surveys (a bridge survey and a cultural resources survey) have occurred and 34 additional cultural resources have been identified within the 0.5-mile study area.

TABLE 1. Previously Recorded Cultural Resources Within and Directly Adjacent to the APE*

Resource Name	Description	Status	Recorded by
Reber Radio Telescope	1937 telescope located at the entrance to GBO within APE	NRHP listed 1972; National Historic Landmark 1986	National Register of Historic Places Registration Form
Riley House (House #15) PH-0331	Circa 1915 farm house within APE	Not eligible for the NRHP	Justin Greenawalt and Mary Stack (Skelly and Loy, Inc.); 2011
Liberty Presbyterian Church PH-0002 PH-0037-0018	1851 Greek Revival Church adjacent to APE	Not formally evaluated for the NRHP, but described as “significant as an excellent example of Greek Revival architecture in the area”	Michael Gioulis (Historic Preservation Consultant); 1993
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PH-0326	Circa 1920 bungalow residence adjacent to APE	Not eligible for the NRHP	Justin Greenawalt and Mary Stack (Skelly and Loy, Inc.); 2011
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PH-0332	1949 bungalow residence adjacent to APE	Not eligible for the NRHP	Justin Greenawalt and Mary Stack (Skelly and Loy, Inc.); 2011
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* Shaded rows indicate previously recorded resources within the APE.

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A Secretary of the Interior-qualified architectural historian with CH2M conducted an intensive architectural survey at the GBO from October 6-9, 2014. The site visit to GBO was also used to engage GBO staff in informal interviews and to conduct archival research, including the review of historic photographs and narratives, newspaper articles, construction records, and architectural drawings.

The field survey encompassed standing structures built in or before 1969, which is 47 years from the present year. The standard NRHP age threshold is 50 years; however, using 47 years as the cutoff allowed a buffer for the execution of the proposed Alternatives. All built environment resources from 1969 or earlier within the GBO boundary were surveyed and assessed, including a determination of eligibility for listing in the NRHP, except for the Reber Radio Telescope. Buildings and structures were evaluated individually as well as part of a potential historic district.

Using aerial photographs of GBO and information provided by GBO staff, 47 built environment resources that had been constructed in or before 1969 were identified as extant within the APE. These include: 5 telescope structures (one of which contains three large telescopes), 2 horn instruments, 1 antenna, 1 airstrip, 1 water tower, 1 recreation area, 24 residential buildings, and 12 operational and administrative buildings. As noted above, one of these telescopes, the Reber Radio Telescope, was previously evaluated. The remaining 46 built environment resources in the APE built in or before 1969 were photographed and evaluated for NRHP eligibility. Data collected through the background research and field investigations were analyzed to determine NRHP eligibility of the 46 surveyed built environment resources individually. In addition, the Green Bank Telescope, which was constructed after 1969, was evaluated individually due to its exceptional importance to radio astronomy over the last 50 years. All 47 historic-era properties (constructed in or before 1969, including the Reber Radio Telescope) and the GBT were also evaluated as a potential historic district. Properties surveyed in 2014 are listed in Attachment A of Enclosure 1. Figure 5-1, included in Enclosure 1, shows the location of each evaluated built environment resource.

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TABLE 2. NRHP-Eligible Built Environment Resources within the APE

Resource Name	Year Constructed	Description/Significance	NRHP Eligibility Recommendation
GBO Historic District	1958-2000	Collection of administrative/operational structures, residential buildings, and radio astronomy equipment associated with the NRAO/GBO.	Eligible (Historic District); 44 contributing resources (Attachment A in Enclosure 1)
Interferometer Range: Howard E. Tatel Telescope (85'-1) and 85'-1 control building; 85'-2 Telescope; 85'-3 Telescope; and the Interferometer control building	85'-1: 1958-1959 85'-2: 1963-1964 85'-3: 1965-1968 Interferometer control building: 1967-1968	The Tatel Telescope (85'-1) was the first telescope constructed by the NRAO and performed the world's first Search For Extra Terrestrial Intelligence (SETI) observations. The Interferometer Range connected two nearly identical telescopes to the Tatel Telescope in a linear formation. The three telescopes operated in unison and proved that dishes could be combined to form very large telescopes. This information spurred the	Individually eligible and contributing to GBO Historic District

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The GBO is a federally-owned property that contains historic properties. Therefore the Proposed Action has the potential to affect historic properties. In compliance with 36 Code of Federal Regulations (CFR) 800.2(c)(2)(ii), NSF is initiating consultation with you on the proposed changes to GBO operations. NSF is also seeking your input on any cultural resources in the project area or any cultural resources concerns you may have related to this undertaking.

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Regards,

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Caroline M. Blanco
Federal Preservation Officer
Assistant General Counsel
Office of the General Counsel

Enclosures:

1. *Cultural Resources Evaluation, Green Bank Observatory, Green Bank, West Virginia*

NATIONAL SCIENCE FOUNDATION

1201 Wilson Boulevard
Arlington, Virginia 22230



OFFICE OF THE
GENERAL COUNSEL

December 12, 2016

Mr. Arnold Printup
Tribal Historic Preservation Officer
St. Regis Mohawk Tribe
412 State Route 37
Akwesasne, NY 13655

RE: Section 106 Consultation for the Proposed Changes to Green Bank
Observatory Operations, Green Bank, West Virginia

Dear Mr. Printup:

The National Science Foundation (NSF) has identified the need to divest several facilities from its portfolio to retain the balance of capabilities needed to deliver the best performance on the key science of the present decade and beyond. Green Bank Observatory (GBO) in Green Bank, Pocahontas County, West Virginia, is one of the facilities identified for potential divestment. The decision regarding the potential changes to GBO operations is considered a federal undertaking. While engaging in Section 106 consultation under the National Historic Preservation Act (NHPA), NSF will be simultaneously conducting an Environmental Impact Statement (EIS) process under the National Environmental Policy Act (NEPA) to identify potential impacts associated with the proposed operational changes due to funding constraints. With this letter, NSF is formally initiating Section 106 consultation under the NHPA and transmitting the *Cultural Resources Evaluation, Green Bank Observatory, Green Bank, West Virginia* (Enclosure 1) for your review and comment.

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The Reber Radio Telescope is the only structure or building located within GBO that is listed in the NRHP. It was listed in the NRHP in 1972 and designated a National Historic Landmark in 1986. The telescope was listed under Criteria A and B for its nationally significant association with the origins of radio astronomy and for its association with Grote Reber.

One residence within the APE, the Riley House (House #15), was previously recorded in 2011. The associated survey form states that the early twentieth-century wood-frame farm house does not appear to be significant under NRHP Criterion C. The literature

review did not identify any prior cultural resources surveys that have occurred within the APE. Two archaeological sites and nine architectural resources have been recorded outside of the APE, along State Routes 28 and 92, directly adjacent to the eastern boundary of the Observatory. The two previously recorded archaeological resources were not evaluated for the NRHP. One of the architectural resources, the Liberty Presbyterian Church on State Route 92 that was constructed in 1851, is described as significant as an excellent example of Greek Revival architecture, although no formal NRHP evaluation is included with the survey form. The church was recorded on two West Virginia Historic Property Inventory Forms (PH-0002 and PH-0037-0018). Four architectural resources were evaluated as not eligible for the NRHP and three buildings were recorded, but not evaluated for the NRHP. The cultural resources that have been previously recorded within or directly adjacent to the APE are listed below in Table 1. In addition, two surveys (a bridge survey and a cultural resources survey) have occurred and 34 additional cultural resources have been identified within the 0.5-mile study area.

TABLE 1. Previously Recorded Cultural Resources Within and Directly Adjacent to the APE*

Resource Name	Description	Status	Recorded by
Reber Radio Telescope	1937 telescope located at the entrance to GBO within APE	NRHP listed 1972; National Historic Landmark 1986	National Register of Historic Places Registration Form
Riley House (House #15) PH-0331	Circa 1915 farm house within APE	Not eligible for the NRHP	Justin Greenawalt and Mary Stack (Skelly and Loy, Inc.); 2011
Liberty Presbyterian Church PH-0002 PH-0037-0018	1851 Greek Revival Church adjacent to APE	Not formally evaluated for the NRHP, but described as “significant as an excellent example of Greek Revival architecture in the area”	Michael Gioulis (Historic Preservation Consultant); 1993
George Porter Kerr House – Historic Orlan Shears House PH-0037-0040	Circa 1901 residence adjacent to APE	Not evaluated for the NRHP	Sherron Waybright; 1986

Dr. J.P. Mooumau House PH-0037-0044	1873 residence adjacent to APE	Not evaluated for the NRHP	Jessie B. Powell; 1986
Hamed House PH-0037-0048	1910 residence adjacent to APE	Not evaluated for the NRHP	Jessie B. Powell; 1986
Jack Nelson House PH-0209	Circa 1900 residence adjacent to the APE	Not eligible for the NRHP	Jeff Drobney (Skelly and Loy, Inc.); 1996
Jerry Thortnon House PH-0210	Circa 1880-1890 vernacular residence adjacent to APE	Not eligible for the NRHP	Jeff Drobney (Skelly and Loy, Inc.); 1996
PH-0326	Circa 1920 bungalow residence adjacent to APE	Not eligible for the NRHP	Justin Greenawalt and Mary Stack (Skelly and Loy, Inc.); 2011
PH-0327	Circa 1920 bungalow residence adjacent to APE	Not eligible for the NRHP	Justin Greenawalt and Mary Stack (Skelly and Loy, Inc.); 2011
PH-0332	1949 bungalow residence adjacent to APE	Not eligible for the NRHP	Justin Greenawalt and Mary Stack (Skelly and Loy, Inc.); 2011
Shinaberry's Fifth Grade Site 46-PH-64	Prehistoric open archaeological site adjacent to APE	Not evaluated for the NRHP	Dick Reigel; 1987
Sheets Site 46-PH-27	Prehistoric campsite adjacent to APE	Not evaluated for the NRHP	Stephen Davis; 1977

* Shaded rows indicate previously recorded resources within the APE.

Determination of Eligibility

A Secretary of the Interior-qualified architectural historian with CH2M conducted an intensive architectural survey at the GBO from October 6-9, 2014. The site visit to GBO was also used to engage GBO staff in informal interviews and to conduct archival research, including the review of historic photographs and narratives, newspaper articles, construction records, and architectural drawings.

The field survey encompassed standing structures built in or before 1969, which is 47 years from the present year. The standard NRHP age threshold is 50 years; however, using 47 years as the cutoff allowed a buffer for the execution of the proposed Alternatives. All built environment resources from 1969 or earlier within the GBO boundary were surveyed and assessed, including a determination of eligibility for listing in the NRHP, except for the Reber Radio Telescope. Buildings and structures were evaluated individually as well as part of a potential historic district.

Using aerial photographs of GBO and information provided by GBO staff, 47 built environment resources that had been constructed in or before 1969 were identified as extant within the APE. These include: 5 telescope structures (one of which contains three large telescopes), 2 horn instruments, 1 antenna, 1 airstrip, 1 water tower, 1 recreation area, 24 residential buildings, and 12 operational and administrative buildings. As noted above, one of these telescopes, the Reber Radio Telescope, was previously evaluated. The remaining 46 built environment resources in the APE built in or before 1969 were photographed and evaluated for NRHP eligibility. Data collected through the background research and field investigations were analyzed to determine NRHP eligibility of the 46 surveyed built environment resources individually. In addition, the Green Bank Telescope, which was constructed after 1969, was evaluated individually due to its exceptional importance to radio astronomy over the last 50 years. All 47 historic-era properties (constructed in or before 1969, including the Reber Radio Telescope) and the GBT were also evaluated as a potential historic district. Properties surveyed in 2014 are listed in Attachment A of Enclosure 1. Figure 5-1, included in Enclosure 1, shows the location of each evaluated built environment resource.

NSF has determined that within the historical context of NRAO/GBO, there are four telescope instruments that are individually eligible for listing in the NRHP: the Interferometer Range, the 40-foot Telescope, the 43-meter Telescope, and the Green Bank Telescope. In addition, NSF has determined that GBO is eligible as a historic district for representing an important time in science history and for its significant contribution to the advancement of radio astronomy. There are 44 resources within the APE that are recommended as contributing to the proposed GBO historic district, the boundaries of which coincide with the site's property boundaries (and the APE). Contributing elements include 8 administrative/operational buildings, 1 airstrip, 1 water tower, 1 recreational area, 24 residential buildings, 2 horns, 1 antenna, and 6 telescopes (the Interferometer includes 3 large telescopes) (Table 2).

The scientific instruments within the APE are a collection of telescopes, horns, and antenna that are significant for their role in the development of radio astronomy and, in several instances, as remarkable feats of engineering. As a whole, the majority of the components that make up the potential district's historic character possess integrity, even though many of the buildings are individually undistinguished. The administrative and operations buildings and structures within the GBO are primarily utilitarian buildings or structures with simple designs executed using practical and standard materials. These elements create a cohesive, visual unit that emphasizes their historically linked function

as support for the observatory. As a group, the 44 contributing built environment resources are a distinct and well-preserved representation of the early years of the NRAO, complete with scientific instruments, administration/operational facilities, recreation area, and residential buildings. Additionally, the scientific instruments present on site illustrate a linear, historical narrative of the history of radio astronomy from the Jansky Replica Antenna and Reber Radio Telescope to the monumental Green Bank Telescope. Four buildings within the APE were identified as non-contributing resources. These include three barns and one cellar building, all of which pre-date the establishment of the NRAO and have been primarily left vacant or used as miscellaneous storage facilities.

Table 2 lists the properties at the GBO that were identified as individually eligible for the NRHP. Attachment A, included in Enclosure 1, lists the buildings that contribute to the NRHP-eligible historic district.

TABLE 2. NRHP-Eligible Built Environment Resources within the APE

Resource Name	Year Constructed	Description/Significance	NRHP Eligibility Recommendation
GBO Historic District	1958-2000	Collection of administrative/operational structures, residential buildings, and radio astronomy equipment associated with the NRAO/GBO.	Eligible (Historic District); 44 contributing resources (Attachment A in Enclosure 1)
Interferometer Range: Howard E. Tatel Telescope (85'-1) and 85'-1 control building; 85'-2 Telescope; 85'-3 Telescope; and the Interferometer control building	85'-1: 1958-1959 85'-2: 1963-1964 85'-3: 1965-1968 Interferometer control building: 1967-1968	The Tatel Telescope (85'-1) was the first telescope constructed by the NRAO and performed the world's first Search For Extra Terrestrial Intelligence (SETI) observations. The Interferometer Range connected two nearly identical telescopes to the Tatel Telescope in a linear formation. The three telescopes operated in unison and proved that dishes could be combined to form very large telescopes. This information spurred the	Individually eligible and contributing to GBO Historic District

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Robert C. Byrd Green Bank Telescope (Green Bank Telescope)	1991-2000	Largest moving structure on land in the world; tilt and point design that can rotate a full 360 degrees; performs highly sensitive data collection.	Individually eligible and contributing to GBO Historic District

Initiation of Section 106 Consultation

The GBO is a federally-owned property that contains historic properties. Therefore the Proposed Action has the potential to affect historic properties. In compliance with 36 Code of Federal Regulations (CFR) 800.2(c)(2)(ii), NSF is initiating consultation with you on the proposed changes to GBO operations. NSF is also seeking your input on any cultural resources in the project area or any cultural resources concerns you may have related to this undertaking.

We respectfully request your response within 30 days from receipt of this letter indicating your interest in participating in consultation for this undertaking. Please respond to:

Ms. Elizabeth Pentecost
National Science Foundation
Division of Astronomical Sciences
4201 Wilson Blvd, Suite 1045
Arlington, Virginia 22230
epenteco@nsf.gov

NSF is also transmitting the *Cultural Resources Evaluation, Green Bank Observatory, Green Bank, West Virginia* (attached as Enclosure 1). If you have any questions, please do not hesitate to contact me by phone at 703-292-4592 or by email at cblanco@nsf.gov. We look forward to further consultation on this proposed undertaking.

Regards,

A handwritten signature in black ink that reads "Caroline M. Blanco". The signature is written in a cursive, flowing style.

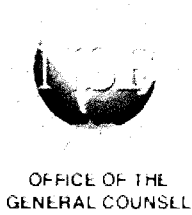
Caroline M. Blanco
Federal Preservation Officer
Assistant General Counsel
Office of the General Counsel

Enclosures:

1. *Cultural Resources Evaluation, Green Bank Observatory, Green Bank, West Virginia*

NATIONAL SCIENCE FOUNDATION

4201 Wilson Boulevard
Arlington, Virginia 22230



December 12, 2016

Mr. Eric Oosahwee-voss
Tribal Historic Preservation Office
United Keetoowah Band of Cherokee Indians
PO Box 746
Tahlequah, OK 74465

RE: Section 106 Consultation for the Proposed Changes to Green Bank
Observatory Operations, Green Bank, West Virginia

Dear Mr. Oosahwee-voss:

The National Science Foundation (NSF) has identified the need to divest several facilities from its portfolio to retain the balance of capabilities needed to deliver the best performance on the key science of the present decade and beyond. Green Bank Observatory (GBO) in Green Bank, Pocahontas County, West Virginia, is one of the facilities identified for potential divestment. The decision regarding the potential changes to GBO operations is considered a federal undertaking. While engaging in Section 106 consultation under the National Historic Preservation Act (NHPA), NSF will be simultaneously conducting an Environmental Impact Statement (EIS) process under the National Environmental Policy Act (NEPA) to identify potential impacts associated with the proposed operational changes due to funding constraints. With this letter, NSF is formally initiating Section 106 consultation under the NHPA and transmitting the *Cultural Resources Evaluation, Green Bank Observatory, Green Bank, West Virginia* (Enclosure 1) for your review and comment.

Project Location and Background

GBO is located on federal lands adjacent to the Monongahela National Forest. This land is owned by NSF and consists of numerous parcels that were acquired/condemned by the U.S. Army Corps of Engineers in the 1950s when GBO was formed as the first (and then, only) site of the National Radio Astronomy Observatory (NRAO). The GBO is the anchor and administrative site of the 13,000-square-mile National Radio Quiet Zone (NRQZ) and is situated on approximately 2,200 acres in the NRQZ, where all radio transmissions are limited. The GBO facility has a long history of science, technology, engineering, and mathematics education, ranging from student training and mentorships through the outreach and training opportunities offered through the NRAO Center for

Science Education, which is based at the GBO site. More than 40,000 visitors each year pass through the Green Bank Science Center, including students, educators, and the general public who generally stay on site for more than one night to take advantage of the educational facilities. The GBO facility is host to multiple educational workshops and programs each year for middle school through post-graduate student training, and an average of 10 to 15 undergraduate and graduate students are mentored at the facility each year.

GBO facilities include the Green Bank Telescope; 43-meter telescope (also referred to as the 140-foot telescope); Green Bank Solar Radio Burst Spectrometer (45-foot telescope); Interferometer Range (includes three 85-foot diameter telescopes); 20-meter Geodetic Telescope; 40-foot telescope; three non-operational historical telescopes (Jansky Replica Antenna, Reber Radio Telescope, and Ewen-Purcell Horn); and other support facilities and infrastructure.

Project Description

NSF's Division of Astronomical Sciences (AST) is the federal steward for ground-based astronomy in the United States, funding research with awards to individual investigators and small research groups, and via cooperative agreements for operation of large telescope facilities. These national and international telescope facilities provide world-leading, one-of-a-kind observational capabilities on a competitive basis to thousands of astronomers per year. These facilities also enable scientific advances by making archived data products available to researchers. Along with funding telescope facilities and research awards, AST supports the development of advanced technologies and instrumentation, and manages the allocation and assignment of specific frequencies in the radio spectrum for scientific use by the entire NSF community. The need for NSF to reduce funding for the GBO has been established through a number of reviews and surveys conducted by the science community.

In 2014, CH2M conducted a Cultural Resources Evaluation for the architectural resources at the GBO. The results of the survey are included below under "Determinations of Eligibility." The associated technical report, entitled *Cultural Resources Evaluation, Green Bank Observatory, Green Bank, West Virginia*, is attached for reference (Enclosure 1).

A range of preliminary proposed Alternatives is being considered for evaluation. These preliminary proposed Alternatives, which will be refined through public input, include the following:

- Continued NSF investment for science-focused operations (No-Action Alternative).
- Collaboration with interested parties for science- and education-focused operations with reduced NSF-funded scope.

- Collaboration with interested parties for operation as a technology and education park.
- Mothballing of facilities (suspension of operations in a manner such that operations could resume efficiently at some future date).
- Deconstruction and site restoration.

These alternatives may be further refined during the early phases of the compliance review and will be informed by the public process.

Proposed Area of Potential Effects

The Area of Potential Effects (APE) being proposed for the project is defined as the property boundary of GBO. The total geographic area of the Observatory was chosen as the APE to encompass all buildings and structures on the property. This inclusive APE enables a determination of whether GBO constitutes a potential historic district that could be affected by the activities associated with the proposed changes to operations at the Observatory. Figure 2-1 included in Enclosure 1 shows the boundaries of the APE.

Public Involvement

A Notice of Intent (NOI) was published in the Federal Register on October 19, 2016 to initiate the public scoping process for the EIS. A revised NOI was published on November 1, 2016. Two Public Scoping Meetings were conducted on November 9, 2016, at GBO. Section 106 public outreach was addressed as part of the public meeting, and participants were invited to identify whether they would like to participate in Section 106 as a consulting party. Concurrent to the mailing of this letter, NSF will email these potential consulting parties a description of the role of a consulting party and requesting that they confirm their interest. A separate Section 106 consulting party meeting will be scheduled following the release of the Draft EIS this spring. Follow-up discussions with consulting parties will occur as needed.

Previously Identified Historic Properties

A literature review was conducted through the West Virginia State Historic Preservation Office (SHPO) Interactive Map on November 7, 2016. The literature review focused on the APE and included a 0.5-mile study area.

The Reber Radio Telescope is the only structure or building located within GBO that is listed in the NRHP. It was listed in the NRHP in 1972 and designated a National Historic Landmark in 1986. The telescope was listed under Criteria A and B for its nationally significant association with the origins of radio astronomy and for its association with Grote Reber.

One residence within the APE, the Riley House (House #15), was previously recorded in 2011. The associated survey form states that the early twentieth-century wood-frame farm house does not appear to be significant under NRHP Criterion C. The literature

review did not identify any prior cultural resources surveys that have occurred within the APE. Two archaeological sites and nine architectural resources have been recorded outside of the APE, along State Routes 28 and 92, directly adjacent to the eastern boundary of the Observatory. The two previously recorded archaeological resources were not evaluated for the NRHP. One of the architectural resources, the Liberty Presbyterian Church on State Route 92 that was constructed in 1851, is described as significant as an excellent example of Greek Revival architecture, although no formal NRHP evaluation is included with the survey form. The church was recorded on two West Virginia Historic Property Inventory Forms (PH-0002 and PH-0037-0018). Four architectural resources were evaluated as not eligible for the NRHP and three buildings were recorded, but not evaluated for the NRHP. The cultural resources that have been previously recorded within or directly adjacent to the APE are listed below in Table 1. In addition, two surveys (a bridge survey and a cultural resources survey) have occurred and 34 additional cultural resources have been identified within the 0.5-mile study area.

TABLE 1. Previously Recorded Cultural Resources Within and Directly Adjacent to the APE*

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Jerry Thorton House PH-0210	Circa 1880-1890 vernacular residence adjacent to APE	Not eligible for the NRHP	Jeff Drobney (Skelly and Loy, Inc.); 1996
PH-0326	Circa 1920 bungalow residence adjacent to APE	Not eligible for the NRHP	Justin Greenawalt and Mary Stack (Skelly and Loy, Inc.); 2011
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PH-0332	1949 bungalow residence adjacent to APE	Not eligible for the NRHP	Justin Greenawalt and Mary Stack (Skelly and Loy, Inc.); 2011
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* Shaded rows indicate previously recorded resources within the APE.

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Using aerial photographs of GBO and information provided by GBO staff, 47 built environment resources that had been constructed in or before 1969 were identified as extant within the APE. These include: 5 telescope structures (one of which contains three large telescopes), 2 horn instruments, 1 antenna, 1 airstrip, 1 water tower, 1 recreation area, 24 residential buildings, and 12 operational and administrative buildings. As noted above, one of these telescopes, the Reber Radio Telescope, was previously evaluated. The remaining 46 built environment resources in the APE built in or before 1969 were photographed and evaluated for NRHP eligibility. Data collected through the background research and field investigations were analyzed to determine NRHP eligibility of the 46 surveyed built environment resources individually. In addition, the Green Bank Telescope, which was constructed after 1969, was evaluated individually due to its exceptional importance to radio astronomy over the last 50 years. All 47 historic-era properties (constructed in or before 1969, including the Reber Radio Telescope) and the GBT were also evaluated as a potential historic district. Properties surveyed in 2014 are listed in Attachment A of Enclosure 1. Figure 5-1, included in Enclosure 1, shows the location of each evaluated built environment resource.

NSF has determined that within the historical context of NRAO/GBO, there are four telescope instruments that are individually eligible for listing in the NRHP: the Interferometer Range, the 40-foot Telescope, the 43-meter Telescope, and the Green Bank Telescope. In addition, NSF has determined that GBO is eligible as a historic district for representing an important time in science history and for its significant contribution to the advancement of radio astronomy. There are 44 resources within the APE that are recommended as contributing to the proposed GBO historic district, the boundaries of which coincide with the site's property boundaries (and the APE). Contributing elements include 8 administrative/operational buildings, 1 airstrip, 1 water tower, 1 recreational area, 24 residential buildings, 2 horns, 1 antenna, and 6 telescopes (the Interferometer includes 3 large telescopes) (Table 2).

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Table 2 lists the properties at the GBO that were identified as individually eligible for the NRHP. Attachment A, included in Enclosure 1, lists the buildings that contribute to the NRHP-eligible historic district.

TABLE 2. NRHP-Eligible Built Environment Resources within the APE

Resource Name	Year Constructed	Description/Significance	NRHP Eligibility Recommendation
GBO Historic District	1958-2000	Collection of administrative/operational structures, residential buildings, and radio astronomy equipment associated with the NRAO/GBO.	Eligible (Historic District); 44 contributing resources (Attachment A in Enclosure 1)
Interferometer Range: Howard E. Tatel Telescope (85'-1) and 85'-1 control building; 85'-2 Telescope; 85'-3 Telescope; and the Interferometer control building	85'-1: 1958-1959 85'-2: 1963-1964 85'-3: 1965-1968 Interferometer control building: 1967-1968	The Tatel Telescope (85'-1) was the first telescope constructed by the NRAO and performed the world's first Search For Extra Terrestrial Intelligence (SETI) observations. The Interferometer Range connected two nearly identical telescopes to the Tatel Telescope in a linear formation. The three telescopes operated in unison and proved that dishes could be combined to form very large telescopes. This information spurred the	Individually eligible and contributing to GBO Historic District

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Caroline M. Blanco
Federal Preservation Officer
Assistant General Counsel
Office of the General Counsel

Enclosures:

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NATIONAL SCIENCE FOUNDATION

4201 Wilson Boulevard
Arlington, Virginia 22230



OFFICE OF THE
GENERAL COUNSEL

December 12, 2016

Chief Leo Henry
Tuscarora Nation
5616 Walmore Road
Lewiston, NY 14092

RE: Section 106 Consultation for the Proposed Changes to Green Bank
Observatory Operations, Green Bank, West Virginia

Dear Chief Henry:

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The Area of Potential Effects (APE) being proposed for the project is defined as the property boundary of GBO. The total geographic area of the Observatory was chosen as the APE to encompass all buildings and structures on the property. This inclusive APE enables a determination of whether GBO constitutes a potential historic district that could be affected by the activities associated with the proposed changes to operations at the Observatory. Figure 2-1 included in Enclosure 1 shows the boundaries of the APE.

Public Involvement

A Notice of Intent (NOI) was published in the Federal Register on October 19, 2016 to initiate the public scoping process for the EIS. A revised NOI was published on November 1, 2016. Two Public Scoping Meetings were conducted on November 9, 2016, at GBO. Section 106 public outreach was addressed as part of the public meeting, and participants were invited to identify whether they would like to participate in Section 106 as a consulting party. Concurrent to the mailing of this letter, NSF will email these potential consulting parties a description of the role of a consulting party and requesting that they confirm their interest. A separate Section 106 consulting party meeting will be scheduled following the release of the Draft EIS this spring. Follow-up discussions with consulting parties will occur as needed.

Previously Identified Historic Properties

A literature review was conducted through the West Virginia State Historic Preservation Office (SHPO) Interactive Map on November 7, 2016. The literature review focused on the APE and included a 0.5-mile study area.

The Reber Radio Telescope is the only structure or building located within GBO that is listed in the NRHP. It was listed in the NRHP in 1972 and designated a National Historic Landmark in 1986. The telescope was listed under Criteria A and B for its nationally significant association with the origins of radio astronomy and for its association with Grote Reber.

One residence within the APE, the Riley House (House #15), was previously recorded in 2011. The associated survey form states that the early twentieth-century wood-frame farm house does not appear to be significant under NRHP Criterion C. The literature review did not identify any prior cultural resources surveys that have occurred within the APE. Two archaeological sites and nine architectural resources have been recorded

outside of the APE, along State Routes 28 and 92, directly adjacent to the eastern boundary of the Observatory. The two previously recorded archaeological resources were not evaluated for the NRHP. One of the architectural resources, the Liberty Presbyterian Church on State Route 92 that was constructed in 1851, is described as significant as an excellent example of Greek Revival architecture, although no formal NRHP evaluation is included with the survey form. The church was recorded on two West Virginia Historic Property Inventory Forms (PH-0002 and PH-0037-0018). Four architectural resources were evaluated as not eligible for the NRHP and three buildings were recorded, but not evaluated for the NRHP. The cultural resources that have been previously recorded within or directly adjacent to the APE are listed below in Table 1. In addition, two surveys (a bridge survey and a cultural resources survey) have occurred and 34 additional cultural resources have been identified within the 0.5-mile study area.

TABLE 1. Previously Recorded Cultural Resources Within and Directly Adjacent to the APE*

Resource Name	Description	Status	Recorded by
Reber Radio Telescope	1937 telescope located at the entrance to GBO within APE	NRHP listed 1972; National Historic Landmark 1986	National Register of Historic Places Registration Form
Riley House (House #15) PH-0331	Circa 1915 farm house within APE	Not eligible for the NRHP	Justin Greenawalt and Mary Stack (Skelly and Loy, Inc.); 2011
Liberty Presbyterian Church PH-0002 PH-0037-0018	1851 Greek Revival Church adjacent to APE	Not formally evaluated for the NRHP, but described as “significant as an excellent example of Greek Revival architecture in the area”	Michael Gioulis (Historic Preservation Consultant); 1993
George Porter Kerr House – Historic Orlan Shears House PH-0037-0040	Circa 1901 residence adjacent to APE	Not evaluated for the NRHP	Sherron Waybright; 1986

Dr. J.P. Mooumau House PH-0037-0044	1873 residence adjacent to APE	Not evaluated for the NRHP	Jessie B. Powell; 1986
Hamed House PH-0037-0048	1910 residence adjacent to APE	Not evaluated for the NRHP	Jessie B. Powell; 1986
Jack Nelson House PH-0209	Circa 1900 residence adjacent to the APE	Not eligible for the NRHP	Jeff Drobney (Skelly and Loy, Inc.); 1996
Jerry Thortnon House PH-0210	Circa 1880-1890 vernacular residence adjacent to APE	Not eligible for the NRHP	Jeff Drobney (Skelly and Loy, Inc.); 1996
PH-0326	Circa 1920 bungalow residence adjacent to APE	Not eligible for the NRHP	Justin Greenawalt and Mary Stack (Skelly and Loy, Inc.); 2011
PH-0327	Circa 1920 bungalow residence adjacent to APE	Not eligible for the NRHP	Justin Greenawalt and Mary Stack (Skelly and Loy, Inc.); 2011
PH-0332	1949 bungalow residence adjacent to APE	Not eligible for the NRHP	Justin Greenawalt and Mary Stack (Skelly and Loy, Inc.); 2011
Shinaberry's Fifth Grade Site 46-PH-64	Prehistoric open archaeological site adjacent to APE	Not evaluated for the NRHP	Dick Reigel; 1987
Sheets Site 46-PH-27	Prehistoric campsite adjacent to APE	Not evaluated for the NRHP	Stephen Davis; 1977

* Shaded rows indicate previously recorded resources within the APE.

Determination of Eligibility

A Secretary of the Interior-qualified architectural historian with CH2M conducted an intensive architectural survey at the GBO from October 6-9, 2014. The site visit to GBO was also used to engage GBO staff in informal interviews and to conduct archival research, including the review of historic photographs and narratives, newspaper articles, construction records, and architectural drawings.

The field survey encompassed standing structures built in or before 1969, which is 47 years from the present year. The standard NRHP age threshold is 50 years; however, using 47 years as the cutoff allowed a buffer for the execution of the proposed Alternatives. All built environment resources from 1969 or earlier within the GBO boundary were surveyed and assessed, including a determination of eligibility for listing in the NRHP, except for the Reber Radio Telescope. Buildings and structures were evaluated individually as well as part of a potential historic district.

Using aerial photographs of GBO and information provided by GBO staff, 47 built environment resources that had been constructed in or before 1969 were identified as extant within the APE. These include: 5 telescope structures (one of which contains three large telescopes), 2 horn instruments, 1 antenna, 1 airstrip, 1 water tower, 1 recreation area, 24 residential buildings, and 12 operational and administrative buildings. As noted above, one of these telescopes, the Reber Radio Telescope, was previously evaluated. The remaining 46 built environment resources in the APE built in or before 1969 were photographed and evaluated for NRHP eligibility. Data collected through the background research and field investigations were analyzed to determine NRHP eligibility of the 46 surveyed built environment resources individually. In addition, the Green Bank Telescope, which was constructed after 1969, was evaluated individually due to its exceptional importance to radio astronomy over the last 50 years. All 47 historic-era properties (constructed in or before 1969, including the Reber Radio Telescope) and the GBT were also evaluated as a potential historic district. Properties surveyed in 2014 are listed in Attachment A of Enclosure 1. Figure 5-1, included in Enclosure 1, shows the location of each evaluated built environment resource.

NSF has determined that within the historical context of NRAO/GBO, there are four telescope instruments that are individually eligible for listing in the NRHP: the Interferometer Range, the 40-foot Telescope, the 43-meter Telescope, and the Green Bank Telescope. In addition, NSF has determined that GBO is eligible as a historic district for representing an important time in science history and for its significant contribution to the advancement of radio astronomy. There are 44 resources within the APE that are recommended as contributing to the proposed GBO historic district, the boundaries of which coincide with the site's property boundaries (and the APE). Contributing elements include 8 administrative/operational buildings, 1 airstrip, 1 water tower, 1 recreational area, 24 residential buildings, 2 horns, 1 antenna, and 6 telescopes (the Interferometer includes 3 large telescopes) (Table 2).

The scientific instruments within the APE are a collection of telescopes, horns, and antenna that are significant for their role in the development of radio astronomy and, in several instances, as remarkable feats of engineering. As a whole, the majority of the components that make up the potential district's historic character possess integrity, even though many of the buildings are individually undistinguished. The administrative and operations buildings and structures within the GBO are primarily utilitarian buildings or structures with simple designs executed using practical and standard materials. These elements create a cohesive, visual unit that emphasizes their historically linked function

as support for the observatory. As a group, the 44 contributing built environment resources are a distinct and well-preserved representation of the early years of the NRAO, complete with scientific instruments, administration/operational facilities, recreation area, and residential buildings. Additionally, the scientific instruments present on site illustrate a linear, historical narrative of the history of radio astronomy from the Jansky Replica Antenna and Reber Radio Telescope to the monumental Green Bank Telescope. Four buildings within the APE were identified as non-contributing resources. These include three barns and one cellar building, all of which pre-date the establishment of the NRAO and have been primarily left vacant or used as miscellaneous storage facilities.

Table 2 lists the properties at the GBO that were identified as individually eligible for the NRHP. Attachment A, included in Enclosure 1, lists the buildings that contribute to the NRHP-eligible historic district.

TABLE 2. NRHP-Eligible Built Environment Resources within the APE

Resource Name	Year Constructed	Description/Significance	NRHP Eligibility Recommendation
GBO Historic District	1958-2000	Collection of administrative/operational structures, residential buildings, and radio astronomy equipment associated with the NRAO/GBO.	Eligible (Historic District); 44 contributing resources (Attachment A in Enclosure 1)
Interferometer Range: Howard E. Tatel Telescope (85'-1) and 85'-1 control building; 85'-2 Telescope; 85'-3 Telescope; and the Interferometer control building	85'-1: 1958-1959 85'-2: 1963-1964 85'-3: 1965-1968 Interferometer control building: 1967-1968	The Tatel Telescope (85'-1) was the first telescope constructed by the NRAO and performed the world's first Search For Extra Terrestrial Intelligence (SETI) observations. The Interferometer Range connected two nearly identical telescopes to the Tatel Telescope in a linear formation. The three telescopes operated in unison and proved that dishes could be combined to form very large telescopes. This information spurred the	Individually eligible and contributing to GBO Historic District

TABLE 2. NRHP-Eligible Built Environment Resources within the APE

Resource Name	Year Constructed	Description/Significance	NRHP Eligibility Recommendation
		construction of the Very Large Array telescope in New Mexico in the 1970s.	
40-foot Telescope and control building	1962	First fully automated radio telescope in the world. Currently operates as an educational telescope for visiting students.	Individually eligible and contributing to GBO Historic District
43-meter Telescope	1958-1965	Largest telescope in the world to use an equatorial (for polar aligned) mount. Currently used as part of the Russian Radioastron project.	Individually eligible and contributing to GBO Historic District
Robert C. Byrd Green Bank Telescope (Green Bank Telescope)	1991-2000	Largest moving structure on land in the world; tilt and point design that can rotate a full 360 degrees; performs highly sensitive data collection.	Individually eligible and contributing to GBO Historic District

Initiation of Section 106 Consultation

The GBO is a federally-owned property that contains historic properties. Therefore the Proposed Action has the potential to affect historic properties. In compliance with 36 Code of Federal Regulations (CFR) 800.2(c)(2)(ii), NSF is initiating consultation with you on the proposed changes to GBO operations. NSF is also seeking your input on any cultural resources in the project area or any cultural resources concerns you may have related to this undertaking.

We respectfully request your response within 30 days from receipt of this letter indicating your interest in participating in consultation for this undertaking. Please respond to:

Ms. Elizabeth Pentecost
National Science Foundation
Division of Astronomical Sciences
4201 Wilson Blvd, Suite 1045
Arlington, Virginia 22230
epenteco@nsf.gov

NSF is also transmitting the *Cultural Resources Evaluation, Green Bank Observatory, Green Bank, West Virginia* (attached as Enclosure 1). If you have any questions, please do not hesitate to contact me by phone at 703-292-4592 or by email at cblanco@nsf.gov. We look forward to further consultation on this proposed undertaking.

Regards,

A handwritten signature in cursive script that reads "Caroline M. Blanco".

Caroline M. Blanco
Federal Preservation Officer
Assistant General Counsel
Office of the General Counsel

Enclosures:

1. *Cultural Resources Evaluation, Green Bank Observatory, Green Bank, West Virginia*

NATIONAL SCIENCE FOUNDATION

4201 Wilson Boulevard
Arlington, Virginia 22230



OFFICE OF THE
GENERAL COUNSEL

December 12, 2016

Ms. Robin Dushane
Tribal Historic Preservation Officer
Eastern Shawnee Tribe of Oklahoma
12755 S. 705 Road
Wyandotte, OK 74370

RE: Section 106 Consultation for the Proposed Changes to Green Bank
Observatory Operations, Green Bank, West Virginia

Dear Ms. Dushane:

The National Science Foundation (NSF) has identified the need to divest several facilities from its portfolio to retain the balance of capabilities needed to deliver the best performance on the key science of the present decade and beyond. Green Bank Observatory (GBO) in Green Bank, Pocahontas County, West Virginia, is one of the facilities identified for potential divestment. The decision regarding the potential changes to GBO operations is considered a federal undertaking. While engaging in Section 106 consultation under the National Historic Preservation Act (NHPA), NSF will be simultaneously conducting an Environmental Impact Statement (EIS) process under the National Environmental Policy Act (NEPA) to identify potential impacts associated with the proposed operational changes due to funding constraints. With this letter, NSF is formally initiating Section 106 consultation under the NHPA and transmitting the *Cultural Resources Evaluation, Green Bank Observatory, Green Bank, West Virginia* (Enclosure 1) for your review and comment.

Project Location and Background

GBO is located on federal lands adjacent to the Monongahela National Forest. This land is owned by NSF and consists of numerous parcels that were acquired/condemned by the U.S. Army Corps of Engineers in the 1950s when GBO was formed as the first (and then, only) site of the National Radio Astronomy Observatory (NRAO). The GBO is the anchor and administrative site of the 13,000-square-mile National Radio Quiet Zone (NRQZ) and is situated on approximately 2,200 acres in the NRQZ, where all radio transmissions are limited. The GBO facility has a long history of science, technology, engineering, and mathematics education, ranging from student training and mentorships through the outreach and training opportunities offered through the NRAO Center for

Science Education, which is based at the GBO site. More than 40,000 visitors each year pass through the Green Bank Science Center, including students, educators, and the general public who generally stay on site for more than one night to take advantage of the educational facilities. The GBO facility is host to multiple educational workshops and programs each year for middle school through post-graduate student training, and an average of 10 to 15 undergraduate and graduate students are mentored at the facility each year.

GBO facilities include the Green Bank Telescope; 43-meter telescope (also referred to as the 140-foot telescope); Green Bank Solar Radio Burst Spectrometer (45-foot telescope); Interferometer Range (includes three 85-foot diameter telescopes); 20-meter Geodetic Telescope; 40-foot telescope; three non-operational historical telescopes (Jansky Replica Antenna, Reber Radio Telescope, and Ewen-Purcell Horn); and other support facilities and infrastructure.

Project Description

NSF's Division of Astronomical Sciences (AST) is the federal steward for ground-based astronomy in the United States, funding research with awards to individual investigators and small research groups, and via cooperative agreements for operation of large telescope facilities. These national and international telescope facilities provide world-leading, one-of-a-kind observational capabilities on a competitive basis to thousands of astronomers per year. These facilities also enable scientific advances by making archived data products available to researchers. Along with funding telescope facilities and research awards, AST supports the development of advanced technologies and instrumentation, and manages the allocation and assignment of specific frequencies in the radio spectrum for scientific use by the entire NSF community. The need for NSF to reduce funding for the GBO has been established through a number of reviews and surveys conducted by the science community.

In 2014, CH2M conducted a Cultural Resources Evaluation for the architectural resources at the GBO. The results of the survey are included below under "Determinations of Eligibility." The associated technical report, entitled *Cultural Resources Evaluation, Green Bank Observatory, Green Bank, West Virginia*, is attached for reference (Enclosure 1).

A range of preliminary proposed Alternatives is being considered for evaluation. These preliminary proposed Alternatives, which will be refined through public input, include the following:

- Continued NSF investment for science-focused operations (No-Action Alternative).
- Collaboration with interested parties for science- and education-focused operations with reduced NSF-funded scope.

- Collaboration with interested parties for operation as a technology and education park.
- Mothballing of facilities (suspension of operations in a manner such that operations could resume efficiently at some future date).
- Deconstruction and site restoration.

These alternatives may be further refined during the early phases of the compliance review and will be informed by the public process.

Proposed Area of Potential Effects

The Area of Potential Effects (APE) being proposed for the project is defined as the property boundary of GBO. The total geographic area of the Observatory was chosen as the APE to encompass all buildings and structures on the property. This inclusive APE enables a determination of whether GBO constitutes a potential historic district that could be affected by the activities associated with the proposed changes to operations at the Observatory. Figure 2-1 included in Enclosure 1 shows the boundaries of the APE.

Public Involvement

A Notice of Intent (NOI) was published in the Federal Register on October 19, 2016 to initiate the public scoping process for the EIS. A revised NOI was published on November 1, 2016. Two Public Scoping Meetings were conducted on November 9, 2016, at GBO. Section 106 public outreach was addressed as part of the public meeting, and participants were invited to identify whether they would like to participate in Section 106 as a consulting party. Concurrent to the mailing of this letter, NSF will email these potential consulting parties a description of the role of a consulting party and requesting that they confirm their interest. A separate Section 106 consulting party meeting will be scheduled following the release of the Draft EIS this spring. Follow-up discussions with consulting parties will occur as needed.

Previously Identified Historic Properties

A literature review was conducted through the West Virginia State Historic Preservation Office (SHPO) Interactive Map on November 7, 2016. The literature review focused on the APE and included a 0.5-mile study area.

The Reber Radio Telescope is the only structure or building located within GBO that is listed in the NRHP. It was listed in the NRHP in 1972 and designated a National Historic Landmark in 1986. The telescope was listed under Criteria A and B for its nationally significant association with the origins of radio astronomy and for its association with Grote Reber.

One residence within the APE, the Riley House (House #15), was previously recorded in 2011. The associated survey form states that the early twentieth-century wood-frame farm house does not appear to be significant under NRHP Criterion C. The literature

review did not identify any prior cultural resources surveys that have occurred within the APE. Two archaeological sites and nine architectural resources have been recorded outside of the APE, along State Routes 28 and 92, directly adjacent to the eastern boundary of the Observatory. The two previously recorded archaeological resources were not evaluated for the NRHP. One of the architectural resources, the Liberty Presbyterian Church on State Route 92 that was constructed in 1851, is described as significant as an excellent example of Greek Revival architecture, although no formal NRHP evaluation is included with the survey form. The church was recorded on two West Virginia Historic Property Inventory Forms (PH-0002 and PH-0037-0018). Four architectural resources were evaluated as not eligible for the NRHP and three buildings were recorded, but not evaluated for the NRHP. The cultural resources that have been previously recorded within or directly adjacent to the APE are listed below in Table 1. In addition, two surveys (a bridge survey and a cultural resources survey) have occurred and 34 additional cultural resources have been identified within the 0.5-mile study area.

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PH-0037-0044			
Hamed House PH-0037-0048	1910 residence adjacent to APE	Not evaluated for the NRHP	Jessie B. Powell; 1986
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Jerry Thortnon House PH-0210	Circa 1880-1890 vernacular residence adjacent to APE	Not eligible for the NRHP	Jeff Drobney (Skelly and Loy, Inc.); 1996
PH-0326	Circa 1920 bungalow residence adjacent to APE	Not eligible for the NRHP	Justin Greenawalt and Mary Stack (Skelly and Loy, Inc.); 2011
PH-0327	Circa 1920 bungalow residence adjacent to APE	Not eligible for the NRHP	Justin Greenawalt and Mary Stack (Skelly and Loy, Inc.); 2011
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Shinaberry's Fifth Grade Site 46-PH-64	Prehistoric open archaeological site adjacent to APE	Not evaluated for the NRHP	Dick Reigel; 1987
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* Shaded rows indicate previously recorded resources within the APE.

Determination of Eligibility

A Secretary of the Interior-qualified architectural historian with CH2M conducted an intensive architectural survey at the GBO from October 6-9, 2014. The site visit to GBO was also used to engage GBO staff in informal interviews and to conduct archival research, including the review of historic photographs and narratives, newspaper articles, construction records, and architectural drawings.

The field survey encompassed standing structures built in or before 1969, which is 47 years from the present year. The standard NRHP age threshold is 50 years; however,

using 47 years as the cutoff allowed a buffer for the execution of the proposed Alternatives. All built environment resources from 1969 or earlier within the GBO boundary were surveyed and assessed, including a determination of eligibility for listing in the NRHP, except for the Reber Radio Telescope. Buildings and structures were evaluated individually as well as part of a potential historic district.

Using aerial photographs of GBO and information provided by GBO staff, 47 built environment resources that had been constructed in or before 1969 were identified as extant within the APE. These include: 5 telescope structures (one of which contains three large telescopes), 2 horn instruments, 1 antenna, 1 airstrip, 1 water tower, 1 recreation area, 24 residential buildings, and 12 operational and administrative buildings. As noted above, one of these telescopes, the Reber Radio Telescope, was previously evaluated. The remaining 46 built environment resources in the APE built in or before 1969 were photographed and evaluated for NRHP eligibility. Data collected through the background research and field investigations were analyzed to determine NRHP eligibility of the 46 surveyed built environment resources individually. In addition, the Green Bank Telescope, which was constructed after 1969, was evaluated individually due to its exceptional importance to radio astronomy over the last 50 years. All 47 historic-era properties (constructed in or before 1969, including the Reber Radio Telescope) and the GBT were also evaluated as a potential historic district. Properties surveyed in 2014 are listed in Attachment A of Enclosure 1. Figure 5-1, included in Enclosure 1, shows the location of each evaluated built environment resource.

NSF has determined that within the historical context of NRAO/GBO, there are four telescope instruments that are individually eligible for listing in the NRHP: the Interferometer Range, the 40-foot Telescope, the 43-meter Telescope, and the Green Bank Telescope. In addition, NSF has determined that GBO is eligible as a historic district for representing an important time in science history and for its significant contribution to the advancement of radio astronomy. There are 44 resources within the APE that are recommended as contributing to the proposed GBO historic district, the boundaries of which coincide with the site's property boundaries (and the APE). Contributing elements include 8 administrative/operational buildings, 1 airstrip, 1 water tower, 1 recreational area, 24 residential buildings, 2 horns, 1 antenna, and 6 telescopes (the Interferometer includes 3 large telescopes) (Table 2).

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complete with scientific instruments, administration/operational facilities, recreation area, and residential buildings. Additionally, the scientific instruments present on site illustrate a linear, historical narrative of the history of radio astronomy from the Jansky Replica Antenna and Reber Radio Telescope to the monumental Green Bank Telescope. Four buildings within the APE were identified as non-contributing resources. These include three barns and one cellar building, all of which pre-date the establishment of the NRAO and have been primarily left vacant or used as miscellaneous storage facilities.

Table 2 lists the properties at the GBO that were identified as individually eligible for the NRHP. Attachment A, included in Enclosure 1, lists the buildings that contribute to the NRHP-eligible historic district.

TABLE 2. NRHP-Eligible Built Environment Resources within the APE

Resource Name	Year Constructed	Description/Significance	NRHP Eligibility Recommendation
GBO Historic District	1958-2000	Collection of administrative/operational structures, residential buildings, and radio astronomy equipment associated with the NRAO/GBO.	Eligible (Historic District); 44 contributing resources (Attachment A in Enclosure 1)
Interferometer Range: Howard E. Tatel Telescope (85'-1) and 85'-1 control building; 85'-2 Telescope; 85'-3 Telescope; and the Interferometer control building	85'-1: 1958-1959 85'-2: 1963-1964 85'-3: 1965-1968 Interferometer control building: 1967-1968	The Tatel Telescope (85'-1) was the first telescope constructed by the NRAO and performed the world's first Search For Extra Terrestrial Intelligence (SETI) observations. The Interferometer Range connected two nearly identical telescopes to the Tatel Telescope in a linear formation. The three telescopes operated in unison and proved that dishes could be combined to form very large telescopes. This information spurred the construction of the Very Large Array telescope in New	Individually eligible and contributing to GBO Historic District

TABLE 2. NRHP-Eligible Built Environment Resources within the APE

Resource Name	Year Constructed	Description/Significance	NRHP Eligibility Recommendation
		Mexico in the 1970s.	
40-foot Telescope and control building	1962	First fully automated radio telescope in the world. Currently operates as an educational telescope for visiting students.	Individually eligible and contributing to GBO Historic District
43-meter Telescope	1958-1965	Largest telescope in the world to use an equatorial (for polar aligned) mount. Currently used as part of the Russian Radioastron project.	Individually eligible and contributing to GBO Historic District
Robert C. Byrd Green Bank Telescope (Green Bank Telescope)	1991-2000	Largest moving structure on land in the world; tilt and point design that can rotate a full 360 degrees; performs highly sensitive data collection.	Individually eligible and contributing to GBO Historic District

Initiation of Section 106 Consultation

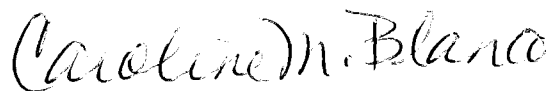
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National Science Foundation
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4201 Wilson Blvd, Suite 1045
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Regards,

A handwritten signature in cursive script that reads "Caroline M. Blanco".

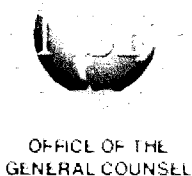
Caroline M. Blanco
Federal Preservation Officer
Assistant General Counsel
Office of the General Counsel

Enclosures:

1. *Cultural Resources Evaluation, Green Bank Observatory, Green Bank, West Virginia*

NATIONAL SCIENCE FOUNDATION

1201 Wilson Boulevard
Arlington, Virginia 22230



December 12, 2016

Ms. Anita Mathis
Director, Cultural Resources Dept.
Delaware Tribe of Indians
5100 Tuxedo Boulevard
Bartlesville, OK 74006

RE: Section 106 Consultation for the Proposed Changes to Green Bank
Observatory Operations, Green Bank, West Virginia

Dear Ms. Mathis:

The National Science Foundation (NSF) has identified the need to divest several facilities from its portfolio to retain the balance of capabilities needed to deliver the best performance on the key science of the present decade and beyond. Green Bank Observatory (GBO) in Green Bank, Pocahontas County, West Virginia, is one of the facilities identified for potential divestment. The decision regarding the potential changes to GBO operations is considered a federal undertaking. While engaging in Section 106 consultation under the National Historic Preservation Act (NHPA), NSF will be simultaneously conducting an Environmental Impact Statement (EIS) process under the National Environmental Policy Act (NEPA) to identify potential impacts associated with the proposed operational changes due to funding constraints. With this letter, NSF is formally initiating Section 106 consultation under the NHPA and transmitting the *Cultural Resources Evaluation, Green Bank Observatory, Green Bank, West Virginia* (Enclosure 1) for your review and comment.

Project Location and Background

GBO is located on federal lands adjacent to the Monongahela National Forest. This land is owned by NSF and consists of numerous parcels that were acquired/condemned by the U.S. Army Corps of Engineers in the 1950s when GBO was formed as the first (and then, only) site of the National Radio Astronomy Observatory (NRAO). The GBO is the anchor and administrative site of the 13,000-square-mile National Radio Quiet Zone (NRQZ) and is situated on approximately 2,200 acres in the NRQZ, where all radio transmissions are limited. The GBO facility has a long history of science, technology, engineering, and mathematics education, ranging from student training and mentorships through the outreach and training opportunities offered through the NRAO Center for

Science Education, which is based at the GBO site. More than 40,000 visitors each year pass through the Green Bank Science Center, including students, educators, and the general public who generally stay on site for more than one night to take advantage of the educational facilities. The GBO facility is host to multiple educational workshops and programs each year for middle school through post-graduate student training, and an average of 10 to 15 undergraduate and graduate students are mentored at the facility each year.

GBO facilities include the Green Bank Telescope; 43-meter telescope (also referred to as the 140-foot telescope); Green Bank Solar Radio Burst Spectrometer (45-foot telescope); Interferometer Range (includes three 85-foot diameter telescopes); 20-meter Geodetic Telescope; 40-foot telescope; three non-operational historical telescopes (Jansky Replica Antenna, Reber Radio Telescope, and Ewen-Purcell Horn); and other support facilities and infrastructure.

Project Description

NSF's Division of Astronomical Sciences (AST) is the federal steward for ground-based astronomy in the United States, funding research with awards to individual investigators and small research groups, and via cooperative agreements for operation of large telescope facilities. These national and international telescope facilities provide world-leading, one-of-a-kind observational capabilities on a competitive basis to thousands of astronomers per year. These facilities also enable scientific advances by making archived data products available to researchers. Along with funding telescope facilities and research awards, AST supports the development of advanced technologies and instrumentation, and manages the allocation and assignment of specific frequencies in the radio spectrum for scientific use by the entire NSF community. The need for NSF to reduce funding for the GBO has been established through a number of reviews and surveys conducted by the science community.

In 2014, CH2M conducted a Cultural Resources Evaluation for the architectural resources at the GBO. The results of the survey are included below under "Determinations of Eligibility." The associated technical report, entitled *Cultural Resources Evaluation, Green Bank Observatory, Green Bank, West Virginia*, is attached for reference (Enclosure 1).

A range of preliminary proposed Alternatives is being considered for evaluation. These preliminary proposed Alternatives, which will be refined through public input, include the following:

- Continued NSF investment for science-focused operations (No-Action Alternative).
- Collaboration with interested parties for science- and education-focused operations with reduced NSF-funded scope.

- Collaboration with interested parties for operation as a technology and education park.
- Mothballing of facilities (suspension of operations in a manner such that operations could resume efficiently at some future date).
- Deconstruction and site restoration.

These alternatives may be further refined during the early phases of the compliance review and will be informed by the public process.

Proposed Area of Potential Effects

The Area of Potential Effects (APE) being proposed for the project is defined as the property boundary of GBO. The total geographic area of the Observatory was chosen as the APE to encompass all buildings and structures on the property. This inclusive APE enables a determination of whether GBO constitutes a potential historic district that could be affected by the activities associated with the proposed changes to operations at the Observatory. Figure 2-1 included in Enclosure 1 shows the boundaries of the APE.

Public Involvement

A Notice of Intent (NOI) was published in the Federal Register on October 19, 2016 to initiate the public scoping process for the EIS. A revised NOI was published on November 1, 2016. Two Public Scoping Meetings were conducted on November 9, 2016, at GBO. Section 106 public outreach was addressed as part of the public meeting, and participants were invited to identify whether they would like to participate in Section 106 as a consulting party. Concurrent to the mailing of this letter, NSF will email these potential consulting parties a description of the role of a consulting party and requesting that they confirm their interest. A separate Section 106 consulting party meeting will be scheduled following the release of the Draft EIS this spring. Follow-up discussions with consulting parties will occur as needed.

Previously Identified Historic Properties

A literature review was conducted through the West Virginia State Historic Preservation Office (SHPO) Interactive Map on November 7, 2016. The literature review focused on the APE and included a 0.5-mile study area.

The Reber Radio Telescope is the only structure or building located within GBO that is listed in the NRHP. It was listed in the NRHP in 1972 and designated a National Historic Landmark in 1986. The telescope was listed under Criteria A and B for its nationally significant association with the origins of radio astronomy and for its association with Grote Reber.

One residence within the APE, the Riley House (House #15), was previously recorded in 2011. The associated survey form states that the early twentieth-century wood-frame farm house does not appear to be significant under NRHP Criterion C. The literature

review did not identify any prior cultural resources surveys that have occurred within the APE. Two archaeological sites and nine architectural resources have been recorded outside of the APE, along State Routes 28 and 92, directly adjacent to the eastern boundary of the Observatory. The two previously recorded archaeological resources were not evaluated for the NRHP. One of the architectural resources, the Liberty Presbyterian Church on State Route 92 that was constructed in 1851, is described as significant as an excellent example of Greek Revival architecture, although no formal NRHP evaluation is included with the survey form. The church was recorded on two West Virginia Historic Property Inventory Forms (PH-0002 and PH-0037-0018). Four architectural resources were evaluated as not eligible for the NRHP and three buildings were recorded, but not evaluated for the NRHP. The cultural resources that have been previously recorded within or directly adjacent to the APE are listed below in Table 1. In addition, two surveys (a bridge survey and a cultural resources survey) have occurred and 34 additional cultural resources have been identified within the 0.5-mile study area.

TABLE 1. Previously Recorded Cultural Resources Within and Directly Adjacent to the APE*

Resource Name	Description	Status	Recorded by
Reber Radio Telescope	1937 telescope located at the entrance to GBO within APE	NRHP listed 1972; National Historic Landmark 1986	National Register of Historic Places Registration Form
Riley House (House #15) PH-0331	Circa 1915 farm house within APE	Not eligible for the NRHP	Justin Greenawalt and Mary Stack (Skelly and Loy, Inc.); 2011
Liberty Presbyterian Church PH-0002 PH-0037-0018	1851 Greek Revival Church adjacent to APE	Not formally evaluated for the NRHP, but described as “significant as an excellent example of Greek Revival architecture in the area”	Michael Gioulis (Historic Preservation Consultant); 1993
George Porter Kerr House – Historic Orlan Shears House PH-0037-0040	Circa 1901 residence adjacent to APE	Not evaluated for the NRHP	Sherron Waybright; 1986
Dr. J.P. Mooumau House	1873 residence adjacent to APE	Not evaluated for the NRHP	Jessie B. Powell; 1986

PH-0037-0044			
Hamed House PH-0037-0048	1910 residence adjacent to APE	Not evaluated for the NRHP	Jessie B. Powell; 1986
Jack Nelson House PH-0209	Circa 1900 residence adjacent to the APE	Not eligible for the NRHP	Jeff Drobney (Skelly and Loy, Inc.); 1996
Jerry Thorton House PH-0210	Circa 1880-1890 vernacular residence adjacent to APE	Not eligible for the NRHP	Jeff Drobney (Skelly and Loy, Inc.); 1996
PH-0326	Circa 1920 bungalow residence adjacent to APE	Not eligible for the NRHP	Justin Greenawalt and Mary Stack (Skelly and Loy, Inc.); 2011
PH-0327	Circa 1920 bungalow residence adjacent to APE	Not eligible for the NRHP	Justin Greenawalt and Mary Stack (Skelly and Loy, Inc.); 2011
PH-0332	1949 bungalow residence adjacent to APE	Not eligible for the NRHP	Justin Greenawalt and Mary Stack (Skelly and Loy, Inc.); 2011
Shinaberry's Fifth Grade Site 46-PH-64	Prehistoric open archaeological site adjacent to APE	Not evaluated for the NRHP	Dick Reigel; 1987
Sheets Site 46-PH-27	Prehistoric campsite adjacent to APE	Not evaluated for the NRHP	Stephen Davis; 1977

* Shaded rows indicate previously recorded resources within the APE.

Determination of Eligibility

A Secretary of the Interior-qualified architectural historian with CH2M conducted an intensive architectural survey at the GBO from October 6-9, 2014. The site visit to GBO was also used to engage GBO staff in informal interviews and to conduct archival research, including the review of historic photographs and narratives, newspaper articles, construction records, and architectural drawings.

The field survey encompassed standing structures built in or before 1969, which is 47 years from the present year. The standard NRHP age threshold is 50 years; however,

using 47 years as the cutoff allowed a buffer for the execution of the proposed Alternatives. All built environment resources from 1969 or earlier within the GBO boundary were surveyed and assessed, including a determination of eligibility for listing in the NRHP, except for the Reber Radio Telescope. Buildings and structures were evaluated individually as well as part of a potential historic district.

Using aerial photographs of GBO and information provided by GBO staff, 47 built environment resources that had been constructed in or before 1969 were identified as extant within the APE. These include: 5 telescope structures (one of which contains three large telescopes), 2 horn instruments, 1 antenna, 1 airstrip, 1 water tower, 1 recreation area, 24 residential buildings, and 12 operational and administrative buildings. As noted above, one of these telescopes, the Reber Radio Telescope, was previously evaluated. The remaining 46 built environment resources in the APE built in or before 1969 were photographed and evaluated for NRHP eligibility. Data collected through the background research and field investigations were analyzed to determine NRHP eligibility of the 46 surveyed built environment resources individually. In addition, the Green Bank Telescope, which was constructed after 1969, was evaluated individually due to its exceptional importance to radio astronomy over the last 50 years. All 47 historic-era properties (constructed in or before 1969, including the Reber Radio Telescope) and the GBT were also evaluated as a potential historic district. Properties surveyed in 2014 are listed in Attachment A of Enclosure 1. Figure 5-1, included in Enclosure 1, shows the location of each evaluated built environment resource.

NSF has determined that within the historical context of NRAO/GBO, there are four telescope instruments that are individually eligible for listing in the NRHP: the Interferometer Range, the 40-foot Telescope, the 43-meter Telescope, and the Green Bank Telescope. In addition, NSF has determined that GBO is eligible as a historic district for representing an important time in science history and for its significant contribution to the advancement of radio astronomy. There are 44 resources within the APE that are recommended as contributing to the proposed GBO historic district, the boundaries of which coincide with the site's property boundaries (and the APE). Contributing elements include 8 administrative/operational buildings, 1 airstrip, 1 water tower, 1 recreational area, 24 residential buildings, 2 horns, 1 antenna, and 6 telescopes (the Interferometer includes 3 large telescopes) (Table 2).

The scientific instruments within the APE are a collection of telescopes, horns, and antenna that are significant for their role in the development of radio astronomy and, in several instances, as remarkable feats of engineering. As a whole, the majority of the components that make up the potential district's historic character possess integrity, even though many of the buildings are individually undistinguished. The administrative and operations buildings and structures within the GBO are primarily utilitarian buildings or structures with simple designs executed using practical and standard materials. These elements create a cohesive, visual unit that emphasizes their historically linked function as support for the observatory. As a group, the 44 contributing built environment resources are a distinct and well-preserved representation of the early years of the NRAO,

complete with scientific instruments, administration/operational facilities, recreation area, and residential buildings. Additionally, the scientific instruments present on site illustrate a linear, historical narrative of the history of radio astronomy from the Jansky Replica Antenna and Reber Radio Telescope to the monumental Green Bank Telescope. Four buildings within the APE were identified as non-contributing resources. These include three barns and one cellar building, all of which pre-date the establishment of the NRAO and have been primarily left vacant or used as miscellaneous storage facilities.

Table 2 lists the properties at the GBO that were identified as individually eligible for the NRHP. Attachment A, included in Enclosure 1, lists the buildings that contribute to the NRHP-eligible historic district.

TABLE 2. NRHP-Eligible Built Environment Resources within the APE

Resource Name	Year Constructed	Description/Significance	NRHP Eligibility Recommendation
GBO Historic District	1958-2000	Collection of administrative/operational structures, residential buildings, and radio astronomy equipment associated with the NRAO/GBO.	Eligible (Historic District); 44 contributing resources (Attachment A in Enclosure 1)
Interferometer Range; Howard E. Tatel Telescope (85'-1) and 85'-1 control building; 85'-2 Telescope; 85'-3 Telescope; and the Interferometer control building	85'-1: 1958-1959 85'-2: 1963-1964 85'-3: 1965-1968 Interferometer control building: 1967-1968	The Tatel Telescope (85'-1) was the first telescope constructed by the NRAO and performed the world's first Search For Extra Terrestrial Intelligence (SETI) observations. The Interferometer Range connected two nearly identical telescopes to the Tatel Telescope in a linear formation. The three telescopes operated in unison and proved that dishes could be combined to form very large telescopes. This information spurred the construction of the Very Large Array telescope in New	Individually eligible and contributing to GBO Historic District

TABLE 2. NRHP-Eligible Built Environment Resources within the APE

Resource Name	Year Constructed	Description/Significance	NRHP Eligibility Recommendation
		Mexico in the 1970s.	
40-foot Telescope and control building	1962	First fully automated radio telescope in the world. Currently operates as an educational telescope for visiting students.	Individually eligible and contributing to GBO Historic District
43-meter Telescope	1958-1965	Largest telescope in the world to use an equatorial (for polar aligned) mount. Currently used as part of the Russian Radioastron project.	Individually eligible and contributing to GBO Historic District
Robert C. Byrd Green Bank Telescope (Green Bank Telescope)	1991-2000	Largest moving structure on land in the world; tilt and point design that can rotate a full 360 degrees; performs highly sensitive data collection.	Individually eligible and contributing to GBO Historic District

Initiation of Section 106 Consultation

The GBO is a federally-owned property that contains historic properties. Therefore the Proposed Action has the potential to affect historic properties. In compliance with 36 Code of Federal Regulations (CFR) 800.2(c)(2)(ii), NSF is initiating consultation with you on the proposed changes to GBO operations. NSF is also seeking your input on any cultural resources in the project area or any cultural resources concerns you may have related to this undertaking.

We respectfully request your response within 30 days from receipt of this letter indicating your interest in participating in consultation for this undertaking. Please respond to:

Ms. Elizabeth Pentecost
National Science Foundation
Division of Astronomical Sciences
4201 Wilson Blvd, Suite 1045
Arlington, Virginia 22230
epenteco@nsf.gov

NSF is also transmitting the *Cultural Resources Evaluation, Green Bank Observatory, Green Bank, West Virginia* (attached as Enclosure 1). If you have any questions, please do not hesitate to contact me by phone at 703-292-4592 or by email at cblanco@nsf.gov. We look forward to further consultation on this proposed undertaking.

Regards,

A handwritten signature in black ink that reads "Caroline M. Blanco". The signature is written in a cursive, flowing style.

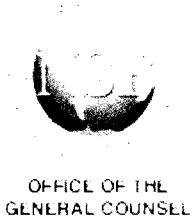
Caroline M. Blanco
Federal Preservation Officer
Assistant General Counsel
Office of the General Counsel

Enclosures:

1. *Cultural Resources Evaluation, Green Bank Observatory, Green Bank, West Virginia*

NATIONAL SCIENCE FOUNDATION

1201 Wilson Boulevard
Arlington, Virginia 22230



December 12, 2016

Ms. Jenne Schenandoah
Onondaga Nation
4040 Route 11
Nedrow, NY 13120

RE: Section 106 Consultation for the Proposed Changes to Green Bank
Observatory Operations, Green Bank, West Virginia

Dear Ms. Schenandoah:

The National Science Foundation (NSF) has identified the need to divest several facilities from its portfolio to retain the balance of capabilities needed to deliver the best performance on the key science of the present decade and beyond. Green Bank Observatory (GBO) in Green Bank, Pocahontas County, West Virginia, is one of the facilities identified for potential divestment. The decision regarding the potential changes to GBO operations is considered a federal undertaking. While engaging in Section 106 consultation under the National Historic Preservation Act (NHPA), NSF will be simultaneously conducting an Environmental Impact Statement (EIS) process under the National Environmental Policy Act (NEPA) to identify potential impacts associated with the proposed operational changes due to funding constraints. With this letter, NSF is formally initiating Section 106 consultation under the NHPA and transmitting the *Cultural Resources Evaluation, Green Bank Observatory, Green Bank, West Virginia* (Enclosure 1) for your review and comment.

Project Location and Background

GBO is located on federal lands adjacent to the Monongahela National Forest. This land is owned by NSF and consists of numerous parcels that were acquired/condemned by the U.S. Army Corps of Engineers in the 1950s when GBO was formed as the first (and then, only) site of the National Radio Astronomy Observatory (NRAO). The GBO is the anchor and administrative site of the 13,000-square-mile National Radio Quiet Zone (NRQZ) and is situated on approximately 2,200 acres in the NRQZ, where all radio transmissions are limited. The GBO facility has a long history of science, technology, engineering, and mathematics education, ranging from student training and mentorships through the outreach and training opportunities offered through the NRAO Center for Science Education, which is based at the GBO site. More than 40,000 visitors each year

pass through the Green Bank Science Center, including students, educators, and the general public who generally stay on site for more than one night to take advantage of the educational facilities. The GBO facility is host to multiple educational workshops and programs each year for middle school through post-graduate student training, and an average of 10 to 15 undergraduate and graduate students are mentored at the facility each year.

GBO facilities include the Green Bank Telescope; 43-meter telescope (also referred to as the 140-foot telescope); Green Bank Solar Radio Burst Spectrometer (45-foot telescope); Interferometer Range (includes three 85-foot diameter telescopes); 20-meter Geodetic Telescope; 40-foot telescope; three non-operational historical telescopes (Jansky Replica Antenna, Reber Radio Telescope, and Ewen-Purcell Horn); and other support facilities and infrastructure.

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Proposed Area of Potential Effects

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One residence within the APE, the Riley House (House #15), was previously recorded in 2011. The associated survey form states that the early twentieth-century wood-frame farm house does not appear to be significant under NRHP Criterion C. The literature review did not identify any prior cultural resources surveys that have occurred within the APE. Two archaeological sites and nine architectural resources have been recorded

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* Shaded rows indicate previously recorded resources within the APE.

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NSF has determined that within the historical context of NRAO/GBO, there are four telescope instruments that are individually eligible for listing in the NRHP: the Interferometer Range, the 40-foot Telescope, the 43-meter Telescope, and the Green Bank Telescope. In addition, NSF has determined that GBO is eligible as a historic district for representing an important time in science history and for its significant contribution to the advancement of radio astronomy. There are 44 resources within the APE that are recommended as contributing to the proposed GBO historic district, the boundaries of which coincide with the site's property boundaries (and the APE). Contributing elements include 8 administrative/operational buildings, 1 airstrip, 1 water tower, 1 recreational area, 24 residential buildings, 2 horns, 1 antenna, and 6 telescopes (the Interferometer includes 3 large telescopes) (Table 2).

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Table 2 lists the properties at the GBO that were identified as individually eligible for the NRHP. Attachment A, included in Enclosure 1, lists the buildings that contribute to the NRHP-eligible historic district.

TABLE 2. NRHP-Eligible Built Environment Resources within the APE

Resource Name	Year Constructed	Description/Significance	NRHP Eligibility Recommendation
GBO Historic District	1958-2000	Collection of administrative/operational structures, residential buildings, and radio astronomy equipment associated with the NRAO/GBO.	Eligible (Historic District); 44 contributing resources (Attachment A in Enclosure 1)
Interferometer Range: Howard E. Tatel Telescope (85'-1) and 85'-1 control building; 85'-2 Telescope; 85'-3 Telescope; and the Interferometer control building	85'-1: 1958-1959 85'-2: 1963-1964 85'-3: 1965-1968 Interferometer control building: 1967-1968	The Tatel Telescope (85'-1) was the first telescope constructed by the NRAO and performed the world's first Search For Extra Terrestrial Intelligence (SETI) observations. The Interferometer Range connected two nearly identical telescopes to the Tatel Telescope in a linear formation. The three telescopes operated in unison and proved that dishes could be combined to form very large telescopes. This information spurred the	Individually eligible and contributing to GBO Historic District

TABLE 2. NRHP-Eligible Built Environment Resources within the APE

Resource Name	Year Constructed	Description/Significance	NRHP Eligibility Recommendation
		construction of the Very Large Array telescope in New Mexico in the 1970s.	
40-foot Telescope and control building	1962	First fully automated radio telescope in the world. Currently operates as an educational telescope for visiting students.	Individually eligible and contributing to GBO Historic District
43-meter Telescope	1958-1965	Largest telescope in the world to use an equatorial (for polar aligned) mount. Currently used as part of the Russian Radioastron project.	Individually eligible and contributing to GBO Historic District
Robert C. Byrd Green Bank Telescope (Green Bank Telescope)	1991-2000	Largest moving structure on land in the world; tilt and point design that can rotate a full 360 degrees; performs highly sensitive data collection.	Individually eligible and contributing to GBO Historic District

Initiation of Section 106 Consultation

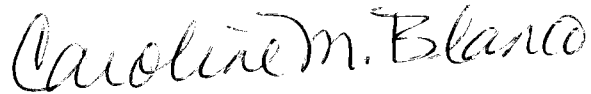
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We respectfully request your response within 30 days from receipt of this letter indicating your interest in participating in consultation for this undertaking. Please respond to:

Ms. Elizabeth Pentecost
National Science Foundation
Division of Astronomical Sciences
4201 Wilson Blvd, Suite 1045
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NSF is also transmitting the *Cultural Resources Evaluation, Green Bank Observatory, Green Bank, West Virginia* (attached as Enclosure 1). If you have any questions, please do not hesitate to contact me by phone at 703-292-4592 or by email at cblanco@nsf.gov. We look forward to further consultation on this proposed undertaking.

Regards,

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Caroline M. Blanco
Federal Preservation Officer
Assistant General Counsel
Office of the General Counsel

Enclosures:

1. *Cultural Resources Evaluation, Green Bank Observatory, Green Bank, West Virginia*

NATIONAL SCIENCE FOUNDATION

4201 Wilson Boulevard
Arlington, Virginia 22230



OFFICE OF THE
GENERAL COUNSELL

December 12, 2016

Dr. Brice Obermeyer
Director, Historic Preservation
Delaware Tribe of Indians
Roosevelt Hall, Rm. 212
1200 Commercial Street
Emporia, KS 66801

RE: Section 106 Consultation for the Proposed Changes to Green Bank
Observatory Operations, Green Bank, West Virginia

Dear Dr. Obermeyer:

The National Science Foundation (NSF) has identified the need to divest several facilities from its portfolio to retain the balance of capabilities needed to deliver the best performance on the key science of the present decade and beyond. Green Bank Observatory (GBO) in Green Bank, Pocahontas County, West Virginia, is one of the facilities identified for potential divestment. The decision regarding the potential changes to GBO operations is considered a federal undertaking. While engaging in Section 106 consultation under the National Historic Preservation Act (NHPA), NSF will be simultaneously conducting an Environmental Impact Statement (EIS) process under the National Environmental Policy Act (NEPA) to identify potential impacts associated with the proposed operational changes due to funding constraints. With this letter, NSF is formally initiating Section 106 consultation under the NHPA and transmitting the *Cultural Resources Evaluation, Green Bank Observatory, Green Bank, West Virginia* (Enclosure 1) for your review and comment.

Project Location and Background

GBO is located on federal lands adjacent to the Monongahela National Forest. This land is owned by NSF and consists of numerous parcels that were acquired/condemned by the U.S. Army Corps of Engineers in the 1950s when GBO was formed as the first (and then, only) site of the National Radio Astronomy Observatory (NRAO). The GBO is the anchor and administrative site of the 13,000-square-mile National Radio Quiet Zone (NRQZ) and is situated on approximately 2,200 acres in the NRQZ, where all radio transmissions are limited. The GBO facility has a long history of science, technology, engineering, and mathematics education, ranging from student training and mentorships

through the outreach and training opportunities offered through the NRAO Center for Science Education, which is based at the GBO site. More than 40,000 visitors each year pass through the Green Bank Science Center, including students, educators, and the general public who generally stay on site for more than one night to take advantage of the educational facilities. The GBO facility is host to multiple educational workshops and programs each year for middle school through post-graduate student training, and an average of 10 to 15 undergraduate and graduate students are mentored at the facility each year.

GBO facilities include the Green Bank Telescope; 43-meter telescope (also referred to as the 140-foot telescope); Green Bank Solar Radio Burst Spectrometer (45-foot telescope); Interferometer Range (includes three 85-foot diameter telescopes); 20-meter Geodetic Telescope; 40-foot telescope; three non-operational historical telescopes (Jansky Replica Antenna, Reber Radio Telescope, and Ewen-Purcell Horn); and other support facilities and infrastructure.

Project Description

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In 2014, CH2M conducted a Cultural Resources Evaluation for the architectural resources at the GBO. The results of the survey are included below under "Determinations of Eligibility." The associated technical report, entitled *Cultural Resources Evaluation, Green Bank Observatory, Green Bank, West Virginia*, is attached for reference (Enclosure 1).

A range of preliminary proposed Alternatives is being considered for evaluation. These preliminary proposed Alternatives, which will be refined through public input, include the following:

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- Collaboration with interested parties for operation as a technology and education park.
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- Deconstruction and site restoration.

These alternatives may be further refined during the early phases of the compliance review and will be informed by the public process.

Proposed Area of Potential Effects

The Area of Potential Effects (APE) being proposed for the project is defined as the property boundary of GBO. The total geographic area of the Observatory was chosen as the APE to encompass all buildings and structures on the property. This inclusive APE enables a determination of whether GBO constitutes a potential historic district that could be affected by the activities associated with the proposed changes to operations at the Observatory. Figure 2-1 included in Enclosure 1 shows the boundaries of the APE.

Public Involvement

A Notice of Intent (NOI) was published in the Federal Register on October 19, 2016 to initiate the public scoping process for the EIS. A revised NOI was published on November 1, 2016. Two Public Scoping Meetings were conducted on November 9, 2016, at GBO. Section 106 public outreach was addressed as part of the public meeting, and participants were invited to identify whether they would like to participate in Section 106 as a consulting party. Concurrent to the mailing of this letter, NSF will email these potential consulting parties a description of the role of a consulting party and requesting that they confirm their interest. A separate Section 106 consulting party meeting will be scheduled following the release of the Draft EIS this spring. Follow-up discussions with consulting parties will occur as needed.

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One residence within the APE, the Riley House (House #15), was previously recorded in 2011. The associated survey form states that the early twentieth-century wood-frame farm house does not appear to be significant under NRHP Criterion C. The literature

review did not identify any prior cultural resources surveys that have occurred within the APE. Two archaeological sites and nine architectural resources have been recorded outside of the APE, along State Routes 28 and 92, directly adjacent to the eastern boundary of the Observatory. The two previously recorded archaeological resources were not evaluated for the NRHP. One of the architectural resources, the Liberty Presbyterian Church on State Route 92 that was constructed in 1851, is described as significant as an excellent example of Greek Revival architecture, although no formal NRHP evaluation is included with the survey form. The church was recorded on two West Virginia Historic Property Inventory Forms (PH-0002 and PH-0037-0018). Four architectural resources were evaluated as not eligible for the NRHP and three buildings were recorded, but not evaluated for the NRHP. The cultural resources that have been previously recorded within or directly adjacent to the APE are listed below in Table 1. In addition, two surveys (a bridge survey and a cultural resources survey) have occurred and 34 additional cultural resources have been identified within the 0.5-mile study area.

TABLE 1. Previously Recorded Cultural Resources Within and Directly Adjacent to the APE*

Resource Name	Description	Status	Recorded by
Reber Radio Telescope	1937 telescope located at the entrance to GBO within APE	NRHP listed 1972; National Historic Landmark 1986	National Register of Historic Places Registration Form
Riley House (House #15) PH-0331	Circa 1915 farm house within APE	Not eligible for the NRHP	Justin Greenawalt and Mary Stack (Skelly and Loy, Inc.); 2011
Liberty Presbyterian Church PH-0002 PH-0037-0018	1851 Greek Revival Church adjacent to APE	Not formally evaluated for the NRHP, but described as “significant as an excellent example of Greek Revival architecture in the area”	Michael Gioulis (Historic Preservation Consultant); 1993
George Porter Kerr House – Historic Orlan Shears House PH-0037-0040	Circa 1901 residence adjacent to APE	Not evaluated for the NRHP	Sherron Waybright; 1986

Dr. J.P. Mooumau House PH-0037-0044	1873 residence adjacent to APE	Not evaluated for the NRHP	Jessie B. Powell; 1986
Hamed House PH-0037-0048	1910 residence adjacent to APE	Not evaluated for the NRHP	Jessie B. Powell; 1986
Jack Nelson House PH-0209	Circa 1900 residence adjacent to the APE	Not eligible for the NRHP	Jeff Drobney (Skelly and Loy, Inc.); 1996
Jerry Thortnon House PH-0210	Circa 1880-1890 vernacular residence adjacent to APE	Not eligible for the NRHP	Jeff Drobney (Skelly and Loy, Inc.); 1996
PH-0326	Circa 1920 bungalow residence adjacent to APE	Not eligible for the NRHP	Justin Greenawalt and Mary Stack (Skelly and Loy, Inc.); 2011
PH-0327	Circa 1920 bungalow residence adjacent to APE	Not eligible for the NRHP	Justin Greenawalt and Mary Stack (Skelly and Loy, Inc.); 2011
PH-0332	1949 bungalow residence adjacent to APE	Not eligible for the NRHP	Justin Greenawalt and Mary Stack (Skelly and Loy, Inc.); 2011
Shinaberry's Fifth Grade Site 46-PH-64	Prehistoric open archaeological site adjacent to APE	Not evaluated for the NRHP	Dick Reigel; 1987
Sheets Site 46-PH-27	Prehistoric campsite adjacent to APE	Not evaluated for the NRHP	Stephen Davis; 1977

* Shaded rows indicate previously recorded resources within the APE.

Determination of Eligibility

A Secretary of the Interior-qualified architectural historian with CH2M conducted an intensive architectural survey at the GBO from October 6-9, 2014. The site visit to GBO was also used to engage GBO staff in informal interviews and to conduct archival research, including the review of historic photographs and narratives, newspaper articles, construction records, and architectural drawings.

The field survey encompassed standing structures built in or before 1969, which is 47 years from the present year. The standard NRHP age threshold is 50 years; however, using 47 years as the cutoff allowed a buffer for the execution of the proposed Alternatives. All built environment resources from 1969 or earlier within the GBO boundary were surveyed and assessed, including a determination of eligibility for listing in the NRHP, except for the Reber Radio Telescope. Buildings and structures were evaluated individually as well as part of a potential historic district.

Using aerial photographs of GBO and information provided by GBO staff, 47 built environment resources that had been constructed in or before 1969 were identified as extant within the APE. These include: 5 telescope structures (one of which contains three large telescopes), 2 horn instruments, 1 antenna, 1 airstrip, 1 water tower, 1 recreation area, 24 residential buildings, and 12 operational and administrative buildings. As noted above, one of these telescopes, the Reber Radio Telescope, was previously evaluated. The remaining 46 built environment resources in the APE built in or before 1969 were photographed and evaluated for NRHP eligibility. Data collected through the background research and field investigations were analyzed to determine NRHP eligibility of the 46 surveyed built environment resources individually. In addition, the Green Bank Telescope, which was constructed after 1969, was evaluated individually due to its exceptional importance to radio astronomy over the last 50 years. All 47 historic-era properties (constructed in or before 1969, including the Reber Radio Telescope) and the GBT were also evaluated as a potential historic district. Properties surveyed in 2014 are listed in Attachment A of Enclosure 1. Figure 5-1, included in Enclosure 1, shows the location of each evaluated built environment resource.

NSF has determined that within the historical context of NRAO/GBO, there are four telescope instruments that are individually eligible for listing in the NRHP: the Interferometer Range, the 40-foot Telescope, the 43-meter Telescope, and the Green Bank Telescope. In addition, NSF has determined that GBO is eligible as a historic district for representing an important time in science history and for its significant contribution to the advancement of radio astronomy. There are 44 resources within the APE that are recommended as contributing to the proposed GBO historic district, the boundaries of which coincide with the site's property boundaries (and the APE). Contributing elements include 8 administrative/operational buildings, 1 airstrip, 1 water tower, 1 recreational area, 24 residential buildings, 2 horns, 1 antenna, and 6 telescopes (the Interferometer includes 3 large telescopes) (Table 2).

The scientific instruments within the APE are a collection of telescopes, horns, and antenna that are significant for their role in the development of radio astronomy and, in several instances, as remarkable feats of engineering. As a whole, the majority of the components that make up the potential district's historic character possess integrity, even though many of the buildings are individually undistinguished. The administrative and operations buildings and structures within the GBO are primarily utilitarian buildings or structures with simple designs executed using practical and standard materials. These elements create a cohesive, visual unit that emphasizes their historically linked function

as support for the observatory. As a group, the 44 contributing built environment resources are a distinct and well-preserved representation of the early years of the NRAO, complete with scientific instruments, administration/operational facilities, recreation area, and residential buildings. Additionally, the scientific instruments present on site illustrate a linear, historical narrative of the history of radio astronomy from the Jansky Replica Antenna and Reber Radio Telescope to the monumental Green Bank Telescope. Four buildings within the APE were identified as non-contributing resources. These include three barns and one cellar building, all of which pre-date the establishment of the NRAO and have been primarily left vacant or used as miscellaneous storage facilities.

Table 2 lists the properties at the GBO that were identified as individually eligible for the NRHP. Attachment A, included in Enclosure 1, lists the buildings that contribute to the NRHP-eligible historic district.

TABLE 2. NRHP-Eligible Built Environment Resources within the APE

Resource Name	Year Constructed	Description/Significance	NRHP Eligibility Recommendation
GBO Historic District	1958-2000	Collection of administrative/operational structures, residential buildings, and radio astronomy equipment associated with the NRAO/GBO.	Eligible (Historic District); 44 contributing resources (Attachment A in Enclosure 1)
Interferometer Range: Howard E. Tatel Telescope (85'-1) and 85'-1 control building; 85'-2 Telescope; 85'-3 Telescope; and the Interferometer control building	85'-1: 1958-1959 85'-2: 1963-1964 85'-3: 1965-1968 Interferometer control building: 1967-1968	The Tatel Telescope (85'-1) was the first telescope constructed by the NRAO and performed the world's first Search For Extra Terrestrial Intelligence (SETI) observations. The Interferometer Range connected two nearly identical telescopes to the Tatel Telescope in a linear formation. The three telescopes operated in unison and proved that dishes could be combined to form very large telescopes. This information spurred the	Individually eligible and contributing to GBO Historic District

TABLE 2. NRHP-Eligible Built Environment Resources within the APE

Resource Name	Year Constructed	Description/Significance	NRHP Eligibility Recommendation
		construction of the Very Large Array telescope in New Mexico in the 1970s.	
40-foot Telescope and control building	1962	First fully automated radio telescope in the world. Currently operates as an educational telescope for visiting students.	Individually eligible and contributing to GBO Historic District
43-meter Telescope	1958-1965	Largest telescope in the world to use an equatorial (for polar aligned) mount. Currently used as part of the Russian Radioastron project.	Individually eligible and contributing to GBO Historic District
Robert C. Byrd Green Bank Telescope (Green Bank Telescope)	1991-2000	Largest moving structure on land in the world; tilt and point design that can rotate a full 360 degrees; performs highly sensitive data collection.	Individually eligible and contributing to GBO Historic District

Initiation of Section 106 Consultation

The GBO is a federally-owned property that contains historic properties. Therefore the Proposed Action has the potential to affect historic properties. In compliance with 36 Code of Federal Regulations (CFR) 800.2(c)(2)(ii), NSF is initiating consultation with you on the proposed changes to GBO operations. NSF is also seeking your input on any cultural resources in the project area or any cultural resources concerns you may have related to this undertaking.

We respectfully request your response within 30 days from receipt of this letter indicating your interest in participating in consultation for this undertaking. Please respond to:

Ms. Elizabeth Pentecost
National Science Foundation
Division of Astronomical Sciences
4201 Wilson Blvd, Suite 1045
Arlington, Virginia 22230
epenteco@nsf.gov

NSF is also transmitting the *Cultural Resources Evaluation, Green Bank Observatory, Green Bank, West Virginia* (attached as Enclosure 1). If you have any questions, please do not hesitate to contact me by phone at 703-292-4592 or by email at cblanco@nsf.gov. We look forward to further consultation on this proposed undertaking.

Regards,

A handwritten signature in black ink that reads "Caroline M. Blanco". The signature is written in a cursive, flowing style.

Caroline M. Blanco
Federal Preservation Officer
Assistant General Counsel
Office of the General Counsel

Enclosures:

1. *Cultural Resources Evaluation, Green Bank Observatory, Green Bank, West Virginia*

NATIONAL SCIENCE FOUNDATION

4201 Wilson Boulevard
Arlington, Virginia 22230



OFFICE OF THE
GENERAL COUNSELL

December 12, 2016

Mr. Russ Townsend
Tribal Historic Preservation Officer
PO Box 455
Cherokee, NC 28719

RE: Section 106 Consultation for the Proposed Changes to Green Bank
Observatory Operations, Green Bank, West Virginia

Dear Mr. Townsend:

The National Science Foundation (NSF) has identified the need to divest several facilities from its portfolio to retain the balance of capabilities needed to deliver the best performance on the key science of the present decade and beyond. Green Bank Observatory (GBO) in Green Bank, Pocahontas County, West Virginia, is one of the facilities identified for potential divestment. The decision regarding the potential changes to GBO operations is considered a federal undertaking. While engaging in Section 106 consultation under the National Historic Preservation Act (NHPA), NSF will be simultaneously conducting an Environmental Impact Statement (EIS) process under the National Environmental Policy Act (NEPA) to identify potential impacts associated with the proposed operational changes due to funding constraints. With this letter, NSF is formally initiating Section 106 consultation under the NHPA and transmitting the *Cultural Resources Evaluation, Green Bank Observatory, Green Bank, West Virginia* (Enclosure 1) for your review and comment.

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The Area of Potential Effects (APE) being proposed for the project is defined as the property boundary of GBO. The total geographic area of the Observatory was chosen as the APE to encompass all buildings and structures on the property. This inclusive APE enables a determination of whether GBO constitutes a potential historic district that could be affected by the activities associated with the proposed changes to operations at the Observatory. Figure 2-1 included in Enclosure 1 shows the boundaries of the APE.

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Table 2 lists the properties at the GBO that were identified as individually eligible for the NRHP. Attachment A, included in Enclosure 1, lists the buildings that contribute to the NRHP-eligible historic district.

TABLE 2. NRHP-Eligible Built Environment Resources within the APE

Resource Name	Year Constructed	Description/Significance	NRHP Eligibility Recommendation
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Interferometer Range: Howard E. Tatel Telescope (85'-1) and 85'-1 control building; 85'-2 Telescope; 85'-3 Telescope; and the Interferometer control building	85'-1: 1958-1959 85'-2: 1963-1964 85'-3: 1965-1968 Interferometer control building: 1967-1968	The Tatel Telescope (85'-1) was the first telescope constructed by the NRAO and performed the world's first Search For Extra Terrestrial Intelligence (SETI) observations. The Interferometer Range connected two nearly identical telescopes to the Tatel Telescope in a linear formation. The three telescopes operated in unison and proved that dishes could be combined to form very large telescopes. This information spurred the construction of the Very Large Array telescope in New Mexico in the 1970s.	Individually eligible and contributing to GBO Historic District

TABLE 2. NRHP-Eligible Built Environment Resources within the APE

Resource Name	Year Constructed	Description/Significance	NRHP Eligibility Recommendation
40-foot Telescope and control building	1962	First fully automated radio telescope in the world. Currently operates as an educational telescope for visiting students.	Individually eligible and contributing to GBO Historic District
43-meter Telescope	1958-1965	Largest telescope in the world to use an equatorial (for polar aligned) mount. Currently used as part of the Russian Radioastron project.	Individually eligible and contributing to GBO Historic District
Robert C. Byrd Green Bank Telescope (Green Bank Telescope)	1991-2000	Largest moving structure on land in the world; tilt and point design that can rotate a full 360 degrees; performs highly sensitive data collection.	Individually eligible and contributing to GBO Historic District

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We respectfully request your response within 30 days from receipt of this letter indicating your interest in participating in consultation for this undertaking. Please respond to:

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do not hesitate to contact me by phone at 703-292-4592 or by email at cblanco@nsf.gov.
We look forward to further consultation on this proposed undertaking.

Regards,

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Caroline M. Blanco
Federal Preservation Officer
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Enclosures:

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NATIONAL SCIENCE FOUNDATION

1201 Wilson Boulevard
Arlington, Virginia 22230



OFFICE OF THE
GENERAL COUNSELL

December 12, 2016

Ms. Sheila Bird
Tribal Historic Preservation Officer
Cherokee Nation
PO Box 948
Tahlequah, OK 74465

RE: Section 106 Consultation for the Proposed Changes to Green Bank
Observatory Operations, Green Bank, West Virginia

Dear Ms. Bird:

The National Science Foundation (NSF) has identified the need to divest several facilities from its portfolio to retain the balance of capabilities needed to deliver the best performance on the key science of the present decade and beyond. Green Bank Observatory (GBO) in Green Bank, Pocahontas County, West Virginia, is one of the facilities identified for potential divestment. The decision regarding the potential changes to GBO operations is considered a federal undertaking. While engaging in Section 106 consultation under the National Historic Preservation Act (NHPA), NSF will be simultaneously conducting an Environmental Impact Statement (EIS) process under the National Environmental Policy Act (NEPA) to identify potential impacts associated with the proposed operational changes due to funding constraints. With this letter, NSF is formally initiating Section 106 consultation under the NHPA and transmitting the *Cultural Resources Evaluation, Green Bank Observatory, Green Bank, West Virginia* (Enclosure 1) for your review and comment.

Project Location and Background

GBO is located on federal lands adjacent to the Monongahela National Forest. This land is owned by NSF and consists of numerous parcels that were acquired/condemned by the U.S. Army Corps of Engineers in the 1950s when GBO was formed as the first (and then, only) site of the National Radio Astronomy Observatory (NRAO). The GBO is the anchor and administrative site of the 13,000-square-mile National Radio Quiet Zone (NRQZ) and is situated on approximately 2,200 acres in the NRQZ, where all radio transmissions are limited. The GBO facility has a long history of science, technology, engineering, and mathematics education, ranging from student training and mentorships through the outreach and training opportunities offered through the NRAO Center for Science Education, which is based at the GBO site. More than 40,000 visitors each year

pass through the Green Bank Science Center, including students, educators, and the general public who generally stay on site for more than one night to take advantage of the educational facilities. The GBO facility is host to multiple educational workshops and programs each year for middle school through post-graduate student training, and an average of 10 to 15 undergraduate and graduate students are mentored at the facility each year.

GBO facilities include the Green Bank Telescope; 43-meter telescope (also referred to as the 140-foot telescope); Green Bank Solar Radio Burst Spectrometer (45-foot telescope); Interferometer Range (includes three 85-foot diameter telescopes); 20-meter Geodetic Telescope; 40-foot telescope; three non-operational historical telescopes (Jansky Replica Antenna, Reber Radio Telescope, and Ewen-Purcell Horn); and other support facilities and infrastructure.

Project Description

NSF's Division of Astronomical Sciences (AST) is the federal steward for ground-based astronomy in the United States, funding research with awards to individual investigators and small research groups, and via cooperative agreements for operation of large telescope facilities. These national and international telescope facilities provide world-leading, one-of-a-kind observational capabilities on a competitive basis to thousands of astronomers per year. These facilities also enable scientific advances by making archived data products available to researchers. Along with funding telescope facilities and research awards, AST supports the development of advanced technologies and instrumentation, and manages the allocation and assignment of specific frequencies in the radio spectrum for scientific use by the entire NSF community. The need for NSF to reduce funding for the GBO has been established through a number of reviews and surveys conducted by the science community.

In 2014, CH2M conducted a Cultural Resources Evaluation for the architectural resources at the GBO. The results of the survey are included below under "Determinations of Eligibility." The associated technical report, entitled *Cultural Resources Evaluation, Green Bank Observatory, Green Bank, West Virginia*, is attached for reference (Enclosure 1).

A range of preliminary proposed Alternatives is being considered for evaluation. These preliminary proposed Alternatives, which will be refined through public input, include the following:

- Continued NSF investment for science-focused operations (No-Action Alternative).
- Collaboration with interested parties for science- and education-focused operations with reduced NSF-funded scope.
- Collaboration with interested parties for operation as a technology and education park.

- Mothballing of facilities (suspension of operations in a manner such that operations could resume efficiently at some future date).
- Deconstruction and site restoration.

These alternatives may be further refined during the early phases of the compliance review and will be informed by the public process.

Proposed Area of Potential Effects

The Area of Potential Effects (APE) being proposed for the project is defined as the property boundary of GBO. The total geographic area of the Observatory was chosen as the APE to encompass all buildings and structures on the property. This inclusive APE enables a determination of whether GBO constitutes a potential historic district that could be affected by the activities associated with the proposed changes to operations at the Observatory. Figure 2-1 included in Enclosure 1 shows the boundaries of the APE.

Public Involvement

A Notice of Intent (NOI) was published in the Federal Register on October 19, 2016 to initiate the public scoping process for the EIS. A revised NOI was published on November 1, 2016. Two Public Scoping Meetings were conducted on November 9, 2016, at GBO. Section 106 public outreach was addressed as part of the public meeting, and participants were invited to identify whether they would like to participate in Section 106 as a consulting party. Concurrent to the mailing of this letter, NSF will email these potential consulting parties a description of the role of a consulting party and requesting that they confirm their interest. A separate Section 106 consulting party meeting will be scheduled following the release of the Draft EIS this spring. Follow-up discussions with consulting parties will occur as needed.

Previously Identified Historic Properties

A literature review was conducted through the West Virginia State Historic Preservation Office (SHPO) Interactive Map on November 7, 2016. The literature review focused on the APE and included a 0.5-mile study area.

The Reber Radio Telescope is the only structure or building located within GBO that is listed in the NRHP. It was listed in the NRHP in 1972 and designated a National Historic Landmark in 1986. The telescope was listed under Criteria A and B for its nationally significant association with the origins of radio astronomy and for its association with Grote Reber.

One residence within the APE, the Riley House (House #15), was previously recorded in 2011. The associated survey form states that the early twentieth-century wood-frame farm house does not appear to be significant under NRHP Criterion C. The literature review did not identify any prior cultural resources surveys that have occurred within the APE. Two archaeological sites and nine architectural resources have been recorded

outside of the APE, along State Routes 28 and 92, directly adjacent to the eastern boundary of the Observatory. The two previously recorded archaeological resources were not evaluated for the NRHP. One of the architectural resources, the Liberty Presbyterian Church on State Route 92 that was constructed in 1851, is described as significant as an excellent example of Greek Revival architecture, although no formal NRHP evaluation is included with the survey form. The church was recorded on two West Virginia Historic Property Inventory Forms (PH-0002 and PH-0037-0018). Four architectural resources were evaluated as not eligible for the NRHP and three buildings were recorded, but not evaluated for the NRHP. The cultural resources that have been previously recorded within or directly adjacent to the APE are listed below in Table 1. In addition, two surveys (a bridge survey and a cultural resources survey) have occurred and 34 additional cultural resources have been identified within the 0.5-mile study area.

TABLE 1. Previously Recorded Cultural Resources Within and Directly Adjacent to the APE*

Resource Name	Description	Status	Recorded by
Reber Radio Telescope	1937 telescope located at the entrance to GBO within APE	NRHP listed 1972; National Historic Landmark 1986	National Register of Historic Places Registration Form
Riley House (House #15) PH-0331	Circa 1915 farm house within APE	Not eligible for the NRHP	Justin Greenawalt and Mary Stack (Skelly and Loy, Inc.); 2011
Liberty Presbyterian Church PH-0002 PH-0037-0018	1851 Greek Revival Church adjacent to APE	Not formally evaluated for the NRHP, but described as “significant as an excellent example of Greek Revival architecture in the area”	Michael Gioulis (Historic Preservation Consultant); 1993
George Porter Kerr House – Historic Orlan Shears House PH-0037-0040	Circa 1901 residence adjacent to APE	Not evaluated for the NRHP	Sherron Waybright; 1986
Dr. J.P. Mooumau House PH-0037-0044	1873 residence adjacent to APE	Not evaluated for the NRHP	Jessie B. Powell; 1986

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Jack Nelson House PH-0209	Circa 1900 residence adjacent to the APE	Not eligible for the NRHP	Jeff Drobney (Skelly and Loy, Inc.); 1996
Jerry Thorton House PH-0210	Circa 1880-1890 vernacular residence adjacent to APE	Not eligible for the NRHP	Jeff Drobney (Skelly and Loy, Inc.); 1996
PH-0326	Circa 1920 bungalow residence adjacent to APE	Not eligible for the NRHP	Justin Greenawalt and Mary Stack (Skelly and Loy, Inc.); 2011
PH-0327	Circa 1920 bungalow residence adjacent to APE	Not eligible for the NRHP	Justin Greenawalt and Mary Stack (Skelly and Loy, Inc.); 2011
PH-0332	1949 bungalow residence adjacent to APE	Not eligible for the NRHP	Justin Greenawalt and Mary Stack (Skelly and Loy, Inc.); 2011
Shinaberry's Fifth Grade Site 46-PH-64	Prehistoric open archaeological site adjacent to APE	Not evaluated for the NRHP	Dick Reigel; 1987
Sheets Site 46-PH-27	Prehistoric campsite adjacent to APE	Not evaluated for the NRHP	Stephen Davis; 1977

* Shaded rows indicate previously recorded resources within the APE.

Determination of Eligibility

A Secretary of the Interior-qualified architectural historian with CH2M conducted an intensive architectural survey at the GBO from October 6-9, 2014. The site visit to GBO was also used to engage GBO staff in informal interviews and to conduct archival research, including the review of historic photographs and narratives, newspaper articles, construction records, and architectural drawings.

The field survey encompassed standing structures built in or before 1969, which is 47 years from the present year. The standard NRHP age threshold is 50 years; however, using 47 years as the cutoff allowed a buffer for the execution of the proposed Alternatives. All built environment resources from 1969 or earlier within the GBO boundary were surveyed and assessed, including a determination of eligibility for listing

in the NRHP, except for the Reber Radio Telescope. Buildings and structures were evaluated individually as well as part of a potential historic district.

Using aerial photographs of GBO and information provided by GBO staff, 47 built environment resources that had been constructed in or before 1969 were identified as extant within the APE. These include: 5 telescope structures (one of which contains three large telescopes), 2 horn instruments, 1 antenna, 1 airstrip, 1 water tower, 1 recreation area, 24 residential buildings, and 12 operational and administrative buildings. As noted above, one of these telescopes, the Reber Radio Telescope, was previously evaluated. The remaining 46 built environment resources in the APE built in or before 1969 were photographed and evaluated for NRHP eligibility. Data collected through the background research and field investigations were analyzed to determine NRHP eligibility of the 46 surveyed built environment resources individually. In addition, the Green Bank Telescope, which was constructed after 1969, was evaluated individually due to its exceptional importance to radio astronomy over the last 50 years. All 47 historic-era properties (constructed in or before 1969, including the Reber Radio Telescope) and the GBT were also evaluated as a potential historic district. Properties surveyed in 2014 are listed in Attachment A of Enclosure 1. Figure 5-1, included in Enclosure 1, shows the location of each evaluated built environment resource.

NSF has determined that within the historical context of NRAO/GBO, there are four telescope instruments that are individually eligible for listing in the NRHP: the Interferometer Range, the 40-foot Telescope, the 43-meter Telescope, and the Green Bank Telescope. In addition, NSF has determined that GBO is eligible as a historic district for representing an important time in science history and for its significant contribution to the advancement of radio astronomy. There are 44 resources within the APE that are recommended as contributing to the proposed GBO historic district, the boundaries of which coincide with the site's property boundaries (and the APE). Contributing elements include 8 administrative/operational buildings, 1 airstrip, 1 water tower, 1 recreational area, 24 residential buildings, 2 horns, 1 antenna, and 6 telescopes (the Interferometer includes 3 large telescopes) (Table 2).

The scientific instruments within the APE are a collection of telescopes, horns, and antenna that are significant for their role in the development of radio astronomy and, in several instances, as remarkable feats of engineering. As a whole, the majority of the components that make up the potential district's historic character possess integrity, even though many of the buildings are individually undistinguished. The administrative and operations buildings and structures within the GBO are primarily utilitarian buildings or structures with simple designs executed using practical and standard materials. These elements create a cohesive, visual unit that emphasizes their historically linked function as support for the observatory. As a group, the 44 contributing built environment resources are a distinct and well-preserved representation of the early years of the NRAO, complete with scientific instruments, administration/operational facilities, recreation area, and residential buildings. Additionally, the scientific instruments present on site illustrate a linear, historical narrative of the history of radio astronomy from the Jansky Replica

Antenna and Reber Radio Telescope to the monumental Green Bank Telescope. Four buildings within the APE were identified as non-contributing resources. These include three barns and one cellar building, all of which pre-date the establishment of the NRAO and have been primarily left vacant or used as miscellaneous storage facilities.

Table 2 lists the properties at the GBO that were identified as individually eligible for the NRHP. Attachment A, included in Enclosure 1, lists the buildings that contribute to the NRHP-eligible historic district.

TABLE 2. NRHP-Eligible Built Environment Resources within the APE

Resource Name	Year Constructed	Description/Significance	NRHP Eligibility Recommendation
GBO Historic District	1958-2000	Collection of administrative/operational structures, residential buildings, and radio astronomy equipment associated with the NRAO/GBO.	Eligible (Historic District); 44 contributing resources (Attachment A in Enclosure 1)
Interferometer Range; Howard E. Tatel Telescope (85'-1) and 85'-1 control building; 85'-2 Telescope; 85'-3 Telescope; and the Interferometer control building	85'-1: 1958-1959 85'-2: 1963-1964 85'-3: 1965-1968 Interferometer control building: 1967-1968	The Tatel Telescope (85'-1) was the first telescope constructed by the NRAO and performed the world's first Search For Extra Terrestrial Intelligence (SETI) observations. The Interferometer Range connected two nearly identical telescopes to the Tatel Telescope in a linear formation. The three telescopes operated in unison and proved that dishes could be combined to form very large telescopes. This information spurred the construction of the Very Large Array telescope in New Mexico in the 1970s.	Individually eligible and contributing to GBO Historic District

TABLE 2. NRHP-Eligible Built Environment Resources within the APE

Resource Name	Year Constructed	Description/Significance	NRHP Eligibility Recommendation
40-foot Telescope and control building	1962	First fully automated radio telescope in the world. Currently operates as an educational telescope for visiting students.	Individually eligible and contributing to GBO Historic District
43-meter Telescope	1958-1965	Largest telescope in the world to use an equatorial (for polar aligned) mount. Currently used as part of the Russian Radioastron project.	Individually eligible and contributing to GBO Historic District
Robert C. Byrd Green Bank Telescope (Green Bank Telescope)	1991-2000	Largest moving structure on land in the world; tilt and point design that can rotate a full 360 degrees; performs highly sensitive data collection.	Individually eligible and contributing to GBO Historic District

Initiation of Section 106 Consultation

The GBO is a federally-owned property that contains historic properties. Therefore the Proposed Action has the potential to affect historic properties. In compliance with 36 Code of Federal Regulations (CFR) 800.2(c)(2)(ii), NSF is initiating consultation with you on the proposed changes to GBO operations. NSF is also seeking your input on any cultural resources in the project area or any cultural resources concerns you may have related to this undertaking.


We respectfully request your response within 30 days from receipt of this letter indicating your interest in participating in consultation for this undertaking. Please respond to:

Ms. Elizabeth Pentecost
National Science Foundation
Division of Astronomical Sciences
4201 Wilson Blvd, Suite 1045
Arlington, Virginia 22230
epenteco@nsf.gov

NSF is also transmitting the *Cultural Resources Evaluation, Green Bank Observatory, Green Bank, West Virginia* (attached as Enclosure 1). If you have any questions, please

do not hesitate to contact me by phone at 703-292-4592 or by email at cblanco@nsf.gov.
We look forward to further consultation on this proposed undertaking.

Regards,

A handwritten signature in black ink that reads "Caroline M. Blanco". The signature is written in a cursive, flowing style.

Caroline M. Blanco
Federal Preservation Officer
Assistant General Counsel
Office of the General Counsel

Enclosures:

1. *Cultural Resources Evaluation, Green Bank Observatory, Green Bank, West Virginia*

NATIONAL SCIENCE FOUNDATION

4201 Wilson Boulevard
Arlington, Virginia 22230



OFFICE OF THE
GENERAL COUNSEL

December 12, 2016

Mr. Clint Halftown
Cayuga Nation
PO Box 803, 2540 NY-89
Seneca Falls, NY 13148

RE: Section 106 Consultation for the Proposed Changes to Green Bank
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Table 2 lists the properties at the GBO that were identified as individually eligible for the NRHP. Attachment A, included in Enclosure 1, lists the buildings that contribute to the NRHP-eligible historic district.

TABLE 2. NRHP-Eligible Built Environment Resources within the APE

Resource Name	Year Constructed	Description/Significance	NRHP Eligibility Recommendation
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Interferometer Range; Howard E. Tatel Telescope (85'-1) and 85'-1 control building; 85'-2 Telescope; 85'-3 Telescope; and the Interferometer control building	85'-1: 1958-1959 85'-2: 1963-1964 85'-3: 1965-1968 Interferometer control building: 1967-1968	The Tatel Telescope (85'-1) was the first telescope constructed by the NRAO and performed the world's first Search For Extra Terrestrial Intelligence (SETI) observations. The Interferometer Range connected two nearly identical telescopes to the Tatel Telescope in a linear formation. The three telescopes operated in unison and proved that dishes could be combined to form very large telescopes. This information spurred the construction of the Very Large Array telescope in New Mexico in the 1970s.	Individually eligible and contributing to GBO Historic District

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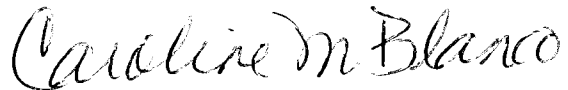
We respectfully request your response within 30 days from receipt of this letter indicating your interest in participating in consultation for this undertaking. Please respond to:

Ms. Elizabeth Pentecost
National Science Foundation
Division of Astronomical Sciences
4201 Wilson Blvd, Suite 1045
Arlington, Virginia 22230
epenteco@nsf.gov

NSF is also transmitting the *Cultural Resources Evaluation, Green Bank Observatory, Green Bank, West Virginia* (attached as Enclosure 1). If you have any questions, please

do not hesitate to contact me by phone at 703-292-4592 or by email at cblanco@nsf.gov.
We look forward to further consultation on this proposed undertaking.

Regards,

A handwritten signature in black ink that reads "Caroline M. Blanco". The signature is written in a cursive, flowing style.

Caroline M. Blanco
Federal Preservation Officer
Assistant General Counsel
Office of the General Counsel

Enclosures:

1. *Cultural Resources Evaluation, Green Bank Observatory, Green Bank, West Virginia*

NATIONAL SCIENCE FOUNDATION

1201 Wilson Boulevard
Arlington, Virginia 22230



December 12, 2016

Mr. Leonard Longhorn
Tribal Historic Preservation Officer
Absentee Shawnee Tribe of Oklahoma
2025 S Gordon Cooper Drive
Shawnee, OK 74801

RE: Section 106 Consultation for the Proposed Changes to Green Bank
Observatory Operations, Green Bank, West Virginia

Dear Mr. Longhorn:

The National Science Foundation (NSF) has identified the need to divest several facilities from its portfolio to retain the balance of capabilities needed to deliver the best performance on the key science of the present decade and beyond. Green Bank Observatory (GBO) in Green Bank, Pocahontas County, West Virginia, is one of the facilities identified for potential divestment. The decision regarding the potential changes to GBO operations is considered a federal undertaking. While engaging in Section 106 consultation under the National Historic Preservation Act (NHPA), NSF will be simultaneously conducting an Environmental Impact Statement (EIS) process under the National Environmental Policy Act (NEPA) to identify potential impacts associated with the proposed operational changes due to funding constraints. With this letter, NSF is formally initiating Section 106 consultation under the NHPA and transmitting the *Cultural Resources Evaluation, Green Bank Observatory, Green Bank, West Virginia* (Enclosure 1) for your review and comment.

Project Location and Background

GBO is located on federal lands adjacent to the Monongahela National Forest. This land is owned by NSF and consists of numerous parcels that were acquired/condemned by the U.S. Army Corps of Engineers in the 1950s when GBO was formed as the first (and then, only) site of the National Radio Astronomy Observatory (NRAO). The GBO is the anchor and administrative site of the 13,000-square-mile National Radio Quiet Zone (NRQZ) and is situated on approximately 2,200 acres in the NRQZ, where all radio transmissions are limited. The GBO facility has a long history of science, technology, engineering, and mathematics education, ranging from student training and mentorships through the outreach and training opportunities offered through the NRAO Center for

Science Education, which is based at the GBO site. More than 40,000 visitors each year pass through the Green Bank Science Center, including students, educators, and the general public who generally stay on site for more than one night to take advantage of the educational facilities. The GBO facility is host to multiple educational workshops and programs each year for middle school through post-graduate student training, and an average of 10 to 15 undergraduate and graduate students are mentored at the facility each year.

GBO facilities include the Green Bank Telescope; 43-meter telescope (also referred to as the 140-foot telescope); Green Bank Solar Radio Burst Spectrometer (45-foot telescope); Interferometer Range (includes three 85-foot diameter telescopes); 20-meter Geodetic Telescope; 40-foot telescope; three non-operational historical telescopes (Jansky Replica Antenna, Reber Radio Telescope, and Ewen-Purcell Horn); and other support facilities and infrastructure.

Project Description

NSF's Division of Astronomical Sciences (AST) is the federal steward for ground-based astronomy in the United States, funding research with awards to individual investigators and small research groups, and via cooperative agreements for operation of large telescope facilities. These national and international telescope facilities provide world-leading, one-of-a-kind observational capabilities on a competitive basis to thousands of astronomers per year. These facilities also enable scientific advances by making archived data products available to researchers. Along with funding telescope facilities and research awards, AST supports the development of advanced technologies and instrumentation, and manages the allocation and assignment of specific frequencies in the radio spectrum for scientific use by the entire NSF community. The need for NSF to reduce funding for the GBO has been established through a number of reviews and surveys conducted by the science community.

In 2014, CH2M conducted a Cultural Resources Evaluation for the architectural resources at the GBO. The results of the survey are included below under "Determinations of Eligibility." The associated technical report, entitled *Cultural Resources Evaluation, Green Bank Observatory, Green Bank, West Virginia*, is attached for reference (Enclosure 1).

A range of preliminary proposed Alternatives is being considered for evaluation. These preliminary proposed Alternatives, which will be refined through public input, include the following:

- Continued NSF investment for science-focused operations (No-Action Alternative).
- Collaboration with interested parties for science- and education-focused operations with reduced NSF-funded scope.

- Collaboration with interested parties for operation as a technology and education park.
- Mothballing of facilities (suspension of operations in a manner such that operations could resume efficiently at some future date).
- Deconstruction and site restoration.

These alternatives may be further refined during the early phases of the compliance review and will be informed by the public process.

Proposed Area of Potential Effects

The Area of Potential Effects (APE) being proposed for the project is defined as the property boundary of GBO. The total geographic area of the Observatory was chosen as the APE to encompass all buildings and structures on the property. This inclusive APE enables a determination of whether GBO constitutes a potential historic district that could be affected by the activities associated with the proposed changes to operations at the Observatory. Figure 2-1 included in Enclosure 1 shows the boundaries of the APE.

Public Involvement

A Notice of Intent (NOI) was published in the Federal Register on October 19, 2016 to initiate the public scoping process for the EIS. A revised NOI was published on November 1, 2016. Two Public Scoping Meetings were conducted on November 9, 2016, at GBO. Section 106 public outreach was addressed as part of the public meeting, and participants were invited to identify whether they would like to participate in Section 106 as a consulting party. Concurrent to the mailing of this letter, NSF will email these potential consulting parties a description of the role of a consulting party and requesting that they confirm their interest. A separate Section 106 consulting party meeting will be scheduled following the release of the Draft EIS this spring. Follow-up discussions with consulting parties will occur as needed.

Previously Identified Historic Properties

A literature review was conducted through the West Virginia State Historic Preservation Office (SHPO) Interactive Map on November 7, 2016. The literature review focused on the APE and included a 0.5-mile study area.

The Reber Radio Telescope is the only structure or building located within GBO that is listed in the NRHP. It was listed in the NRHP in 1972 and designated a National Historic Landmark in 1986. The telescope was listed under Criteria A and B for its nationally significant association with the origins of radio astronomy and for its association with Grote Reber.

One residence within the APE, the Riley House (House #15), was previously recorded in 2011. The associated survey form states that the early twentieth-century wood-frame farm house does not appear to be significant under NRHP Criterion C. The literature

review did not identify any prior cultural resources surveys that have occurred within the APE. Two archaeological sites and nine architectural resources have been recorded outside of the APE, along State Routes 28 and 92, directly adjacent to the eastern boundary of the Observatory. The two previously recorded archaeological resources were not evaluated for the NRHP. One of the architectural resources, the Liberty Presbyterian Church on State Route 92 that was constructed in 1851, is described as significant as an excellent example of Greek Revival architecture, although no formal NRHP evaluation is included with the survey form. The church was recorded on two West Virginia Historic Property Inventory Forms (PH-0002 and PH-0037-0018). Four architectural resources were evaluated as not eligible for the NRHP and three buildings were recorded, but not evaluated for the NRHP. The cultural resources that have been previously recorded within or directly adjacent to the APE are listed below in Table 1. In addition, two surveys (a bridge survey and a cultural resources survey) have occurred and 34 additional cultural resources have been identified within the 0.5-mile study area.

TABLE 1. Previously Recorded Cultural Resources Within and Directly Adjacent to the APE*

Resource Name	Description	Status	Recorded by
Reber Radio Telescope	1937 telescope located at the entrance to GBO within APE	NRHP listed 1972; National Historic Landmark 1986	National Register of Historic Places Registration Form
Riley House (House #15) PH-0331	Circa 1915 farm house within APE	Not eligible for the NRHP	Justin Greenawalt and Mary Stack (Skelly and Loy, Inc.); 2011
Liberty Presbyterian Church PH-0002 PH-0037-0018	1851 Greek Revival Church adjacent to APE	Not formally evaluated for the NRHP, but described as “significant as an excellent example of Greek Revival architecture in the area”	Michael Gioulis (Historic Preservation Consultant); 1993
George Porter Kerr House – Historic Orlan Shears House PH-0037-0040	Circa 1901 residence adjacent to APE	Not evaluated for the NRHP	Sherron Waybright; 1986
Dr. J.P. Mooumau House PH-0037-0044	1873 residence adjacent to APE	Not evaluated for the NRHP	Jessie B. Powell; 1986

Hamed House PH-0037-0048	1910 residence adjacent to APE	Not evaluated for the NRHP	Jessie B. Powell; 1986
Jack Nelson House PH-0209	Circa 1900 residence adjacent to the APE	Not eligible for the NRHP	Jeff Drobney (Skelly and Loy, Inc.); 1996
Jerry Thorton House PH-0210	Circa 1880-1890 vernacular residence adjacent to APE	Not eligible for the NRHP	Jeff Drobney (Skelly and Loy, Inc.); 1996
PH-0326	Circa 1920 bungalow residence adjacent to APE	Not eligible for the NRHP	Justin Greenawalt and Mary Stack (Skelly and Loy, Inc.); 2011
PH-0327	Circa 1920 bungalow residence adjacent to APE	Not eligible for the NRHP	Justin Greenawalt and Mary Stack (Skelly and Loy, Inc.); 2011
PH-0332	1949 bungalow residence adjacent to APE	Not eligible for the NRHP	Justin Greenawalt and Mary Stack (Skelly and Loy, Inc.); 2011
Shinaberry's Fifth Grade Site 46-PH-64	Prehistoric open archaeological site adjacent to APE	Not evaluated for the NRHP	Dick Reigel; 1987
Sheets Site 46-PH-27	Prehistoric campsite adjacent to APE	Not evaluated for the NRHP	Stephen Davis; 1977

* Shaded rows indicate previously recorded resources within the APE.

Determination of Eligibility

A Secretary of the Interior-qualified architectural historian with CH2M conducted an intensive architectural survey at the GBO from October 6-9, 2014. The site visit to GBO was also used to engage GBO staff in informal interviews and to conduct archival research, including the review of historic photographs and narratives, newspaper articles, construction records, and architectural drawings.

The field survey encompassed standing structures built in or before 1969, which is 47 years from the present year. The standard NRHP age threshold is 50 years; however, using 47 years as the cutoff allowed a buffer for the execution of the proposed Alternatives. All built environment resources from 1969 or earlier within the GBO boundary were surveyed and assessed, including a determination of eligibility for listing

in the NRHP, except for the Reber Radio Telescope. Buildings and structures were evaluated individually as well as part of a potential historic district.

Using aerial photographs of GBO and information provided by GBO staff, 47 built environment resources that had been constructed in or before 1969 were identified as extant within the APE. These include: 5 telescope structures (one of which contains three large telescopes), 2 horn instruments, 1 antenna, 1 airstrip, 1 water tower, 1 recreation area, 24 residential buildings, and 12 operational and administrative buildings. As noted above, one of these telescopes, the Reber Radio Telescope, was previously evaluated. The remaining 46 built environment resources in the APE built in or before 1969 were photographed and evaluated for NRHP eligibility. Data collected through the background research and field investigations were analyzed to determine NRHP eligibility of the 46 surveyed built environment resources individually. In addition, the Green Bank Telescope, which was constructed after 1969, was evaluated individually due to its exceptional importance to radio astronomy over the last 50 years. All 47 historic-era properties (constructed in or before 1969, including the Reber Radio Telescope) and the GBT were also evaluated as a potential historic district. Properties surveyed in 2014 are listed in Attachment A of Enclosure 1. Figure 5-1, included in Enclosure 1, shows the location of each evaluated built environment resource.

NSF has determined that within the historical context of NRAO/GBO, there are four telescope instruments that are individually eligible for listing in the NRHP: the Interferometer Range, the 40-foot Telescope, the 43-meter Telescope, and the Green Bank Telescope. In addition, NSF has determined that GBO is eligible as a historic district for representing an important time in science history and for its significant contribution to the advancement of radio astronomy. There are 44 resources within the APE that are recommended as contributing to the proposed GBO historic district, the boundaries of which coincide with the site's property boundaries (and the APE). Contributing elements include 8 administrative/operational buildings, 1 airstrip, 1 water tower, 1 recreational area, 24 residential buildings, 2 horns, 1 antenna, and 6 telescopes (the Interferometer includes 3 large telescopes) (Table 2).

The scientific instruments within the APE are a collection of telescopes, horns, and antenna that are significant for their role in the development of radio astronomy and, in several instances, as remarkable feats of engineering. As a whole, the majority of the components that make up the potential district's historic character possess integrity, even though many of the buildings are individually undistinguished. The administrative and operations buildings and structures within the GBO are primarily utilitarian buildings or structures with simple designs executed using practical and standard materials. These elements create a cohesive, visual unit that emphasizes their historically linked function as support for the observatory. As a group, the 44 contributing built environment resources are a distinct and well-preserved representation of the early years of the NRAO, complete with scientific instruments, administration/operational facilities, recreation area, and residential buildings. Additionally, the scientific instruments present on site illustrate a linear, historical narrative of the history of radio astronomy from the Jansky Replica

Antenna and Reber Radio Telescope to the monumental Green Bank Telescope. Four buildings within the APE were identified as non-contributing resources. These include three barns and one cellar building, all of which pre-date the establishment of the NRAO and have been primarily left vacant or used as miscellaneous storage facilities.

Table 2 lists the properties at the GBO that were identified as individually eligible for the NRHP. Attachment A, included in Enclosure 1, lists the buildings that contribute to the NRHP-eligible historic district.

TABLE 2. NRHP-Eligible Built Environment Resources within the APE

Resource Name	Year Constructed	Description/Significance	NRHP Eligibility Recommendation
GBO Historic District	1958-2000	Collection of administrative/operational structures, residential buildings, and radio astronomy equipment associated with the NRAO/GBO.	Eligible (Historic District); 44 contributing resources (Attachment A in Enclosure 1)
Interferometer Range: Howard E. Tatel Telescope (85'-1) and 85'-1 control building; 85'-2 Telescope; 85'-3 Telescope; and the Interferometer control building	85'-1: 1958-1959 85'-2: 1963-1964 85'-3: 1965-1968 Interferometer control building: 1967-1968	The Tatel Telescope (85'-1) was the first telescope constructed by the NRAO and performed the world's first Search For Extra Terrestrial Intelligence (SETI) observations. The Interferometer Range connected two nearly identical telescopes to the Tatel Telescope in a linear formation. The three telescopes operated in unison and proved that dishes could be combined to form very large telescopes. This information spurred the construction of the Very Large Array telescope in New Mexico in the 1970s.	Individually eligible and contributing to GBO Historic District

TABLE 2. NRHP-Eligible Built Environment Resources within the APE

Resource Name	Year Constructed	Description/Significance	NRHP Eligibility Recommendation
40-foot Telescope and control building	1962	First fully automated radio telescope in the world. Currently operates as an educational telescope for visiting students.	Individually eligible and contributing to GBO Historic District
43-meter Telescope	1958-1965	Largest telescope in the world to use an equatorial (for polar aligned) mount. Currently used as part of the Russian Radioastron project.	Individually eligible and contributing to GBO Historic District
Robert C. Byrd Green Bank Telescope (Green Bank Telescope)	1991-2000	Largest moving structure on land in the world; tilt and point design that can rotate a full 360 degrees; performs highly sensitive data collection.	Individually eligible and contributing to GBO Historic District

Initiation of Section 106 Consultation

The GBO is a federally-owned property that contains historic properties. Therefore the Proposed Action has the potential to affect historic properties. In compliance with 36 Code of Federal Regulations (CFR) 800.2(c)(2)(ii), NSF is initiating consultation with you on the proposed changes to GBO operations. NSF is also seeking your input on any cultural resources in the project area or any cultural resources concerns you may have related to this undertaking.

We respectfully request your response within 30 days from receipt of this letter indicating your interest in participating in consultation for this undertaking. Please respond to:

Ms. Elizabeth Pentecost
National Science Foundation
Division of Astronomical Sciences
4201 Wilson Blvd, Suite 1045
Arlington, Virginia 22230
epenteco@nsf.gov

NSF is also transmitting the *Cultural Resources Evaluation, Green Bank Observatory, Green Bank, West Virginia* (attached as Enclosure 1). If you have any questions, please

do not hesitate to contact me by phone at 703-292-4592 or by email at cblanco@nsf.gov.
We look forward to further consultation on this proposed undertaking.

Regards,

A handwritten signature in black ink that reads "Caroline M. Blanco". The signature is written in a cursive, flowing style.

Caroline M. Blanco
Federal Preservation Officer
Assistant General Counsel
Office of the General Counsel

Enclosures:

1. *Cultural Resources Evaluation, Green Bank Observatory, Green Bank, West Virginia*

From: Grayg Ralphsnyder (US) <grayg.ralphsnyder@draglobal.com>
Sent: Wednesday, December 14, 2016 6:23 PM
To: Pentecost, Elizabeth A.
Cc: Grayg Ralphsnyder (US)
Subject: RE: EIS for Green Bank Observatory - Identification of Consulting Parties

Elizabeth,

I would like to be involved with this project.

thank you ,
grayg

Grayg Ralphsnyder - KC8SVT
Electrical Engineer
DRA Global
Phone 304 220 6306
Mobile 304 860 7459
grayg.ralphsnyder@draglobal.com
4996 Elk River Road South
Elkview, West Virginia 25071

- be safe man -

From: Pentecost, Elizabeth A. [mailto:epenteco@nsf.gov]
Sent: Thursday, December 08, 2016 5:07 PM
To: Grayg Ralphsnyder (US)
Subject: EIS for Green Bank Observatory - Identification of Consulting Parties

December 8, 2016

Subject: Identification of Consulting Parties for Section 106 Compliance for Proposed Changes to Green Bank Observatory Operations, Green Bank, West Virginia

Dear Mr. Ralph Snyder:

Please disregard the earlier email. There was a cut/paste error. At this time NSF has not identified a preferred alternative.

The National Science Foundation (NSF) has identified the need to divest several facilities from its portfolio to retain the balance of capabilities needed to deliver the best performance on the key science of the present decade and beyond. Green Bank Observatory (GBO) in Green Bank, Pocahontas County, West Virginia, is one of the facilities identified for potential divestment. NSF has initiated consultation under Section 106 of the National Historic Preservation Act (NHPA).

The Reber Radio Telescope located within GBO is listed in the NRHP. It was listed in the NRHP in 1972 and designated a National Historic Landmark in 1986. The telescope was listed under Criteria A and B for its nationally significant association with the origins of radio astronomy and for its association with Grote Reber.

NSF will be conducting an Environmental Impact Statement (EIS) under the National Environmental Policy Act (NEPA) to identify potential impacts associated with this potential change in operations while simultaneously engaging in Section 106 consultation under the NHPA.

At present, alternatives under consideration include:

- Continued NSF investment for science-focused operations (No-Action Alternative).
- Collaboration with interested parties for science- and education-focused operations with reduced NSF-funded scope.
- Collaboration with interested parties for operation as a technology and education park.
- Mothballing of facilities (suspension of operations in a manner such that operations could resume efficiently at some future date).
- Deconstruction and site restoration.

NSF is identifying organizations and individuals with an interest in the project's potential to affect historic properties who may qualify as consulting parties. Consulting parties can include individuals and organizations with a demonstrated interest in the project "due to the nature of their legal or economic relation to the undertaking or affected properties, or their concern with the undertaking's effects on historic properties" (30 CFR Part 800.2[5]). You indicated an interest in participating as a consulting party at the NEPA scoping meeting on November 9, 2016, by checking the Section 106 consulting party box on the sign-in sheet. The purpose of this letter is to determine if you wish to be a consulting party under Section 106 for this project. The Section 106 process is described at <http://www.achp.gov/citizensguide.html>.

As a consulting party, you will be actively informed of and able to participate in the Section 106 process, including potential consultation meetings, and your views will be actively sought. If you would like to request consulting party status on this project, please respond no later than January 5, 2017 by contacting:

Ms. Elizabeth Pentecost, National Science Foundation, Division of Astronomical Sciences, Suite 1045, 4201 Wilson Blvd., Arlington, Virginia 22230; telephone: (703) 292-4907; email: epenteco@nsf.gov.

If you do not respond within this time frame, you may request consulting party status in the future; however, the project may advance without your input and you won't have an opportunity to comment on the previous steps. If you are requesting consulting party status as part of an organization, we do ask that your organization nominate one representative and an alternate to participate on behalf of the group. There is also an opportunity for individuals to participate in the Section 106 process in a more limited capacity as members of the public.

We look forward to your response to this request and to your role as a consulting party on this project, should you choose to participate. Should you have any questions, or wish to discuss the project or our agency's responsibilities in more detail, please contact me at epenteco@nsf.gov.

Sincerely,

Elizabeth Pentecost
Project Management Administrator
Division of Astronomical Sciences

National Science Foundation
Division of Astronomical Sciences
Room 1045
4201 Wilson Boulevard
Arlington, VA 22230
Tel: 703-292-4907
Fax: 703-292-9034

From: Robert Sheets <fortwarwick@gmail.com>
Sent: Friday, December 30, 2016 5:10 PM
To: epenteco@nsf.gov
Subject: Pocahontas County Historical Landmarks Commission

Dear Ms. Pentecost,

My name is Robert A. Sheets. I am a member of the Pocahontas County Landmarks Commission and I have been designated by the Commission to serve as the representative on behalf of PCLC as a consulting party in the Section 106 process. Mr. Jason Bauserman, our president, will be the alternate representative.

My contact information is:

Robert A. Sheets
450 Fort Warwick Passage
Green Bank, WV 24944
304-456-4815 (H)
email: fortwarwick@gmail.com

Mr. Bauserman's contact information is:

Jason Bauserman
106 Bauserman Loop

Bartow, WV 24920

304-456-4915

jbauserman@[frontiernet.net](mailto:jbauserman@frontiernet.net)

Sincerely,

Robert A. Sheets

Dec. 30, 2016



The Culture Center
1900 Kanawha Blvd., E.
Charleston, WV 25305-0300

Randall Reid-Smith, Commissioner

Phone 304.558.0220 • www.wvculture.org
Fax 304.558.2779 • TDD 304.558.3562
EEO/AA Employer

December 22, 2016

Mr. James Ulvestad
Division Director, Division of Astronomical Sciences
National Science Foundation
4201 Wilson Boulevard
Arlington, Virginia 22230

RE: NEPA Analysis for Changes to Green Bank Observatory Operations
FR#: 17-49-PH-1

Dear Mr. Ulvestad:

We have reviewed the above-mentioned project to determine its effects to cultural resources. As required by Section 106 of the National Historic Preservation Act of 1966, as amended, and its implementing regulations, 36 CFR § 800: "Protection of Historic Properties," we submit our comments.

According to submitted information from this and previous submissions, the National Science Foundation (NSF) plans to complete an Environmental Impact Statement (EIS) to evaluate potential effects of proposed operational changes at the Green Bank Observatory (GBO) in Pocahontas County, West Virginia. According to the submitted information, five (5) case alternatives are being considered by the EIS. These include:

- Continued NSF investment for science-focused operations (No-Action Alternative)
- Collaboration with interested parties for science- and education-focused operations with reduced NSF-funded scope
- Collaboration with interested parties for operation as a technology and education park
- Mothballing of facilities (suspension of operations in a manner such that operations could resume efficiently at some future date)
- Deconstruction and site restoration

Also included in this submission is a Cultural Resources Evaluation, which includes a survey, documentation, and evaluation for National Register of Historic Places eligibility of the built resources at the Green Bank Observatory. We concur with the recommendation that the area of potential effects (APE) should be defined as the property boundary for GBO because this will encompass all of the buildings and structures associated with the observatory. We find that the Reber Radio Telescope (NR# 72001291), which was listed in the National Register of Historic Places in 1972 and was named a National Historic Landmark in 1986, remains historically significant. In addition, we concur with the recommendations that four (4) additional telescopes are individually eligible for the National Register. These include:

- 1) the Interferometer Range: Howard E. Tatel Telescope (85'-1) and 85' 1-1 control building; 85'-2 Telescope; 85'-3 Telescope; and the Interferometer control building (eligible under Criterion A);
- 2) 40-foot Telescope and control building (eligible under Criterion A);
- 3) 43-meter Telescope (eligible under Criteria A and C);
- 4) Robert C. Byrd Green Bank Telescope (GBT) (eligible under Criteria A and C and Criterion Consideration G because it is less than 50 years of age);

However, while it appears likely that the GBO is eligible for the National Register of Historic Places as a historic district because the collection of buildings, structures, and scientific instrumentation represents the early history of radio astronomy while illustrating the continued development of the field, we will require more details before we can officially concur with this recommendation. The Cultural Resources Evaluation identified 44 resources within the APE as being recommended as contributing to the GBO historic district, but it provides no evidence or documentation to support this assessment.

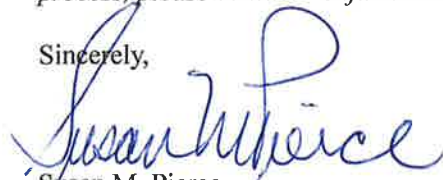
At this time, we request the completion of a Historic Property Inventory (HPI) form for each resource at least forty-five (45) years of age located at the GBO, as well as any resource less than forty-five (45) years of age that may contribute to the potential historic district. If additional guidance regarding which resources warrant this level of documentation, a representative from our office will be glad to attend a site visit to assist in determining which resources should be documented with HPI forms. The HPI form is available, along with instructions to fill it out, at www.wvculture.org/shpo/forms.html. Please be sure to indicate the original date of construction as well as details about any changes, additions, and/or alterations each facility has experienced. Each HPI form should include two (2) color photographs of each of the documented resources. Your photographs need to be keyed to a USGS topographic or aerial map and should accurately depict from various angles any architectural resources, building or structural details, and outbuildings. Please contact Historian, Michael Burdette (Michael.A.Burdette@wv.gov), to obtain an HPI Site numbers for the newly-documented resources. We will provide further comments after the submission of the HPI forms and as the NEPA analysis and EIS for the GBO progresses. We look forward to participating in the continuation of the Section 106 process of identifying historic resources with the NSF, which will be supported by the completion of these HPI forms.

Public Comments:

Federal regulations in 36 CFR §§ 800.2(c-d), 800.3(e-f), and 800.6(a)(4) all stress the importance of involving the general public, local government representatives, and organizations that have a demonstrated interest in historic preservation or the undertaking in the Section 106 review process. If you have already completed this aspect of the requirements under Section 106, please provide written documentation along with any comments you have received, or any that you receive in the future, to this office. If you have not already done so, please consider forwarding a copy of the submitted information for the above-mentioned project to the Pocahontas County Historical Society and the Preservation Alliance of West Virginia to request their comments or opinions on the matter. Please forward any comments that you receive to this office. If you receive no comments within thirty (30) days, please indicate that *in writing* to this office. Also according to an earlier submittal, an all-day scoping meeting was planned for November 9, 2016, and we request that any correspondence or comments generated during this meeting be included with the next submittal regarding the GBO to assist with our continuation of the Section 106 process.

We appreciate the opportunity to be of service. *If you have questions regarding our comments or the Section 106 process, please contact Benjamin M. Riggle, Structural Historian, at (304) 558-0240.*

Sincerely,



Susan M. Pierce
Deputy State Historic Preservation Officer

SMP/BMR

From: DARYL WHITE <darylwhite1@icloud.com>
Sent: Monday, January 02, 2017 5:08 PM
To: Pentecost, Elizabeth A.
Subject: Re: EIS for Green Bank Observatory - Identification of Consulting Parties

Hello! Thank you for sending this email. I did sign up as an interested party at the Green Bank Observatory Public Hearing on November 9th. I would like to participate as a consulting party or have my wife, Deana White, participate on my behalf, however, we were uncertain if we qualify. We are concerned citizens - and are advocates for the GBO in all respects - the science community, the STEM education community, the Green Bank and surrounding communities, as well as for the historical significance this site represents. As it is the original NRAO site, it houses the Grote Reber radio telescope, and has a long and rich history contributing to radio astronomy and scientific discovery as we have been lucky enough to learn about and hear from renowned astronomer Dr. Frank Drake. Please let us know if we are eligible to participate.

Thank you,

Daryl And Deana White
Home phone 304 733 5781

Sent from my iPhone

On Dec 6, 2016, at 9:17 AM, Pentecost, Elizabeth A. <epenteco@nsf.gov> wrote:

December 6, 2016

Subject: Identification of Consulting Parties for Section 106 Compliance for Proposed Changes to Green Bank Observatory Operations, Green Bank, West Virginia

Dear Mr. White:

The National Science Foundation (NSF) has identified the need to divest several facilities from its portfolio to retain the balance of capabilities needed to deliver the best performance on the key science of the present decade and beyond. Green Bank Observatory (GBO) in Green Bank, Pocahontas County, West Virginia, is one of the facilities identified for potential divestment. NSF has initiated consultation under Section 106 of the National Historic Preservation Act (NHPA).

The Reber Radio Telescope located within GBO is listed in the NRHP. It was listed in the NRHP in 1972 and designated a National Historic Landmark in 1986. The telescope was listed under Criteria A and B for its nationally significant association with the origins of radio astronomy and for its association with Grote Reber.

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- Deconstruction and site restoration.

NSF is identifying organizations and individuals with an interest in the project's potential to affect historic properties who may qualify as consulting parties. Consulting parties can include individuals and organizations with a demonstrated interest in the project "due to the nature of their legal or economic relation to the undertaking or affected properties, or their concern with the undertaking's effects on historic properties" (30 CFR Part 800.2[5]). You indicated an interest in participating as a consulting party at the NEPA scoping meeting on November 9, 2016, by checking the Section 106 consulting party box on the sign-in sheet. The purpose of this letter is to determine if you wish to be a consulting party under Section 106 for this project. The Section 106 process is described at <http://www.achp.gov/citizensguide.html>.

As a consulting party, you will be actively informed of and able to participate in the Section 106 process, including potential consultation meetings, and your views will be actively sought. If you would like to request consulting party status on this project, please respond no later than January 5, 2017 by contacting:

Ms. Elizabeth Pentecost, National Science Foundation, Division of Astronomical Sciences, Suite 1045, 4201 Wilson Blvd., Arlington, Virginia 22230; telephone: (703) 292-4907; email: epenteco@nsf.gov.

If you do not respond within this time frame, you may request consulting party status in the future; however, the project may advance without your input and you won't have an opportunity to comment on the previous steps. If you are requesting consulting party status as part of an organization, we do ask that your organization nominate one representative and an alternate to participate on behalf of the group. There is also an opportunity for individuals to participate in the Section 106 process in a more limited capacity as members of the public.

We look forward to your response to this request and to your role as a consulting party on this project, should you choose to participate. Should you have any questions, or wish to discuss the project or our agency's responsibilities in more detail, please contact me at epenteco@nsf.gov.

Sincerely,

Elizabeth Pentecost
Project Management Administrator
Division of Astronomical Sciences

National Science Foundation
Division of Astronomical Sciences
Room 1045
4201 Wilson Boulevard
Arlington, VA 22230

Tel: 703-292-4907
Fax: 703-292-9034

Subject: RE: Follow-up Regarding National Science Foundation Letter Concerning Green Bank Observatory...

Date: Thursday, January 5, 2017 at 9:39:46 AM Eastern Standard Time

From: Holly Austin

To: Hamilton, Kristen

Ms. Hamilton,

This project falls outside of the traditional aboriginal territory of the Cherokee. As such, we wish to defer this project to the Shawnee. If you have any questions or concerns, please do not hesitate to contact me.

Sincerely,

--

Holly Austin
Tribal Historic Preservation Office
Eastern Band of the Cherokee Indians
hollymaustin94@gmail.com
Ph: (828) 359-6852

NATIONAL SCIENCE FOUNDATION
4201 WILSON BOULEVARD
ARLINGTON, VIRGINIA 22230



DIVISION OF ASTRONOMICAL
SCIENCES

January 12, 2017

Ms. B. J. Sharp-Gudmundsson
Historic Preservation Officer
Pocahontas Historical Society
PO Box 453
Marlinton, WV 24954

Subject: Section 106 Consultation for the Proposed Changes to Green Bank Observatory Operations, Green Bank, West Virginia

Dear Ms. Gudmundsson:

The National Science Foundation (NSF) has identified the need to divest several facilities from its portfolio to retain the balance of capabilities needed to deliver the best performance on the key science of the present decade and beyond. Green Bank Observatory (GBO) in Green Bank, Pocahontas County, West Virginia, is one of the facilities identified for potential divestment. NSF has initiated consultation under Section 106 of the National Historic Preservation Act (NHPA).

Ms. Susan Pierce, Deputy State Historic Preservation Officer, requested that NSF provide your organization the information that was sent to her office on December 2 for your comments (Enclosures 1-3).

If you would like to comment, please respond by contacting:

Ms. Elizabeth Pentecost, National Science Foundation, Division of Astronomical Sciences, Suite 1045,
4201 Wilson Blvd., Arlington, Virginia 22230; telephone: (703) 292-4907; email: epenteco@nsf.gov.

We look forward to your response to this request. Should you have any questions, or wish to discuss the project or our agency's responsibilities in more detail, please contact me at epenteco@nsf.gov.

Sincerely,

A handwritten signature in black ink that reads 'Elizabeth Pentecost'.

Elizabeth Pentecost
Project Management Administrator
Alternate Contracting Officer's Representative

Enclosures:

1. Letter to Mr. Randall Reid-Smith, Commissioner, West Virginia Division of Culture and History, dated December 2, 2016
2. *Cultural Resources Evaluation, Green Bank Observatory, Green Bank, West Virginia*, May 2016
3. Email from SHPO's office with list of tribes with potential interest in West Virginia projects

NATIONAL SCIENCE FOUNDATION
4201 Wilson Boulevard
Arlington, Virginia 22230



**OFFICE OF THE
GENERAL COUNSEL**

December 2, 2016

Mr. Randall Reid-Smith
State Historic Preservation Officer
West Virginia Division of Culture and History
Historic Preservation Office
1900 Kanawha Boulevard East
Charleston, West Virginia 25305

RE: Section 106 Consultation for the Proposed Changes to Green Bank
Observatory Operations, Green Bank, West Virginia

Dear Mr. Reid-Smith:

The National Science Foundation (NSF) has identified the need to divest several facilities from its portfolio to retain the balance of capabilities needed to deliver the best performance on the key science of the present decade and beyond. Green Bank Observatory (GBO) in Green Bank, Pocahontas County, West Virginia, is one of the facilities identified for potential divestment. The decision regarding the potential changes to GBO operations is considered a federal undertaking. While engaging in Section 106 consultation under the National Historic Preservation Act (NHPA), NSF will be simultaneously conducting an Environmental Impact Statement (EIS) process under the National Environmental Policy Act (NEPA) to identify potential impacts associated with the proposed operational changes due to funding constraints. With this letter, NSF is formally initiating Section 106 consultation under the NHPA, transmitting the *Cultural Resources Evaluation, Green Bank Observatory, Green Bank, West Virginia* (Enclosure 1) for your review and comment, and requesting concurrence on determinations of eligibility for properties surveyed at GBO.

Project Location and Background

GBO is located on federal lands adjacent to the Monongahela National Forest. This land is owned by NSF and consists of numerous parcels that were acquired/condemned by the U.S. Army Corps of Engineers in the 1950s when GBO was formed as the first (and then, only) site of the National Radio Astronomy Observatory (NRAO). The GBO is the anchor and

administrative site of the 13,000-square-mile National Radio Quiet Zone (NRQZ) and is situated on approximately 2,200 acres in the NRQZ, where all radio transmissions are limited. The GBO facility has a long history of science, technology, engineering, and mathematics education, ranging from student training and mentorships through the outreach and training opportunities offered through the NRAO Center for Science Education, which is based at the GBO site. More than 40,000 visitors each year pass through the Green Bank Science Center, including students, educators, and the general public who generally stay on site for more than one night to take advantage of the educational facilities. The GBO facility is host to multiple educational workshops and programs each year for middle school through post-graduate student training, and an average of 10 to 15 undergraduate and graduate students are mentored at the facility each year.

GBO facilities include the Green Bank Telescope; 43-meter telescope (also referred to as the 140-foot telescope); Green Bank Solar Radio Burst Spectrometer (45-foot telescope); Interferometer Range (includes three 85-foot diameter telescopes); 20-meter Geodetic Telescope; 40-foot telescope; three non-operational historical telescopes (Jansky Replica Antenna, Reber Radio Telescope, and Ewen-Purcell Horn); and other support facilities and infrastructure.

Project Description

NSF's Division of Astronomical Sciences (AST) is the federal steward for ground-based astronomy in the United States, funding research with awards to individual investigators and small research groups, and via cooperative agreements for operation of large telescope facilities. These national and international telescope facilities provide world-leading, one-of-a-kind observational capabilities on a competitive basis to thousands of astronomers per year. These facilities also enable scientific advances by making archived data products available to researchers. Along with funding telescope facilities and research awards, AST supports the development of advanced technologies and instrumentation, and manages the allocation and assignment of specific frequencies in the radio spectrum for scientific use by the entire NSF community. The need for NSF to reduce funding for the GBO has been established through a number of reviews and surveys conducted by the science community.

In 2014, CH2M conducted a Cultural Resources Evaluation for the architectural resources at the GBO. The results of the survey are included below under "Determinations of Eligibility." The associated technical report, entitled *Cultural*

Resources Evaluation, Green Bank Observatory, Green Bank, West Virginia, is attached for reference (Enclosure 1).

A range of preliminary proposed Alternatives is being considered for evaluation. These preliminary proposed Alternatives, which will be refined through public input, include the following:

- Continued NSF investment for science-focused operations (No-Action Alternative).
- Collaboration with interested parties for science- and education-focused operations with reduced NSF-funded scope (Agency-Preferred Alternative).
- Collaboration with interested parties for operation as a technology and education park.
- Mothballing of facilities (suspension of operations in a manner such that operations could resume efficiently at some future date).
- Deconstruction and site restoration.

These alternatives may be further refined during the early phases of the compliance review and will be informed by the public process.

Proposed Area of Potential Effects

The Area of Potential Effects (APE) being proposed for the project is defined as the property boundary of GBO. The total geographic area of the Observatory was chosen as the APE to encompass all buildings and structures on the property. This inclusive APE enables a determination of whether GBO constitutes a potential historic district that could be affected by the activities associated with the proposed changes to operations at the Observatory. Figure 2-1 included in Enclosure 1 shows the boundaries of the APE. We invite your comments on this proposed APE.

Public Involvement

A Notice of Intent (NOI) was published in the Federal Register on October 19, 2016 to initiate the public scoping process for the EIS. A revised NOI was published on November 1, 2016. Two public scoping meetings were conducted on November 9, 2016, at GBO. Section 106 public outreach was addressed as part of the public meeting,

and participants were invited to identify whether they would like to participate in Section 106 as a consulting party. Concurrent to the mailing of this letter, NSF will email these potential consulting parties a description of the role of a consulting party and requesting that they confirm their interest. A separate Section 106 consulting party meeting will be scheduled following the release of the Draft EIS this spring. Follow-up discussions with consulting parties will occur as needed.

Tribal Involvement

Your office provided a list of tribes with historic ties to West Virginia (email correspondence from Ms. Lora Lamarre, November 7, 2016, see Enclosure 2). These tribes were provided email notice of the proposal during NEPA scoping, and we will be providing them with letters inviting them to participate in Section 106 consultation.

Previously Identified Historic Properties

A literature review was conducted through the West Virginia State Historic Preservation Office (SHPO) Interactive Map on November 7, 2016. The literature review focused on the APE and included a 0.5-mile study area.

The Reber Radio Telescope is the only structure or building located within GBO that is listed in the NRHP. It was listed in the NRHP in 1972 and designated a National Historic Landmark in 1986. The telescope was listed under Criteria A and B for its nationally significant association with the origins of radio astronomy and for its association with Grote Reber.

One residence within the APE, the Riley House (House #15), was previously recorded in 2011. The associated survey form states that the early twentieth-century wood-frame farm house does not appear to be significant under NRHP Criterion C. The literature review did not identify any prior cultural resources surveys that have occurred within the APE. Two archaeological sites and nine architectural resources have been recorded outside of the APE, along State Routes 28 and 92, directly adjacent to the eastern boundary of the Observatory. The two previously recorded archaeological resources were not evaluated for the NRHP. One of the architectural resources, the Liberty Presbyterian Church on State Route 92 that was constructed in 1851, is described as significant as an excellent example of Greek Revival architecture, although no formal NRHP evaluation is included with the survey form. The church was recorded on two West Virginia Historic Property Inventory Forms (PH-0002 and PH-0037-0018). Four architectural resources were evaluated as not eligible for the NRHP and three buildings

were recorded, but not evaluated for the NRHP. The cultural resources that have been previously recorded within or directly adjacent to the APE are listed below in Table 1. In addition, two surveys (a bridge survey and a cultural resources survey) have occurred and 34 additional cultural resources have been identified within the 0.5-mile study area.

TABLE 1. Previously Recorded Cultural Resources Within and Directly Adjacent to the APE*

Resource Name	Description	Status	Recorded by
Reber Radio Telescope	1937 telescope located at the entrance to GBO within APE	NRHP listed 1972; National Historic Landmark 1986	National Register of Historic Places Registration Form
Riley House (House #15) PH-0331	Circa 1915 farm house within APE	Not eligible for the NRHP	Justin Greenawalt and Mary Stack (Skelly and Loy, Inc.); 2011
Liberty Presbyterian Church PH-0002 PH-0037-0018	1851 Greek Revival Church adjacent to APE	Not formally evaluated for the NRHP, but described as "significant as an excellent example of Greek Revival architecture in the area"	Michael Gioulis (Historic Preservation Consultant); 1993
George Porter Kerr House – Historic Orlan Shears House PH-0037-0040	Circa 1901 residence adjacent to APE	Not evaluated for the NRHP	Sherron Waybright; 1986
Dr. J.P. Mooumau House PH-0037-0044	1873 residence adjacent to APE	Not evaluated for the NRHP	Jessie B. Powell; 1986

Hamed House PH-0037-0048	1910 residence adjacent to APE	Not evaluated for the NRHP	Jessie B. Powell; 1986
Jack Nelson House PH-0209	Circa 1900 residence adjacent to the APE	Not eligible for the NRHP	Jeff Drobney (Skelly and Loy, Inc.); 1996
Jerry Thortnon House PH-0210	Circa 1880-1890 vernacular residence adjacent to APE	Not eligible for the NRHP	Jeff Drobney (Skelly and Loy, Inc.); 1996
PH-0326	Circa 1920 bungalow residence adjacent to APE	Not eligible for the NRHP	Justin Greenawalt and Mary Stack (Skelly and Loy, Inc.); 2011
PH-0327	Circa 1920 bungalow residence adjacent to APE	Not eligible for the NRHP	Justin Greenawalt and Mary Stack (Skelly and Loy, Inc.); 2011
PH-0332	1949 bungalow residence adjacent to APE	Not eligible for the NRHP	Justin Greenawalt and Mary Stack (Skelly and Loy, Inc.); 2011
Shinaberry's Fifth Grade Site 46-PH-64	Prehistoric open archaeological site adjacent to APE	Not evaluated for the NRHP	Dick Reigel; 1987
Sheets Site 46-PH-27	Prehistoric campsite adjacent to APE	Not evaluated for the NRHP	Stephen Davis; 1977

* Shaded rows indicate previously recorded resources within the APE.

Determination of Eligibility

A Secretary of the Interior-qualified architectural historian with CH2M conducted an intensive architectural survey at the GBO from October 6-9, 2014. The site visit to GBO was also used to engage GBO staff in informal interviews and to conduct archival research, including the review of historic photographs and narratives, newspaper articles, construction records, and architectural drawings.

The field survey encompassed standing structures built in or before 1969, which is 47 years from the present year. The standard NRHP age threshold is 50 years; however, using 47 years as the cutoff allowed a buffer for the execution of the proposed Alternatives. All built environment resources from 1969 or earlier within the GBO boundary were surveyed and assessed, including a determination of eligibility for listing in the NRHP, except for the Reber Radio Telescope. Buildings and structures were evaluated individually as well as part of a potential historic district.

Using aerial photographs of GBO and information provided by GBO staff, 47 built environment resources that had been constructed in or before 1969 were identified as extant within the APE. These include: 5 telescope structures (one of which contains three large telescopes), 2 horn instruments, 1 antenna, 1 airstrip, 1 water tower, 1 recreation area, 24 residential buildings, and 12 operational and administrative buildings. As noted above, one of these telescopes, the Reber Radio Telescope, was previously evaluated. The remaining 46 built environment resources in the APE built in or before 1969 were photographed and evaluated for NRHP eligibility. Data collected through the background research and field investigations were analyzed to determine NRHP eligibility of the 46 surveyed built environment resources individually. In addition, the Green Bank Telescope, which was constructed after 1969, was evaluated individually due to its exceptional importance to radio astronomy over the last 50 years. All 47 historic-era properties (constructed in or before 1969, including the Reber Radio Telescope) and the GBT were also evaluated as a potential historic district. Properties surveyed in 2014 are listed in Attachment A of Enclosure 1. Figure 5-1, included in Enclosure 1, shows the location of each evaluated built environment resource.

NSF has determined that within the historical context of NRAO/GBO, there are four telescope instruments that are individually eligible for listing in the NRHP: the Interferometer Range, the 40-foot Telescope, the 43-meter Telescope, and the Green Bank Telescope. In addition, NSF has determined that GBO is eligible as a historic district for representing an important time in science history and for its significant contribution to the advancement of radio astronomy. There are 44 resources within the APE that are recommended as contributing to the proposed GBO historic district, the boundaries of which coincide with the site's property boundaries (and the APE). Contributing elements include 8 administrative/operational buildings, 1 airstrip, 1 water tower, 1 recreational area, 24 residential buildings, 2 horns, 1 antenna, and 6 telescopes (the Interferometer includes 3 large telescopes) (Table 2).

The scientific instruments within the APE are a collection of telescopes, horns, and antenna that are significant for their role in the development of radio astronomy and, in several instances, as remarkable feats of engineering. As a whole, the majority of the components that make up the potential district’s historic character possess integrity, even though many of the buildings are individually undistinguished. The administrative and operations buildings and structures within the GBO are primarily utilitarian buildings or structures with simple designs executed using practical and standard materials. These elements create a cohesive, visual unit that emphasizes their historically linked function as support for the observatory. As a group, the 44 contributing built environment resources are a distinct and well-preserved representation of the early years of the NRAO, complete with scientific instruments, administration/operational facilities, recreation area, and residential buildings. Additionally, the scientific instruments present on site illustrate a linear, historical narrative of the history of radio astronomy from the Jansky Replica Antenna and Reber Radio Telescope to the monumental Green Bank Telescope. Four buildings within the APE were identified as non-contributing resources. These include three barns and one cellar building, all of which pre-date the establishment of the NRAO and have been primarily left vacant or used as miscellaneous storage facilities.

Table 2 lists the properties at the GBO that were identified as individually eligible for the NRHP. Attachment A, included in Enclosure 1, lists the buildings that contribute to the NRHP-eligible historic district.

TABLE 2. NRHP-Eligible Built Environment Resources within the APE

Resource Name	Year Constructed	Description/Significance	NRHP Eligibility Recommendation
GBO Historic District	1958-2000	Collection of administrative/operational structures, residential buildings, and radio astronomy equipment associated with the NRAO/GBO.	Eligible (Historic District); 44 contributing resources (Attachment A in Enclosure 1)
Interferometer Range:	85’-1: 1958-1959	The Tatel Telescope (85’-1) was the first telescope	Individually eligible and contributing to

TABLE 2. NRHP-Eligible Built Environment Resources within the APE

Resource Name	Year Constructed	Description/Significance	NRHP Eligibility Recommendation
Howard E. Tatel Telescope (85'-1) and 85'-1 control building; 85'-2 Telescope; 85'-3 Telescope; and the Interferometer control building	85'-2: 1963-1964 85'-3: 1965-1968 Interferometer control building: 1967-1968	constructed by the NRAO and performed the world's first Search For Extra Terrestrial Intelligence (SETI) observations. The Interferometer Range connected two nearly identical telescopes to the Tatel Telescope in a linear formation. The three telescopes operated in unison and proved that dishes could be combined to form very large telescopes. This information spurred the construction of the Very Large Array telescope in New Mexico in the 1970s.	GBO Historic District
40-foot Telescope and control building	1962	First fully automated radio telescope in the world. Currently operates as an educational telescope for visiting students.	Individually eligible and contributing to GBO Historic District
43-meter Telescope	1958-1965	Largest telescope in the world to use an equatorial (for polar aligned) mount. Currently used as part of the Russian Radioastron project.	Individually eligible and contributing to GBO Historic District

TABLE 2. NRHP-Eligible Built Environment Resources within the APE

Resource Name	Year Constructed	Description/Significance	NRHP Eligibility Recommendation
Robert C. Byrd Green Bank Telescope (Green Bank Telescope)	1991-2000	Largest moving structure on land in the world; tilt and point design that can rotate a full 360 degrees; performs highly sensitive data collection.	Individually eligible and contributing to GBO Historic District

Request for Concurrence

NSF requests your input on the proposed APE and concurrence with the determination that there are four telescopes at the GBO that are individually eligible for listing in the NRHP (one of which is the Interferometer which encompasses three large telescopes) and that the GBO is eligible for the NRHP as a historic district, containing 44 contributing resources.

Initiation of Section 106 Consultation

The GBO is a federally-owned property that contains historic properties. Therefore the Proposed Action has the potential to affect historic properties. In compliance with 36 Code of Federal Regulations (CFR) 800.3(c), NSF is initiating consultation with the West Virginia State Historic Preservation Officer (SHPO) on the proposed changes to GBO operations. Please respond within 30 days from receipt of this letter to:

Ms. Elizabeth Pentecost
National Science Foundation
Division of Astronomical Sciences
4201 Wilson Blvd, Suite 1045
Arlington, Virginia 22230
epenteco@nsf.gov

NSF is also transmitting the *Cultural Resources Evaluation, Green Bank Observatory, Green Bank, West Virginia* (attached as Enclosure 1). If you have any questions, please do not hesitate to contact me by phone at 703-292-4592 or by email at

cblanco@nsf.gov. Information about this proposal will be posted, throughout the NEPA and Section 106 processes, at www.nsf.gov/AST (click on "AST Facilities-Environmental Reviews," the "Green Bank Observatory.") We look forward to further consultation on this proposed undertaking.

Regards,

A handwritten signature in blue ink that reads "Caroline M. Blanco". The signature is written in a cursive style with a large initial 'C'.

Caroline M. Blanco
Federal Preservation Officer
Assistant General Counsel
Office of the General Counsel

Enclosures:

1. *Cultural Resources Evaluation, Green Bank Observatory, Green Bank, West Virginia*
2. Email from SHPO's office with list of tribes with potential interest in West Virginia projects

Subject: RE: Notice of Intent To Prepare an Environmental Impact Statement and Initiate Consultation for Proposed Changes to Green Bank Observatory Operations, Green Bank, West Virginia; Notice of Public Scoping Meetings and Comment Period

Date: Monday, November 7, 2016 at 12:01:52 PM Eastern Standard Time

From: Lamarre, Lora A

To: Hamilton, Kristen

Hi Kristen,

I put together a list of tribes who have historic ties to WV. I don't know that any of them will be interested in the proposed Green Bank project, especially since, as you said, archaeology isn't likely to be a huge issue. But these are tribes that my agency has invited to consultation for other, non-Section 106 issues. The list does not include the Catawba or the Osage, both of whom have indicated they are not interested in projects in Pocahontas County. Please let me know if you have any questions or if we can be of further assistance. The list is below.

Sincerely,

Lora A Lamarre-DeMott
Senior Archaeologist
WV SHPO
The Cultural Center
1900 Kanawha Blvd., East
Charleston, WV 25305-0300
304-558-0220 x711 (p)
304-558-2779 (f)

Iroquoian Tribes:

Tuscarora Nation
Tonawanda Band of Seneca
Seneca Nation of Indians
St. Regis Mohawk Tribe
Onondaga Indian Nation
Seneca-Cayuga Tribe of Oklahoma
Oneida Nation of New York
Oneida Tribe of Wisconsin
Cayuga Nation

Cherokee Tribes:

Eastern Band of Cherokee Indians
Cherokee Nation
United Keetoowah Band of Cherokee Indians

Algonquian Tribes:

Absentee Shawnee Tribe
Eastern Shawnee Tribe of Oklahoma
Shawnee Tribe
Delaware Nation
Delaware Tribe of Indians

**NATIONAL SCIENCE FOUNDATION
4201 WILSON BOULEVARD
ARLINGTON, VIRGINIA 22230**



**DIVISION OF ASTRONOMICAL
SCIENCES**

January 12, 2017

Ms. Danielle La Presta Parker
The Preservation Alliance of West Virginia
421 Davis Avenue, #4
Elkins, WV 26241

Subject: Section 106 Consultation for the Proposed Changes to Green Bank Observatory Operations, Green Bank, West Virginia

Dear Ms. Parker:

The National Science Foundation (NSF) has identified the need to divest several facilities from its portfolio to retain the balance of capabilities needed to deliver the best performance on the key science of the present decade and beyond. Green Bank Observatory (GBO) in Green Bank, Pocahontas County, West Virginia, is one of the facilities identified for potential divestment. NSF has initiated consultation under Section 106 of the National Historic Preservation Act (NHPA).

Ms. Susan Pierce, Deputy State Historic Preservation Officer, requested that NSF provide your organization the information that was sent to her office on December 2 for your comments (Enclosures 1-3).

If you would like to comment, please respond by contacting:

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We look forward to your response to this request. Should you have any questions, or wish to discuss the project or our agency's responsibilities in more detail, please contact me at epenteco@nsf.gov.

Sincerely,

Elizabeth Pentecost
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Alternate Contracting Officer's Representative

Enclosures:

1. Letter to Mr. Randall Reid-Smith, Commissioner, West Virginia Division of Culture and History, dated December 2, 2016
2. *Cultural Resources Evaluation, Green Bank Observatory, Green Bank, West Virginia*, May 2016
3. Email from SHPO's office with list of tribes with potential interest in West Virginia projects

NATIONAL SCIENCE FOUNDATION
4201 Wilson Boulevard
Arlington, Virginia 22230



**OFFICE OF THE
GENERAL COUNSEL**

December 2, 2016

Mr. Randall Reid-Smith
State Historic Preservation Officer
West Virginia Division of Culture and History
Historic Preservation Office
1900 Kanawha Boulevard East
Charleston, West Virginia 25305

RE: Section 106 Consultation for the Proposed Changes to Green Bank
Observatory Operations, Green Bank, West Virginia

Dear Mr. Reid-Smith:

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Previously Identified Historic Properties

A literature review was conducted through the West Virginia State Historic Preservation Office (SHPO) Interactive Map on November 7, 2016. The literature review focused on the APE and included a 0.5-mile study area.

The Reber Radio Telescope is the only structure or building located within GBO that is listed in the NRHP. It was listed in the NRHP in 1972 and designated a National Historic Landmark in 1986. The telescope was listed under Criteria A and B for its nationally significant association with the origins of radio astronomy and for its association with Grote Reber.

One residence within the APE, the Riley House (House #15), was previously recorded in 2011. The associated survey form states that the early twentieth-century wood-frame farm house does not appear to be significant under NRHP Criterion C. The literature review did not identify any prior cultural resources surveys that have occurred within the APE. Two archaeological sites and nine architectural resources have been recorded outside of the APE, along State Routes 28 and 92, directly adjacent to the eastern boundary of the Observatory. The two previously recorded archaeological resources were not evaluated for the NRHP. One of the architectural resources, the Liberty Presbyterian Church on State Route 92 that was constructed in 1851, is described as significant as an excellent example of Greek Revival architecture, although no formal NRHP evaluation is included with the survey form. The church was recorded on two West Virginia Historic Property Inventory Forms (PH-0002 and PH-0037-0018). Four architectural resources were evaluated as not eligible for the NRHP and three buildings

were recorded, but not evaluated for the NRHP. The cultural resources that have been previously recorded within or directly adjacent to the APE are listed below in Table 1. In addition, two surveys (a bridge survey and a cultural resources survey) have occurred and 34 additional cultural resources have been identified within the 0.5-mile study area.

TABLE 1. Previously Recorded Cultural Resources Within and Directly Adjacent to the APE*

Resource Name	Description	Status	Recorded by
Reber Radio Telescope	1937 telescope located at the entrance to GBO within APE	NRHP listed 1972; National Historic Landmark 1986	National Register of Historic Places Registration Form
Riley House (House #15) PH-0331	Circa 1915 farm house within APE	Not eligible for the NRHP	Justin Greenawalt and Mary Stack (Skelly and Loy, Inc.); 2011
Liberty Presbyterian Church PH-0002 PH-0037-0018	1851 Greek Revival Church adjacent to APE	Not formally evaluated for the NRHP, but described as "significant as an excellent example of Greek Revival architecture in the area"	Michael Gioulis (Historic Preservation Consultant); 1993
George Porter Kerr House – Historic Orlan Shears House PH-0037-0040	Circa 1901 residence adjacent to APE	Not evaluated for the NRHP	Sherron Waybright; 1986
Dr. J.P. Mooumau House PH-0037-0044	1873 residence adjacent to APE	Not evaluated for the NRHP	Jessie B. Powell; 1986

Hamed House PH-0037-0048	1910 residence adjacent to APE	Not evaluated for the NRHP	Jessie B. Powell; 1986
Jack Nelson House PH-0209	Circa 1900 residence adjacent to the APE	Not eligible for the NRHP	Jeff Drobney (Skelly and Loy, Inc.); 1996
Jerry Thortnon House PH-0210	Circa 1880-1890 vernacular residence adjacent to APE	Not eligible for the NRHP	Jeff Drobney (Skelly and Loy, Inc.); 1996
PH-0326	Circa 1920 bungalow residence adjacent to APE	Not eligible for the NRHP	Justin Greenawalt and Mary Stack (Skelly and Loy, Inc.); 2011
PH-0327	Circa 1920 bungalow residence adjacent to APE	Not eligible for the NRHP	Justin Greenawalt and Mary Stack (Skelly and Loy, Inc.); 2011
PH-0332	1949 bungalow residence adjacent to APE	Not eligible for the NRHP	Justin Greenawalt and Mary Stack (Skelly and Loy, Inc.); 2011
Shinaberry's Fifth Grade Site 46-PH-64	Prehistoric open archaeological site adjacent to APE	Not evaluated for the NRHP	Dick Reigel; 1987
Sheets Site 46-PH-27	Prehistoric campsite adjacent to APE	Not evaluated for the NRHP	Stephen Davis; 1977

* Shaded rows indicate previously recorded resources within the APE.

Determination of Eligibility

A Secretary of the Interior-qualified architectural historian with CH2M conducted an intensive architectural survey at the GBO from October 6-9, 2014. The site visit to GBO was also used to engage GBO staff in informal interviews and to conduct archival research, including the review of historic photographs and narratives, newspaper articles, construction records, and architectural drawings.

The field survey encompassed standing structures built in or before 1969, which is 47 years from the present year. The standard NRHP age threshold is 50 years; however, using 47 years as the cutoff allowed a buffer for the execution of the proposed Alternatives. All built environment resources from 1969 or earlier within the GBO boundary were surveyed and assessed, including a determination of eligibility for listing in the NRHP, except for the Reber Radio Telescope. Buildings and structures were evaluated individually as well as part of a potential historic district.

Using aerial photographs of GBO and information provided by GBO staff, 47 built environment resources that had been constructed in or before 1969 were identified as extant within the APE. These include: 5 telescope structures (one of which contains three large telescopes), 2 horn instruments, 1 antenna, 1 airstrip, 1 water tower, 1 recreation area, 24 residential buildings, and 12 operational and administrative buildings. As noted above, one of these telescopes, the Reber Radio Telescope, was previously evaluated. The remaining 46 built environment resources in the APE built in or before 1969 were photographed and evaluated for NRHP eligibility. Data collected through the background research and field investigations were analyzed to determine NRHP eligibility of the 46 surveyed built environment resources individually. In addition, the Green Bank Telescope, which was constructed after 1969, was evaluated individually due to its exceptional importance to radio astronomy over the last 50 years. All 47 historic-era properties (constructed in or before 1969, including the Reber Radio Telescope) and the GBT were also evaluated as a potential historic district. Properties surveyed in 2014 are listed in Attachment A of Enclosure 1. Figure 5-1, included in Enclosure 1, shows the location of each evaluated built environment resource.

NSF has determined that within the historical context of NRAO/GBO, there are four telescope instruments that are individually eligible for listing in the NRHP: the Interferometer Range, the 40-foot Telescope, the 43-meter Telescope, and the Green Bank Telescope. In addition, NSF has determined that GBO is eligible as a historic district for representing an important time in science history and for its significant contribution to the advancement of radio astronomy. There are 44 resources within the APE that are recommended as contributing to the proposed GBO historic district, the boundaries of which coincide with the site's property boundaries (and the APE). Contributing elements include 8 administrative/operational buildings, 1 airstrip, 1 water tower, 1 recreational area, 24 residential buildings, 2 horns, 1 antenna, and 6 telescopes (the Interferometer includes 3 large telescopes) (Table 2).

The scientific instruments within the APE are a collection of telescopes, horns, and antenna that are significant for their role in the development of radio astronomy and, in several instances, as remarkable feats of engineering. As a whole, the majority of the components that make up the potential district's historic character possess integrity, even though many of the buildings are individually undistinguished. The administrative and operations buildings and structures within the GBO are primarily utilitarian buildings or structures with simple designs executed using practical and standard materials. These elements create a cohesive, visual unit that emphasizes their historically linked function as support for the observatory. As a group, the 44 contributing built environment resources are a distinct and well-preserved representation of the early years of the NRAO, complete with scientific instruments, administration/operational facilities, recreation area, and residential buildings. Additionally, the scientific instruments present on site illustrate a linear, historical narrative of the history of radio astronomy from the Jansky Replica Antenna and Reber Radio Telescope to the monumental Green Bank Telescope. Four buildings within the APE were identified as non-contributing resources. These include three barns and one cellar building, all of which pre-date the establishment of the NRAO and have been primarily left vacant or used as miscellaneous storage facilities.

Table 2 lists the properties at the GBO that were identified as individually eligible for the NRHP. Attachment A, included in Enclosure 1, lists the buildings that contribute to the NRHP-eligible historic district.

TABLE 2. NRHP-Eligible Built Environment Resources within the APE

Resource Name	Year Constructed	Description/Significance	NRHP Eligibility Recommendation
GBO Historic District	1958-2000	Collection of administrative/operational structures, residential buildings, and radio astronomy equipment associated with the NRAO/GBO.	Eligible (Historic District); 44 contributing resources (Attachment A in Enclosure 1)
Interferometer Range:	85'-1: 1958-1959	The Tatel Telescope (85'-1) was the first telescope	Individually eligible and contributing to

TABLE 2. NRHP-Eligible Built Environment Resources within the APE

Resource Name	Year Constructed	Description/Significance	NRHP Eligibility Recommendation
Howard E. Tatel Telescope (85'-1) and 85'-1 control building; 85'-2 Telescope; 85'-3 Telescope; and the Interferometer control building	85'-2: 1963-1964 85'-3: 1965-1968 Interferometer control building: 1967-1968	constructed by the NRAO and performed the world's first Search For Extra Terrestrial Intelligence (SETI) observations. The Interferometer Range connected two nearly identical telescopes to the Tatel Telescope in a linear formation. The three telescopes operated in unison and proved that dishes could be combined to form very large telescopes. This information spurred the construction of the Very Large Array telescope in New Mexico in the 1970s.	GBO Historic District
40-foot Telescope and control building	1962	First fully automated radio telescope in the world. Currently operates as an educational telescope for visiting students.	Individually eligible and contributing to GBO Historic District
43-meter Telescope	1958-1965	Largest telescope in the world to use an equatorial (for polar aligned) mount. Currently used as part of the Russian Radioastron project.	Individually eligible and contributing to GBO Historic District

TABLE 2. NRHP-Eligible Built Environment Resources within the APE

Resource Name	Year Constructed	Description/Significance	NRHP Eligibility Recommendation
Robert C. Byrd Green Bank Telescope (Green Bank Telescope)	1991-2000	Largest moving structure on land in the world; tilt and point design that can rotate a full 360 degrees; performs highly sensitive data collection.	Individually eligible and contributing to GBO Historic District

Request for Concurrence

NSF requests your input on the proposed APE and concurrence with the determination that there are four telescopes at the GBO that are individually eligible for listing in the NRHP (one of which is the Interferometer which encompasses three large telescopes) and that the GBO is eligible for the NRHP as a historic district, containing 44 contributing resources.

Initiation of Section 106 Consultation

The GBO is a federally-owned property that contains historic properties. Therefore the Proposed Action has the potential to affect historic properties. In compliance with 36 Code of Federal Regulations (CFR) 800.3(c), NSF is initiating consultation with the West Virginia State Historic Preservation Officer (SHPO) on the proposed changes to GBO operations. Please respond within 30 days from receipt of this letter to:

Ms. Elizabeth Pentecost
National Science Foundation
Division of Astronomical Sciences
4201 Wilson Blvd, Suite 1045
Arlington, Virginia 22230
epenteco@nsf.gov

NSF is also transmitting the *Cultural Resources Evaluation, Green Bank Observatory, Green Bank, West Virginia* (attached as Enclosure 1). If you have any questions, please do not hesitate to contact me by phone at 703-292-4592 or by email at

cblanco@nsf.gov. Information about this proposal will be posted, throughout the NEPA and Section 106 processes, at www.nsf.gov/AST (click on "AST Facilities-Environmental Reviews," the "Green Bank Observatory.") We look forward to further consultation on this proposed undertaking.

Regards,

A handwritten signature in blue ink that reads "Caroline M. Blanco". The signature is written in a cursive style.

Caroline M. Blanco
Federal Preservation Officer
Assistant General Counsel
Office of the General Counsel

Enclosures:

1. *Cultural Resources Evaluation, Green Bank Observatory, Green Bank, West Virginia*
2. Email from SHPO's office with list of tribes with potential interest in West Virginia projects

Subject: RE: Notice of Intent To Prepare an Environmental Impact Statement and Initiate Consultation for Proposed Changes to Green Bank Observatory Operations, Green Bank, West Virginia; Notice of Public Scoping Meetings and Comment Period

Date: Monday, November 7, 2016 at 12:01:52 PM Eastern Standard Time

From: Lamarre, Lora A

To: Hamilton, Kristen

Hi Kristen,

I put together a list of tribes who have historic ties to WV. I don't know that any of them will be interested in the proposed Green Bank project, especially since, as you said, archaeology isn't likely to be a huge issue. But these are tribes that my agency has invited to consultation for other, non-Section 106 issues. The list does not include the Catawba or the Osage, both of whom have indicated they are not interested in projects in Pocahontas County. Please let me know if you have any questions or if we can be of further assistance. The list is below.

Sincerely,

Lora A Lamarre-DeMott
Senior Archaeologist
WV SHPO
The Cultural Center
1900 Kanawha Blvd., East
Charleston, WV 25305-0300
304-558-0220 x711 (p)
304-558-2779 (f)

Iroquoian Tribes:

Tuscarora Nation
Tonawanda Band of Seneca
Seneca Nation of Indians
St. Regis Mohawk Tribe
Onondaga Indian Nation
Seneca-Cayuga Tribe of Oklahoma
Oneida Nation of New York
Oneida Tribe of Wisconsin
Cayuga Nation

Cherokee Tribes:

Eastern Band of Cherokee Indians
Cherokee Nation
United Keetoowah Band of Cherokee Indians

Algonquian Tribes:

Absentee Shawnee Tribe
Eastern Shawnee Tribe of Oklahoma
Shawnee Tribe
Delaware Nation
Delaware Tribe of Indians



Preservation Alliance of West Virginia
421 Davis Avenue
Elkins, WV 26241
304-345-6005
www.pawv.org

February 3, 2017

Ms. Elizabeth Pentecost
National Science Foundation
Division of Astronomical Sciences, Suite 1045
4201 Wilson Blvd.
Arlington, VA 22230

Re: Section 106 Consultation for the Proposed Changes to Green Bank Observatory Operations,
Green Bank, West Virginia

Dear Ms. Pentecost,

Thank you for your letter dated January 12, 2017, regarding the Green Bank Observatory Operations. I am writing to submit comments regarding this project.

The Preservation Alliance of West Virginia (PAWV) would like to continue to be a consulting party during the Section 106 review of this National Historic Landmark and appreciate your initial outreach regarding this matter. PAWV recognizes the cultural importance of the Green Bank Observatory and also values its significance as an economic engine for West Virginia and Pocahontas County.

PAWV has received the packet sent by your office, and we have reviewed the preliminary proposed Alternatives. We support the following alternatives in this order (1 being most appealing and 3 being least appealing):

1. Continued NSF investment for science-focused operations;
2. Collaboration with interested parties for science- and education-focused operations with reduced NSF-funded scope; or
3. Collaboration with interested parties for operation as a technology and education park.

PAWV does not recommend mothballing the facilities and does not support the deconstruction of the Green Bank Observatory. Closing this facility would be a great detriment to the surrounding economy, and mothballing the property leaves the future of this important cultural

resource uncertain. It would be unfortunate for the property to be left vacant as it is a vital historic asset for West Virginia. There are financial incentives available to preserve the historic structure including historic preservation grants and historic rehabilitation tax credits. These grants and tax credits may help to alleviate any financial commitments related to maintaining this property.

These are all of the comments that PAWV has at this time. We look forward to working with you on this project.

Thank you for your consideration,

A handwritten signature in cursive script that reads "Danielle LaPresta Parker".

Danielle LaPresta Parker
Executive Director

CC: Susan Pierce, West Virginia State Historic Preservation Office

NATIONAL SCIENCE FOUNDATION

4201 Wilson Boulevard
Arlington, Virginia 22230



OFFICE OF THE
GENERAL COUNSEL

May 18, 2017

Mr. Randall Reid-Smith, State Historic Preservation Officer
West Virginia Division of Culture and History
Historic Preservation Office
1900 Kanawha Boulevard East
Charleston, West Virginia 25305

RE: Transmittal of 48 Historic Property Inventory Forms for Section 106 Compliance
for the Proposed Changes to Green Bank Observatory Operations, Green Bank,
Pocahontas County, West Virginia

FR#: 17-49-PH-1

Dear Mr. Reid-Smith:

The National Science Foundation (NSF) initiated Section 106 consultation with the West Virginia Division of Culture and History, Historic Preservation Office (SHPO) on December 2, 2016, regarding the undertaking of Proposed Changes to Green Bank Observatory (GBO) Operations in Pocahontas County, West Virginia. Along with the Section 106 consultation letter, NSF transmitted a report to SHPO entitled *Cultural Resources Evaluation, Green Bank Observatory, Green Bank, West Virginia*, which included a historical context for the Observatory and determinations of eligibility. NSF requested input on the proposed area of potential effects (APE) and concurrence on the determination that there are four telescopes at GBO that are individually eligible for listing in the National Register of Historic Places (NRHP) and that the GBO is eligible for listing in the NRHP as a historic district.

On December 22, 2016, NSF received a response letter from the West Virginia SHPO that provided concurrence on the APE, which was defined as the property boundary for GBO. SHPO agreed that the Reber Radio Telescope (NR# 72001291), which was listed in the NRHP in 1972 and was named a National Historic Landmark (NHL) in 1986, remains historically significant. In addition, SHPO concurred that there are four additional GBO telescopes that are individually eligible for the NRHP, including:

1. Interferometer Range: Howard E. Tatel Telescope (85'-1) and 85'-1 control building; 85'-2 Telescope; 85'-3 Telescope; and the Interferometer Control building (eligible under Criterion A);
2. 40-foot Telescope and control building (eligible under Criterion A);

3. 43-meter (140-foot) Telescope (eligible under Criteria A and C); and
4. Robert C. Byrd Green Bank Telescope (GBT) (eligible under Criteria A and C and Criterion Consideration G).

NSF determined that GBO is eligible as a historic district for representing an important time in science history and for its significant contribution to the advancement of radio astronomy. The boundaries of the proposed GBO Historic District coincide with the site's property boundaries (and the APE). The December 22, 2016 response letter from SHPO noted that while it appears likely that the GBO is eligible for the NRHP as a historic district, additional documentation would be required for SHPO to concur with this assessment. SHPO requested that Historic Property Inventory (HPI) forms be completed for each resource at least 45 years old located at the GBO, as well as any resource less than 45 years old that may contribute to the potential historic district.

HPI forms were completed for a total of 48 resources, 44 of which NSF determined contribute to the GBO Historic District. Contributing elements include 8 administrative/operational buildings, 1 airstrip, 1 water tower, 1 recreational area, 24 residential (or formerly residential) buildings, 2 horns, 1 antenna, and 6 telescopes (the Interferometer includes 3 large telescopes). One contributing residence within the APE, the Riley House (PH-0331), was previously recorded in 2011; an updated HPI form was completed for this property. As a group, the 44 contributing resources are a distinct and well-preserved representation of the early years of the National Radio Astronomy Observatory (NRAO), complete with scientific instruments, administration/operational facilities, recreation area, and residential buildings. Additionally, the scientific instruments present on site illustrate a linear, historical narrative of the history of radio astronomy from the Jansky Replica Antenna and Reber Radio Telescope to the monumental GBT. With this letter, NSF is transmitting the 48 HPI forms for review and requesting concurrence on the determination that the GBO is an NRHP-eligible historic district containing 44 contributing resources.

We respectfully request a response within 30 days from receipt of this letter to:

Ms. Elizabeth Pentecost
National Science Foundation
Division of Astronomical Sciences
4201 Wilson Blvd, Suite 1045
Arlington, Virginia 22230
epenteco@nsf.gov

The December 22, 2016, SHPO response letter also requested that NSF forward any comments received as a result of the Section 106 consultation process to the SHPO. The West Virginia SHPO provided NSF with a list of Native American tribes with historical ties to West Virginia. The Oneida Nation of Wisconsin notified NSF by email on November 9, 2016, that it is not interested in participating as a Consulting Party in the Section 106 process. NSF initiated

Section 106 consultation with the other identified Native American tribes by sending letters on December 12, 2016, to the following tribes:

- United Keetoowah Band of Cherokee Indians;
- Tuscarora Nation;
- Shawnee Tribe;
- Seneca-Cayuga Tribe of Oklahoma;
- Seneca Nation of Indians;
- Tonawanda Band of Seneca;
- St. Regis Mohawk Tribe;
- United Keetoowah Band of Cherokee Indians;
- Eastern Shawnee Tribe of Oklahoma;
- Delaware Tribe of Indians;
- Onondaga Nation;
- Eastern Band of Cherokee Indians;
- Cherokee Nation;
- Cayuga Nation; and
- Absentee Shawnee Tribe of Oklahoma.

No responses were received from the Native American tribes.

During the NEPA public scoping meetings held at the GBO on November 9, 2016, Section 106 public outreach was also addressed, and participants were invited to identify whether they would like to participate in Section 106 as a Consulting Party. The following individuals confirmed that they would like to participate as Consulting Parties:

- Daryl and Deana White
- Grayg Ralphsnyder

In response to the scoping meeting, 14 public comments were received that included references to cultural resources. These generally cited the historic significance of the GBO and its contributions to astronomy and the sciences in general.

Additional local organizations were contacted to verify whether they wished to participate as Consulting Parties in the Section 106 process. Letters were sent to the following organizations:

- Pocahontas County Historical Landmarks Commission
- Pocahontas County Historical Society
- Preservation Alliance of West Virginia

On December 30, 2016, Robert A. Sheets responded via email as the individual designated by the Pocahontas County Historical Landmarks Commission to serve as the Consulting Party representative. At SHPO's request, NSF provided the Pocahontas County Historical Society and

the Preservation Alliance of West Virginia with copies of the Section 106 initiation letter and attachments that were sent to SHPO on December 2, 2016. The Preservation Alliance of West Virginia sent a letter to NSF on February 3, 2017, indicating that it would like to continue as a Consulting Party during the Section 106 process. No other responses have been received to date.

A list of all evaluated resources, including each resource's HPI site number (provided by the staff historian at SHPO) and respective NRHP status, is included in Enclosure 1. An aerial map showing the GBO Historic District boundaries and locations of evaluated resources is included in Enclosure 2. Hard-copies of the 48 completed HPI forms are included in Enclosure 3. In addition, two CDs are included with this package: the first CD includes electronic copies of all the HPI forms and the second CD includes GIS data. A spreadsheet with the public scoping meeting comments relating to cultural resources, as well as Section 106 responses and comments received to date, are included in Enclosure 4. If you have any questions, please do not hesitate to contact me by phone at 703-292-4592 or by email at cblanco@nsf.gov. We look forward to your comments and further consultation on this proposed undertaking.

Regards,



Caroline M. Blanco
Federal Preservation Officer
Assistant General Counsel
Office of the General Counsel

Cc: E. Pentecost
K. Hamilton
M. Rau, CH2M

Enclosures:

1. List of All Evaluated Properties at GBO
2. GBO Historic District Boundary
3. 48 HPI Forms (and 2 CDs)
4. Section 106 Correspondence

Enclosure 1

List of All Evaluated Properties at GBO

HPI Site Number	Resource Type	Resource Name	NRHP Status
PH-0907	Administrative/ operational	Karl Guthe Jansky Laboratory	Eligible as a contributing resource to the GBO Historic District
PH-0908	Administrative/ operational	Cafeteria Building and Residence	Eligible as a contributing resource to the GBO Historic District
PH-0909	Administrative/ operational	Warehouse	Eligible as a contributing resource to the GBO Historic District
PH-0910	Other	Water Tower	Eligible as a contributing resource to the GBO Historic District
PH-0911	Administrative/ operational	Works Area Building	Eligible as a contributing resource to the GBO Historic District
PH-0912	Administrative/ operational	Telescope Mechanics Office (formerly Cable Storage Warehouse)	Eligible as a contributing resource to the GBO Historic District
PH-0913	Administrative/ operational	Millimeter Array Experiment Building	Eligible as a contributing resource to the GBO Historic District
PH-0914	Administrative/ operational	Outdoor Test Building	Eligible as a contributing resource to the GBO Historic District
PH-0915	Administrative/ operational	Laser Lab (formerly 300' Telescope Control Building)	Eligible as a contributing resource to the GBO Historic District
PH-0916	Other	Airstrip	Eligible as a contributing resource to the GBO Historic District
PH-0917	Other	Recreation Area	Eligible as a contributing resource to the GBO Historic District
PH-0918	Other/storage	Barn	Not eligible/non-contributing
PH-0919	Other/storage	Barn	Not eligible/non-contributing
PH-0920	Other/storage	Barn	Not eligible/non-contributing
PH-0921	Vacant	Slaven Hollow Orchard Cellar Building	Not eligible/non-contributing
PH-0922	Residential	Redwood House; Director's House (House #1)	Eligible as a contributing resource to the GBO Historic District
PH-0923	Residential	House #2 (Rabbit Patch) - 2 Rabbit Patch	Eligible as a contributing resource to the GBO Historic District
PH-0924	Residential	House #3 (Rabbit Patch) - 3 Rabbit Patch	Eligible as a contributing resource to the GBO Historic District
PH-0925	Residential	House #4 (Rabbit Patch) - 4 Rabbit Patch	Eligible as a contributing resource to the GBO Historic District
PH-0926	Residential	House #5 (Rabbit Patch) - 5 Rabbit Patch	Eligible as a contributing resource to the GBO Historic District
PH-0927	Residential	House #6 (Rabbit Patch) - 6 Rabbit Patch	Eligible as a contributing resource to the GBO Historic District
PH-0928	Residential	House #7 (Rabbit Patch) - 7 Rabbit Patch	Eligible as a contributing resource to the GBO Historic District
PH-0929	Residential	House #8 (Rabbit Patch) - 8 Rabbit Patch	Eligible as a contributing resource to the GBO Historic District
PH-0930	Residential	House #9 (Rabbit Patch) - 9 Rabbit Patch	Eligible as a contributing resource to the GBO Historic District
PH-0931	Residential	House #10 (Rabbit Patch) - 10 Rabbit Patch	Eligible as a contributing resource to the GBO Historic District
PH-0932	Residential	House #11 (Rabbit Patch) - 11 Rabbit Patch	Eligible as a contributing resource to the GBO Historic District
PH-0933	Residential	House #14 - 14 Hannah Run Road	Eligible as a contributing resource to the GBO Historic District
PH-0934	Residential	House #16 - 16 Hannah Run Road	Eligible as a contributing resource to the GBO Historic District
PH-0935	Residential	House #19 - 19 Hannah Run Road	Eligible as a contributing resource to the GBO Historic District

PH-0936	Residential	House #21 - 21 Hannah Run Road	Eligible as a contributing resource to the GBO Historic District
PH-0937	Residential	House #23 - 23 Hannah Run Road	Eligible as a contributing resource to the GBO Historic District
PH-0938	Residential	House #24 - 24 Hannah Run Road	Eligible as a contributing resource to the GBO Historic District
PH-0939	Residential	Shinnaberry House - 20 Route 28	Eligible as a contributing resource to the GBO Historic District
PH-0940	Residential	Nut Bin	Eligible as a contributing resource to the GBO Historic District
PH-0331 Updated	Residential	Riley House (#15) - 15 Hannah Run Road	Eligible as a contributing resource to the GBO Historic District
PH-0941	Residential	Hill House (#17) - 17 Hannah Run Road	Eligible as a contributing resource to the GBO Historic District
PH-0942	Residential	Tracy House (#18) - 18 Hannah Run Road	Eligible as a contributing resource to the GBO Historic District
PH-0943	Vacant	Beard House	Eligible as a contributing resource to the GBO Historic District
PH-0944	Residential	Hannah House	Eligible as a contributing resource to the GBO Historic District
PH-0945	Telescope/ instrument (no longer in active use)	Calibration Horn	Eligible as a contributing resource to the GBO Historic District
PH-0946	Telescope/ instrument (display)	Karl Guthe Jansky Replica Antenna	Eligible as a contributing resource to the GBO Historic District
PH-0947	Telescope/ instrument (display)	Ewen-Purcell Horn	Eligible as a contributing resource to the GBO Historic District
PH-0948	Telescope/ instrument (no longer in active use)	Interferometer Range: Includes Howard E. Tatel (85'-1) Telescope and 85'-1 control building; 85'-2 Telescope; 85'-3 Telescope; and the Interferometer Control Building	Individually eligible under Criterion A (SHPO concurrence 2016); contributes to the GBO Historic District
PH-0949	Telescope/ instrument	40' Telescope & 40' Telescope Control Building	Individually eligible under Criterion A (SHPO concurrence 2016); contributes to the GBO Historic District
PH-0950	Telescope/ instrument	140' Telescope (43m Telescope)	Individually eligible under Criteria A and C (SHPO concurrence 2016); contributes to the GBO Historic District
PH-0951	Telescope/ instrument	45' Telescope	Eligible as a contributing resource to the GBO Historic District
PH-0952	Telescope/ instrument	Robert C. Byrd Green Bank Telescope (GBT)	Individually eligible under Criteria A and C and Criterion Consideration G; contributes to the GBO Historic District
PH-0953	Telescope/ instrument (display)	Reber Radio Telescope	Listed in the NRHP in 1972; named a NHL in 1986; contributes to the GBO Historic District

Enclosure 2

GBO Historic District Boundary

Building / Structure Name

Administrative / Operational

- ▲ 1. Karl Guthe Jansky Laboratory
- ▲ 2. Cafeteria Building and Residence
- ▲ 3. Warehouse
- ▲ 4. Water Tower
- ▲ 5. Works Area Building
- ▲ 6. Telescope Mechanics Office (formerly Cable Storage Warehouse)
- ▲ 7. Millimeter Array Experiment Building
- ▲ 8. Outdoor Test Building
- ▲ 9. Laser Lab (formerly 300" Telescope Control Building)
- ▲ 10. Airstrip
- ▲ 11. Recreation Area
- ▲ 12. Barn
- ▲ 13. Barn
- ▲ 14. Barn
- ▲ 15. Slaven Hollow Orchard Cellar Building

Residential Buildings

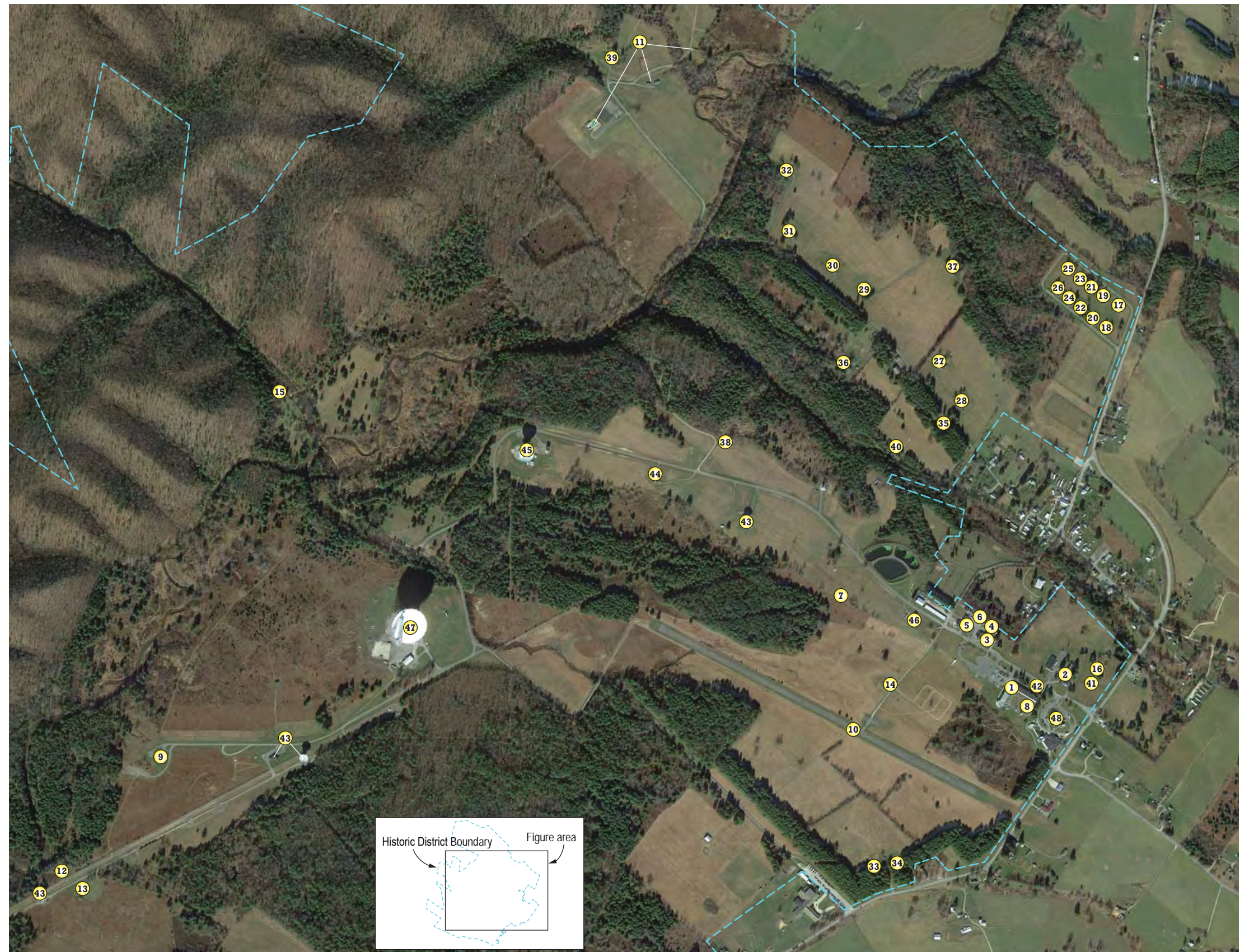
- ▲ 16. Redwood House (House #1; Director's House)
- ▲ 17. House #2 (Rabbit Patch)
- ▲ 18. House #3 (Rabbit Patch)
- ▲ 19. House #4 (Rabbit Patch)
- ▲ 20. House #5 (Rabbit Patch)
- ▲ 21. House #6 (Rabbit Patch)
- ▲ 22. House #7 (Rabbit Patch)
- ▲ 23. House #8 (Rabbit Patch)
- ▲ 24. House #9 (Rabbit Patch)
- ▲ 25. House #10 (Rabbit Patch)
- ▲ 26. House #11 (Rabbit Patch)
- ▲ 27. House #16
- ▲ 28. House #14
- ▲ 29. House #19
- ▲ 30. House #21
- ▲ 31. House #23
- ▲ 32. House #24
- ▲ 33. Shinnaberry House
- ▲ 34. Nut Bin
- ▲ 35. Riley House (#15)
- ▲ 36. Hill House (#17)
- ▲ 37. Tracy House (#18)
- ▲ 38. Beard House
- ▲ 39. Hannah House

Structures / Telescopes

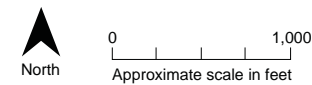
- ▲ 40. Calibration Horn
- ▲ 41. Karl Guthe Jansky Replica Antenna
- ▲ 42. Ewen-Purcell Horn
- ▲ 43. Green Bank Interferometer: Includes Howard E. Tatel (85'-1) Telescope & 85'-1 control building; 85'-2 Telescope; 85'-3 Telescope; and the Interferometer Control Building
- ▲ 44. 40' Telescope & 40' Telescope Control Building
- ▲ 45. 140' Telescope (43m Telescope) & maintenance structure
- ▲ 46. 45' Telescope
- ▲ 47. Robert C. Byrd Green Bank Telescope (GBT)
- ▲ 48. Reber Radio Telescope

LEGEND

- | | | | |
|---|----------------------------|-------|----------------------------|
| ▲ | NRHP Contributing | ● | Surveyed Property |
| ▲ | NRHP Non-Contributing | - - - | Historic District Boundary |
| ▲ | NRHP Individually Eligible | | |
| ▲ | NRHP Individually Listed | | |



Aerial photo source: Google ©2014, modified by CH2M HILL



GBO Historic District
Green Bank Observatory
Pocahontas County, West Virginia

Enclosure 3

48 HPI Forms (and 2 CDs)

Enclosure 4

Section 106 Correspondence

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Date Comment Received
49	b	Adam	Taylor	Community Member/Small Business Owner	I also feel that the historic value of the numerous telescopes is significant to mankind. Many break throughs in modern science were derived right here in Greenbank, West Virginia and with options 3-5 that history could be lost and/or forgotten.	11/9/2016
54	d	Erica	Engquist	Community Member	Handwritten notes on letter: - Deer Creek Valley = Fort Warwick 1774 site	11/9/2016
116	a	Michael	Holstine		Please accept this email as comment to the EIS statement being prepared by the NSF with regards to the Green Bank Observatory. As I am certain that you have been inundated with emails concerning the socio-economic impact of the Observatory to the local community, County and State, it is important to also note the historic factors existing at the site. The Observatory houses a replica and display of the original Jansky antenna used to first detect and quantify radio waves coming from the Milky Way galaxy. Across the road from the Jansky antenna exists the actual and original Reber Telescope, donated to the site by Grote Reber and registered on the National Registry of Historic Places. Both of these antennae have been utilized to recreate their original discoveries. Remember, these represent the birth of radio astronomy. Further down the site exist telescopes used for original interferometry and correlator experiments, the 40' telescope (the first fully computer-controlled radio telescope in the world, and now refitted as a fully manually-controlled telescope for education purposes), the 40m telescope (a polar-mount telescope with the largest spherical bearing ever produced at its tolerances), and the GBT (the largest fully steerable telescope in the world). It is amazing that all of these telescopes, varied and precisely built, all exist in one unique location - Green Bank. It is inestimable the value that can be placed on such a unique suite of instruments all in one place.	11/24/2016
148		Eric	Briggs		The past week in November is auspicious for several NRAO anniversaries: the foundation of the agency in 1956 and the collapse of the 300-foot transit in 1988 to name a few. Over the past 10 years I have gained good experience in studying historic observatories. I have watched the original film about the difficult completion of the 140 foot equatorial dish at Green Bank, and from that I can tell how often we should have to replace the previous generation's largest telescopes: Not Often. I have visited the GBT just this last month for the first time and I hope to return for many more visits. Please, everyone work together on this one.	11/26/2016
193	f	Joe	Swiggum	Postdoctoral Research Associate Center for Gravitation, Cosmology, and Astrophysics	In addition, the elimination of this scientific institution will remove a technology center in a region with few skilled positions. Even conversion to an education and technology center would still likely result in the export of a number of good-paying jobs to higher tech areas of the country. The people of Pocahontas County are proud of the observatory. At the November 2016 public comment meeting regarding the future of the GBO, not a single person complained about living in the National Radio Quiet Zone, and the public was clearly supportive of continued public funding of the GBO. As you can see, the scientific, socioeconomic, and cultural impacts of reducing NSF funding for GBO are numerous and severe. Such action would be a huge loss for my career, the careers of my colleagues, the NANOGrav collaboration, the US astronomical community, and the people of Pocahontas County, West Virginia. I urge NSF to adopt the no-action alternative in the strongest possible terms. Thank you for your consideration. If you have any questions or need further information, please contact me at the address above.	11/25/2016
260	e	J. Bruce	McKean		The historical telescopes on this site must remain as a museum/ tourist attraction forever. Just as the Civil War battlefields in the area continue to draw visitors to this area, so do the historical telescopes. Local people gave up their farms and homes for this site to become a world center for radio astronomy, and the NSF should give back to their offspring.	11/22/2016
261	a	John	Saunders		I have close family that are lifelong residents of Pocahontas County, and a few of those are in Green Bank. While the GBO is in fact an absolute critical employer in that area of the country it's sooo much more than that! It's an institution, with historical significance akin to any memorial of the Civil War, or the home Wilma Lee Cooper!	11/22/2016
379		Lawrence	Matson		Unfortunately, I just received notification of a comment period now. My abbreviated comment is simply that the historical, educational, and scientific benefit of this site exceeds the costs as well as benefits of other expenditures currently being made. Deconstruction would be a very poor option.	11/19/2016
453	a	Daniel	Keeney		I ask that, beyond questions raised as to compliance with the intent and purpose of the public scoping process, you reconsider any thoughts to close the Green Bank Observatory, which is and has been of such importance to all. Beyond the direct benefit to science, the greater concern for society should be the inspiration of our children: Have considered the GBO's impact upon them? As to the unimaginable possibility that the National Science Foundation might actually erase this treasure from our world? The impact upon places of historical importance are obvious: Green Bank Observatory IS one, in and of itself. The NSF may choose to close Green Bank, or even dismantle it and perform site restoration, effectively erasing much more than a treasured monument of historical significance. After all ... it is still being useful and productive, even as I type today.	11/17/2016

468	a	Terry and Dodi	Shore		We do not need to remind you of the cultural and historical significance of the Green Bank Observatory. That heritage is well established and forever will be a part of the scientific community's group memory. And while we understand that the reasons for soliciting public input on the fate of the observatory are budgetary and concern the ability of the NSF to adequately fund future science, that history must be a consideration in any determination of the value of Green Bank.	11/16/2016
470		Catherine	Lally	Jet Propulsion Laboratory Earth Science and Technology Directorate Sentinel-6 SWOT Jet Propulsion Laboratory	<p>My name is Cathy Lally and I am a native West Virginian currently working at the Jet Propulsion Laboratory in Pasadena, California. During my previous work experience at the NASA West Virginia Space Grant Consortium, I became very familiar with the Green Bank Observatory and had the opportunity to spend a weekend there during a board of director's meeting in 2012 (see attached photo).</p> <p>Recently, I became aware that the National Science Foundation will be evaluating the environmental impact of the GBO which will result in operational changes at the facility. Obviously, I am concerned about the "deconstruction and site restoration" option and here is why:</p> <ol style="list-style-type: none"> 1. The Observatory is crucial for maintaining STEM (Science, Technology, Engineering, Mathematics) outreach and opportunities in the state of West Virginia. 2. The Green Bank Telescope is a historical landmark. 3. The Observatory is a source of pride for the state of West Virginia. <p>The people of West Virginia are in dire need of support from the science community. Organizations like the NASA WV Space Grant have spent countless hours on cultivating STEM opportunities for children and adults in our state. To consider deconstruction of a facility that significantly aids in that effort would be a devastating blow to the state. The sense of pride that is associated with the GBO, as well as the historical importance, is undeniable and so obvious that it does not require explanation.</p> <p>I understand that operational changes at the facility are inevitable. However, I implore the NSF to not pursue the route of deconstruction.</p> <p>Thank you for your time and consideration regarding this matter.</p>	11/16/2016
639	b	Mike	Hedrick		<p>3. A facility for the scientific community, in this rural area, on the east coast, and so close to so many collages, in the "National Quite Zone, that if it is ever lost, will not ever be regained " a place that can be used to prototype, try new ideas, new one of the kind receivers, or a whole new line of thought, with the infrastructure already here, the lab, the Machine shop, the Electrical shop, Carpenter shop, Plumbers shop, Mechanic shop, and with people with the ability to help and show how to learn, build and complete any project.</p>	11/10/2016

640		Diane	Schou		<p>Below are comments for the NSF for support of the Green Bank Observatory from another perspective of people harmed by electromagnetic radiation (EMR) and their exposure to environments with higher levels of EMR:</p> <ul style="list-style-type: none"> • Air quality considerations: Studies to detect changes of EMR in the radio quiet zone are valuable. o Why do several people detect unusual EMR at the same time, yet they live a distance apart? What are the emissions that injure some people? o Funding is requested to measure, log, and document emissions, and correlate resulting effects. o To help the observatory, 1) some persons are better than meters. 2) these people choose to live without EMR and hence are good neighbors in the environment near the Green Bank Observatory. • Safety, health, and long-term biological effects are important to study in this unique environment here. o EMR levels are increasing, injure biological systems, and there may be nowhere else that is as protected as the unique environment around Green Bank, West Virginia. o Before coming to this extra protected area many of us became injured from EMR emissions and escaped to live elsewhere in a car, tent, shed or cave. We lived without easy access to food, water, and without protection from weather. We also lived without contact to other people because of the wireless communication devices they carried (not commonly done in Green Bank). • Cities have many, many emissions, and rural areas often have stronger emissions (likely because EMR have to travel farther for communication systems). Then we found Green Bank, in the National Radio Quiet Zone and our health has improved here. • We feel we are an endangered species, harmed by EMR as well as are animals, plants, and other systems on earth. It would be of value to use this area as a control in tests. o Needs for EMR people include a life without injury and pain from unnatural EMR exposures. • Social economics o Before discovering Green Bank, many of us left family, friends, careers, and homes (at great financial loss) and escaped to and lived in almost primitive environments such as in cars, tents, sheds, and caves. Many of us are college educated and could contribute, but at this stage the first focus is on survival. The urgent question is will this happen to many more people soon? o Without the Green Bank Observatory, there would not be security or a support system for us to contribute to in a manner to better prepare for others to understand coping with EMR. • National Historical Preservation: Green Bank's radio observatory's protected National Radio Quiet Zone is rare both in the United States of America and in the world. o People move to Green Bank for 1) safety (much electromagnetic radiation is unnatural and man-made), 2) security because people injured by EMR find no other protected quiet zone and 3) social connections with people as this is a humane place to live (versus in a remote cave or in a car). • Recommend expanding research at the Green Bank Observatory with goals to study physical needs. o Why do many people detect EMR? Additional funding is needed to measure, log and report EMR, especially the EMR that is artificial. Perhaps the NSF would fund this as a different entity, (i.e. in addition to or other than astronomy)? o There is also a facility for sale that could become a humane refuge at Sugar Grove, WV. Could the NSF purchase this facility, and/or work with other government groups there? <p>People harmed by EMR would be good neighbors, not needing cell phones, wi-fi, or other wireless devices. And vice versa, we need the Green Bank Observatory National Radio Quiet Zone's survival and protection.</p>	11/10/2016
641		Jeffrey	Mears	Environmental Area Manager Oneida Nation Environmental Health & Safety Division	<p>The Oneida Nation, located in Wisconsin, is not interested in participating as a consulting party at this time. I can serve as the Point of Contact for any questions. Please see my contact information listed below.</p>	11/9/2016

From: Jeffrey M. Mears
To: ["epenteco@nsf.gov"](mailto:epenteco@nsf.gov)
Cc: [Patrick J. Pelky](#)
Subject: Notice of Intent To Prepare an Environmental Impact Statement and Initiate Consultation for Proposed Changes to Green Bank Observatory Operations, Green Bank, West Virginia
Date: Wednesday, November 9, 2016 9:06:17 AM
Attachments: [image001.png](#)
[image002.png](#)

Hi Elizabeth,

The Oneida Nation, located in Wisconsin, is not interested in participating as a consulting party at this time.

I can serve as the Point of Contact for any questions. Please see my contact information listed below.

From: Pentecost, Elizabeth A. [<mailto:epenteco@nsf.gov>]
Sent: Monday, November 07, 2016 12:00 PM
To: Communications_Department
Subject: Notice of Intent To Prepare an Environmental Impact Statement and Initiate Consultation for Proposed Changes to Green Bank Observatory Operations, Green Bank, West Virginia; Notice of Public Scoping Meetings and Comment Period

To Whom It May Concern,

In compliance with the National Environmental Policy Act of 1969, as amended, the National Science Foundation (NSF) intends to prepare an Environmental Impact Statement (EIS) to evaluate potential environmental effects of proposed operational changes due to funding constraints for Green Bank Observatory, in Green Bank, West Virginia. On October 19, 2016, NSF announced the beginning of the scoping process to solicit public comments and identify issues to be analyzed in the EIS. At this juncture, NSF welcomes public comments on the preliminary proposed alternatives and resource areas identified for analysis. NSF also intends to initiate consultation under Section 106 of the National Historic Preservation Act to evaluate potential effects, if any, on historic properties as a result of the Proposed Action.

NSF invites the Oneida Tribe of Wisconsin to participate in this EIS process. We would appreciate a Point of Contact and email address so that we can provide the Oneida Tribe with additional information and ask if they would like participate as a Consulting Party in the EIS process.

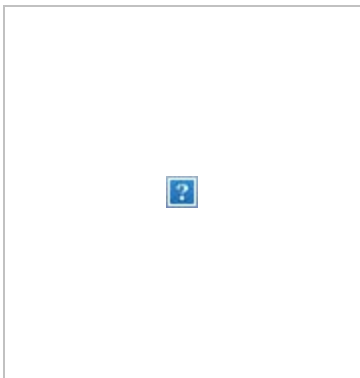
Sincerely,

Elizabeth Pentecost
National Science Foundation
Division of Astronomical Sciences
Room 1045
4201 Wilson Boulevard
Arlington, VA 22230
Tel: 703-292-4907
Fax: 703-292-9034

epenteco@nsf.gov

Yaw^ko (Thank you),

Jeffrey M. Mears, MPA
Environmental Area Manager
Oneida Nation
Environmental Health & Safety Division
P.O. Box 365
Oneida, WI 54155
Office 920/869-4555
Cell 920/639-7457
jmears@oneidanation.org



From: Grayg Ralphsnyder (US)
To: [Pentecost, Elizabeth A.](#)
Cc: [Grayg Ralphsnyder \(US\)](#)
Subject: RE: EIS for Green Bank Observatory - Identification of Consulting Parties
Date: Wednesday, December 14, 2016 9:23:36 PM

Elizabeth,

I would like to be involved with this project.

thank you ,
grayg

Grayg Ralphsnyder - KC8SVT
Electrical Engineer
DRA Global
Phone 304 220 6306
Mobile 304 860 7459
grayg.ralphsnyder@draglobal.com
4996 Elk River Road South
Elkview, West Virginia 25071

- be safe man -

From: Pentecost, Elizabeth A. [mailto:epenteco@nsf.gov]
Sent: Thursday, December 08, 2016 5:07 PM
To: Grayg Ralphsnyder (US)
Subject: EIS for Green Bank Observatory - Identification of Consulting Parties

December 8, 2016

Subject: Identification of Consulting Parties for Section106 Compliance for Proposed Changes to Green Bank Observatory Operations, Green Bank, West Virginia

Dear Mr. Ralphsnyder:

Please disregard the earlier email. There was a cut/paste error. At this time NSF has not identified a preferred alternative.

The National Science Foundation (NSF) has identified the need to divest several facilities from its portfolio to retain the balance of capabilities needed to deliver the best performance on the key science of the present decade and beyond. Green Bank Observatory (GBO) in Green Bank, Pocahontas County, West Virginia, is one of the facilities identified for potential divestment. NSF has initiated consultation under Section 106 of the National Historic Preservation Act (NHPA).

The Reber Radio Telescope located within GBO is listed in the NRHP. It was listed in the NRHP in 1972 and designated a National Historic Landmark in 1986. The telescope was listed under Criteria A and B for its nationally significant association with the origins of radio astronomy and for its association with Grote Reber.

NSF will be conducting an Environmental Impact Statement (EIS) under the National Environmental Policy Act (NEPA) to identify potential impacts associated with this potential change in operations while simultaneously engaging in Section 106 consultation under the NHPA.

At present, alternatives under consideration include:

- Continued NSF investment for science-focused operations (No-Action Alternative).
- Collaboration with interested parties for science- and education-focused operations with reduced NSF-funded scope.
- Collaboration with interested parties for operation as a technology and education park.
- Mothballing of facilities (suspension of operations in a manner such that operations could resume efficiently at some future date).
- Deconstruction and site restoration.

NSF is identifying organizations and individuals with an interest in the project's potential to affect historic properties who may qualify as consulting parties. Consulting parties can include individuals and organizations with a demonstrated interest in the project "due to the nature of their legal or economic relation to the undertaking or affected properties, or their concern with the undertaking's effects on historic properties" (30 CFR Part 800.2[5]). You indicated an interest in participating as a consulting party at the NEPA scoping meeting on November 9, 2016, by checking the Section 106 consulting party box on the sign-in sheet. The purpose of this letter is to determine if you wish to be a consulting party under Section 106 for this project. The Section 106 process is described at <http://www.achp.gov/citizensguide.html>.

As a consulting party, you will be actively informed of and able to participate in the Section 106 process, including potential consultation meetings, and your views will be actively sought. If you would like to request consulting party status on this project, please respond no later than January 5, 2017 by contacting:

Ms. Elizabeth Pentecost, National Science Foundation, Division of Astronomical Sciences, Suite 1045, 4201 Wilson Blvd., Arlington, Virginia 22230; telephone: (703) 292-4907; email: epenteco@nsf.gov.

If you do not respond within this time frame, you may request consulting party status in the future; however, the project may advance without your input and you won't have an opportunity to comment on the previous steps. If you are requesting consulting party status as part of an organization, we do ask that your organization nominate one representative and an alternate to participate on behalf of the group. There is also an opportunity for individuals to participate in the Section 106 process in a more limited capacity as members of the public.

We look forward to your response to this request and to your role as a consulting party on this project, should you choose to participate. Should you have any questions, or wish to discuss the project or our agency's responsibilities in more detail, please contact me at epenteco@nsf.gov.

Sincerely,

Elizabeth Pentecost
Project Management Administrator
Division of Astronomical Sciences

National Science Foundation
Division of Astronomical Sciences
Room 1045
4201 Wilson Boulevard
Arlington, VA 22230
Tel: 703-292-4907
Fax: 703-292-9034

From: Robert Sheets
To: epenteco@nsf.gov
Subject: Pocahontas County Historical Landmarks Commission
Date: Friday, December 30, 2016 8:09:43 PM

Dear Ms. Pentecost,

My name is Robert A. Sheets. I am a member of the Pocahontas County Landmarks Commission and I have been designated by the Commission to serve as the representative on behalf of PCLC as a consulting party in the Section 106 process. Mr. Jason Bauserman, our president, will be the alternate representative.

My contact information is:

Robert A. Sheets
450 Fort Warwick Passage
Green Bank, WV 24944
304-456-4815 (H)
email: fortwarwick@gmail.com

Mr. Bauserman's contact information is:

Jason Bauserman
106 Bauserman Loop
Bartow, WV 24920
304-456-4915
jbauserman@[frontiernet.net](mailto:jbauserman@frontiernet.net)

Sincerely,

Robert A. Sheets
Dec. 30, 2016

From: DARYL WHITE
To: [Pentecost, Elizabeth A.](mailto:epenteco@nsf.gov)
Subject: Re: EIS for Green Bank Observatory - Identification of Consulting Parties
Date: Monday, January 2, 2017 8:08:19 PM

Hello! Thank you for sending this email. I did sign up as an interested party at the Green Bank Observatory Public Hearing on November 9th. I would like to participate as a consulting party or have my wife, Deana White, participate on my behalf, however, we were uncertain if we qualify. We are concerned citizens - and are advocates for the GBO in all respects - the science community, the STEM education community, the Green Bank and surrounding communities, as well as for the historical significance this site represents. As it is the original NRAO site, it houses the Grote Reber radio telescope, and has a long and rich history contributing to radio astronomy and scientific discovery as we have been lucky enough to learn about and hear from renowned astronomer Dr. Frank Drake. Please let us know if we are eligible to participate.

Thank you,

Daryl And Deana White
Home phone 304 733 5781

Sent from my iPhone

On Dec 6, 2016, at 9:17 AM, Pentecost, Elizabeth A. <epenteco@nsf.gov> wrote:

December 6, 2016

Subject: Identification of Consulting Parties for Section 106 Compliance for Proposed Changes to Green Bank Observatory Operations, Green Bank, West Virginia

Dear Mr. White:

The National Science Foundation (NSF) has identified the need to divest several facilities from its portfolio to retain the balance of capabilities needed to deliver the best performance on the key science of the present decade and beyond. Green Bank Observatory (GBO) in Green Bank, Pocahontas County, West Virginia, is one of the facilities identified for potential divestment. NSF has initiated consultation under Section 106 of the National Historic Preservation Act (NHPA).

The Reber Radio Telescope located within GBO is listed in the NRHP. It was listed in the NRHP in 1972 and designated a National Historic Landmark in 1986. The telescope was listed under Criteria A and B for its nationally significant association with the origins of radio astronomy and for its association with Grote Reber.

NSF will be conducting an Environmental Impact Statement (EIS) under the National Environmental Policy Act (NEPA) to identify potential impacts associated with this potential change in operations while simultaneously engaging in Section 106 consultation under the NHPA.

At present, alternatives under consideration include:

- Continued NSF investment for science-focused operations (No-Action Alternative).
- Collaboration with interested parties for science- and education-focused operations with

reduced NSF-funded scope (Agency-Preferred Alternative).

- Collaboration with interested parties for operation as a technology and education park.
- Mothballing of facilities (suspension of operations in a manner such that operations could resume efficiently at some future date).
- Deconstruction and site restoration.

NSF is identifying organizations and individuals with an interest in the project's potential to affect historic properties who may qualify as consulting parties. Consulting parties can include individuals and organizations with a demonstrated interest in the project "due to the nature of their legal or economic relation to the undertaking or affected properties, or their concern with the undertaking's effects on historic properties" (30 CFR Part 800.2[5]). You indicated an interest in participating as a consulting party at the NEPA scoping meeting on November 9, 2016, by checking the Section 106 consulting party box on the sign-in sheet. The purpose of this letter is to determine if you wish to be a consulting party under Section 106 for this project. The Section 106 process is described at <http://www.achp.gov/citizensguide.html>.

As a consulting party, you will be actively informed of and able to participate in the Section 106 process, including potential consultation meetings, and your views will be actively sought. If you would like to request consulting party status on this project, please respond no later than January 5, 2017 by contacting:

Ms. Elizabeth Pentecost, National Science Foundation, Division of Astronomical Sciences, Suite 1045, 4201 Wilson Blvd., Arlington, Virginia 22230; telephone: (703) 292-4907; email: epenteco@nsf.gov.

If you do not respond within this time frame, you may request consulting party status in the future; however, the project may advance without your input and you won't have an opportunity to comment on the previous steps. If you are requesting consulting party status as part of an organization, we do ask that your organization nominate one representative and an alternate to participate on behalf of the group. There is also an opportunity for individuals to participate in the Section 106 process in a more limited capacity as members of the public.

We look forward to your response to this request and to your role as a consulting party on this project, should you choose to participate. Should you have any questions, or wish to discuss the project or our agency's responsibilities in more detail, please contact me at epenteco@nsf.gov.

Sincerely,

Elizabeth Pentecost
Project Management Administrator
Division of Astronomical Sciences

National Science Foundation
Division of Astronomical Sciences
Room 1045
4201 Wilson Boulevard
Arlington, VA 22230
Tel: 703-292-4907
Fax: 703-292-9034



Preservation Alliance of West Virginia
421 Davis Avenue
Elkins, WV 26241
304-345-6005
www.pawv.org

February 3, 2017

Ms. Elizabeth Pentecost
National Science Foundation
Division of Astronomical Sciences, Suite 1045
4201 Wilson Blvd.
Arlington, VA 22230

Re: Section 106 Consultation for the Proposed Changes to Green Bank Observatory Operations,
Green Bank, West Virginia

Dear Ms. Pentecost,

Thank you for your letter dated January 12, 2017, regarding the Green Bank Observatory Operations. I am writing to submit comments regarding this project.

The Preservation Alliance of West Virginia (PAWV) would like to continue to be a consulting party during the Section 106 review of this National Historic Landmark and appreciate your initial outreach regarding this matter. PAWV recognizes the cultural importance of the Green Bank Observatory and also values its significance as an economic engine for West Virginia and Pocahontas County.

PAWV has received the packet sent by your office, and we have reviewed the preliminary proposed Alternatives. We support the following alternatives in this order (1 being most appealing and 3 being least appealing):

1. Continued NSF investment for science-focused operations;
2. Collaboration with interested parties for science- and education-focused operations with reduced NSF-funded scope; or
3. Collaboration with interested parties for operation as a technology and education park.

PAWV does not recommend mothballing the facilities and does not support the deconstruction of the Green Bank Observatory. Closing this facility would be a great detriment to the surrounding economy, and mothballing the property leaves the future of this important cultural

resource uncertain. It would be unfortunate for the property to be left vacant as it is a vital historic asset for West Virginia. There are financial incentives available to preserve the historic structure including historic preservation grants and historic rehabilitation tax credits. These grants and tax credits may help to alleviate any financial commitments related to maintaining this property.

These are all of the comments that PAWV has at this time. We look forward to working with you on this project.

Thank you for your consideration,

A handwritten signature in cursive script that reads "Danielle LaPresta Parker".

Danielle LaPresta Parker
Executive Director

CC: Susan Pierce, West Virginia State Historic Preservation Office



The Culture Center
1900 Kanawha Blvd., E.
Charleston, WV 25305-0300

Randall Reid-Smith, Commissioner

Phone 304.558.0220 • www.wvculture.org
Fax 304.558.2779 • TDD 304.558.3562
EEO/AA Employer

June 12, 2017

Mr. James Ulvestad
Division Director, Division of Astronomical Sciences
National Science Foundation
4201 Wilson Boulevard
Arlington, Virginia 22230

RE: NEPA Analysis for Changes to Green Bank Observatory Operations
FR#: 17-49-PH-2

Dear Mr. Ulvestad:

We have reviewed the additional information submitted for the above-mentioned project to determine its effects to cultural resources. As required by Section 106 of the National Historic Preservation Act of 1966, as amended, and its implementing regulations, 36 CFR 800: "Protection of Historic Properties," we submit our comments.

According to submitted information, the National Science Foundation (NSF) plans to complete an Environmental Impact Statement (EIS) to evaluate potential effects of proposed operational changes at the Green Bank Observatory (GBO) in Pocahontas County, West Virginia. This additional information was prepared in response to our request in a letter dated December 22, 2016,

Architectural Resources:

As stated in our December 22, 2016 letter, our office agreed that the area of potential (APE) for this project was defined as the property boundary of the GBO. We also concurred that four (4) of the telescopes at GBO were individually eligible for the National Register of Historic Places, and the Reber Radio Telescope (NR# 72001291), which was listed in the National Register in 1972 and as a National Historic Landmark in 1986, retained its historical significance. While we felt that the GBO, as a whole, may represent a National Register-eligible historic district, we requested additional documentation and evaluation of all resources older than 45 years of age within the property boundary of the GBO to confirm this conclusion.

Thank you for the submission of the Historic Property Inventory forms. We have reviewed the submitted documentation and concur with the NSF that the GBO is eligible as a historic district under Criteria A for its significant contribution to radio astronomy and under Criteria C for its various unique instruments engineered to study the universe, as well as an excellent example of a scientific campus. Of the 48 documented resources over 45 years of age on the GBO, we agree that four resources, barns (PH-0918–PH-920) and the orchard cellar building (PH-0921) do not contribute to the National Register-eligible GBO historic district and are not individually eligible for the National Register because they were never used for anything beyond random storage for the GBO and lack individual significance. However, because these resources are associated with agriculture, it is possible that additional survey, outside the scope of this project, could reveal that these resources contribute to an agricultural historic district within the region.

We concur that the remaining 44 resources contribute to the National Register-eligible GBO historic district. This includes the four telescopes previously determined to be individually eligible for the National Register (PH-0948–PH-0950 and PH-0952), as well as the Reber Radio Telescope (NR# 72001291; PH-0953). The remaining

June 12, 2017
Mr. Ulvestad
FR#: 17-49-PH-2
Page 2

contributing resources (PH-0331; PH-0907–PH-0917; PH-0922–PH-0947; and PH-0952) include 24 residential buildings, eight administrative/operational buildings, two horn antennas, one telescope, a replica antenna, an airstrip, a water tower, and a recreational area. We agree that none of these remaining contributing resources are individually eligible for the National Register.

Because a preferred alternative for the GBO project has not yet been chosen, an assessment of potential effects resulting from the proposed project cannot be completed at this point. As the EIS process continues and a preferred alternative is developed, please provide our office an assessment of the potential effects to the National Register-eligible GBO, as well as any of the individually eligible or listed resources, resulting from the preferred alternative. We look forward to continuing our participation in the Section 106 process and will provide additional comments once we receive the details regarding the NSF's preferred alternative and the assessment of effects.

Public Comments:

We note that the NSF received an email from the Oneida Nation of Wisconsin on November 9, 2016 indicating that they are not interested in becoming a consulting party. Also, we note that your office sent letters on December 12, 2016 about the proposed project to the 15 Native American tribes identified by our office with historical ties to West Virginia. No response has been received from these tribes. During the November 9, 2016 NEPA public scoping meeting, three individuals (Daryl and Deana White and Grayg Ralphsnyder) confirmed their desire to be included as consulting parties.

The Pocahontas County Historical Landmarks Commission (PCHLC), the Pocahontas County Historical Society (PCHS), and the Preservation Alliance of West Virginia (PAWV) were also notified about the project. On December 30, 2016, Robert A. Sheets, designated representative of the PCHLC, notified NSF via email of his organization's interest in being included as a consulting party. On February 3, 2017, the PAWV sent a letter to the NSF to indicate that the PAWV would like to continue as a consulting party for this project. In addition, several public comments regarding the cultural and historical significance of the GBO were received during the public comment period, which NSF included with this submittal. No other responses had been received by the NSF at the time of submittal. We understand that any further correspondence or comments will be sent to our office.

We appreciate the opportunity to be of service. *If you have questions regarding our comments or the Section 106 process, please contact Benjamin M. Riggle, Structural Historian, at (304) 558-0240.*

Sincerely,



Susan M. Pierce
Deputy State Historic Preservation Officer

SMP/BMR

NATIONAL SCIENCE FOUNDATION
4201 Wilson Boulevard
Arlington, Virginia 22230



OFFICE OF THE
GENERAL COUNSEL

August 7, 2017

Ms. Kim Penrod
Director of Cultural Resources
Delaware Nation
P.O. Box 825
Anadarko, OK 73005

RE: Section 106 Consultation for the Proposed Changes to Green Bank
Observatory Operations, Green Bank, West Virginia

Dear Ms. Penrod:

The National Science Foundation (NSF) has identified the need to divest several facilities from its portfolio to retain the balance of capabilities needed to deliver the best performance on the key science of the present decade and beyond. Green Bank Observatory (GBO) in Green Bank, Pocahontas County, West Virginia, is one of the facilities identified for potential divestment. The decision regarding the potential changes to GBO operations is considered a federal undertaking. While engaging in Section 106 consultation under the National Historic Preservation Act (NHPA), NSF will be simultaneously conducting an Environmental Impact Statement (EIS) process under the National Environmental Policy Act (NEPA) to identify potential impacts associated with the proposed operational changes due to funding constraints. With this letter, NSF is formally initiating Section 106 consultation under the NHPA and transmitting the *Cultural Resources Evaluation, Green Bank Observatory, Green Bank, West Virginia* (Enclosure 1) for your review and comment.

Project Location and Background

GBO is located on federal lands adjacent to the Monongahela National Forest. This land is owned by NSF and consists of numerous parcels that were acquired/condemned by the U.S. Army Corps of Engineers in the 1950s when GBO was formed as the first (and then, only) site of the National Radio Astronomy Observatory (NRAO). The GBO is the anchor and administrative site of the 13,000-square-mile National Radio Quiet Zone (NRQZ) and is situated on approximately 2,200 acres in the NRQZ, where all radio transmissions are limited. The GBO facility has a long history of science, technology, engineering, and mathematics education, ranging from student training and mentorships through the outreach and training opportunities offered through the NRAO Center for

Science Education, which is based at the GBO site. More than 40,000 visitors each year pass through the Green Bank Science Center, including students, educators, and the general public who generally stay on site for more than one night to take advantage of the educational facilities. The GBO facility is host to multiple educational workshops and programs each year for middle school through post-graduate student training, and an average of 10 to 15 undergraduate and graduate students are mentored at the facility each year.

GBO facilities include the Green Bank Telescope; 43-meter telescope (also referred to as the 140-foot telescope); Green Bank Solar Radio Burst Spectrometer (45-foot telescope); Interferometer Range (includes three 85-foot diameter telescopes); 20-meter Geodetic Telescope; 40-foot telescope; three non-operational historical telescopes (Jansky Replica Antenna, Reber Radio Telescope, and Ewen-Purcell Horn); and other support facilities and infrastructure.

Project Description

NSF's Division of Astronomical Sciences (AST) is the federal steward for ground-based astronomy in the United States, funding research with awards to individual investigators and small research groups, and via cooperative agreements for operation of large telescope facilities. These national and international telescope facilities provide world-leading, one-of-a-kind observational capabilities on a competitive basis to thousands of astronomers per year. These facilities also enable scientific advances by making archived data products available to researchers. Along with funding telescope facilities and research awards, AST supports the development of advanced technologies and instrumentation, and manages the allocation and assignment of specific frequencies in the radio spectrum for scientific use by the entire NSF community. The need for NSF to reduce funding for the GBO has been established through a number of reviews and surveys conducted by the science community.

In 2014, CH2M conducted a Cultural Resources Evaluation for the architectural resources at the GBO. The results of the survey are included below under "Determinations of Eligibility." The associated technical report, entitled *Cultural Resources Evaluation, Green Bank Observatory, Green Bank, West Virginia*, is attached for reference (Enclosure 1).

A range of preliminary proposed Alternatives is being considered for evaluation. These preliminary proposed Alternatives, which will be refined through public input, include the following:

- Continued NSF investment for science-focused operations (No-Action Alternative).
- Collaboration with interested parties for science- and education-focused operations with reduced NSF-funded scope.

- Collaboration with interested parties for operation as a technology and education park.
- Mothballing of facilities (suspension of operations in a manner such that operations could resume efficiently at some future date).
- Deconstruction and site restoration.

These alternatives may be further refined during the early phases of the compliance review and will be informed by the public process.

Proposed Area of Potential Effects

The Area of Potential Effects (APE) proposed for the project is defined as the property boundary of GBO. The total geographic area of the Observatory was chosen as the APE to encompass all buildings and structures on the property. This inclusive APE enables a determination of whether GBO constitutes a potential historic district that could be affected by the activities associated with the proposed changes to operations at the Observatory. Figure 2-1 included in Enclosure 1 shows the boundaries of the APE. The West Virginia State Historic Preservation Office (SHPO) concurred with the APE in a letter dated December 22, 2016.

Public Involvement

A Notice of Intent (NOI) was published in the Federal Register on October 19, 2016 to initiate the public scoping process for the EIS. A revised NOI was published on November 1, 2016. Two Public Scoping Meetings were conducted on November 9, 2016, at GBO. Section 106 public outreach was addressed as part of the public meeting, and participants were invited to identify whether they would like to participate in Section 106 as a consulting party. NSF followed up with these potential consulting parties to confirm their interest. A separate Section 106 consulting party meeting will be scheduled following the release of the Draft EIS this fall. Follow-up discussions with consulting parties will occur as needed.

Previously Identified Historic Properties

A literature review was conducted through the West Virginia SHPO Interactive Map on November 7, 2016. The literature review focused on the APE and included a 0.5-mile study area.

The Reber Radio Telescope is the only structure or building located within GBO that is listed in the NRHP. It was listed in the NRHP in 1972 and designated a National Historic Landmark in 1986. The telescope was listed under Criteria A and B for its nationally significant association with the origins of radio astronomy and for its association with Grote Reber.

One residence within the APE, the Riley House (House #15), was previously recorded in 2011. The associated survey form states that the early twentieth-century wood-frame

farm house does not appear to be significant under NRHP Criterion C. The literature review did not identify any prior cultural resources surveys that have occurred within the APE. Two archaeological sites and nine architectural resources have been recorded outside of the APE, along State Routes 28 and 92, directly adjacent to the eastern boundary of the Observatory. The two previously recorded archaeological resources were not evaluated for the NRHP. One of the architectural resources, the Liberty Presbyterian Church on State Route 92 that was constructed in 1851, is described as significant as an excellent example of Greek Revival architecture, although no formal NRHP evaluation is included with the survey form. The church was recorded on two West Virginia Historic Property Inventory Forms (PH-0002 and PH-0037-0018). Four architectural resources were evaluated as not eligible for the NRHP and three buildings were recorded, but not evaluated for the NRHP. The cultural resources that have been previously recorded within or directly adjacent to the APE are listed below in Table 1. In addition, two surveys (a bridge survey and a cultural resources survey) have occurred and 34 additional cultural resources have been identified within the 0.5-mile study area.

TABLE 1. Previously Recorded Cultural Resources Within and Directly Adjacent to the APE*

Resource Name	Description	Status	Recorded by
Reber Radio Telescope	1937 telescope located at the entrance to GBO within APE	NRHP listed 1972; National Historic Landmark 1986	National Register of Historic Places Registration Form
Riley House (House #15) PH-0331	Circa 1915 farm house within APE	Not eligible for the NRHP	Justin Greenawalt and Mary Stack (Skelly and Loy, Inc.); 2011
Liberty Presbyterian Church PH-0002 PH-0037-0018	1851 Greek Revival Church adjacent to APE	Not formally evaluated for the NRHP, but described as "significant as an excellent example of Greek Revival architecture in the area"	Michael Gioulis (Historic Preservation Consultant); 1993
George Porter Kerr House – Historic Orlan Shears House PH-0037-0040	Circa 1901 residence adjacent to APE	Not evaluated for the NRHP	Sherron Waybright; 1986

Dr. J.P. Mooumau House PH-0037-0044	1873 residence adjacent to APE	Not evaluated for the NRHP	Jessie B. Powell; 1986
Hamed House PH-0037-0048	1910 residence adjacent to APE	Not evaluated for the NRHP	Jessie B. Powell; 1986
Jack Nelson House PH-0209	Circa 1900 residence adjacent to the APE	Not eligible for the NRHP	Jeff Drobney (Skelly and Loy, Inc.); 1996
Jerry Thorton House PH-0210	Circa 1880-1890 vernacular residence adjacent to APE	Not eligible for the NRHP	Jeff Drobney (Skelly and Loy, Inc.); 1996
PH-0326	Circa 1920 bungalow residence adjacent to APE	Not eligible for the NRHP	Justin Greenawalt and Mary Stack (Skelly and Loy, Inc.); 2011
PH-0327	Circa 1920 bungalow residence adjacent to APE	Not eligible for the NRHP	Justin Greenawalt and Mary Stack (Skelly and Loy, Inc.); 2011
PH-0332	1949 bungalow residence adjacent to APE	Not eligible for the NRHP	Justin Greenawalt and Mary Stack (Skelly and Loy, Inc.); 2011
Shinaberry's Fifth Grade Site 46-PH-64	Prehistoric open archaeological site adjacent to APE	Not evaluated for the NRHP	Dick Reigel; 1987
Sheets Site 46-PH-27	Prehistoric campsite adjacent to APE	Not evaluated for the NRHP	Stephen Davis; 1977

* Shaded rows indicate previously recorded resources within the APE.

Determination of Eligibility

A Secretary of the Interior-qualified architectural historian with CH2M conducted an intensive architectural survey at the GBO from October 6-9, 2014. The site visit to GBO was also used to engage GBO staff in informal interviews and to conduct archival research, including the review of historic photographs and narratives, newspaper articles, construction records, and architectural drawings.

The field survey encompassed standing structures built in or before 1969, which is 47 years from the present year. The standard NRHP age threshold is 50 years; however, using 47 years as the cutoff allowed a buffer for the execution of the proposed Alternatives. All built environment resources from 1969 or earlier within the GBO boundary were surveyed and assessed, including a determination of eligibility for listing in the NRHP, except for the Reber Radio Telescope. Buildings and structures were evaluated individually as well as part of a potential historic district.

Using aerial photographs of GBO and information provided by GBO staff, 47 built environment resources that had been constructed in or before 1969 were identified as extant within the APE. These include: 5 telescope structures (one of which contains three large telescopes), 2 horn instruments, 1 antenna, 1 airstrip, 1 water tower, 1 recreation area, 24 residential buildings, and 12 operational and administrative buildings. As noted above, one of these telescopes, the Reber Radio Telescope, was previously evaluated. The remaining 46 built environment resources in the APE built in or before 1969 were photographed and evaluated for NRHP eligibility. Data collected through the background research and field investigations were analyzed to determine NRHP eligibility of the 46 surveyed built environment resources individually. In addition, the Green Bank Telescope, which was constructed after 1969, was evaluated individually due to its exceptional importance to radio astronomy over the last 50 years. All 47 historic-era properties (constructed in or before 1969, including the Reber Radio Telescope) and the GBT were also evaluated as a potential historic district. Properties surveyed in 2014 are listed in Attachment A of Enclosure 1. Figure 5-1, included in Enclosure 1, shows the location of each evaluated built environment resource.

NSF has determined that within the historical context of NRAO/GBO, there are four telescope instruments that are individually eligible for listing in the NRHP: the Interferometer Range, the 40-foot Telescope, the 43-meter Telescope, and the Green Bank Telescope. In addition, NSF has determined that GBO is eligible as a historic district for representing an important time in science history and for its significant contribution to the advancement of radio astronomy. There are 44 resources within the APE that are recommended as contributing to the proposed GBO historic district, the boundaries of which coincide with the site's property boundaries (and the APE). Contributing elements include 8 administrative/operational buildings, 1 airstrip, 1 water tower, 1 recreational area, 24 residential buildings, 2 horns, 1 antenna, and 6 telescopes (the Interferometer includes 3 large telescopes) (Table 2).

The scientific instruments within the APE are a collection of telescopes, horns, and antenna that are significant for their role in the development of radio astronomy and, in several instances, as remarkable feats of engineering. As a whole, the majority of the components that make up the potential district's historic character possess integrity, even though many of the buildings are individually undistinguished. The administrative and operations buildings and structures within the GBO are primarily utilitarian buildings or structures with simple designs executed using practical and standard materials. These elements create a cohesive, visual unit that emphasizes their historically linked function

as support for the observatory. As a group, the 44 contributing built environment resources are a distinct and well-preserved representation of the early years of the NRAO, complete with scientific instruments, administration/operational facilities, recreation area, and residential buildings. Additionally, the scientific instruments present on site illustrate a linear, historical narrative of the history of radio astronomy from the Jansky Replica Antenna and Reber Radio Telescope to the monumental Green Bank Telescope. Four buildings within the APE were identified as non-contributing resources. These include three barns and one cellar building, all of which pre-date the establishment of the NRAO and have been primarily left vacant or used as miscellaneous storage facilities.

Table 2 lists the properties at the GBO that were identified as individually eligible for the NRHP. Attachment A, included in Enclosure 1, lists the buildings that contribute to the NRHP-eligible historic district.

In its letter dated December 22, 2016, the West Virginia SHPO concurred that four of the telescopes are individually eligible for listing on the National Register. In order to evaluate NSF's determination regarding historic district eligibility, the SHPO requested that NSF complete Historic Property Inventory Forms on all resources within the APE that are older than 45 years of age. Following submission of this additional documentation, the SHPO concurred, on June 12, 2017, that GBO is eligible as a historic district with 44 contributing resources.

TABLE 2. NRHP-Eligible Built Environment Resources within the APE

Resource Name	Year Constructed	Description/Significance	NRHP Eligibility Recommendation
GBO Historic District	1958-2000	Collection of administrative/operational structures, residential buildings, and radio astronomy equipment associated with the NRAO/GBO.	Eligible (Historic District); 44 contributing resources (Attachment A in Enclosure 1)
Interferometer Range: Howard E. Tatel Telescope (85'-1) and 85'-1 control building; 85'-2 Telescope; 85'-3 Telescope;	85'-1: 1958-1959 85'-2: 1963-1964 85'-3: 1965-1968 Interferometer control	The Tatel Telescope (85'-1) was the first telescope constructed by the NRAO and performed the world's first Search For Extra Terrestrial Intelligence (SETI) observations. The Interferometer Range connected two nearly identical	Individually eligible and contributing to GBO Historic District

TABLE 2. NRHP-Eligible Built Environment Resources within the APE

Resource Name	Year Constructed	Description/Significance	NRHP Eligibility Recommendation
and the Interferometer control building	building: 1967-1968	telescopes to the Tatel Telescope in a linear formation. The three telescopes operated in unison and proved that dishes could be combined to form very large telescopes. This information spurred the construction of the Very Large Array telescope in New Mexico in the 1970s.	
40-foot Telescope and control building	1962	First fully automated radio telescope in the world. Currently operates as an educational telescope for visiting students.	Individually eligible and contributing to GBO Historic District
43-meter Telescope	1958-1965	Largest telescope in the world to use an equatorial (for polar aligned) mount. Currently used as part of the Russian Radioastron project.	Individually eligible and contributing to GBO Historic District
Robert C. Byrd Green Bank Telescope (Green Bank Telescope)	1991-2000	Largest moving structure on land in the world; tilt and point design that can rotate a full 360 degrees; performs highly sensitive data collection.	Individually eligible and contributing to GBO Historic District

Initiation of Section 106 Consultation

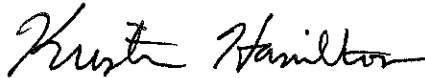
The GBO is a federally-owned property that contains historic properties. Therefore the Proposed Action has the potential to affect historic properties. In compliance with 36 Code of Federal Regulations (CFR) 800.2(c)(2)(ii), NSF is initiating consultation with you on the proposed changes to GBO operations. NSF is also seeking your input on any cultural resources in the project area or any cultural resources concerns you may have related to this undertaking.

We respectfully request your response within 30 days from receipt of this letter indicating your interest in participating in consultation for this undertaking. Please respond to:

Ms. Elizabeth Pentecost
National Science Foundation
Division of Astronomical Sciences
4201 Wilson Blvd, Suite 1045
Arlington, Virginia 22230
epenteco@nsf.gov

NSF is also transmitting the *Cultural Resources Evaluation, Green Bank Observatory, Green Bank, West Virginia* (attached as Enclosure 1). If you have any questions, please do not hesitate to contact me by phone at 703-292-4592 or by email at cblanco@nsf.gov. We look forward to further consultation on this proposed undertaking.

Regards,



for Caroline M. Blanco
Federal Preservation Officer
Assistant General Counsel
Office of the General Counsel

Enclosures:

1. *Cultural Resources Evaluation, Green Bank Observatory, Green Bank, West Virginia*

From: Kimberly Penrod <kpenrod@delawarenation.com>
Date: Thursday, August 24, 2017 at 10:36 AM
To: Elizabeth Pentecost <epenteco@nsf.gov>
Cc: Kimberly Penrod <kpenrod@delawarenation.com>
Subject: RE: Cultural Resources Evaluation/ Green Bank Observatory, Green Bank, West Virginia

Elizabeth,

The protection of our tribal cultural resources and tribal trust resources will take all of us working together.

We look forward to working with you and your agency.

With the information you have submitted we can concur at present with this proposed plan and request to be a consulting party on this project.

As with any new project, we never know what may come to light until work begins.

The Delaware Nation asks that you keep us up to date on the progress of this project and if any discoveries arise please contact us immediately.

Our department is trying to go as paper free as possible. If it is at all feasible for your office to send email correspondence we would greatly appreciate.

If you need anything additional from me please do not hesitate to contact me.

Respectfully,

*Kim Penrod
Delaware Nation
Director, Cultural Resources/106
Archives, Library and Museum
31064 State Highway 281
PO Box 825
Anadarko, OK 73005
(405)-247-2448 Ext. 1403 Office
(405)-924-9485 Cell
kpenrod@delawarenation.com*

Appendix 4.12A
EPA EJSCREEN Results

1
2
3



Location: User-specified point center at 38.433060, -79.839947
 Ring (buffer): 5-mile radius
 Description: Green Bank Observatory

Summary of ACS Estimates		2010 - 2014
Population		992
Population Density (per sq. mile)		16
Minority Population		36
% Minority		4%
Households		370
Housing Units		1,058
Housing Units Built Before 1950		183
Per Capita Income		28,576
Land Area (sq. miles) (Source: SF1)		62.97
% Land Area		100%
Water Area (sq. miles) (Source: SF1)		0.00
% Water Area		0%

	2010 - 2014 ACS Estimates	Percent	MOE (±)
Population by Race			
Total	992	100%	210
Population Reporting One Race	992	100%	320
White	961	97%	210
Black	30	3%	66
American Indian	0	0%	11
Asian	0	0%	11
Pacific Islander	0	0%	11
Some Other Race	1	0%	11
Population Reporting Two or More Races	0	0%	11
Total Hispanic Population	6	1%	15
Total Non-Hispanic Population	986		
White Alone	956	96%	206
Black Alone	30	3%	66
American Indian Alone	0	0%	11
Non-Hispanic Asian Alone	0	0%	11
Pacific Islander Alone	0	0%	11
Other Race Alone	0	0%	11
Two or More Races Alone	0	0%	11
Population by Sex			
Male	472	48%	132
Female	520	52%	104
Population by Age			
Age 0-4	69	7%	47
Age 0-17	192	19%	80
Age 18+	800	81%	142
Age 65+	189	19%	66

Data Note: Detail may not sum to totals due to rounding. Hispanic population can be of any race. N/A means not available.

Source: U.S. Census Bureau, American Community Survey (ACS) 2010 - 2014.

Location: User-specified point center at 38.433060, -79.839947

Ring (buffer): 5-mile radius

Description: Green Bank Observatory

	2010 - 2014 ACS Estimates	Percent	MOE (±)
Population 25+ by Educational Attainment			
Total	771	100%	140
Less than 9th Grade	49	6%	42
9th - 12th Grade, No Diploma	31	4%	26
High School Graduate	416	54%	102
Some College, No Degree	139	18%	61
Associate Degree	40	5%	40
Bachelor's Degree or more	136	18%	53
Population Age 5+ Years by Ability to Speak English			
Total	923	100%	189
Speak only English	916	99%	180
Non-English at Home ¹⁺²⁺³⁺⁴	7	1%	23
¹ Speak English "very well"	7	1%	23
² Speak English "well"	0	0%	11
³ Speak English "not well"	0	0%	11
⁴ Speak English "not at all"	0	0%	11
³⁺⁴ Speak English "less than well"	0	0%	11
²⁺³⁺⁴ Speak English "less than very well"	0	0%	19
Linguistically Isolated Households*			
Total	0	0%	11
Speak Spanish	0	0%	11
Speak Other Indo-European Languages	0	0%	11
Speak Asian-Pacific Island Languages	0	0%	11
Speak Other Languages	0	0%	11
Households by Household Income			
Household Income Base	370	100%	89
< \$15,000	63	17%	50
\$15,000 - \$25,000	61	17%	70
\$25,000 - \$50,000	98	27%	59
\$50,000 - \$75,000	94	25%	51
\$75,000 +	54	15%	46
Occupied Housing Units by Tenure			
Total	370	100%	89
Owner Occupied	309	84%	68
Renter Occupied	61	16%	80
Employed Population Age 16+ Years			
Total	818	100%	154
In Labor Force	525	64%	141
Civilian Unemployed in Labor Force	26	3%	34
Not In Labor Force	293	36%	111

Data Note: Detail may not sum to totals due to rounding. Hispanic population can be of any race. N/A means not available. **Source:** U.S. Census Bureau, American Community Survey (ACS) 2010 - 2014.

*Households in which no one 14 and over speaks English "very well" or speaks English only.

Location: User-specified point center at 38.433060, -79.839947

Ring (buffer): 5-mile radius

Description: Green Bank Observatory

	2010 - 2014 ACS Estimates	Percent	MOE (±)
Population by Language Spoken at Home*			
Total (persons age 5 and above)	923	100%	189
English	N/A	N/A	N/A
Spanish	N/A	N/A	N/A
French	N/A	N/A	N/A
French Creole	N/A	N/A	N/A
Italian	N/A	N/A	N/A
Portuguese	N/A	N/A	N/A
German	N/A	N/A	N/A
Yiddish	N/A	N/A	N/A
Other West Germanic	N/A	N/A	N/A
Scandinavian	N/A	N/A	N/A
Greek	N/A	N/A	N/A
Russian	N/A	N/A	N/A
Polish	N/A	N/A	N/A
Serbo-Croatian	N/A	N/A	N/A
Other Slavic	N/A	N/A	N/A
Armenian	N/A	N/A	N/A
Persian	N/A	N/A	N/A
Gujarathi	N/A	N/A	N/A
Hindi	N/A	N/A	N/A
Urdu	N/A	N/A	N/A
Other Indic	N/A	N/A	N/A
Other Indo-European	N/A	N/A	N/A
Chinese	N/A	N/A	N/A
Japanese	N/A	N/A	N/A
Korean	N/A	N/A	N/A
Mon-Khmer, Cambodian	N/A	N/A	N/A
Hmong	N/A	N/A	N/A
Thai	N/A	N/A	N/A
Laotian	N/A	N/A	N/A
Vietnamese	N/A	N/A	N/A
Other Asian	N/A	N/A	N/A
Tagalog	N/A	N/A	N/A
Other Pacific Island	N/A	N/A	N/A
Navajo	N/A	N/A	N/A
Other Native American	N/A	N/A	N/A
Hungarian	N/A	N/A	N/A
Arabic	N/A	N/A	N/A
Hebrew	N/A	N/A	N/A
African	N/A	N/A	N/A
Other and non-specified	N/A	N/A	N/A
Total Non-English	N/A	N/A	N/A

Data Note: Detail may not sum to totals due to rounding. Hispanic population can be of any race. N/A means not available. **Source:** U.S. Census Bureau, American Community Survey (ACS) 2010 - 2014.

*Population by Language Spoken at Home is available at the census tract summary level and up.

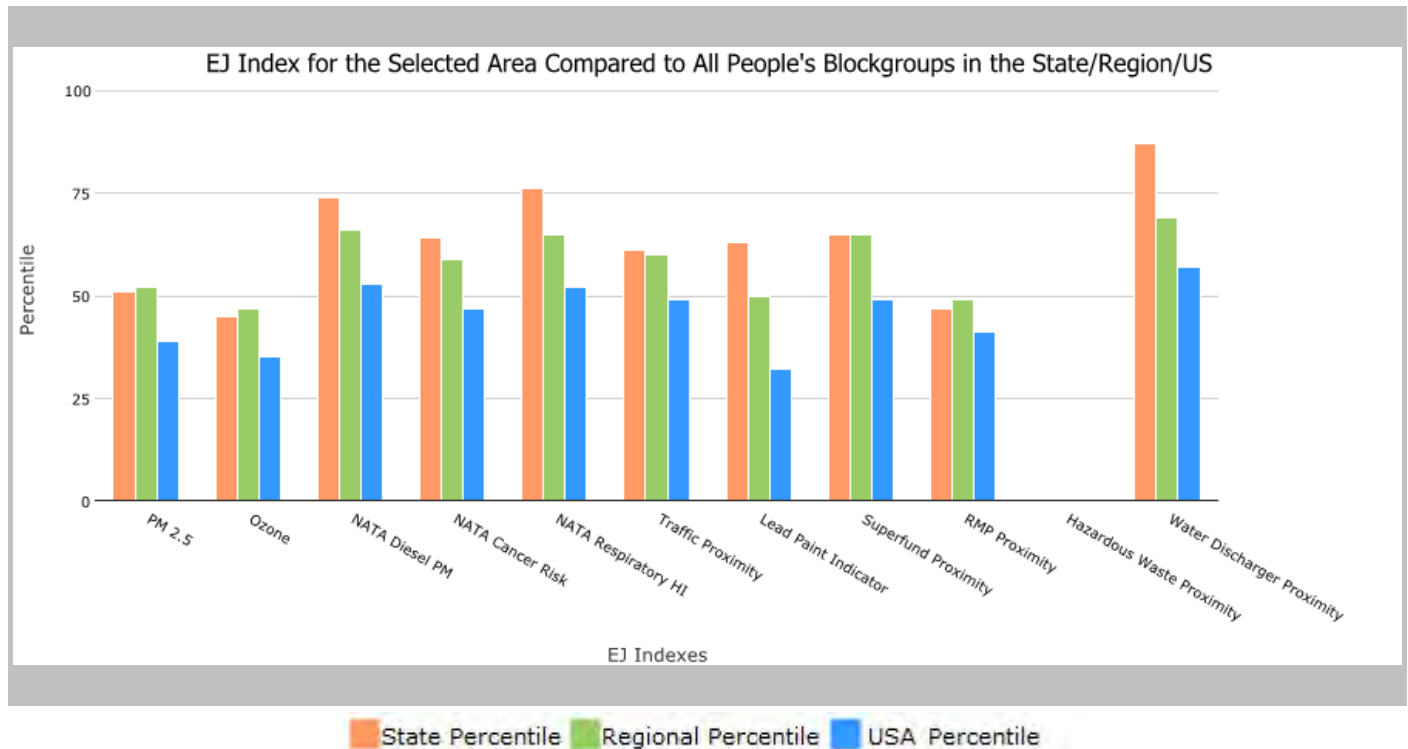
5 mile Ring Centered at 38.433060,-79.839947, WEST VIRGINIA, EPA Region 3

Approximate Population: 992

Input Area (sq. miles): 78.53

Green Bank Observatory

Selected Variables	State Percentile	EPA Region Percentile	USA Percentile
EJ Indexes			
EJ Index for PM2.5	51	52	39
EJ Index for Ozone	45	47	35
EJ Index for NATA* Diesel PM	74	66	53
EJ Index for NATA* Air Toxics Cancer Risk	64	59	47
EJ Index for NATA* Respiratory Hazard Index	76	65	52
EJ Index for Traffic Proximity and Volume	61	60	49
EJ Index for Lead Paint Indicator	63	50	32
EJ Index for Superfund Proximity	65	65	49
EJ Index for RMP Proximity	47	49	41
EJ Index for Hazardous Waste Proximity ⁺	N/A	N/A	N/A
EJ Index for Water Discharger Proximity	87	69	57



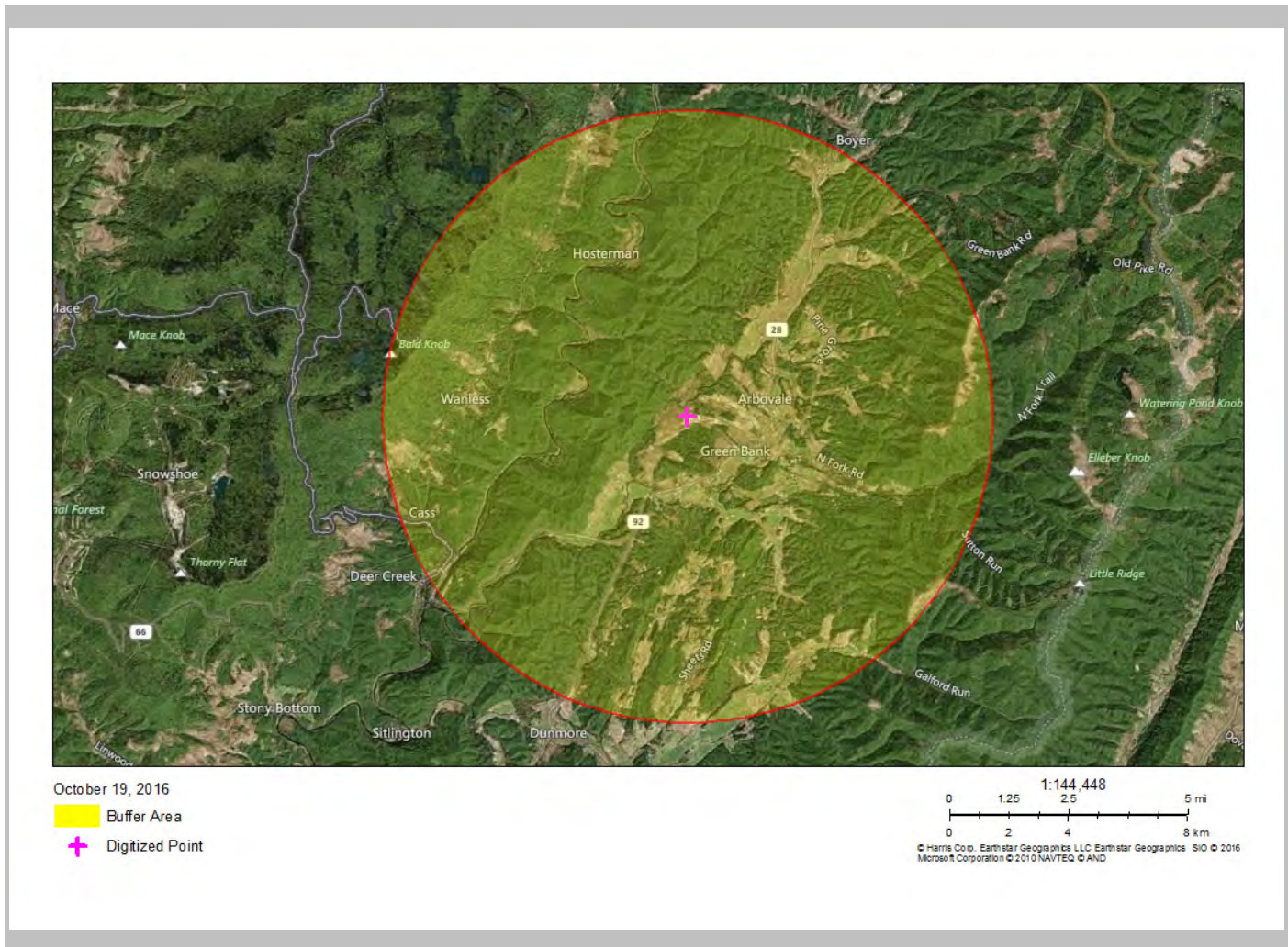
This report shows the values for environmental and demographic indicators and EJSCREEN indexes. It shows environmental and demographic raw data (e.g., the estimated concentration of ozone in the air), and also shows what percentile each raw data value represents. These percentiles provide perspective on how the selected block group or buffer area compares to the entire state, EPA region, or nation. For example, if a given location is at the 95th percentile nationwide, this means that only 5 percent of the US population has a higher block group value than the average person in the location being analyzed. The years for which the data are available, and the methods used, vary across these indicators. Important caveats and uncertainties apply to this screening-level information, so it is essential to understand the limitations on appropriate interpretations and applications of these indicators. Please see EJSCREEN documentation for discussion of these issues before using reports.

5 mile Ring Centered at 38.433060,-79.839947, WEST VIRGINIA, EPA Region 3

Approximate Population: 992

Input Area (sq. miles): 78.53

Green Bank Observatory



Sites reporting to EPA	
Superfund NPL	0
Hazardous Waste Treatment, Storage, and Disposal Facilities (TSDF)	0
National Pollutant Discharge Elimination System (NPDES)	0

EJSCREEN Report (Version 2016)



5 mile Ring Centered at 38.433060,-79.839947, WEST VIRGINIA, EPA Region 3

Approximate Population: 992

Input Area (sq. miles): 78.53

Green Bank Observatory

Selected Variables	Value	State Avg.	%ile in State	EPA Region Avg.	%ile in EPA Region	USA Avg.	%ile in USA
Environmental Indicators							
Particulate Matter (PM 2.5 in $\mu\text{g}/\text{m}^3$)	7.65	9.51	0	9.84	0	9.32	16
Ozone (ppb)	47.2	50.1	4	49.8	15	47.4	43
NATA* Diesel PM ($\mu\text{g}/\text{m}^3$)	0.105	0.439	1	0.918	<50th	0.937	<50th
NATA* Cancer Risk (lifetime risk per million)	19	34	0	42	<50th	40	<50th
NATA* Respiratory Hazard Index	0.39	1.3	0	1.8	<50th	1.8	<50th
Traffic Proximity and Volume (daily traffic count/distance to road)	4	58	22	350	9	590	9
Lead Paint Indicator (% Pre-1960 Housing)	0.15	0.35	23	0.37	32	0.3	44
Superfund Proximity (site count/km distance)	0.00022	0.074	27	0.15	5	0.13	16
RMP Proximity (facility count/km distance)	0.11	0.29	46	0.35	37	0.43	31
Hazardous Waste Proximity* (facility count/km distance)	N/A	0.12	N/A	0.12	N/A	0.11	N/A
Water Discharger Proximity (facility count/km distance)	0.0056	0.42	0	0.37	0	0.31	1
Demographic Indicators							
Demographic Index	17%	24%	23	30%	31	36%	23
Minority Population	4%	7%	48	31%	16	37%	9
Low Income Population	30%	40%	27	29%	58	35%	47
Linguistically Isolated Population	0%	0%	87	2%	55	5%	44
Population With Less Than High School Education	10%	16%	34	12%	54	14%	49
Population Under 5 years of age	7%	6%	68	6%	66	6%	60
Population over 64 years of age	19%	17%	67	15%	75	14%	79

* The National-Scale Air Toxics Assessment (NATA) is EPA's ongoing, comprehensive evaluation of air toxics in the United States. EPA developed the NATA to prioritize air toxics, emission sources, and locations of interest for further study. It is important to remember that NATA provides broad estimates of health risks over geographic areas of the country, not definitive risks to specific individuals or locations. More information on the NATA analysis can be found at: <https://www.epa.gov/national-air-toxics-assessment>.

+ The hazardous waste environmental indicator and the corresponding EJ index will appear as N/A if there are no hazardous waste facilities within 50 km of a selected location.

For additional information, see: www.epa.gov/environmentaljustice

EJSCREEN is a screening tool for pre-decisional use only. It can help identify areas that may warrant additional consideration, analysis, or outreach. It does not provide a basis for decision-making, but it may help identify potential areas of EJ concern. Users should keep in mind that screening tools are subject to substantial uncertainty in their demographic and environmental data, particularly when looking at small geographic areas. Important caveats and uncertainties apply to this screening-level information, so it is essential to understand the limitations on appropriate interpretations and applications of these indicators. Please see EJSCREEN documentation for discussion of these issues before using reports. This screening tool does not provide data on every environmental impact and demographic factor that may be relevant to a particular location. EJSCREEN outputs should be supplemented with additional information and local knowledge before taking any action to address potential EJ concerns.

Appendix 5-A
Public Notice

requests, and related administrative materials.

7. Department of Justice, Agency-wide (DAA-0060-2016-0004, 1 item, 1 temporary item). Records relating to evaluation and selection of prospective employees, interns, and volunteers.

8. Department of Justice, INTERPOL Washington United States National Central Bureau (DAA-0060-2015-0002, 8 items, 8 temporary items). Records relating to United States representation to INTERPOL including reports, meeting minutes, agreements, and administrative records.

9. Department of Justice, Office of Information Policy (DAA-0060-2016-0005, 10 items, 7 temporary items). Records relating to oversight of Federal agency compliance with the Freedom of Information Act (FOIA). Records include report drafts, background and resource material gathered in preparing final reports, records relating to the administration of the FOIA, compliance monitoring, and legal advice to agencies. Proposed for permanent retention are Government-wide FOIA Reports, the Department of Justice Guide to the FOIA, and records of the Chief FOIA Officers Council.

10. Department of Transportation, Federal Transit Administration (DAA-0408-2013-0004, 2 items, 2 temporary items). General financial records, including Government Accountability Office exception files, and accountable officer designee records.

11. Department of Transportation, National Highway Traffic Safety Administration (DAA-0416-2015-0001, 1 item, 1 temporary item). Electronic information system used to facilitate the criminal investigation of odometer fraud.

12. Department of Transportation, Pipeline and Hazardous Materials Safety Administration (DAA-0571-2015-0001, 4 items, 4 temporary items). Web site records including internal and external Web sites, content management system, Web site logs and statistical compilations.

13. Department of Transportation, Pipeline and Hazardous Materials Safety Administration (DAA-0571-2015-0010, 1 item, 1 temporary item). Records pertaining to plans for responding to pipeline spills.

14. Department of Transportation, Pipeline and Hazardous Materials Safety Administration (DAA-0571-2015-0015, 1 item, 1 temporary item). Activity files to include quarterly and technical program activity reports.

15. National Archives and Records Administration, Government-wide (DAA-GRS-2014-0002, 21 items, 21 temporary items). General Records

Schedule for employee acquisition records including classification standards, position descriptions, classification appeals, job vacancy case files and application packages, interview records, records relating to political appointments, special hiring authority program records, pre-appointment files, and administrative records of agency agreements with the Office of Personnel Management to process examination and certification of potential employees.

16. National Archives and Records Administration, Government-wide (DAA-GRS-2015-0007, 23 items, 23 temporary items). General Records Schedule for employee relations records such as Alternative Dispute Resolution files; Reasonable Accommodation program records; Equal Employment Opportunity program and complaint files; anti-harassment program records; labor management relations records; administrative grievance, disciplinary and adverse action files; displaced employee program records; and telework/alternative worksite program files.

17. Peace Corps, Overseas Posts (DAA-0490-2016-0012, 6 items, 6 temporary items). Records include administrative records, copies of policies and procedures, handbooks, logs, and emergency planning materials.

18. Securities and Exchange Commission, Office of Human Resources (DAA-0266-2016-0013, 2 items, 2 temporary items). Records of agency employee applications for assistance in repaying outstanding qualifying Federal student loans.

19. Securities and Exchange Commission, Office of Human Resources (DAA-0266-2016-0014, 1 item, 1 temporary item). Records of employee temporary work assignments with Federal, State, local, and American Indian tribal governments; colleges and universities; and other eligible organizations.

Laurence Brewer,

Chief Records Officer for the U.S. Government.

[FR Doc. 2016-25224 Filed 10-18-16; 8:45 am]

BILLING CODE 7515-01-P

NATIONAL SCIENCE FOUNDATION

Notice of Intent To Prepare an Environmental Impact Statement and Initiate Section 106 Consultation for Proposed Changes to Green Bank Observatory Operations, Green Bank, West Virginia and Notice of Public Scoping Meetings and Comment Period

AGENCY: National Science Foundation.

ACTION: Notice of intent to prepare an Environmental Impact Statement and Initiate Section 106 Consultation for proposed changes to Green Bank Observatory operations, Green Bank, West Virginia and notice of public scoping meetings and comment period.

SUMMARY: In compliance with the National Environmental Policy Act of 1969, as amended, the National Science Foundation (NSF) intends to prepare an Environmental Impact Statement (EIS) to evaluate potential environmental effects of proposed changes to operations at Green Bank Observatory, in Green Bank, West Virginia (Proposed Action). (See **SUPPLEMENTARY INFORMATION** for more details.) By this notice, NSF announces the beginning of the scoping process to solicit public comments and identify issues to be analyzed in the EIS. At this juncture, NSF welcomes public comments on the preliminary proposed alternatives and resource areas identified for analysis. NSF also intends to initiate consultation under section 106 of the National Historic Preservation Act to evaluate potential effects, if any, on historic properties as a result of the Proposed Action.

DATES: This Notice initiates the public scoping process for the EIS and the initiation of public involvement under section 106 per 36 CFR 800.2(d). Comments on the scope of the preliminary proposed alternatives and resource areas to be studied may be submitted verbally during the scoping meetings scheduled for November 9, 2016 (see details in **SUPPLEMENTARY INFORMATION**) or in writing until November 19, 2016. To be eligible for inclusion in the Draft EIS, all comments must be received prior to the close of the scoping period. NSF will provide additional opportunities for public participation upon publication of the Draft EIS.

ADDRESSES: You may submit written comments by either of the following methods:

- *Email to: envcomp-AST-greenbank@nsf.gov*, with subject line "Green Bank Observatory."

• *Mail to:* Elizabeth Pentecost, RE: Green Bank Observatory, National Science Foundation, 4201 Wilson Blvd., Suite 1045, Arlington, VA 22230.

EIS INFORMATION: Information will be posted, throughout the EIS process, at www.nsf.gov/AST.

FOR FURTHER INFORMATION CONTACT: For further information regarding the EIS process or Section 106 consultation, contact: Elizabeth Pentecost, National Science Foundation, Division of Astronomical Sciences, 4201 Wilson Blvd., Suite 1045, Arlington, VA 22230; telephone: (703) 292-4907; email: epenteco@nsf.gov.

SUPPLEMENTARY INFORMATION: Green Bank Observatory (GBO) is located in Pocahontas County, West Virginia adjacent to the Monongahela National Forest. NSF owns the GBO land, which consists of numerous parcels acquired by the U.S. Army Corps of Engineers in the 1950s, when GBO was formed as the first (and then, only) site of the National Radio Astronomy Observatory (NRAO). The Allegheny Trail passes through portions of the NRAO property along the Little Mountain ridgeline. GBO is the anchor and administrative site of the 13,000-square-mile National Radio Quiet Zone (NRQZ). GBO is located on approximately 2,200 acres in the NRQZ, where all radio transmissions are limited. Having telescopes within the NRQZ allows for detection of faint scientific signals that would otherwise be drowned-out by man-made signals. The GBO facilities include the Robert C. Byrd Green Bank Telescope, the largest fully steerable radio telescope in the world; the 43-meter Telescope; the Green Bank Solar Radio Burst Spectrometer; the 20-meter Geodetic Telescope; the 40-foot Telescope; the Interferometer Range; and previously operational telescopes.

The NSF Directorate for Mathematical and Physical Sciences, Division of Astronomical Sciences, through a series of academic community-based reviews, has identified the need to divest several facilities from its portfolio. This would allow NSF to retain the balance of capabilities needed to deliver the best performance on emerging and key science technology of the present decade and beyond. In 2012, NSF's Division of Astronomical Sciences' (AST's) portfolio review committee recommended divestment of the Green Bank Telescope (GBT) from the AST portfolio, stating the following: "The GBT is the world's most sensitive single-dish radio telescope at wavelengths shorter than 10 cm; however, its capabilities are not as critical to *New World New Horizons*

[astronomy and astrophysics decadal survey] science goals as the higher-ranked facilities." In response to these recommendations, in 2016, NSF completed a feasibility study to inform and define options for the Observatory's future disposition that would involve significantly decreasing or eliminating NSF funding of Green Bank Observatory. Alternatives to be evaluated in the EIS will be refined through public input, with preliminary proposed alternatives that include the following:

- Continued NSF investment for science-focused operations (No-Action Alternative)
- Collaboration with interested parties for science- and education-focused operations with reduced NSF-funded scope
- Collaboration with interested parties for operation as a technology and education park
- Mothballing of facilities (suspension of operations in a manner such that operations could resume efficiently at some future date)
- Deconstruction and site restoration

The purpose of the public scoping process is to determine relevant issues that will influence the scope of the environmental analysis, including identifying viable alternatives. At present, NSF has identified the following preliminary resource areas to analyze potential impacts: Air quality, biological resources, cultural resources, geological resources, solid waste generation, health and safety, socioeconomic, traffic, and groundwater resources. NSF will consult under section 106 of the National Historic Preservation Act and section 7 of the Endangered Species Act in coordination with this EIS process, as appropriate. Federal, state, and local agencies, along with other stakeholders that may be interested or affected by NSF's decision on this Proposed Action are invited to participate in the scoping process and, if eligible, may request to participate as a cooperating agency.

Scoping Meetings: NSF will host two public scoping meetings.

- *Afternoon meeting:* November 9, 2016, at 3:00 p.m. to 5:00 p.m., Green Bank Science Center, 155 Observatory Road, Green Bank, WV 24915, Telephone: (304) 456-2011.

- *Evening meeting:* November 9, 2016, at 6:00 p.m. to 8:00 p.m., Green Bank Science Center, 155 Observatory Road, Green Bank, WV 24915, Telephone: (304) 456-2011.

Oral comments provided at the scoping meetings will be transcribed by a court reporter. Please contact NSF at

least one week in advance of the meeting if you would like to request special accommodations (*i.e.*, sign language interpretation, etc.).

Dated: October 13, 2016.

Suzanne H. Plimpton,
Reports Clearance Officer, National Science Foundation.

[FR Doc. 2016-25213 Filed 10-18-16; 8:45 am]

BILLING CODE 7555-01-P

POSTAL REGULATORY COMMISSION

[Docket No. R2017-1; Order No. 3565]

Market Dominant Price Adjustment

AGENCY: Postal Regulatory Commission.

ACTION: Notice.

SUMMARY: The Commission is noticing a recently-filed Postal Service notice of inflation-based rate adjustments affecting market dominant domestic and international products and services, along with numerous proposed classification changes. The adjustments and other changes are scheduled to take effect January 22, 2017. This notice informs the public of the filing, invites public comment, and takes other administrative steps.

DATES: *Comments are due:* November 1, 2016.

ADDRESSES: Submit comments electronically via the Commission's Filing Online system at <http://www.prc.gov>. Those who cannot submit comments electronically should contact the person identified in the **FOR FURTHER INFORMATION CONTACT** section by telephone for advice on filing alternatives.

FOR FURTHER INFORMATION CONTACT: David A. Trissell, General Counsel, at 202-789-6820.

SUPPLEMENTARY INFORMATION:

Table of Contents

- I. Introduction and Overview
- II. Initial Administrative Actions
- III. Ordering Paragraphs

I. Introduction and Overview

On October 12, 2016, the Postal Service filed a notice of inflation-based rate adjustments affecting market dominant domestic and international products and services, along with numerous proposed classification changes.¹ The intended effective date is January 22, 2017. Notice at 1.

Contents of filing. The Postal Service's filing consists of the Notice which the

¹ United States Postal Service Notice of Market Dominant Price Adjustment, October 12, 2016 (Notice).

Department of Labor-OASAM, Office of the Chief Information Officer, Attn: Departmental Information Compliance Management Program, Room N1301, 200 Constitution Avenue NW., Washington, DC 20210; or by email: DOL_PRA_PUBLIC@dol.gov.

FOR FURTHER INFORMATION CONTACT: Michel Smyth by telephone at 202-693-4129 (this is not a toll-free number) or by email at DOL_PRA_PUBLIC@dol.gov. Authority: 44 U.S.C. 3507(a)(1)(D).

SUPPLEMENTARY INFORMATION: This ICR seeks PRA authority for the Ready to Work (RTW) Partnership Grants Evaluation 18-Month Follow-up Survey information collection. The DOL is conducting an evaluation of RTW Partnership Grants. The evaluation includes: (1) An implementation study that examines the operation of the programs and participation patterns of program enrollees in key program activities, and (2) an impact study that uses a random assignment research design to determine whether selected grantee programs increased participants' employment, earnings, and other outcomes. This submission seeks OMB approval for the impact evaluation 18-month follow-up survey of study participants. American Competitiveness and Workforce Improvement Act of 1998 section 414(c) authorizes this information collection. See 29 U.S.C. 2916a(7).

This proposed information collection is subject to the PRA. A Federal agency generally cannot conduct or sponsor a collection of information, and the public is generally not required to respond to an information collection, unless it is approved by the OMB under the PRA and displays a currently valid OMB Control Number. In addition, notwithstanding any other provisions of law, no person shall generally be subject to penalty for failing to comply with a collection of information if the collection of information does not display a valid Control Number. See 5 CFR 1320.5(a) and 1320.6. For additional information, see the related notice published in the **Federal Register** on April 25, 2016 (81 FR 24131).

Interested parties are encouraged to send comments to the OMB, Office of Information and Regulatory Affairs at the address shown in the **ADDRESSES** section within thirty (30) days of publication of this notice in the **Federal Register**. In order to help ensure appropriate consideration, comments should mention OMB ICR Reference Number 201605-1291-001. The OMB is particularly interested in comments that:

- Evaluate whether the proposed collection of information is necessary for the proper performance of the functions of the agency, including whether the information will have practical utility;
- Evaluate the accuracy of the agency's estimate of the burden of the proposed collection of information, including the validity of the methodology and assumptions used;
- Enhance the quality, utility, and clarity of the information to be collected; and
- Minimize the burden of the collection of information on those who are to respond, including through the use of appropriate automated, electronic, mechanical, or other technological collection techniques or other forms of information technology, e.g., permitting electronic submission of responses.

Agency: DOL-OASAM.

Title of Collection: Ready to Work Partnership Grants Evaluation 18-Month Follow-up Survey.

OMB ICR Reference Number: 201605-1291-001.

Affected Public: Individuals or Households.

Total Estimated Number of Respondents: 1,339.

Total Estimated Number of Responses: 1,339.

Total Estimated Annual Time Burden: 897 hours.

Total Estimated Annual Other Costs Burden: \$0.

Dated: October 26, 2016.

Michel Smyth,
Departmental Clearance Officer.

[FR Doc. 2016-26337 Filed 10-31-16; 8:45 am]

BILLING CODE 4510-HX-P

NATIONAL SCIENCE FOUNDATION

Extension of Comment Period on the Environmental Impact Statement for the Proposed Changes to Green Bank Observatory Operations

AGENCY: National Science Foundation.

ACTION: Notice.

SUMMARY: The National Science Foundation published a notice on October 19, 2016, at 81 FR 72124, seeking comments on identifying issues to be analyzed in the Environmental Impact Statement for the proposed changes to Green Bank Observatory operations. The original comment date was to end on November 19, 2016.

DATES: Comments on this notice will now be accepted through November 25, 2016.

ADDRESSES: Submit comments electronically to envcomp-AST-greenbank@nsf.gov or send by mail to National Science Foundation, Division of Astronomical Sciences, 4201 Wilson Blvd., Suite 1045, Arlington, VA 22230.

FOR FURTHER INFORMATION CONTACT: Elizabeth Pentecost, National Science Foundation, Division of Astronomical Sciences, 4201 Wilson Blvd., Suite 1045, Arlington, VA 22230; telephone: (703) 292-4907; email: epenteco@nsf.gov.

SUPPLEMENTARY INFORMATION: Comments on the scope of the preliminary proposed alternatives and resource areas to be studied may be submitted in writing through November 25, 2016. To be eligible for inclusion in the Draft EIS, all comments must be received prior to the close of the scoping period. NSF will provide additional opportunities for public participation upon publication of the Draft EIS. Information will be posted, throughout the EIS process, at www.nsf.gov/AST.

Dated: October 27, 2016.

Suzanne H. Plimpton,
Reports Clearance Officer, National Science Foundation.

[FR Doc. 2016-26343 Filed 10-31-16; 8:45 am]

BILLING CODE 7555-01-P

NATIONAL TRANSPORTATION SAFETY BOARD

Sunshine Act Meeting

Agenda

TIME AND DATE: 9:30 a.m., Tuesday, November 15, 2016

PLACE: NTSB Conference Center, 429 L'Enfant Plaza SW., Washington, DC 20594.

STATUS: The two items are open to the public.

MATTERS TO BE CONSIDERED:

8791 *ADMS Briefs on Two Midair Collisions*—July 7, 2015, accident involving a Cessna 150M and a Lockheed Martin F-16CM near Moncks Corner, South Carolina (ERA15MA259A/B); and August 16, 2015, accident involving a Cessna 172M and a North American Rockwell NA265-60SC Sabreliner near San Diego, California (WPR15MA243A/B); and Safety Alert—Preventing Midair Collisions: Don't Depend on Vision Alone

8737A *Highway Accident Report: Amphibious Passenger Vehicle DUCK 6 Lane Crossover Collision With Motorcoach on State Route 99, Aurora Bridge, Seattle, Washington, September 24, 2015* (HWY15MH011)

ENVIRONMENTAL IMPACT STATEMENT (EIS)



In compliance with the National Environmental Policy Act of 1969 (NEPA), as amended, the National Science Foundation (NSF) intends to prepare an Environmental Impact Statement (EIS) to evaluate potential environmental effects of proposed changes to operations at Green Bank Observatory, in Green Bank, West Virginia. The Proposed Action is to reduce funding for the Green Bank Observatory. NSF also intends to initiate consultation under Section 106 of the National Historic Preservation Act (NHPA) to evaluate potential effects to any historic properties within the area of the Proposed Action.

By this notice, NSF is announcing the beginning of the scoping process to solicit public comments and identify issues to be analyzed in the EIS and the initiation of public involvement under Section 106. Comments on issues may be submitted verbally during scoping meetings scheduled for November 9, 2016 (see details below) or in writing until November 25, 2016. To be eligible for inclusion in the Draft EIS, all comments must be received prior to the close of the scoping period. NSF will provide additional opportunities for public participation upon publication of the Draft EIS.

NSF WILL HOST TWO PUBLIC SCOPING MEETINGS:

November 9, 2016

Session 1 - 3:00 pm to 5:00 pm

Session 2 - 6:00 pm to 8:00 pm

Green Bank Science Center

155 Observatory Road

Green Bank, WV, 24915

Phone: (304) 456-2011

You may also submit written comments related to this Proposed Action by either of the following methods:

Email to: envcomp-AST-greenbank@nsf.gov

Mail to: Elizabeth Pentecost RE: Green Bank Observatory
National Science Foundation
4201 Wilson Blvd., Suite 1045, Arlington, VA 22230

Information regarding the Proposed Action will be posted, throughout the EIS process, at www.nsf.gov/AST.

Comments will be transcribed by a court reporter. Please contact NSF at least one week in advance of the meeting if you would like to request special accommodations (for example, sign language interpretation).

AFFIDAVIT OF INSERTION

This is to certify that the insertion for Green Bank Observatory
(Advertiser Name)

Titled Environmental Impact Statement appeared in the
(Headline)

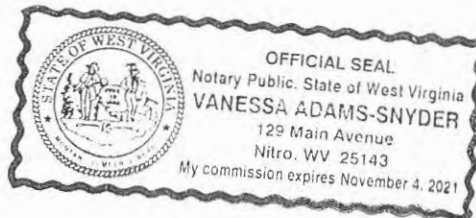
Charleston, WV Charleston Gazette-Mail on October 30, 2016
(City, Paper, Name) (Date)

Advertising Representative: Lisa Skeens

Sworn to and subscribed before me this 4th day of Nov, 2016

Notary Public: 

Seal: _____



State of West Virginia, County of Randolph, ss.

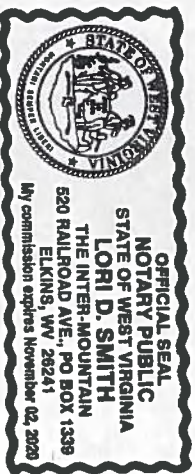
I, Heather Henline, General Manager of THE INTER-MOUNTAIN, a newspaper published at Elkins, in said county, do hereby certify that the annexed advertisement was published on the following dates:

10/29 _____ as required by law.
20 16 _____

Given under my hand this 14 day of Nov 20, 16

Heather Henline

General Manager



Printer's Fee: \$ _____

Subscribed and sworn to before me this 14th day of November, 20, 16

Lori D. Smith

Notary Public

My Commission Expires the 2nd day of November, 20, 20

The Pocahontas Times
206 - 8th Street
Marlinton, WV 24954
(304) 799-4973

DATE	INVOICE #
10/27/2016	2016-77661

PAID
10/21/2016

BILL TO

Christina McDonough, PE -CH2M
5555 Tech Center Drive, Suite 212
Colorado Springs, CO 80919

P.O. NO.	TERMS	PROJECT
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QUANTITY	DESCRIPTION	RATE	AMOUNT
	PTI Display ADV., Oct 27 2016 - 3x5 column inch, Black & White, 1 Run - Environmental Impact Statement (EIS)	88.05	88.05

	Total	\$88.05
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AFFIDAVIT OF INSERTION

This is to certify that the insertion for NSF
(Advertiser Name)

Titled Environmental Impact Statement appeared in the
(Headline)

Marlinton - The Pocahontas Times on 10/27/16
(City, Paper Name) (Date of Insertion)

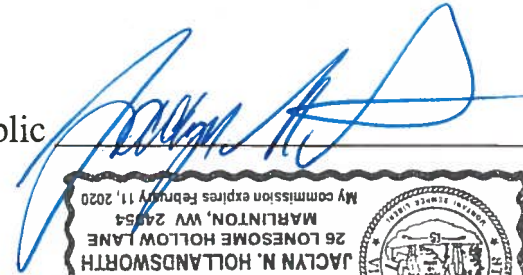
Total Inserts Distributed _____

Cost of Insertion \$88.05

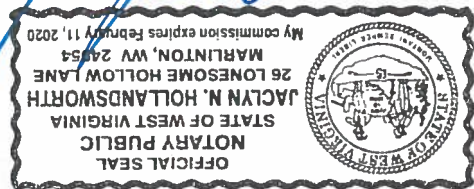
Advertising Manager Kimberly J. Jetter

Sworn to and subscribed before me this 27th day of October 20 16.

Notary Public _____



Seal _____



AMR, from page 7

Norris is your host Friday afternoon from 2 to 3 p.m.

Jeneration Variations – Jenn brings great alternative folk to the AMR airwaves Saturday afternoon from 3 to 5 p.m.

Midnight Ride – Dan is the man Saturday from 8 to 11 p.m. – blues and a little jazz

AMR Hosts next week
Soul Survivor – Wayne is your host Thursday 1 to 3 p.m.

Alternate Transmission – tune in for an eclectic mix of alternative music with your host Josh – Thursday 6 to 8 p.m. from the WVMR studio.

TGIF Bluegrass – DJ Willie is your host Friday afternoon from 2 to 3 p.m.

For Those About To Rock – Joyce will be rockin' and rollin' Saturday 3 to 5 p.m.

Midnight Ride – Blues and interesting background on the artists – Keith provides both Saturday 8 to 11 p.m.

Interested in being a volunteer DJ for AMR? Call Heather or Dwayne at WVMR, 304-799-6004, Danny at WCHG 540-839-5400, or Scott at 540-468-1234.

Thanks for listening to Allegheny Mountain Radio. Your feedback is always welcome – you can contact me at heather@amrmail.org.

Location: MARLINTON, POCAHONTAS COUNTY

Latitude: 38:12:19

Receiving Stream: Greenbrier River

Activity: To operate and maintain an existing consisting 0.2 million gallons per day wastewater treatment equivalent of approximately 2,000 persons in discharge treated wastewater via Outlet No. 001 to from its mouth, of the New River of the Kanawha I ducted for Outlet 001 and Tier 2 protection is prov 6. To accept nondomestic flow from Rite Aid Store Treatment Plant and Pocahontas Continuous Care To operate and maintain disposal systems, best m controls for the direct discharge of sanitary waste, Overflow (CSO) Outlet No. C002 to Knapp Creek, Greenbrier River. The CSO outlet is permitted to collection system is exceeded during wet-weather the wet weather discharge from CSO Outlet No. C CSO Long-term Control Plan.

Business conducted: Municipality

Implementation: Compliance with the Combined mit shall be attained in accordance with the provis March 31, 2009, and any amendments, thereto.

Compliance with the continuing terms and conc dance with the provisions of Administrative Conse On the basis of review of the application, the "V 11-8(a)," and the "West Virginia Legislative Rules application.

Any interested person may submit written comm lic hearing by addressing such to the Director of tl within 30 days of the date of the public notice. Su to:

Director, Division of Water a
ATTN: Lori Devereu:
601 57th
Charleston, WV

The public comment period begins October 27, Comments received within this period will be cc Correspondence should include the name, address a concise statement of the nature of the issues re whenever a finding is made, on the basis of requer terest on issues relevant to the Draft Permit(s). Ir tion office to obtain further information.

The application, draft permit and any required f the Division of Water and Waste Management Pu Charleston, WV 25304-2345, between 8 a.m. and ments may be obtained from the Division at a nor p.m. Monday through Friday.

Veteran's Day is November 11

ENVIRONMENTAL IMPACT STATEMENT (EIS)



In compliance with the National Environmental Policy Act of 1969 (NEPA), as amended, the National Science Foundation (NSF) intends to prepare an Environmental Impact Statement (EIS) to evaluate potential environmental effects of proposed changes to operations at Green Bank Observatory, in Green Bank, West Virginia. The Proposed Action is to reduce funding for the Green Bank Observatory. NSF also intends to initiate consultation under Section 106 of the National Historic Preservation Act (NHPA) to evaluate potential effects to any historic properties within the area of the Proposed Action.

By this notice, NSF is announcing the beginning of the scoping process to solicit public comments and identify issues to be analyzed in the EIS and the initiation of public involvement under Section 106. Comments on issues may be submitted verbally during scoping meetings scheduled for November 9, 2016 (see details below) or in writing until November 19, 2016. To be eligible for inclusion in the Draft EIS, all comments must be received prior to the close of the scoping period. NSF will provide additional opportunities for public participation upon publication of the Draft EIS.

NSF WILL HOST TWO PUBLIC SCOPING MEETINGS:

November 9, 2016

Session 1 - 3:00 pm to 5:00 pm

Session 2 - 6:00 pm to 8:00 pm

Green Bank Science Center
 155 Observatory Road
 Green Bank, WV, 24915
 Phone: (304) 456-2011

You may also submit written comments related to this Proposed Action by either of the following methods:

Email to: envcomp-AST-greenbank@nsf.gov

Mail to: Elizabeth Pentecost RE: Green Bank Observatory
 National Science Foundation
 4201 Wilson Blvd., Suite 1045, Arlington, VA 22230

Information regarding the Proposed Action will be posted, throughout the EIS process, at www.nsf.gov/AST.

Comments will be transcribed by a court reporter. Please contact NSF at least one week in advance of the meeting if you would like to request special accommodations (for example, sign language interpretation).

HARVEST OF VALUES

TRENT'S GENERAL STORE

EBT CARDS

IN THE LOOP - ARBOVALE, WV 24915
Phone: 304-456-9906

STORE HOURS:
 Mon. - Sat. 7 a.m. to 7 p.m.
 Sundays - CLOSED

PRICES EFFECTIVE November 1st - 4th, 2016

\$700 **\$140**

THE PLACE FOR THOSE WHO HUNT

ALL YOU NEED TO ATTRACT GAME

WE'LL GET YOU





GREEN BANK
OBSERVATORY



NATIONAL SCIENCE FOUNDATION PUBLIC SCOPING MEETINGS

In compliance with the National Environmental Policy Act, the National Science Foundation (NSF) intends to prepare an Environmental Impact Statement (EIS) to evaluate potential environmental effects of proposed operational changes due to funding constraints at Green Bank Observatory, in Green Bank, West Virginia. NSF is conducting scoping meetings to obtain feedback from the community. A range of alternatives is being considered for evaluation in the EIS. These alternatives will be refined through continued public input, with preliminary alternatives that include the following:

- Continued NSF investment for science-focused operations (No-Action Alternative)
- Collaboration with interested parties for science- and education-focused operations with reduced NSF-funded scope
- Collaboration with interested parties for operation as a technology and education park
- Mothballing of facilities
- Deconstruction and site restoration

Comments on issues may be submitted verbally during scoping meetings scheduled for November 9, 2016, or in writing through November 25, 2016. NSF will provide additional opportunities for public participation upon publication of the Draft EIS.

PUBLIC SCOPING MEETINGS:

November 9, 2016
Session 1 - 3:00 pm to 5:00 pm
Session 2 – 6:00 pm to 8:00 pm
Green Bank Science Center
155 Observatory Road
Green Bank, WV, 24915
304-456-2011

TO SUBMIT WRITTEN COMMENTS:

Email: envcomp-AST-greenbank@nsf.gov
OR Mail: Elizabeth Pentecost
RE: Green Bank Observatory
National Science Foundation
4201 Wilson Blvd., Suite 1045
Arlington, VA 22230

Information will be posted, throughout the EIS process, at www.nsf.gov/AST

Appendix 5-B
Scoping Materials



National Science
Foundation

Environmental Impact Statement and Section 106 Consultation for Proposed Changes to Green Bank Observatory Operations

Green Bank, West Virginia

Overview:

The National Environmental Policy Act requires federal agencies to conduct an environmental review to assess the potential environmental impacts of federal actions that could significantly affect the environment.

Section 106 of the National Historic Preservation Act requires federal agencies to consult with interested parties and the State Historic Preservation Officer regarding potential effects of their proposed actions on significant historic properties.

The purpose of the public scoping process is to determine relevant issues that will influence the scope of the environmental analysis, including identification of viable alternatives. Additional opportunities for public participation will be available during the process.

Timeline for Public Involvement:

- **Scoping Comment Period:**
October 19 - November 25, 2016
- **Draft EIS target:**
Spring 2017
 - 45-Day Comment Period on Draft EIS
 - Public meeting on Draft EIS
- **Final EIS target:**
Fall 2017
- **Record of Decision target:**
Winter 2017-2018

Submit Comments:

You may submit written comments on or before November 25, 2016 by either of the following methods:

Email to: envcomp-AST-greenbank@nsf.gov,
with subject line
"Green Bank Observatory"

Mail to: Ms. Elizabeth Pentecost,
RE: Green Bank Observatory
National Science Foundation,
4201 Wilson Blvd, Suite 1045
Arlington, VA 22230

Project information will be posted, throughout the EIS process, at www.nsf.gov/AST.



Environmental Impact Statement and Section 106 Consultation for Proposed Changes to Green Bank Observatory Operations

Green Bank, West Virginia

Alternatives to be evaluated in the EIS will be refined through public input. Preliminary proposed alternatives include the following:

- Collaboration with interested parties for science- and education-focused operations with reduced NSF-funded scope.
- Collaboration with interested parties for operations as a technology and education park.
- Mothballing of facilities (suspension of operations in a manner such that operations could resume efficiently at some future date).
- Deconstruction and site restoration
- Continued NSF investment for science-focused operations (No-Action Alternative)



Potential Resources to be considered:

An impact is a change or consequence that results from a proposed activity; it can be positive, negative or both. It may be mitigated to lessen or remove the impact. At present, NSF has preliminarily identified the following resource areas for analysis of potential impacts:

air quality

biological resources

traffic

geological resources

health and safety

solid waste generation

cultural resources

groundwater resources

socioeconomics

Section 106 Process for the Green Bank Observatory:

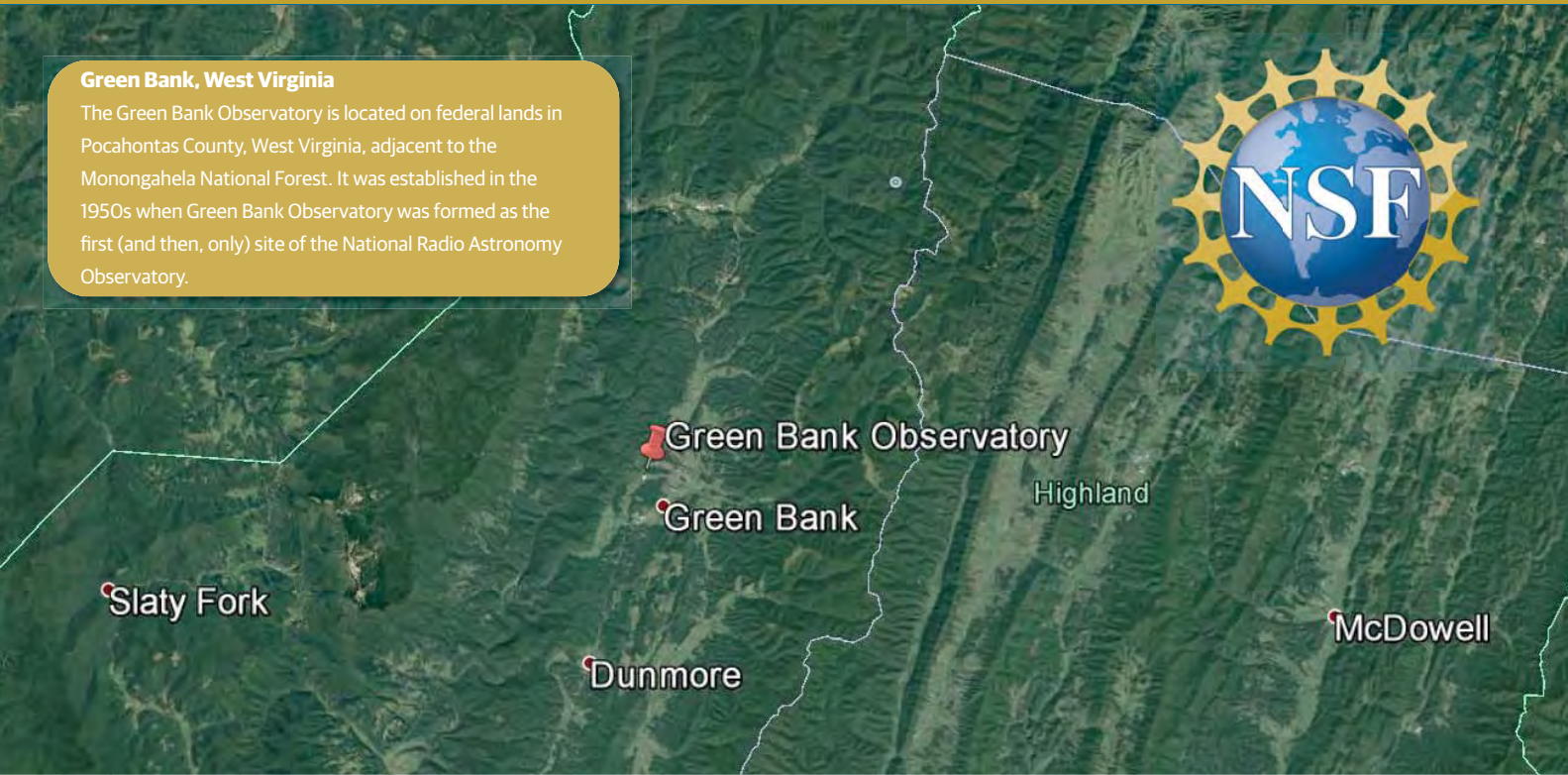
In coordination with the EIS, NSF will consult with the State Historic Preservation Officer and other consulting parties on potential effects to historic properties located within the Area of Potential Effects (APE).

- The APE is expected to be defined as the boundary of the existing Green Bank Observatory property.
- Consultation would be focused on identifying potential effects, if any, on historic properties eligible for listing or listed on the National Register of Historic Places. If any potential effects are anticipated, consultation with Consulting Parties would occur to identify measures to avoid, minimize, and/or mitigate those effects. Often those measures are memorialized in a Memorandum of Agreement.

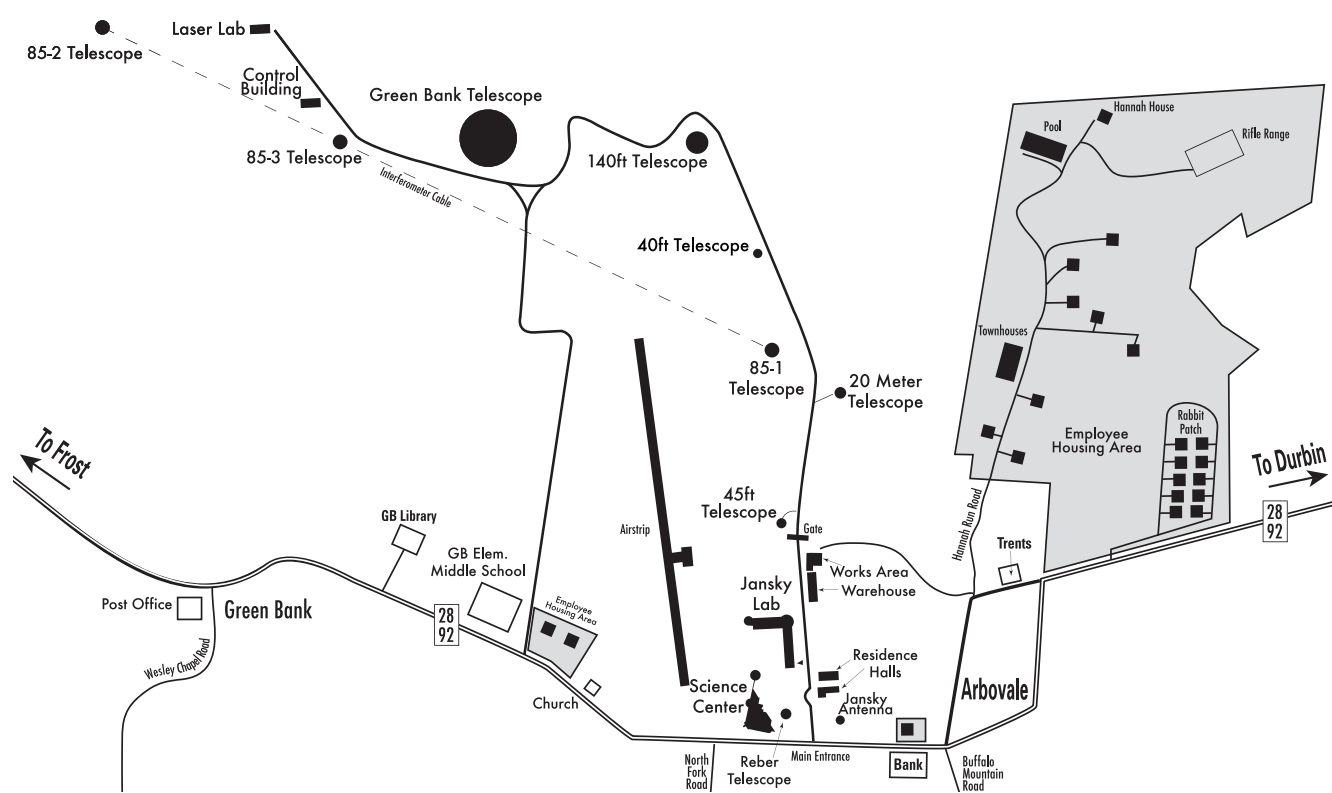
Environmental Impact Statement and Section 106 Consultation for Proposed Changes to Green Bank Observatory Operations

Green Bank, West Virginia

The Green Bank Observatory is located on federal lands in Pocahontas County, West Virginia, adjacent to the Monongahela National Forest. It was established in the 1950s when Green Bank Observatory was formed as the first (and then, only) site of the National Radio Astronomy Observatory.



Site Plan





National Science Foundation



National Science Foundation

GREEN BANK
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EIS Public Scoping Meetings

Green Bank Science Center

2016 November 9

3:00—5:00 and 6:00—8:00 pm

Green Bank Observatory Environmental Impact Statement (EIS) Scoping Meeting: *Overview*

- Introduction of team members
- Background information
- Preliminary proposed alternatives and resource areas to be studied
- EIS process
- Public comments



The Role of NSF

- The National Science Foundation (NSF) is the federal steward for ground-based astronomy and astrophysics.
- NSF provides funding for national and international telescopes and facilities and provides funding for research grants that allow individuals and groups to conduct specific science investigations.



Stewardship of NSF's Portfolio

- Over the past decade NSF has received advice from external review committees.
- The 2010 decadal survey, *New Worlds, New Horizons in Astronomy and Astrophysics*, stated: “NSF-Astronomy should complete its next senior review ... so as to determine which, if any, facilities NSF-AST should cease to support in order to release funds for (1) the construction and ongoing operation of new telescopes and instruments and (2) the science analysis needed to capitalize on the results from existing and future facilities.”



Radio facility recommendations

- The 2010 report's recommended review of the NSF Astronomical Sciences portfolio was completed in 2012.
 - 2012 Portfolio Review: *Advancing Astronomy in the Coming Decade: Opportunities and Challenges*
- Regarding the Green Bank Telescope, the 2012 review recommended divestment and stated the following:

“The GBT is the world’s most sensitive single-dish radio telescope at wavelengths shorter than 10 cm; however, its capabilities are not as critical to *NWNH* [astronomy and astrophysics decadal survey] science goals as the higher-ranked facilities.”



Radio facility recommendations

- In August 2016, the *National Academies of Sciences, Engineering, and Medicine* published their *Midterm Assessment* of the 2010 decadal survey and reaffirmed the 2012 Portfolio Review's recommendations for divestment of these AST facilities:

“The NSF should proceed with divestment from ground-based facilities that have a lower scientific impact, implementing the recommendations of the NSF Portfolio Review, which is essential to sustaining the scientific vitality of the U.S. ground-based astronomy program as new facilities come into operation.”



Resulting Developments at GBO

- In FY12, NSF provided 95% of the site's funding.
- On March 22, 2013, in Dear Colleague Letter NSF 13-074, NSF announced that the Green Bank Telescope (GBT) would be separated from the National Radio Astronomy Observatory (NRAO) competition and requested ideas for collaborations involving GBT.
- On October 1, 2016, following the path published in NSF 13-074, NSF separated NRAO Green Bank from NRAO.
- The site was renamed the Green Bank Observatory (GBO), and Associated Universities, Inc. (AUI), continues to manage GBO under a cooperative agreement with NSF.



Current Status of GBO

- FY17 President's Request Budget (PRB) for "Other Astronomical Facilities" asked for \$11.5M total for GBO and the Long Baseline Observatory (LBO).
- FY17 PRB also shows an increase to \$11.85M in FY18, for planning purposes.
- Following a review of AUI's proposal that provides the exact division between GBO and LBO for FY17 and FY18, NSF allocated \$8.2M in FY17 should the PRB be appropriated.
- The \$8.2M level represents approximately 75% of the base budget for GBO that was part of previous appropriations to NRAO.



Current Status of GBO

- GBO has established collaborations with Breakthrough Listen, West Virginia University, and NANOGrav.
- GBO continues seeking new funding sources.



NSF plans moving forward

- Given previous astronomical community recommendations combined with current budget constraints, NSF has a need to reduce funding for a number of its astronomical telescopes and facilities.
- The NSF is initiating the EIS/Section 106 consultation process for the Green Bank Observatory.



EIS Preliminary Proposed Alternatives

- Continued NSF investment for science-focused operations (No-Action Alternative).
- Collaboration with interested parties for science- and education-focused operations with reduced NSF-funded scope.
- Collaboration with interested parties for operation as a technology and education park.
- Mothballing of facilities (suspension of operations in a manner such that operations could resume efficiently at some future date).
- Deconstruction and site restoration.



National Environmental Policy Act

- The National Environmental Policy Act of 1969 (NEPA) requires federal agencies to consider the potential environmental consequences of proposed actions on the environment prior to making final decisions.
- NSF intends to prepare an Environmental Impact Statement (EIS) to evaluate the potential environmental effects of proposed operational changes due to funding constraints for the Green Bank Observatory
 - NSF will prepare a Draft and Final EIS
- On October 19, 2016, NSF announced the beginning of the scoping process for development of an EIS



NEPA Scoping Process

- The purpose of the scoping process is to seek public input regarding relevant issues that will influence the scope of the environmental analysis
- Comments will inform the EIS
 - We invite your input regarding relevant issues, including identification of viable alternatives and resource areas to be analyzed.
 - The more specific your comment, the more helpful to the development of the EIS



EIS Preliminary Resource Areas to Be Analyzed

- Air quality
- Biological resources
- Cultural resources
- Geological resources
- Solid waste generation
- Health and safety
- Socioeconomics
- Traffic
- Groundwater resources



Section 106 of the National Historic Preservation Act

- The Section 106 consultation process requires federal agencies to consult with interested parties and the State Historic Preservation Officer regarding potential effects of their proposed actions on nationally significant historic properties. There are four basic steps:
 1. Initiate Section 106 consultation
 2. Identify Area of Potential Effects (APE) and nationally-significant historic properties within the APE
 3. Assess whether there are adverse effects
 4. Resolve any adverse effects through a Memorandum of Agreement
- Section 106 consultation will occur in coordination with the NEPA process

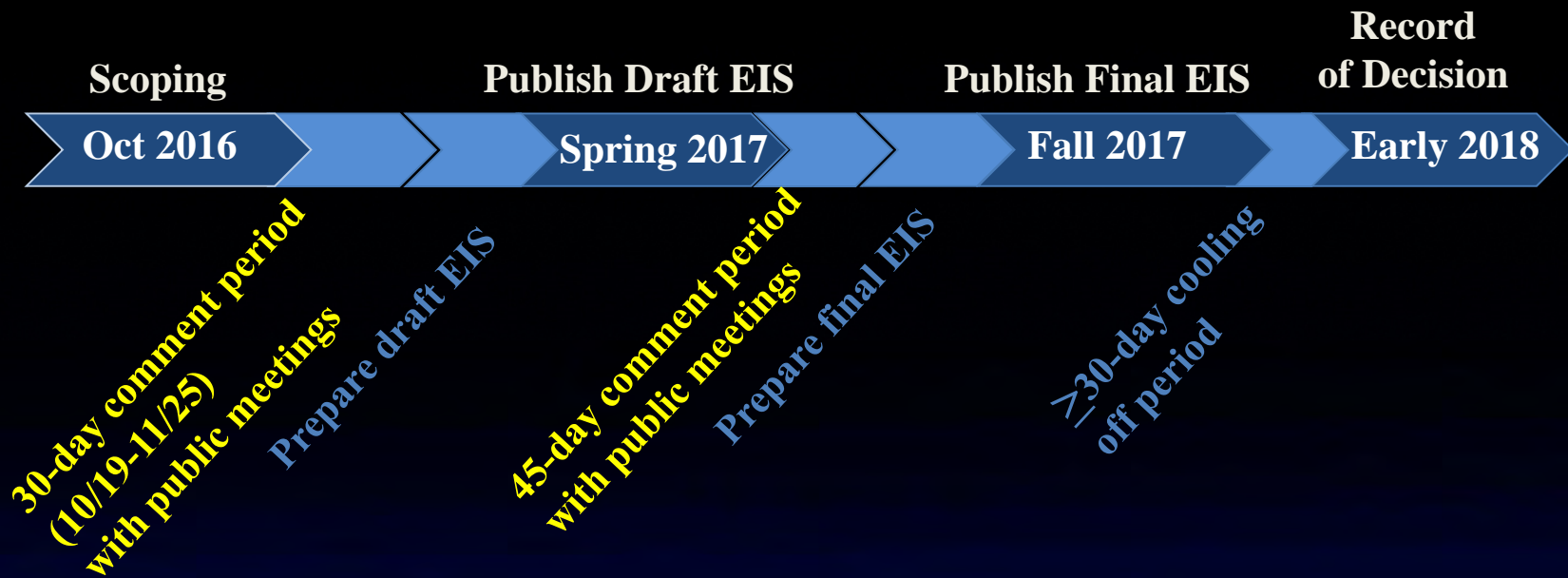


Endangered Species Act

- NSF must also consider whether the proposal's activities may impact threatened or endangered species and/or their habitat under the Endangered Species Act (ESA).
- If it is determined that such an impact may occur, NSF will consult with the US Fish and Wildlife Service to determine next steps.



Target Dates & Opportunities to Comment



National Historic Preservation Act Compliance

Endangered Species Act Compliance



How to submit comments

- Provide verbal comments today
- Submit written comments today
- Mail or email comments to NSF by November 25
 - envcomp-AST-greenbank@nsf.gov
 - Ms. Elizabeth Pentecost, National Science Foundation, Division of Astronomical Sciences, 4201 Wilson Blvd., Suite 1045, Arlington, VA 22230



Where to find Information

- The fact sheet, informational boards, and presentation will be posted at:
 - www.nsf.gov/AST
- Documents and meeting information will continue to be posted throughout the process





GREEN BANK OBSERVATORY



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Appendix 5-C Transcripts

1 NATIONAL RADIO ASTRONOMY OBSERVATORY

2 (GREEN BANK OBSERVATORY)

3 EIS PUBLIC SCOPING MEETING - NUMBER 1

4

5 HELD AT THE

6 GREEN BANK SCIENCE CENTER

7 155 Observatory Road

8 Arbovale, West Virginia 24915

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10 Wednesday, November 9, 2016

11 3:30 p.m.

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1 IN ATTENDANCE:

2 EDWARD A. AJHAR, Ph.D., Program Director
3 Division of Astronomical Sciences
4 National Science Foundation
5 4201 Wilson Boulevard, Room 1045.21
6 Arlington, Virginia 22230
7 Telephone: 703-292-7456
8 Facsimile: 703-292-9034
9 E-mail: eajhar@nsf.gov

10 CAROLINE M. BLANCO, Assistant General Counsel
11 Office of the General Counsel
12 National Science Foundation
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14 Arlington, Virginia 22230
15 Telephone: 703-292-4592
16 Facsimile: 703-292-9242
17 E-mail: cblanco@nsf.gov

18 ELIZABETH A. PENTECOST, Project Manager
19 Division of Astronomical Sciences
20 National Science Foundation
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22 Arlington, Virginia 22230
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24 Facsimile: 703-292-9034
E-mail: epenteco@nsf.gov

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PROCEEDINGS 4

P R O C E E D I N G S

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Whereupon,

DR. EDWARD AJHAR: Thank you everybody for attending our Environmental Impact Statement Public Scoping Meeting. I also want to take this moment to thank our host, the Green Bank Observatory and the director, Karen O'Neil. They've been great hosts in helping us get all of these logistics set up.

The other thing I want to mention just before we get started is that you know you've heard a lot of things or read a lot of things in the news. Not everything gets translated perfectly so I'm going to try to clarify some of those things for you today. I just want to emphasize how important your comments are to us because contrary to some of the things you may have heard, right, there has been no decision made regarding Green Bank Observatory's future. We have not decided to close it and that's why your public comments are a very important part of this whole process. You know, it's a challenging process for all of us right now, but again, I appreciate your presence.

So what we're going to do I'm going to introduce myself and the rest of the team. I'm going to go over some background information so that you understand why we're here and I will discuss what the preliminary proposal

1 alternatives and the resource areas that are going to be
2 studied as a part of this Environmental Impact Statement.
3 We will talk about the Environmental Impact Statement
4 process, and when all of that is done we will open the
5 floor to public comments.

6 So first of all my name. I'm Edward Ajhar. I am an
7 astronomer in the Division of Astronomical Sciences at the
8 National Science Foundation, and I'm the program officer
9 for Green Bank Observatory.

10 Joining me from our Division of Astronomical Sciences
11 is Liz Pentecost. Liz is back there. Thank you, Liz. And
12 we have Caroline Blanco and Christin Hamilton from our
13 Office of General Counsel. From our Office of Legislative
14 and Public Affairs we have Karen Pearce and Ivy Kupec.
15 Karen, Ivy, thank you. We also have a couple of
16 contractors with us Michelle Rouwe and Chris McDonough. I
17 don't know if any of them are here. They're sitting out
18 probably welcoming other people.

19 Let me now start talking about the role of the
20 National Science Foundation. We serve as the federal
21 stewards of ground-based astronomy and astrophysics, and
22 NSF provides funding for national and international
23 telescopes and facilities and provides funding for research
24 that allow individuals and groups to conduct

1 specific science investigations.

2 So what is our stewardship role of NSF's astronomy
3 portfolio? Over the past decade the National Science
4 Foundation has received advice from several external review
5 committees. These are made up of members of the
6 astronomical research community. In the 2010 decadal
7 survey titled New Worlds, New Horizons in Astronomy and
8 Astrophysics stated that, "NSF astronomy should complete
9 its next senior review so as to determine which, if any,
10 facilities astronomy should cease to support in order to
11 release funds for one, the construction and ongoing
12 operation of new telescopes and instruments; and two, the
13 science analysis needed to capitalize on the results from
14 existing and future facilities."

15 The 2010 report reports recommended review of the
16 National Science Foundation Astronomical Sciences Portfolio
17 was completed in 2012. That 2012 portfolio review was
18 titled, Advancing Astronomy in the Coming Decade:
19 Opportunities and Challenges. "Regarding the Green Bank
20 Telescope, the 2012 review recommended divestment and
21 stated the following, "The GBT is the world's most
22 sensitive single-dish radio telescope at wavelengths
23 shorter than ten centimeters; however, its capabilities are
24 not as critical to the decadal survey science goals as

1 higher-ranked facilities."

2 In August of this year, 2016, the National Academies
3 of Sciences, Engineering, and Medicine published their
4 midterm assessment of the 2010 decadal survey and
5 reaffirmed the 2012 portfolio reviews recommendation for
6 divestment of these astronomy facilities. To quote from
7 that report, "The NSF should proceed with divestment from
8 ground-based facilities that have a lower scientific impact
9 implementing the recommendations of the NSF Portfolio
10 Review, which is essential to sustaining a scientific
11 vitality of the U.S. ground-based astronomy program as new
12 facilities come into operation."

13 So given all of that input over the past several years
14 that I just tried to summarize very quickly for you, what
15 are the resulting developments here at Green Bank? Well,
16 going back to fiscal year 2012, the National Science
17 Foundation provided about 95 percent of this site's
18 funding, and on March 22nd, 2013, in a Dear Colleague
19 Letter that the National Science Foundation announced that
20 the Green Bank Telescope would be separated from the
21 National Radio Astronomy Observatory competition and
22 requested ideas for collaborations involving GBT. I will
23 have more to say about that in a second.

24 October 1st of this year following the path that was

1 published in that 2013 Dear Colleague Letter, the National
2 Science Foundation separated NRAO Green Bank from the whole
3 NRAO and this site was renamed the Green Bank Observatory.
4 Associated Universities Incorporated, AUI, continues to
5 manage the Green Bank Observatory under a cooperative
6 agreement with the National Science Foundation. I know
7 many of you were here. I was here last month when we had a
8 very nice inauguration ceremony for that
9 event. So those are the things that happened.

10 I want to give you some information about the current
11 budget for Green Bank Observatory. In the fiscal year
12 2017, President's Request Budget of other astronomical
13 facilities, that budget asked for \$11.5 million total for
14 the Green Bank Observatory and the Long Baseline
15 Observatory. In this fiscal 2017 President's Request
16 Budget, it also shows an increase to \$11.85 million in the
17 following fiscal year of 2018 for planning purposes. So
18 that's published. You can see that.

19 Following a review of AUI, that's the managing
20 organization, following review of their proposal that
21 provides the exact division between Green Bank Observatory
22 and Long Baseline Observatory for the current fiscal year
23 2017 and fiscal year 2018, the National Science Foundation
24 allocated \$8.2 million in the current fiscal year should

1 the President's Request Budget be appropriated. Of course,
2 that hasn't happened yet. We're operating under a
3 continuing resolution as many people are aware so the \$8.2
4 million level represents approximately 75 percent of the
5 base budget for Green Bank Observatory that was part of the
6 previous appropriations for the National Radio Astronomy
7 Observatory.

8 Another very important part of what's a part of Green
9 Bank Observatory now is that GBO has established
10 collaborations with Breakthrough Listen, which you've heard
11 a lot about probably in the news, and West Virginia
12 University and the North American Nanoherzt Gravitational
13 Wave Project known as NANOGrav. GBO continues to seek new
14 funding sources so that's where we are today.

15 So what are the National Science Foundation's plans
16 moving forward which is bringing us to one of the reasons
17 why we're here today. So given the previous astronomical
18 community's recommendations that I summarized very briefly
19 for you today, combined with the current budget
20 constraints, NSF has a need to reduce funding for a number
21 of its astronomical telescopes and facilities so that's why
22 the NSF is now initiating the Environmental Impact
23 Statement Section 106 consultation process which involves
24 you, the public, for the Green Bank Observatory. This is

1 in addition to similar processes which we've already
2 initiated for the Arecibo Observatory and the Sacramento
3 Peak Observatory so that's why we're here today.

4 The Environmental Impact Statement Preliminary
5 Proposed Alternatives for operations at Green Bank that are
6 being considered are the following, and I will go through
7 them with you, and these are preliminary and that's why
8 this is one of the important things that your comments will
9 be considered for these alternatives and other ones that
10 may come up in this process.

11 The first one is continued NSF investment for science-
12 focused operations. That's the no action alternative.
13 That's continuing what we are doing today.

14 Number two is the collaboration with interested
15 parties for science- and education-focused operations with
16 reduced NSF-funded scope.

17 Third one, collaboration with interested parties for
18 operation as a technology and education park.

19 The fourth one is mothballing of facilities. By that
20 we mean the suspension of the operations in a manner such
21 that operations could resume efficiently at some future
22 time.

23 The last alternative that we're looking at is
24 construction -- deconstruction of the site and site

1 restoration.

2 That's the range that we're looking at, and at this
3 point I would like to turn over the presentation to our
4 general counsel, Caroline Blanco, to go through some of the
5 details of this process. Thanks.

6 CAROLINE BLANCO: Well, thank you so much, and thank
7 you to you, Dr. Ajhar, who just gave me a promotion. I'm
8 the assistant general counsel for the National Science
9 Foundation. I oversee environmental matters.

10 My name again is Caroline Blanco, and I, too, would
11 like to thank you very much for coming this afternoon. I'm
12 going to speak a little bit about the process. This is an
13 unusual type of process perhaps for some folks, but it does
14 look at the environmental consequences to proposed
15 alternatives so these alternatives came from the
16 national -- or as a result of the National Environmental
17 Policy Act.

18 This is a statute that requires federal agencies to
19 consider the potential environmental consequences of their
20 proposed actions before a decision has been made. NSF has
21 decided to prepare an Environmental Impact Study -- an
22 Environmental Impact Statement to evaluate the potential
23 environmental effects of proposed operational changes due
24 to funding constraints for the Green Bank Observatory.

1 There is a set process that's established by law and
2 the process starts out with this very one which is the
3 scoping process. There is a 30-day public comment period.
4 It has been extended a little bit due to a technological
5 glitch but it's extended to November 25th, and you are
6 invited and welcome, encouraged to send public comments.
7 The comments really largely are focused on how the scope of
8 the Environmental Impact Statement will be shaped. Two
9 main things to look at are the proposed alternatives that
10 Dr. Ajhar just mentioned and any other viable alternatives
11 that you may suggest. Also the different resource areas to
12 be studied, and we will go through that in a moment.

13 So on October 19th is when we announced the beginning
14 of this scoping process and the development of the
15 Environmental Impact Statement. And, again, we invite your
16 comments on them on these relevant issues. Again,
17 including -- this is not just -- to be as clear as I can be
18 about it, it's not -- this process is focused on
19 environmental impacts. It's not a process to debate the
20 merits of science and, you know, those types of things.
21 We're looking at environmental impacts associated with
22 proposed alternatives so your thoughts on a range of viable
23 alternatives would be most welcome as well as resource
24 areas to be studied.

1 So looking to the resource areas that we preliminarily
2 identified that need to be analyzed in our Environmental
3 Impact Statement are air quality, biological resources,
4 cultural resources, geological resources, solid waste
5 generation, health and safety issues, socioeconomic
6 impacts, traffic, and groundwater resources.

7 What will happen after this is we will prepare a draft
8 Environmental Impact Statement and then there will be a 45
9 day for the comment period. The issuance of that draft EIS
10 will be announced, again, in the Federal Register. Also
11 you can see, and I will mention this again at the end, that
12 there will be the availability of the website NSF.gov/AST?
13 Yeah. You will be able to see ongoing documents there.
14 The draft EIS will be posted there as well. Then we will
15 come back and have another meeting, probably two meetings
16 afternoon and evening, and allow for more public comments
17 then.

18 Another process that we're doing at the same time is
19 Section 106 of the National Historic Preservation Act.
20 What 106 is is a consultation process that requires federal
21 agencies to consult with interested parties in the State
22 Historic Preservation Office regarding potential effects of
23 their proposed actions on nationally significant historic
24 properties.

1 There are four basic steps to this process. We
2 initiate our consultation process and then we identify an
3 area of potential effects, the ATE, which is likely going
4 to be within the boundaries of this observatory, and the
5 nationally significant properties within the area of
6 potential effects. The EIS process in contrast doesn't
7 look at the significance level of those historic resources,
8 but Section 106 does focus on those resources on the
9 nationally significant ones. Then we assess whether there
10 are effects. If so, whether they are adverse to those
11 nationally significant historic properties, and they can
12 include archeological, historic, or cultural resources.
13 Then we resolve those adverse effects with consulting
14 parties and through typically a memorandum of agreements.

15 You may have noticed when you signed in, and hopefully
16 everybody signed in, that's one way we can make sure we
17 communicate with you. When the draft EIS comes out we will
18 notify you. There's also a box or a column there where you
19 will see that there is a request did you want to be a
20 consulting party and that simply means that you would be
21 interested in participating in this process, the Section
22 106 one.

23 The other process that we're taking a look at is the
24 Endangered Species Act. This is an Act that NSF as a

1 federal agency is also required to comply with. It
2 considers whether the proposed activities impact threatened
3 or endangered species or their habitats, and if so, then we
4 consult with the Fish and Wildlife Service, the U.S. Fish
5 and Wildlife Service and look at ways to address those
6 impacts.

7 So looking forward, our target dates, as we mentioned,
8 the scoping process started October 19th and it will
9 continue through November 25th. We're having this public
10 meeting as well as the one beginning at 6 p.m. tonight.

11 Moving forward after that, we will accumulate your
12 comments, we will review them, consider them. We will be
13 working with our environmental contractors, CH 2 M Hill,
14 and we will prepare a draft Environmental Impact Statement
15 that will analyze, take a look at all of those proposed
16 alternatives that will hopefully be more typed up as a
17 result of this process, and then we will take a look at
18 impacts associated with each of those alternatives. The
19 resource areas that we listed if those change as a result
20 of the public comments we receive here we will take a look
21 at that as well.

22 We expect roughly that that will be published and
23 available in the spring of 2017, and that will, as I said,
24 that will start off the 45-day public comment period and

1 public meetings and then we will prepare a final EIS. That
2 process takes a bit and we're looking at publishing the
3 final EIS sometime in the fall of 2017. These are merely
4 target dates. Things may shift depending upon the number
5 of comments we received and how much information we may
6 need to complete our process.

7 After that, by law, we have to wait at least 30 days
8 before a Record of Decision is issued. That Record of
9 Decision is expected sometime in early 2018. That Record
10 of Decision will select ultimately an action. The process
11 for doing it will include several components, one of which
12 is the environmental consequences, but there will be other
13 factors such as scientific policies and budget issues and
14 NSF submission, a whole host of things will go and be
15 wrapped into that final Record of Decision.

16 As you can see at the base of the slide concurrently
17 we will be completing our National Historic Preservation
18 Act compliance. That's the Section 106 compliance
19 process. Again, if you're interested in participating in
20 that process, please make sure that you let us know.
21 Endangered Species Act as well we will be compliant with.

22 So how do you submit your comments? You can provide
23 verbal comments today. You can submit written comments
24 today. We have a written comment form. Also, just as a

1 note, hopefully all of you will have -- these are also
2 available on the website. This particulate is a fact
3 sheet, several pages that explain a little bit more about
4 this process and provides some additional information. You
5 can mail or e-mail your comments to NSF by November 25th.
6 You can submit them by e-mail or by regular mail but those
7 are the two addresses there.

8 Again, we have the fact sheet. We have informational
9 boards, the boards that are out there, all of that
10 information including this PowerPoint presentation will be
11 posted after today on our website and that's the
12 NSF.gov/AST website. The documents and meeting information
13 will be posted on that same website throughout this
14 process.

15 So now we're at the public comment portion of this
16 meeting. We have a court reporter here to transcribe.
17 This will become part of the public record and Elizabeth
18 Pentecost from the National Science Foundation will call
19 your name for those folks who have indicated that they
20 would like to provide oral comments.

21 If you would, please, when your name is called please
22 come here, take the microphone, and go ahead and provide
23 your comments. We have roughly about 27, 28 people that
24 indicated they wanted to comment so we're looking at --

1 we're not going to be hard and fast about it, but if you
2 could try to limit your comments to about three minutes,
3 that would be great. If we have more time left over at the
4 end we can always have you supplement and, again, just
5 because you provide oral comments here doesn't mean you
6 can't add additional written comments before November 25th
7 as well. That will be great. Thank you so much.

8 ELIZABETH PENTECOST: I would like to introduce
9 Congressman Evan Jenkins.

10 CONGRESSMAN EVAN JENKINS: Well, thank you very much.
11 Good afternoon. I'm Evan Jenkins. I'm the congressman
12 from the Third Congressional District. That goes from
13 Mason and Cabell County over on the west all the way right
14 here to Pocahontas County.

15 To all of the Pocahontas County residents, to the
16 employees of Green Bank, to those who have traveled from
17 out of state to come here to have your voice heard, thank
18 you. This was important for me as well to come over to
19 make sure that I join your voices to make sure that this
20 critically important asset is preserved.

21 I appreciate the Green Bank Observatory for hosting
22 this event and the wonderful accommodations, and I
23 appreciate, again, all that you do.

24 I want to thank the National Science Foundation for

1 their work and for their engagement in this facility. I
2 welcome you to this wonderful State of West Virginia. This
3 is a very special place. Green Bank Observatory is the
4 reason that the United States is a global leader in radio
5 astronomy. The Green Bank Telescope is leading the way in
6 tracking pulsars, investigating star formation, exploring
7 our galaxy, and even looking for alien life.

8 I understand that this is about an Environmental
9 Impact Statement. This is about impact. Without this
10 critical asset, the United States would lose its footing in
11 radio astronomy, a position that could take decades to
12 reclaim. Scientists from all over the world use the Green
13 Bank for cutting-edge research. Many of these scientists
14 at one time or another find themselves in this beautiful
15 mountainous area of Pocahontas County.

16 This bridge has been of key importance for the
17 students from our state and many others. Every year Green
18 Bank brings in 3 to 5,000 students and teachers to
19 participate in educational programs. Students are given
20 the opportunity to use the equipment and look for
21 astronomical bodies including discovering pulsars. These
22 educational programs are giving West Virginia students the
23 opportunity to have hands-on experience in science and
24 research fields. For many students, especially

1 underprivileged and female, these students, they need these
2 opportunities, and these are opportunities that they can't
3 get or have copied simply in the classroom or at home.

4 The Green Bank Observatory is giving a chance to
5 students that will truly change their lives. Green Bank
6 provides even more to the community than creating the next
7 generation of scientists. The facility provides an
8 irreplaceable economic boost to Pocahontas County and West
9 Virginia.

10 Green Bank as we know employs over 100 people year-
11 round and during the busy season about 400 -- 40 additional
12 seasonal jobs. During this time Green Bank is the largest
13 private employer in this county. The Green Bank
14 Observatory's employees contribute an all important \$17.1
15 million to the local economy and when included with the
16 economic impact from tourism, the Green Bank Observatory
17 adds nearly \$30 million to the West Virginia economy.

18 Our state is hurting right now. We are hurting.
19 Green Bank is the shining beacon for our future and for
20 hope for that future. There is a continued need for Green
21 Bank and it could not be more apparent than the recent
22 efforts being undertaken by the Breakthrough Listening
23 Project. Green Bank is a key part of investigating the
24 skies for intelligent life. The impacts of science for

1 education and for the community is why there is such an
2 outpouring as shown here today for this facility.

3 I want to make it perfectly clear, I think options
4 four and five on the chart are simply unacceptable. I
5 fully support the Green Bank Observatory and know that it
6 can be a critical asset for science and West Virginia for
7 decades to come. Thank you.

8 ELIZABETH PENTECOST: Okay, the next person is J.T
9 Jezierski from Senator Capito's office.

10 J.T. JEZIERSKI: I was going to make a
11 lame joke about finding pulsars was easier than saying my
12 last name but since this is public I won't make that joke.

13 My name is J.T. Jezierski. I'm born and raised in
14 Weirton, West Virginia, Hancock County. I work for Senator
15 Shelley Moore Capito. I'm in her Washington, DC office and
16 I support her work on the appropriations committee.
17 Unfortunately, she couldn't be here today so she asked me
18 to read this statement if I could.

19 "Ladies and gentlemen, fellow West Virginians. I am
20 sorry I am unable to attend today's meeting. Although I
21 regret not being there, I am glad you all are, particularly
22 the team from the National Science Foundation. They will
23 see how important and impactful the work of the Green Bank
24 Observatory is to our world, to West Virginia, and to

1 Pocahontas County.

2 There are many impressive stats and facts that one can
3 recite about this facility, but to be here, to see the
4 structure in person and to hear your stories, that is worth
5 more than any statistics.

6 It was my pleasure to experience this just a few weeks
7 ago when I visited Green Bank. You cannot help but be
8 inspired and excited for our future by seeing this unique
9 equipment or meeting the men and women who make it work.

10 We are gathered to talk about the future of the Green
11 Bank Observatory, but we are also here to talk about the
12 future of scientific research in the United States. I have
13 long advocated for the continued operation of this facility
14 supporting robust levels of funding and research. Doing so
15 will not only employ West Virginians but it keeps people
16 inspired whether current researchers or the thousands of
17 students who come through here wanting to become
18 researchers. We have to invest in science research in our
19 nation. The promise of discoveries are beyond our
20 imagination if we make the right investments.

21 Whether on the appropriations committee where I am a
22 member or working with my partners in this effort, Senator
23 Manchin and Congressman Jenkins, I will convey -- continue
24 to convey my support for Green Bank.

1 I look forward to reconnecting with Director Cordova
2 tomorrow to discuss the significance of this observatory.
3 I know there's a process to write this Environmental Impact
4 Study, and I plan to be involved every step of the way. I
5 recognize the challenges presented by a limited federal
6 budget and support any and all efforts to reduce waste and
7 inefficiencies; however, investment in Green Bank does not
8 fall into either of those categories. Every dollar
9 invested here is spent wisely. Meanwhile, Green Bank has
10 been a responsible partner with the National Science
11 Foundation in recognizing the budgetary challenges we all
12 face.

13 Green Bank has been extremely aggressive and forward
14 thinking to partner with educational institutions like West
15 Virginia University and with organizations such as the
16 Breakthrough Foundation to balance government investment
17 with private funds.

18 There are many quantifiable impacts of this facility
19 on this community and we know your study will factor and
20 measure them all. As you complete your study, we ask that
21 you please not overlook the less easily measured impacts.

22 Green Bank is not just looking towards the stars to
23 discover new worlds but looking towards students in West
24 Virginia and across our nation for new scientists,

1 astronomers, researchers, and teachers. May their
2 discoveries continue to inspire us all. Senator Shelley
3 Moore Capito."

4 Thank you for your time.

5 ELIZABETH PENTECOST: The next person is Peggy Hawse
6 from Senator Manchin's office.

7 PEGGY HAWSE: Good afternoon. I'm Peggy Hawse and I'm
8 a regional coordinator for Senator Joe Manchin. I live
9 about 80 miles from here in Hardy County, so please don't
10 hold that against me. I know Moorefield plays Pocahontas
11 County, that's why I threw that out there.

12 The Senator is very committed to Green Bank
13 Observatory. He sent not only myself today but the
14 legislative director from Washington on the senator staff,
15 Wes Congle, and I am very happy to be here.

16 GBO, Green Bank Observatory, is very near and dear to
17 my heart. I kind of consider it a friend and when you have
18 a friend sometimes you give them a nickname. I understand
19 that the nickname of the Green Bank Telescope is the Great
20 Big Thing. The first time I said that at my home my
21 husband said what in the world are you talking about. I
22 said it is the Great Big Thing and you have to see it, you
23 have to experience it to really understand that.
24 Obviously, U-Haul did because they chose the Green Bank

1 Telescope as the symbol of West Virginia to put on the
2 sides of their trucks so it is a friend. It is a status of
3 pride for all of us that live in West Virginia and also in
4 the USA.

5 I do have some comments from the Senator. The NRAO
6 was established here in Green Bank in 1956. The people of
7 this community and this region have made many sacrifices
8 and they have embraced it. Obviously, there's no cellphone
9 coverage, but if you ask anyone in this area they will say
10 that is not a big deal.

11 I want to emphasize the economic impact, what happens
12 here at GBO. Well, first of all, there is a \$17 million
13 contribution to the local economy. Taking this a little
14 bit further, there are over 50,000 visitors to GBO every
15 year so if you equate that to the impact on the economy of
16 this area, \$8 million turns into 30 million. Now, I don't
17 know about you, but my economics says if you take eight and
18 you turn it into 30, you're doing something right.

19 Tomorrow afternoon Senator Manchin along with Senator
20 Capito and Congressman Jenkins will speak directly to
21 Dr. France Cordova, the director of the National Science
22 Foundation, to ensure that she understands the importance
23 of the Green Bank Observatory to this community and to the
24 surrounding region and West Virginia.

1 Senator Manchin thanks all of you for taking your time
2 out of your busy schedules to come and make your voice
3 known in this process. We would welcome any additional
4 information you would like to share with us about how this
5 facility has impacted you and your family.

6 As a member of the Commerce Committee, Senator Manchin
7 will have the responsibility of interviewing and confirming
8 the next director of the National Science Foundation, and
9 we would like to do everything we can to ensure your voice
10 and your concerns are heard at the highest levels. So on
11 behalf of Senator Manchin, I strongly encourage the
12 National Science Foundation to maintain their commitment to
13 this facility and to the critical contributions it makes to
14 the international, and I will say that again, to the
15 international scientific community throughout this review
16 process. Thank you.

17 I want to recognize the members of West Virginia
18 University staff. I understand there's a large delegation
19 of students coming later and I appreciate that effort on
20 their behalf, so thank you all for coming, and as I say,
21 the Great Big Thing is one of my friends.

22 ELIZABETH PENTECOST: The next person is Senator Greg
23 Boso.

24 SENATOR GREG BOSO: Good afternoon. I am Senator Greg

1 Boso and it is a privilege to be with you this evening to
2 be able to talk about this essential piece of
3 infrastructure, scientific infrastructure that has an
4 impact worldwide on science, on education, on technology,
5 and on my profession which is as an engineer.

6 I'm a registered civil engineer, professional engineer
7 working in West Virginia, but I also get to serve as a West
8 Virginia Senator. As an engineer, I've learned that
9 science has as an impact on our society, on our people, on
10 our world. Why, because we get to take the science and
11 adapt it so that it's useful in today's society.

12 I have already gone on record by providing a letter to
13 Ms. Pentecost that she should have already received and
14 made that letter aware -- or distributed it as well on to
15 our congressional delegation. Our congressional delegation
16 has already done a good job of making you aware of some of
17 the key aspects, but this is an Environmental Impact
18 Statement.

19 I've prepared environmental impact statements and I'm
20 really concerned about the impacts that this facility --
21 any potential closure that's contemplated would have on
22 Pocahontas County and on the region of the 11th Senatorial
23 District in which I represent. Why, because when you get
24 to looking at just a hundred jobs, it's not just a hundred

1 jobs. We get to looking at the economic impact. We've
2 already mentioned the fact that there's a \$30 million
3 ancillary investment within the community. You pull that
4 out, all of a sudden we would be losing our firefighters,
5 our EMTs, and the local community, those people who invest
6 their philanthropic efforts back into the community so that
7 this community thrives.

8 The National Radio Quiet Zone was established when
9 this particular facility was established. In doing so, it
10 made radio communications very limited. Does that mean
11 that Pocahontas County has suffered as a result of that? I
12 don't think so. And the reason I say that is because
13 people talk to people. They interact. You know, I love
14 coming to Pocahontas County. Why, because we don't have
15 telephones, we don't have wireless communications, and so
16 guess what? I get to shake hands, we smile, we talk, we
17 enjoy a cup of coffee. Those are things -- those are key
18 human interactions that the rest of the world is suffering
19 from.

20 When you get to looking at the rest of the world it's
21 breaking down. Why, because they don't interrelate with
22 one another, but I can tell you that that is just a part of
23 why this particular facility is so quiet.

24 When we get to looking at the environmental impact if

1 we start talking about removing this particular facility
2 we're going to remove the financial flow of money into the
3 local businesses. We're going to see businesses within
4 Pocahontas County, Green Bank, Durbin, Bartow, Dunmore
5 closing. Why, because there's no money to support this
6 particular area.

7 We're going to see Green Bank Elementary School
8 suffer. Why, because the population of the workforce here
9 provides people in the local school. Then we're going to
10 see school closures. These are impacts that we cannot, we
11 must not allow.

12 When we started talking about closure we talked about
13 the environmental impacts. We're going to start seeing
14 things happen here in Pocahontas County like is happening
15 already in Southern West Virginia as a result of the loss
16 of coal jobs. People are picking up and leaving,
17 abandoning their homes, and we're seeing structures
18 deteriorate in local landscapes, and as a result, the
19 environmental impacts as those structures begin to decay
20 impacts our water, our groundwater, and other -- creating
21 other environmental problems.

22 It's for these reasons that I support a no action
23 alternative that is proposed as a part of this
24 Environmental Impact Statement. Thank you. And I will

1 continue to support Pocahontas County and the State of West
2 Virginia.

3 ELIZABETH PENTECOST: Mr. Fred King.

4 DR. FRED KING: Good afternoon, everyone. I'm Fred
5 King. I'm the vice president of research at West Virginia
6 University, and I am here to talk to you about what I
7 consider to be the socioeconomic impacts as opposed to
8 necessarily the research impacts although these things run
9 together, and of course, being from the University it's
10 really in terms of the educational impact and workforce
11 development.

12 Over the last 15 years the University has worked,
13 collaborating with Green Bank as we've grown astrophysics
14 at our university. We've created a university center for
15 astrophysics and we've also renamed the Department of
16 Physics as the Department of Physics and Astronomy,
17 because of the growth of this at the university.

18 We've moved from one faculty member working the area
19 of astrophysics to seven who are now engaged in
20 astrophysics. These faculty have secured funding and
21 awards over that time and perhaps most significant among
22 those are National Science Foundation PIRE award for
23 International Research Collaborations focused on the Green
24 Bank Observatory as well as in last year a National Science

1 Foundation Physics Frontier Center award. This focused on
2 gravitational wave research.

3 I want to point out that the National Science
4 Foundation's Physics Frontier Center awards are given to
5 the most important problems being addressed within the
6 physics community. A large part of that work is done in
7 collaboration with the Green Bank Observatory.

8 To date, our faculty have brought in some \$14.5
9 million to the State of West Virginia in support of
10 research at the Green Bank facility. The work has also
11 provided our state with an international reputation in the
12 study of physics of pulsars and their potential use in the
13 study of gravitational waves.

14 You may recall back in the fall there was a great
15 fanfare about gravitational wave detections. Scientists
16 working here at Green Bank are working in an alternative
17 approach to that detection at a different part of the
18 gravitational wave spectrum. To date, there have been some
19 56 journal articles that have come out of the collaboration
20 between WVU faculty and the staff at the Green Bank
21 Observatory. And, of course, as you grow faculty, you're
22 going to grow more importantly student impact.

23 Over the last decade since we've been working
24 together, there have been some 6,000 undergraduate students

1 that have gone through the intro course at the
2 university. For some of these it has opened a new career
3 path. A path in science, technology, engineering, and
4 mathematics that they may not have previously considered.

5 The number of students graduating with an
6 undergraduate degree in physics during this time has
7 tripled and the diversity of students pursuing those
8 degrees has doubled.

9 To date, ten students have completed their Ph.D. to
10 this program. We currently have nine in the pipeline.
11 These Ph.D. graduates have gone on to more faculty
12 positions at other universities, to serve at staff at a
13 variety of observatories, or to translate their skills in
14 signal detection and processing into positions within the
15 industry.

16 Perhaps one of the most significant broader impacts
17 that I'm aware of is the Pulsar Search Collaboratory. It
18 is a joint effort between the University and the Green Bank
19 Observatory to engage K to 12 students and teachers in the
20 quest for pulsars.

21 If you have not already done so, I recommend you to
22 view the documentary that's available on-line called Little
23 Green Men. This documentary provides a great overview of
24 the pulsar research collaboratory in its efforts to engage

1 students and their teachers in this quest for new pulsar
2 discoveries. This is a fabulous example of hands-on
3 science. More significantly, you hear from these students
4 how it has profoundly impacted their lives.

5 Many of them, particularly those from rural areas and
6 potential first-generation students, have come to see that
7 they can be a part of the scientific enterprise. They can
8 pursue a career in science and technology, and oftentimes
9 this was something that prior to engagement of the pulsar
10 research collaborative effort, they never dreamed of.

11 Some of these have discovered new pulsars, but that is
12 less important than the competence and skills that they
13 have developed as participants and as future members of our
14 nation's workforce and lead us as a nation.

15 They also gain hands-on experience in the increasingly
16 important area of data science and analytics. They realize
17 that they can do this kind of work. Remember I mentioned
18 the confidence building aspect of this. These are not just
19 schools in West Virginia, but there are schools across the
20 country where they're using software, analyzing data, and
21 looking for signs of a pulsar. They appreciate the need to
22 document what they observe and to verify what they believe
23 they have discovered. But also importantly is in this film
24 you see the true joy and inspiration that arises from their

1 participation in the program. This is really encouraging
2 students to think about science, technology, engineering,
3 and mathematics as a way to the future.

4 It is also clear that those who spend time at the
5 Observatory are inspired with a sense of awe at the
6 phenomenal engineering accomplishment that is the Green
7 Bank Telescope. It lets them see what human endeavor can
8 result and what we as humans can accomplish. That's
9 important these days.

10 To date, more than 2,000 students have participated in
11 this program. In terms of diversity roughly 50 percent of
12 these students come from underrepresented or
13 underprivileged groups. From a workforce development
14 perspective, 99 percent of these students are either in
15 college or plan to attend college. Of those, 68 percent
16 plan to pursue a post-secondary education in STEM or STEM-
17 related fields such as medicine. To date we've had roughly
18 20 of these students attend West Virginia University and
19 eight of them major in physics and astronomy. They're a
20 real joy to have around I must say.

21 The Green Bank Telescope is certainly a point of pride
22 for the State of West Virginia. It profoundly impacts our
23 efforts to grow technology in a STEM workforce across the
24 state. The educational outreach provided both within West

1 Virginia and regionally continues to change the lives for
2 students who come from rural and underserved areas.

3 I notice that Jan Taylor is here from the State
4 Science and Technology Office. I serve on the Science and
5 Technology Counsel, and when we recently selected topics
6 for the NSF, RII EPSCoR opportunity, those are clients that
7 we use to build infrastructure within the state to promote
8 science and technology. We recognize the potential that
9 astronomy had for developing these skills and the
10 collaboration with Green Bank, and for that reason, we
11 focused our proposal in this area and we were successful
12 and won this.

13 Certainly as we heard before there's a great economic
14 impact locally of the Green Bank Observatory. High wage,
15 high quality jobs are few and far between in Pocahontas
16 County, but equally important, as the Senator noted, is the
17 social impact that the staff of Green Bank Observatory has
18 in the local community and the roles these provide in terms
19 of community service and engagement of citizens within this
20 community. Outside of the work that they do at the
21 Observatory, the telescope and its staff provide this
22 community with a quality of life that would simply not
23 exist absent the telescope and the Observatory.

24 As West Virginia works --

1 ELIZABETH PENTECOST: Excuse me. If I could just ask,
2 we have over 20 more people signed up and if we have time
3 left over --

4 DR. FRED KING: I will conclude.

5 ELIZABETH PENTECOST: Thank you so much. Again,
6 please provide written comments. We are going to have to
7 limit comments to three minutes from this time forward to
8 allow everybody the opportunity to participate.

9 DR. FRED KING: Thank you.

10 ELIZABETH PENTECOST: Thank you so much.

11 DR. FRED KING: I appreciate that over six years Green
12 Bank Observatory has provided the state with great
13 opportunities and hope it continues to do so, and I agree
14 that options four and five are really not viable options
15 for the state. Thank you.

16 ELIZABETH PENTECOST: The next speaker is Mark
17 Devlin.

18 DR. MARK DEVLIN: Hello. I guess I'm the first person
19 who is not from West Virginia so I hope you don't hold that
20 against me. I come from Philadelphia, Pennsylvania. I'm
21 an astronomer. I teach physics and astronomy at the
22 University of Pennsylvania. I've been doing that for 20
23 years. I've been coming to Green Bank for ten years to do
24 research on the telescope.

1 I want to say over the course of ten years I've met a
2 lot of people here. I've become friends with the staff and
3 with the astronomers here. I know them. I've met some of
4 their families. Even though I have a vested interest in
5 what's going on, I do research on the telescope, what would
6 happen to me pales in comparison to what would happen to my
7 friends and colleagues here if this observatory were to
8 close. It also pales in comparison to how it would damage
9 the international astronomical community which I'm not
10 supposed to talk about science but I'm going to talk about
11 it anyway because I can ignore them.

12 So what I want to point out is that during the
13 initial -- during the first couple of minutes of the
14 presentations you might have gotten the impression that the
15 entire astronomical community has just basically written
16 off the Green Bank Observatory; we had a meeting, we all
17 voted, and we said forget this place, we don't want it
18 anymore. I'm here to tell you that can't be further from
19 the truth. In fact, a large percentage of the astronomical
20 community finds that some of the reports that were gathered
21 were deeply flawed and did not represent what was actually
22 going on and what the impacts on the community would be,
23 and I say community because it is an astronomical
24 community. Includes astronomers from all over the world,

1 okay. Not just obviously here at the Green Bank
2 Observatory. All over the country, in Europe, I've got
3 letters here from South Africa and Japan from people who
4 support what is going on here. Clearly they don't know the
5 staff and people around here as well as I do, but they do
6 care what happens at this observatory.

7 What I would like to do is to read -- I have pages and
8 pages of letters from astronomers, again, from all over the
9 world. I want to read just a few of their comments on
10 what's going to go on and I will be ending with the -- with
11 what's going on with the alternative, some of the
12 alternatives that are proposed.

13 From around the world: A decision to drop any one of
14 the current facilities such as the GBT would leave a
15 distressing and unfillable hole in the field of radio
16 astronomy. The most impressive upgrades of the GBT have
17 only recently been commissioned and are still undergoing
18 commissioning keeping the GBT poised for great discoveries
19 and new capabilities. What I mean by that -- what this
20 person means by that is that when the study that was done
21 to determine whether this Observatory was competitive was
22 done before the Observatory was working, okay. That's not
23 fair. It needs to be redone in the context of what the
24 Observatory is currently capable of doing which is

1 expensive.

2 I don't want to get cut off by that woman over there
3 so I'm going to skip forward here. She's going to cut me
4 off already? What? I can have your three? I'm going to
5 take his three.

6 Speaking to what we plan for the Observatory, theGBT
7 has been an excellent observatory for hands-on student
8 training; however, we would like to strongly discourage its
9 usage of a world-leading observatory as a pure educational
10 site, let alone an amusement park. Science and its high
11 technology facilities serve the public best when focusing
12 on breaking the frontiers of our very understanding of how
13 nature works. This can only be achieved by using
14 facilities for research, not by making them silent
15 monuments or tearing them down.

16 Another person comments imagine the impression on kids
17 and other visitors if all they see is a mothball or
18 dismantled instruments. What better way to reveal that the
19 U.S. is letting its lead in science slowly slip away.

20 I'm in trouble. I will stop. But I'm here to let you
21 know that you're not alone. There's people all over the
22 world care what happens here and I especially do, too.
23 Thank you very much.

24 ELIZABETH PENTECOST: Mr. Charles Sheets.

1 CHARLES SHEETS: Thank you all. Thanks for coming.
2 I'm Charles Sheets as she said. I'm a resident of Green
3 Bank. About a month ago we were here and we heard a lot of
4 scientists, researchers talking in glowing terms about the
5 Green Bank Observatory and all the efforts that they have
6 done and all the latest in technology experiences and
7 things in particular GBT can do.

8 I'm astonished to hear now as you all just have heard
9 that the National Science Foundation has made up its mind.
10 We just saw attorneys on the board there. Now if there
11 wasn't the federal law or federal regulations we wouldn't
12 be here today and they had already made up their minds to
13 this decision.

14 I was in Green Bank High School when the grounds broke
15 for this Observatory. All kind of rumors were going around
16 at that time; it was going to be a nudist colony coming in
17 here, all kinds of things. Our great principal, Virgil B.
18 Harris, called all the students together in the assembly
19 hall in old Green Bank High School and laid out the plans
20 of what was going to happen. It was a great time. It was
21 a great time celebration for the young kids in high school
22 to see what -- and we had no idea what a radio telescope
23 was at the time.

24 I just want to refer back to the three options. The

1 first two options are the only viable options for the
2 National Science Foundation. Robert C. Byrd right now when
3 he hears those last two options he's rolling around in his
4 grave. He is absolutely rolling around in his grave
5 because he was a friend of the National Science Foundation
6 apparently because he had \$95 million to build this great
7 GBT telescope. Thank you all very much.

8 ELIZABETH PENTECOST: Mr. Skip Crilly, C-R-I-L-L-Y.

9 SKIP CRILLY: Hello. Thank you for the opportunity
10 here to say a few words. I will make it short. I'm a
11 volunteer here. I've been working at GBO for two years.
12 I'm a retired electrical engineer and I decided to take
13 advantage of a fantastic opportunity to help work on the
14 40-foot telescope and improve it so as a volunteer, and I
15 want to specifically address the idea that the science
16 outreach volunteers need to have an observatory. They need
17 to have something that they can work with, a facility that
18 they can work with. It's very difficult to volunteer
19 otherwise.

20 As a volunteer, I have decided to essentially
21 volunteer my time and my money so I don't request any money
22 from the Observatory. I don't file expense reports. The
23 equipment that I've installed on the 40-foot telescope, the
24 educational telescope, is all equipment that I purchased.

1 This is what volunteers very often do. They need a
2 facility, they need something that they can work towards,
3 and without that, you know, what can they do.

4 I would like to use one quick example. I brought with
5 me another example of volunteer work. These are the
6 journals, the proceedings of the Society of Amateur Radio
7 Astronomers and I brought ten years of proceedings. This
8 organization is the premiere organization for radio
9 astronomy -- for amateur radio astronomy in the world and
10 it meets here in Green Bank every year, June-July time
11 frame and it's been doing that since the mid-1980s. So
12 I've got one-third of the proceedings here with me and this
13 is hundreds of papers are written.

14 We've been continuing to improve the telescopes on the
15 site for educational outreach and I've had two requests
16 from universities to try out the mobile interferometer that
17 we built here in SARA this year and we're going
18 to extend that.

19 So I would just like to say that, you know, it's
20 really important for the work of an organization like this
21 that are all volunteers that a place like this, the Green
22 Bank Observatory is available to do this science outreach.
23 Thank you very much.

24 ELIZABETH PENTECOST: Mr. John Dennis.

1 JOHN DENNIS: Hi. My name is John Dennis. I'm just a
2 citizen of West Virginia. I live in Parkersburg, West
3 Virginia. It's three-and-a-half hours west of here right
4 on the Ohio River, but I was born right over the mountain
5 here in Elkins.

6 My grandparents were from the Belington area and when
7 this place was built they brought me over here. They made
8 sure that I saw this place in the '60s when it was first
9 built so I've been coming back here as often as I can.
10 I've brought my children here. I will bring my grand kids
11 here when I come over.

12 As an amateur astronomer, optical, I don't do the SARA
13 radio stuff, but I'm an optical astronomer, I've got to
14 come over here with our two astronomy clubs that West
15 Virginia has, one in the Clarksburg area and one in the
16 Charleston area, and we bring in between 100 and 300 people
17 for a week over here. We have speakers nationally known.
18 We've had Seth Shostak here. We've had several of the
19 Ph.D. guys that are talking about pulsars from WVU. We've
20 had one of the students in our club that she grew up is now
21 working -- has worked through the WVU program undergrad,
22 Caitlin Aarons, and she is now working in planetary
23 sciences. She worked on the Mars' systems and now she's
24 working on the information that came back from Pluto so

1 it's fantastic to see what impact small places like this
2 do. It is a small area, just a few hundred square -- or
3 just a few square miles over here but it is impacting
4 people throughout the world.

5 In my family, you know, I hope that one of my kids
6 will eventually see this and turn into a scientist somehow
7 so that's all I can say. Thank you very much.

8 ELIZABETH PENTECOST: Carla Beaudet.

9 CARLA BEAUDET: So my name is Carla Beaudet. I'm an
10 engineer here at the Green Bank Observatory and I'm here to
11 talk about the socioeconomic impact to the local community
12 under any scenario in which the GBT were to cease
13 operations. The losses needed to be estimated in dollars
14 and these estimates need to make it into the Green Bank
15 EIS.

16 I have read the socioeconomics section of the draft
17 EIS for the funding of Arecibo Observatory and
18 a number of things concern me. Under housing it reads, "An
19 indirect effect of alternatives three, four, and five."
20 These are the alternatives where the science operations go
21 away. "Could be an increase in housing vacancies as the
22 workforce potentially relocates over time in search of
23 comparable employment." Could be. Yeah. Exactly. Could
24 be. Potentially relocates. I do not want to see this kind

1 of language in the EIS for Green Bank. A little research
2 will assure you that anyone employed at the professional
3 level and not prepared to retire will have to move to find
4 comparable employment. This will have a significant impact
5 on the local real estate market as it is flooded with homes
6 for sale. This impact can be estimated and it is your job
7 to do so.

8 In the same section under population, the Arecibo EIS
9 reads it is difficult to predict when and how many
10 workforce personnel were to relocate, therefore, the
11 potential loss of population is addressed qualitatively in
12 this section. Again, there is no excuse for not estimating
13 and quantifying this loss. If the only costs that can be
14 quantified are the costs to the NSF then the EIS is
15 designed to support a foregone conclusion.

16 A quick hand-waving estimate for you. The GBO
17 currently has 108 permanent full-time employees, offers an
18 additional 40 seasonal positions which all account for
19 giving us a nominal 148. Maybe ten percent of
20 those employees would choose and be able to find a way to
21 stay in the area. That's a loss of 106 people from the
22 Green Bank Arbovale area whose combined population in 2014
23 was 303, a loss of 34 percent of the total population.
24 This number is probably inflated because we don't all live

1 in Green Bank or Arbovale, but it's easy to find out where
2 118 people live and adjust these numbers.

3 In Section 4.9 economy, employment, and income are
4 lumped together, but only employment and income are
5 quantitatively addressed. It reads the direct effect of
6 the proposed alternatives on the employment and income of
7 the population of the municipality of Arecibo are
8 quantified while the effects on economy are qualitatively
9 described to account for the secondary indirect and educed
10 economic effects. Economic impacts are necessarily the
11 indirect product of employment or lack thereof and deserve
12 their own section as well as best estimates.

13 I know of at least one community sponsored agriculture
14 operation that would not likely be in business if it
15 weren't for the GBO. You could ask the local branch of
16 First Citizens Bank what the impact would be if they lost
17 all their Observatory employee accounts.

18 There are other quantifiable losses to the area that
19 come from losing the many volunteer services of Observatory
20 employees and the sharing of our facilities with the
21 community. Observatory employees volunteer as firefighters
22 and EMTs, as volunteers of yoga, aerobics, Zumba,
23 Taekwondo, as sound and lighting engineers at the Marlinton
24 Opera House, as soccer, basketball, football coaches and

1 that by no means is an exhaustive list.

2 CAROLINE BLANCO: Excuse me. Could you hold the
3 balance of your comments either for written submission or
4 if we have time left over. We're almost at four minutes.

5 CARLA BEAUDET: Okay. Thanks.

6 ELIZABETH PENTECOST: Sue Ann Heatherly.

7 CAROLINE BLANCO: We really appreciate it, folks. We
8 hate to cut people off but --

9 UNIDENTIFIED SPEAKER: You're cutting our community
10 off though.

11 SUE ANN HEATHERLY: I just want to make one point and
12 that is about those last three options and why they're not
13 good ones for us. My name is Sue Ann Heatherly. I'm the
14 education officer here at the Observatory. A lot of the
15 programs you've been hearing about, thank you so much for
16 bringing them up, are part of what I do for my job, the
17 Pulsar Search Collaboratory and other programs that we do
18 that I will put into the record.

19 The reason why options one and two are really
20 necessary is that the reason why our programs are so
21 impactful for the students that participate in them is
22 because they are in a working research facility. They're
23 not just pretending to be scientists and they're not just
24 playing at it. They're part of the community where you've

1 got professional scientists, professional engineers,
2 professional technicians, machinists, mechanics, the whole
3 STEM village here, and that's what makes our program so
4 impactful. Thank you.

5 ELIZABETH PENTECOST: Janet Ghigo. Sorry if I
6 mispronounced it.

7 JANET GHIGO: I'm Janet Ghigo and I'm just going to
8 say a few things about the community. First, a few of the
9 issues that have been brought up that had to do with health
10 and safety which was one of those items that were
11 mentioned, and I wanted to just briefly mention the Green
12 Bank Observatory and emergency medical services in the
13 area. I'm not going to do it all. I will send this in.

14 But I just wanted to mention that when EMS was first
15 invented in West Virginia in 1975 we had -- the local fire
16 department had a man that was an EMT. At that time the
17 Observatory had their own fire -- well, had two fire trucks
18 and an ambulance, but the local medic who started -- got
19 things started at the local fire department was associated
20 with the Observatory. She also became -- several of her
21 colleagues who are also associated with the Observatory
22 either employees or spouses became medics. She became an
23 instructor. She taught classes and her students then
24 became instructors, taught classes.

1 In one of my estimates recently is that if you count
2 the EMTs in the county that have been taught by Observatory
3 people we're talking 200 to 300 people. The backbone of
4 every agency is students of these instructors. Sorry.

5 I also wanted to mention the EMS Authority which is an
6 organization that represents all of the EMS services, and
7 if you look at the people who are members of that you can
8 go back to the very beginning with Tom who was an Observatory
9 employee. We had the people who are representing all of
10 their squads are students of NRAO spouse instructors.
11 For example, we also have -- I will submit this, but all
12 of the members and how they are -- all have ties to the
13 Observatory in one way.

14 Just as a final thing, I want to mention this past
15 year the county squads responded to over 1600 calls,
16 traveling close to a hundred thousand miles. Paid
17 paramedic service is now available from four of the
18 County's six squads along with continued volunteer
19 service. A majority of these squad leaders and active
20 members can trace their training back to NRAO spouses and
21 employees. At present, the assisted fire chief, rescue
22 chief, and assistant rescue chief for the local ambulance
23 service, and that includes that building you saw just
24 across the road there, which provides EMS and fire service

1 to this site which means that NSF does not have to provide
2 that money for that are all NRAO employees or spouses.

3 It's not the main role of NSF to provide community
4 services, but closing the Observatory for the necessary
5 movement of these employees as Carla mentioned, moving the
6 employees and spouses out of the county would be a
7 devastating blow to the network that's been built over 40
8 years.

9 ELIZABETH PENTECOST: Hanna Sizemore.

10 DR. HANNA SIZEMORE: Hi, everyone. My name is Hanna
11 Sizemore. I'm a planetary scientist which is a little bit
12 different than any of the other scientists here at Green
13 Bank. Basically I study planets, Mars, and asteroids based
14 on data from space craft missions flown by NASA. I'm also
15 a Pocahontas County native. I grew up here and I attended
16 local schools, kindergarten through 12th grade, and as a
17 high school student I had the opportunity to do research
18 here in Green Bank working with Ron Maddalena who is a
19 permanent member of the science staff and an active
20 researcher.

21 Now the training, the advice, and the exposure to the
22 international scientific community that I received here
23 were ultimately instrumental in me being accepted to
24 college, receiving the scholarships and grants that paid

1 for me to go to college, and ultimately getting advanced
2 degrees and working at NASA Ames Research Center.

3 Now about 16 years ago for personal reasons I decided
4 to move my family from California back to Pocahontas
5 County. When I did that people -- NRAO reached out to me
6 and offered me an adjunct position here in Green Bank, and
7 I want to emphasize this is a free unpaid position that
8 provides very cheap nominal administrative support for me,
9 but thanks to that position I was able to bring my mass of
10 work back here with me to the county and the grant money
11 that I bring in came back with me. I'm able to raise my
12 children here where I grew up and keep them in the public
13 schools and are allowed to be a part of this community
14 again.

15 My life would be very different if there were not a
16 world-class research facility staffed by active scientists
17 here in Green Bank. I think the importance of the
18 Observatory in my life personally is a microcosm of the
19 importance of the Observatory to the local community and to
20 the state as a whole. A reduction of science activities or
21 staff at GBO would be culturally and socioeconomically
22 devastating. Thank you.

23 ELIZABETH PENTECOST: Father Arthur Bufogle.

24 FATHER ARTHUR BUFOGLE: I'm Father Arthur. I'm the

1 Catholic priest here in Pocahontas County. I love a
2 pulpit, but I'm not going to preach to you today. I'm
3 going to talk about the second favorite topic of any
4 preacher and that is money.

5 We heard a lot about the economic benefits of GBO for
6 the county and the community. I second all of that, so add
7 all of that to my comments and that will make it sound like
8 I was really preaching for a long time.

9 There's a second area that I think got some expression
10 but not enough, and that is the economic benefit of this
11 facility not just to the area but to the nation. We heard
12 so much about making America great. Well, this place helps
13 makes America great. I'm a priest but I come from a
14 science background. I was a science teacher for many years
15 and then in plant science and soil science both at LSU and
16 Mississippi State, and I know what basic science does and
17 it's expensive. It doesn't have immediate results, but
18 it's the basis of what others use for the economic
19 benefits, and for our country something like this is not
20 just for us and our community but it is for the entire
21 nation and the entire world so I think it's very important
22 that we not be shortsighted and maybe save a few pennies
23 but lose a fortune and so I really support this place, and
24 I hope the National Science Foundation will look at the

1 wisdom that the people here, local people who are often
2 dismissed and limited to three minutes or less but really
3 have a lot to say and a lot of wisdom that you might
4 benefit from hearing. Thank you.

5 ELIZABETH PENTECOST: Mr. Ryan Lynch.

6 DR. RYAN LYNCH: My name is Ryan Lynch. I'm a staff
7 scientist here and I will try and make this brief and just
8 summarize my comments and submit the rest in writing.

9 I just want to say a little bit in my role as the
10 summer student program coordinator here at Green Bank so I
11 want to stress that the EIS really needs to include
12 education as its own impact area but as well as how
13 education intersects with socioeconomic and cultural
14 impacts.

15 I just want to summarize a little bit about the summer
16 student program here. We've had hundreds of summer
17 students come through Green Bank in the years that it
18 exists. For the last 25 years, 40 percent of those have
19 been women which is the highest percentage than the rest of
20 the astronomy field as a whole. Some of those students
21 have come back to Green Bank and to West Virginia because
22 they realized this is a special place but the impact -- the
23 region of impact is not just Pocahontas County or West
24 Virginia. It's the whole United States and really the

1 whole world.

2 Even though that's only looking at the summer students
3 here, hundreds of other students at research universities
4 across the nation and across the world rely on this
5 facility to advance their careers. Some of them go into
6 professional astronomy, many of them go into other STEM
7 fields in finance, in education, in journalism, and that
8 has a huge socioeconomic impact on the rest of the country
9 because those are high value jobs and they give back to the
10 rest of the economy.

11 Any reduction negatively impacts
12 those careers because the students are coming from
13 institutions that do not have the resources to necessarily
14 buy time on the telescope or to join up with another
15 private institution to offer its own facility so I'm going
16 to strongly urge that you include education as an explicit
17 area tied into the other areas of the impact statement and
18 that you recommend option one, no action alternative.
19 Thank you.

20 ELIZABETH PENTECOST: Ms. Savannah Horton.

21 SAVANNAH HORTON: Hello. My name is Savannah Horton.
22 I'm a 17-year-old student and I drove two hours and left
23 school early to come and attend this seminar. I live in
24 rural Broadway, Virginia, and it is so imperative that

1 Green Bank remains open and operative for women and STEM.
2 The Green Bank Observatory has profoundly impacted
3 the scientists. My research partner, Dana Jones,
4 is here today. We attend Massanutten Regional Governor's
5 School for integrated science and technology, and Green
6 Bank Observatory was our first view into the world of
7 astronomy.

8 Green Bank Observatory is what led us to go this
9 summer to go and work at Caltech and study active galactic
10 nuclei at the age of 17. I advocate for continued
11 investment and the no action alternative for Green Bank.

12 Jocelyn Bell Burnell who was a Cambridge student and a
13 young woman in the 1960s who discovered pulsars but was
14 wrongfully robbed of her Nobel prize. It would be an
15 embarrassment for a facility like GBO to be shut down as it
16 provides women in STEM an opportunity to succeed in a field
17 that was once dominated by men.

18 The GBO is critical to the next generation of
19 scientists and I stand here as an example of a young woman
20 who once doubted my abilities in science but Green Bank
21 opened the doors. Ryan Lynch was my mentor that has led me
22 to a complete world of astronomy that I once never expected
23 for myself.

24 Restricted funding harms cultural resources and

1 socioeconomic resources for students like Dana and I who
2 would never have had the abilities because of where we come
3 from to be able to study astronomy so I think it is
4 imperative to preserve science in rural areas and it is so
5 important that option one is considered today. Thank you.

6 ELIZABETH PENTECOST: Ricky Sharp.

7 RICKY SHARP: I am Ricky Sharp. I'm the principal at
8 Green Bank Elementary Middle School next door. I hope that
9 the NSF really steps back and they think about how deep-
10 rooted the GBO is in our community. Your ASB extends well
11 beyond the fence of this facility.

12 At our school we have 16 students that are
13 decedents -- or I'm sorry, their parents work here at the
14 scope. That's six percent of our student population. We
15 talk about tax base and how that is going to affect our
16 schools, but just pulling those students out alone if they
17 had to relocate would be a huge impact on our school. The
18 tax base for our school systems we're already struggling as
19 it is. We can't afford to have an additional cut.
20 Whenever we're talking \$17 million and \$30 million as it
21 comes across that's huge. That means a lot for our
22 system.

23 We talked -- Mr. Boso, Senator Boso talked about the
24 students and how it affects the students here, and yes,

1 we've had some struggles here with the Observatory and not
2 having wireless and not having some of the technologies
3 that other facilities do, but if you were to ask our
4 students which happens often because of the national
5 publicity that the National Science Foundation gains, we
6 see it time in and time out with the British Broadcast
7 Television, PBS, CNN, Chinese reporters come in, it's all
8 these different international broadcast facilities come in
9 and they ask questions to our students, how are you
10 affected by this. Do you know what our students say time
11 in and time out? Whenever our cousins or our relatives
12 come in all they want to do is they want to be stuck on
13 their phones and they're looking down. We want to talk to
14 them and we want to visit with them. We want to go out and
15 we want to play outside. We want to have a conversation
16 and they're not able to do that.

17 I'm proud to say that my students at my school can sit
18 and have a conversation with you and don't have to have the
19 interruptions of today's technology and they can operate
20 without that. What an important skill that we miss out on
21 in today's society.

22 The school and GBO, we talk about what they do for our
23 school, the location. They allow us to have our county
24 social studies fair, our math field days, our science

1 fairs. They offer their facilities for incentives to our
2 students which means a lot. In a community that does not
3 have a lot of funding for their schools and to offer these
4 programs and additional opportunities and we have to travel
5 so far and we pay for transportation and then we pay for
6 the fees, it's nice to have something in your backdoor to
7 where you can come over and you can encourage students and
8 you can have a video on the screen here and offer the
9 auditorium to them. You can use the pool, you can use the
10 rec area. What a nice thing to have in our backdoor.

11 We talk about the hundred staff members here and one
12 key part of our community that we don't have and we don't
13 recognize is there's a hundred people employed by this
14 facility and every single one of them value the importance
15 of education and play a crucial part in each student's life
16 that come into that building. They're volunteering their
17 time at our doors, they're serving as judges in science
18 fair, social studies fair. Their own kids. What they
19 offer goes well beyond what is here.

20 You talk about health and safety as being one of the
21 impacts and the things here. We're a very rural community,
22 very rural school. If we have to evacuate our building we
23 come to this site and different locations on this site.
24 That needs to be taken into consideration. There's not a

1 place with our community a close distance that I could
2 evacuate my students to if need be.

3 They assist with repairs on electronic equipment, they
4 assist with our radios for safety. In repairing those
5 radios -- and even school furniture they help with
6 construction, different projects. They're really crucial.
7 I know I have to cut it off. I will tell you that I have
8 listed all of this and this is on the site and everything
9 and --

10 CAROLINE BLANCO: If you can submit them written or --

11 RICKY SHARP: I have. I have. I've submitted them
12 written. I left a copy here and I also posted on-line,
13 too. Thank you.

14 ELIZABETH PENTECOST: Maury Johnson.

15 MAURY JOHNSON: My name is Maury Johnson. I come from
16 and bring greetings from your neighbors in Monroe County.
17 A few days ago I read an article in the Charleston Gazette
18 and I was astounded that options three, four, and five are
19 even thought of.

20 The first time I came to Green Bank I was about nine
21 years old, 1969, weeks before the Apollo moon mission
22 landed on the moon. My father brought myself, my brothers
23 up here. Coming around the bend I see this great big
24 telescope thing. It inspired us.

1 My brother, my older brother became a science
2 teacher. Teaches science in Monroe County and now
3 Greenbrier County. I became a teacher. I've taught
4 science. This has been a world of -- to so many students
5 across the area. Monroe, all the counties nearby, it's a
6 gem.

7 Now let's talk about something. Who wants to know
8 something about biological resources? This area mainly
9 because of this facility has some very unique endangered
10 species in the area. It's very diverse because of the no
11 pollution we have here. The cultural resources, well, the
12 cultural of the entire area is around this Green Bank is as
13 many people said, people talk to each other. We're
14 isolated. A lot of areas are not isolated anymore. You
15 have a culture here going back to pioneer days
16 and stuff, you've got a culture here that has found no
17 other place mainly because of this Green Bank facility.

18 There's a lot of things to say. I will let other
19 people speak. I will let you know that folks in Monroe
20 County a lot of them wanted to be here today. We have an
21 article in the Monroe Watchman and we will be with you. No
22 action alternative. Do not do anything with this facility
23 to hinder the science work it's doing and inspiring young
24 ladies.

1 ELIZABETH PENTECOST: Tracie Shrader Flack.

2 TRACIE SHRADER FLACK: Good afternoon. My name is
3 Tracie Shrader Flack and I, too, come from Monroe County.
4 I am the president of the Friends of the Second Creek,
5 Inc. We are a nonprofit organization whose mission is
6 water and water life preservation as well as historical
7 preservation of the Second Creek Watershed.

8 If you've never been to Monroe County I strongly
9 encourage you to come visit us where we have some of the
10 most beautiful farmlands like right here in Pocahontas
11 County. I noticed that when I was driving up here today.
12 So you come to visit us. We also have historically
13 significant features in Monroe County as well as here in
14 Pocahontas County.

15 West Virginia, Monroe County, and the Friends of the
16 Second Creek depend upon tourism as a major source of
17 income and support. I realize that the Green Bank
18 Observatory has been -- long been a tourism draw for the
19 state. I can remember as a small child my parents bringing
20 me up here and I stood in awe of this place and I still
21 brag about it. I lived in Arizona for 40 years and, of
22 course, you know, there's observatories out there and I was
23 talking about this place when I was out there. It's a big
24 tourism draw.

1 I support keeping this site open and operational as it
2 stands as a tourism source, and if you need more money see
3 if the state has got some tourism money to give you.
4 That's about all I got to say. I thank you all for coming.

5 ELIZABETH PENTECOST: Robert Sheets.

6 ROBERT SHEETS: Thank you all. I'm Bob Sheets. I'm a
7 lifelong resident of Green Bank, West Virginia. I sat on
8 my grandmother's porch right across from the entrance and
9 watched them tear down the fence and build the road for the
10 GBO. My mother was employee number three here at Green
11 Bank. I'm often asked what it's like to live near a radio
12 free quiet zone without cellphones. My answer is quite
13 simple, you should have been here before the Observatory.
14 It was really quiet.

15 My sister and I used to sit in the barn loft down the
16 road here and write down license plate numbers and if we
17 got an out-of-state plate we got really excited. Now when
18 I pull out my driveway below Green Bank I see people stop
19 their vehicle, jump out, pose, and take a selfie under the
20 Green Bank, Unincorporated sign. That speaks to our
21 national and international presence. It speaks to the
22 educational opportunities that are available here.

23 I taught English for 40 years, 35 of them in
24 Pocahontas County High School. I was a recipient of one of

1 the AUI scholarships in the 1960s to further my education.
2 I came back here. I've seen so many of our students
3 complete mentorships here. I was a member of the first
4 class at Green Bank High School that benefited from the
5 technological expertise of observatory techs. They came,
6 they taught me electricity and electronics. I still see
7 that going on as many of the programmers here are
8 volunteering their time to work with computer programming
9 classes at the high school. You cannot underestimate the
10 educational, the socioeconomic impact of the National Radio
11 Astronomy Observatory or as it is now called the Green Bank
12 Observatory which actually makes me kind of proud.

13 Now I will give you one other tidbit because not too
14 many people have talked about the historical component of
15 this particular place, but if you are so fortunate as to
16 pick up a copy of the Pocahontas Times today you will see
17 unfortunately my face on the front cover beside an
18 (inaudible) of King George III because about one-half mile
19 off the Green Bank Observatory site is actually the largest
20 governmental institution ever here in Pocahontas County.
21 In 1774 there were over 125 colonial militia stationed
22 there. This is a historic site. It's been that way for a
23 long time and it's been further enhanced by the presence of
24 the GBO. Thank you.

1 ELIZABETH PENTECOST: Paul Marganian.

2 PAUL MARGANIAN: Hi. I'm Paul Marganian. A lot of
3 you know me. I am a software engineer here at the
4 Observatory. Obviously, you know, options four and five
5 would have a huge impact on me personally, but I want to
6 talk -- I don't want to talk about the impact of me or
7 Green Bank or even West Virginia. I want to talk about the
8 impact on our nation.

9 My father was an immigrant. He came to this country
10 in part because at the time in the 1950s this was where you
11 went to get a cutting edge education. This was the center
12 of science and research, and I'm proud to say we still are
13 in my lifetime.

14 This time last year I happened to be in China on
15 observatory business. I was in China because they're
16 investing in science and research. They're building
17 facilities larger than ours. One day I was sitting in the
18 Xixiang astronomy building and there was this huge
19 construction site next to us and this huge 30-story
20 building. I said, you know, what's going on there. They
21 said, oh, that's our new lab. I come back here and options
22 four and five are staring at us in the face. That doesn't
23 make a lot of sense to me. So I would like to ask why
24 we're abdicating our leadership role in the world as

1 leaders in science and technology.

2 If my own children want to go into science and
3 research, are they going to have to go to China to receive
4 that best education? I certainly hope not.

5 Now the Father already stole my punch-line, but I just
6 wanted to say, you know, there's been a lot of talk about
7 making America great again. Options four and five are
8 obviously steps in the wrong direction. Thank you.

9 ELIZABETH PENTECOST: Larry Garretson.

10 LARRY GARRETSON: Hi. My name is Larry Garretson. My
11 wife and I live here in Pocahontas County. My wife Paula
12 and I have been here in Northern Pocahontas County for ten
13 years and have been operating a bed and breakfast the
14 entire time we have been here.

15 We settled in this area because the importance of
16 tourism with the GBO being one of the primary destinations
17 for our guests. We've seen a steady increase of visitors
18 both tourists staying with us who want to visit the GBO and
19 to see for themselves the science and technology that's on
20 display here. Also scientists and engineers who come here
21 to work and stay with us during their visit. Our business
22 depends on the continuation of the GBO's existence and
23 enjoys a good relationship with the GBO and the employees
24 that work here both at the facility and in the community

1 which we all live. We enjoy ten to 15 percent of our
2 business coming from the existence of GBO and expect that
3 to grow each year primarily from tourism.

4 We respectfully request that you consider the economic
5 impact of small businesses like ours and the ability to
6 continue to grow and to draw visitors to our beautiful
7 county.

8 We have to say that guests walk in the door those that
9 are not aware of GBO existence and ask what that giant
10 telescope here is and must say that they are all inspired
11 by the technology that's located here.

12 Speaking of guests that stay with us, not only do we
13 have tourists, not only do we have scientists who stay with
14 us, we have also had a quite a number of people stay with
15 us who are what I term electronic -- electromagnetically
16 sensitive. In other words, they come here to get away from
17 the noise, the pollution of the rest of the world. That's
18 not just a few guests. We've had probably ten to 20
19 couples come here and stay with us that are like that.

20 The other thing about our list of guests is that we've
21 had quite a number of people that come here because the GBO
22 is -- creates the quiet zone. To list a few, NBC has been
23 here and stayed with us, BBC was here and stayed with us,
24 Al Jazeera film crew was here and stayed with us. There

1 are others that I can't remember but we've had quite a
2 few.

3 So all I ask is your careful consideration of the
4 personal and economic impact of the GBO on our small
5 community and consider us when you do finalize your EIS.
6 Thank you.

7 CAROLINE BLANCO: Folks, just to let you know what's
8 going on, it is five o'clock and our next meeting is at 6.
9 We realize we have about 20 more people to comment. We
10 were going to take a break for an hour in between. We're
11 just going to keep on going to allow you to comment but at
12 six o'clock we have to stop because the next meeting
13 starts.

14 We're going to take five to give the court reporter a
15 break so he doesn't hurt his fingers. When we do come back
16 please, please, please, so many people are going over and
17 we would like to get everybody as much of an opportunity --

18 UNIDENTIFIED SPEAKER: Wait a minute, everybody. This
19 gentleman needs to leave and what is your name.

20 JOSEPH RILEY: Joseph Riley.

21 ELIZABETH PENTECOST: Joseph Riley.

22 JOSEPH RILEY: Thank you for letting me step up here a
23 little bit because I'm supposed to be at a board meeting in
24 Marlinton at six and I saw the superintendent already

1 leave.

2 My name is Joseph Riley. I'm the principal at
3 Pocahontas County High School and prior to that was
4 principal at Marlinton Middle School. I just want to take
5 and add to what Sue Ann Heatherly talked about.

6 Whenever we look at the opportunity students have we
7 can do a lot with teachers and we can do a lot in our labs,
8 but we don't have quite what they have here. To give you
9 an example, my little daughter just came back on two
10 occasions where she came to a science day here at the
11 Observatory and came back one time with a toothbrush that
12 had wires all over it and she put a battery out of a watch
13 in it and it run all over the table and she could explain
14 how all of that worked. Another year she come back with a
15 Christmas ornament that blinked different colors and would
16 do different sequences and that was something that she
17 learned here. I don't know that we could have did that
18 within the labs we have at Marlinton Middle School.

19 Moving on through, I mean, even with the science fair
20 they sent people down to help students with projects at the
21 science fair so if they made it on to the state level they
22 could keep moving so they give support in that.

23 Looking at the high school standpoint, one thing that
24 the Department of Education is wanting us to do is to get

1 more computer science involved. Well, this is not
2 something that we're getting a lot of training in so I have
3 teachers that are struggling trying to get into saying
4 okay, what do we do in order to get this STEM in, what are
5 we going to do for computer science. We have people that
6 come from the Observatory on a weekly basis to give kids
7 this is more information and this is what we can do so that
8 aspect.

9 Memberships. We sent out memberships to come to the
10 Observatory to get training whenever they're seniors to say
11 okay, is this really something you want to do, and we did
12 from the science aspect, but we also did from the machinist
13 side. I had kids that learned things about welding that
14 they never even knew existed because they were working with
15 a machinist in the machine shop here at the Observatory.

16 To end with, I want to talk about one little aspect
17 that really hit home with me. We were at math field day
18 last year and this was all full of kids from across the
19 county when they were announcing who had won and all that,
20 and Hanna Sizemore came up here to the front and she did a
21 presentation and had a picture of Mars and she talked to
22 the kids about this is what I'm studying, does anyone know
23 what it was. Once she said it was Mars and the kids were
24 like -- and she was telling them everything they were

1 doing, she had them. Then the last thing she said was and
2 I was sitting in the seats that you all are one day back
3 before I was a participant in math field day and look what
4 I'm able to do.

5 At Pocahontas High School we're trying to figure out
6 how we can keep kids here that want to stay here. This can
7 be avenues for it so I would really like for to you think
8 about our kids also in being able to keep them within the
9 county. Thank you.

10 ELIZABETH PENTECOST: One more before the break.

11 CAROLINE BLANCO: One more and then we will take a
12 five-minute break.

13 ELIZABETH PENTECOST: Sarah Riley.

14 SARAH RILEY: Thank you all for your patience for one
15 more. If anybody else is going to Hillsboro I'm having to
16 get a ride; otherwise, I have to take him to the board
17 meeting because we only have one car. But my name is Sarah
18 Riley. I'm the executive director of the High Rocks
19 Educational Corporation which is a regional nonprofit that
20 is dedicated to educating and empowering and inspiring
21 young people in West Virginia so what I have tried to do
22 for the last 20 years is move young people from the very
23 first beginning of adulthood when they're about 12 years
24 old up until about the time they're 35 when they're

1 establishing their career.

2 What I want to talk about is access and equity in
3 education and that is both cultural and socioeconomic.
4 There is -- the Green Bank Observatory has been an
5 incredible partner both as a business partner for us as a
6 business from everything from providing volunteers, board
7 members, I can certainly speak to that, and even they
8 looked over our personnel policy and helped us make it
9 better so they're sharing all those resources, but as an
10 education partner in helping us think about how we can
11 serve these communities.

12 West Virginia and Appalachia are in a really, really
13 hard place. The programs that I run are reflective of the
14 communities that we serve. That means 70 percent of the
15 kids that we serve are free and reduced price lunch. It
16 means that more than half of the children that we serve are
17 first-generation college students and the idea that you
18 could not only go to college but you could have a
19 professional pathway ahead of you, you can't introduce
20 that. You can't have people understand that unless they
21 can be here and be experiencing it.

22 I'm really honored to be a formal partner with the
23 Green Bank Observatory and a new program that we're doing
24 to help first-generation West Virginia students complete

1 their first two years in an undergraduate level of STEM and
2 to have a hundred percent retention of this new pilot that
3 we're going to do and to be working with them. I'm really
4 thinking about for rural America, for Appalachia and for
5 West Virginia specifically how we can build computers,
6 science, education pathways so that our kids can grow up
7 and my kids can live two miles away from me and have a
8 great life, and I'm really looking forward to it so there
9 is so much opportunity for growth and partnership here and
10 there's such important and deep issues about equity and
11 access so thank you.

12 ELIZABETH PENTECOST: We will take a ten-minute break.

13 (Recess was had.)

14 CAROLINE BLANCO: Thank you for your patience. We
15 have now I understand about 11 people still but we're
16 really going to try to stick to the three minutes as much
17 as possible. Thank you.

18 ELIZABETH PENTECOST: You have the opportunity to send
19 in your comments as well.

20 The next person is Mali Minter.

21 MALI MINTER: I'm Mali Minter. I've lived in Green
22 Bank for 21 years or the Greater Green Bank Arbovale
23 Metropolitan Area as we like to call it, and I don't know
24 if I can add much more than Carla or the young lady

1 Savannah spoke about because they just said things so much
2 better than I could so I'm just going to talk about one
3 little thing, which is that I have nine nieces and
4 nephews, and every single one of them, every one, from the
5 youngest all the way through out of school are in STEM-type
6 programs because of the GBO.

7 My nephew Conner has Asperger's, and I get emotional.
8 Sorry. He comes every year from Minnesota for a week and
9 all he wants to do is go to the telescope, can we go to the
10 telescope, can we go to the science center, I need to see
11 that stuff. He is so excited about science and it focuses
12 him. It's just the science is here. Keep it here.

13 I know they keep saying talk about viable options.
14 Three, four, and five are awful. I really think there
15 should be a zero. Honestly. I don't know how viable it
16 is, but honestly there should be a zero, one, and two.
17 Zero should be go back and fund us fully. Do it. Find the
18 money. Find it. Fund us. Help us.

19 ELIZABETH PENTECOST: Rodney Waugh.

20 RODNEY WAUGH: Yes, my name is Rodney Waugh. I'm a
21 lifelong West Virginia resident. I'm an amateur
22 astronomer. I've taken part in Star Quest. It's been here
23 for 13 years. It's an optical astronomy educational
24 undertaking.

1 As a West Virginian and American, I'm very proud of
2 this facility. There's cutting edge research that takes
3 place here. It adds to the culture of the local area.
4 This is something that all West Virginians can be proud of
5 and I'm going to leave before my three minutes are up.
6 Thank you.

7 ELIZABETH PENTECOST: Brynn Kusic.

8 BRYNN KUSIC: Hi there. My name is Brynn Kusic. I'm
9 the operations manager of the Pocahontas County Opera House
10 in Marlinton, West Virginia. The opera house is a center
11 for performing arts in our county but it is also a center
12 for civic and cultural engagement. People are surprised to
13 hear that Pocahontas County has an opera house like they're
14 surprised to hear that the Green Bank Observatory exists
15 here.

16 I just wanted to say that it's been very inspiring to
17 be here. The Green Bank Observatory is a very important
18 part of our community. It's a great neighbor and we've
19 heard that from many different voices whether it be in our
20 schools or in areas of performing arts. I say that whether
21 it's a performance series event at the opera house or a
22 Chamber of Commerce dinner, Green Bank Observatory
23 employees are present.

24 Green Bank Observatory makes it possible for people of

1 the highest caliber to live and work in Pocahontas County.
2 These community members are not only making great
3 contributions in the field of science, but they are
4 dedicated to participating in the community in real ways
5 that matter and that affect positive change both for our
6 students and for all of our community members, and like I
7 said, the Green Bank Observatory employees are integral in
8 every part of the opera house. They donate their time,
9 their technical expertise. They attend performances. They
10 are the performers on the stage. They organize events.
11 They are us. It is our community. We are a community
12 together, and I think that is something that I hope you
13 hear and that you take away from today.

14 This is not just a place where people come and work.
15 This is the people who work in this place, our community,
16 and they're making our community a really -- a place to
17 feel proud of living and they're enriching the people that
18 live here in every element and in every way they
19 participate in our community.

20 I also want to say that we have board members at the
21 Pocahontas County Opera House that are employees. The
22 Green Bank Observatory and the National Radio Astronomy
23 Observatory have been local business sponsors of our
24 performance series for the last 16 years which is the

1 entire time that we've been presenting performing arts
2 opportunities and cultural experiences in this community so
3 the opera house is now we actually -- people know about us
4 in other parts of the state, in the rest of the country,
5 and that would not be true if we did not have the technical
6 expertise and volunteered time and dedicated energy of
7 volunteers who are literally at the opera house from the
8 minute that the door opens until after everybody has
9 cleared out when the doors are closed, and that's true for
10 everything that we do there, so I just can't imagine
11 Pocahontas County without this place.

12 I hope that you choose option one and keep it going as
13 it is to continue to inspire people not only in this
14 country and this county but across the country and around
15 the world. Thank you.

16 ELIZABETH PENTECOST: Judith Clark. She wasn't sure
17 if she could stay.

18 UNIDENTIFIED SPEAKER: She doesn't like to drive when
19 it's dark.

20 ELIZABETH PENTECOST: Okay. Maybe she can submit her
21 comments.

22 Erica Engquist.

23 ERICA ENGQUIST: Thank you all for giving me the
24 opportunity to speak today. I would like to voice my

1 strong support for full NSF funding and continued operation
2 of the Green Bank Observatory, option one.

3 Ever since I first became interested in the field of
4 astrophysics and technology, the Green Bank Observatory has
5 been an absolutely tremendous resource in so many ways. As
6 a young student from rural West Virginia, the Green Bank
7 Observatory's education and science center staff have
8 provided me with so many amazing and inspiring educational
9 opportunities like none other in the state or region.

10 From starting out with the Radio Astronomer for a Day
11 program and the Skynet Junior Scholars programs to get
12 to participate in the summer long radio frequency
13 interference litigation project under a talented and an
14 accomplished astronomer here, Dr. Richard Prestage, all of
15 these opportunities are continued not only to teach but to
16 inspire and encourage me to want to pursue a career in
17 STEM.

18 I'm not the only one that GBO's STEM education
19 opportunities have touched. Students of all backgrounds
20 from around the country benefit from these programs and
21 camps every year. One particularly shining example is the
22 Physicists Inspiring the Next Generation or PING camp which
23 brings underserved, minority, and female students from
24 across the country together and gives them extremely

1 valuable exposure to a world-class research facility while
2 introducing them to several fields of science.

3 Over the time I've been coming to Green Bank I've
4 started hearing stories of other young people particularly
5 two women from rural West Virginia who the GBO has inspired
6 to pursue careers in STEM. These two women, Hanna
7 Sizemore, who you heard from earlier, and Naomi Bates,
8 worked on projects here at the Observatory as high school
9 students like me and went on to get their Ph.D.s and pursue
10 successful careers at the Planetary Science Institute and
11 the Delaware Geological Survey.

12 These scientists are an inspiration to me and many
13 others and are a great testament to the tremendous
14 effectiveness of the educational programs at Green Bank.

15 As a young female hoping to pursue a career in a
16 historically male dominated field, my experiences at the
17 GBO have been extremely heartening. The atmosphere is very
18 open and all-inclusive. In my time here I've had many very
19 rewarding interactions with scientists and students alike
20 and never felt that I was treated differently because of my
21 gender.

22 In a similar vein, it is very unusual and
23 exciting that the GBO is currently home to three female
24 scientists from around the world. Clearly, the GBO is

1 helping grow the next generation of women scientists from
2 grade school to grad school and beyond.

3 I see the Green Bank Observatory is playing a key role
4 in ensuring that in the future the scientific community
5 will fully reflect there was diversity and
6 inclusiveness.

7 In addition to this, the GBO is also a top-of-the-line
8 science facility with uniquely versatile and cutting edge
9 capabilities for research and everything from planet
10 formation to cosmology to searching for life beyond earth,
11 and it's really still a very up-to-date and tremendous
12 facility. It's not even fully reached its full
13 capability. It's still growing and spawning these new
14 technologies for radio astronomy across the country and
15 across the world in a way that no other research facility
16 can do because of its unique nature.

17 The single dish steerable structure is very unusual.
18 It's the largest one of its kind in the world and it's just
19 extremely important to the field of radio astronomy and
20 astronomy in general really.

21 So for all these reasons I think it is absolutely
22 essential to the State of West Virginia, the United States,
23 and the entire scientific establishment that Green Bank
24 Observatory continues to receive full NSF funding for years

1 from now.

2 ELIZABETH PENTECOST: Deanna White.

3 DEANNA WHITE: Thank you all for having me. We've
4 driven four hours this evening and will be driving four
5 hours back. We wanted to -- this is very important to us.
6 We've been coming here for 18 years as a family. That was
7 my daughter.

8 So I want to thank you for allowing me to have the
9 opportunity to go on public record to register my strong
10 support for the National Science Foundation to provide full
11 funding for the Green Bank Observatory. I've already
12 submitted a written comment. That was from the head. This
13 one is from the heart.

14 Each time my family and I visit I'm more and more
15 convinced this place is magical. Bear with me. To start
16 simply, just from using your senses you can see the
17 beauty. The juxtaposition with the technological wonders
18 of each decade represented by each of the telescopes
19 against the majestic quiet mountains. Imagine taking a
20 walk down the Observatory road, listening to the breeze
21 whispering through the pines, seeing the sun reflect at all
22 different angles off the hills and telescopes whenever so
23 quietly one of the telescopes turns to its next
24 (inaudible). Right there and then in the peace and beauty

1 of your evening stroll it could be that the next discovery
2 of an exotic binary pulsar system, the secret to dark
3 matter, or even the first sign that we are not alone could
4 be happening. This is exciting, all inspiring magic.

5 Seeing a group of young students gather together
6 around the display and the science exhibit hall, receiving
7 instruction from a staff member, participating in a STEM
8 activity, or independently operating the 40-foot telescope
9 is magic. This is not your typical
10 experience. It is beyond that. Young minds are learning
11 and being challenged to learn concepts, operate equipment,
12 and analyze data in a way that is satisfying by seeing real
13 unique results that only their decisions and actions
14 yield.

15 College undergraduates have the opportunity to design
16 features that will put in place in an actual operating
17 facility. High school students have the opportunity
18 through the Pulsar Search Collaboratory to analyze data
19 that could yield fascinating new discoveries. Middle
20 school students from all over the country representing
21 minority and female future scientists can participate in a
22 Physicists Inspiring the Next Generation camp each summer.

23 There are many more unique programs available here
24 that thousands of students have had the opportunity to

1 participate in and regain excitement about learning and
2 problem solving that are more traditional methods of
3 teaching that teachers are struggling with. This is
4 magic.

5 To see my own daughter and son both have -- both have
6 always been artistically inclined. To grow and learn from
7 their experiences at the Green Bank Observatory has been
8 utter magic. My daughter has had the amazing opportunity
9 at 16 to work alongside of an undergraduate student from
10 Oregon Tech and under the leadership of a highly
11 accomplished astronomer, Dr. Richard Prestage, to learn
12 computer coding, statistical analysis, research paper
13 protocol, and presentation skills. She has been aspired to
14 pursue a career in engineering and science from her first
15 visits to the Green Bank Observatory and these experiences
16 only increase her enthusiasm about this field of study.

17 My son, a computer animator and enthusiast, is
18 encouraged by his exposure to the multiple uses of
19 computers and coding to process and analyze the tremendous
20 amount of data generated from observing the GBT.

21 The Green Bank Observatory inspires students of all
22 backgrounds to learn about or even pursue careers in
23 science, technology, engineering, and math. The
24 inspiration experienced at Green Bank in turn enriches

1 those fields by benefit of incorporating art and other
2 talents to solve our future challenges. This again, is
3 magic.

4 To learn about distinguished scientists whose careers
5 began at the Green Bank Observatory particularly two
6 accomplished women who you've heard about, Hanna Sizemore
7 with the Planetary Science Institute who works on site, and
8 Naomi Bates, (inaudible) educated Ph.D. in civil and
9 environmental engineering who now works at the Delaware
10 Geological Survey at the University of Delaware.

11 CAROLINE BLANCO: Excuse me.

12 DEANNA WHITE: I'm almost finished. Both of whom will
13 readily tell you the invaluable experiences that they
14 (inaudible) research methodology and (inaudible) skills as
15 level high school students is inspiring.

16 So the Green Bank Observatory arising in the midst of
17 this rural out-of-the-way radio quiet zone where
18 groundbreaking scientific discovery and innovation is
19 happening, where students are being inspired, satisfied by
20 their contributions and challenge to think deeper in more
21 complicated ways, where a community thrives to its very
22 existence must be fully funded by the NSF to continue to
23 provide this magical experience. Thank you.

24 ELIZABETH PENTECOST: Grayg Rousnyder.

1 GRAYG ROUSNYDER: Hello. My name is Grayg Rousnyder,
2 KCSVT, and I am a -- one of the volunteer people after
3 work. Go out and I like working with kids and working 4-H,
4 and scouting and different areas, different STEM
5 activities, and this facility has been awesome for that.

6 I come from -- I live in Kanawha County and came over
7 for this. We bring kids over here and we have like a girls
8 (inaudible) code class learning to program PYTHON, you
9 young girls in middle school, and they come out here and
10 they were able to go up to the GBT the control room and
11 look at the same programming code that they're working with
12 is the same stuff that runs it. A lot of what this
13 facility does is let kids see that these things are
14 accessible to them. The telescope and the science and the
15 professors, you know, we have some of the world leaders in
16 astronomy are here -- or at Morgantown and come here and
17 these kids can come and sit right with them, you know, like
18 (inaudible) other people and sit right with people that are
19 (inaudible) top people in the fields and have published
20 books, etcetera, so they see it's accessible and so they're
21 willing to try to do something so try to make things equal
22 access, equal opportunity for everyone and that's part of
23 that.

24 You know, this is -- also the Society of Amateur Radio

1 Astronomers they have their annual meetings here. We come
2 here every year. Have one of our annual meetings. These
3 are people from all around the world come just for a club.
4 They're in a club, Amateur Radio Astronomy Club, and they
5 come here. This is the place they want to go.

6 Also another thing to get involved with is the Pulsar
7 Search Collaboratory which was mentioned before which
8 students from all around the country come to this thing
9 every year. Students get to work with real data that
10 astronomers have not looked at that have been collected by
11 the GBT and they get the first crack of looking at data and
12 a lot of these kids have found pulsars and other
13 astronomical events and it's like that is so awesome.
14 These are kids. They get the first crack at this stuff.
15 Nobody else has seen any of this information before that
16 was collected.

17 You know, this is -- I'm going to say this is on my
18 list as a kid of things to do in life was to go to Green
19 Bank. Grew up in Ohio. Go to Green Bank, hamfests, go to
20 McMurdo one day, but you know, this was the place that I
21 always wanted to go.

22 Like the previous lady said, it is a magical place.
23 You come here every time, it's like this is exciting. You
24 bring kids. We bring different groups of kids out here and

1 we have an awesome staff here that just does whatever to
2 help any kid and things come out of kids, you know, that
3 how smart and how bright they are and what they can do.

4 Real quick example, they have the 40-foot teaching
5 telescope down here which is accessible to the public to
6 use with some training, and my 12-year-old son, you know,
7 we had class with Sue Ann here one day and that evening he
8 and I went down and got on the telescope. He said, Dad, I
9 got this, and he produced these really nice graphs. Let me
10 show them here. But a whole bunch of nice graphs of
11 looking at hydrogen clouds in the spiral arms of the
12 galaxy, you know, like that and the astronomer is like wow,
13 that's cool, this kid is 12 and first time. So now he sees
14 wow, this is accessible, I can do this kind of stuff. Take
15 the mystery away from it. I think, you know, that's --

16 CAROLINE BLANCO: If you could please wrap up. We've
17 got two more.

18 GRAYG ROUSNYDER: Yeah, I will. I apologize. I
19 will. Sorry. So just as part of your potential resources
20 to be considered should be the educational impact.
21 Probably add that to that. That's so important. This is
22 just a hidden treasure in West Virginia. Thank you.

23 ELIZABETH PENTECOST: John Taylor.

24 JOHN TAYLOR: Hello. My name is John Taylor. I'm the

1 vice president of the Central Appalachian Astronomy Club.
2 We're centered out of Clarksburg, West Virginia. I would
3 like to urge you to fully fund this facility. If you can't
4 fully fund it, keep it operating. It's vital to our
5 organization and to amateur astronomers all around.

6 Let me say that we operate a little star party called
7 Star Quest every year right here at Green Bank. Star Quest
8 is we inundate this place with several hundred people and
9 we receive just fabulous cooperation from this facility.
10 We do this in partnership with Kanawha Valley Astronomical
11 Society and also with some support through several years
12 from Dominion Energy and we bring a number of people in and
13 do an educational operation. We like to think of it as the
14 largest optical and radio star party in the nation and we
15 can only do it because we have this marvelous magical
16 facility here. We have speakers for four nights. We have
17 speakers all day for four days. We have an absolutely
18 fantastic event and it's only because of this facility.
19 Our people -- amateur astronomers come in and get trained
20 and work the 40-foot telescope. You know, this next coming
21 year will be the Star Quest 14. We've been doing this for
22 quite sometime now and it's only from this facility that we
23 can do this.

24 Now, let me tell you, this is a world-class science

1 facility. I'm sure others can speak much better to this,
2 but it boggles my mind to think that one would even say
3 they were considering shutting down the largest fully
4 steerable radio telescope in the whole world. How could
5 you even think of that? It's disgraceful to even say it.

6 I can't speak to this as an education facility near as
7 much as some other people probably already have, but about
8 25 years ago I came here as a classroom teacher for a
9 weeklong National Science Foundation funded science
10 facility, science workshop, and ran the radio telescope
11 every night for a week. It was a marvelous experience that
12 I took back to my classroom and shared with my students.
13 Many other students -- many students, actual high school
14 students, come here for programs. They have a nice
15 bunkhouse down there to house them in and they come here
16 for programs. It's a fantastic experience for those kids.

17 Please, please fully fund this facility, and if you
18 can't fully fund it, keep it operating. This is a vital
19 magical facility that needs to be here in West Virginia.
20 This is the only radio quiet zone in the whole world.
21 Where else can you have a facility like this? Keep it
22 going. Thank you.

23 ELIZABETH PENTECOST: Anthony Minter.

24 DR. ANTHONY MINTER: I'm privileged to be an

1 astronomer here at Green Bank Observatory. Astronomy gets
2 kids interested in science very early in their
3 development. What three-year-old hasn't grabbed a
4 cardboard box and taken that rocket ship to the stars just
5 because they saw a picture of a planet or an image of a
6 galaxy, but that's not enough to get them into science,
7 keep them there, and get them to a STEM education. The
8 programs here in Green Bank do that extremely well.

9 We have programs for elementary schools, middle
10 schools, high schools, kids in college. All get to come
11 here and those programs work because we have telescopes
12 they have access to because we are a science facility. You
13 take that science away, those telescopes go away, those
14 opportunities to get the kids interested in science is
15 diminished greatly if it doesn't go away itself.

16 Now why did I say it was a privilege to be an
17 astronomer here? It's because I get to interact with those
18 kids that come here all the time. That's one of the
19 greatest things about working here is working with the
20 youngsters and getting them interested in science or
21 keeping them interested in science. We have had kids come
22 through our programs at various levels. One was an
23 astronaut. Several have gone on as you've heard to get
24 their degrees in various fields. We've had medical

1 doctors. We've had lots of engineers. Even a few
2 astronomers have come through here. The privilege is to
3 take that three-year-old sitting in a box and help guide
4 them through their whole educational career and see them
5 become world-class scientists. You cannot produce that in
6 any other facility that I'm aware of other than here at
7 Green Bank. It is a tremendous privilege to work here.
8 Thank you.

9 CAROLINE BLANCO: Okay, folks, thank you so much for
10 staying. It's an hour after our specified time. The next
11 meeting is going to start now. They will be reviewing the
12 boards outside and then we will come back here for our
13 presentation again (inaudible) the one we started at three
14 o'clock today. Thank you all so much for coming.

15 If you didn't have a chance to either complete your
16 comments please put those in writing. I hope you
17 understand there are a lot of people that want that
18 opportunity and we're trying to accommodate (inaudible) but
19 we do look forward to having you participate as fully as
20 you can, and remember we will be taking these comments back
21 and reviewing them, preparing a draft Environmental Impact
22 Statement, and at some point in the spring when it's ready
23 it will be issued. If you've signed up you have the e-mail
24 address on there. We will notify you when it's ready and

1 then we will have another meeting that will be heard at the
2 45-day time period. Thank you again.

3 (Whereupon, this public meeting
4 was concluded at 6:00 p.m.)

5 - - -

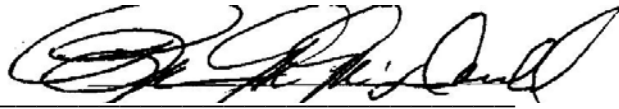
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CERTIFICATION OF REPORTER

I do hereby certify that the above and foregoing is a true and complete transcription of my stenotype notes and electronic recording of the meeting held at the time and place aforesaid.

I further certify that I am not interested in the outcome of this case, nor am I related to any of the parties herein.



Brian M. McDonald

Certified Shorthand Reporter

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1 NATIONAL RADIO ASTRONOMY OBSERVATORY

2 (GREEN BANK OBSERVATORY)

3 EIS PUBLIC SCOPING MEETING - NUMBER 2

4

5 HELD AT THE

6 GREEN BANK SCIENCE CENTER

7 155 Observatory Road

8 Arbovale, West Virginia 24915

9

10 Wednesday, November 9, 2016

11 6:30 p.m.

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I N D E X

PAGE

PROCEEDINGS 4

P R O C E E D I N G S

Whereupon,

MS. BLANCO: Dr. Ajhar.

DR. EDWARD AJHAR: Thank you. Thank you for coming to our Environmental Impact Statement Public Scoping Meeting, and I want to thank the entire staff of Green Bank Observatory and Karen O'Neil may have just stepped out, our director here. They've been very supportive of all logistics that we have to do.

I want to again thank you all for coming and just start out letting everybody know that a lot of times there's things that are published, things that are discussed, they're not always accurate so we want to try to get some of those points there, and fundamentally, it's very important that you understand that we have made no decision to close Green Bank Observatory. We are here as a part of a process looking at different things but there's been no decision at this point.

What we really need today are your comments and your input in the beginning of this process considering the different alternatives so that's our main purpose for being here today.

I'm going to start by introducing myself and the rest of the team members and then we're going to talk about some

1 background information and why we're here, what's the
2 background for -- that brought us here today and we will
3 talk about the preliminary proposed alternatives that
4 you've seen published and the resource areas to be studied
5 and that's what we're seeking input on. We will talk about
6 the Environmental Impact Statement process, and once our
7 brief presentation is over, we will open the floor to
8 public comments.

9 So my name is Edward Ajhar. I am an astronomer in the
10 Division of Astronomical Sciences at the National Science
11 Foundation, and I'm the program officer for Green Bank
12 Observatory.

13 Joining me today in our Division of Astronomical
14 Sciences is Liz Pentecost. She's back there. She will be
15 helping to direct the people making comments today.

16 From our Office of General Counsel we have Caroline
17 Blanco and Christin Hamilton.

18 In our Office of Legislative and Public Affairs, Karen
19 Pearce and Ivy Kupec.

20 We have some contractors that are helping us from CH 2
21 M Hill, Michelle Rouwe and Chris McDonough. I don't know
22 if they're in the room. Back here is one. Thank you.

23 So what is the role of the National Science
24 Foundation. We at NSF are the federal stewards of ground-

1 based astronomy and astrophysics. We provide funding for
2 national and international telescopes and facilities, and
3 we provide funding for research grants that allow
4 individuals and groups to conduct specific science
5 investigations.

6 As the stewards of the National Science Foundation's
7 Astronomy Portfolio we get a lot of input. Over the past
8 decade the NSF has received advice from external review
9 committees made up of the astronomical community and the
10 2010 decadal survey which is titled New Worlds, New
11 Horizons in Astronomy and Astrophysics stated the
12 following: "NSF Astronomy should complete its next senior
13 review so as to determine which, if any, facilities should
14 Astronomy cease to support in order to release funds for
15 one, the construction and ongoing operation of new
16 telescopes and instruments, and two, the science analysis
17 needed to capitalize on the results from existing and
18 future facilities."

19 So the 2010 reports recommended review that I just
20 mentioned of the NSF Astronomical Sciences Portfolio was
21 completed in 2012 and that portfolio review report is
22 titled Advancing Astronomy in the Coming Decade:
23 Opportunities and Challenges. So regarding the Green Bank
24 Telescope the 2012 review recommended divestment and stated

1 the following: "The GBT is the world's most sensitive
2 single-dish radio telescope at wavelengths shorter than 10
3 centimeters; however, its capabilities are not as critical
4 to the decadal survey science goals as the higher-ranked
5 facilities."

6 In August of this year, 2016, the National Academies
7 of Sciences, Engineering, and Medicine published their
8 mid-term assessment of the 2010 decadal survey and
9 reaffirmed the 2012 portfolio review's recommendation for
10 the divestment of these astronomy facilities. The quote is
11 "The NSF should proceed with divestment from ground-based
12 facilities that have a lower scientific impact implementing
13 the recommendations of the NSF Portfolio Review which is
14 essential to sustain the scientific vitality of the U.S.
15 ground-based astronomy program as new facilities come into
16 operation."

17 So as a result of that input we received from several
18 committees over the last few years I want to kind of go
19 over the resulting developments at Green Bank Observatory.
20 Starting in FY 2012, fiscal year 2012, the NSF provided 95
21 percent of this site's funding. On March 22nd, 2013, the
22 NSF published a Dear Colleague Letter, and there's the
23 number 13-074, and in that letter NSF announced that the
24 Green Bank Telescope would be separated from the National

1 Radio Astronomy Observatory competition and requested at
2 that time ideas for collaborations involving the Green Bank
3 Telescope, and we will say more about that in a moment.

4 On October 1st, 2016, just last month, following the
5 path published in that Dear Colleague Letter, 13-074, the
6 National Science Foundation separated NRAO Green Bank from
7 NRAO and the site was renamed the Green Bank Observatory,
8 and Associated Universities, Incorporated, AUI, continues
9 to manage Green Bank Observatory under a cooperative
10 agreement with the National Science Foundation.

11 I was here and many of you I'm sure were for the
12 inauguration ceremony last month and very nice ceremony
13 kicking off the new Green Bank Observatory.

14 So the current status then again to clarify what are
15 the budget levels and things, in the current fiscal year,
16 FY 2017, the President's Request Budget for other
17 astronomical facilities asked for \$11.5 million total for
18 Green Bank Observatory and Long Baseline Observatory and
19 the fiscal year 2017 President's Request Budget also shows
20 an increase to \$11.85 million in the following fiscal year
21 2018 for planning purposes.

22 Following a review of AUI's proposal that provides the
23 exact division between Green Bank Observatory and Long
24 Baseline Observatory for the current fiscal year 2017 and

1 following year fiscal year 2018, NSF allocated \$8.2 million
2 in fiscal year 2017 should the President's Request Budget
3 be appropriated, and as many of you know, we're operating
4 under continuing resolution. There is no fiscal year 2017
5 budget yet but that's so you know what the plan is.

6 This \$8.2 million level represents approximately 75
7 percent of the base budget for Green Bank Observatory that
8 was part of the previous appropriations to NRAO.

9 The collaborations that I talked about a few slides
10 ago, Green Bank Observatory has established collaborations
11 with Breakthrough Listen, West Virginia University, and
12 North American Nanohertz Observatory for Gravitational
13 Waves known as NANOGrav. Green Bank Observatory continues
14 seeking new funding sources so that's where we are today as
15 far as the budgets go.

16 Now what are NSF's plans moving forward? Well, given
17 the previous astronomical community recommendations that I
18 quickly summarized combined with current budget
19 constraints, NSF has a need to reduce funding for a number
20 of astronomical telescopes and facilities and because of
21 that the NSF is initiating the Environmental Impact
22 Statement, Section 106 consultation process for the Green
23 Bank Observatory as it already has with Arecibo Observatory
24 and the Sacramento Peak Observatory. So this is why we're

1 here today to start that process as part of beginning of
2 this process.

3 You've seen these Environmental Impact Statement
4 preliminary proposed alternatives that have been published
5 as part of the notification of these meetings and the
6 comment period. So we are interested in knowing comments
7 about these is this the right step of alternatives, are
8 there other suggestions so that's a part of the comments.

9 These proposed -- preliminary proposed alternatives
10 are the first is continued NSF investment for science-
11 focused operations. That's a no action alternative.
12 That's where we are today.

13 Number two is the collaboration with interested
14 parties for science- and education-focused operations with
15 reduced NSF funded scope.

16 The third, collaborations with interested parties for
17 operation as a technology and education park.

18 The fourth is mothballing of facilities, and by that
19 we mean a suspension of operations in a manner such that
20 operations could resume efficiently at some future date.

21 Finally, the last alternative being considered here is
22 deconstruction and site restoration.

23 So that's where we are with -- that's how we got to
24 the point we are today and that's why we're here to hear

1 your comments and a very important part of this process is
2 to hear directly written and oral comments from the public
3 on these alternatives so I'm going to turn over the rest of
4 the presentation to Christin Hamilton from our Office of
5 General Counsel. Christin.

6 CHRISTIN HAMILTON: Hello. Good evening. Thank you
7 for attending. We had a 3 p.m. meeting as well that was
8 very well attended. Your voices are important to the
9 environmental review process so we appreciate you taking
10 the time this evening to be here.

11 As Dr. Ajhar said, I am from the Office of General
12 Counsel, but I like to clarify that I'm actually not an
13 attorney. I'm an environmental compliance officer and I'm
14 here to walk you through the Environmental Impact Statement
15 process as I suspect a lot of you are unfamiliar with that
16 process.

17 It's dictated by the National Environmental Policy Act
18 or what we call NEPA which requires federal agencies to
19 consider the potential environmental consequences of
20 proposed actions on the environment prior to making final
21 decisions so we do this very early on in a decision-making
22 process.

23 There are three levels of investigation that occur
24 under NEPA and for this particular proposal because of the

1 nature of potential impacts we're taking the most in-depth
2 look which is the Environmental Impact Statement. We
3 intend to prepare one of these statements to evaluate the
4 potential environmental effects, proposed operational
5 changes due to funding constraints for the Green Bank
6 Observatory. We will do a draft and final EIS.

7 We announced the beginning of this process which is
8 very public on October 19th. That began the scoping
9 process for the development of this EIS.

10 So what is scoping? The purpose of scoping is to seek
11 public input regarding relevant issues that will influence
12 the scope of that environmental analysis. So what you say
13 here today and what you submit in written comments will
14 inform that Environmental Impact Statement -- will be
15 addressed in it.

16 We invite your input regarding all of the issues to be
17 evaluated including the identification of viable
18 alternatives and the resource areas which I will get to in
19 a minute.

20 The more specific your comment, the more helpful to
21 the development of the EIS. I also want to clarify that
22 this evaluation is to look at environmental impacts. The
23 that's what the focus is. It's not to provide an analysis
24 on the state of the science, for example.

1 So there's two sort of pieces of information that we
2 have developed at this early date and that is the list of
3 preliminarily identified proposed alternatives that
4 Dr. Ajhar presented and it is also in your fact sheet.
5 That's one piece of information that we do have at this
6 point, and the other is this list of preliminary resource
7 areas that we expect to evaluate in that Environmental
8 Impact Statement.

9 These are our diverse range of aspects of the
10 environment from air quality to biological and cultural
11 resources to socioeconomics, traffic, and groundwater
12 resources.

13 Concurrent to the NEPA process we will also be doing
14 consultation under what we call Section 106 of the National
15 Historic Preservation Act. This requires federal agencies
16 to consult with interested parties and the state historic
17 preservation officer regarding potential effects of their
18 proposed actions on nationally significant historic
19 properties.

20 So there are four basic steps outlined here to this
21 process: Initiation, identification of the historic
22 properties within the area of potential effects, an
23 assessment as to what are their adverse effects on the
24 historic properties, and then resolution which is often a

1 form of a memorandum of agreement.

2 This process will occur in coordination with a NEPA
3 process, and the way that works is the information that's
4 developed through this 106 process you will also see that
5 same information in the draft EIS, for example, and the
6 final EIS as well so they will track each other.

7 We invite consulting parties to participate in this
8 and we've asked you to sort of self-identify if you're
9 interested in participating as a consulting party on the
10 sign-in sheets so you had the opportunity to check if
11 you're interested and we will follow up with you via e-mail
12 to confirm your interest in participating in 106
13 consultation as a consulting party.

14 One more statutory obligation that I wanted to mention
15 today is the Endangered Species Act. We need to consider
16 whether the proposal's activities might affect a listed
17 threatened or endangered species or their habitat, and if
18 this potential exist, we would consult with the U.S. Fish
19 and Wildlife Service. Again, that same information that we
20 gain from the consultation will be seen in our draft and
21 final EIS.

22 I want to go through target dates and the
23 opportunities for comments. As I mentioned, October 19th
24 we began the public scoping process. There's a 30-day

1 comment period. We delayed a little bit due to an
2 issue with e-mail so we wanted to make sure we had the full
3 30 days when you can e-mail in comments. We're having
4 these two public meetings today.

5 We will take that input, we will be preparing a draft
6 Environmental Impact Statement. We're targeting spring to
7 release that. Everybody who is on our e-mail list and if
8 you signed in today you will be on our e-mail list will get
9 notification when that is released and it will be on our
10 website as well.

11 Following that release we will have a 45-day comment
12 period and, again, we will have two public meetings, a
13 daytime and an evening to try to accommodate people's
14 schedules. Those times again will inform the final
15 Environmental Impact Statement which we're targeting for
16 sometime around fall.

17 Concurrent to those processes we will be doing, as I
18 mentioned, a National Historic Preservation Act
19 consultation and potentially Endangered Species Act
20 consultation as well.

21 We're required by regulation to wait at least 30 days
22 following the release of the final EIS before making any
23 agency decision. The agency decision is recorded in what
24 we call the Record of Decision which we're targeting for

1 early 2018. That considers not only the environmental
2 considerations and any mitigation measures that are
3 identified in the final Environmental Impact Statement, but
4 also any other factor that is of importance to the National
5 Science Foundation and that could be science priorities or
6 budgetary constraints.

7 As for how to submit comments, you can provide verbal
8 comments today. We will have a full transcript of this
9 meeting attached to the draft Environmental Impact
10 Statement. You can submit written comments today. We have
11 written comment forms out at the tables where you signed
12 in. Give your comments to anybody with a name tag and we
13 will make sure that they get on the record.

14 You can also mail or e-mail your comments to NSF by
15 these two methods which are also on your fact sheet if you
16 want to refer to it later and it's also at our website
17 which I will get to in a moment.

18 So at any point along the way if you need information
19 on the process or if you need to review documents, please
20 see our website www.NSF.gov/AST, that's for Astronomical
21 Sciences Division.

22 The fact sheet, the copies of the informational boards
23 that are out there and this presentation itself will be
24 posted there, and as we move forward, for example,

1 documents relevant to that 106 consultation
2 will also be posted there.

3 So at this point we're ready to move into the public
4 comment period. We will be having my colleague Liz
5 Pentecost will be announcing according to how people signed
6 up.

7 Because of the number of people who are interested in
8 speaking today we really want to make sure that everybody
9 who wants to speak can speak. So much as we hate to set a
10 time limit we're going to try to keep comments to three
11 minutes each and if we have more time at the end and you
12 didn't get to complete your comments we will invite you to
13 come back up so I know when I'm speaking I never know how
14 much time has gone by so what I will do is I will time it.
15 I will be sitting right there and when I get to two minutes
16 I will stand up so that you know you have one minute more
17 to sort of wrap things up. Thank you for your
18 participation.

19 ELIZABETH PENTECOST: The first person Kathryn
20 Williamson.

21 DR. KATHRYN WILLIAMSON: Hi. I used to work here as
22 the public education specialist. My name is Kathryn
23 Williamson. I worked here until this past December and it
24 was a few years that I was here and it was transformative

1 for me. The Observatory helped me finish my dissertation.
2 I started working here before I got my degree. It was
3 inspiring.

4 I mean, I had all these degrees in physics, but I had
5 no practical skills so I came here and I learned about real
6 true STEM based education and I saw firsthand how
7 inspired students can be so I worked with the 40-foot
8 telescope and also the 20-meter telescope through Skynet
9 online.

10 I know you've heard a lot of comments from people that
11 have used the 40-foot educational telescope so I won't
12 repeat how that can be.

13 Now I teach at WVU in Morgantown and I use the
14 20-meter online with my students and you can do the same
15 types of experiments. We can detect hydrogen gas in the
16 Milky Way, map our solar systems rotation around the
17 Galactic Center, and even find information about the
18 presence of dark matter. All of this with like the
19 hundreds of students who take my class each semester,
20 college students from all kinds of backgrounds that are
21 non-science majors and they're getting this authentic
22 experience in large numbers.

23 In my letter that I wrote, you can see many of their
24 comments how transformative it was, how it made them feel

1 like real scientists, and how they realized it's actually
2 not that hard to do science. Many of my students have
3 wanted to continue in astronomy or science after taking my
4 class and using the 20-meter because there's no other way
5 to give them that kind of authentic radio astronomy
6 experience.

7 You know, a lot of astronomy labs around the country
8 use regular optical telescopes but you can only do basic
9 astronomy with those. You can't find evidence of dark
10 matter with those especially not in cities like Morgantown
11 where the light pollution is really bad so not only are my
12 students getting this like really different authentic
13 science experience, they're having this pride that is in
14 West Virginia and they collected their own data and it's
15 different. It's different than anything they've ever done
16 before and so I just -- I hope you consider the impact of
17 all the telescopes on site, not just the GBT, for its
18 educational and inspirational impact. So thank you.

19 ELIZABETH PENTECOST: Dave McLaughlin.

20 DAVE MCLAUGHLIN: I promise you I will be short. A
21 few comments I thought about today that came up. My name
22 is Dave McLaughlin, and I would like to thank National
23 Science Foundation for providing this time for public input
24 concerning the future of the GBO.

1 First things, as Pocahontas County Commissioner, you
2 would expect me to address the economic impact GBO has on
3 the local economy. Well, with 100 to 140 jobs, depending
4 on the GBO, I'm quite sure that is what is on top of most
5 folk's minds here today. That paycheck they earn is spread
6 throughout our county and communities. So every business
7 in the county is affected when that doesn't happen. Very
8 important for any small county like ours.

9 Secondly, I ask why if the NSF would continue to
10 pursue scientific research like what is done at the GBO,
11 why would they even consider defunding this site? Most
12 companies and businesses would do a cost-benefit ratio
13 process when they consider downsizing or realigning their
14 company. We know what the cost is of the GBO, but how is
15 it possible to put a dollar figure on the benefit side at
16 the GBO?

17 Discovering a new galaxy, a new planet, or even
18 extraterrestrial beings are priceless to a scientist and
19 that is what is happening here.

20 I don't know exactly how the NSF is funded, but I did
21 read in your pamphlet some of that so I understand a little
22 bit now. But I do know that millions of tax dollars are
23 invested at this site. I believe that NSF has to have a
24 very good argument if they plan on walking away from this

1 investment made by all taxpayers in the United States.

2 With the GBT being the largest fully steerable
3 satellite in the world is being used by several students,
4 scientists around the world. Shame on all of us if we let
5 it be taken out of service. It is one of the greatest
6 also -- it is one of the greatest resource -- research
7 tools ever built by man. Also, where else in the world or
8 U.S. can a radio free zone be established like the one at
9 Green Bank?

10 One final thought. The Green Bank Observatory the
11 last 50 years has become a great community partner. We
12 have help with our schools, emergency services, fire
13 service, and always willing to help with any community
14 activity when asked.

15 The GBO isn't some big secret site where the general
16 public isn't welcome. They always extend a hearty welcome
17 and a helping hand so please consider very carefully what
18 is at stake and what will be lost if defunding continues at
19 the GBO. Thank you again.

20 ELIZABETH PENTECOST: Dennis Egan.

21 DENNIS EGAN: Hi. I'm here to speak for the BFD Fire
22 and Rescue, the fire department that's served this area.
23 I'm also indirectly going to speak for the two just south
24 of here where we also get service.

1 The GBO is a significant supporter of the fire and
2 rescue in this end of the county. Oftentimes when we have
3 to have someone air evaced we use the airstrip down here as
4 an air evacuation landing zone and it's one of the better
5 ones we have because it is actually an airstrip.

6 The GBO site here is also our certified Red Cross
7 emergency evacuation area so it can be used for when we
8 have disaster in the county to bring people here. When we
9 had the storm in this area, a significant area here
10 was out of power and this was one of the few places where
11 people who were on oxygen could come and plug their oxygen
12 generators in and things like that so that's very
13 significant for this county. When we have floods, when we
14 have power outages especially in the wintertime we have
15 heat and electricity here.

16 Also, it's an emergency staging area. When we had a
17 helicopter go down from the Army National Guard, I guess
18 the National Guard, this is the area where everybody comes
19 to coordinate and there's facilities here to feed large
20 numbers of people and there's facilities here that they can
21 get warm and get rested so it's very important to this
22 area. It is a very rugged area. It's hard to get to
23 another place where you can do something like that.

24 The GBO also supports us with emergency equipment

1 repair sometimes if we have something that is -- that we
2 need fixed right away for the emergency services we can
3 bring it here and the facilities here can do that.

4 One of the biggest things that the Green Bank
5 Observatory provides is water. We have nowhere right
6 nearby here where we can get water in any kind of a fire so
7 we would have to draft out of the stream. The Green Bank
8 Observatory here provides us with water which is one of the
9 major things that helps us with our ISO rating which is an
10 insurance rating so you talk about -- you talk about
11 economic impact, the insurance -- fire insurance for this
12 area would go up 15 to 20 percent within about six miles of
13 here which is most of the Green Bank area. Would be about
14 15 to 20 percent if we didn't have the water here with GBO
15 so that's a significant impact.

16 We also have indirect benefits here. The people here
17 who work for the Green Bank Observatory are people who have
18 technical abilities that help us a lot. Radio and any kind
19 of -- a lot of mechanical things they can help out with
20 maintenance and with getting things set up so it's very
21 important that if those people were to go away -- if the
22 technical people were to go away that are here only for the
23 science if they were to leave we would have a very
24 difficult time from about halfway to Durbin down to about

1 Dunmore serving this area at all.

2 CHRISTIN HAMILTON: I'm going to have to stop you
3 there, sir. If there's more time afterwards you can come
4 back.

5 ELIZABETH PENTECOST: Alex Bryant. The next person
6 after Mr. Bryant is Ruth Blond or is it Bland?

7 RUTH BLAND: Bland.

8 ELIZABETH PENTECOST: Sorry.

9 RUTH BLAND: That's okay.

10 ELIZABETH PENTECOST: Mr. Bryant. Is Mr. Bryant
11 here? I guess not.

12 RUTH BLAND: Good evening, and thank you very much for
13 affording me the opportunity to speak concerning the GBO.
14 I am Ruth Bland, and I am the Director of Student Support
15 Services Transportation and Technology for the Pocahontas
16 County Board of Education.

17 The Pocahontas County Board of Education supports
18 total funding from the NSF for the Green Bank Observatory.
19 I have been an employee here in Pocahontas County schools
20 for 34 years and spent ten years as a principal at Green
21 Bank Elementary-Middle School.

22 The National Radio Astronomy Observatory at the time
23 provided many services for Green Bank school and when the
24 Internet first came to Pocahontas County, the technicians

1 here at the Observatory wired that school. We now have
2 over ten miles of hardwiring in that school that the
3 Observatory has helped us purchase, to maintain, and to
4 continue to grow the network. Even though it isn't
5 wireless it is growing throughout the building. We just
6 had a major upgrade over \$41,000 from our E-Rate and the
7 help that we received from the Green Bank Observatory to do
8 that is instrumental in being able to keep that system
9 functioning.

10 The other thing is as a principal we live in a
11 laboratory here, not only with the stars, but with the
12 environment in general, and the wetlands, and the
13 opportunity to have a Golden Eagle station on
14 this property for our students to observe the Golden Eagle
15 in their natural habitat was just absolutely phenomenal.

16 I'm going to put aside my profession and I'm going to
17 talk to you as a mother. My youngest daughter is now a new
18 first-year teacher teaching biology and earth science at
19 Pocahontas County High School. She has a biology degree,
20 not earth science, but this summer in a cooperative program
21 with Fairmont State University she was able to take two
22 weeks of classes here to prepare her to be a better teacher
23 for those kids at Pocahontas County High School so those
24 type of programs are instrumental for us as a community and

1 as families. My daughter has come back to live in
2 Pocahontas County because of this opportunity. Thank you
3 very much.

4 ELIZABETH PENTECOST: Next is Joe Gonzalez and then
5 Alan Balogh.

6 JOE GONZALEZ: Thank you. I don't think I've ever
7 been restricted to three minutes but I'm going give it a
8 try.

9 First of all, I would like to thank all of you for
10 coming and giving us all an opportunity to participate.

11 The Green Bank Observatory is the community in
12 Northern Pocahontas County, every aspect of it, all the
13 employees, all the support that's given.

14 I'm the president of the Central Appalachian Astronomy
15 Club that we co-sponsor the Green Bank Star Quest as you've
16 heard earlier testimony. I'm the former communications
17 director for the state emergency medical service so we've
18 had for many, many years the opportunity to work with the
19 Observatory in maintaining a healthy radio quiet zone so
20 everybody can work together because our interest was in
21 public safety and without communications people can die.
22 It's just that simple.

23 The important thing is option four and five are not
24 even to be considered. It's ludicrous to think that you've

1 got nearly a one billion dollar facility of taxpayers'
2 money that's invested in this area to even think of ever
3 closing it.

4 The amount of science that has been created here, the
5 new technologies that's been created here is an ongoing
6 thing. You can put the GBO up against any other facility
7 in this country and they are number one in their
8 accomplishments.

9 The science alone, the things that we do with the
10 Green Bank Star Quest we've been very fortunate to have
11 Alan Bean, fourth man to walk on the moon; the Rocket Boys;
12 Carolyn Shoemaker; Seth Shostak, all those folks come here
13 and it's the only facility that's available that you can
14 collaborate with the general public, anybody, and to be
15 able to learn science.

16 We've got a new administration and maybe I ought to
17 knock on some doors and see how we can restructure to
18 refund science because in the past decade we have not had
19 science in the United States. We wish you well. Let us
20 know what we can do for you to help keep the facility
21 open. Thank you.

22 ALAN BALOGH: Thank you. My name is Alan Balogh. I'm
23 the Mountain Party's candidate for the 43rd District House
24 of Delegates this year.

1 I would urge the National Science Foundation to
2 continue funding the facility here for a number of
3 reasons. One, the Observatory it's a historic site at this
4 point. I mean, it does pretty much define Green Bank. It
5 does important work here, and like it's been said before,
6 there aren't many places in the Eastern United States that
7 are quiet zones like this. I mean, I've driven a truck,
8 retired earlier this year, been to 48 states and six
9 Provinces of Canada, and I'm keenly aware of what a rare
10 area this is for this type of thing.

11 It's also a tourist attraction. When we moved here,
12 my family and I 27 years ago, this was one of the
13 attractions. It's just really cool having this here in
14 this county. Many of my friends and relatives that have
15 visited this is where they wanted to come and visit.

16 Also, the facility is used by local groups. My wife
17 is real prominent in the Pocahontas Nature Club and they've
18 used the facilities here to hold meetings. It's in this
19 end of the county, it's a great place to do that.

20 The other thing is Pocahontas County, it's, you know,
21 a lot of farming and timbering, and if you're a kid it
22 isn't oriented toward that type of thing. The facility
23 here, the scientists and the technicians and their
24 families, it's a great opportunity for other students to

1 spark an interest in different careers that they wouldn't
2 normally have.

3 This is a general comment. I know you're not really
4 looking for that but I think we need to think about it.
5 What we're really talking about is economic man versus
6 culture man. Science, art, music, literature, these are
7 the things that separate us from animals. I mean, animals
8 have economies; ants, beavers, but what makes us special is
9 places -- science and art and so forth, and if you put
10 everything on just a profitability basis, it's not going to
11 work. Some things are worth sacrificing for.

12 I think the money is out there. We spend like a
13 budget probably every day and somewhere overseas
14 and the next day they rebuild it so the money is there.
15 But if our governor-elect would pay his taxes it would
16 probably be funded for a third of the year or so, but what
17 we really need to do in the long run is to elect people to
18 office who put people in culture ahead of just profits;
19 otherwise, we're going to sacrifice everything like this.
20 Thank you.

21 ELIZABETH PENTECOST: Loren Anderson, and I know I'm
22 going to mispronounce your name. Kaustubh Rajwade.

23 KAUSTUBH RAJWADE: Rajwade.

24 ELIZABETH PENTECOST: Rajwade. Okay. Sorry.

1 DR. LOREN ANDERSON: All right. My name is Loren
2 Anderson. I'm a faculty member at West Virginia
3 University. Fifteen years ago WVU only had one
4 astronomer. Today we have seven including Kathryn who
5 spoke earlier.

6 The Department at that time 15 years ago had zero
7 graduate students. We currently have over 20, many of whom
8 are in the audience today. We have accounted eight post-
9 docs and hundreds of undergraduates at WVU,
10 many of whom are from the local area, so as our Department
11 has grown, our scope has grown and we're able to educate a
12 much larger number of students now today.

13 All of this growth is due to our connection with the
14 GBT so we bring many students down here for training. All
15 of us faculty members come down here and stay for a couple
16 of weeks each year and this is where we train our
17 students. This gives our students hands-on experience
18 doing science that is not available for most departments in
19 the country.

20 If the NSF decides to remove funding for the telescope
21 entirely or even decrease funding to a level where it is
22 difficult for us scientists to get telescope time, all of
23 those gains would go away.

24 Our connection with the telescope is so strong that it

1 has brought all of us faculty members here to West
2 Virginia, and if the connection were reversed all of us
3 faculty members, I'm convinced, would leave and that would
4 have serious detrimental effects on our ability to educate
5 West Virginia students. Thanks.

6 KAUSTUBH RAJWADE: Good evening, everyone. My name is
7 Kaustubh Rajwade. So I'm a graduate student in the Department
8 of Astronomy at West Virginia University and I come from India
9 so when I started applying for graduate schools WVU was one
10 of my top choices and the reason was that I always wanted
11 to do radio astronomy when I was looking for grad schools.
12 The only reason I came here was for so that I could use
13 the Green Bank Telescope. It has been the only reason
14 that I was able to do research in the last three years at
15 grad school.

16 When I say this, I believe I say this for all the
17 other international graduate students that are there in the
18 Department that this has been one of the major factors that
19 has attracted so many international students to WVU
20 especially the Department of Astronomy. If this facility
21 is closed it is going to have a severe impact on the
22 international reputation of not only the Department but
23 also at the university in general. So I hope the NSF takes
24 that it into account when they take a decision on GBO.

1 Thank you.

2 ELIZABETH PENTECOST: Nick Pingel and Pete is it
3 Gentile?

4 PETE GENTILE: Gentile.

5 ELIZABETH PENTECOST: Gentile. Close.

6 NICK PINGEL: Thank you. My name is Nick Pingel and
7 I'm also a graduate student at WVU. I come from one of the
8 smaller kind of research groups where it's just myself, my
9 advisor, and two other grad students.

10 Since when I started here in 2013 we collectively have
11 observed on the GBO 600 hours and that 600 hours is
12 translated to \$1.5 million in grant money using that
13 research so I only say this to point out that you are
14 getting a return in your investment when you fund the
15 science for this telescope, and I hope you consider that
16 when -- if you would close it, the economic effects that it
17 would have on the state level and, of course, the local
18 level as well so thank you.

19 PETE GENTILE: Hi. We are so lucky to be here, right
20 here in West Virginia. Over the past couple of years I've
21 had the opportunity to say those exact words in middle
22 school and high school classrooms to prospective and
23 current West Virginia University students and to amateur
24 astronomers at their club meetings across the state and

1 then I get to tell them why. Because their state, their
2 home is home to the largest fully steerable telescope that
3 man has ever built.

4 Space is inspiring. It touches us. Apollo 11, the
5 Hubbell Deep Field Image, the Pale Blue Dot, they all have
6 this uncanny way of exercising that universal feeling of
7 awe in connection to nature. The Green Bank Telescope
8 makes that connection with astronomy a two-way connection.

9 Perhaps more than any other telescope it lets students
10 touch space. In programs like the one I work with, the
11 Pulsar Search Collaboratory, kids can come to Green Bank,
12 literally touch the telescope, go to the control room, sit
13 behind the computer, and with a guide in hand students can
14 control the Green Bank Telescope. It shows these students
15 that science and astronomy isn't reserved for some academic
16 inner circle but if you like this crazy cool sciencey stuff
17 then it's for you.

18 This isn't some ideal version of what we as people who
19 are trying to connect students with science hope will
20 happen here. This is what has happened here. This is what
21 is happening here.

22 We keep in touch with these students and astounding
23 numbers of them tell us how their experiences at Green Bank
24 have changed the path through high school and college,

1 through life, and they want to share these experiences that
2 have inspired them here at Green Bank with their fellow
3 students back home so in the age of Pokemon GO, I kid you
4 not, these kids go back home and start pulsar clubs. How
5 nerdy and awesome is that.

6 It's all because the Green Bank Observatory does what
7 a thousand Petes or a thousand Kathryns could never do. It
8 lets students make their own connection with science and
9 lets them know that they can go as far as their curiosity
10 will take them, and so I urge you to consider funding the
11 Green Bank Observatory because it's simply too unique and
12 too important not to. Thank you.

13 ELIZABETH PENTECOST: Ryan Lynch and then Will
14 Armentrout.

15 DR. RYAN LYNCH: Hello again. The last time I talked
16 as the summer student program coordinator. I'm going to
17 put my science hat on today and talk as a member of the
18 NANOGrav collaboration and just as a user of the GBT from
19 the pulsar astronomy community.

20 I know you said in the beginning the scientific merits
21 are not in consideration here, but I really think the
22 impact on the scientific community at large needs to be a
23 part of the Environmental Impact Statement because science
24 is the primary reason that this telescope exists in the

1 first place. So in that vein I just want to mention a few
2 keep points.

3 The first is that you mentioned earlier that the
4 community has recommended that lower impact facilities
5 might be divested from, but the GBT is not a low-impact
6 facility. Frankly, the portfolio review that recommended
7 closure is outdated. It's been eclipsed by the science
8 that has occurred in the last four years.

9 We in NANOGrav are on the verge of discovering low
10 frequency gravitational waves from black holes throughout
11 the universe. Gravitation wave astronomy has been
12 highlighted by the NSF, the whole NSF, not just the
13 astronomy division as one of five big idea areas that NSF
14 would like to invest in in the future. It's also been
15 highlighted by the decadal survey reviews as a key science
16 frontier discovery area for astronomy in particular.

17 The other thing I want to mention is that reading the
18 Arecibo draft report I was struck by how limited the scope
19 was in terms of the bigger picture, the bigger context.
20 The NSF is really talking about shutting down potentially
21 or severely reducing the amount of time available for
22 science on its two large single-dish radio telescopes. You
23 can't really look at one without looking at the impact of
24 the other because if we lose both of those then we

1 effectively see U.S. leadership in low frequently radio
2 astronomy just at a time when we are on the verge of making
3 some of the biggest discoveries in the field really in
4 history.

5 There is a lot of talk about using other facilities
6 like the VLA as a fill-in for that. The Very Large Array
7 is a fantastic facility but it cannot make up for the GBT
8 or Arecibo.

9 There's been a lot of talk about international
10 facilities that are coming online in the future such as
11 FAST in China and MeerKAT in South Africa, but these
12 facilities are not yet completed. We don't yet know
13 whether or not they're actually going to work as
14 advertised, and we don't yet know what U.S. astronomers
15 will have in terms of access and time on these facilities
16 so we could be losing our leadership at a time when
17 the rest of the world is investing. That is going to cause
18 astronomers to leave the U.S. and take their expertise
19 elsewhere and basically leave us without that core
20 community.

21 That has a huge socioeconomic and cultural impact as
22 well because these people give back to the communities that
23 they're in as we've heard time and time again here today
24 and they contribute to the types of things that Pete just

1 talked about in terms of building a culture that
2 appreciates science and takes pride in what it does.

3 The only other thing I want to say is that we've heard
4 a lot, rightly so, about how options four and five really
5 are just unacceptable and I reiterate that, but really any
6 cut in the amount of open-skies science time that is
7 available for the wider astronomical community is going to
8 severely impact the large community at Green Bank.

9 The facility -- the people who are here if we cannot
10 continue to do high-impact science some of them are going
11 to consider going elsewhere. There are other impacts that
12 will propagate throughout the community even if it is -- we
13 do stay open under options one through three, and that's
14 why I would strongly urge you to recommend option one.
15 Thank you.

16 WILL ARMENTROUT: Hello. My name is Will Armentrout
17 and I'm a doctoral student at West Virginia University. I
18 will reiterate a bit of what you've heard from other Ph.D.
19 students at the university, but kind of lay it out in a
20 three-tier process.

21 I would like to talk about the educational impact on
22 students, the public, and professionals from around the
23 West Virginia area and from the international community.

24 If you can imagine this pure middle structure where at

1 the bottom we have public outreach, the middle we have
2 students, and at the top we have professional astronomers
3 coming here to work and to interface at meetings.

4 Now the Pulsar Search Collaboratory as Pete mentioned
5 is a way to engage very heavily students for weeks at a
6 time in the summer in learning pulsar astronomy,
7 understanding the basics of science, but the outreach at
8 the Observatory, the public museum, and outreach efforts
9 that the Observatory does is important in engaging tens of
10 thousands of people throughout the community to draw them
11 here maybe to spark their interest in science or in
12 technology for years to come in the future. That's a very
13 important stage or step we have in West Virginia to really
14 engage the next generation of scientists.

15 I will move from the base structure then to kind of
16 this middle section, and the middle section, like I said,
17 is engagement with students at the university. This is a
18 huge draw for graduate students attending West Virginia
19 University. If you are a graduate student in the audience
20 from West Virginia University could you raise your hand?
21 You can see we have dozens here. We have dozens back at
22 home who couldn't make it. They get the chance to
23 interface with the telescope from day one becoming
24 technical astronomers that use not only the Green Bank

1 Observatory but observatories from all around the world and
2 they're really honing those skills here.

3 The last stop that I would like to talk about is the
4 importance of the Green Bank Observatory and the
5 professional community. So every few years the Green Bank
6 Observatory has a single-dish observing school that brings
7 astronomers here, students, and professionals from all
8 around the world to really hone their skills as a technical
9 astronomer and they have other meetings throughout the year
10 that highlight many different high-impact areas of science,
11 but it is a way to connect professional astronomers and
12 student astronomers and the public at all three of these
13 very important levels to give you the full path of science
14 in America and science in West Virginia. Thank you very
15 much, and I urge you to consider options one through
16 three.

17 ELIZABETH PENTECOST: Robert Wilson and Paul Baker.

18 ROBERT WILSON: Hi. I'm Robert Wilson. I would like
19 to thank you for allowing me to speak here on behalf of the
20 GBM, GBT. I'm an undergraduate at West Virginia
21 University. I'm an aerospace engineering major, not
22 physics or astronomy, but I have been involved in things in
23 the past where -- that have brought me to the Green Bank
24 Observatory. It has had a profound impact on my life.

1 I remember being six or seven years old and coming
2 here with my dad when it just opened up. I will talk about
3 when I first started at WVU back in 2014 I joined something
4 that Kathryn Williamson who is in the audience started
5 which is the Space Public Outreach team for West Virginia.

6 What the Space Public Outreach team does is it fosters
7 the spreading of the word of science kind of to the K
8 through 12 students and I guess students in the state of
9 West Virginia.

10 What we do in the Space Public Outreach team is we go
11 to students in West Virginia and we try to communicate
12 science to them in a way that's understandable to them.

13 When you try to talk to students about science
14 sometimes things can get abstract. When you want to talk
15 about pulsars these are things that are out in space that
16 these students will never see in their lives. It's very
17 easy to just make these things kind of seem very detached
18 from what these students usually go through in their
19 day-to-day lives.

20 When you have something like the Green Bank
21 Observatory and something that they can physically link
22 these students to the kind of things that are out there,
23 it's a great tool for me when I'm trying to explain to
24 these kids what these things are. It's a really great tool

1 and it's something that is really profound that we have
2 here in West Virginia.

3 The low income areas in the state it's very difficult
4 for some of those students to actually you know just
5 understand -- not understand, but be informed of kind of
6 some of the science that's going on. Essentially --
7 sorry. I'm blanking here. It's kind of embarrassing. No,
8 no, it's fine.

9 It's really important that these kids kind of grow up
10 and are able to, you know, interject themselves into a
11 society and have the ability to become professionals and
12 having the GBT here is a great way to do that. It's very
13 important that these students know this state has a future
14 in science and technology and it's not just coal and
15 natural gas. You can't put a dollar sign on the things
16 that the Green Bank Observatory is doing for the students
17 in the State of West Virginia.

18 DR. PAUL BAKER: Hello. I'm Paul Baker. I'm a
19 postdoctoral fellow in the Center for Gravitational Waves
20 and Cosmology at West Virginia University. I'm also a
21 member of the NANOGrav Collaboration.

22 NANOGrav uses the Green Bank Telescope for most of its
23 observing, and seeing the facility close down would be a
24 huge detriment to that effort so NANOGrav is looking to

1 detect low-frequency gravitational waves and we saw with
2 the recent LIGO detection of gravitational waves it brought
3 up a great deal of public enthusiasm in science and physics
4 and astrophysics. I see using the Green Bank Telescope for
5 NANOGrav to continue on in that as a way to reach out to
6 not just students but the general public in thinking about
7 these fundamental questions of science.

8 Also, my decision to come to West Virginia to work at
9 West Virginia University hinges on the university's
10 involvement in NANOGrav and this particular project and the
11 Green Bank Telescope, so I think without the Green Bank
12 Telescope, West Virginia University and the State of West
13 Virginia would be missing out on people coming to this
14 state to work on science. Thanks.

15 ELIZABETH PENTECOST: Navid Motlaghi. Did I pronounce
16 it right? I hope. And Michael Lamb.

17 DR. MICHAEL LAMB: Hi. So I'm Michael Lamb. I'm a
18 postdoctoral fellow at West Virginia University and I'm
19 also a member of the NANOGrav Physics Frontier Center. I
20 am the NANOGrav PFC post-doc for West Virginia University.

21 I just wanted to talk about the impact on students
22 from the broader national community. In 2009 I was a
23 member of the NRAO Research Experience for undergraduates
24 in Charlottesville, not at Green Bank, but we came over to

1 Green Bank to do a lot of training and we met with students
2 here at Green Bank and we used data at Green Bank. We took
3 observations from Charlottesville, and I want to say like
4 what a huge impact this has been for me.

5 I went to a small teaching college where there was
6 only one astronomer at the time so the astronomy research
7 opportunities were very limited. I ended up working in the
8 pulsar astronomy community. That informed my decision of
9 what I wanted to do for graduate school was to continue
10 working in pulsar astronomy so I attended Cornell
11 University. I finished my dissertation this past year and
12 now I'm at West Virginia continuing to do what I think is
13 really, really amazing forefront science.

14 Without the Green Bank Telescope I would echo what a
15 number of people have said, I don't think that West
16 Virginia University and I don't think the State of West
17 Virginia would really have a huge impact on science. I
18 think that the amount of people that it brings in both
19 internationally, which has also been mentioned, locally,
20 and nationally, people are coming from all over the place
21 to use the facility to do really, really good science and
22 to really make a difference. Thank you.

23 ELIZABETH PENTECOST: Paul Brook and Laurel Dilley.

24 DR. PAUL BROOK: Hi, guys. My name is Paul Brook, and

1 I'm a postdoctoral researcher at West Virginia University
2 also. I just wanted to add my voice to those who have
3 talked about coming from elsewhere in the world to come and
4 study or work here in West Virginia.

5 I finished my Ph.D. last year at the University of
6 Oxford in England and when I was looking for the next step
7 in my career the reason I wanted to come to West Virginia
8 University is because as we've heard, there's a great bunch
9 of people in the physics department. It is a growing
10 department and they work on really important and
11 interesting science in areas of particular interest to
12 myself. Also, I've had -- the main reason for all those
13 positives is not in small measure due to the Green Bank
14 Telescope.

15 There's not many English people in Morgantown, West
16 Virginia. When I'm walking around doing my shopping and
17 speaking to members of the general public and they hear my
18 accent which they initially think is Australian and then
19 eventually they can see that I'm English, it doesn't take
20 very long for the question what the heck are you doing in
21 West Virginia. We have a little conversation about that,
22 but the bottom line is always I'm here because Green Bank
23 Observatory is here.

24 So if you want to continue to attract people from all

1 over the world, which I hope you do, then we have to
2 recognize that this is in big part due to the telescope
3 here and the Observatory. Thanks.

4 ELIZABETH PENTECOST: Lesley Goodall and Adam
5 Kobelski.

6 UNIDENTIFIED: I think you've got Laurel Dilley still.

7 ELIZABETH PENTECOST: Oh, I'm sorry.

8 LAUREL DILLEY: Hello. I'm Laurel Dilley. I have two
9 things I wanted to address tonight. The first is just as a
10 lifelong resident of West Virginia and huge advocate for
11 the state. I grew up in neighboring Pendleton County and
12 the Observatory was always such a cool thing to have right
13 next door. We would be so excited when we could go on
14 field trips over here to Green Bank.

15 I attended West Virginia University and majored in
16 math and helped out with the governor's school for math and
17 science for several years and I know it was stationed here
18 occasionally. There's just so many cool academic
19 opportunities for kids in this state.

20 I also think West Virginia suffers from the rural
21 brain drain and this is something that can actually reverse
22 that and get students who want -- are interested in West
23 Virginia and want to come back it gives them something in
24 technology or engineering or science field that they can

1 actually look forward to and come home.

2 The second thing I wanted to address is I teach math
3 and computer science at the high school. Computer science
4 was just started about two years ago with the help of a
5 math coach in our county and nobody had any background in
6 computer science. I was one of the math teachers so I
7 volunteered to do it, but I absolutely would not have been
8 brave enough to do that or would not have been possible if
9 it wasn't for the Observatory.

10 Ray Creager specifically stepped up and he comes to
11 our classroom one day every single week and volunteers his
12 time to teach the kids to code PYTHON.

13 The NRAO also -- or the GBO hosts the Hour of Code
14 field trip for all the ninth graders every single year so
15 that they can come and see just what coding is all about
16 and learn binary and get to see the machine shop. It's a
17 really, really cool experience for these high school
18 students.

19 We only had a graduating class of about 62 last year.
20 Ten of those 62 seniors were in the first computer science
21 class, and five of them are now majoring in computer
22 science in college. This year we have 17 students in that
23 class and almost all of them say they either want to major
24 or minor in computer science, so once again, that wouldn't

1 be possible if not for the collaboration of Green Bank with
2 our schools.

3 They've also hosted math field day regionally and so
4 many other things. Anything we ask them to do at the high
5 school they are very cooperative and it is a huge
6 inspiration to me as a teacher to know that I have that
7 support. Thank you.

8 LESLEY GOODALL: I'm Lesley Goodall. I guess what I'm
9 going to say is kind of putsy compared to everybody else.
10 I'm an occupational therapist. I work in the schools. I
11 work in the home health and intervention and the
12 hospital. I know pretty much everybody in the county or at
13 least their child or their grandchild.

14 Almost every aspect of my life has been touched by the
15 GBO. We need the population to keep our schools and our
16 hospitals going.

17 Most of what the GBO meant in my life is through my
18 son who is now 20, but he attended the Green Bank school
19 and there was Star Lab, which I was asking somebody, do you
20 all know what that is, the cool thing that the kids get to
21 see? Okay. Yeah. That's such a cool thing and it goes
22 to -- we have five schools in this county. It goes to all
23 the schools and they teach the kids about the universe and
24 all these great things.

1 Most of the judges for our social studies fair,
2 science fair, if I'm not mistaken, come up from up here.
3 What I'm trying to say is the employees of GBO contribute a
4 lot to our schools and to our communities.

5 My son was able to become an Eagle Scout because some
6 of the staff up here and their kids all -- we did Boy
7 Scouts up here. We did the overnights. My son and I both
8 became EMTs due to Janet Ghigo because she teaches it up
9 here. She teaches it every year, and her husband works
10 here if I'm not mistaken.

11 My son got his first paying job painting the satellite
12 dish and is now certified to climb way up in the air which
13 is great because he wants to work in the rain forest.

14 Also, he's at Virginia Tech. No boos, please. But I
15 am from Virginia. He considers himself from West Virginia,
16 but he's constantly defending West Virginia, and the one
17 thing that he can talk about is yes, the satellite dish.
18 Wow, you got near that. Wow, that's like brain stuff.
19 It's really good for our state. He was actually on the
20 plane to Spain with Ms. Minter whose husband also works
21 here, and he was saying that to some Russian -- some
22 foreign group and he got off the plane and he goes man, he
23 said those guys asked me where I was from. He said you
24 don't know. They were like where. He said West Virginia.

1 Oh really. He said, yeah, this little place called Green
2 Bank. Oh yeah, it's the telescope. You know, they knew
3 it. But GBO is really a part of our community.

4 I'm also in the book group that's run by -- where is
5 she? Out there. Yeah. That's run by people that are
6 staffed here.

7 I think our churches would shut if we didn't have the
8 GBO. It means a lot to the community. The walking trails
9 and the riding trails it's where everybody gets our
10 exercise. Please fund it.

11 DR. ADAM KOBELSKI: Hi. Thanks for being here. I
12 know this has got to be a long day for you all so I
13 appreciate you taking the time for this. I'm Adam
14 Kobelski. I used to be a post-doc here and I came all the
15 way from Alabama to attend this and be here today so if
16 there's nothing I say here that is relevant, hopefully that
17 carries some weight to it.

18 One of the things that I think is really important
19 about places like this which there are very few of these
20 places left of real science camps, places where you can
21 come and be cut away and do your science. We all do our
22 work now at our desktops in our offices and we never
23 actually get away and actually connect to the data to what
24 we're trying to do and get our heads out of doing laundry

1 and connecting all these other chores. This is one of the
2 last facilities left to do that.

3 On that same note, this is also one of the last
4 facilities where as a scientist you get to see and meet and
5 talk to and know everybody that's involved in doing the
6 science.

7 I know most of the people in this room. Where I work
8 now I know very few people in the building. But you know
9 everyone in the town, everyone who makes the telescope
10 work, and it's an amazing team that is unrivaled anywhere
11 else at least as these types of facilities and it's not a
12 commonplace thing and it's really gone just because of the
13 state of how we have to do science now and it's real
14 important to at least keep a few of these going.

15 One of the last things I wanted to talk about is how
16 facilities like this provide the opportunity to train
17 cross-disciplinary science which is something that often
18 is lacking.

19 I'm a solar physicist. I moved here with very little
20 radio astronomy knowledge and I am now somewhat qualified
21 to do radio astronomy. I now am able to use these skills
22 to use other NSF facilities to study the science there at
23 the sun which is the huge benefit to all the other
24 opportunities and things available for NSF so it's really

1 great to keep places like this alive to train other people
2 like me to be able to use all the facilities that NSF has
3 to offer. Thank you.

4 ELIZABETH PENTECOST: John Leyzarek.

5 UNIDENTIFIED: I believe he's out in the other room.

6 UNIDENTIFIED: He will hear you. You can do the next
7 person.

8 ELIZABETH PENTECOST: He's the last person.

9 UNIDENTIFIED: If someone didn't sign up can they
10 speak?

11 ELIZABETH PENTECOST: Did you sign --

12 UNIDENTIFIED: I guess also if there's anybody from
13 the last session who didn't have an opportunity to finish
14 their comments if they would like to, I would like to offer
15 them that opportunity as well.

16 ELIZABETH PENTECOST: Did you sign in to begin with?

17 UNIDENTIFIED: Yes, but I didn't know how many people
18 would be speaking so --

19 ELIZABETH PENTECOST: That's fine. You can speak
20 after Mr. Leyzarek.

21 CHRISTIN HAMILTON: Liz, you had another hand back
22 there as well.

23 JOHN LEYZAREK: My name is John Leyzarek. Thank you.
24 I'm sorry for the delay. I was going to put this in

1 writing. I appreciate the opportunity to be here. This is
2 a place I only want to say should be preserved and it
3 has -- it's a unique phenomenon in not only Pocahontas
4 County and West Virginia, but in the country and in the
5 world. It makes an enormous contribution to the cultural
6 environment as well as the scientific world here in
7 Pocahontas County.

8 Among the alternatives that I've seen discussed are
9 the deconstruction and restoration, and that's kind of in
10 addition to being a dreadful thought it's almost laughable
11 because as far as I can tell this place is already managed
12 with a high degree environmental responsibility and it
13 apparently maintains an enormous deer herd.

14 I don't want to waste anybody's time. This is a long
15 night, but I want to support very strongly the second
16 alternative that I've seen proposed which is to maintain
17 National Science Foundation involvement and also make the
18 facilities available to and solicit funding from the widest
19 possible range of potential users.

20 I understand to some extent this is already being
21 done, but I think without being a marketer, without having
22 studied the market for all the different facilities that
23 there are here, I'm sure many more players can be involved
24 and have been so far, and anything I as an individual can

1 do to promote that, I'm sure there are a lot of other
2 people who would like to do that also.

3 I think collaboration, privatization is a wonderful
4 thing, the coming thing. We can only look at the
5 transition of physical space exploration out of the
6 exclusive hands of government into partnerships between
7 government and private entities so I strongly support,
8 hopefully the Observatory will stay here and thrive and
9 make its contribution even more widely. Thank you.

10 UNIDENTIFIED: Liz, if we can just hold on one
11 second. We can go one, two. People who haven't spoken
12 yet. Three, four, five.

13 ELIZABETH PENTECOST: I think this lady right here
14 first, please. Go ahead.

15 CHRISTINA CUNNINGHAM: Well, my name is Christina
16 Cunningham, and I wasn't going to speak at first because
17 there's actually so much to talk about. I will be writing
18 a letter and I will be addressing most of the concerns.

19 I have a unique background in that I wouldn't have
20 been here at Pocahontas County if it wouldn't have been for
21 the Observatory. My dad decided to move us here and give
22 us an opportunity to live in rural West Virginia. I have
23 made friends, I have made people we consider aunts and
24 uncles, I have made all kinds of contacts, and I have been

1 shown by the Observatory that you can actually live your
2 dreams. It does happen here. You can see it. It's real.
3 You can touch it.

4 Also, I have a different background from a lot of
5 people that have spoken because I went into forestry. I
6 have had my certified -- arborist certification, and if you
7 want to talk about environmental impact, I know the
8 Observatory is very well maintained. I believe that the
9 sewage system won an award for being very environmental
10 friendly.

11 You talk about air quality. You can't get any better
12 air quality here. The telescopes would not be emitting
13 anything so I can't see how that would even be an issue.
14 That should be null and void because they listen.

15 To be honest with you, you can't get any better
16 water. This is the birthplace of seven rivers in West
17 Virginia.

18 I don't really know what else to say other than I hope
19 that you have listened to everybody and I hope that you
20 will definitely be taking this seriously because it is
21 affecting not just people here but it's worldwide. Even
22 though we are a very tiny state in the nation, we are the
23 third largest land county in the state, but one of the very
24 most rural populated areas, but it would be devastating to

1 see this place shut down. Thank you.

2 DI PANG: Hi. My name is Di Pang. I'm a Ph.D.
3 student at WVU. I'm studying computer science there. I'm
4 from China by the way so I'm from some rural area like
5 this. When my friends ask where I am I tell them I'm in
6 West Virginia. They don't know much about West Virginia
7 but they know two things. One is the song, Country Roads,
8 Take Me Home. The other one is the big telescope.

9 So in the past year, I've been working on
10 algorithms and look for pulsars in single pulse search so
11 pulses are weak and radio frequency interference is strong
12 so you don't know how sweet the words radio quiet zone
13 means to me. I really like those words.

14 You think of the GBT algorithms that's -- in
15 the past all those parts have to be diagnostically pulsar
16 signal part have to be inspected manually and there are
17 like hundreds of thousands of parts. We were able to
18 reduce this parts that need to be inspected by people by 90
19 percent and write up all of this so once we finished our algorithm,
20 this algorithm can be used by pulsars researchers, all pulsar
21 researchers, most specifically around the world, at the
22 universities as well.

23 So I'm also -- I came this summer to camp. I
24 met many talented students. Looking for -- we worked on

1 this pulsar. It's not we're only inspiring
2 people to study physics. Also inspire people to study
3 computer science, engineering, electronics.

4 In our department there are several professors who
5 work on the astronomy signal as well. So,
6 okay, we don't -- if you keep -- the students here want to
7 learn astronomy. You don't want to take them to China
8 because it cost a lot.

9 ELIZABETH PENTECOST: The next person. Anybody else?

10 JENNIFER NAIL: I want to say something.

11 UNIDENTIFIED: One, two, three, four.

12 JENNIFER NAIL: I was three or four. I can't
13 remember.

14 UNIDENTIFIED: You're a mathematician.

15 JENNIFER NAIL: I'm here now. They were just
16 pointing.

17 UNIDENTIFIED: We will come to you as well.

18 JENNIFER NAIL: Hello. I'm Jennifer Nail. I'm a
19 teacher at Pocahontas County High School. I also teach
20 math. What I want to talk about is the impact that this
21 has on our school systems.

22 Like Laurel talked about a minute ago, they
23 facilitated the field trip for our freshman class for the
24 last several years and this has been an incredible

1 opportunity for our students to see over the past few
2 years.

3 Also, guys, it's really hard to get people to move
4 here. I moved here from Charleston five years ago to teach
5 here because they offered me a contract first. There are
6 at least 20 school employees whose spouses work here. If
7 we lost 20 teachers we would not have qualified teachers in
8 our schools. As it is right now, I am proud to say that I
9 feel like we have a very strong school system and if that
10 happened we wouldn't.

11 It is so difficult to convince people to move here
12 because you're asking them to move here to the middle of
13 nowhere where your Internet is terrible and where they
14 don't have cellphones, and for people my age that's like
15 living without water so it's very important.

16 I would also like to talk on a personal note to when I
17 moved here five years ago I was a poor beginning teacher
18 and I needed a second job. So I worked here one summer at
19 the Observatory as a tour guide and I can say that that was
20 one of the best and most welcoming opportunities I've had
21 since moving to Pocahontas County. I met so many people
22 from working here and it made me feel so much more at home
23 than I was when I started here. I can say that if I didn't
24 have that opportunity I might not still be working in

1 Pocahontas County right now. So thank you.

2 UNIDENTIFIED: After this gentleman, who else has not
3 spoken before I go in the back of the room? Have you
4 spoken before? And you have not. We're going to take
5 people who haven't spoken first and then we will go back to
6 people who already had an opportunity and if they want to
7 supplement their responses because they ran out of time
8 they will be welcome to do that. We could even stay a
9 little bit later to accommodate that.

10 So the gentleman in the back will be after this
11 gentleman here. You can be after him. Who else was there
12 that wanted to speak?

13 UNIDENTIFIED: I was.

14 UNIDENTIFIED: You did. Okay. So oh do we have
15 another person here who didn't speak before? New speaker?
16 Did you speak already?

17 UNIDENTIFIED: No.

18 UNIDENTIFIED: So then you will follow this young
19 woman and then we will go.

20 BOB VANCE: I'm Bob Vance. First of all, I want to
21 say these people from the University of -- West Virginia
22 University, I was there a long time ago. I had an
23 astronomy class and you had to meet on top of the physics
24 building and we were supposed to look at stars. We

1 couldn't see anything but fog so when I
2 graduated I graduated with an education degree, math and
3 science.

4 I had to -- I spent one year teaching high school,
5 went in the service because I had a commission. Came back
6 to the Observatory in 1961 as a telescope operator because
7 we did everything manually at that time. That was the
8 requirement, they wanted math or electronics. So I spent
9 about three years as the operation group, 85 foot, 300
10 foot, and 140 foot. Then I moved to the computer group.

11 We didn't have much computer group at that time.
12 Computer science was not even one of the options in
13 Morgantown. From there I worked with all the astronomers
14 that came through. We had people from -- we had
15 astronomers from Russia. We had them from everywhere. The
16 staff was made up of several people from Germany. Well,
17 they just -- all kinds of foreign countries the staff was
18 made up of.

19 I was working the night that the 300 foot fell down in
20 1988 in the lab. And from that point Senator Byrd got
21 money to build the GBT and it was put into operation I
22 think in the year 2000 because I retired in 1999.

23 The telescope was a savior for the Observatory. It
24 was also a savior to the scientific community. The whole

1 community dearly loves that telescope and the observatory
2 is very -- it's a very economical part of the whole
3 county. There's several people who live in the outskirts.
4 Most of the people retired are still here or somewhere in
5 the neighborhood. It's not a good place to be. The
6 hospital and things are too far away, but they like Green
7 Bank and the Observatory is a very -- it's just a common
8 person for everybody, and I would like to urge the National
9 Science Foundation to do all they can to keep the GBT in
10 operation since it would also be a big morale booster for
11 the community as well.

12 BUSTER VARNER: I'm Buster Varner from Durbin. I'm
13 the local fire chief, president of the fire department --
14 rescue squad and fire departments for this area. I've
15 taken classes here for EMT class that Janet Ghigo has
16 taught every year here for several years that supplies the
17 EMTs for all of Pocahontas County. That's a very vital
18 thing here. I met a lot of people that has come here. Got
19 a lot of friends. My assistant chief is Dennis Egan that
20 works here. If we have problems with our trucks
21 ambulances, anything; I'm local business owner, I own
22 several businesses, if I need a special part or something
23 made I can have it made here.

24 Just I can't -- I've heard everybody talk and I

1 understand a lot of it, but business wise, how could you
2 take and spend the money you have spent in this area for
3 this telescope and this nice facility here and even for a
4 second think about closing it down? I can't understand how
5 this would happen. I mean, this is everybody's money and
6 we're known worldwide because of this telescope and all the
7 people that come here.

8 I think you're barking up the wrong tree. You need to
9 look at somewhere else to shut something down because if
10 this facility went out of here this would be a ghost town
11 in this area.

12 UNIDENTIFIED: Amen.

13 UNIDENTIFIED: Keep the money in America.

14 BUSTER VARNER: Yes. But I just want you to seriously
15 consider do not do anything different.

16 I can ask Mike Holstein for anything. We come here
17 when the helicopter crashed. Whenever the power goes out
18 or we have any kind of catastrophe here I can go to Mike.
19 I know I went to Mike when the power was off. They had a
20 scheduled power outage and a friend of mine had passed
21 away. Wasn't going to have no power at the funeral home
22 that day. I called Mike up. Mike, got a problem, buddy.
23 What is it. I said, well, lady is going to be at the
24 funeral home at two o'clock for a funeral, there's not

1 going to be any power there. It was really hot that day.
2 I will take care of it. What more can you ask for?

3 So this is things that goes way beyond what you
4 think. I don't know much about this science or nothing
5 like that. There's a lot of people here that does and
6 that's great. But I do not want to see anything to happen
7 to this facility. Period.

8 MARY SUE BURNS: My name is Mary Sue Burns, and I
9 moved to Pocahontas County in 1980 because I was offered
10 the job of Green Bank Middle School science teacher. That
11 was when the building was condemned and I had to work in
12 temporary housing down at the high school.

13 In 1985 I was talked into transferring to Pocahontas
14 County High School. I fought to be the chemistry teacher
15 which was fine and they said oh, by the way, you have to
16 teach the physics class, you're all we've got. You've got
17 enough credits we can get you a permit. Okay.

18 Teaching physics was the last thing I had ever
19 considered and it so happened that in 1987 -- I kind of
20 struggled along there a couple of years. In 1987 the
21 Investigating the University Workshop for teachers pilot
22 project for West Virginia teachers was held here at at that
23 time NRAO and a group of West Virginia teachers were
24 intensively trained in radio astronomy. We called it radio

1 astronomy boot camp.

2 From that I not only learned a lot but I made
3 incredible contacts and realized the tremendous resource I
4 had here and ended up making kind of lifelong collaborative
5 relationships with astronomers and engineers here who then
6 mentored my students and the kind of trickled down effect
7 from that was tremendous.

8 I was also on the staff for that project that
9 Ms. Bland mentioned, the Earth Space Science Passport grant
10 in collaboration with Fairmont State University. We
11 trained 36 West Virginia teachers in new science standards
12 this summer.

13 I was on the geology team so even though this is an
14 astronomy facility we were able to find sites within NRAO
15 and Green Bank, NRAO at that time, and Green Bank in order
16 to reconstruct geologic history of this area and give
17 teachers the inquiry experience into that kind of research
18 as well as the astronomy research so I think we have a rich
19 facility here and I would really like to see it
20 maintained.

21 I just retired from 37 years of teaching science in
22 West Virginia and in a moment of insanity agreed to long-
23 term sub position back at Green Bank Middle School so I
24 will be here for the science fair on December 6th and I

1 know that a lot of the staff here are going to be serving
2 as judges and hosts for that event, and I want to thank
3 them for that because a lot of them are here right now, and
4 thank you all for coming and listening. I tend to talk
5 really fast so this guy is good here. Thank you very much.

6 UNIDENTIFIED: And after our next speaker do we have
7 anybody else who has not had the opportunity to speak that
8 would like to?

9 UNIDENTIFIED: I would like to say something.

10 UNIDENTIFIED: Anybody else? No. Okay. Then you
11 were first. Did you want to speak?

12 UNIDENTIFIED: I already spoke but I want to go
13 again.

14 UNIDENTIFIED: Okay. So we will go after her go to
15 the other new speaker and then you and then you and then
16 you. Thank you, folks.

17 DIANE SCHOU: My name is Diane Schou. I'm a resident
18 of Green Bank and I did not check the form to talk but I
19 sort of gathered --

20 UNIDENTIFIED: You're on it now.

21 DIANE SCHOU: Thank you. I'm coming to about -- want
22 to talk about Green Bank from another direction, another
23 perspective. One, about air quality in Green Bank. This
24 is something that is very rare in the world here to be in

1 the national quiet zone.

2 I was injured by a cell tower that was built a third
3 of a mile away from my home. I didn't argue with it all
4 because I'm told that it was safe. Nine months later I got
5 symptoms of radiation sickness. I had a headache. I slept
6 very rarely. I had, what do you call it, chronic fatigue.
7 I had a rash. I thought I was eating something wrong. I
8 lost hair. I thought I was getting older.

9 My son took a class or was studying for a hand radio
10 license and in that book of learning about getting the hand
11 radio license there was a chapter about the radio -- the
12 hand radio operators what they experience when they stand
13 in front of antennas, and he put two and two together that
14 that sounds like what mother has.

15 My husband is a scientist so we did some simple
16 experiments. He drove me away from home, my headaches
17 disappeared. I felt much better. Came back home, the
18 headache returned and this happened repeatedly. When I was
19 returning home from the grocery store or from the post
20 office I was driving up top of a hill heading home and as I
21 approached the top I had a headache that was sort of like a
22 sledge hammer hitting me on my head. When I was coming
23 from another direction maybe about ten miles away I had a
24 tiny headache. Just barely discernible but the closer and

1 closer we got to home the headache grew. Because of that
2 is why I'm living here in Green Bank because I can live --
3 I'm acute person here. I don't have the health effects.

4 Am I running out of time?

5 CHRISTIN HAMILTON: You still have another 30
6 seconds.

7 DIANE SCHOU: Oh dear. I want to talk about safety
8 and health. I want to talk about the socioeconomic of
9 being in Green Bank. The historical preservation of
10 needing to keep this as a radio quiet zone and keep it as a
11 safe area because people around the world come here. Their
12 health improves, they go back home, they become ill again.
13 They come here, their health improves. They go back
14 home -- but they have to go back home because their family
15 is important.

16 From another perspective, instead of just asking for
17 the first preference for the Observatory, I would like to
18 ask for additional funding so that we can have some meters
19 to prove that people like me we are detecting things
20 because why on some days I feel ill, another person feels
21 ill, a third person feels ill, a fourth person had an
22 accident because that person was feeling ill. I even
23 called Virginia. They were feeling ill. I even called
24 Indiana. That person was feeling ill. So why were all

1 these people at the same hour detecting something. Thank
2 you.

3 LAURA HEIST: Hi. Most of you all know me. My name
4 is Laura Heist. We've lived in this area for a long time.
5 My husband is a tenth generation Pocahontas County
6 individual. We love this area for how unique it is and it
7 is unique in part because of the National Science
8 Foundation funding this observatory here.

9 I work for the Forest Service and I'm able to work at
10 home and work for Milwaukee, Wisconsin, and it's great to
11 be able to choose where you want to be and this is a
12 special place.

13 I would ask that you would look at the direct,
14 indirect, and cumulative impacts of the economic impacts to
15 the local area, to the state, and I'm just really wondering
16 just like they've said before, why are we spending so much
17 money to get this here and to invest in it and then to just
18 walk away with that much money? You may say it is outside
19 of your NEPA scope, but I'm asking you to look at it, and
20 if you're going to dismiss it for consideration, I would
21 like you to explain why you're dismissing it from
22 consideration. We want to know why you would be putting
23 money down in Chile instead of spending money in the United
24 States.

1 Whether you like him or not, we have a new president
2 who says he wants us to invest in America. I'm asking you
3 to invest in America and this is a great place to do it.
4 You've already put the money here so explain to me why you
5 would want to deinvest from this area. You can say that your
6 scope of your analysis is just to look at the alternatives
7 of what to do with this facility, but did you ever do the
8 analysis to come to this conclusion? I would just like to
9 understand it more and I think you can provide that
10 information in your response to comments to the public.
11 Thank you.

12 UNIDENTIFIED: No more new speakers; correct? I think
13 she was first and then you're next.

14 CARLA BEAUDET: Okay. To pick up where I left off and
15 actually -- Carla Beudet. I work at the Observatory. To
16 pick up, the previous speaker kind of, you know, pointed to
17 the points I made earlier that the socioeconomic impact
18 needs to be quantified in ways that it has not been done
19 for the EIS at Arecibo.

20 But to pick up, there are other quantifiable costs to
21 the area that come from losing the many volunteer services
22 of Observatory employees and the sharing of our facilities
23 with the community. Observatory employees volunteer as
24 firefighters and EMTs, as volunteer teachers of aerobics,

1 yoga, Zumba, Taekwondo, as sound and lighting engineers at
2 the Marlinton Opera House, as soccer, basketball, football
3 coaches and that is by no means an exhaustive list.

4 The Observatory partners with the parks and rec office
5 to offer swimming and dance lessons at Observatory
6 facilities for minimal cost. This in a place where the
7 nearest municipal swimming pool is at least an hours drive
8 away.

9 The impact to the community of losing the pool and the
10 exercise room can only be assessed by considering the cost
11 of a municipal wellness facility to replace those
12 services. Will your EIS consider that?

13 As my husband and I have been the ones doing sound and
14 lights at the opera house for the past 12 years we've
15 looked into the cost of having an outside sound company
16 come in. About \$1500 per show maybe 14 shows a year.
17 These things can be quantified and I want to see them
18 quantified in the Green Bank EIS if only estimated.

19 I cannot finish without expressing my disbelief that
20 this is even happening. The NSF's recommendation to defund
21 the GBT left a lot of people, particularly a scientific
22 community of users, completely dumbfounded given the recent
23 construction, innovative design, and scientific vitality of
24 this instrument. the GBT's capability has continued to

1 evolve. It is, in fact, just coming into its own with
2 high-frequency multi-receivers.

3 This is no dinosaur but rather a cutting edge
4 instrument with sensitivity unattainable by any array of
5 smaller dishes. It's capable and these are absolutely
6 unique in the scientific community. Just
7 not apparently from the majority of scientists selected to
8 serve on the NSF's 2012 Portfolio Review Committee. Thank
9 you.

10 PEGGY HAWSE: Good evening. I'm Peggy Hawse. I'm
11 Senator Manchin's representative and I work in West
12 Virginia. I represent him in Pocahontas County, and I've
13 already spoken. I've been here since three o'clock and I
14 stayed because I feel it is so important. The senator
15 thought it was so important that he also sent his
16 legislative director from Washington, and unfortunately, he
17 had to leave because he had to go to Charleston so I
18 stayed.

19 I wanted to add those of you who came in late, don't
20 worry, I'm not going to give my comments again. Just a
21 couple. There were representatives here earlier from
22 Senator Capito's office. Excuse me. Congressman Jenkins
23 was here, Senator Boso was here, and there may have been
24 some other locals that were here so it is important and

1 certainly your West Virginia delegation recognizes that.

2 I'm only going to make just a few comments repeated.

3 First, I want to say to the WVU students you have made a
4 tremendous impact by coming tonight. Thank you. I have
5 been privy to sit here and listen to everything and there
6 have been so many great comments made but I have to tell
7 you when you started speaking from your heart and there are
8 others have spoken from their heart, too, but you have come
9 here, you've chosen to come to West Virginia University to
10 further your experience to share your expertise. You made
11 a decision to do that. You're not getting a paycheck at
12 Green Bank Observatory. This isn't a job here for you.
13 You are passionate and that came through, and from a local
14 standpoint from somebody from West Virginia, you have made
15 me so proud and I want to thank you for that.

16 I want to tell you what the senator is doing
17 tomorrow. Tomorrow -- let me find my note here. Tomorrow
18 afternoon Senator Manchin along with Senator Capito and
19 Congressman Jenkins will speak directly to the Director
20 France Cordova, the director of the National Science
21 Foundation. I hope I'm saying the name right. To ensure
22 that she understands the importance of the Green Bank
23 Observatory to this community, the surrounding region, and
24 the State of West Virginia as well as the USA.

1 Senator Manchin thanks you for coming, and I want to
2 add one more thing. As a member of the Congress Committee,
3 Senator Manchin will have the responsibility of
4 interviewing and confirming the next director of the
5 National Science Foundation. We would like to do
6 everything we can to ensure your voice and your concerns
7 are held at the highest levels.

8 Mr. Vance, you called the Green Bank Telescope a
9 person. Well, when I gave my comments earlier I said that
10 the Green Bank Telescope was my friend. When I started
11 coming here I started calling it the Great Big Thing, and I
12 said, you know, you give nicknames to your friends so the
13 Green Bank Telescope has become my friend, and I'm so happy
14 to know that it has friends all over the world. Thank you.

15 DR. KATHRYN WILLIAMSON: Hi again. My name is Kathryn
16 Williamson. I'm a professor at WVU. I talked about the
17 20-meter telescope and how my students use it on Skynet
18 They control it online. It kind of worried me I heard that
19 I was the only person who mentioned the 20-meter because
20 it can be used online from anywhere and students from
21 more than WVU, more than just the hundreds the students
22 who take my classes use it. Students from all over the
23 country use it and I, unfortunately, don't know how many
24 but it's in the tens of thousands.

1 Earlier this year in January I submitted a grant to
2 the NSF to create workshops and activities for college
3 astronomy with the American Astronomical Society, the
4 people who offer the teaching workshops are there so that's
5 with EWAS people, and with other universities around the
6 country, and that grant review did extremely well but was
7 not funded because of the uncertain future of Green Bank
8 and the 20-meter.

9 Our grant had funding in there for it and it's just --
10 it blows my mind that the NSF would choose to know best for
11 one facility and ask for amazing educational opportunities
12 and then review those very well and then not
13 fund it because of the NSF's own decision so I just want to
14 reiterate that the 20-meter is an important telescope.
15 Everybody talks about the GBT, it's amazing, the 40-foot
16 telescope is an amazing opportunity, but the 20-meter
17 telescope is connected to the Internet so the possibilities
18 are endless for education. You don't have to come here.
19 It doesn't cost much of any at all to bring that kind of
20 quality science to our students so I just want to reiterate
21 the importance of the 20-meter. Thank you.

22 UNIDENTIFIED: Promised him first. And then, again,
23 we will have a hard stop at 8:30 if anybody else wants to
24 consider speaking.

1 DR. RYAN LYNCH: Okay, I will make it quick. I'm Ryan
2 Lynch. I'm a staff scientist here. So I talked earlier
3 about the student program and I want to just mention that
4 there's very, very few places in the world that allow
5 students to come and get a hands-on experience at a
6 telescope like this, but having gone through grad school I
7 came here first as a student back in grad school ten years
8 ago and now I'm here as an employee. It wasn't just
9 because I got to use a telescope which is great for my own
10 personal research. If that was all that this facility
11 offered I wouldn't be back here today as an employee.

12 Our summer students who come here they don't just
13 leave having had an experience. They learn something.
14 They walk away with the thing that I think I've taken away
15 from every comment here so much which is that this is such
16 an incredible community with such an incredible network of
17 people in every aspect of making this place work and the
18 community around it supports it.

19 When people come here they recognize that and it
20 inspires them to keep working through a career that can
21 often be very difficult or stressful. It helps get them
22 through those difficult times, and you can't really
23 quantify that easily, but it's a huge, huge, huge cultural
24 impact on the students that come here, on the other

1 astronomers that come here, and on every single person who
2 comes here to work and be a part of the community so I just
3 wanted to -- that was my time to speak from the heart.
4 Thank you.

5 UNIDENTIFIED: Anybody else want to speak after him?
6 You do. Okay.

7 PETE GENTILE: Pete Gentile again. I don't think I
8 mentioned it the first time but I'm a grad student at WVU
9 and I wanted to mention because it might seem a little
10 funny actually for people to have an emotional connection
11 to a telescope or to an observatory, and as hard as it is
12 maybe to understand it's much harder, I think, to quantify
13 that so it struck me tonight how many people said or
14 embodied the phrase I didn't sign up to speak tonight but I
15 wanted to get up and say something.

16 I think that's really indicative of the emotional
17 connection that this observatory has, not only with this
18 community but with the state and all of us here so I just
19 didn't want it to go without mentioning at least once how
20 emotion plays a part, even tonight. Thank you.

21 DR. LOREN ANDERSON: Hi. I'm Loren Anderson. Again,
22 WVU professor. One point I didn't think I had time for
23 last time was the amount of grant money that is tied to the
24 GBT so over the last few years we've been very successful

1 as faculty at WVU in bringing in money that is associated
2 with observation conducted on the GBT and that number is
3 almost \$10 million over just the last few years.

4 Most of that money goes to funding personnel. That's
5 post-docs and grad students and they spend it in the
6 community mostly on pizza and beer as far as I can tell so
7 those are good West Virginia dollars that stay very local
8 when you bring in those monies which we've been very
9 successful doing. Thanks.

10 UNIDENTIFIED: I believe this is our last speaker.

11 REBECCA GARVER: My name is Rebecca Garver, and I'm a
12 community member here. I honestly have no idea why I
13 decided to talk, but I just want to voice my concerns. I
14 completely get what everybody is saying but I want to say
15 from my perspective I don't think you understand how
16 devastating this would be to this community without this
17 here. It would be horrific. Buster Varner said it would
18 be a ghost town. He's not kidding.

19 My husband works at the high school. I'm not so
20 concerned about us not having good schools if this were to
21 close and the teachers were to leave; I worry about us
22 having no school. I worked at the bank across the street.
23 A couple years ago when we were worried this was going to
24 go down we were terrified there we were going to lose our

1 jobs because of how close we are and all of the community
2 members that we needed for our business. This would
3 trickle down to every single aspect of this community and
4 it would be an absolute nightmare for here and I just don't
5 want to see that happen. I couldn't sit and not say
6 anything.

7 UNIDENTIFIED: Amen.

8 UNIDENTIFIED: Thank you all so very much for coming
9 out. I know it's been a long day for many people and I
10 know it's hard to add something like this on at the end of
11 a long day or whatever endeavor you're involved in.

12 We thank you very, very much. We're going to take the
13 comments back, look at them, and review it, and they will
14 help shape the preparation of the draft of the
15 Environmental Impact Statement which is the next phase of
16 this process.

17 So, again, that will be -- we expect roughly spring of
18 next year we will be issuing the draft Environmental Impact
19 Statement. Thank you again. Be safe driving home.

20 (Whereupon, this meeting
21 was concluded at 8:30 p.m.)

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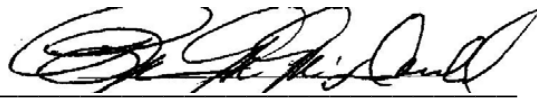
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CERTIFICATION OF REPORTER

I do hereby certify that the above and foregoing is a true and complete transcription of my stenotype notes and electronic recording of the meeting held at the time and place aforesaid.

I further certify that I am not interested in the outcome of this case, nor am I related to any of the parties herein.



Brian M. McDonald

Certified Shorthand Reporter

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Appendix 5-D
Scoping Comment Matrix

Green Bank Observatory -Written NSF Public Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
1	a	Kristy	Tritapoe	Assistant Principal/Athletic Director, Pocahontas County High School	The Green Bank Observatory is nestled in Pocahontas County where community members, students, and tourists take advantage of all it has to offer. This superior science site has offered the students of Pocahontas; County opportunities and assistance in various areas. Ibis facility serves as a hands on learning site, a conference center, a post-graduation summer employment site, and assist with annual fundraising events.	Against Closure	Email and Letter - mailed	11/9/2016	201611090912.pdf
1	b	Kristy	Tritapoe	Assistant Principal/Athletic Director, Pocahontas County High School	Students of Pocahontas County High School (PCHS) have participated in multiple work experiences at the Green Bank Observatory over the years. The Forestry classes have assisted -with the removal of trees, the ground preparation and planting of new trees, and the measurement of growth for each tree. Students are developing skills, building relationships, and learning about the real-world work environment. Pocahontas County students also participate in a friendly competition during the annual science fair sponsored by the Green Bank Observatory. Once again, reinforcing communication skills, the importance of teamwork, and the opportunity for students to receive constructive criticism from experts in this field, Students from the Agriculture program at PCHS attended a conference held at the Green Bank site last year. This conference consisted of developing and implementing a program to assist our Ag department with growing and harvesting potatoes. The Ag students were responsible for planting, maintaining, and harvesting the potatoes. For this project, the Green Bank Observatory granted the use of some property in order for our students to receive funds from the selling of the potatoes. This project assisted in teaching students communication skills, work ethic, and responsibility.	Against Closure	Email and Letter - mailed	11/9/2016	201611090912.pdf
1	c	Kristy	Tritapoe	Assistant Principal/Athletic Director, Pocahontas County High School	College students often return seeking employment during the summer months, The Green Bank Observatory offers various work experiences for these students. They are able to learn basic ground maintenance skills, public speaking skills while providing tours of the site, and life saving techniques while being a lifeguard at the pool. There are also opportunities to acquire skills in painting, food service, and housekeeping on site. Over the past several years, seniors at PCHS have completed a Mentorship Project for graduation, Students at PCHS have had the opportunity to complete their Mentorship Project at the Green Bank Observatory. Seniors are able to choose a career path that interests them in and then they must obtain 40 hours of onsite experience in that pathway, The Green Bank Observatory is the perfect place to complete this project, due to its location, various level of employment opportunities, and the vested interest of the employees at the site to assist the students of PCHS with their career paths and future goals.	Against Closure	Email and Letter - mailed	11/9/2016	201611090912.pdf
1	d	Kristy	Tritapoe	Assistant Principal/Athletic Director, Pocahontas County High School	The Green Bank Observatory donates materials, staff, and funds to PCHS, Our students have benefited from generous donations that fund academic trips, post-graduation scholarships, and at times we have received various pieces of technology that have assisted with keeping PCHS up-to-date on the latest equipment being used, Staff from this site have assisted with wiring and running internet cables, the purchase and installation of new speakers at our football field and gymnasium, and assisted with the heating and cooling system at PCHS, A few years ago, PCHS implemented a Computer Science Course, the students have an opportunity to work one-on-one with an expert in this field from the Green Bank Observatory. This site also serves as a fundraising site for the PCHS Boys and Girls Track Teams with their annual Turkey Trot 5K or 10K. This fundraiser also provides a scholarship to an outstanding track athlete each year. At times, due to our isolated area, athletic teams travel from long distances to participate in games and tournaments held at PCHS. The Green Bank Observatory has graciously opened up the dorms on site for these teams to have a place to rest overnight before making the long journey back to their hometown.	Against Closure	Email and Letter - mailed	11/9/2016	201611090912.pdf
1	e	Kristy	Tritapoe	Assistant Principal/Athletic Director, Pocahontas County High School	The individuals that are employed by the Green Bank Observatory have roles on various committees that benefit the students of Pocahontas County. They serve on Local School Improvement Councils, the county Technology Committee, the local Board of Education, and they serve as announcers for our local radio station to broadcast events. Often times, individuals from the Green Bank Observatory are volunteer coaches for various athletic teams at PCHS.	Against Closure	Email and Letter - mailed	11/9/2016	201611090912.pdf
1	f	Kristy	Tritapoe	Assistant Principal/Athletic Director, Pocahontas County High School	The Green Bank Observatory provides many things to the students and staff of PCHS. It serves as a work site for students during high school, as well as post-graduation employment, an onsite work facility for our forestry and agriculture departments, and a fundraising area. They assist with overnight accommodations for various events. The individuals employed by the Green Bank Observatory serve as advisors, volunteer coaches, committee members, and general supporters of PCHS students. They are willing to donate time and effort to the educational experience and apply their expertise whenever needed. Pocahontas County High School students and staff benefit all around from the Green Bank Observatory as our partner in education.	Against Closure	Email and Letter - mailed	11/9/2016	201611090912.pdf
2		Mr. and Mrs.	Criss		To Whom it May Concern, We as citizens of West Virginia would like you to immediately give your support to the funding of the Green Bank Observatory. We feel it is of national interest and certainly an economic importance to the citizens of West Virginia. It is critical for you to act upon this immediately.	Against Closure	Email	11/9/2016	
3	a	Cynthia	Pritt	Pocahontas County High School Leadership Team	The student leadership team of Pocahontas County High School would like to express our concerns regarding the future of the Green Bank Observatory. The students of Pocahontas County Schools have had the privilege of participating in several different events and activities at the Observatory. These events include, but are not limited to: The Science Fair, Space Rumpus, tours, and the annual Turkey Trot We are strongly in favor of keeping the Green Bank Observatory, due to the benefits that it not only provides for us, but for the community and its visitors. The Green Bank Observatory has impacted our lives greatly throughout our school careers. We have had many opportunities to visit the Observatory, tour the different telescopes, and participate in the various hand-on scientific demonstrations located in the science center. This site has also served as a recreational area providing opportunities for students to go hiking, biking, swimming, and other various outdoor activities aiding our overall well-being.	Against Closure	Email and Letter - mailed	11/9/2016	201611090841.pdf
3	b	Cynthia	Pritt	Pocahontas County High School Leadership Team	The Green Bank Observatory has always had an open door policy for students to participate in Science Fairs, Mentorship Projects, Computer Science course, and star gazing activities. The Observatory has also been very supportive of our Forestry and Ag programs. Due to the limited employment opportunities in our area, the Observatory has provided positions for students during the summer months, for which we are very appreciative. Thanks to the Green Bank Observatory, Pocahontas County students have the opportunity to work with scientist that are willing to volunteer in classrooms and within the community. Our Computer Science course currently works with a volunteer from the Observatory a few times a week. As you can see, the Green Bank Observatory has played a large role in our education. We are thankful for the opportunities that we have had and hope to continue these experiences in the future. The Observatory does an outstanding job incorporating us in their activities and studies. We hope that you take this letter and use it as evidence that the work that is being done there is vital to our community and our education.	Against Closure	Email and Letter - mailed	11/9/2016	201611090841.pdf

Green Bank Observatory -Written NSF Public Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
4		Anne	Adams		Thank you for your notification. Though I can not come in person, I do desire to register my strong hope that the Observatory will be funded. It is important that we in West Virginia keep our treasures, and this one is important.	Against Closure	Email	11/9/2016	
5		Paul	Marganian		I believe that proposals to mothball or shutdown operations at the Green Bank Observatory are ill conceived and detrimental to our nation's status as a leader in science, our state's stake in cutting edge technology and education, and finally, our local economy.	Against Closure	Email	11/9/2016	
6		Paul	Marganian		I would like to give my opinion on the proposed changes to the Green Bank Observatory operations. During the 1950's, my father immigrated to the United States in part for a world-class education. At the time, our country was the center of scientific development, research and education. And so it has continued to be during my life time as well. This time last year I was in China on business. I saw a lot of interesting things on that trip, but what particularly got my attention was the investment they are making in research facilities. One day, while working in the offices of the Xinjiang Astronomy Observatory, I asked what the huge construction site next door was for: "Oh, that's our new lab". Contrast this with the proposal to shutdown or mothball operations at the Green Bank Observatory. Why are we discussing shutting down a world class research instrument like the GBT in the prime of it's life? Why are we abdicating our role as world leaders in scientific development and education? What disturbs me the most is the thought that, if my children decide to purse the best education in science and technology, will they need to immigrate to another country to do so, like my father did?	Against Closure	Email	11/9/2016	
7		Michele	Adams	6th grade science teacher	I am a WV teacher who learned all I know about EM waves at the GreenBank Telescope. I spent the best two weeks of my 25 years of professional development at the GBT and consequently took hundreds of students there over the course of 10 years. I have taken my science club there to speak to scientists about career choices, and I had a student that decided on a career in science after a student program there. She is currently at WVU and was considered for a Rhodes Scholarship. Although my school is three hours away from the GBT, it has played an important role in my education and that of my students. Please continue to fully fund this important endeavor for both science and education-related activities.	Against Closure	Email	11/9/2016	
8		James	Moran		I,James H.Moran am in total support for federal funding of Greenbank . Total support of Senator Joe Manchin in his fight for keeping in Greenbank,	Against Closure	Email	11/9/2016	
9		Jack	Bowers	Captain, U.S. Navy Retired	The National Science Foundation, I fully support the Federal Government continued funding for the Green Bank Observatory. Do not let it be destroyed or removed from West Virginia. I wish to thank Senator Manchin for allowing me the opportunity to show my support for this effort.	Against Closure	Email	11/10/2016	
10	a	Russell	Cronquist		I am a WV tax payer and advocate for the Greenbank Observatory. The reasons are manifold. • The infrastructure has immense value for a host of civil and social scientific reasons. I wish I could be at the public forum to personally articulate these benefits.	Against Closure	Email	11/10/2016	
10	b	Russell	Cronquist		• Perpetuation of the national radio quiet zone is a national security priority. This asset must be maintained and further developed. We need redundancy and diversity in our ability to monitor space-to-ground communications. Sometimes what is old is new.	Against Closure	Email	11/10/2016	
10	c	Russell	Cronquist		• The asset has huge educational value to West Virginia's youth. We should be bussing hordes of youngsters to an educational center here to inspire scientific wonderment and curiosity. The facility could be a center for science advocacy, natural history education and ecological awareness. I am an example of one who was inspired by the history of radio astronomy that is on exhibit at GBO. My 35 year carrier as a satellite engineer was in part inspired by a visit to Green Bank many years ago.	Against Closure	Email	11/10/2016	
10	d	Russell	Cronquist		• WV's coal predicament. We must join the 21st century. Developing this asset is but one element of our challenge. Why not make the GBO a demonstration project for wind, solar and energy storage technology? We need VISION here.	Against Closure	Email	11/10/2016	
11		Charlotte	Grimmett		The Greenback Observatory has been a boon to W.Va as a state, and I believe to the local community as well. I am told that it has been used by many scientists to study the heavens by even other nationalities. It would be unfortunate for it to be discarded like an old toy. Quite possibly, it could garner income to support the site by continuing tours at a more accelerated pace. While I live at a bit of a distance from the observatory, I have visited the grounds and find it quite inspiring. Good wishes for continued progress.	Against Closure	Email	11/9/2016	
12	a	Emery	Grimes	President, Pocahontas County Schools Board of Education	We, the Pocahontas County Board of Education Members are writing in regards to the environment impact study of the Green Bank Observatory (GBO). We encourage the National Science Foundation (NSF) to continue with the investment support for the science-focused operations of the GBO. The Green Bank Observatory is an educational partner of Pocahontas County Schools in many ways. Pocahontas County Schools for over the fifty years have seen our high school graduates make their employer the GBO in some facet.	Against Closure	Email	11/9/2016	SKMBT_75116110909350.pdf
12	b	Emery	Grimes	President, Pocahontas County Schools Board of Education	Here are some of the reason the Pocahontas County Board Members support the GBO: • GBO provides over \$11.5 million annual in job security to Pocahontas County. • Over 50,000 tourists visit the GBO each year. That in itself provides a high volume of tourism dollars to Pocahontas County-economic stability to a rural county. • The financial loss of not having the GBO in Pocahontas County would have a huge negative impact of Pocahontas County Schools, including loss of tax dollars and students attendance in the school system because of employees moving to find other jobs. This in turn would likely create employee reduction of Pocahontas Schools.	Against Closure	Email	11/9/2016	SKMBT_75116110909350.pdf

Green Bank Observatory -Written NSF Public Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
12	c	Emery	Grimes	President, Pocahontas County Schools Board of Education	<ul style="list-style-type: none"> Pocahontas County students collaborate with GBO during science and math projects. Pocahontas students and residents take pride that the GBO is part of their county. GBO employers for many years have been viable volunteers of Pocahontas County School projects, such as sports, band, forestry program, and science competitions. <p>We would like to provide our sincere appreciation for National Science Foundation's support of the GBO in the past and we enthusiastically ask for the continued support of the Green Bank Observatory.</p>	Against Closure	Email	11/9/2016	SKMBT_75116110909350.pdf
13	a	Ray and Mary	Ratliff		The Green Bank Observatory is both a vital contributor to science and a tremendously important part of the community of northern Pocahontas County and the surrounding area.	Against Closure	Email	11/9/2016	
13	b	Ray and Mary	Ratliff		In this very rural and somewhat remote part of West Virginia, the community of talented scientists and the associated jobs the Observatory provides to the area are essential. West Virginia has lost many once-productive areas to the changing economy, and we cannot afford to lose what is a continuing valuable partner.	Against Closure	Email	11/9/2016	
					Please do not cut funding to the Green Bank Observatory. Thank you for your consideration.				
14	a	Jeanette	Wagner	Itinerant Teacher of Special Education Pocahontas County High School	It is extremely difficult and heart wrenching to even begin to think of the negative impact of NOT having the Green Bank Observatory open and operating. I cannot tell you the countless times I have accompanied children to the facility and the pride I witnessed by their actions as they experienced the various aspects, or the number of family members I have had come stay with me from as far as New Mexico just to take a tour.	Against Closure	Email	11/9/2016	LETTER TO GREENBANK.docx
14	b	Jeanette	Wagner	Itinerant Teacher of Special Education Pocahontas County High School	Other than job loss and astrological exploration, the greatest economic loss is the benefits of having a "quiet zone". My previous employment as a Real Estate Broker allowed me the opportunity to work with folks whose primary appeal to the area was the Observatory. Without the facility being operational, Pocahontas County would no longer offer this luxury.	Against Closure	Email	11/9/2016	LETTER TO GREENBANK.docx
					To sum it up, the economic devastation to our county is immeasurable and I, personally, do not want to find out what it would mean to our county if we did not have the Green Bank Observatory. Thank you for this opportunity to express how I feel on the matter.				
15		Steve	Malcomb		Joe, I am in support of any financial support you would be able to obtain for the observatory.	Against Closure	Email	11/9/2016	
					Although I now live in Greenbrier County, I was born and raised in Pocahontas before taking employment on the Washington DC Police Department. My wife worked in Correspondence at the White House.				
					It was good to see you last night at Jim's Victory Celebration.				
16		Melinda	Gabe	SENECA Health Services, Inc. County Director of Pocahontas County	Please keep the observatory open and funded. I enjoy going there to visit with my family and hope to see this remain open for many years to come.	Against Closure	Email	11/9/2016	
17	a	Lori	Wayne		I am writing in response to the possible closing of the Green Bank Observatory and the impact this action would have on our community. The following is just a few areas that this closure would have an effect on: The Observatory provides employment for many local families.	Against Closure	Email	11/9/2016	
					Green Bank, as well as all of Pocahontas County, has very few job opportunities for men and women seeking employment. Many young people in our county are forced to move after graduation in order to find jobs.				
					Closing the Observatory will have a sever ripple down effect for our community. Loss of jobs and families moving to find work will mean loss of students for our local schools. This will cause the loss of jobs for people that are working in our school system, professionals as well as service personnel. Less people means less support for our local businesses.				
17	b	Lori	Wayne		I am writing in response to the possible closing of the Green Bank Observatory and the impact this action would have on our community. The following is just a few areas that this closure would have an effect on: Green Bank School Business Partner and Emergency Shelter.	Against Closure	Email	11/9/2016	
					The staff and their families are actively involved with school activities, afterschool activities, local Fire Department, sports, and are board members of many different county committees.				
					Green Bank, as you know, is a very rural, beautiful, special place to live. Many people cannot imagine living here without cell phone service. To the locals, this is a beautiful asset. It is a great place to raise a family, generation after generation.				
					Thank you for hearing my concerns, and as I mentioned above, this only touches on a few of them. Please consider fully funding the Green Bank Observatory as this business is vital to our community in so many ways.				

Green Bank Observatory -Written NSF Public Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
17	c	Lori	Wayne		I am writing in response to the possible closing of the Green Bank Observatory and the impact this action would have on our community. The following is just a few areas that this closure would have an effect on: Employees of the Observatory provides academic instruction/opportunities for Green Bank students in their different fields of expertise.	Against Closure	Email	11/9/2016	
18		Jo	Weisbrod		I totally support the continuance of the observatory. When relatives visit, that is the FIRST place we take them and their opinion of WV triples. It is a great source of pride and hopefully money. West Virginians CANNOT let this valuable asset go down.	Against Closure	Email	11/9/2016	
19		John	Francis		As a resident of Greenbrier County, WV, I am well aware of the importance of the observatory for the State of WV. I have visited there several times and have also met some of the staff and am aware of the excellence of the work that is done there. They have much to contribute to the education of our residents and students from all around the world. In times when science and learning are frequent targets for politicians looking for low-hanging fruit to prune in their scramble to balance the state budget, I support all those who would fight to preserve this great state asset.	Against Closure	Email	11/9/2016	
20	a	Frank	DeBerry	President & COO Snowshoe Mountain Resort	My name is Frank DeBerry and I serve as President and COO of Snowshoe Mountain Resort; a mountain resort just a few miles from the Green Bank Observatory. It is difficult to overstate the importance of the Green Bank Observatory to Pocahontas County because that importance itself is so great. As an employer, the Observatory's impact is obvious as it serves as the life's blood of the Greenbank / Edray economy. From service to science, business to education, the jobs of the Observatory are performed by the many people of Pocahontas county who very proudly fulfill their duties and who appreciate the chance to put their skills to work in a mountain community that most couldn't imagine having to leave in search of work. Further still is the Observatory's impact on tourism for an area that has become increasingly dependent upon, and has fully embraced its role as a year-round regional tourism destination. The Observatory's 50,000 annual visitors stimulate and support the entire tourism economy of the County. It's worth noting that the tourism impact itself does science good. My own nine-year-old daughter's trips to the Observatory have ignited an interest in science and has led us to share many conversations around cosmology, physics, and philosophy. As the State desperately seeks to diversify from its economic dependency on the coal and gas extraction industries that have literally fueled the US for decades, West Virginia needs and deserves more opportunities for science based education and employment. In this spirit, I truly hope that the NSF will continue to support the operation of the Observatory, and to apply the truly unique remote mountain setting towards new and expanding forms of research in all areas of science. In exchange, I'm certain that you'll not find a more loyally committed community to help you achieve your ever-changing goals.	Against Closure	Email	11/9/2016	
20	b	Frank	DeBerry	President & COO Snowshoe Mountain Resort	Beyond the direct impacts of employment is the otherwise irreplaceable gateway to science and learning that the Observatory provides to a community with few such outlets. Rural West Virginia's students and teachers simply don't have easy access to facilities that can ignite a love for science and research. The Observatory provides what is a truly unique opportunity for just that through the programs offered to a student population who might otherwise never have practical exposure to these advanced sciences.	Against Closure	Email	11/9/2016	
21		Nancy	Gillespie		The observatory is a valuable learning tool for all students in West Virginia. Please consider keeping the funding going for this resource for all of us in the area and the state. We pride ourselves in having such a fine scientific research facility. It would be devastating to lose it.	Against Closure	Email	11/9/2016	
22	a	Sarah	Guyette	Pocahontas County resident	Letter: I am writing to urge you to continue investment in the Green Bank Observatory in Pocahontas County, WV. The facility is an asset to our community and local economy as well as the scientific community. The Green Bank Observatory generates nearly \$30 million per year for the local economy. With approximately 40,000 visitors to the campus each year, it provides resources for educational programs and scientific research for people across the country. It contributes greatly to the county's tourism industry, which is depended upon by the people. According to research conducted by the West Virginia Division of Tourism, the impact of travel and tourism is greater to Pocahontas County than to any other county in the state. One out of every four jobs is generated by travel and tourism. That is the largest percentage state-wide.	Against Closure	Email	11/9/2016	Green Bank Observatory Scoping Comments.pdf
22	b	Sarah	Guyette	Pocahontas County resident	For over half a century, the Green Bank Observatory has been an active contributor to the scientific community. I hope that the National Science Foundation sees the value in continuing support for this facility.	Against Closure	Email	11/9/2016	Green Bank Observatory Scoping Comments.pdf

Green Bank Observatory -Written NSF Public Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
23	a	David	Rose		<p>I'm writing this letter in support of the Green Bank Observatory, hereafter referred to as GBO. There are a number of reasons I believe this facility should remain open at or near its current level of operations. These I will address below:</p> <p>1. Economics From an economic standpoint, the observatory plays a major role in supporting the local economy as well as small businesses in neighboring counties and the state of Virginia. Local businesses are very dependent on the spending by individuals employed by the GBO and by the GBO organization itself. Given the remote location and distances to other major shopping areas, personnel working for GBO do much of their spending locally for everything from fuels to food items and durable goods. What can't be found locally is frequently ordered and shipped here via USPS, FedEx, and/or UPS. In that respect, even global corporations and federal services benefit from the dollars generated by GBO. Some GBO employees live in Virginia. While these individuals may not spend as much in the local economies of Green Bank, Arbovale, and Marlinton, etc., they do contribute to a small extent and help support the communities of Monterey, Va. And Highland County. The last economic aspect I would like to mention comes from outside visitors. Since the completion of the Green Bank Telescope, and most recently the Robert C. Byrd Science Center, tourism to this county and this locality has increased significantly. The GBO routinely receives visitors from across the country. Many foreign tourists make a trip to the GBO as well. Tourist dollars are a significant factor in supporting many small businesses here.</p> <p>3. Tourism Suffice it to say that when your town is the home of the world's largest fully moving telescope, you become a tourist hot spot. That we are. While the Snowshoe Resort plays a significant role in the local community, the GBO attracts a lion's share of visitors as well. With tourism comes the obvious benefits of tourist dollars, but it also presents an opportunity to expose visitors to the importance of science and engineering. The GBO frequently hosts star parties to include major regional events focused on astronomy. The GBO also hosts sporting events, bike-a-thons, and cultural activities relevant to Appalachian history and the arts. The GBO is a lot more than just a collection of telescopes looking at the sky as tourists visiting the area soon find out.</p>	Against Closure	Email and Letter - mailed	11/9/2016	Environmental Impact Study Support Letter 9Nov16.docx
23	b	David	Rose		<p>2. Education The GBO is the go-to source for science and mathematics in this county and in many respects this region. The GBO frequently hosts math and science fairs for the county schools. Many GBO employees volunteer their personal time supporting these events. The GBO has many times been a host of the Governor's School of Math and Science. The GBO opens its facility to STEM activities organized by schools and higher education institutions from neighboring counties and states. GBO employees frequently serve as mentors to local school students and state universities. The GBO is a major partner in these same schools and the West Virginia University. While the sciences are the bread and butter so to speak in what's provided, trade crafts and similar skills play a role as well. School mentorship programs in the industrial arts such as welding, machining, construction, and engineering are also supported by GBO. Students wishing to focus their careers in these areas frequently seek out mentors on the GBO staff and complete their mentorship requirements at the observatory. STEM is very important to this country's future. The GBO is doing its part in supporting that.</p>	Against Closure	Email and Letter - mailed	11/9/2016	Environmental Impact Study Support Letter 9Nov16.docx
23	c	David	Rose		<p>4. Wildlife Management Given the acreage managed by the GBO, a diverse range of plant and animal life calls this their home. I believe the GBO does an outstanding job in protecting their habitat. The GBO contributes to the activities of the West Virginia Division of Natural Resources (WVDNR) through its controlled hunts program, assisting the WVDNR to manage the deer population in this area. Migratory fowl frequently make the GBO site a stopping point. Ornithology groups frequent this county and given the openness of the facility to foot traffic, make the GBO a stopping point on their trips.</p> <p>5. Agriculture Given the GBO site was originally farmland within this farming region, it was an obvious choice for a site to host a West Virginia Department of Agriculture project to promote the potato as a crop suitable for this region. That project was a major success and a step forward in helping to diversify the county and states agrarian economy.</p>	Resource Considerations	Email and Letter - mailed	11/9/2016	Environmental Impact Study Support Letter 9Nov16.docx
23	d	David	Rose		<p>6. Science Last but not least, the GBO does science. I will leave it to the trained astronomers, research scientists, and engineering specialists to make the case for maintaining the GBO as the world renowned facility for radio astronomy that it is. Suffice it to say that the GBO hosts the world's largest, most sensitive radio telescope. It's service life is far from over. Its contributions to science and technology have only begun. It's a telescope and facility that's usefulness to this country goes far beyond scientific study. Thank you for the opportunity to make my personal case for the continued operation of the Green Bank Observatory.</p>	Against Closure	Email and Letter - mailed	11/9/2016	Environmental Impact Study Support Letter 9Nov16.docx
24		Michael	Sweeney		<p>My opinion is that the Greenbank Observatory is a "Too Big To Fail" organization for this region in West Virginia. The Socio-Economic value and specific scientific applications this facility provides is an advantage for at the very least, a Self-Sustainability Action Plan that would enable an opportunity to prove the portion of marketable services and community outreach in education this facility provides to the whole state of West Virginia, as well as the indirect benefits provided through commerce brought on by GBO's presence.</p>	Against Closure	Email	11/9/2016	
25		Francis	Hughes		<p>I have had an association with the Green Bank Observatory for the last 45 years with professional and amateur communications. The personnel at the Observatory have always been very competent, knowledgeable, helpful and always extremely gracious. I have worked on a variety of projects, such as licensing for 2-way radio systems thru my employment with West Virginia Wesleyan College and the West Virginia Department of Highways. I am aware of the very advanced technology that Green Bank uses and the very sensitive issues they have to deal with on a daily basis. The Green Bank Facility is a shining star in the field of technology, educational and scientific studies performed there. The continuation of funding for this facility is greatly needed to continue the studies and preserve the observatory for future generations.</p>	Against Closure	Email	11/9/2016	
26		Louis	Hart		<p>Deconstruction and restoration of the great and historic observatory would be a painful and tragic course of action. One of my concerns is that the 'radio quiet' zone itself would be lost. My understanding is that it is the only one on Earth.</p>	Against Closure	Email	11/9/2016	

Green Bank Observatory -Written NSF Public Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
27		Mary	Dailey		I would like to express my support for the continuation of Green Bank Observatory which is of vital educational, cultural, and economic value to West Virginia. This is an example of the kind of project we need to grow in our state to replace coal (which is on the decline) as an employer, tourist attraction and important educational resource for our children.	Against Closure	Email	11/9/2016	
28	a	Jared	Keown	Graduate Student	Growing up in a rural town in western Kentucky, my exposure to science and technology was limited as a child. By the time I graduated high school, I knew little about careers in the STEM fields (science, technology, engineering, and mathematics) and had no interest in pursuing them due to my lack of awareness. It wasn't until I enrolled in an introductory astronomy course during my first semester at university that I discovered astrophysics was my true passion. That passion motivated me to obtain my bachelor's degree in physics and begin my PhD in astronomy. Unfortunately, my path into STEM is undoubtedly the exception for students growing up in rural towns similar to mine. Many young adults in those areas never consider a career in science because it seems distant and out-of-reach from their remote communities. Facilities like the Green Bank Observatory provide a beacon of opportunity to the students of Appalachia by bringing world-class scientific research and education to their doorstep. For this reason, it is imperative the Green Bank Observatory remains in operation. It is no secret that rural states and commonwealths, such as West Virginia and Kentucky, must adapt to changing trends in global energy consumption and manufacturing to prevent future economic hardships. To do so requires a well-trained workforce that is adept in the STEM fields. In order for this change to occur, we must start with the education and inspiration of our youth. We must show children from rural regions that careers in science and technology are exciting and urge them to think outside the confines of their sheltered environments. When children from my home state are asked what they want to be when they grow up, we should be hearing a higher fraction provide responses such as: "Computer Programmer," "Chemist," "Environmental Engineer," or "Astrophysicist." The Green Bank Observatory serves as a stimulus that helps promote that message to our youth.	Against Closure	Email	11/9/2016	
28	b	Jared	Keown	Graduate Student	In addition to the Observatory's positive impact upon the future of its surrounding communities, it is also host to some of the most cutting-edge scientific instruments being used in modern radio astronomy. The 100-meter collecting dish of the Green Bank Telescope, combined with its advanced array cameras, allow it to be one of the best facilities in the world for quickly mapping faint high frequency radio emission sources both within and outside our Galaxy. The telescope is also poised to remain a world-class research facility in the future since new instruments can be readily added to it at minimal costs. Investment in the Green Bank Observatory is an investment in both the youth of Appalachia and the forefront of scientific discovery. Therefore, I strongly urge the National Science Foundation to continue its funding of the Observatory for both scientific research and educational outreach. It would be a shame to allow such a productive facility, and source of scientific pride for Appalachia, to be left by the wayside.	Against Closure	Email	11/9/2016	
29		Steve	Issenberg		The observatory is an important economic asset for the region. The roughly \$8 million annual NSF investment in this facility generates nearly \$30 million every year for the local economy	Against Closure	Email	11/9/2016	
30	a	Art	Glick		I am writing as both a citizen scientist and a West Virginian about NSF's plans for the Greenbank observatory I have heard that decommissioning is a possibility, and it boggles my mind that people that call themselves scientists could possibly be so short-sighted. I have to assume that such a foolish alternative is only offered to make the others look better. The GBT is a unique key asset to the astronomical community. We need more such facilities, not less, and if the NSF is really about science, it should restore its fullest funding. The fact that roughly 3-4 hours are requested for each hour of time available for science on the GBT is evidence enough of its need and importance.	Against Closure	Email	11/9/2016	
30	b	Art	Glick		And you won't find an area of the country more in need of the economic support that such a facility provides, either, so there's a double benefit.	Against Closure	Email	11/9/2016	
31	a	James	Shuman	Associate Professor of Education, Emeritus	My Credentials to Comment I first came to the NRAO 53 years ago, as a delegate from the State of Iowa to the first annual National Youth Science Camp in 1963. The annual camp, held just up the road from Green Bank, is one of the nation's premier honors programs for just-graduated high school seniors with potential for entering careers in science, technology, engineering, and mathematics, and it has maintained an active partnership with the NRAO every year since then. In fact, one of the big reasons it was held there was to highlight the NRAO as a scientific research facility in this very special region of the State of West Virginia. As a graduating high school senior from Iowa, I had expressed an interest in astronomy since I was a youngster, and I was headed to college in major in Astronomy. Two things stood out to me upon visiting the NRAO for the first time: 1) the facility itself inspired ideas about entirely new types of discoveries to be made about the universe (things most of us had never even considered before), and 2) we were given opportunities to hear and talk with some of NRAO's most highly regarded astronomers and technologists at the time (people like Frank Drake, David Hogg, and Sebastian von Hoerner, all of whom were downright inspirational to us at the camp in 1963). But for me, it didn't end there. I returned to the Science Camp as a counselor each summer during my four years in college, visiting the observatory again and again. In 1966, I even lived at the NRAO for three months while serving as a summer intern there, one of three former Science Campers to do so that year. I interned with T. K. Menon, assisting him and Ken Kellerman on their initial research on quasars, which at the time were entirely new and quite unknown. While at NRAO that summer, I met other astronomers, especially Gart Westerhout and Frank Kerr from the University of Maryland as they worked on mapping the Milky Way on the 21 cm wavelength using the old 300-foot telescope. They encouraged me to come to Maryland for graduate work with them after college, which I did. It was only after my time there that I went into school teaching, and eventually on to a doctoral degree in education at West Virginia University and a career in science education and teacher education. However, even all this didn't end my time with the National Youth Science Camp, nor with the NRAO. I returned to the staff of the Science Camp in the 1970s and 1980s, becoming the camp's fourth Director in 1986 and 1987. NRAO continued to partner with the Science Camp throughout those years, providing lectures, tours, and even research and observing sessions - all predecessors to what is now called informal STEM education. And the partnership continues today, as over 5,000 Science Camp alumni have now visited NRAO and been inspired by it. Many of these people have become well-known scientists themselves; and many of them can recall the influence that NRAO had on their subsequent learning, careers, and dreams. The value of the NRAO can't be underestimated for its contribution to their progression into the top levels of the STEM pipeline. Research on our alumni has shown that the Science Camp was a significant factor in reinforcing their progression into further STEM education and STEM careers, and the NRAO has played an important role in this, and it continues to do so today.	Against Closure	Email	11/9/2016	Comments for the GBO Scoping Meeting - Shuman 11-9-2016.docx

Green Bank Observatory -Written NSF Public Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
31	b	James	Shuman	Associate Professor of Education, Emeritus	<p>NRAO's Expanded Partnership with the NYSF in the 21st Century</p> <p>In the past decade, the National Youth Science Foundation not only continues to operate the annual National Youth Science Camp and partner with the NRAO for that program, but the foundation has also operated other informal STEM education programs with NRAO for younger high school students. In particular, from 2005-2014, the NRAO and the foundation together operated the West Virginia Governor's School for Mathematics and Science each summer. The program was held in Green Bank, where students from across the state lived in the bunkhouse and interacted with the NRAO professional staff in the same kinds of ways that happened for the National Youth Science Campers each summer. Validated and reliable research on the Governor's School has showed that the Governor's School at NRAO was highly effective for the scores of high school students lucky enough to attend throughout all those years.</p> <p>And now these days, the National Youth Science Foundation continues to operate the Science Camp for some of the nation's top high school graduating seniors, and it also has new plans to operate camps both for high school students and for middle-school students, not only from West Virginia school districts but also from nearby states. GBO continues to fit right into the foundation's plans, and mothballing or deconstruction of the facility would deprive literally hundreds and hundreds of students each year the opportunity to be inspired about science and to learn about astronomy at Green Bank.</p> <ul style="list-style-type: none"> • As an educational facility, GBO already has a solid reputation among college professors, high school teachers, and their students throughout the secondary and post-secondary levels. At a time when the nation's STEM pipeline is still so restricted, decommissioning GBO runs entirely counter to the nation's needs for STEM education. • GBO has effective educational partnerships, not only with the National Youth Science Foundation but with many other educational organizations and agencies. Many of these entities would suffer with GBO's mothballing or decommissioning. 	Against Closure	Email	11/9/2016	Comments for the GBO Scoping Meeting - Shuman 11-9-2016.docx
31	c	James	Shuman	Associate Professor of Education, Emeritus	<p>Five Reasons to Continue Operating the GBO</p> <p>Beyond the importance of NRAO's long partnership with the National Youth Science Foundation in STEM education, there are other important reasons to continue to operate the GBO due to its unique qualities as a center for research and for education:</p> <ul style="list-style-type: none"> • Unlike any other radio astronomy facility, GBO is situated within 500 miles of most major cities in the eastern United States. Travel here is much more possible for more than one half of the entire U.S. population of researchers, students, and teachers. It is situated just a few hours' drive from the nation's capital in Washington, DC, far closer than any other radio astronomy facility of its scope or promise. In short, the Green Bank Observatory has logistic potential as a unique research center and as a unique education center for much of the US population. • The Green Bank Telescope itself has unique capabilities in terms of wavelength and accuracy that few other radio telescopes in the world possess. These capabilities promise types of research that cannot be accomplished elsewhere easily. Much of the telescope's promise isn't even realized yet. 	Against Closure	Email	11/9/2016	Comments for the GBO Scoping Meeting - Shuman 11-9-2016.docx
31	d	James	Shuman	Associate Professor of Education, Emeritus	<ul style="list-style-type: none"> • The establishment of the NRAO radio-quiet zone almost 60 years ago has created a unique and endangered kind of place, unlike any other in the eastern U.S. Its influence goes far beyond simply meeting the research needs of radio astronomers. And this isn't just for the EMF-phobic individuals who have discovered it to be a haven for their needs. The zone has created and maintained a region of exceptional peacefulness, natural abundance, pastoral beauty, and recreational opportunity that is difficult to match throughout any of the states east of the Rocky Mountains. To abandon the quiet-zone designation it would be to deny a major segment of the U.S. population the opportunity to experience the area's particular charm and appeal, thereby impacting the region's potential for tourism and economic stability. Removing the designation would be akin to taking a protected species off the list. Not only could it endanger a place that currently has unique characteristics, but would it would also inflict one more affront to our community psyche about the protection of special places in an increasingly hectic world. It shouldn't happen. As a person who has lived and worked with the NRAO for decades, and for all the additional STEM-related reasons stated above, I urge the committee to recommend the "no action" alternative of continued investment in science-focused operations at the Green Bank Observatory. Any other decision would be an irreparable mistake. 	Against Closure	Email	11/9/2016	Comments for the GBO Scoping Meeting - Shuman 11-9-2016.docx
32		Mike	Snyder	Retired teacher and USMCR veteran	<p>As a retired educator I strongly urge that Green Bank be left open. It represents the best efforts of the scientific exploration of outer space not only for our nation, but for the state of West Virginia as well. It is also an important economic asset to the rural Appalachian county in which it is located.</p> <p>The observatory is a neighbor to the National Youth Science camp where the top science scholars from each of the 50 states come together each summer for a week to share their visions into the future of scientific pursuit by the United States. Their proximity in this beautiful mountain setting enhances both of these important entities.</p> <p>The returns for the comparatively small operating budget of the observatory are major accomplishments by any yardstick.</p>	Against Closure	Email	11/9/2016	
33	a	Ricky	Sharp	Principal, Green Bank Elementary/Middle School	<p>As Principal of Green Bank Elementary Middle School, I would formally like to express my concerns over the removal of funding for the GBO by the National Science Foundation. It is my understanding that the NSF is completing an environmental impact study to determine the impact of the proposed changes to the GBO operations. The proposed changes will greatly impact my school as a whole, as our relationship with the GBO goes well beyond our long-term educational partnership. The following is a list of duties and responsibilities that the GBO completes for our school:</p> <ul style="list-style-type: none"> • The GBO staff instructs STEM classes for the student body. <p>As you can see, the GBO is very active in the education of our students and within our community as a whole. Please strongly consider your actions, before removing your funding. Through my personal experience with this organization, I know how deep their roots run within this community. I have realistic fears that your proposed actions, may very well destroy the foundation that this community has built upon since the construction of GBO. Without this well built foundation, I fear that our community, as a whole, will eventually cease to exist.</p>	Against Closure	Email	11/9/2016	letter for the GBO.doc

Green Bank Observatory -Written NSF Public Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
33	b	Ricky	Sharp	Principal, Green Bank Elementary/Middle School	<ul style="list-style-type: none"> • With the remote location of our school and the size of our student body, the GBO facilities are the only logical location for our emergency evacuation location. • The GBO assisted with the purchase of our emergency radios and assists with any repairs of these devices. 	Against Closure	Email	11/9/2016	letter for the GBO.doc
33	c	Ricky	Sharp	Principal, Green Bank Elementary/Middle School	<ul style="list-style-type: none"> • 16 students (about 6%) of the student body are the sons or daughters of GBO staff. • Members of the GBO staff are active members in the local school board, Local School Improvement Councils, School Calendar Committee, Title I Committee, and serve on the 5yr Strategic Planning Committee. • The GBO staff serves as judges for all of our school fairs; science, social studies, and literacy. • GBO staff has served as tutors for struggling students. • They allow the use of their facilities for county competitions (Math Field Day, Science Fair, and Social Studies Fairs). • The GBO allows use of the facilities for recreation and support of school fundraisers. • The GBO supports the school by offering student incentives at their facilities. This is a huge cost savings to the school due to not having to travel to distant locations that charge fees for use of their facilities. • The GBO staff supports outdoor education and has allowed the creation of a wetland on GBO property. • The GBO supports staff recognition and allow use of the facilities for staff functions. • A large number of the staff use the StarLight Café for lunch. • In addition to the repairs of the emergency equipment the GBO staff also donates their time to complete repairs to PE equipment, electronic equipment, and even school furniture. 	Against Closure	Email	11/9/2016	letter for the GBO.doc
34	a	Greg	Morgan	Local School Improvement Council of Green Bank Elementary Middle School , Co-Chairman	<p>The Local School Improvement Counsel of Green Bank Elementary Middle School, would like to express our concerns over the removal of funding for the GBO, by the National Science Foundation. It is our understanding that the NSF is completing an environmental impact study to determine the impact of the proposed changes to the GBO operations. The proposed changes will greatly impact GBEMS. Mr. Sharp, the Principal of our school, has shared the following concerns with the committee and is worried about the impact that the proposed actions would force upon the school. We too share his concerns and worry about how we would fill the void without the continued assistance from the GBO.</p> <ul style="list-style-type: none"> • The GBO staff instructs STEM classes for the student body. <p>The GBO is very active in the education of our students and within our community as a whole. Please strongly consider your actions, before removing your funding. We as the LSIC committee are worried about the fallout from your actions. We ask that an alternative long term solution be proposed that adequately addresses the issues.</p>	Against Closure	Email and Letter - mailed	11/9/2016	letter for the GBO LSIC.doc
34	b	Greg	Morgan	Local School Improvement Council of Green Bank Elementary Middle School , Co-Chairman	<ul style="list-style-type: none"> • With the remote location of our school and the size of our student body, the GBO facilities are the only logical location for our emergency evacuation location. • The GBO assisted with the purchase of our emergency radios and assists with any repairs of these devices. 	Against Closure	Email and Letter - mailed	11/9/2016	letter for the GBO LSIC.doc
34	c	Greg	Morgan	Local School Improvement Council of Green Bank Elementary Middle School , Co-Chairman	<ul style="list-style-type: none"> • 16 students (about 16%) of the student body are the sons or daughters of GBO staff. • Members of the GBO staff are active members in the local school board, Local School Improvement Councils, School Calendar Committee, Title I Committee, and serve on the 5yr Strategic Planning Committee. • The GBO staff serves as judges for all of our school fairs; science, social studies, and literacy. • GBO staff has served as tutors for struggling students. • They allow the use of their facilities for county competitions (Math Field Day, Science Fair, and Social Studies Fairs). • The GBO allows use of the facilities for recreation and support of school fundraisers. • The GBO supports the school by offering student incentives at their facilities. This is a huge cost savings to the school due to not having to travel to distant locations that charge fees for use of their facilities. • The GBO staff supports outdoor education and has allowed the creation of a wetland on GBO property. • The GBO supports staff recognition and allow use of the facilities for staff functions. • A large number of the staff use the StarLight Café for lunch. • In addition to the repairs of the emergency equipment the GBO staff also donates their time to complete repairs to PE equipment, electronic equipment, and even school furniture. 	Against Closure	Email and Letter - mailed	11/9/2016	letter for the GBO LSIC.doc
35		Patricia	Lally	Physician	<p>I, among others in our state, am proud of the world renown scientific research that occurs at Green Bank Observatory. The contributions to the scientific and educational communities are great. "For over half a century, the observatory has contributed to West Virginia's scientific, educational and economic well-being. The observatory is the largest scientific asset in our state and an important economic engine in the region. The observatory is an important economic asset for the region. The roughly \$8 million annual NSF investment in this facility generates nearly \$30 million every year for the local economy."</p> <p>In the 28 years that I have lived in WV, I have visited the Observatory many, many times -- trying to tour most summers myself and always to showcase for out of town guests. I care about Green Bank.</p> <p>Please find continued scientific and educational partnerships for the Observatory. Help create and sustain a community respectful and desirous of learning & science, research and achievement for our citizens especially our youth. This is paramount now more than ever given the great hopelessness and lack of educational & employment opportunities that face our young West Virginian's and their families.</p>	Against Closure	Email	11/9/2016	

Green Bank Observatory -Written NSF Public Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
36	a	Susan	Herold		I am writing out of concern for the proposed changes to the operation of Green Bank Observatory. Green Bank Observatory is an essential part of the local community for its contributions in the areas of education, socioeconomic, health and safety. In addition to all of the above items, loss or even continued funding reduction to the Green Bank Observatory would also have a significant impact on the local school system in two ways – loss of student population could greatly reduce the relevancy of the Green Bank Elementary Middle School, and partners and spouses of Observatory employees make up a significant percentage of educators within the county school system.	Against Closure	Email	11/9/2016	
36	b	Susan	Herold		Contributions from the Green Bank Observatory to this community include: <ul style="list-style-type: none"> • Internships for local high school students, my own son participated in this program a number of years ago. • Teaching and tutoring in advanced mathematics and programming class • Annual support and volunteers (GBEMS and PCHS Career Days; Read Aloud; Literacy Fair judges 	Against Closure	Email	11/9/2016	
37		Phyllis			After spending sooooo much money on the observatory, why close it down NOW? It seems such a waste. AND, was there sufficient information obtained over the past many years to warrant its continued use? It seems such a waste of time, money and effort to close it. IF there was NO information obtained then why has it been used for the past many years?? Someone somewhere surely has correct information as to Greenbanks use and livelihood? And, if I recall the information, it was situated where it is so as to have a low noise environment, yes? Think of the waste of THAT and probably more than I can think of???	Against Closure	Email	11/9/2016	
38	a	Susan	Herold	Library Media Specialist, Green Bank School	I am writing out of concern for the proposed changes to the operation of Green Bank Observatory. Green Bank Observatory is an essential part of the local community for its contributions in the areas of education, socioeconomic, health and safety. In addition to all of the above items, loss or even continued funding reduction to the Green Bank Observatory would also have a significant impact on the local school system in two ways – loss of student population could greatly reduce the relevancy of the Green Bank Elementary Middle School, and partners and spouses of Observatory employees make up a significant percentage of educators within the county school system.	Against Closure	Email	11/9/2016	
38	b	Susan	Herold	Library Media Specialist, Green Bank School	Contributions from the Green Bank Observatory to this community include: Serving on school and school board committees (10 year planning committee; 5 year strategic planning committee; Superintendent’s Advisory Committee; Local School Improvement Council (GBEMS, PCHS); Title IV Committee (GBEMS))	Against Closure	Email	11/9/2016	
39	a	Elizabeth	Brown Lockman	Resident	I am a resident of Pocahontas County, West Virginia, a taxpayer, and, perhaps most importantly, a person who is deeply concerned about the United States' future as an intellectual presence on the world stage. As such, I am dumbfounded by the wastefulness and myopia evidenced by what I see as the National Science Foundation's determination to close down the Green Bank Telescope and Observatory. As an astronomer's spouse, I have spent enough time in the company of scientists and other academics to recognize the disingenuousness of alternative Number Two. Exactly how "reduced" is the "reduced NSF funded scope" projected to be? If the reduction is substantial, as I suspect it is, the Green Bank Observatory might as well hold bake sales as bleed itself dry through the endless pursuit of the funding alternative Number Two represents. It might take five years, it might take more, but realistically speaking, the inevitable outcome of alternative Number Two is the annihilation of the Green Bank Observatory. Money is always an issue. Fiscal restraints are a reality. Apparently, so is profligate waste. The Green Bank Telescope is a state-of-the-art instrument currently served by a fully functional Observatory staffed by talented and experienced people. To discard a world-class instrument, to dismiss the potential of the countless scientific discoveries for which the GBT might well be either the best or the only instrument, is so wasteful, so blind to the interests of this country and its scientific community that it seems unworthy of NSF and its mission. That's why I can't help but wonder if other considerations, perhaps of a personal or political rather than an academic nature, were in play when the proposals were made. If there is a chance that I may be right in this, I trust that appropriate steps will be taken. I strongly support Number One, "continued NSF investment for science-focused, no- action alternative," which I understand to mean full funding of the Green Bank Observatory by the National Science Foundation.	Against Closure	Letter - mail	11/9/2016	
39	b	Elizabeth	Brown Lockman	Resident	In reference to the "five preliminary proposed alternatives for the GBT" as cited in the November 3, 2016 edition of The Pocahontas Times, alternatives Numbers Four and Five speak for themselves. Number Three, "operation as a technology and education park," is a travesty of and an affront to the Observatory's unique educational outreach program and its well-documented success. The students who come to the Observatory find the experience intellectually stimulating because it gives them the opportunity to see, and even work alongside, professional scientists, engineers, and computer specialists actually doing their jobs in real time at an active, internationally respected scientific facility. In this, the Green Bank Observatory is of inestimable value. It's also a very far cry from "a technology and education park." My eyes glaze over with boredom at the very thought. Yours probably do, too.	Against Closure	Letter - mail	11/9/2016	
40		Andrew	Morgan		I feel this project should continue to do this work as intended for space exploration	Against Closure	Email	11/9/2016	
41		Unnamed		West Virginia Citizen	After listening for ET for 60 years and no results! Isn't Green Bank Observatory pointless?	For Closure	Letter - mail	UNK	

Green Bank Observatory -Written NSF Public Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
42	a	Charles	Herr		<p>This is my response to the loss of funding from the National Science Foundation for the Green Bank Observatory. I am a resident of West Virginia. I for one feel that this loss of funding and possible closure of GBO, is a big mistake!! There is more at stake then just the funding of GBO. If funding is lost and the Observatory closes it will have profound effect on those that are employed at GBO plus those that receive income from the tourism business in Pocahontas County. Including the economic impact to the tax base of the County and West Virginia Tourism.</p> <p>It would also be fiscally irresponsible to close or dismantle the Observatory after all of the funds that of been spent on building and rebuilding the Observatory since it's beginning.</p> <p>I do not know all of the science that has occurred or the discoveries that have been made at the Observatory but I do know that it has been beneficial to humanity in some way.</p>	Against Closure	Email	11/9/2016	
42	b	Charles	Herr		<p>As for educational opportunities. By having a facility as the Observatory in eastern West Virginia that is close to Colleges, Universities and secondary schools that are in driving distance of many these schools in Eastern states. It gives these students a real chance to observe and learn a form of astronomy directly. What they learn can spark a students interest in Astronomy or other sciences and engineering.</p> <p>The only thing left I can say please fund the Green Bank Observatory and do not close the Observatory.</p>	Against Closure	Email	11/9/2016	
43	a	Majid	Jaridi	Director, NASA West Virginia Space Grant Consortium	<p>At the fall meeting of the Board of Directors of the NASA West Virginia Space Grant Consortium, composed of representatives from 12 colleges and universities and several high tech companies in West Virginia, the Board authorized and approved the submission of this letter of support for the Green Bank Observatory. List of our academic and non-academic affiliates may be found at the bottom of this page.</p> <p>The importance of this facility to science and the state of West Virginia simply cannot be overstated. The science is fascinating and cutting-edge. The Green Bank facility has the world's largest fully steerable radio telescope which is used to detect faint signals from celestial sources. As you know, the Green Bank Telescope (GBT) is one of NSF's newest large telescopes and remains at the cutting edge of astronomy, making ground breaking discoveries in fields as broad as quantum mechanics, the study of gravity, and the search for life beyond Earth. Recently the Russian billionaire Yuri Milner, who was joined on-stage for the announcement by Stephen Hawking, gave \$100 million to UC Berkeley to search for alien life - whether one "believes in aliens or not" this is an incredible private investment in science and the telescopes at Green Bank Observatory are one of only two facilities in the world that can be employed to search for these long range communications. News articles on the gift cite the fact that monetary resources such as this were needed by researchers because the telescopes are in such high demand, that previously they could only get on them 1.5 days per year.</p> <p>We humbly request that you continue to provide the maximum support possible to Green Bank Observatory and remove the untenable and truly unthinkable options of mothballing or deconstruction off the table. Instead of discussing these options, we should be discussing how to elevate the facility back to a national lab status. Green Bank Observatory is truly a national treasure and the best in the entire world.</p>	Against Closure	Email and Letter - mail	11/1/2016	letter of support for Green Bank Observatory.pdf
43	b	Majid	Jaridi	Director, NASA West Virginia Space Grant Consortium	<p>On a more traditional front, the telescopes are the best in the world at detecting fast radio bursts which enable one to find pulsars. Recently several high school students who are part of the Pulsar Search Collaboratory, discovered 6 new pulsars. One student described this experience as "a once in a lifetime experience"; another student got the opportunity to explain pulsars to President Obama at the White House. One can imagine the sense of accomplishment and affinity to science that these students felt - to have made such an amazing discovery as only high schoolers. Their find was recently immortalized in a documentary film called "little green men" (http://lgmfilm.com/). One of our Board members directed a summer science academy for high school students for 15 years in another state and said " If I had easy access to such an amazing scientific resource, I am confident I could have kept 98% of my students as STEM majors and the 2% I did not would have become fans of science for their whole lives."</p>	Against Closure	Email and Letter - mail	11/1/2016	letter of support for Green Bank Observatory.pdf
43	c	Majid	Jaridi	Director, NASA West Virginia Space Grant Consortium	<p>Every year, over 50,000 visitors and 3,500 students get a chance to experience the scientific wonder that is Green Bank Observatory. In addition to needing this facility for the science, the economic impact of Green Bank Observatory on the state is immense -30 million dollars per year. As you are aware, WV is a state in desperate need of economic diversity and development -Green Bank Observatory is a perfect example of the type of opportunity that changes lives. It is also an example of the best America can be - not only does it contribute to innovation and economic prosperity - it has built a community; one that sacrifices modem conveniences like garage doors openers and cell phones for the good of everyone.</p>	Against Closure	Email and Letter - mail	11/1/2016	letter of support for Green Bank Observatory.pdf
44		David	Romine		<p>For over half a century, the Greenbank observatory has contributed to West Virginia's scientific, educational and economic well-being. The observatory is the largest scientific asset in our state and an important economic engine in the region. Please consider this when you plan to change it status for a place and people who so much depend on this fact , for their livelihood.</p>	Against Closure	Email	11/9/2016	

Green Bank Observatory -Written NSF Public Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
45	a	Jan	Taylor	Director, Division of Science and Research, West Virginia Higher Education Policy Commission	<p>This letter is to express the support of the West Virginia EPSCoR office and its administrative agency, the West Virginia Higher Education Policy Commission's Division of Science and Research, for the Green Bank Observatory (GBO). In fact, I urge funding at the highest possible level.</p> <p>First and foremost, research conducted at Green Bank could quite plausibly transform our understanding of the universe. In addition, the Green Bank Telescope (GBT) is one of National Science Foundation's (NSF) newest large telescopes and remains at the cutting edge of astronomy, making groundbreaking discoveries in fields as broad as quantum mechanics, the study of gravity and the search for life beyond earth.</p> <p>It is our opinion that it would be fiscally irresponsible to shut down the GBO because it is the focus of several current projects - funded directly by the NSF. In fact, just last year, the NSF awarded West Virginia EPSCoR a highly-competitive \$20 million Research Infrastructure Improvement (RII) grant which supports basic and applied research in gravitational wave astrophysics focusing on early universe cosmology and galaxies.</p> <p>The GBO is integral to the Nanohertz Observatory for Gravitational Waves, or NANOGrav, founded in 2007. As you may be aware, NANOGrav is a consortium of more than 50 researchers at 12 institutions and international liaisons in 11 countries. In 2015, NANOGrav received a five-year, \$14.5 million grant from the NSF. As part of this grant, NANOGrav was designated a Physics Frontier Center. The mission of the Physics Frontier Center is to "enable transformative advances in the most promising research areas." I believe the GBO remains one of the world's most promising research facilities.</p> <p>Cutting edge research happens at Green Bank which puts West Virginia and the United States at the forefront of international, collaborative, trailblazing science. In fact, the GBT is just as cutting edge as it was when it first began operating in 2001 because it has been continuously updated and improved by the scientists and engineers who work there. As you may recall, in December 2015 scientists at WVU used the GBT to help uncover the most detailed record ever of a Fast Radio Burst (FRB) - the results of which were published in the prestigious journal, Nature.</p> <p>In addition, ceasing science operations at the GBO will directly impact the careers of more than 900 astronomers in the United States, including many who are just entering the field. This number is based on the number of scientists in the nation who submitted formal requests for research time on the GBT in the last year alone.</p>	Against Closure	Letter - mail	11/9/2016	
45	b	Jan	Taylor	Director, Division of Science and Research, West Virginia Higher Education Policy Commission	<p>The GBO is a highly-critical component of this research, which will bolster the Science, Technology, Engineering and Math (STEM) workforce in our nation by providing specialized training in signal processing and electronics design techniques. In addition, just this year, West Virginia University (WVU) received a \$578,000 grant from NSF to provide high school teachers with research experiences using the radio telescopes at the facility.</p>	Against Closure	Letter - mail	11/9/2016	
45	c	Jan	Taylor	Director, Division of Science and Research, West Virginia Higher Education Policy Commission	<p>GBO is also a unique source of distinction for this region of the country. Not only does it bring in an estimated \$30 million annually in economic benefit to West Virginia, it also is the home of the National Radio Quiet Zone which makes the GBT one of the most sensitive radio telescopes in the world. The National Radio Quiet Zone was established by the Federal Communications Commission in 1958 to minimize possible harmful electromagnetic interference to the National Radio Astronomy Observatory. It encloses a land area of approximately 13,000 square miles near the state border between Virginia and West Virginia.</p> <p>Should you have any questions regarding this endorsement of the Green Bank Observatory, please do not hesitate to contact me.</p>	Against Closure	Letter - mail	11/9/2016	
46	a	Rhonda	Hamm	Board Certified Psychiatrist	<p>I wanted to express my strong concerns about the need to keep the Greenbank Observatory operational in Greenbank, West Virginia. This is a very impoverished area. West Virginian's need to have more opportunities to see science and technology than probably any other state. This facility gives children of the region many opportunities to see science in action. The facility's technology, the dedication of staff there to their science, and, most importantly, the incredible educational opportunities for students across the state make this invaluable to our state. . Our state takes enormous pride in the scientific research of the observatory and I want us to preserve the observatory for future generations. For over half a century, the observatory has contributed to West Virginia's scientific, educational and economic well being. The observatory is the largest scientific asset in our precious state and we need its positive impacts on our state for years to come. I want to help save this important facility. West Virginia strongly cares about Green Bank.</p>	Against Closure	Email	11/9/2016	
46	b	Rhonda	Hamm	Board Certified Psychiatrist	<p>In addition, the observatory is an important economic asset for the region. The roughly \$8 million annual NSF investment in this facility generates nearly \$30 million every year for the local economy. In this extremely poor state, we need this opportunity.</p>	Against Closure	Email	11/9/2016	
47		Joe	Tekel		<p>My name is Joe Tekel from Elkins, WV and I feel very strongly about supporting the mission of the Green Bank Observatory. This facility is an outstanding feature having national significance. Anyone in or out of WV interested in outer space science realizes the value of the observatory in promoting a better understanding of the universe.</p> <p>I am in favor of the following alternative: Continued National Science Foundation investment for science-focused operations.(No-Action Alternative)</p>	Against Closure	Email	11/9/2016	

Green Bank Observatory -Written NSF Public Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
48	a	Carolyn	Postelwait		To Whom it May Concern: It was brought to my attention by Senator Joe Manchin that the Green Bank Observatory is in danger of having it's funding cut. This is completely unacceptable. West Virginia already trails in education and revenue. We can't afford to fall any further behind! Our children are the future and if we aren't willing to invest in them, then we are in a sad state. I have personally visited the Green Bank Observatory and I was VERY impressed with all that I learned. The staff there do a fantastic job at educating and answering any questions that visitors may have. They are all very friendly and skilled in their jobs.	Against Closure	Email	11/9/2016	
48	b	Carolyn	Postelwait		With all the recent loss of revenue in our state due to the coal mines being shut down, do we honestly need to put any more hard working Americans out of a job??? I think not!!! Thank you for taking the time to read my letter. Please don't hesitate to contact me if I can offer anymore input on this situation. I can be reached at cpostelwait@yahoo.com, Carolyn Postelwait HC 73 Box 3 Valley Head, WV 26294, or (304) 339-3322.	Against Closure	Email	11/9/2016	
49	a	Adam	Taylor	Community Member/Small Business Owner	I am concerned that the socioeconomic impacts of alternative 3-5 will not be taken seriously due to the low population in this area. The amount of GBO employees living in our area has a very extreme direct impact on all of our small businesses. The tourism that GBO currently provides for Pocahontas County is tremendous. This tourism brings money from outside our community and enhance the reach for small businesses like mine. I also have concerns that NSF pulling funding from this site and using that to fund the construction of new facilities is an economic catastrophe. I too work for the Federal Government and tightening funding is not an option now it is a must. So saving eight to eleven million dollars per year and allowing a multi-billion dollar site to fall to the wayside is fiscal irresponsibility.	Against Closure	Letter - mail	11/9/2016	
49	b	Adam	Taylor	Community Member/Small Business Owner	I also feel that the historic value of the numerous telescopes is significant to mankind. Many break throughs in modern science were derived right here in Greenbank, West Virginia and with options 3-5 that history could be lost and/or forgotten.	Against Closure	Letter - mail	11/9/2016	
50		Janet	Ghigo		The history of the development of Emergency Medical Services (EMS) in Pocahontas Co, WV, is closely tied to the presence of the National Radio Astronomy Observatory in Green Bank. ... Early EMTs included NRAO employees Harriet "Harry" Waddell and Zula Taylor as well as NRAO spouses Ann Coe, JoAnn Smith, and Kathy Norrod. Advanced Life Support by the BFD was expanded beyond the services of Medic Theresa Weimer when Ron Weimer, Jr., completed MICP training along with Dwayne Barker, NRAO employee, and Dwayne's wife Rose Mary Barker, who became a paramedic. Ron Weimer, Jr., was instrumental in working with the Observatory to help the BFD in the early days of EMS to run their own dispatch tower on Cheat Mountain before the county had 911. The Observatory had their own fire trucks and an ambulance, but only employees could serve as EMTs. ... Weimer taught a paramedic class in Pocahontas County. This course in 1993-94 allowed squads other than the BFD to offer Advanced Life Services. In 1997, Theresa's last EMT class coincided with the training of NRAO spouse, Janet Ghigo, as an EMT instructor. Since 1998, Janet has taught 20 EMT classes, providing an additional 200-300 EMTs to the county. ...The Authority members include representatives from each of the county EMS squads. Tom Dunbrack, an NRAO employee, represented the Marlinton squad on the first Authority and was its Treasurer.The present Secretary and Treasurer of the Authority is NRAO spouse, Janet Ghigo, representing the BFD. Although the present director of EMS service for Pocahontas Memorial Hospital is from out of county, many of the EMTs and medics employed there started with either Theresa or Janet. Ron Weimer, Jr, and Helen Clark, NRAO spouse, have served and presently serve as the county representative to the state regional EMS organization. In the past 25 years the county Authority has collaborated to bring e-911 to the county, to promote collaboration among the EMS services in the county, and to work to assure the best service possible to all county residents. This past year county squads responded to over 1600 calls, traveling close to 100,000 miles.Paid paramedic service is now available from four of the county's six squads, along with continued volunteer service. A majority of these squad leaders and active members can trace their training back to NRAO spouses and employees. At present the Assistant Fire Chief, Rescue Chief, and Assistant Rescue Chief for the BFD are all NRAO employees or spouses. It is not the main role of NSF to provide community services, but closing the Green Bank Observatory, with the necessary movement of these employees and spouses out of the county, would be a devastating blow to the network built over the past 40 years.	Against Closure	Letter - mail	UNK	
51	a	Samuel	Felton, Jr.	Mayor	I am writing in support of continued full operations at The Green Bank Observatory and in support of the National Science Foundation operations program, as it relates to Section 106 proposed changes. As a citizen of Pocahontas County, I have personally observed the valuable contributions of The Green Bank Observatory. The payroll deposited in the County coffers is a stabilizing factor in an already shaky economy. The support provided by GBO to the Pocahontas County educational programs cannot be overstated. Our school system and social fabric have benefited from the GBO being here. The facility is a tremendous asset to our State, the Green Bank community and Pocahontas County. Tourism is a huge part of the Pocahontas County economy. Literally, thousands of tourists visit each year. Many of our county businesses have grown to depend upon the traffic that we receive, because, of GBO. The loss of this facility would be devastating to these businesses.	Against Closure	Letter - mail	11/9/2016	
51	b	Samuel	Felton, Jr.	Mayor	The Green Bank Observatory has provided opportunities for employees and visiting scientists. The NSF science camps, student mentorships, and teacher work-study programs are unique in their own right. GBO has provided technology support and other assistance to our overall educational system.	Against Closure	Letter - mail	11/9/2016	
51	c	Samuel	Felton, Jr.	Mayor	As GBO has given to us - our people have given of themselves. A long list of residents from my community and personal friends have provided loyal service to NRAO & GBO for up to 49 years.	Against Closure	Letter - mail	11/9/2016	
51	d	Samuel	Felton, Jr.	Mayor	In summary, Pocahontas County is one of the most sparsely populated counties east of the Mississippi River, with an area of nearly 1,000 sq. miles. While the community has welcomed and embraced The Green Bank Observatory, it must be considered, the quiet zone that surrounds the GBO, has also limited other opportunities these last fifty years. If this facility were to cease operations - The quiet zone would be all we had left.	Against Closure	Letter - mail	11/9/2016	

Green Bank Observatory -Written NSF Public Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
52	a	Kenneth	Woods	Secretary, Rotary Club of Marlinton	<p>The Rotary Club of Marlinton, without any reservations, recommends the full operation of the Green Bank Observatory [GBO] with support from NSF for science focused operations and capitalizing upon additional support through collaboration with interested parties for science and education-focused operations. This Rotary Club believes these viable efforts will be most beneficial for GBO, Pocahontas County and the State of West Virginia.</p> <p>The Rotary Club of Marlinton recognizes the invaluable contributions that the GBO contributes to Pocahontas County and West Virginia's economic and educational well-being. The GBO has 100 full-time employees and approximately 40 part-time summer employees. Additionally, the GBO has approximately 50,000 tourists visiting the facility annually. With a payroll over \$14 million and tourist spending over \$7.5 million, Pocahontas County and West Virginia receive millions of dollars to support education, health, human services, public safety, highways and other public services.</p>	Against Closure	Letter - mail	11/7/2016	
52	b	Kenneth	Woods	Secretary, Rotary Club of Marlinton	<p>The GBO offers numerous educational opportunities for education K-12, post-secondary and post-graduate levels for local, state, national and international institutions and students. As a result, all West Virginia school systems have opportunities to participate through field trips, teacher training programs, science camps and other hands-on educational activities.</p> <p>In closing, The Rotary Club of Marlinton endorses the full operation of GBO through NSF and collaborating parties. The GBO is an invaluable facility for Pocahontas County, State of West Virginia and the Nation. In fact, the GBO is represented as this Rotary Club's banner, being presented to visiting Rotarians from various locations.</p>	Against Closure	Letter - mail	11/7/2016	
53	a	Rachel	Taylor	Community Member	<p>I have lived my whole life here in Pocahontas Co. except for my time away at collage. After school, I was able to return as a Physician Assistant in the local clinics. If the GBO was to close, I would be impacted in many ways. Below are a few:</p> <p>1. I would lose patients. I work in a family practice office and provide services to many GBO employees and family members.</p>	Against Closure	Letter - mail	11/8/2016	
53	b	Rachel	Taylor	Community Member	<p>2. I recommend many of my patients exercise. The GBO offers year-round free exercise classes that are open to the public.</p> <p>3. We utilize the pool and rec area for exercise-based community events in the summer months. U.S Masters Swim Team, the Green Bank Turtles, swims multiple times per week. The Northern Pocahontas Community Wellness Center has hosted multiple triathlons at the rec area site.</p> <p>On a personal nostalgic note, the NRAO was my first employer. When I was 15-17 I life guarded at the pool. Not only did this provide me with money to help support myself, it helped shape my decision to go into healthcare.</p>	Against Closure	Letter - mail	11/8/2016	
53	c	Rachel	Taylor	Community Member	<p>Also, many employees of the NRAO would come to Green Bank School when I was a student there. In particular, in the late 90s there was a program called "Hands on Science" started by many NRAO scientists. One told me "you have such potential, you'll shine like a star". I never forgot those words. I know that regularly the people of GBO are touching lives like they did mine!</p>	Against Closure	Letter - mail	11/8/2016	
54	a	Erica	Engquist	Community Member	<p>I am here today, as a tourism professional, a Pocahontas County, WV resident, a Citizen of the USA, and a human on this planet. Please understand that this is the National Quiet Zone, a rural community (8k people), and a place where galactic science has flourished.</p>	Against Closure	Letter - mail	11/9/2016	
54	b	Erica	Engquist	Community Member	<p>The economic and educational value of GBO, its operations, tours, and science center must be considered during the NSF's environmental impact statement. This facility is a tourist attraction and economic driver for our community.</p> <p>Handwritten notes on letter: - 50k visitors is a lot for our county of 8k residents. - Loss of jobs = loss of tax base</p>	Against Closure	Letter - mail	11/9/2016	
54	c	Erica	Engquist	Community Member	<p>The facility also plays a major role in helping our fellow humans think outside of our galaxy. These telescopes are important, and although thought to be outdated, still show one the advancement in time and landmarks in human knowledge. I highly oppose "mothballing" and/or "deconstruction and site restoration" of this facility due to the severity of impact it will have on me, my community, the State of West Virginia, and our World. Please continue investment for the Green Bank Observatory and its science-focused operations.</p> <p>Handwritten notes on letter: - Teach the masses about the heavens</p>	Against Closure	Letter - mail	11/9/2016	
54	d	Erica	Engquist	Community Member	<p>Handwritten notes on letter: - Deer Creek Valley = Fort Warwick 1774 site</p>	Against Closure	Letter - mail	11/9/2016	

Green Bank Observatory -Written NSF Public Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
55		Larry and Paula	Garretson	Community Members	<p>Paula and I have been here in northern Pocahontas County for 10 years and have been operating a bed and breakfast the entire time we have been here. We settled on this area because of the importance of tourism, with the GBO being one of the primary destinations for our guests.</p> <p>We have seen a steady increase of visitors, bo tourists staying with us who want to visit the GBO and see for themselves the science and technology that is on display here, and also scientists and engineers who come here to work and stay with us during their visit.</p> <p>Our business depends on the continuation of the GBO's existence and enjoys a good relationship with the GBO and the employees that work here, both at the facility and in the community which we all live.</p> <p>We enjoy 10-15% of our business coming from the existence of the GBO and expect that to grow each year, primarily tourism.</p> <p>We respectfully request that you consider the economic impact on small businesses like ours in our ability to continue to grow and to draw visitors to our beautiful county.</p> <p>We have to say that guests walk in the door, those that are not aware of the GBO existence, to ask about this giant telescope here and must say they are awed and inspired by technology that is located here.</p> <p>Your careful consideration of the personal and economic impact of the GBO on our small community is of utmost importance.</p>	Against Closure	Letter - mail	11/9/2016	
56	a	Roger	Trusler		<p>This letter is written to strongly encourage the full operation of Green Bank Observatory with continued support from NSF for science focused operations, including further support through collaboration with interested parties for science and education-focused operations. This is the best method for the enhancement of the Green Bank Observatory [GBO] and the Pocahontas County Community.</p> <p>As a citizen of Pocahontas County since 1973, I have personally experienced and observd the valuable contributions that the GBO has contributed to the County's school system, business community and social fabric. Over the years, the GBO has been a valued supporter of Pocahontas County educational initiatives involving math, science and technology. GBO employees and visiting scientists have been actively providing: 1]. opportunities for science camp hands-on experiences, School-to-Work mentorships for high school students, teacher work-study programs; 2]. technology support for computer installation, networking, programming; and 3]. consultations for system-wide troubleshooting regarding technical issues.</p>	Against Closure	Letter - mail	11/3/2016	
56	b	Roger	Trusler		<p>County-wide, the GBO continues to contribute significantly to the Pocahontas County business community. Millions of dollars of employees' payroll flow through the local banks and business community. This influx of dollars plays a critical role in sustaining and creating business and job development. Payroll and sales tax revenue from the circulation of these dollars contribute millions of dollars to support governmental entities locally and within West Virginia. Additionally, thousands of tourists visit GBO each year, spending approximately 7.5 million dollars in the local and State economies.</p>	Against Closure	Letter - mail	11/3/2016	
56	c	Roger	Trusler		<p>The employees and visiting scientist contribute greatly to the social fabric of Pocahontas County. These individuals become involved in community service activities/projects that have positive impact upon adult and youth activities.serving with fire and rescue; coaching little league, soccer, midget football and/or varsity sport; participating in civic, religious, senior citizen and/or school organizations/functions; and devoting volunteers on local boards and/or committees involving education, recreation, health-safety, scouting, 4-H, etc.</p> <p>Illustrating one of many examples involving a major project that GBO provided technical support, Pocahontas County Schools needed assistance with an initiative entitled "Careers in Broadcasting", a vocational project for developing a radio station at Pocahontas County High School. Mr. Omar Boyer, GBO Engineer, worked with Superintendent of Schools, Dr. James Lannan and Ifor the initial ground-work for FCC and Quiet Zone approval. Due to his dedicated interest, Dr. Gibbs Kinderman, a Doctorate in Communication student at Virginia Tech, approached us about taking over the project. Approval was given and through Dr. Kinderman's dedication and the continued technical assistance of GBO employees, WVMR Public Radio was born and has matured into Allegheny Mountain Radio, serving a Pocahontas Community that previously had no radio station to communicate emergencies, special announcements, community affairs and entertainment for youth and adults, especially senior citizens who are unable to attend social functions.</p> <p>In summary, Pocahontas County is the most sparsely populated county East of the Mississippi River, with an area of approximately 1,000 sq. mi. GBO is a critical component of the educational, economic and social fabric of this rural County and the State of West Virginia. A viable means must be determined for the continued science and education-focused operations of GBO.</p>	Against Closure	Letter - mail	11/3/2016	
57	a	Amy	Haden	Teacher, Charleston, WV	<p>My name is Amy Haden, a teacher from Charleston, West Virginia.</p> <p>I am writing in support on continued funding for the Green Bank facility. Its has played and can continue to play a contributing role in the advancement of scientific knowledge. A great educational facility, like Green Bank, should be repurposed, not scrapped, as such action would be wasteful.</p> <p>Please consider the educational benefits of the facility, for high school, college, and graduate students, and continued value of the facility for research.</p>	Against Closure	Email	11/23/2016	
57	b	Amy	Haden	Teacher, Charleston, WV	<p>As a West Virginia, I want to keep the facility for the direct and indirect benefits it provides to this State which so needs a boost, as the economy continues to decline in our State.</p>	Against Closure	Email	11/23/2016	

Green Bank Observatory -Written NSF Public Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
58		Dom	Pesce	Student, Department of Astronomy, University of Virginia	<p>My name is Dom Pesce, and I am a graduate student in the astronomy department at the University of Virginia. I am writing to lend my support to the “no-action” option for proposed changes to operations at the Green Bank Telescope (GBT).</p> <p>Even in just the few years that I’ve been involved in astronomical research, the GBT has proven to be an invaluable resource. As a member of the Megamaser Cosmology Project I’ve regularly used the GBT for the monitoring and survey components of the project, as well as a critical component of the High Sensitivity Array for very long baseline interferometry (the GBT alone provides nearly half the sensitivity of the combined array). I’ve also led a couple of related projects, which have made use of the GBT to (1) study the recoil motion of a supermassive black hole in a distant galaxy and (2) study the chemical environment around another supermassive black hole. For this second project in particular, the high-frequency capabilities of the GBT (which are unmatched by any other available telescope) make it the only option for these sorts of “chemical inventory” studies.</p> <p>The efficient dynamic scheduling capabilities of the GBT have also allowed me to use it to make near-simultaneous observations of objects that I’ve targeted with other (rigidly-scheduled) telescopes. For certain types of highly-variable objects, like the ones I study, waiting a long time in between observations can really hurt the science goals (or even eliminate them completely). These kinds of studies are only possible thanks to the scheduling flexibility afforded by the GBT.</p> <p>Ultimately, the GBT provides a large number of unique science capabilities that have enabled much of my research. Many of these projects would simply not have been possible without it, and the future of my field in the absence of the GBT would be depressingly bleak.</p>	Against Closure	Email	11/23/2016	GBT_support_letter.docx
59		Charles	Sheets	Resident	<p>I am a native and resident of Green Bank, WV, and was a Green Bank HS student when word came out in our small rural community about a large project coming that would employ folks. Many rumors were circulating until our High School principal, (1956) called an assembly of students with an official government spokesman to announce that an observatory would be established in Green Bank under the direction of the National Science Foundation. This was welcomed news and was quickly embraced by the community and State.</p> <ul style="list-style-type: none"> For the past 60 years NRAO, now GBO, has been an integral part of our community, providing educational opportunities for young aspiring students from elementary school through graduate school. November 9, 2016, at public scoping meetings, State & Federal Congressional Representatives, concerned citizens, and students, spoke of the importance of the education and scientific future value of continuing support of the GBO. During the October open house dedication and renaming of NRAO to GBO, Scientifics from around the world spoke of the cutting edge technology of the GBT as well as the value of the other radio telescopes and all the discoveries about the universe the past 60 years which have been uncovered at Green Bank. On CBS Morning America November 22, 2016, Neil Degross Tyson, noted Astronomer was interviewed about his new book, A Guided Tour of the Universe and quoted the Frank Drake’s theory for search of extra-terrestrial life in the universe. <p>The NSF Mission Statement is as follows:</p> <ul style="list-style-type: none"> To advance the progress of science, a mission accomplished by funding proposals for research and education made by scientists, ... <p>If this is your agency’s Mission Statement, the final Environmental Impact Statement (EIS) must make the following finding: Continue NSF investment for science –focus operation. (No Action Alternative)</p> <p>There are many reasons to continue NSF funding. I, as a tax paying citizen am appalled that NSF can turn its back and walk away from the world’s largest and most accurate \$95 million radio telescope, the only one of its kind. Instead NSF would rather spend billions of dollars on a project in Chile while turning its back on it US tax paying citizens.</p> <p>Thanks for the opportunity to write in support of the GBO.</p>	Against Closure	Email	11/23/2016	GBO-NSF Support Ltr 11-23-2016.docx
60		Steve	Hard	Software Systems Engineer NASA IV&V Facility Capability Development	<p>In my opinion, mothballing the GBT seems silly and considering the deconstruction of the GBT is just absurd. Would you really want to inhibit another high school student from discovering another pulsar? The observatory is world renowned and the value/benefits it provides to the scientific community and to STEM education should be very obvious. If the telescope needs repairs, it should be fix without question. However, the management of the program may require more than routine maintenance if the future of the observatory is really in question. Please consider the future of the green bank observatory very closely and really look at what you have before making any rash decisions.</p>	Against Closure	Email	11/23/2016	

Green Bank Observatory -Written NSF Public Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
61		Justin	Spradling		<p>I am writing in support of the Green Bank Telescope. As a native West Virginian, as well as someone with degrees in both science and international affairs, I have unique insight on the growing skepticism and contempt that an alarming and growing number of West Virginians (and Americans across the country) feel toward science. Relative to the rest of the country, West Virginia is greatly impaired in its ability to progress at any significant rate, and relative to the rest of the world West Virginia is essentially unknown. By dismantling the Green Bank Telescope, science literacy in the area will become virtually nonexistent, dying along with the current generation that is literate in scientific fields.</p> <p>The unique abilities of the Green Bank Telescope not only further the interests of West Virginia by bringing federal funds and highly intelligent individuals into our borders, but through these very same principles further the interests of the country at large. International cooperation and education achieved via the Green Bank Telescope should be a shining beacon that we should strive for, and implement more opportunities for, rather than dismantle and de-fund.</p> <p>I urge whoever is responsible understand that the loss of this scientific community in West Virginia will be a drain on both West Virginia and the United States for the foreseeable future. With anti-science information being mandated in school textbooks an extremely alarming frequency, the Green Bank Observatory can remain as a shining symbol of truth and an instrument of knowledge in an area of scientific darkness. Putting out this light, so to speak, will engulf this state in near-permanent darkness. To gain pace in science and math literacy in West Virginia and, by extension, the United States, the Green Bank Telescope must remain operational. Otherwise, the United States will lose yet another battle in the struggle to close the gap between math and science literacy here versus other developed countries.</p>	Against Closure	Email	11/23/2016	
62	a	Rhett	Herman	Professor of Physics, College of Science and Technology Department of Physics, Radford University	<p>Email: I am sending this email to let you know how great the Green Bank NRAO is as an educational resource for my students and our faculty members. I had so much to say that I had to include it as the attached pdf (although I did try to keep it as short as possible). We have visited Green Bank since 2002, with our students benefitting tremendously from the amazing hands-on experience they receive. This is a laboratory experience that our campus –and frankly almost no other – has the resources to replicate. Not by a long shot. The resources at Green Bank NRAO are part of the broader educational and scientific community and that must be taken into consideration with this decision.</p> <p>We have had a number of students throughout the years who have specifically been inspired by the Green Bank trips. One even went on to get her PhD studying interstellar molecules using radio astronomy at the U. of Arizona, taking a position at NRAO in Charlottesville after completing her studies. Our undergraduates have used our data after these trips in a number of Independent Study projects, learning how to use the raw data we obtained ourselves to reconstruct powerful ideas such as the spiral structure of our own galaxy. Several in fact have been so inspired that they have pursued their graduate degrees in not only astronomy in general, but radio astronomy in particular.</p> <p>This is a truly valuable resource for our students, one that simply cannot be allowed to lapse.</p>	Against Closure	Email	11/23/2016	2016-Nov22-NRAO Green Bank letter.pdf
62	b	Rhett	Herman	Professor of Physics, College of Science and Technology Department of Physics, Radford University	<p>I am writing this letter to let you know how the National Radio Astronomy Observatory at Green Bank has positively impacted our students for well over a decade of hands-on learning at this facility. The Radford University Society of Physics Students has been visiting Green Bank for nearly 15 years. We have spent many weekends there touring the facility and – most importantly – using the educationally tasked 40-foot radio dish. Our students have not only enjoyed using this dish, but they have also learned a tremendous amount from that use. For example, we have replicated the observations that showed the spiral structure of our galaxy, mapping out the angular distribution of the great hydrogen gas clouds as seen from Earth’s location. We have observed supernova remnants, interstellar nebulae, and the radio emissions from planets in our own solar system. Ironically enough our students have said throughout the years that they even prefer this altitude-only telescope since it really does give them the chance to delve into the original type of work that led to so many facts that we now take for granted. When asked if they would prefer to have the 40-foot teaching dish updated to a fully-steerable dish, and have the data acquisition automated, their answer is invariably a resounding “No!” From the first moments we arrive for our weekends (yes, during the regular semesters) on Friday evenings to right before we leave on Sunday afternoons our students spend nearly every minute of the 40+ hours that we are there in the 40-foot control “bunker” recording the radio emissions of our universe. As a physics professor I can tell you that it’s a wonderful opportunity for yet another hands-on laboratory experience for my students, one that I simply do not have the resources on our campus to reproduce. In fact, so few campuses have such capabilities that this is truly a broader resource that belong to the greater whole in education in our country. We have been told throughout the years that the current trend in education is towards “collaborative efforts.” The Green Bank NRAO is just that type of broad educational collaboration. I know that many student groups visit Green Bank and experience this amazing resource. I know the reality that budgets are tight and continue to tighten. However, just as with our own Science Day educational outreach to the broader community outside of Radford University, I feel that the Green Bank NRAO serves a greater community and is an irreplaceable resource. I am including images that show our times visiting Green Bank.Our trips to Green Bank have also inspired our students to further their careers in radio astronomy. One of our students went further and obtained her PhD studying radio astronomy, and even worked at the NRAO in Charlottesville for several years. One student received his PhD in solar physics from Montana State University, also having been inspired at Green Bank. Another student is currently in graduate school at Clemson in astronomy/astrophysics after completing a number of independent study projects in radio astronomy while at Radford, including one involving Green Bank data. I am encouraging you in the strongest terms to maintain the funding for the Green Bank NRAO at the current levels such that they can continue their current level of operations. This is the “No-Action Alternative” in the EIS of the NSF. Or at the very least to maintain sufficient funding so that, if necessary, perhaps we could pay a small fee to support their educational work. This resource is too valuable to the broader educational community to let lapse. My students and I would be greatly diminished without it.</p>	Against Closure	Email	11/23/2016	2016-Nov22-NRAO Green Bank letter.pdf
63	a	Duncan	Lorimer	Professor of Physics and Astronomy West Virginia University	<p>I am writing in response to the Notice of Intent to Prepare an Environmental Impact Statement for the Green Bank Observatory (GBO) published in the Federal Register on October 19, 2016. As a Professor of Astronomy based at the Department of Physics and Astronomy at West Virginia University for the past decade, I would like to impress upon you the unique and iconic status of GBO here in the state of West Virginia, and on both the national and international astronomical and science communities in general. Since its construction in 2000, the Robert C. Byrd Green Bank Telescope (GBT) has been at the forefront of many areas of modern astrophysics. In my own research, which is centered around Radio Pulsars, the GBT has made a number of far-reaching contributions which are well documented in the literature. For example, the measurement of a two solar mass neutron star (Demorest et al. 2010, Nature, 367, 1081) has amassed over 1300 citations to date and has profound implications for our understanding of the nature of matter at high densities which are impossible to constrain elsewhere. More recently, the GBT has for the first time detected one of the enigmatic Fast Radio Bursts (FRBs; Masui et al. 2015, 528, 523) and places important constraints on the origin and distance scale of these radio sources.</p>	Against Closure	Email	11/23/2016	GBT.pdf

Green Bank Observatory -Written NSF Public Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
63	b	Duncan	Lorimer	Professor of Physics and Astronomy West Virginia University	My relationship with GBO dates back 15 years, and in particular over the last decade I have worked very closely with observatory staff since being a faculty member at WVU. Motivated by the promise of finding new pulsars, and my experience at engaging students in understanding the exotic properties of pulsars,... The PSC is now in its 10th year and has been incredibly successful in engaging high-school students in STEM fields and is currently funded by an NSF Advancing Informal STEM Learning (AISL) grant as well as a five-year NSF Track I EPSCoR award. Each year, the PSC has grown by reaching more students, training more teachers, and making more scientific discoveries. So far, the PSC has engaged over 2000 students and 100 teachers in 20 states. The PSC has achieved notable educational goals including reaching first time college-goers and seeing gains in self-efficacy and interest in scientific careers, especially in girls. The GBT is one of the best telescopes for pulsar searching. During the summer of 2007, while the GBT track was being refurbished, the PSC received 300 hours of telescope time, totaling approximately 30 TB of data. Since the initial survey observations, further GBT data sets have been acquired. All these data belong solely to the PSC students. While the PSC is part of a larger collaboration of professional astronomers, it is important to note that the PSC data have not been analyzed by astronomers.	Against Closure	Email	11/23/2016	GBT.pdf
63	c	Duncan	Lorimer	Professor of Physics and Astronomy West Virginia University	The ownership of the data, complexity of the plots for pulsar searching, and the interactive nature of the science make the PSC unique among student research programs. In our initial model of the PSC, teachers and students came to NRAO Green Bank each summer for periods of between one and three weeks to learn the fundamentals of radio astronomy and pulsars. During the academic year, teachers recruited new students to participate in the PSC through whole-class activities, then student leaders and teachers form teams at their schools to participate in the PSC throughout the year. ... In data analyzed so far, PSC students have discovered seven new pulsars, including one millisecond pulsar and one pulsar in a binary system. The millisecond pulsar, and others that we expect the students to find, are potentially very useful additions to pulsar timing arrays which aim to detect low-frequency gravitational waves. The letter written on behalf of the North American Nanohertz Observatory for Gravitational Waves (NANOGrav) addresses specifically the GBT's importance to this project. Over the years, the PSC has received a significant amount of press coverage. One of the original student discoveries, Lucas Bolyard, was featured as a guest at one of President Obama's star parties at the Whitehouse in 2009..... In surveys that we have carried out with PSC participants, over 90% of all respondents said that the PSC had changed them in some way. The strongest motivating factors reported were being involved in scientific research, working with their friends and team-mates, and enjoyment. Students reported gains in knowledge, research skills, leadership and friends from participating in the project. When reporting ways in which participating in the PSC had changed them, students listed changes in career path, appreciation for how science is done, confidence and motivation. We found statistically significant increases in interest in three careers as scientists and engineers a result of participating in the PSC. I hope that this letter has described the critical role that the GBT and GBO in general is playing in developing STEM careers on both a state and National level. The PSC is a unique experience for the students and teachers. Students and teachers work hand-in hand with world-renowned scientists. They gain real-world experience as to what it truly is to be part of a scientific team. In these troubled times, where the political landscape of our country and the world needs, more than ever, the next generation of scientists and engineers, I cannot stress how devastating it would be to these efforts if the GBO site were to be decommissioned.	Against Closure	Email	11/23/2016	GBT.pdf
64		Josh	Smith		I have recently learned from my former astrophysics professor that the NSF is reviewing the current funding of the Green Bank Observatory and is interested in hearing from those who have had experiences at the site. In April of 2013 I had the pleasure of participating in an educational experience as part of my course curriculum for a 400 level radio astronomy lab at Rutgers University. My professor, my classmates, and myself all happily made the 8 hour commute for 2 days of observations using one of the radio telescopes built in the 60's. Learning the history behind the field and engaging with period specific equipment was an indelible moment for me. It was one of the first moments I could actively see myself as a professional scientist, and I can confidently say my peers felt the same. Touring the facilities was also exciting; after using a radio telescope from the 60's there was a newfound appreciation for the control room at Green Bank, as well as the equipment we all took for granted on the roof of the physics building back home in New Jersey. The excitement stuck with me through the years, and as a physics teacher it is a trip that I share with my current students whenever they ask me about the exciting things they'll experience in college. Continued funding of the Green Bank Observatory is an investment in America's future scientists. The team at the observatory did an amazing job of making two dozen 20-something year old students from New Jersey feel like they had the ability to work in a field they love at a professional level, and that is a feeling I try to instill in my students every day. The experiences I had at Green Bank are part of the reason I am a physicist today, and I truly believe every budding physicist deserves the opportunity to see exactly what American ingenuity can produce. I hope my words can help influence the NSF's decision, and I sincerely hope the Observatory can continue its mission with the full support of the US government.	Against Closure	Email	11/23/2016	

Green Bank Observatory -Written NSF Public Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
65		Marc	Eimers		The day was May 25th, 2008. It was my first day as a "summer student" at the National Radio Astronomy Observatory in Green Bank, WV. ... Before me lay the type of scene that is often portrayed in movies. Scientists, engineers, and technicians sat in front of banks of computers and sophisticated monitoring equipment calling out technical commands to one another. ... For a kid fascinated with math and science, and who had once dreamed of becoming an astronaut, it was the experience of a lifetime. But it was just the beginning. My summer at the Green Bank Observatory would prove to be a significant period of professional and personal growth for me, and it was the observatory and its people that made it possible. Working in concert, the physical capital and human resources at the Green Bank Observatory provided invaluable opportunities for immersive educational experiences. During my time at Green Bank, I learned about the history, theory, and practice of radio astronomy. I learned about the early days of radio astronomy by actually using the 1960's era 40' telescope to observe hydrogen emission lines in the galactic plane. I learned about instrumentation by seeing the inner workings of the backend spectrometers in the control rooms. I learned about programming by creating a graphical user interface to send commands to the 43 meter telescope for my summer observation project. I learned about telescope optics by climbing to the top of the GBT feed arm to see the massive sub-reflector. I learned about cutting edge observational astronomy by participating in a study using the GBT to measure OH emission from a comet. There were countless opportunities for me to apply myself. At the Green Bank Observatory, I learned by doing. While the observatory's facilities provided a unique environment for learning, it was the observatory's staff that created the immersive, hands-on educational experiences that came to define my summer in Green Bank. My direct advisors created a challenging summer project for me to help develop and test a system to observe pulsars with the 43 meter telescope. There also seemed to be a genuine desire among staff members to share the wonders of the observatory with me in meaningful ways to help advance my understanding of radio astronomy...And even as a young undergrad with limited work experience in an office, I always felt comfortable around other staff members as I developed my professional skill set. If I had to sum up in one word the staff and work culture at the Green Bank Observatory, it would be "inclusive." It was the incredible hands-on experiences and the welcoming environment that made the lessons I learned that summer stick with me all of these years. I definitely advanced my education and grew professionally at Green Bank, but I also grew personally. I attribute that growth to my interactions both with the community and with the place itself. As an introvert, I feel perfectly at ease spending time alone by myself. In the secluded, radio-quiet expanse of the Green Bank Observatory and surrounding properties, I enjoyed many a day contemplating the larger questions in life. The GBT, always visible in the distance above the trees, inspires one to look not only up toward the skies, but also to look inside oneself....I heard so many stories about the Observatory from community members who had grown up in the area (my favorite story being about the creative tactics employed one year by staff members in their attempt to remove a larger than normal snowfall from the dish of the old 300' telescope). ...When I left the Green Bank Observatory to return to school, I immediately landed a research assistant position in the astronomy department at my university. It's safe to say that after my time at the Green Bank Observatory, I was more mature, better educated, and better off financially. I know that this is the case for many other individuals whom the Observatory has impacted as well. For all of these reasons, and for so many more that I have not captured here, I urge the National Science Foundation to continue to invest in science-focused operations at the Green Bank Observatory. Thank you for your time and consideration.	Against Closure	Email	11/23/2016	
66	a	Steven	Spangler		I am writing to encourage you to continue the status of the Green Bank Observatory and choose "no action" on the change of the environmental impact of the observatory. I am a professional astronomer with a primary research interest in radio astronomy. Although most of my research in the last few decades has been with radio interferometers like the Very Large Array, I consider it crucial for the science of radio astronomy in the United States to have a large, modern single dish radio telescope with state of the art receivers. To make a specific point, in my opinion most physicists consider gravitational radiation of more fundamental importance than most of what we do in astronomy. The recent detection of gravitational wave bursts by the LIGO observatory has begun the era of gravitational wave astronomy. Precision pulsar timing provides the best way to investigate gravitational waves at much lower frequencies than those accessible to LIGO. I agree with the statement of Dr. Lockman and colleagues that the GBT, with its pulsar receivers, is the pre-eminent instrument for pulsar studies in the world at the present time, and can play an important role in the exciting future of gravitational wave science. The location of the GBT and the Green Bank Observatory in the National Radio Quiet Zone, a unique resource, strengthens this argument. I believe it should also be emphasized that the GBT was only dedicated 15 years ago, and even more recently has received the instrumentation to permit it to observe at its full potential. I think actions that would close the observatory or change its direction from a basic research installation, and end the career of the GBT would send a message that astronomers are profligate with public funds, and will quickly abandon large and expensive instruments for new ones on a wish list. In summary, I encourage the NSF to continue the current environmental use statement for the Green Bank Observatory, and to continue operation of the Observatory and the Green Bank Telescope.	Against Closure	Email	11/23/2016	
66	b	Steven	Spangler		In my opinion, Dr. Jay Lockman and colleagues have made a convincing argument for continued operation and support of the Green Bank Telescope (GBT) in their article arXiv:1610.02329, stating the case that the NSF "portfolio review" is no longer applicable to the GBT. I read and agree with the points made there that recent improvements to the GBT position it to make important contributions to astronomy such as study of molecular transitions in star formation regions.	Against Closure	Email	11/23/2016	

Green Bank Observatory -Written NSF Public Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
67		Andrew	Seymour		I think I might hold one of the most unique stances on the Greenbank Observatory (GBO) and its role to the local and scientific community. See I grew up only a county over from the GBO, and maybe because I was a kid the world only seemed 30 miles wide. All your friends, most of your family, and your future seemed to be within that radius. If you were born into a farming family, like most of us were, it was expected that you would continue that tradition. Perhaps you could get a second job "plucking chickens" at the poultry plant at the edge of that radius. It was not until junior high that this radius would be expanded. That is when we took a field trip to the Greenbank Observatory. There we learned about other worlds and the great science that occurs all the way to the edges of the universe. Not only that, there was wonderful and mysterious engineering that made all of this possible. I did not have my own "great expansion" until I saw what was only the base of the newly built Greenbank telescope. Then I realized that science was not just for academics, it was happening just beyond my radius, and would be for many years to come. From thereon the future seemed bright and felt that anything was possible. This sent me down to the road of science, but growing up in an utilitarian world engineering seemed like the only choice, and it was. There were no options to go into any astronomy programs. Even the largest university in the state, West Virginia University (WVU), did not have an astronomy program. This was until 2012, when I was in graduate school, that WVU hired new faculty. Once that opportunity arose, I jumped on it. Now I am currently graduated with a Ph.D. in Astronomy from WVU and working at the Arecibo Observatory as a postdoctoral scientist. Instead of "plucking chickens", I am plucking radio signals from distant stars and galaxies. Yet I find myself back in a 30-mile world, where the NSF has budget constraints and is investigating the uncertain futures of both GBO and AO. Not since my childhood have I felt that my future rest with someone else's decision. These facilities have much greater impact than one can measure. I think it is short sighted to close these facilities for a budget constraints, considering that the Arlington Libraries have a larger operational budget than either one of these sites (https://budget.arlingtonva.us/fy-2017-proposed-budget-2/). If we are willing to spend 13 million to preserve knowledge in one city, why are we not willing to spend that much in the pursuit of it, and with in some of the most economically disadvantaged areas of our country? Even by switching to a partnership model, this creates a "pay-to-play" atmosphere, where only those with the money will be able to use the telescope. I strongly believe this will close opportunities for people in these areas to expand their world, much as I was able to. Therefore, I ask the NSF and those who are writing this report, to expand their own horizons and to look beyond our politics and short-term budget constraints. It is only the power of the government that can ensure equal opportunity, to have the sites open to all, and to explore the ideas that will help all of mankind. Failing under these pressures will cause longer-term effects. I fear that all of these comments will fall on to deaf ears with a predetermined "non-decision" with an "only a 30 mile" view. If we must go down this road, please take these comments with an open scientific mind. "Science is much more than a body of knowledge. It is a way of thinking. This is central to its success. Science invites us to let the facts in, even when they don't conform to our preconceptions." Carl Sagan	Against Closure	Email	11/23/2016	
68	a	Philip	Engelke		I am a graduate student at Johns Hopkins University writing to describe what an important instrument the Green Bank Telescope is and how it has contributed greatly to my research in astrophysics. My research group has been using the Green Bank Telescope to study OH 18-cm emission from the Galaxy, as a new tracer to map the quantity and location of molecular gas. We are finding with this new method that there is in fact much more mass of molecular gas in the Galaxy than is assumed using the traditional methods for tracing it--perhaps twice as much! Our work contributes to an understanding of the total mass of the Galaxy, which is a question of much importance when theories of dark matter are being proposed and tried out, and is also important for better understanding processes such as star-formation that are not currently well understood. Our work is powerful and far-reaching in its applications, but is only possible because of the high sensitivity and low noise levels of the Green Bank Telescope. The Very Large Array in New Mexico, while a powerful radio telescope in its own right, is not ideal for the same purposes, as it has a higher resolution, meaning that longer exposure times are needed to observe our signals, and our work becomes less feasible. The Green Bank Telescope is essential to our exciting research work, and I hope to see it continue to be available for the science community in the future.	Against Closure	Email	11/23/2016	
68	b	Philip	Engelke		I will also add that the Green Bank Telescope has provided me with a great training as an astronomer during my time in graduate school. Unlike some telescopes, where the scientist simply prepares a list of targets for observation and submits it to the telescope operators, who decide when they have time to do the observations, scientists using the Green Bank Telescope have control of what they observe in real-time. It is a more hands-on, involved, decision-making experience, and far better I think for budding new astronomers learning how observing works. As such a powerful tool for groundbreaking research, as well as a resource for educational purposes, I greatly appreciate the funding that the NSF has provided for the Green Bank Telescope thus far, and hope to see it functioning and open to proposals from the scientific community for years into the future. And keeping the top-notch radio astronomy facilities in the United States would be beneficial for the future of American science.	Against Closure	Email	11/23/2016	
69		Shea	Garrison-Kimmel	astronomer	I'm writing to register my support for the continued operation of the Green Bank Telescope (GBT). As an astronomer who grew up in the state of West Virginia, GBT has a very special meaning to me -- it has both served as an early inspiration and glimpse into the field of astronomy, and as a valuable instrument for HI astronomy. GBT serves a vital role in the West Virginia community as one of the places that young schoolchildren can receive exposure to modern science, and particularly astronomy. The impact of their outreach is only strengthened by their location in one of the most impoverished states in the country. Losing GBT would be a huge blow to the astronomy community, as it is able to provide increasingly useful data for near-field cosmology. It would also be an enormous loss to the state of West Virginia, and as a former resident of that state, I wholeheartedly support funding GBT.	Against Closure	Email	11/23/2016	
70	a	Golnoosh	Golpayegani	student	I am a PhD astronomy student at West Virginia University and I'm writing to share how Green Bank Observatory made a huge impact in my life. I'm from Iran and I chose to study at WVU two years ago because of the collaborations with GBO. I never forget the very first moment that I saw this unique telescope on my first trip to Green Bank. I had a chance to get trained on how to observe with the GBT, I participated in a summer school there, and very recently, I proudly took my high school astronomy teacher who is now a science communicator and astrophotographer, collaborating with National Geographic and other organizations there so that he can take pictures of the Green Bank Telescope with the night sky in the background. Every time I visited GBO, I met wonderful staff and scientists there working from the cafeteria to the Jansky Lab, and made so many good friends and memories. I'm impressed with the fact that the community in Green Bank are so connected to each other.	Against Closure	Email	11/23/2016	

Green Bank Observatory -Written NSF Public Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
70	b	Golnoosh	Golpayegani	student	<p>Right now, my advisor and I are trying to detect Fast Radio Bursts (FRBs) using the GBT. There is still so much we don't know about FRBs, and the fact that GBT is located in the National Radio Quiet Zone makes this a one of a kind facility we can use to detect these mysterious objects.</p> <p>I really hope NSF considers the amount of science and culture contributed because of GBO, and keeps funding it. I'm sure this investment pays back with wonderful results and accomplishments.</p>	Against Closure	Email	11/23/2016	
71		Nancy	Laroche	visitor	<p>We visited Green Bank a couple of years ago with our entire family and had a personal tour by our niece, Kathryn Williamson, who worked there at the time. Our three young granddaughters were fascinated with the fun aspects of the tour and seeing the observatory. It was great to see them so excited about science and to experience some hands-on astronomy. Perhaps we have a future astronomer in the family! Thanks Green Bank for an educational and fun experience. We hope the observatory continues to be funded.</p>	Against Closure	Email	11/23/2016	
72		Cree	Lahti	resident	<p>As I write this letter I can hear a telescope at the Green Bank Observatory turn from my home office window. How cool is that? That I can live in the mountains, incredibly rural, yet have state of the art technology next door. The opportunities that the GBO brings to the community, to my family, and to me are unique and valued.</p> <p>The Pocahontas County Free Libraries were established fifty years ago this year, and the Green Bank Observatory was incremental in the establishment of the original four libraries, including donating the land on which the Green Bank Library Branch is located. The Observatory provided and continues to provide support, both financially and in-kind, in the form of technical expertise, materials, and helping hands. Additionally, the libraries have benefited tremendously with the resource of people that have moved to the area and stayed because of the GBO. They become our patrons, our volunteers, our board members, and our librarians. Our libraries are centers of information; offering cultural, literary, and historical programming. They are business centers; for sending faxes, making copies, using computers. They offer a social outlet in the mountains; space to hold a meeting, or take an art class, or have a potluck. Not to mention finding the New York Times bestsellers, for free. But our success relies on the success of the communities in which we are located, and with fewer than 8,700 residents in the entire county, the patrons that are affiliated with the GBO in some way (whether directly working at the GBO, or family members, or visitors of the GBO) are one of the reasons we exist. Without the influx of ideas of folks coming from different places, with different experiences, we risk becoming stagnant. We risk becoming obsolete. We risk becoming just another struggling community in rural America.</p> <p>Personally, I feel the GBO is one of the best parts of living in Green Bank. I have chosen to raise my family here, and I selfishly want my son (a thirteen year old, that goes to school in the shadow of the GBT) to be well-rounded. To realize there is a whole wide world out there to explore, to dream, and even if he winds up back where he started, he will have a solid foundation that began in a community that is influenced by astronomy, space, and science. A community that is not afraid to dream big. Thus, as a representative of the Pocahontas County Free Libraries, and as a concerned citizen, I strongly urge the NSF to support option one or option two in future planning regarding the GBO. Thank you for your consideration.</p>	Against Closure	Email	11/23/2016	PCFL letter to NSF.docx
73	a	Bob	Lindner		<p>I'm writing to express my opinion about the fate of the Green Bank Observatory. I spent time at the observatory as a teaching assistant supporting my advisor Prof Andrew Baker (Rutgers). He brought students to site to collect and analyze data every time he taught the Rutgers Observational Radio Astronomy course. I visited the site twice, and finished by PhD in astrophysics in 2008. I currently work in industry as a data scientist in Madison WI.</p> <p>My personal experience visiting the site was an empowering, formative experience, and absolutely one for the students I was helping supervise.</p>	Against Closure	Email	11/23/2016	
73	b	Bob	Lindner		<p>As well as functioning as a world class observatory, the telescope has serves as an important testing bed for new receiver technologies and should be maintained as a site of scientific innovation. I appreciate this because I analyzed data from new experimental receivers like these. They are the pathfinders that allow us to see the farthest into our Universe and break open entirely new fields of astronomy. The pathfinders are possible because of flexible, available, platforms like the GBT.</p> <p>I'd like to see either:</p> <ol style="list-style-type: none"> 1. Continued NSF investment for science-focused operations (No-Action Alternative) or 2. Collaboration with interested parties for science- and education-focused operations with reduced NSF-funded scope 	Against Closure	Email	11/23/2016	
74		Dave	Bruton		<p>I disagree with any option that reduces funding for the Green Bank Observatory. I hope the NSF will continue investing. I also hope to see a collaboration with interested parties for science- and education-focused operations with reduced NSF-funded scope and a collaboration with interested parties for operation as a technology and education park.</p>	Against Closure	Email	11/23/2016	
75		Yvonne	Shepard		<p>I strongly urge you to not shut down the Greenbank Observatory in West Virginia.</p> <p>One major justification for no longer funding the Green Bank Observatory was that many of its capabilities were duplicated by the stationary Arecibo Telescope; however, this is not a valid justification. The GBT has unique capabilities not available at other observatories in operation or planned. The GBT is both very large and fully steerable. With its large 110-meter dish, GBT is able to "hear" incredibly faint radio waves emitted from the universe that smaller radio dishes wouldn't be able to capture. With its ability to move its large dish, GBT can cover 80 percent of the sky. In contrast, the Arecibo Telescope can observe about 33 percent of the sky. Furthermore, stationary telescopes like Arecibo can't collect the same types or amounts of data as the GBT because of the restricted portion of the sky they cover.</p> <p>Recent discoveries show that GBT is necessary and important. The discovery of gravitational waves has put pulsar research, an area where GBT is well-known, at the forefront of modern astronomy.</p>	Against Closure	Email	11/23/2016	

Green Bank Observatory -Written NSF Public Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
76	a	Nicolas	Lehner	Dept. of Physics, Univ. of Notre Dame	<p>I am a research associate professor at the University of Notre Dame and I urge you to keep the GBT funded for research. I've been using the GBT for constraining the properties of the diffuse gas around galaxies. It has been revealed via GBT and UV observations how important this halo gas is to understand the evolution of galaxies. For example, the ability of the galaxies to form stars depends sensitively on the content and physical conditions of their gas. A galaxy may gain mass from its circumgalactic environment through the infall of intergalactic matter or of remnants resulting from galaxy interactions and lose mass through outflows driven by stellar and AGN feedback. While we do not fully understand this exchange of baryons between galaxies and their environments, we do know that it must result in a net gain of mass if galaxies are to form stars over many billions of years.</p> <p>The GBT has been unique for undertaking this research. It is the sole radio instrument that has a stable baseline and the dish area to detect extremely weak emission of HI 21 cm with a small beam. Typically most of the HI surveys (or even deep HI observations) with current and future instruments other than the GBT have a sensitivity of $2-5 \times 10^{18} \text{ cm}^{-2}$. The GBT can routinely reach a factor >10 better in sensitivity. It can probe a regime in HI column density that is similar to the QSO absorption line surveys, the so-called Lyman limit systems (i.e., with HI column density of $10^{17}-10^{18.5} \text{ cm}^{-2}$), providing a direct comparison between the local and higher redshift universe.</p> <p>While my area of expertise is HI 21 cm emission, the GBT has clearly been always in forefront of technology and science as these two white papers arXiv:1610.02329 and arXiv:1610.09014 show that very well. I therefore urge you to continue sustainably funding the GBT.</p>	Against Closure	Email	11/23/2016	
76	b	Nicolas	Lehner	Dept. of Physics, Univ. of Notre Dame	The GBT has not only been critical for my research, but also for the continuing formation of my postdocs and grad students. With its easy access, hands-on on the observation, the GBT has provide a unique experience to my students in this generation of queue mode observations.	Against Closure	Email	11/23/2016	
77	a	Lewis and Rose Ann	Harvey	Resident	<p>My wife and I are writing to express our feelings about keeping the Greenbank Observatory open. My wife is a school teacher and has taken several groups of children on field trips to the observatory. Not only is it educational, it is also encouraging to youth of our state to expand their knowledge of this wonderful facility and it opens their minds to the world of science.</p> <p>I am a native West Virginian that has visited the observatory many times over my lifetime. It never ceases to amaze me as to how much knowledge is readily available to the visitor. I also believe that it would be detrimental to the science community, as well because our future explorations of space and beyond wouldn't have the advantages of what knowledge the observatory can provide. I cannot emphasize enough on how much the educational aspects would be taken away from our children and adults as well, if the facility was to close.</p> <p>I was wondering if any research has been done to check on grants or to see if money is available from outside sources? In closing I hope that every effort will be made to keep the observatory open.</p>	Against Closure	Email	11/23/2016	
77	b	Lewis and Rose Ann	Harvey	Resident	With tourism being a large factor in West Virginia and with the downturn of our economy, to lose the observatory would be devastating to this region.	Against Closure	Email	11/23/2016	
78	a	David	Hogg		<p>I write to recommend that upon completion of the NSF EIS for the Green Bank Observatory the alternative "Continued NSF investment for science-focused operations (No-Action Alternative)" be selected. I make this recommendation based on a number of considerations.</p> <p>First, the Green Bank Telescope (GBT) is highly productive, and is recognized as a world-class research instrument. It is central in the quest to evaluate the Hubble Constant by independent means; it is central in the effort to measure gravitational waves at wavelengths different from those being detected by LIGO; it is an important tool in the study of forming stars and their associated debris disks; and it offers the opportunity to explore the manner in which planets might form.</p>	Against Closure	Email	11/23/2016	
78	b	David	Hogg		Second, the Green Bank Observatory (GBO) has been an outstanding place for the furtherance of science education. It has numerous programs, a few of which I cite here. These include the enrichment programs for teachers of science at the public school level; the support provided annually to the National Youth Science Camp, support which began with the founding of the Camp in 1963; support for the science programs offered by others, such as Chautauqua; and the continuing program of science education provided to the thousands of visitors who come to the GBO each year.	Against Closure	Email	11/23/2016	
78	c	David	Hogg		<p>Third, the GBO has been of great importance to the local community. When the Observatory first came to Pocahontas County there were a number of other major employers, but with the passage of time most have closed. That the work force at the Observatory continues has provided important stability to the County. In addition, many of the staff have contributed personal effort to the betterment of the County, be it by serving in County government, or by initiating and then supporting the widely-recognized County library system, or by providing guidance in science and sports programs. As an interesting historical note, it was an Observatory employee who worked with others in the County to persuade the State to take over the Cass lumber works and lumber railroad and turn it into the hugely successful state park.</p> <p>I believe that when the contributions of the GBO in science, STEM educations, and community support are evaluated, it will be obvious that the continued NSF support of the GBO is both necessary and wise.</p>	Against Closure	Email	11/23/2016	
79	a	Charles	Kerton	Associate Professor Department of Physics & Astronomy Iowa State University	The 2017 version of the Green Bank Telescope provides US-based astronomers an important, and unique, capability at millimeter wavelengths that should not be lost. In the interest of brevity, I will not reiterate the excellent points made regarding the changes in the GBT's capability at high-frequencies (millimeter wavelengths) since 2012, and the resulting science that this has enabled: see Lockman et al. (arXiv 1610.02329) and Bally et al. (arXiv 1610.09014) respectively. To their points I will simply add that, as an observational astronomer interested in the area of massive star formation, the capability of the GBT to examine the large-scale environment surrounding regions of massive star formation is very exciting, and I think will lead to an understanding of what allows massive stars to form.	Against Closure	Email	11/23/2016	

Green Bank Observatory -Written NSF Public Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
79	b	Charles	Kerton	Associate Professor Department of Physics & Astronomy Iowa State University	<p>The GBT will also play a crucial role in providing low-spatial frequency information for many ALMA observations. The importance of short-spacing information in radio astronomy is sometimes treated as an afterthought, but it can be crucial for the correct astrophysical interpretation of objects. My personal research has involved radio observations of HII regions (the ionized gas surrounding massive stars). Without short-spacing information, these regions can look completely different, and it is very easy to draw incorrect conclusions regarding the astrophysics involved.</p> <p>Shutting down the GBT (options 3, 4, and 5 of the EIS) would completely snuff out the potential of GBT in the area of mm astrophysics just as it is starting to gather momentum. Option 2, while preferable to option 3, 4, or 5, is of concern to me since it will clearly limit access to the GBT. As a researcher based in a small astronomy group, I need competitive open access to national research facilities in order to work effectively. I strongly encourage NSF to look at the 2017 version of the GBT when considering options for the Green Bank Observatory, and I hope they will support option 1 – continued NSF investment for science-focused operations.</p>	Against Closure	Email	11/23/2016	
80		Trupti	Ranka		<p>I interned at GBO as a graduate student during summer of 2012, 2013 and 2014. Now I work as an engineer at Giant Magellan Telescope, one of the next generation ELTs. The opportunities provided to me by GBO during graduate school, has directly resulted me in getting an opportunity to work at an ELT.</p> <p>I am one of many examples as to how exceptional facilities like GBO can train astronomers and engineers for the next generation. No other experience in my academic career would have prepared me for my current job as much as my work at GBO.</p> <p>Though the cost of 10 million dollars/year is a large sum needed to operate GBO, it is a very vital and relatively small cost if it helps train engineers and astronomers to lead billion dollar astronomy projects of the future. Hence it is my sincere request to NSF-AST to try its best to continue to fully fund GBT which will allow its open access to engineers and astronomers around the world.</p>	Against Closure	Email	11/23/2016	
81		Jim	Braatz	astronomer	<p>I am writing to express my strong support for maintaining the Green Bank Telescope as a general-purpose, NSF-funded research facility. The GBT is doing cutting-edge research, and I would like to particularly emphasize in this letter the unique and essential contributions that the GBT is making and will continue to make in the fields of cosmology and galaxy evolution. The GBT is helping us understand Dark Energy, and it is unique in its ability to measure masses of extragalactic black holes with the highest precision. With regard to the Environmental Impact study being conducted by the NSF, I would like to voice support for "Continued NSF investment for science-focused operations", the No-Action Alternative. I am an astronomer at NRAO in Charlottesville, Virginia. Here I lead the Megamaser Cosmology Project (MCP), which is a multi-year, international effort to measure the Hubble Constant, H₀. The MCP uses observations of nuclear water vapor megamasers to measure galaxy distances and thereby determine H₀, leading to a powerful test of cosmological models. ... Current measurements using standard candles disagree with the value of H₀ predicted from exquisite observations of the Cosmic Microwave Background in the context of the standard cosmological model. Either the cosmological model is wrong or there are unrecognized errors in the observations. We are addressing this controversy by measuring H₀ independently from all other observations and assumptions. Ours is a straightforward, geometric method that determines H₀ in one step, with no "distance ladder" or uncertainty related to standard candles. So far our observations are in agreement with the prediction of the standard cosmological model, but we must push the observations to improve our scientific conclusions. With ongoing observations, we will test whether Einstein's Cosmological Constant is the "dark energy" that explains the accelerating expansion of the universe. Besides this fundamental contribution to cosmology and physics, the MCP is also measuring gold-standard masses of supermassive black holes as a critical secondary science objective. These measurements are being used to understand galaxy formation and the role of the central supermassive black hole in galaxy evolution. With the GBT as the critical element of a VLBI array, we map gas directly in the sphere of influence of the central black holes. No other technique measures extragalactic black hole masses as precisely. Our observations are being used to demonstrate critical difference in the role of the supermassive black holes in disk galaxies, as compared to massive ellipticals. These are two examples of the cutting-edge research enabled by the GBT. I would like to emphasize that these studies were *revolutionized* by the GBT because at the critical water maser frequency, 22 GHz, the GBT is by far the most sensitive single-dish telescope on Earth. In the past decade, nearly all new megamasers have been discovered with the GBT. Because of its sensitivity and location, the GBT is the most critical antenna for VLBI follow-up studies. The MCP was made possible by the GBT. Future studies of megamasers rely on the GBT remaining available as a general-purpose science instrument. The MCP is an international project with critical contributions from senior astronomers as well as students and postdocs. ... In summary, I would like to express my wholehearted support for keeping the GBT available for open science. I strongly advocate continued NSF investment for science-focused operations. Studies of megamasers represent one example where the GBT is revolutionizing a field at the forefront of research. Continued involvement by the NSF is essential to push these investigations forward. Please don't hesitate to contact me for more information.</p>	Against Closure	Email	11/23/2016	
82	a	Edward	Murphy	Associate Professor of Astronomy University of Virginia	<p>I am writing to urge the NSF Division of Astronomical Sciences to continue funding and support for the Green Bank Observatory (the No-Action Alternative). In particular, I believe it is a mistake for the NSF to divest itself of the Green Bank Observatory, and I believe full divestiture will do serious harm to astronomical research and STEM education in the United States.</p> <p>First, as a scientist, I believe that the Green Bank Telescope is a unique, world class facility. The GBT has capabilities that are found in no other telescope in the world. For example, in my area of work, neutral hydrogen studies of the Milky Way, the unblocked aperture of the GBT is essential to providing spectra free from contaminating stray radiation. In terms of ability to survey low column density gas in the Milky Way, the GBT is unsurpassed. In addition, the GBT is the only single-dish radio telescope available to the general community in the United States that can observe the majority of the Galaxy. Eliminating, or even significantly reducing, the available observing time for basic research will negatively impact many research programs.</p> <p>I know that they all left with a greater appreciation of the research conducted there and the agency that made the research possible.</p> <p>In closing, I strongly urge the NSF to continue investing in the science and education focused operations of the Green Bank Observatory.</p>	Against Closure	Email	11/23/2016	

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82	b	Edward	Murphy	Associate Professor of Astronomy University of Virginia	<p>Second, as an educator, I believe that reducing support for the Green Bank Observatory will significantly harm science education and outreach efforts in astronomy. The Green Bank Science Center provides an array of education and public outreach programs that are important not only to the local community, but to the nation as a whole. I have personally participated in teacher professional development programs, research experiences for undergraduates, programs for visiting educational groups including school groups and scout troops, and informal visits by the general public. In the case of teacher professional development programs, I have acted as the astronomy instructor for a few of the NSF funded RARE-CATS programs. The teachers, from across the East Coast, found the program to be a life changing experience. In addition to their gains in content knowledge, the teachers left with increased skills and improved attitudes toward science teaching. Most of them told me it was the best professional development they had ever had. The other education and outreach programs in Green Bank have had similar impacts on other groups.</p> <p>Finally, let me point out that the education and public outreach programs are an excellent venue for promoting the work of the National Science Foundation. Over the last 25 years, I have brought a few dozen Boy Scouts, their parents and adult leaders, and other adults, to visit the Green Bank Observatory. For the vast majority of these visitors, it was their first experience with a facility funded by the NSF and the first time they have connected the NSF to specific scientific research.</p>	Against Closure	Email	11/23/2016	
83		Anna Belle	Sheets Gillespie		<p>I taught sixth grade at Green Bank Elementary School in 1959-1962, and the Green Bank Observatory was in operation then. Scientists and their families lived on the observatory campus; their children attended our local elementary and high school. The Green Bank area was primarily an agricultural and forestry community. However, the students from the observatory brought diversity and fresh interest to the classrooms. Their presence was (and continues to be) a valuable boost to the intellectual climate of the school, and to discontinue the observatory would have a negative impact to the school system in Pocahontas County.</p> <p>Much money and knowledge have been invested in the functions of the observatory, and to ditch this unique operation that has the possibility of augmenting mankind's understanding of space seems to me to be not only wasteful but also short sighted. What is to be gained by abandoning the observatory? Isn't everything in place to make discoveries that will have great impact on human survival in the future?</p> <p>I hope the NSF will continue to support the important research underway at the Green Bank Observatory in West Virginia.</p>	Against Closure	Email	11/23/2016	
84	a	Preston	Ozmar, III	Adjunct Science Professor Wave Leadership College	<p>I just wanted to send you a note about the Green Bank Observatory. I know that others have sent you messages also.</p> <p>Each year when I visit the Green Bank Observatory I am greatly inspired and I bring that inspiration back with me and inspire others, especially my students, to learn how to use science to understand the amazing universe surrounding us.</p> <p>I have seen classes of middle or high school students learning in classrooms at the Observatory and I read an amazing paper written by middle school students (I do not recall the name of the paper but I am sure I can obtain a copy if you would like to have one).</p>	Against Closure	Email	11/23/2016	
84	b	Preston	Ozmar, III	Adjunct Science Professor Wave Leadership College	<p>I read the paper entitled "The Case For a Publically Available, Well Instrumented GBT Operating at 20 - 115 GHz.". It is well written and illustrates some of the many scientific applications of the GBT.</p> <p>I see success at Green Bank in both the scientific and the educational missions and I recommend that full funding be established for them. It is an investment that has paid off in the past and I believe it will continue to pay off in the future.</p>	Against Closure	Email	11/23/2016	
85	a	Jeremy	Darling	Associate Professor of Astrophysics Astrophysical and Planetary Sciences University of Colorado, Boulder	<p>I write this letter to express strong support for the No-Action Alternative for continued NSF investment for science-focused operations.</p> <p>The NSF AST portfolio review measured the GBT against the metrics and goals detailed in the New Worlds New Horizons (NWNH) decadal survey, which was beyond the scope of the survey. The 2010 survey was explicitly tasked to address future facilities, taking current facilities *as given*. The NSF portfolio review deliberately misused NWNH and the review's findings should be regarded as invalid and unsupported.</p> <p>As the NSF AST portfolio review itself said, "The GBT is the world's most sensitive single-dish radio telescope at wavelengths shorter than 10 cm". Since these words were written, the GBT has become the world's most sensitive single-dish radio telescope at millimeter wavelengths and provides a crucial multiplier for NSF-supported ALMA science.</p>	Against Closure	Email	11/23/2016	
85	b	Jeremy	Darling	Associate Professor of Astrophysics Astrophysical and Planetary Sciences University of Colorado, Boulder	<p>The GBT is a best-in-the-world facility, enabling unique and crucial scientific capabilities (as outlined in recent white papers). Ending or curtailing NSF support for science-focused operations will significantly negatively impact U.S. competitiveness in STEM fields. I personally have trained many students (undergraduate and graduate) and a postdoc on the GBT --- nearly all members of traditionally under-represented groups in astrophysics -- and their access to the facility enabled them to continue on their career paths. Several undergraduates are now in PhD programs in astrophysics, and the postdoc now works at NASA JPL.</p>	Against Closure	Email	11/23/2016	

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85	c	Jeremy	Darling	Associate Professor of Astrophysics Astrophysical and Planetary Sciences University of Colorado, Boulder	<p>The science the GBT enables is forefront, ground-breaking, and is crucial to the scientific endeavor. It is a testbed for innovation: scientific, technical, and educational. There is no alternative to the GBT for many of its scientific constituencies, and choosing any option other than continued NSF support for science will be a deliberate truncation of many exceptional careers, particularly in the area of gravitational wave detection in the epoch of LIGO and multi-messenger astronomy. One of the NSF's new "big ideas" initiatives is "Windows on the Universe: the Era of Multi-Messenger Astrophysics." If this is indeed a goal of the NSF, then ending scientific support of the GBT is a contradictory action.</p> <p>The GBT, unlike most of the other facilities recommended for divestment, is unique, is still in its scientific prime, and multiplies the NSF's modest investment, supporting the guiding principles of the NSF as a federal agency.</p>	Against Closure	Email	11/23/2016	
86		David	Buchner		<p>I wouldn't have realized that The Green Bank facility was endangered — or, frankly, that it was in West Virginia, to be honest — had I not read it on Homer Hickam's Facebook page. The name was familiar, but I confess I didn't know where it was.</p> <p>In these weird times, we need to be safeguarding our scientific and technological assets. Not pruning or retiring them.</p> <p>I'm nobody special: just an American taxpayer and space fan. But I hate to see it when resources and iconic structures like this are brushed aside. Were it up to me, we'd keep the telescope.</p>	Against Closure	Email	11/23/2016	
87		Ali	Printz		<p>As a life long West Virginian, it has always been a struggle for us to break out of the stereotype that others states and the nation as a whole seem to pin on us. It is important that we break out of this mold continuously and show the rest of the country and world that we are educated, nature conscious, and can be an important part of scientific research. The Green Bank Observatory is an amazing place and has contributed enormously to astronomy and should continue to do so indefinitely. It would be a terrible loss that we might never be able to recover from to see such an amazing place go inactive.</p>	Against Closure	Email	11/23/2016	
88		Bill	Mullin		<p>From letter: Thank you for the opportunity to provide my comments regarding the 19 October 2016 Federal Register Notice regarding the National Science Foundation's Intent to Prepare a Public Impact Statement regarding the operation of the Green Bank Observatory in West Virginia.</p> <p>I retired from Merck and Co., Inc. after 37 years as the Vice President of Global Vaccines and Sterile Quality Operations and currently volunteer at the American Museum of Natural History in NY as an Explainer in the Rose Center for Earth and Space and a Tour guide and Docent hosting in part the five million visitors annually from all over the world. I have had a great interest in Science throughout my life and obtained a M.S. Degree in Astronomy as part of fostering a greater understanding of science in people of all ages in my retirement.</p> <p>I have visited the Radio Astronomy Operations in Green Bank, WV largely through a professional development program for college teachers that has been coordinated through the University of Dayton (Chautauqua) multiple times over the last 10 years. In my opinion the NRAO Green Bank Facility, now the Green Bank Observatory, remains a vital and premier scientific research facility with the largest steerable radio telescope in the world (GBT). Because of its unique capabilities, the Green Bank Observatory is well suited to complement the ALMA facilities in Chile for the US Scientific Community in pioneering research and I believe given the pioneering research at LIGO, where gravitational waves were discovered; the GBT is at the forefront of modern astrophysics with its research focus and capability in pulsar observations using nano-HZ gravitational radiation.</p> <p>In carefully reviewing the five options provided in the Environmental Impact Statement, I fear that as presented, two options create the immediate or short term destruction of the facility. Two options re-purpose the facility as a technology park which does not reflect the scientific research capability that would be sacrificed for modern astrophysics, or one option provides an over-reliance on future partnerships that will create a very uncertain outcome/sustainability. It is my deep hope that our Country will take a longer view on the need for this historic and scientifically advanced facility and provide for a modified Alternative #1 providing budgeting at 100% levels by NSF while actively pursuing partnerships with other partners to create new areas of interest while offsetting costs of operation.</p> <p>It saddens me to realize the NRAO Facility created in Green Bank West Virginia in the 1950's was executed to ensure the United States role in Radio Astronomy research would narrow the gap that existed in the US vs other countries. Indeed, the leaders at that time took a long view with respect to pioneering scientific research and the benefits that follow. For 60 years, the team at Green Bank and their pioneering spirit has made wonderful scientific contributions to increasing our knowledge of the universe and did it in a way that also benefits the local community and state of West Virginia. Because of the importance of this facility to scientific research in the United States, I will be providing copies of my comment to our elected officials from the region and other Congressional representatives on science and appropriations committees.</p>	Against Closure	Email	11/23/2016	NSF EIS Public comment.docx
89		Bill	Mullin		<p>Additionally, the Green Bank Observatory plays a vital outreach role in advancing Science, Technology, Engineering and Math with students of all ages coupled with the thousands of visitors they host annually. Their educational camps, courses, Science museum and staff set the right path and commitment to have a profound impact on all visitors and students at the Green Bank observatory Campus. To risk or compromise the presence of this world class facility in the middle of very rural West Virginia, in my opinion would also be a devastating blow to the local community and region which I cannot quantify.</p> <p>I sincerely hope that we do not close the book on the Green Bank observatory, given the wonderful chapters they have written in modern astrophysics of radio astronomy and the intensity of their outreach in Science, Technology, Engineering and Math for students of all ages.</p>	Against Closure	Email	11/23/2016	NSF EIS Public comment.docx
90		Dan	McCarthy	Director, Boy Scouts of America Summit Group	<p>It recently came to my attention that the future of the Greenbank observatory is being actively discussed. It is my hope that these discussions will lead to continued funding for the facility.</p> <p>As the Boy Scouts of America continues to expand its STEM- related program offerings, the Summit Bechtel Reserve expects to serve as a key component of those offerings. The Greenbank facility has consistently been seen as an attractive asset in supporting those programs as they evolve over the next several years. It would be disappointing were this facility and the potential advantage it provides for educating youth in this important scientific research area to no longer be available in proximity to our reserve here in Southern West Virginia.</p> <p>I hope you will take this into consideration as your discussions proceed.</p>	Against Closure	Email	11/23/2016	

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91		Stefanie	Muhle		<p>I was appalled to learn that the future of full scientific operation at the Green Bank Observatory is being questioned. This instrument with its unique sensitivity and suite of receivers has produced numerous valuable results in the past and is expected to continue to do so.</p> <p>Anything else but continued full scientific operation would effectively rob the North American astronomical community of a valuable means to conduct their research and compete on a global scale.</p>	Against Closure	Email	11/25/2016	
92		David	Blank		<p>WHY I STRONGLY URGE CONTINUING NSF FUNDING FOR THE ROBERT C. BYRD GREEN BANK TELESCOPE</p> <p>I am writing this letter to express my strong support for continuing NSF funding of the Robert C. Byrd Green Bank Telescope (GBT). As an astronomer affiliated with a university which has no connections to any private astronomical facility, public facilities like the GBT make it possible for scientists like myself to conduct research as the excellence of the project is the only criteria used in granting observing time.</p> <p>The sensitivity and frequency range of the GBT is greater than that of any existing radio telescope making it possible to do research that is harder or impossible to do elsewhere. For example, my research has been on searching for radio emission from exoplanets. Recently my collaborators and I have used the GBT to search for 43 GHz SiO MASER emission from the "disintegrating" exoplanet KIC 12557548 b. KIC 12557548 b orbits its star with an orbital period of only 16 hours. It is also a member of a class of exoplanets discovered from Kepler telescope data that are distinguished both by having periods of under a day and having variable transit profiles which are caused by outflowing material from the planet. The planet is so close to its star, that its surface gets hot enough to be vaporized and with the material expelled from exoplanet by the stellar wind. We used the GBT to search for MASER emission from the SiO molecule as the physical conditions present were very similar to where such emission has been observed elsewhere. Detecting such emission would have been the first direct detection of the composition of a rocky exoplanet and would have given much information about the origin and evolution of such objects.</p> <p>The GBT is the most sensitive telescope anywhere for conducting these observations and the only other telescope that could have been used was the less sensitive JVLA. My colleagues and I are looking forward to the launch of the TESS satellite in 2018. TESS will be searching for transiting exoplanets around bright, nearby stars and it is estimated that it will find 20,000 exoplanets no further away than about 60 parsecs. By comparison KIC 12557548 b, like the majority of the exoplanets found from Kepler data, is at a distance of roughly 500 parsecs. If exoplanets like KIC 12557548 b are as common in TESS data as they are in Kepler data, then a few dozen will be found and their much nearer distance will make any MASER signal stronger by at least a factor of 70 from what they would otherwise be if they were at the distance of KIC 12557548 b thus making a detection more likely.</p> <p>The GBT was commissioned in 2001, eleven years before the surprising discovery of close-in exoplanets like KIC 12557548 b. In the decades to come, I have no doubts that other new and surprising astronomical discoveries will continue to be made. I also have no doubts that the sensitivity and frequency range of the GBT will make it important in understanding such discoveries which is why I urge the NSF to continue to fund the GBT at a level that is at least as great as present.</p>	Against Closure	Email	11/25/2016	GBT_Funding.pst
93		Karen	Masters	Spokesperson for the Sloan Digital Sky Survey Reader in Astronomy and Astrophysics (equiv. to US Associate Prof)	<p>I am writing to express my strong support of continued funding on the Green Bank Telescope as a valuable asset to both US and international science.</p> <p>I first made use of the Green Bank Telescope almost 10 years ago as a postdoctoral researcher at Harvard University. In this project I observed a large sample of nearby galaxies with GBT with the aim of detect their radio 21cm emission to measure the rotation of the galaxies. These data were published as Masters et al. 2014 , and combined with other similar data made an essential contribution to our understanding of the motions of galaxies in the local Universe via Davis et al. 2011 (http://adsabs.harvard.edu/abs/2011MNRAS.413.2906D), Hong et al. 2014 (http://adsabs.harvard.edu/abs/2014MNRAS.445..402H). These data are still being used today by my collaborators in Australia.</p> <p>I currently am making use the Green Bank Telescope to make similar observations of a sample of nearby galaxies which have been selected to be observed with a new resolved spectroscopy instrument in the optical-NIR part of the spectrum by the Sloan Digital Sky Survey. This "MaNGA" survey will be the gold standard for local galaxy observations for years to come, observing the motions and make-up of stars and ionised gas in 10,000 nearby galaxies. However by only observing in the optical we miss vital parts of the ingredients of galaxies. Making use of GBT to followup these galaxies and measure their neutral hydrogen content (via its 21cm radio emission) is an extremely valuable contribution to add to our understanding of how these galaxies form stars, and process their interstellar medium.</p> <p>My team was granted 200 hours to begin this work at the beginning of this year; we will publicly release those reduced data as a Value Added Catalogue in the SDSS Data Release 14 (planned for July 2017). We heard only just over a week ago that we have been granted a further 700 hours to continue this programme through to the end of 2017. Put together these 900 hours of GBT filler time (when the weather is too poor for higher frequency observing) will allow us to measure neutral hydrogen gas content in over 1500 galaxies in the MaNGA sample which are in parts of the sky inaccessible to any other radio telescope which can make observations of this quality.</p> <p>Green Bank is by far the best northern hemisphere telescope to followup the MaNGA sample, and as such its contribution to the science of understanding how galaxies in the nearby Universe formed, process their gas into stars, and cease star formation to become passive, dead galaxies is essential to our developing picture of the Universe we live in. Making these data public via the widely used SDSS database will ensure they provide a legacy dataset for years to come.</p> <p>I urge you to chose the "no action" option and continue to support the Green Bank Telescope as the cutting edge astronomical facility it is.</p>	Against Closure	Email	11/25/2016	

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94	a	Paul	Demorest	Associate Scientist, National Radio Astronomy Observatory North American Nanohertz Observatory for Gravitational Waves	I am writing to submit a formal comment on the proposed changes to the operation of the Green Bank Observatory (GBO). I am a scientist at the National Radio Astronomy Observatory, and have worked with the Green Bank Telescope for over 12 years as a student, telescope user, and NRAO staff member. My first involvement with Green Bank was as a graduate student at the University of California, Berkeley; as part of my PhD research, I helped design, install and commission a new instrument to record pulsar data from the Green Bank Telescope. This ended up being used not just by me, but by many other researchers for their own projects. Green Bank is one of only a few US facilities where students can get this experience of being deeply and meaningfully involved in instrumentation research and development. In my case, this experience was directly responsible for my continuing on with a career in astronomy. In addition to the scientific capability of the telescope, Green Bank continues to provide unique opportunities for students in our program – at levels from high school through PhD – to become directly involved in high-profile, exciting scientific research. Several scenarios proposed for review include ending science operations at Green Bank. These scenarios would devastate NANOGrav science and the careers of dozens of astronomers. This would come as other countries around the world are improving their infrastructure and instrumental capabilities in the search for low-frequency gravitational waves (e.g., the FAST telescope under construction in China). Changes to GBO operations that adversely impact NANOGrav will thus effectively cede US leadership in low-frequency gravitational wave astronomy to other nations. This will result in talented young scientists leaving the US to pursue careers in other countries that are expanding rather than reducing their investment in this cutting-edge field of research. Over the long term this will have negative consequences for the entire field of astronomy in the US. The GBT and Arecibo are currently the best telescopes in the world for NANOGrav science and with continued NSF support they will remain so for at least the next decade.	Against Closure	Email	11/25/2016	demorest_gbo_eis.pdf
94	b	Paul	Demorest	Associate Scientist, National Radio Astronomy Observatory North American Nanohertz Observatory for Gravitational Waves	Furthermore, the National Radio Quiet Zone ensures an environment free of many of the man-made radio emissions that can interfere with these sensitive measurements.	Against Closure	Email	11/25/2016	demorest_gbo_eis.pdf
94	c	Paul	Demorest	Associate Scientist, National Radio Astronomy Observatory North American Nanohertz Observatory for Gravitational Waves	The research program I became involved with as a student has grown dramatically over the past 10 years into the North American Nanohertz Observatory for GravitationalWaves (NANOGrav), a collaboration of over 100 students, astronomers, physicists, engineers, and data scientists at 34 institutions across North America. We are now on the verge of making the first detection of low-frequency gravitational waves from supermassive black holes — a discovery as transformational as the recent discovery of gravitational waves from stellar mass black holes announced by LIGO. NANOGrav uses an array of high-precision radio millisecond pulsars - precise astrophysical clocks — to search for small perturbations caused by gravitational waves. The Green Bank Telescope is absolutely critical to this effort because it provides outstanding sensitivity to these weak astronomical signals over 85% of the sky. No other facility in the world offers this combination of sensitivity and sky coverage.	Against Closure	Email	11/25/2016	demorest_gbo_eis.pdf
94	d	Paul	Demorest	Associate Scientist, National Radio Astronomy Observatory North American Nanohertz Observatory for Gravitational Waves	In addition, the elimination of this scientific institution will remove a technology center in a region with few skilled positions. Even conversion to an education and technology center would still likely result in the export of a number of good-paying jobs to higher-tech areas of the country. The people of Pocahontas County are proud of the observatory. At the November 2016 public comment meeting regarding the future of the GBO, not a single person complained about living in the National Radio Quiet Zone, and the public was clearly supportive of continued public funding of the GBO. The scientific, socioeconomic, and cultural impacts of reducing NSF funding for GBO are numerous and severe. Such action would be a huge loss for my career, the careers of my colleagues, the NANOGrav collaboration, the US astronomical community, and the people of Pocahontas County, West Virginia. This will result directly in loss of US leadership in one of the most exiting frontiers in modern astronomy and physics, and remove a unique national resource for training the next generation of innovative, highly-skilled scientists and engineers. I urge NSF to continue its investment in science-focused operations at Green Bank (the “no-action alternative”) in the strongest possible terms. Thank you for your consideration. If you have any questions or need further information, please contact me at the address above.	Against Closure	Email	11/25/2016	demorest_gbo_eis.pdf
95	a	Erin	Matheson		It took me longer than it should have to write this, so feel free to take my words. It's much better to say something than nothing: Please keep the Green Bank Observatory open. It has economic importance for West Virginia and Pocahontas County. It gives poor children in the coalfields something to aspire to. More importantly, Central Appalachia is in a state of economic transition. The extraction industries that have been central to the region's economy for the past hundred years are disappearing through automation, globalization, and technological change. This period of transition has been devastating already, causing many people to flee the state and many communities to dissolve.	Against Closure	Email	11/25/2016	
95	b	Erin	Matheson		And if we lost the National Radio Quite Zone, there'll be nothing like it on this side of the Mississippi for years to come. Quiet spaces are important.	Against Closure	Email	11/25/2016	
95	c	Erin	Matheson		Now more than ever, Appalachians, and especially West Virginians, need the hope and inspiration that Green Bank offers -- the hope that there is a future in education, that school matters and that, even in West Virginia, the mysteries of the universe are accessible through these telescopes. Please keep Green Bank open.	Against Closure	Email	11/25/2016	

Green Bank Observatory -Written NSF Public Comments

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96	a	Ingrid	Stairs	Professor Dept. of Physics and Astronomy	The Green Bank Telescope (GBT) has been an essential instrument throughout most of my research career. I had the good fortune of holding an NRAO Jansky Research Associateship at the Green Bank site from 2000 to 2002, when I obtained my faculty position at UBC. Being on-site at Green Bank for two years was a unique experience that allowed me to focus exclusively on my research and imagine new projects to be undertaken by the GBT, which was then undergoing commissioning. Over the years, I have helped fund and install a precision pulsar observing instrument (the Green Bank Astronomical Signal Processor, or GASP) at the GBT, written software for reduction of data from other instruments and carried out numerous research projects involving the rapidly spinning, magnetized neutron stars known as pulsars. In 2007, the long-term timing collaboration that I have been part of since my graduate-student days extended its scope to become the North American Nanohertz Observatory for Gravitational Waves (NANOGrav). This collaboration is on the road to making a direct detection of gravitational waves passing near the Earth; the loss of the GBT, or even a significant reduction in the observing time available to NANOGrav would delay the time to detection and reduce our ability to carry out astrophysical studies of the waves. The GBT is also absolutely essential for studies of the double pulsar: it has a unique combination of high sensitivity and ability to track the system for 3 orbits at a time. This system provides the more precise constraints available on departures from Einstein's theory of general relativity in the strong gravitational-field regime. Losing the ability to time this binary with the GBT would slow down the science dramatically in the near term. The GBT has provided the scientific community with a wealth of new pulsars, including multiple millisecond pulsars in several globular clusters, several new millisecond pulsars that we have included in NANOGrav timing, and exotic systems such as a pulsar in a short-period triple system with two white dwarfs, and the first pulsar known to switch between radio pulsar and X-ray-binary states. I count myself fortunate to have been involved in most of these exciting discoveries. The GBT is still a young and versatile instrument, with years of fundamental and high-impact science ahead of it. The "open skies" policy has been a boon to worldwide radio astronomy and also the means to ensure that the best science is done with the telescope. I advocate strongly for the first option under consideration: Continued NSF investment for science focused operations.	Against Closure	Email	11/25/2016	GBT_EIS_Stairs.pdf
96	b	Ingrid	Stairs	Professor Dept. of Physics and Astronomy	I have trained students and postdocs on searching for new pulsars in the field of our Galaxy and in globular clusters, on timing both young and millisecond pulsars, on understanding the unique double-pulsar system and on deciphering pulsars in triple systems. I have so far mentored 19 trainees ranging from undergraduates to postdoctoral fellows on the use of GBT data and hope to be able to continue doing this for years to come.	Against Closure	Email	11/25/2016	GBT_EIS_Stairs.pdf
97		Josh	Simon		I am writing to support continued scientific operation of the Green Bank Telescope by NSF. Although I am not a radio astronomer, the GBT makes significant contributions relevant to my research. I will give two very recent examples. First, Spekkens et al. (2014) and Crnojevic et al. (2016) used the GBT to search for neutral hydrogen associated with a number of recently discovered dwarf galaxies orbiting the Milky Way. One particularly interesting galaxy they studied is Eridanus II (Eri II), which is the Milky Way's second most distant satellite. They placed tight upper limits on the gas content of Eri II, while my optical spectroscopy of stars in the system and HST imaging shows that Eri II has not formed any stars in many billions of years (Li, Simon et al. 2016). The combination of these results presents a major puzzle: how did Eri II stop forming stars and lose its gas despite being so far away from the Milky Way? It has long been known that all of the dwarf galaxies within 250 kpc of the Galaxy lack gas, while those at larger distances generally have retained some gas, which provides significant clues about how star formation shuts off in small galaxies and about the hot gas halo surrounding the Milky Way. However, the details of quenching and gas stripping in dwarfs are still not understood. As the most sensitive steerable cm-wave telescope, GBT can play an important role in resolving this decades-old mystery. Second, I recently used Kepler imaging to study the long-term photometric behavior of Boyajian's Star, which became famous last year as "the most interesting star in the Galaxy" as a result of its unexplained dimming events observed by Kepler. I showed that in addition to briefly fading by as much as 20% for a few days, the star's brightness also steadily declined over the course of several years (Montet & Simon 2016). Both behaviors are completely unprecedented in stellar astrophysics for main sequence stars, leading to speculation of a non-natural origin. Several members of the Breakthrough Listen project recently used the GBT to search for SETI signals from the star. While detection of a signal is of course unlikely, Boyajian's Star is unquestionably the best SETI target we know of today, and GBT is the most sensitive radio telescope that can observe it. These are just two examples of the importance of the GBT to the US astronomy community (again, not limited to radio astronomers). Because it is the most sensitive facility that can observe outside the declination range accessible to Arecibo, NSF divestment from GBT would result in a major loss of scientific capabilities. I therefore urge you to adopt the No-Action alternative and continue NSF support of the telescope.	Against Closure	Email	11/25/2016	

Green Bank Observatory -Written NSF Public Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
98	a	Edward	Jenkins		I have been made aware of the fact that NSF is undergoing a review of different possibilities for the future of the Green Bank Telescope (GBT), with options that range from a continuation of totally science-focused operations (the No-Action Alternative), to some compromises in support, to complete deconstruction and site restoration. ... I am not a radio astronomer, nor do I work in an academic department that is heavily dependent on radio astronomical research. Thus, I feel that in expressing an opinion on the fate of the GBT I am relatively free of any conflict of interest, other than my enthusiasm for astronomical observations in general. Of course, I must acknowledge that my lack of technical or programmatic expertise in radio astronomy matters puts me at some disadvantage in posing any well informed advice. I understand that the Astronomy Division of the NSF is under severe budget pressure and faces strong fiscal challenges in supporting a new generation of important, highly ambitious new projects that will advance our understanding of the universe. As a result, the agency needs to save on operating costs and decommission old observing facilities that have outlived their usefulness. However, I do not consider the GBT as particularly old: the scientific operations of this unique facility began only 15 years ago. Since that time, there have been significant investments in creating upgrades for tracking, active surface control, and high frequency receivers. Since my research background is in the interstellar medium, it would be tempting (and probably easiest) for me to address the potential benefits from the GBT in its new capabilities to observe at millimeter wavelengths and the ensuing prospects for studying molecular species and supporting ALMA investigations. There is no doubt that this is a valuable enterprise for the GBT. The GBT also offers important contributions to a large number of other astronomical topics, as outlined in a recent white paper (Lockman et al. arXiv 1610.02329). However, I'd like to focus on one particular subject, namely, the potential of using the GBT to detect pulse phase variations caused by gravitational waves of very low frequency for a network of millisecond pulsars distributed across the sky. Over a long period of time, NSF made a very substantial financial investment in gravitational wave astronomy with the building and perfection of the Advanced LIGO facility. That venture paid off with the spectacular detection of gravitational events in the hecto- to kilohertz regime. We now have a start in gravitational wave astronomy in one frequency domain with an excellent promise of future discoveries. However, it is important to recognize that we have the potential to build upon this achievement in an entirely different frequency range. My understanding is that in our country, the only telescope facilities that can contribute effectively to the NANOGrav enterprise are the Green Bank and the Arecibo telescopes, since the pulsars that are useful for this investigation are extremely faint and require large apertures. The fact that the GBT is fully steerable is an important strength since it can access pulsars over broad areas of the sky, which helps to increase the precision of the measurements. I sense that not too long from now, the sensitivity for detecting the low frequency gravitational wave background will penetrate the level of signal amplitudes expected from disturbances produced by binary black holes at their very early stages of inspiral. Moreover, GBT investigations of individual systems containing millisecond pulsars will allow observers to probe such fundamental physics problems as the equivalence principle, the equation of state of extremely dense matter, and general relativistic effects in the strong field approximation.	Against Closure	Email	11/24/2016	GBT.pdf
98	b	Edward	Jenkins		I would like to go beyond simply expressing my support for maintaining operations of the GBT and make a pragmatic suggestion. I understand that LIGO in its various stages of development was funded by the physics division of NSF. I presume that the premise for this support plan was that gravitational wave detections were primarily a basic physics undertaking, even though we recognize that they benefitted astronomy as well. I would like to propose that the same reasoning could be applied to partial support of GBT operations, i.e., use some funds from the physics division to decrease the financial burden on the astronomy division and thus rescue the GBT from any curtailment of its science research. Now I understand that NANOGrav receives some support from the physics division, and it is contributing a modest amount to the operation of the GBT, according to an article that I read in a recent issue of Science (Clery, D., Science, 354, 693). According to this article, NSF will be experiencing an annual savings of 2.5M\$ in operational costs from this and other sources, but it still is supporting a remaining annual budget of 8.2M\$ for GBT operations. In view of the relevance of millisecond pulsar research to fundamental physics that I mentioned in the previous paragraph, does it not seem reasonable that the physics division could provide some additional financial relief to the astronomy division by increasing the contribution to GBT operations at a level of spending that is still substantially less than the support for Advanced LIGO? I think we can recognize that LIGO and Advanced LIGO have established a precedent for funding gravitational wave detection by the physics division. I realize that the proposal that I suggested in the above paragraph may be out of line with the balance of various types of observing, i.e., gravitational wave research versus all of the other kinds of investigations. Thus, my suggestion may be unwarranted in the light of realities in the demands on telescope time. Nevertheless, I thought I should put this idea forward in the hope that we can forestall any curtailment of a full time use of the GBT for astronomical observations. I hope that you find my opinions to be useful in your decision on the fate of the GBT, a telescope that has unique attributes and is a valuable resource for the US and the entire world.	Alternatives Consideration	Email	11/24/2016	GBT.pdf
99	a	Rita	Wilson		I am writing in support of maintaining funding for the Green Bank Telescope. Many things have changed at GBT since 2012 including pulsar timing for gravitational wave research and listening for radio signals from Tabby's Star. NSF Open Skies support is critically important to our country's scientists who need radio telescope access for their research.	Against Closure	Email	11/24/2016	
99	b	Rita	Wilson		The Green Bank Observatory invests about \$30 Million into the local economy annually. Shutting down or mothballing the facilities would have a devastating effect on the area.	Against Closure	Email	11/24/2016	
99	c	Rita	Wilson		Time on the GBT is a key to research by professors and students in the West Virginia University Department of Physics and Astronomy. Shutting down, mothballing or repurposing the GBO would have a chilling effect on that WVU Department.	Against Closure	Email	11/24/2016	

Green Bank Observatory -Written NSF Public Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
100	a	Laura	Jensen		<p>I strongly urge NSF to consider either continuing its existing investment for science-focused operations for the Green Bank Observatory or supporting its collaboration with interested parties to establish funding partnerships with proportionally reduced NSF funding.</p> <p>For the past year, I have had the opportunity to manage projects involving the Green Bank Observatory. Previously, I worked with well-known media, technology, and policy organizations in Washington, D.C. The capabilities of the staff at the Green Bank Observatory to deliver on projects rival those of any other major institution I have worked with. Green Bank staff have considerable multi-disciplinary expertise in science, engineering, electronics, software development, and computer sciences. In the last year, Green Bank teams have successfully delivered on several international consulting and engineering projects, as well as domestic and US-university-based instrument development, research, and support initiatives. Green Bank staff are in demand to consult on radio astronomy and engineering initiatives around the world.</p> <p>The Green Bank Observatory represents a significant and valuable US-based resource for the NSF—not only for the scientific and educational value of the GBT and the observatory facilities, but also for the expertise and international reputation of the staff that have been assembled at the site. It's inconceivable that this impressive combination of physical and human resources could not continue to be effectively leveraged by NSF as part of its mission "to promote the progress of science; to advance the national health, prosperity, and welfare; to secure the national defense..."</p>	Against Closure	Email	11/24/2016	
100	b	Laura	Jensen		<p>Many people spoke eloquently at the public meetings on November 9, 2016, about the socioeconomic impact that a reduction or closure of the Green Bank facility would have on the local community. There is no question that a reduction in the scope of the Green Bank site would require its professional staff to find employment elsewhere. The local community impact would be profound.</p>	Against Closure	Email	11/24/2016	
100	c	Laura	Jensen		<p>The implications of any reduction on the site's ability to continue its established educational and STEM programs would be devastating and far reaching for the next generation of US students.</p>	Against Closure	Email	11/24/2016	
101		J.N.	McDonald		<p>I just want to let you know that I feel the Green Bank Observatory, despite, or perhaps because of, its remote location it has continually contributed to the advancement of our understanding of the vast amount of space beyond our own. In addition to its huge steerable telescope, it serves a vital role educating children and adults alike on the mission of the National Science Foundation and NRAO. While facilities in the southwest and Peru have been constructed with different capacities, they are not nearly as accessible for most Americans.</p> <p>In closing, I ask you to consider Option 1 (no change) or Option 2 for the Green Bank Observatory.</p>	Against Closure	Email	11/24/2016	
102	a	Maura	McLaughlin	Eberly Family Distinguished Professor Department of Physics and Astronomy	<p>I am writing in response to the environmental review being conducted of the Green Bank Observatory (GBO). I have been a user of several telescopes at Green Bank for over 20 years, have worked at West Virginia University (WVU) for over 10 years, and have owned property in Pocahontas County for roughly five years. The closure of the GBO or a severe reduction in the time available for astronomical observations would have serious and far-reaching consequences for not only on the local and international astronomy community, but also for students and residents in the state. In the 10 years since I've been a professor at WVU, the number of faculty in the Department of Physics and Astronomy doing astronomy-related research has grown from one to six. In addition, WVU has hired faculty in Math and Computer Science and Electrical Engineering whose research complements the astronomy research in our Department. We've been able to recruit and retain excellent faculty in large part due to our proximity to the GBO. (Indeed, I wouldn't have accepted a faculty position at WVU were it not for the GBO proximity!) It is an extremely valuable resource for STEM education collaborations. It is also critical for training our undergraduate and graduate students, who can easily visit the GBO and use some of the smaller telescopes on site for independent research projects. It is incredibly useful for faculty and students developing instrumentation, as they can access both world-class facilities and engineers. Just last year, we were named an official university research center (the Center for Gravitational Waves and Cosmology). This would not have happened without the support of our GBO collaborations (and in fact several GBO employees are affiliate members of the Center). If the GBO would close, or cease performing astronomical observations, we would likely lose faculty to other institutions. We would also have a more difficult time recruiting the best graduate students. And, our undergraduate retention rate would certainly decrease as trips to the GBO are a prime motivator for our undergraduate physics majors. This would be accompanied by a decrease in the fraction of female Physics majors, as astronomy is the most diverse of the sub-specialities in the Department. Finally, as the large majority of awards coming into the Center are related to GBT research, teaching, or outreach, our Center would likely cease to exist as it would not satisfy WVU's Center designation criterion. This would negate a large intellectual and financial investment by the state, just before the true scientific potential of many of our GBO programs is realized. (We are likely only five years away from detecting low-frequency gravitational waves in Green Bank Telescope data through the efforts funded by our NSF Physics Frontiers Center award. This will revolutionize our understanding of cosmology, galaxy evolution, and gravity). The impact on STEM education in the state would be equally, or even more, devastating. A visit to and/or research experience at the GBO is often the only exposure to real-world STEM that rural students in WV receive through their entire K-12 education. (The number of freshman at WVU who tell me they are majoring in STEM due to an early experience at the GBO is astounding!)</p>	Against Closure	Email	11/25/2016	gbo2016.doc
102	b	Maura	McLaughlin	Eberly Family Distinguished Professor Department of Physics and Astronomy	<p>It also provides teachers in the state access to world-class research facilities and enables them to incorporate astronomy research experience into their classes. One program that I am involved in is the Pulsar Search Collaboratory (PSC), in which high-school students are able to analyze data from the Green Bank Telescope to search for pulsars. We have been carrying this program out, in collaboration with the GBO, for eight years and, in that time, have involved over 2000 high-school students and 100 high-school teachers. Roughly 50% of the students are female, and nearly 50% of the students who participate have an ultimate career goal of a PhD in a STEM field. In addition, seven pulsars have been discovered thus far, representing a remarkable scientific achievement. I have co-produced an NSF-funded documentary about the program called little green men that will expand the sphere of influence of the PSC to students world-wide. If the GBO would close, the PSC and other programs using the GBO would be impossible to carry on, having a very negative impact on WV's ability to produce students trained in 21st century skills. This would also have implications for students throughout the country – our current NSF award for the PSC funds the establishment of PSC hubs in nine other states. Note that while the continued operation of the GBT is of course paramount, the smaller telescopes on site are also critical to the education efforts and must remain operational for the GBO to continue its impact.</p>	Against Closure	Email	11/25/2016	gbo2016.doc

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102	c	Maura	McLaughlin	Eberly Family Distinguished Professor Department of Physics and Astronomy	Finally, the impact of the GBO on the economy and culture of the region is significant. Astronomers and students from all over the world visit either to use the telescope or to attend conferences, and these visitors also patronize Cass, Snowshoe, and many state parks in the region. And, of course, there is a large tourism industry built around the GBO, drawing astronomy enthusiasts or simply people who are curious about a quieter way of life without cell phones and wi-fi to the region. We love the area so much that we purchased property there, and visit often. None of our neighbors are astronomers, but all realize the economic benefits of the telescope and are proud and supportive of the facility. If the GBO would close, not only would jobs, but an important source of revenue to the county, would be lost."	Against Closure	Email	11/25/2016	gbo2016.doc
103	a	Loren	Anderson	Assistant Professor of Physics and Astronomy	I am writing in regards to the Environmental Impact Statement of the Green Bank Telescope (GBT). I am an assistant professor of physics and astronomy at West Virginia University (WVU). Removing NSF funding from the GBT, as you have already begun to do, would have severe negative impacts on the people of West Virginia, the faculty of WVU, and on our ability to educate the next generation of scientists. I arrived at WVU in 2011, drawn to the close connection with the GBT and to the growing emphasis on astrophysics in the department. It was one of only two jobs that I applied for. My work centers on single-dish radio observations of massive star formation regions, and the GBT is my primary instrument. To date, I have been the PI of about a dozen projects on the GBT totaling hundreds of telescope hours, published five first-author papers, and written two successful grants (one to NASA and one to the NSF) requiring the use of the GBT. Personally, the GBT is necessary for me to continue my research. No other facility has comparable surface brightness sensitivity. I understand the need to divest from some facilities to make room for others. This is foolish for the GBT, however, as it has just become a mature instrument and has numerous NSF-funded projects related to it. For example, the new ARGUS and MUSTANG-2 receivers, both NSF-funded, are just now being commissioned on the telescope. Its best work is yet to come, since researchers now know its true capabilities at high frequency. While decreasing funding seems like a viable option, this is untenable. The telescope operates ~3600 science hours per year with a shoestring scientific staff. Cutting to 60% funding, as was just done, will further reduce the staff and put ongoing operations, including NSF-funded FLAG, MUSTANG-2, and ARGUS, in jeopardy. Many large projects have already had their hours reduced. Mature instruments like the GBT have a niche in large projects, but these large projects are severely negatively impacted by the current reduction in funds. I implore you to restore funding to this important and vital facility.	Against Closure	Email	11/25/2016	nsf_gbt_letter.pdf
103	b	Loren	Anderson	Assistant Professor of Physics and Astronomy	Our department's connection with the GBT has allowed us to grow tremendously. I was the fourth astronomer hired; 12 years ago there was only one in the department. Since I arrived, we have hired three additional astronomers, two tenure track and one teaching assistant professor. All this growth has been due to our connection with the GBT. There is little other reason for people to move across the country to work at WVU. If the GBT funding were cut, or even if it were reduced to the point that we cannot get the telescope time we need, I have no doubt that our faculty would move elsewhere. I would immediately begin pursuing other options. Our GBT connection has also enabled numerous successful grants, most funded by the NSF. Since 2006, our faculty have been awarded \$14.5M. In the last few years we have been awarded ~\$10M of this amount. Much of this money has been in related to the efforts to use pulsar timing to detect gravitational waves. The GBT is necessary if this effort is to be successful. All of our faculty have been funded by the NSF, and all of our research involves the GBT. These grants have resulted in an enormous influx of dollars in the the West Virginia economy. West Virginia is economically poorly performing, and is hurting badly due to the decrease in revenue from coal.	Against Closure	Email	11/25/2016	nsf_gbt_letter.pdf
103	c	Loren	Anderson	Assistant Professor of Physics and Astronomy	We badly need to re-train the workforce in new industries, most importantly in STEM fields. The grant funds have mostly been used to hire WVU students and postdocs, keeping the money in West Virginia. We now have 15-20 physics and astronomy majors graduate each year, up from 6 a decade ago. We now have ~15 astronomy graduate students in astronomy, up from zero a decade ago. We now have 8 astronomy postdocs, up from zero a decade ago. Unlike most modern facilities, students can be trained on-site at the GBT, and see directly how science is done. This is incredibly powerful for motivating young scientists. We need the GBT to keep this vital industry of radio astronomy in West Virginia. We are an EPSCOR state, and the obvious way to positively impact our state is to maintain funding for its only major scientific research facility. We have so little in the state. It is no stretch to say that the GBT is the focal point of the community in Pocohontus county. It is the meeting place for citizens and the source of extracurricular education in the area. Most of us faculty, together with our students and postdocs, spend weeks to months on-site at the GBT each summer. We talk with the locals. Removing the GBT would be devastating to the community.	Against Closure	Email	11/25/2016	nsf_gbt_letter.pdf
104	a	Carmen	Fragapane		As a science educator, the experiences that I have had the privilege of being a part of at Green Bank have had a tangible and meaningful impact, both personally and professionally. I first had the opportunity to visit Green Bank in 1989 as part of a field trip with the WVU Physics and Astronomy club. Since that initial visit I have taken part in several programs geared towards science education: RARE CATS (Radio Astronomy Research Enhanced Coordinated and Thematic Science); Hands on Universe, Living With a Star, and Quiet Skies. Each of these experiences equipped me with the knowledge and experiences to bring back to the classroom hands-on lessons that not only introduced students to radio astronomy, but got them genuinely excited about science. Each year I share the experiences that I have had at Green Bank over the years with my students during our unit on light and the electromagnetic spectrum. Several have visited me over the years and shared that they were led to make a visit themselves, and the indelible impression that their time in Green Bank had on them; having the opportunity to see the Green Bank Telescope and learn about the cutting edge science made possible by it at the Science Center exhibits. On a personal level, my experiences at Green Bank have instilled a visceral fascination with astronomy that led me not only to my professional position as a science educator, but also to public outreach endeavors. As a member of the NASA Langley Skywatchers, I share the wonders of the night sky with both young and old during telescope viewing sessions throughout the Hampton Roads area. I also serve as an instructor of an introductory astronomy course at The College of William & Mary's Christopher Wren lifelong learning program.	Against Closure	Email	11/25/2016	
104	b	Carmen	Fragapane		It is my fervent hope that the Green Bank Observatory remain a vital part of radio astronomy research. With state of the art instruments, some of which are currently employed and some that are still in development, the GBT is poised to continue to make groundbreaking discoveries in a number of areas. Having such a facility in the United States - and in the optimum radio quiet area of Green Bank - is a vivid testimonial that we as a nation are committed to cutting edge research and science education.	Against Closure	Email	11/25/2016	

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105	a	Martin	Chestnut	GBO employee and resident	<p>I'm writing this as both an employee at the Green Bank Observatory and a lifelong resident of Pocahontas County, Wv where the observatory is located. I'm a second generation employee. My mother worked there when I was a teenager. After graduating from College, I had an opportunity to apply for a position and was hired. Thirty two years later, I'm still an employee and hope very much to be able to retire from the observatory. Recently, my son had an opportunity to apply for an open position and decided not to due to the uncertainty of our future. Obviously, there is no way to say he would have been offered the job but he now continues to work out of state in Ohio while his fiancée continues to teach school at Pocahontas County High School. At some point, they may have to decide if she will seek employment closer to where he works, and leave the County. I am part of a large work force at the Observatory that are in out fifties. many of which are lifetime residents. It would be very difficult for many of to find new jobs in our craft, and we certainly could not find similar positions in this county or even in in surrounding counties, certainly not within driving distance. We would be forced to move our families or work away and come home to our families on weekends. If the observatory could remain funded, many of the jobs that would be vacated due to retirement over the next ten to 15 years could potentially be filled by college graduates from our own County. As has been stated by many in the recent scoping meetings, there are very few job opportunities in our County and our kids are forced to leave to find employment and raise families elsewhere. This impacts our school systems as well businesses where they would by gas, groceries, etc, as well as our county tax income. Again, as stated by others in the meetings, local businesses, including the local bank branch would be devastated by the loss of the observatory work force, and it would be a major blow to the County's tax revenue.</p> <p>I feel I could go on and on with why the Observatory should continue to be funded and remain in operation, including the impact on the Astronomy community and West Virginia University, but those topics were presented very well in the recent meetings.</p>	Against Closure	Email	11/24/2016	
105	b	Martin	Chestnut	GBO employee and resident	<p>As for as other impacts of the the Observatory's closure on the community, many things were mentioned in the meetings. The observatory provides a great deal of services to the local schools to support children's education (mentoring, tutoring, help with science and history fair projects, etc), as well as labor to help keep the aging schools' infrastructure in working order. Many Observatory employees over the years have served as volunteers for youth programs, and still do. This includes coaches, leaders, referees, and so on. I myself have been a cub scout leader, youth baseball and soccer coach, and assisted with middle school basketball. We've also had and currently have an employee that serves on the County Board of Education.</p> <p>The Observatory also opens it doors to county activities. It has hosted High School proms, field trips, science fairs, math field days, annual Eighth grade picnic/play day at our Recreation Area. The Wv Sate Department of Natural Resources holds Hunter Safety courses in our Auditorium. There have been town meetings, Fire and Rescue/CPR training meetings, and many others. The Residence hall has been made available multiple times during States of emergencies or extended power outages. Folks without power that have to use oxygen machines have a place they can come to. Local area residents take advantage of our site just for walking and biking where they can feel safe, and employees have the use of an exercise room. Currently, I believe there is only one exercise gym in the County, which is approximately 25 miles away.</p>	Against Closure	Email	11/24/2016	
105	c	Martin	Chestnut	GBO employee and resident	<p>In reference to the impact of budget cuts to the Observatory, any cuts could affect safety of telescopes and personnel (reduced money for painting, upkeep of facilities). Mothballing the GBT isn't as simple as parking it and leaving it alone. It requires yearly painting to prevent rust and potential structural failure., and the tri-annual contractor structural inspections. A structure this large requires continues painting to assure complete coverage over time, and inspections to find/remedy any possible or potential structural problems.</p> <p>Through all of this, I can't stop remembering that the National Radio Astronomy started in Green Bank. I truly hope and request that that NSF will continue to fund the Green Bank Observatory at the fullest extent possible (option 1).</p> <p>Thank you for the opportunity to give you my thoughts and concerns.</p>	Against Closure	Email	11/24/2016	
105	d	Martin	Chestnut	GBO employee and resident	<p>I do not understand option 1 since a change has already been made. The budget has already been reduced we have become "The Green Bank Observatory". Thus, I assume you mean option 1 would be the current "reduced" funding level?</p>	Alternatives Consideration	Email	11/24/2016	
106		Catherine	Pastor		<p>It has recently come to my attention that you are considering shutting down the Green Bank Observatory. I'm writing to you this Thanksgiving night to ask you to choose options 1 or 2 which would allow students to continue to use educational telescopes. It wasn't so long ago that I was a student visiting Green Bank. I cherish the memories that trip. I know that my experience at Green Bank influenced my decision to pursue a career in STEM. Today I work as a Medical Laboratory Scientist in the Pathology department at the University of Maryland Medical Center. I hope with the current emphasis on STEM education the National Science Foundation will continue its partnership with the Green Bank Observatory.</p>	Against Closure	Email	11/24/2016	
107	a	Ryan	Endsley		<p>My name is Ryan Endsley and I am a current graduate student at the University of Arizona pursuing a PhD in Astronomy. During the summer of 2014, I was an REU student at Green Bank Observatory. As a former REU student of Green Bank and as a young graduate student in astronomy, I write to you with a firm request that the No-Action Alternative be taken for Green Bank Observatory operations.</p>	Against Closure	Email	11/24/2016	
107	b	Ryan	Endsley		<p>After speaking with colleagues, looking through past GBT press releases, and reading through two recent papers on the abilities of the GBT to perform high-interest astronomical science (arXiv:1610.02329 and arXiv:1610.09014), it is very clear to me that the GBT is a highly valuable resource for the astronomical community and should be a high priority target for funding.</p>	Against Closure	Email	11/24/2016	
107	c	Ryan	Endsley		<p>What may be less clear to the committee is the cultural impact of discontinuing scientific operations at the observatory. After participating in local community events and meeting the residents of Pocahontas County and surrounding areas, I am strongly convinced that cutting astronomical funding for the observatory would lead to undesired cultural effects for these residents. Many of the these residents of Green Bank and surrounding towns worked for the observatory or visited frequently. Moreover, it seemed that the observatory was a location where local events for the whole county would take place, including the "Space Race Rumpus". The observatory is seen as the location where rural living individuals in America can go to connect with the extremely high-quality science being performed in their vicinity. Discontinuing scientific operations would, over time, break that connection between the local public and astronomers essential to maintaining public interest in science.</p>	Against Closure	Email	11/24/2016	

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Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
107	d	Ryan	Endsley		<p>Lastly, if scientific research terminates for the GBT this will have a lasting impact on the diversity of REU opportunities. Many REU opportunities focus strictly on theory or observation, but the Green Bank Observatory is an excellent location for research in astronomical instrumentation. Instrumentation should be seen as a highly valued avenue for astronomical studies by younger generations so that world-leading telescopes can continue to be planned and constructed by U.S. academics. Moreover, most REU's take place at a university while Green Bank Observatory exposes students to a completely different type of research environment which is critical to maintaining diverse opportunities and research.</p> <p>Thus, I strongly request that the committee take the No-Action alternative for the Green Bank Observatory.</p> <p>Thank you for your time and for your consideration of my opinion on this matter.</p>	Against Closure	Email	11/24/2016	
108	a	Kristine	Spekkens	Associate Professor, RMCC Physics	<p>I am writing in response to NSF's solicitation of input in its preparation of an Environmental Impact Statement (EIS) for changes to operations of the Robert C. Byrd Green Bank Telescope (GBT). As a world expert on cosmological galaxy structure as well as a heavy scientific user of the GBT, I strongly support the "No Action Alternative" of continued NSF investment for science-focused GBT operations. The GBT is a world-class research facility now and will remain so for years to come; any further NSF investment of this important resource will jeopardize the GBT's unparalleled impact on our understanding of the universe. Let me first provide some background information regarding my scientific and technical expertise. The scientific focus of my research is to understand how galaxies form and evolve in the context of the cosmological model that describes the structure and evolution of the universe as a whole. My technical expertise lies in deep radio observations of nearby galaxies to constrain competing models. I have thus used the GBT dozens of times over the past several years to carry out my research program. In the last three years in particular, I have authored or coauthored 8 refereed publications of GBT observations that together have been cited almost 100 times..... In particular, I am heavily involved in Square Kilometre Array (SKA) precursor and Phase 1 scientific design and development, and served on the panel of NSF's FY 2014 AUI/NRAO Program Review. I am therefore eminently qualified to provide an expert opinion on value of the GBT for scientific research. Simply put, the GBT is a world-class instrument for carrying out astronomical research of all kinds, and it is unsurpassed in several important regimes. For these reasons, maintaining current science operations through moderate NSF investment is critical for the US to stay at the forefront of radio astronomical research. Allow me to delve into specifics with an example from my own research on cosmological galaxy structure and evolution. An important piece of this puzzle is how gas cycles in and out of galaxies, regulating star formation and thus galaxy growth. Cosmology predicts that the lowest mass galaxies are the building blocks of all larger structures in the cosmos, and thus the process by which they deliver gas to their parent systems is of profound importance for understanding the role of gas in galaxy evolution. The combination of sensitivity, steerability and directionality (afforded by its unlocked aperture) make the GBT the best instrument in the world for characterizing the gas reservoirs of the faintest known galaxies in the universe, a fact that my research team showcased in 2014 (Spekkens et al. 2014, ApJ, 759, L5) and continues to exploit today. It is important to realize that the GBT will remain unrivalled in carrying out deep searches for gas reservoirs in faint satellites around gas-rich hosts until the SKA era, which may well be decades away. The GBT certainly remains both unique and relevant in the context of the SKA pathfinders in Australia (ASKAP), South Africa (MeerkAT) and the Netherlands (Apertif) that will likely begin full science operations in 2018: the searches that these instruments will carry out for gas-rich nearby dwarf satellites remain shallow by GBT standards, making the latter a fabulous follow-up instrument. To summarize, as a world expert on gas in galaxies and a radio astronomy black belt, the GBT is critical to my research and that of my extensive network of US collaborators. It is making important scientific contributions to several important fields including my own, and will remain an impactful facility in the coming decades. I strongly support the "No Action Alternative" of the EIS. In my opinion, all other options will lead to the cessation of meaningful scientific research at the GBT, representing a huge loss not only for US radio astronomy but also for the international astronomical community as a whole. I strongly recommend that NSF continue to invest in the GBT at its current level (which is modest within the NSF AST portfolio) in order to preserve this precious resource. I hope to have the opportunity to use the GBT for scientific research for years to come.</p>	Against Closure	Email	11/24/2016	GBS_EIS_letter_Spekkens.pdf
108	b	Kristine	Spekkens	Associate Professor, RMCC Physics	<p>It is well documented that the GBT's new and unrivalled capabilities for 3mm operations to complement ALMA, and its unique constraints on the nature of the gravitational waves first detected by LIGO in 2015, make it a fundamentally different instrument than the one considered by the Portfolio Review committee in 2012 (Lockman et al. 2016, arXiv: 1610.02329); it should therefore not be treated as such.</p>	Against Closure	Email	11/24/2016	GBS_EIS_letter_Spekkens.pdf
109	a	Martin	Bloss		<p>In response to FR Doc. 2016-25213 I am writing today to request that the National Science Foundation continue either full funding of the Green Bank Observatory (GBO) or provide substantial ongoing funding in addition to other Green Bank support partners. These are the first and second alternatives listed in the NSF Environmental Impact Statement dated 13-October 2016. Specific comments follow.</p> <p>Science Capabilities: The Green Bank Telescope at the GBO remains a unique and valuable instrument to the world scientific community.</p> <p>Poor return from this action: In the public meetings on 9 November 2016, Dr Ajhar of the NSF presented a graphic illustrating the future financial challenges that prompted the NSF to look for cost reductions. The amount of savings to the overall NSF AST budget by reduced GBO funding is minuscule compared to the projected cost increases that accompany the new facilities the NSF has chosen to champion. In the current uncertain economic climate and the public's weak support for the sciences in general, there is no assurance that funding for these facilities will become available. It could lead to a future where the only outcome of this action is to reduce the USA's competitiveness and relevance in the international science community and the NSF will have failed in its educational mandate. Budget considerations with this potential to do such harm should be evaluated as a result of actual pressure from approved and funded facility construction, not projections based on a wish list of desired facilities. Expansion of the NSF AST funding is a more prudent and permanent solution to NSF's funding challenges.</p> <p>Thank you for this opportunity to comment on this action which is so critical the scientific, educational, and economic leadership of the nation and NSF's promise to the American people.</p>	Against Closure	Email	11/25/2016	

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109	b	Martin	Bloss		Socioeconomic Impacts; The GBO plays a critical role in multiple socioeconomic areas, two of which I will expand on in this letter. The GBO, located in Pocahontas County West Virginia is one of the largest employers in the county and is the only high tech facility in a multi-county radius. The staff of the GBO are prominent members and leaders of the local community, providing a significant percentage of the Health and Safety, educational, and civic volunteers essential for preserving a basic quality of life for a highly underserved population. The loss of the GBO wages, tourism dollars, and subsidiary economic benefits would cause unrecoverable harm to the county's and area's business community.	Against Closure	Email	11/25/2016	
109	c	Martin	Bloss		Secondly the GBO via its world class instruments is one of, if not the last, United States astronomical facilities with a comprehensive education and public outreach portfolio providing unmatched hands-on educational programs for students from elementary to post-graduate levels. Should funding pressures force the GBO to curtail these programs, there is no facility outfitted and positioned to take on this critical aspect of the United States' STEM and astronomy world leadership.	Against Closure	Email	11/25/2016	
109	d	Martin	Bloss		At the point of the scientific capabilities assessment of the 2012, NSF's Division of Astronomical Sciences' (AST's) portfolio review committee, the GBT was just beginning a substantial series of enhancements to actualize the inherent capabilities designed into the GBT. By 2014 the first of a series of 100 GHz high frequency receivers were added to updated surface control and servo algorithms and regular 3mm observations began. NSF grants awarded after the portfolio review committee's report funded two of the three 100 GHz receivers set to begin observations in the 2016/2017 high frequency observing season. Nearly all observable frequencies and in particular the high frequency receivers are heavily oversubscribed. Two recent white papers describing the improved GBT capabilities are published at: arXiv:1610.02329 and arXiv:1610.09014.	Against Closure	Email	11/25/2016	
110		Russell	Kohrs	Environmental Science Teacher - Massanutten Regional Governor's School Adjunct Faculty -- Lord Fairfax Community College VAST - Earth Science Board Chair	The purpose of this letter is to urge the NSF to remain vested, fully or as much as possible, in the operations of the Green Bank Observatory. Over the long years of association between the National Science Foundation, Associated Universities, and the National Radio Astronomy Observatory (NRAO), amazing and groundbreaking science, irreplaceable educational opportunities, and valuable outreach between the federal government and the local communities Green Bank and Arbovale, WV have had a profound effect on the lives of countless people. As a STEM educator who has availed himself of all of this richness offered by the NRAO, I feel that it would be a travesty for the NSF to reduce its involvement in the operations of the Green Bank site any more than it has. For a teacher such as myself, who works in a rural, low income area, and often lacking opportunities for both my students and myself for growth and education, the loss of the Green Bank Observatory as a refuge for such enrichment would be devastating. For thirteen years, I have journeyed three hours each way by school bus with groups of students to the observatory, typically overnight. I would estimate that, over these years, I brought with me nearly 250 students on these trips. These students were largely of very modest means, many of whom might not have attended college, though certainly some have. And, for those that have, many of them were inspired by their overnight experience at a place which, to them, was larger than life and really made science come alive in a more profound way than I ever could manage in the classroom. It is one thing to visit and admire the grandeur of the largest fully-steerable radio telescope on the planet, located practically in your rural backyard. It is quite another to be able to work at this amazing place, even for a night, collecting data that told them something about the universe beyond their tangible experience. Science, after all, is a tricky thing.... A visit to Green Bank never disappointed. Not really knowing what they were getting into on such a trip, the afterglow of the experience is carried with many of my former students to this day. ... These were always special times for them and also for me. I learned so much - particularly about how to be a better teacher. So, these field trips were not only important to my students, they set my own career as a teacher on a trajectory where the importance of giving all students, not just those who are gifted, the opportunity to reach beyond what they thought was possible for themselves. Green Bank became an extension of my classroom. This annual sojourn and association with NSF and NRAO led to even more opportunities for my students and myself. One such opportunity is the Pulsar Search Collaboratory (PSC), of which I have now been a member for over six years of my fourteen year career. This NSF funded project allowed me to bring the work of the NRAO, NSF, and also new direct associations with astronomers from West Virginia University, into my home classroom and to all of my students. Thus, over my years of involvement, though not all of my students participated fully in the PSC program, over 300 students were exposed to pulsar astronomy, data analysis, and an opportunity to make a solid contribution to science that is very real and important. A critical part of this work was the chance for each PSC team to bring with them to WVU a group of active PSC students, who had conducted research and created a poster, to an annual conference where they could see what college was like, hear astronomy lectures, meet astronomers, share their work, and spend time with peers from other schools from around the region and country. For my students, this was very important to them, as they did a great deal of extra work to make it possible for them to attend. I know for sure that at least two of these students, both young women, are now pursuing astronomy or astrophysics in college and that, if not for this program, this very well may not have been the case. This was, and is, a special program with a powerful reach. And, the partnership between NSF and the NRAO is what made it possible.	Against Closure	Email	11/24/2016	LettertoNSF.pdf

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111		Russell	Kohrs	Environmental Science Teacher - Massanutten Regional Governor's School Adjunct Faculty -- Lord Fairfax Community College VAST - Earth Science Board Chair	<p>One final and very personal story is imperative for me to share, and that is something about my experience serving as an NSF-RET (Research Experience for Teachers) for eight weeks at the NRAO site during the summer of 2012. That summer was one of the best of my life, not only because of the chance to live and work in Green Bank and at the NRAO, but because it taught me a great deal about myself as an educator and as a researcher. I hold an MS in Geology, but I completed that in 2003. Secondary teachers really do not have the time to conduct research and, well, much of the time have not had the opportunity to do so. It had been nine years for me. During that summer, I really realized that this drought in my life had been far too long. My time at the observatory was spent helping to bring the 20m telescope back online, literally in fact, via SKYNET. That telescope and I became good friends that summer, and for the four years since, as I have continued to use it with students to ask questions about the universe and conduct our own investigations. During that summer when I lived onsite, made my own food in my rented townhouse, practiced my bagpipes in the pines, soaked in the history of the site from my bicycle, hiked the surrounding woods (even coming to work late one day after getting lost), worked with a team of fabulous undergraduate REU students, worked with amazing professional astronomers, conducted a "Messier Marathon" for a full day on the 20m, ascended the GBT more than once, climbed the dish of the 140ft with Dr. Langston, hosted my family onsite more than once, witnessed the amazing outreach to the community in great need after the derecho that July, and participated in countless other activities, I really grew into a professional. My work there that summer would propel my career in ways I could not have predicted and have made me the educator that I am today and the researcher and research mentor that I am in my current position. Such opportunities for teachers like myself are so very rare. Again, it was the partnership between NSF and the NRAO that made this possible.</p> <p>I have written enough, though I could go on for many more pages about the importance of the observatory in my life and career and the amazing fruits I have experienced as a result of the partnership between the NSF and NRAO. I urge NSF to remain fully vested in the now Green Bank Observatory (GBO). I urge NSF to keep its funding at current levels and even to increase its obligations in the future, not only because of the amazing science that still remains to be attempted there, but because of the importance of the observatory to the lives and academic experiences of so many students and teachers. Few places offer what the NSF and GBO offer as partners.</p>	Against Closure	Email	11/24/2016	LettertoNSF.pdf
112	a	Justin	Dilley	Business owner	<p>I would first like to thank you for giving our community the opportunity to show the National Science Foundation what the Green Bank Observatory (GBO) means not just to Pocahontas County, but also to West Virginia. We have been very fortunate to have this amazing site in our area for so many years and would be so appreciative to have the GBO open and operating at full capacity for several years to come. I was born in 1989, I witnessed the Green Bank Telescope being constructed, the initial operation of the telescope, and completed my high school senior project for civil engineering at the site. Now, after completing my degree in civil engineering at West Virginia University and my degree in land surveying at Glenville State College, I have returned home and started my own land surveying business. My wife Laurel Dilley teaches math at Pocahontas County High School and in 2015 started one of the first computer science classes in the state with the help of employees from the GBO.</p> <p>West Virginia, as you may well know, is a very poor state and is losing more and more jobs every day. People here are in dire need of something positive to boost morale and give hope that our state is not done yet and I firmly believe that the "Moth Balling" or complete destruction of the GBO site would be a catastrophic loss to our state and another "nail in the coffin" for the spirit of our people. I don't know if you yourself have ever been to West Virginia, but no matter the economic or social status of a person here, they would gladly give you the shirt off their back and help anyone in a time of need, and I think that West Virginians are owed this same show of gratitude in the form of keeping the GBO operational.</p>	Against Closure	Email	11/25/2016	NSF Letter.docx
112	b	Justin	Dilley	Business owner	<p>Thanks in part to the Green Bank Observatory and Snowshoe Mountain, Pocahontas County has a very diverse and rare collection of people for a rural community. This helps to make our county a more well-rounded and open environment for people of all races, colors, and creeds. I attended the recent open forum meeting that the National Science Foundation (NSF) held at the GBO. The one thing that stood out to me, especially during a very intense election year, was not only the number of people who attended, but the diversity of those present. Astronomers, physicists, teachers, and engineers sat side by side with farmers, fireman, loggers, and local business owners all in favor of the same end goal, to see the GBO succeed. Not to mention Democrats and Republicans coming together to support and agree on the same cause? If that doesn't show how important it is to keep the site open, I don't know what does!</p>	Against Closure	Email	11/25/2016	NSF Letter.docx
112	c	Justin	Dilley	Business owner	<p>My wife fought a hard battle to initiate one of the first computer science classes in the state of West Virginia and in 2015 she was granted the opportunity to start the course. Having had only a few computer science courses herself, she was worried that she would not be able to provide the students with all the knowledge that they might need. Three employees from the GBO volunteered their time to come to the high school and help the kids learn coding languages such as Python, C++, and Java. The first year was a huge success. In 2016 West Virginia mandated that all high schools in West Virginia offer computer science. Thanks to Laurel and the employees from the GBO, Pocahontas County High School was ahead of the curve. More and more students, boys and girls, want to take computer science. Many students, from Pocahontas County High School, have stated that they now want to go into computer science, engineering or other STEM fields because they have enjoyed the class so much. Former students from the first year the class was offered, who are now in college, have told my wife that they have found their first computer science classes in college very easy thanks to the initial experiences they had in high school.</p> <p>There are many other reasons why the GBO should remain open. I have not even begun to touch on the hardships a closure would cause to local businesses, West Virginia University and their physics and astronomy department, or the Green Bank community itself. I ask you to please keep the GBO open, for the people of Pocahontas County and the State of West Virginia, for the coal miners who helped to keep the lights on and no longer have jobs, and for our future youth, to help inspire them and show them that even though you grow up and live in a rural and poor area you can still become anything you want to be, and hopefully return to West Virginia to peruse your goals. Also, for Robert C. Byrd who helped to grow funding for the Green Bank Telescope in the first place and always had the best interest of the people of West Virginia and the United States in mind until the day he passed. I beg you, please, continue to fund and keep open the GBO for all of us.</p> <p>Thank you again for the opportunity to express our heartfelt opinions on the matter.</p>	Against Closure	Email	11/25/2016	NSF Letter.docx

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113		Chuck	Haden		Please save the observatory we all value the science and West Virginia needs the jobs WVU uses the information daily and will have to cut classes or source the info from other places that will be more expensive and less informing.	Against Closure	Email	11/24/2016	
114		Joe	Halstead		<p>Fund the Green Bank Observatory</p> <p>By cutting funding at the Green Bank Observatory, the National Science Foundation is trying to convince the public incorrectly that the Green Bank Observatory is outdated and no longer necessary. We must take action, not out of love for an observatory but because of a sense of duty to science.</p> <p>The Green Bank Observatory is a remarkable tool for astronomers to collect very precise and sensitive data from outer space. In 2002, the observatory discovered a windfall of three previously undetected millisecond pulsars in a dense cluster of stars in the Milky Way Galaxy. In 2006, it was discovered a "superbubble" of hydrogen gas above the Milky Way Galaxy by combining numerous smaller images made with the GBT into one large image. It's in the unique position of being extraordinarily sensitive to faint radio-emitting signals and other phenomenon in space since it exists within a 13,000 square mile "bubble" of radio silence. In fact, the number of discoveries made by the Green Bank Observatory has increased greatly since its inception in 2000. This is, in itself, compelling evidence for the value of continued funding.</p> <p>Knowing that there are abundant scientific possibilities out there, we ask for continued science-based operations at the Green Bank Observatory, as well as call for NSF funding to develop major long range research goals. More specifically, the research should focus on gaining a deep understanding of radio signals possibly emitted by alien lifeforms in a universe literally bursting at the seams with the ingredients of life.</p> <p>Filter out the noise. Fund the Green Bank Observatory.</p>	Against Closure	Email	11/24/2016	
115	a	Aaron "Ernie"	Williams		To the fellow inhabitants of our collective future, My name is Aaron Williams and I am a current graduate student in Art + Technology at the University of Florida. I am from French Creek, WV and an alumn of West Virginia University's sculpture and printmaking programs. Over the summer I was selected as a participant in a Science + Art residency at WVU called CESTA (Community Engagement in Science Through Art) along with another sculptor, two engineers, and two chemists. During my time there, I took one of the chemists with me on a road trip around West Virginia to see all its great wonders. In a single day we saw the Mummies of Philippi, Seneca Rock, the Dolly Sods, Spruce Knob, and did a tour at the Green Bank Observatory. Our visit there was by far the most incredible thing I witnessed on that day, but in fact in my lifetime.	Against Closure	Email	11/24/2016	
115	b	Aaron "Ernie"	Williams		Anytime that I close my eyes and imagine the future of West Virginia, I see its sky so untainted by light that the molecules of sugar seen by the GBO actually shine over the valleys. Where mountaintops were once removed now sit radio arrays to coordinate with findings in the valleys below. People from all over the world come there to see how dark it is and to hear how quiet it is. They see and hear things not of this earth while enveloped in the embrace of Appalachia which is almost alien in its worldliness. West Virginia's pride is that of the coal miner; they sacrificed everything to give power to the world. And now, with that same conviction, they protected those same mountains with laws which suspended the proliferation of light and the tide of electromagnetic waves in the hills and hollers. In this new West Virginia they saw the world, as they always have, from a very different perspective. And it was the sum of all of these things that made every discovery henceforth possible. Stories of the Mothman and of the Flatwoods Monster were true! The Quiet Zone shudders when a barn owl shrieks or a blue heron calls. These familiar bird calls, once mistaken for alien cryptids, helped to identify a far flung radio signal as a signature of an alien organism. There was a turning point, though, and it almost didn't happen. That time is right now.	Against Closure	Email	11/24/2016	
115	c	Aaron "Ernie"	Williams		When I heard the news of the National Science Foundation's review of the Green Bank Observatory and that deconstruction was on the table my head filled with fear. Fear that West Virginia would lose brilliant minds, economies, and technologies that are essential to the future of not only our state but ultimately the planet. Our history has played out time and again, and it's very tired. What we need, more than ever, is something to believe in. We need the educational opportunities given to our children, our communities, and the world by radio astronomy. We need the Green Bank Observatory.	Against Closure	Email	11/24/2016	
116	a	Michael	Holstine		Please accept this email as comment to the EIS statement being prepared by the NSF with regards to the Green Bank Observatory. As I am certain that you have been inundated with emails concerning the socio-economic impact of the Observatory to the local community, County and State, it is important to also note the historic factors existing at the site. The Observatory houses a replica and display of the original Jansky antenna used to first detect and quantify radio waves coming from the Milky Way galaxy. Across the road from the Jansky antenna exists the actual and original Reber Telescope, donated to the site by Grote Reber and registered on the National Registry of Historic Places. Both of these antennae have been utilized to recreate their original discoveries. Remember, these represent the birth of radio astronomy. Further down the site exist telescopes used for original interferometry and correlator experiments, the 40' telescope (the first fully computer-controlled radio telescope in the world, and now refitted as a fully manually-controlled telescope for education purposes), the 40m telescope (a polar-mount telescope with the largest spherical bearing ever produced at its tolerances), and the GBT (the largest fully steerable telescope in the world). It is amazing that all of these telescopes, varied and precisely built, all exist in one unique location - Green Bank. It is inestimable the value that can be placed on such a unique suite of instruments all in one place.	Against Closure	Email	11/24/2016	
116	b	Michael	Holstine		Another unique aspect of the facility is the existence of the National Radio Quiet Zone and the West Virginia Radio Astronomy Zone. These unique areas provide to the Green Bank site protections for radio astronomy that exist nowhere else in the world. Beyond that, however, are the protections that these zones provide to a wide contingent of contractors and other governmental departments that need to test and refine operational projects requiring radio quiet. Many of these contractors come from DOD, military and other agencies to the Green Bank site to work through the problems associated with their projects and available nowhere else in the world.	Against Closure	Email	11/24/2016	

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116	c	Michael	Holstine		<p>Land management has been a focus of the management of the site, as well, and is therefore utilized by various State agencies to develop model programs not available elsewhere. Two of these programs have been instituted by the WV Department of Natural Resources and by the WV Department of Agriculture. The WVDNR worked with the site to develop and maintain a controlled hunt program on the site to benefit wildlife diversity. Instituting this program at a facility where controlled conditions exist allowed testing of herd health, development of statistics through the Southern States Wildlife cooperative, and the opportunity for under- and graduate students to refine their education. Additionally, the techniques used in this controlled hunt allowed the State of WV to expand their experience gained to municipal and State Park hunts, for the first time in State history. Several firsts were accomplished through this program, including the first controlled program, the first early-season hunt, the first early season firearm hunt, and the model hunt for every future controlled program in WV.</p> <p>The WV Department of Agriculture utilized the site to resume a farming operation to develop a potato project for the purposes of modeling statistics for Pocahontas County soil yields of potatoes. This is the first year of the project and will be used to further refine planting and treatment methods for farming in the eastern part of the State.</p>	Against Closure	Email	11/24/2016	
116	d	Michael	Holstine		<p>Lastly, but nowhere near least, is the value of the social connections garnered by the employees of the Observatory with the local and broader community. This is a place of living and purpose. People here interact with each other like those of years past. We help each other in every aspect of our lives. When our neighbor needs help, we help. When the Observatory needs help, our neighbors help us. We are the only Red Cross-certified emergency shelter in the northern end of Pocahontas County. When people need heat when it's cold, or cooling when it's hot, or electric power for personal oxygen production, we provide it. We are integral to the community, in every stitch of the community fabric, in ways that cannot be replaced. Much like the effects of losing the QZ's, loss of parts of this community will have a devastating and irreplaceable effect on what remains. Tearing asunder the fabric of this community will never be repairable, and I hope that you have been able to witness this worry in even the smallest amount. When you consider every facet of life in Green Bank, no matter how small, that life is held together by all members of the community - Observatory and non-Observatory. Gratitude is hard-won among the people here and not easily regained. I stand in force with those that want to see the Observatory continue, not only for the irreplaceable scientific merit of the site but for the irreplaceable love and kinship of the Green Bank community. I beg you to consider Options 1 and 2 only. No other options are in the least bit tenable.</p> <p>As a final thought, please consider entering the book ""But It Was Fun"" in the record of the effect this site has had in regards to everything from science to personal relations, good or bad.</p>	Against Closure	Email	11/24/2016	
117	a	Jeffrey	Marganian		<p>Hello. To whom it may concern, I am writing in support of the continued financial and administrative maintenance of the Green Bank Observatory in West Virginia. Green Bank Observatory provides jobs and livelihoods for many people in a rural area of West Virginia that suffers from poverty, underdevelopment, and lack of economic opportunity. A closure of the Observatory would result in unnecessary economic hardship and privation for numerous families and individuals. There would simply be no recourse but financial crisis for hundreds of people dependent on the work offered by the telescope(s) and its various functions.</p>	Against Closure	Email	11/24/2016	
117	b	Jeffrey	Marganian		<p>Additionally the Observatory is of course the home of a myriad number of dedicated scientists, engineers and technicians doing invaluable scientific research. This research should be allowed to continue in the interests of scientific inquiry and discovery.</p>	Against Closure	Email	11/24/2016	
117	c	Jeffrey	Marganian		<p>It is my understanding that the Observatory also functions as an instrument of national security and intelligence gathering. For all these reasons the Observatory is a vital part of the economy and culture of the Green Bank area and should be allowed to be maintained and well administrated into the foreseeable future.</p>	Against Closure	Email	11/24/2016	
118	a	Nichol	Cunningham		<p>I strongly urge the National Science Foundation (NSF) to support Option 1: ""Continued NSF investment for science-focused operations"" for the Green Bank Telescope and the Green Bank Observatory (note: specific references supporting the matters discussed here can be found in the two attached documents, available at https://arxiv.org/abs/1610.02329 and https://arxiv.org/abs/1610.09014). The No-Action Alternative is the only option that will not lead to detrimental, long term negative socioeconomic, cultural, ducational and scientific impacts on not only the local community, that heavily depend on the infrastructure of the telescope and support of the staff, but to the global scientific community as a whole.Impacts of the Green Bank Observatory Impacts on the Scientific EnvironmentAs discussed in both https://arxiv.org/abs/1610.02329 and https://arxiv.org/abs/1610.09014 "The National Science Foundation (NSF) Astronomy Division's Portfolio Review of 2012 is no longer relevant to the Green Bank Telescope (GBT) of 2017".That committee recommended that AST divest from the GBT because of its ""lower scientific impact"". This assessment was not justified in 2012 and is not justified now. As an early career, female postdoctoral fellow, specializing in the formation of massive stars I can fully attest to those statements. Massive stars are the nuclear powerhouses that drive the chemical evolution within galaxies, without which the complex molecules and elements we need to live would not exist. In spite of this, we still do not have a comprehensive understanding of how these progenitors of our existence actually form. The scientific merit of the GBT in understanding these very early stages in the birth of a star, particularly in the vitally important high mass regime, is stronger than ever. This is due to a myriad of new instruments on the GBT that were not in existence or still being commissioned during the 2012 review. Examples include University of California Berkeley development of the VEGAS spectrometer, University of Pennsylvania development of the MUSTANG family of bolometers, and the Stanford University development of the Argus 3mm camera.These new NSF funded instruments open up a frequency range that is deeply beneficial to the star formation community, allowing us peer into the cold, dense environments as stars are being born and will greatly add to our understanding of these initial stages. These new instruments have also captured the interest of a slew of new users to the GBT.</p>	Against Closure	Email	11/24/2016	Nicol_Cunningham_GBO_EIS_Co mments.pdf
118	b	Nichol	Cunningham		<p>More importantly, the GBT offers merit-based access to a world-class facility. The NSF-funded open skies time is allocated on merit. What this means, is early researchers such as myself have the opportunity to develop our own scientific research projects. Forge new collaborations and networks and become the future leaders of radio astronomy. It means the GBT is not only for the rich, or only for scientists from wealthy institutions, but is accessible to early PhD, postdoctoral and even undergraduate level researchers with a strong science project. The loss of open skies time, in my opinion, would be one of the most damaging and detrimental things to the success of the Green Bank Observatory as a functioning world class research facility and to the future of radio astronomy in the US.</p>	Against Closure	Email	11/24/2016	Nicol_Cunningham_GBO_EIS_Co mments.pdf

Green Bank Observatory -Written NSF Public Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
118	c	Nichol	Cunningham		Impacts on the Socioeconomic, Cultural and Educational environment Aside from the scientific impact, there is a deeper, more insidious impact any cut in funding would result in to the local community, to the thousands of visitors and the hundreds of students that are inspired by the GBT each year. I have had the honor of talking with, mentoring, teaching, and presenting to countless students of all ages about science, and about my own research in the year I have been working in Green Bank. A place I would not currently be if it were not a world class leading facility in radio astronomy. I believe the students interaction with an actual astronomer, and the ability to do actual research on a radio telescope is something incredibly wonderful and unfortunately becoming more and more rare. I am always humbled by their enthusiasm, excitement and joy at being here. Moreover, the fact that I am an early career female is something that, while should no longer be an issue, is a very valuable aspect for female students to see firsthand. In addition, the staff at GBO have a strong connection with the local schools and community. I myself have gone into the local school and talked with the elementary classes about radio astronomy as I know countless other staff have. Staff that would likely not be here if anything other than the No-Action Alternative is implemented. Furthermore, I have participated in science fairs, Hour of Code, open days, and career days, again along with countless other staff. I also recently participated on the Space Race Rumpus committee (http://www.spaceracerumpus.org/) a fundraising event that directly benefits the local community, but more than that serves as a wonderful outreach event with hundreds of families coming each year to Green Bank and participating in Star Parties, enjoying the wonderful science center and interacting with the scientists here (all of which volunteer their own personal time to participate in the weekend long event).	Against Closure	Email	11/24/2016	Nicol_Cunningham_GBO_EIS_Comments.pdf
118	d	Nichol	Cunningham		This telescope is a wonderful educational tool, but without the world class researchers that work here or come here to observe it would not be able to function in the same manner and would not have the same impact on the students that come to learn astronomy and what it means to be an astronomer or a scientist. Any loss of open skies time would completely change the functionality of the telescope as an educational tool doing real research. For all of the reasons cited here, I hope that NSF will choose the No-Action Alternative. I ask you to ensure that the EIS fully account for the impacts of all the proposed scenarios. The GBO is a shining example of the many positive impacts of investment in basic research.	Against Closure	Email	11/24/2016	Nicol_Cunningham_GBO_EIS_Comments.pdf
119	a	Linda Lee	Jones Marganian		I am a well educated person with a B.S. in Biology and an M.A. in Chemistry and a certified secondary level educator and would like to say something about the work of the Green Bank observatory. I have visited several times over the years that my son and daughter-in-law have worked there. It is a tremendous resource for our nation and the region in understanding our universe and other nations on our planet. Without Green Bank I think we would take a giant step backward and become victims once again of impoverished thinking and fear of the unknown where there are no principles based on fact to guide us in the right direction. Progress in not guaranteed in a world where science and instrumentation such as we have in Green Bank are shut down for whatever reason.	Against Closure	Email	11/24/2016	
119	b	Linda Lee	Jones Marganian		In the case of National Defense I think it would be foolish to cut the measures we have in Green Bank Observatory to secure our country against enemy activities .	Against Closure	Email	11/24/2016	
120	a	Violette	Impellizzeri		I am a radio astronomer working at ALMA. I have been using world-class radio instruments since I was an undergraduate at the Max Planck Institute for Radioastronomy in Bonn. During my PhD, I had the privilege to use 100-m telescope in Effelsberg, the VLBI, Arecibo, and the VLA. After finishing my PhD, I moved to NRAO for my first postdoc - which was for me the 'mecca' of radio astronomy. There I had the opportunity to observe with the GBT regularly for full three years (which extended into many more years). There is no doubt in my mind today that the Green Bank Telescope it is the best single dish telescope in the world. No other instrument in the world today that can replace the GBT. After spending many hundred hours observing both with Effelsberg and the GBT - the two biggest fully steerable telescopes in the world - I feel strongly that losing the GBT would be a great loss to the whole astronomical community. While Effelsberg is still doing great work in the lower frequency bands and pulsar work, the GBT is irreplaceable at both low frequency but also at the higher frequencies where it operates. Beside being a relatively "new" telescope itself (construction only finished in 2003), it has been continually evolving and new further instruments were only recently commissioned. With an un-obstructed surface it displays an incredibly flat and stable spectrum, the active surface makes it one of the best surfaces to observe at the higher frequencies in both single dish mode and with the focal plane array. The wide bands and flexibility of the GBT have allowed for surveys to be carried out accurately at both low and high redshifts. The GBT has been involved in a number of discoveries, and a witness of its popularity is its oversubscription. The GBT is truly a jewel, to all astronomers world-wide. I can imagine the budgetary stress the NSF and funding agencies find themselves under, with so many new telescopes coming on the horizon and older ones still running. However, the GBT is not an older telescope, it is all ways possible a new, state-of-the-art machine. I hope that the NSF will consider continuing support of the GBT operations into the future. Beside being a great instrument for all astronomers in the world, I think that it should be a matter of national pride for both West Virginia and the United States science as a whole.	Against Closure	Email	11/24/2016	

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Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
121	a	Ryan	Lynch		<p>I urge the National Science Foundation (NSF) in the strongest possible terms to select the No-Action Alternative (continued NSF investment for science-focused operations) for the future of the Green Bank Observatory (GBO). The No-Action Alternative is the only option that will not have severe, long-term negative impacts on the socioeconomic, cultural, educational, and scientific environments of the local community of Green Bank, the State of West Virginia, the surrounding region, the entirety of the United States, and the global community. The No-Action Alternative is also the only option that will not have severe, long-term negative impacts on NSF's mission to broaden the impacts of its activities and facilities.</p> <p>Scope of the Environmental Impact Statement Areas of Study</p> <p>The environmental impact statement (EIS) should formally include the educational and scientific environment as independent areas of study within the scope of the EIS. The EIS should also include broader impacts as an independent area of study in the scope of the EIS; NSF defines1 broader impacts as those that:</p> <ul style="list-style-type: none"> Advance discovery and understanding while promoting teaching, training, and learning Broaden participation of under-represented groups Enhance infrastructure for research and education Broaden dissemination to enhance scientific and technological understanding Benefit society <p>I understand that the scope of the EIS as defined by the National Environmental Policy Act of 1969, as amended (42 USC x4321-4347), does not explicitly call for assessing the educational and scientific environments, or agency-level considerations such as NSF's broader impacts. However, nothing in the statute prevents the EIS from expanding its scope. Furthermore, the purpose of the EIS scoping period is, in part, to "determine relevant issues that will influence the scope of the environmental analysis"2. A full assessment of the impact of the GBO must consider educational, scientific, and broader impacts. After all, the primary purpose of the GBO is to be a scientific research facility with a strong educational component, in keeping with NSF's mission.</p>	Against Closure	Email	11/24/2016	Ryan_Lynch_GBO_EIS_Comments.pdf
121	b	Ryan	Lynch		<p>Region of Impact</p> <p>The region of impact (ROI) for the GBO as it relates to cultural, socioeconomic, educational, scientific, and broader impacts should be defined as encompassing the entire global community, and should especially focus on the United States. The GBO serves users around the world, and to limit the ROI for any area of study to just the local community or State of West Virginia will necessarily underestimate the impacts of proposed alternatives for the GBO.</p>	Resource Considerations	Email	11/24/2016	Ryan_Lynch_GBO_EIS_Comments.pdf
121	c	Ryan	Lynch		<p>Context of the EIS</p> <p>The true impact of the proposed alternatives for the GBO cannot be measured without considering the broader national and global context in which the GBO operates, and in which the EIS is being conducted. The Arecibo Observatory is undergoing its own EIS and is facing possible divestment by NSF. If science-focused operations at the Arecibo Observatory are substantially reduced, it will compound any similar reductions at GBO because astronomers in the United States will have no single-dish radio telescopes to turn to as an alternative. The Five Hundred-meter Aperture Spherical Telescope (FAST) under construction in China cannot be viewed as a viable alternative to the GBO for several reasons: 1) it has not yet started full science operations, 2) its performance and sensitivity have yet to actually be demonstrated, 3) it is not fully steerable and cannot access the same parts of the sky as the Green Bank Telescope (GBT), 4) it does not benefit from an extensive radio quiet zone like the one that protects the GBO, and 5) it is not yet known under what conditions astronomers in the United States will be able to access FAST. Similarly, the Square Kilometer Array (SKA) and its predecessors 1) have not yet begun full science operations, 2) are located in the Southern Hemisphere and so will not be able to access the same regions of the sky as the GBT, and 3) currently have no support or involvement from the NSF or the United States. The EIS should take this context into consideration when assessing the impacts of the proposed alternatives for the GBO.</p> <p>For all of the reasons cited here, I expect that NSF will choose the No-Action Alternative. I ask you to ensure that the EIS fully account for the impacts of all the proposed scenarios. The GBO is a shining example of the many positive impacts of investment in basic research.</p> <p>Please do not hesitate to contact me if you have any questions about the issues I have raised or would like more information.</p>	Resource Considerations	Email	11/24/2016	Ryan_Lynch_GBO_EIS_Comments.pdf

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121	d	Ryan	Lynch		<p>...That committee recommended that AST divest from the GBT because of its "lower scientific impact". This assessment was not justified in 2012 and is not justified now. The PRC report contained some incorrect assumptions that impacted its decision to classify the GBT as having lower scientific impact. Three telescopes were cited as potential replacements for the GBT: The Jansky Very Large Array (VLA), Arecibo Observatory, and the Effelsberg Telescope in Germany. However, The VLA has reduced sensitivity at the lowest frequencies when compared to the GBT, no capabilities at the highest frequencies at which the GBT operates, is already heavily oversubscribed, and is not designed to accomplish the same science as the GBT with good efficiency, if at all. The Arecibo Observatory is also under threat of divestment, but regardless, it does not offer the same sky-coverage as the GBT and does not operate at the highest frequencies accessible with the GBT. The Effelsberg Telescope's blocked aperture and suite of receivers substantially reduces its sensitivity compared to the GBT, and it is only available under open-skies for 40% of the time, much of which is used by European astronomers in ways that make better use of the available instrumentation. None of these telescopes are suitable replacements for the GBT. Furthermore, the scientific landscape has changed so profoundly since 2012 that the PRC recommendation is simply no longer relevant. New technical capabilities have made the GBT a uniquely powerful instrument in the 3 mm band. At the same time, the recent detection of gravitational waves (GWs) by the Laser Interferometric Gravitational Observatory (LIGO) have officially ushered in the era of GW astronomy. The GBT (along with the Arecibo Observatory) are used by the North American Nanohertz Observatory for Gravitational Waves (NANOGrav) to search for and characterize low-frequency GWs. The GBT and the Arecibo Observatory together represent the best telescopes in the world for studying this unique part of the GW spectrum (the GBT and the Arecibo Observatory both contribute approximately half of NANOGrav's sensitivity), which is totally inaccessible to LIGO and the planned Laser Interferometric Space Antenna (LISA). Use of the GBT and the Arecibo Observatory also offers an extremely cost-efficient way of studying the GW universe — both LIGO and LISA are billion-dollar-scale instruments, and LIGO's operating budget is \$130 million per year, while the GBT operates for approximately \$12 million per year (and only a portion of this is in support of NANOGrav). When given the opportunity to fully participate and comment, the wider scientific community has consistently judged GW astronomy to be of high scientific impact and priority. The New Worlds, New Horizons decadal survey highlighted GW astronomy as one of five science frontier discovery areas capable of "transformational discovery". NSF is currently funding NANOGrav through a Physics Frontier Center award of \$14.5 million (with contributions from the Midscale Innovations Program) after a competitive, community-sourced review judged it to be of high intellectual merit and broader impact. NSF itself has chosen multi-messenger astronomy as one of ten "Big Ideas" to be pursued in the coming decades by the Foundation as a whole — combining GW and electromagnetic observations is an example of multi-messenger astronomy. Outside of GW astronomy, the GBT contributes to a stunning diversity of scientific inquiry. It answers questions related to gravity and general relativity, nuclear physics, time-domain and transient astronomy, astrochemistry and astrophysics, astrometry, and galaxy formation and structure. This is far from an exhaustive list... As you can see, the conclusion that the GBT has lower scientific impact is simply incorrect. New capabilities and a changing scientific landscape ensure that the GBT will continue to make unique contributions to highly valued scientific areas throughout the coming decades if GBO continues to operate as a healthy scientific facility. If the EIS cites the PRC recommendation as providing a need for the EIS process, then it should address the errors and inconsistencies in that report and acknowledge the numerous examples of strong support for the GBT and the work it carries out that have been expressed by the scientific community. To not do so threatens to place the EIS on a shaky foundation.</p>	Alternatives Consideration	Email	11/24/2016	Ryan_Lynch_GBO_EIS_Comments.pdf
121	e	Ryan	Lynch		<p>Educational Impacts</p> <p>The GBO has a long and exemplary tradition of educating the next generation of science, technology, engineering, and mathematics (STEM) professionals. This includes, but is not limited to, summer research programs for undergraduate and graduate students pursuing degrees in STEM fields, which involves approximately ten students per year. This program began when GBO was formally a part of the National Radio Astronomy Observatory (NRAO) but will continue if GBO remains a scientific facility. These programs provide a critical educational opportunity to students from small colleges and universities that may not have large research programs. GBO has recently partnered with the National Society of Black Physicists on Physicists Inspiring the Next Generation (PING). This program offers a summer research experience to two underrepresented minority students as well as a two week leadership experience as mentors for middle school students attending a science camp at GBO. PING mentors are typically rising sophomores or juniors and so receive a unique educational opportunity at a critical point in their careers. GBO also partners with West Virginia University to offer senior undergraduate research opportunities.</p> <p>Educational programs also extend to high school students through the Pulsar Search Collaboratory (PSC). The PSC gives students across the country the opportunity to analyze real GBT data while searching for pulsars. A critical aspect of the PSC experience is students' interaction with real, research grade data — they are not simply carrying out a pre-packaged science fair project, they are working with the same data as professional astronomers.</p> <p>The GBO is one of the few world-class research facilities that offers true hands-on training for undergraduate and graduate students. Universities have led instrumentation projects for the GBT that provide technical training for scientists and engineers. Student observers at the GBT are required to go through on-site training and so receive an education in the design and operation of a large radio telescope. Unfortunately, these types of experiences are disappearing from many graduate curricula, making the GBO ever more important to the education of future scientists and engineers.</p> <p>The GBT is not the only GBO telescope that plays an educational role. The 20-meter telescope is used by the Skynet Junior Scholars program, which students across the country the chance to collect their own data. The 40-foot telescope is used for hands-on observing projects by hundreds of student groups every year. The Tatel telescope is historically significant as the first telescope constructed on the site and because of its use in the first Search for Extraterrestrial Intelligence experiment. The Tatel telescope is currently featured in the very popular SETI public tour. The remaining 85-foot telescopes are featured in public tours and provide an opportunity to introduce the concept of interferometry.</p> <p>Broader Impacts</p> <p>The educational programs discussed above have far reaching broader impacts. Since 1991, over 40% of NRAO/GBO summer students have been women, a larger percentage than is present in astronomy at-large. Women have historically been underrepresented in STEM fields, and the NRAO/GBO summer student programs are a critical pipeline for increasing participation by women in STEM. The PING program specifically targets underrepresented minorities, with all eight of the PING mentors thus far being of African American descent. Middle school students participating in PING are mostly minority students, as well. Finally, GBO has a disproportionately large positive impact on socioeconomically disadvantaged populations. Thousands of visitors come from rural parts of West Virginia and neighboring states. GBO acts as a rare example of cutting edge STEM investment in these regions of the country, increasing science literacy substantially. The scientific program of the GBT also cuts across a wide range of disciplines and administrative areas of NSF.</p> <p>I am personally spearheading a new educational initiative in partnership with NROCKS, a local outdoor adventure and education company in Pendleton County, WV. We are piloting a program that will combine night-sky observing with outdoor experiences for youth and the general public. While in its early stages, this program promises to increase knowledge and appreciation of both astronomy and natural resources, such as dark skies and fragile ecosystems.</p>	Against Closure	Email	11/24/2016	Ryan_Lynch_GBO_EIS_Comments.pdf

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121	f	Ryan	Lynch		<p>Broader Impacts</p> <p>The educational programs discussed above have far reaching broader impacts. Since 1991, over 40% of NRAO/GBO summer students have been women, a larger percentage than is present in astronomy at-large. Women have historically been underrepresented in STEM fields, and the NRAO/GBO summer student programs are a critical pipeline for increasing participation by women in STEM. The PING program specifically targets underrepresented minorities, with all eight of the PING mentors thus far being of African American descent. Middle school students participating in PING are mostly minority students, as well. Finally, GBO has a disproportionately large positive impact on socioeconomically disadvantaged populations. Thousands of visitors come from rural parts of West Virginia and neighboring states. GBO acts as a rare example of cutting edge STEM investment in these regions of the country, increasing science literacy substantially. The scientific program of the GBT also cuts across a wide range of disciplines and administrative areas of NSF.</p> <p>I am personally spearheading a new educational initiative in partnership with NROCKS, a local outdoor adventure and education company in Pendleton County, WV. We are piloting a program that will combine night-sky observing with outdoor experiences for youth and the general public. While in its early stages, this program promises to increase knowledge and appreciation of both astronomy and natural resources, such as dark skies and fragile ecosystems.</p>	Against Closure	Email	11/24/2016	Ryan_Lynch_GBO_EIS_Comments.pdf
121	g	Ryan	Lynch		<p>Socioeconomic and Cultural Impacts</p> <p>Local, state, and regional socioeconomic impacts were thoroughly discussed at the EIS public scoping meetings held at GBO on November 9th, 2016. However, the scientific and educational programs of the GBO have positive socioeconomic impacts at the national level, as well. NRAO has not performed longitudinal tracking of summer students but anecdotally I can attest to several students who have gone on to academic careers in astronomy and/or come back to work for NRAO and GBO. Students have also gone on to non-academic careers in software design, electrical engineering, renewable energy, education, journalism, and finance, to name a few. These are high-paying jobs that add tremendous value to the economy of the United States. Many of these careers also increase science literacy, which is a positive cultural impact. Hundreds of researchers at all career levels, but especially students and early-career scientists, depend on research activities at the GBO for their continued employment and income. The GBO makes the United States a global leader in radio astronomy, especially in the emerging field of low-frequency GW astronomy. High visibility science of this sort contributes to the cultural environment of United States as a whole.</p> <p>The GBO is also a prominent member of the local community. In addition to supporting the local school system and emergency services, GBO staff hold an annual mountain and road biking festival called the Space Race Rumpus. All proceeds are donated to the Northern Pocahontas County Wellness Center, school system, and senior center. The Rumpus uses multiple facilities on-site, including the old tour center (which is also used as a day care for employees and for employee events). The recreation area, which includes a pool, tennis and basketball courts, a shooting range, and playground, are also open to the local community. These contributions raise the profile of the observatory and, in turn, the role of science in the local culture.</p>	Against Closure	Email	11/24/2016	Ryan_Lynch_GBO_EIS_Comments.pdf
121	h	Ryan	Lynch		<p>Consequences of the Proposed Alternatives for the GBO</p> <p>No-Action Alternative</p> <p>This is the only scenario that will avoid severe, long-term negative impacts on the socioeconomic, cultural, educational, and scientific environments and that supports NSF's mission to broaden the impacts of facilities and activities.</p>	Alternatives Consideration	Email	11/24/2016	Ryan_Lynch_GBO_EIS_Comments.pdf
121	i	Ryan	Lynch		<p>Collaboration with interested parties for science- and education-focused operations with reduced NSF-funded scope</p> <p>This scenario will have negative, long-term impacts on the socioeconomic, cultural, educational, and scientific environments and on NSF's mission to broaden the impacts of its facilities and activities. Specifically, it threatens the open-skies science program which is the foundation of GBO. I was struck by the assumption in the Arecibo Observatory draft EIS that reduced NSF-funded scope for that facility would have minimal impacts — this assumption is incorrect. The staff of GBO supports a wide range of science operations that in turn require broad technical and scientific expertise. A healthy open-skies program also supports a large user community. If funding and time for open-skies science decreases, this user community will necessarily shrink due to decreased supply, not decreased demand. Interested parties will likely need more specialized modes of operation and may provide their own technical and scientific support based away from GBO. This will make it more difficult to recruit the best scientists, engineers, technicians, and educators to GBO. Educational programs that rely on these staff will suffer. If staffing levels decrease it will have a severe, long-term negative impact on the surrounding community. Students and researchers that depend on the GBO for their employment and income will be forced to look elsewhere, but with the Arecibo Observatory also facing possible reductions of open-skies time, they will need to look internationally. Since astronomers in the United States currently have no guaranteed access to facilities like FAST and the SKA, those who are able may leave the United States, taking their expertise and socioeconomic, cultural, scientific, and educational outputs with them. Unfortunately, those without the resources to reorient their careers will disproportionately be women, underrepresented minorities, and members of socioeconomically disadvantaged populations that have been historically underserved in STEM fields. The United States will effectively cede leadership in cutting edge areas of science at the exact moment when it is poised to assume an even greater role, harming vulnerable members of the scientific community. These artificially imposed outcomes will decrease the vibrancy of the GBO and may be cited as reasons to further reduce funding for open-skies science in a negative feedback loop. The EIS must therefore not assume that operations with reduced NSF-funded scope will have minimal impacts.</p>	Alternatives Consideration	Email	11/24/2016	Ryan_Lynch_GBO_EIS_Comments.pdf
121	j	Ryan	Lynch		<p>Collaboration with interested parties for operation as a technology and education park</p> <p>All of the impacts discussed previously will be exacerbated and will manifest more quickly. Educational programs will suffer because the GBO cannot act as a quality education park if it is not engaged in science. This alternative will thus have severe, long-term negative consequences on the socioeconomic, cultural, educational, and scientific environments and on NSF's mission to broaden the impacts of its facilities and activities.</p>	Alternatives Consideration	Email	11/24/2016	Ryan_Lynch_GBO_EIS_Comments.pdf
121	k	Ryan	Lynch		<p>Mothballing of facilities or deconstruction and site restoration</p> <p>These scenarios should speak for themselves. They would devastate the socioeconomic, cultural, educational, and scientific environments and abdicate NSF's mission to broaden the impacts of its facilities and activities. The impact on the socioeconomic, cultural, and educational environment of the local community and the State of West Virginia would be especially destructive."</p>	Alternatives Consideration	Email	11/24/2016	Ryan_Lynch_GBO_EIS_Comments.pdf

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Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
122	a	Alex	Hill	Senior Postdoctoral Research Associate	<p>I write as an astronomer in support of Green Bank Observatory's ongoing operation of the Green Bank Telescope (GBT) as a premier radio facility with NSF-funded, science-focused operations, the no-action alternative. From my perspective as a multi-wavelength astronomer, the GBT's unique capabilities cannot be replaced by any other telescope. Removing these capabilities from the US portfolio would harm our progress towards addressing the key questions highlighted by the New Worlds, New Horizons decadal survey in midterm assessment. As the decadal survey highlighted, the GBT enables a variety of transformational science in astrochemistry, star formation, Solar System astronomy, stellar astronomy, and galactic science. In my own research, the GBT offers unparalleled resolution (both spatial and spectral) and sensitivity over a wide field of view for study of the dynamics of interstellar hydrogen gas in the Milky Way and other galaxies, teaching us about how stars form in galactic environments. The GBT makes this research possible, allowing us to address fundamental questions identified by the decadal survey including "what are the connections between dark and luminous matter?", "how do baryons cycle in and out of galaxies, and what do they do while they are there?", and "how do stars form?"</p> <p>The GBT is one of NSF's premier facilities, and recent scientific advancements in astronomy in general combined with the new 3 mm capability should solidify its place as a necessary component of the NSF's astronomy portfolio. All of the options under consideration other than no action threaten the GBT and NSF's intellectual merit and broader impacts goals.</p>	Against Closure	Email	11/24/2016	GBT support letter Hill.pdf
122	b	Alex	Hill	Senior Postdoctoral Research Associate	<p>In addition to these crucial capabilities, which were clear at the time of the decadal survey, the GBT has been upgraded with fundamentally new capabilities since 2012. The GBT is now a 3 mm telescope, enabling wide-field surveys which directly complement ALMA's capabilities and provide short-spacing data as a counterpart to ALMA 3 mm synthesis observations. Moreover, the recent detection of gravitational waves by LIGO has opened an entirely new field of astronomy. The GBT will open a separate window into gravitational wave astronomy through pulsar timing, which will most likely detect low-frequency gravitational waves in the near future. Without the GBT, the US contribution to low-frequency gravitational wave astronomy will suffer.</p>	Against Closure	Email	11/24/2016	GBT support letter Hill.pdf
122	c	Alex	Hill	Senior Postdoctoral Research Associate	<p>Because of the sensitivity and survey speed of a single dish radio telescope and the GBT's location in the National Radio Quiet Zone, no telescope can match the GBT's capabilities in this exciting new field of astronomy and fundamental physics.</p>	Against Closure	Email	11/24/2016	GBT support letter Hill.pdf
122	d	Alex	Hill	Senior Postdoctoral Research Associate	<p>As an educator and researcher at a small, undergraduate-focused college, I am keenly aware of the GBT's importance as an education and outreach tool. This education mission is best-served by maintaining the GBT as a world class research telescope so that students trained on the GBT are working on a premier facility.</p>	Against Closure	Email	11/24/2016	GBT support letter Hill.pdf
123		Sylvester	Burford	West Virginia native and current resident of Greenbrier County	<p>I attended the Nov. 9 public meeting at the Green Bank Observatory and was distressed to hear that the National Science Foundation was even considering decommissioning the Green Bank Telescope.</p> <p>I believe the number that was thrown out that night was \$11.5 million in yearly expenses to keep the telescope running. In a society that pours half its tax resources into military spending with a Dept. of Defense budget over \$500 billion, are we seriously discussing the paltry sum of \$11.5 million to keep an instrument of science, discovery, and education working?</p> <p>If the telescope were not being used, then get rid of it, but that is not the case. Scientists from around the world rely upon the data collected from the Green Bank Telescope for research. Two of the attendees at the Nov. 9 meeting were from Asia and both stated that they came to West Virginia specifically for access to this telescope. The telescope is the largest and most sensitive of all moveable radio astronomy telescopes currently in operation and is a great source of National and state pride.</p> <p>In a world of increasingly violent politics, we cannot afford to dismiss science as an instrument of peace and unity. For a fraction of the cost of weapons, instruments that divide mankind with war and misery (the worst of human nature) we could instead keep this instrument of science that unites the world in curiosity and knowledge (the best of human nature).</p> <p>I fear what this says about America, as a whole, that we are so willing to sacrifice our science and future so easily.</p>	Against Closure	Email	11/24/2016	
124		Sue Ann	Heatherly	Senior Education Officer, Green Bank Observatory	<p>From email: As the National Science Foundation weighs the value of the Green Bank Observatory against the five options listed in the environmental impact survey scoping meetings, it is critical that you expand the criteria by which impact is measured. The educational program of the Green Bank Observatory has had deep impact on thousands of US students since we began our undergraduate program in 1959. Since then, the education program has grown to offer truly authentic research experiences to participants from youth starting in the upper elementary grades, to college professors who teach at small colleges and community colleges which do not have research programs of their own.</p> <p>What makes these programs deeply impactful, is that participants in our programs are embedded in a working research center where the all of the staff-- whether they be astronomers, engineers, technicians or machinists--welcome and include them in the work that is going on. The open-skies operation of the Observatory is inspiring to our visitors no matter where they sit on the educational ladder. The collaborative problem solving environment, the very visible work-ethic of our staff, and the notable fruits of that labor- namely GBT discoveries--result in the development of aspiration toward STEM in our youngest participants.</p> <p>As a facility of the NSF, the Green Bank Observatory EPO program is YOUR EPO program; one that celebrates your mission: the value and worth of basic research, and the understanding that we can ALL do science.</p> <p>Our educational program is strong, diverse and effective at meeting our nation's STEM education goals. As you deliberate the future of the Green Bank Observatory, I invite you to study the following overview of our current education program. It is imperative to the future success of these programs that the Green Bank Observatory remains a cutting edge research center dedicated to astronomical research.</p>	Resource Considerations	Email	11/24/2016	EPO summary.pdf

Green Bank Observatory -Written NSF Public Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
125		Nissim	Kanekar	Associate Professor	I am writing this mail to you as an international user of the Green Bank Telescope (GBT). I have obtained nearly a thousand observing hours of GBT time,... and have written around twenty refereed scientific papers based on GBT data, on a variety of subjects including studies of gas in high-redshift galaxies, pulsars at the centre of the Milky Way, and fundamental constant evolution. I feel that the GBT is an outstanding telescope for astronomy today and (certainly) for the next decade, and also feel that it would be a huge loss to US and world astronomy if the GBT's scientific potential were curtailed in any way. From my perspective, some of the areas in which the GBT is likely to make a huge impact in the near future are pulsar timing (and the search for gravitational waves), searches for pulsars at the Galactic Centre (which would allow us to test general relativity in the strong field regime), using spectral lines of methanol, ammonia, hydroxyl, and other molecules to probe changes in the fundamental constants of physics, searches for atomic and molecular line emission in galaxies at cosmological distances, interstellar chemistry, finding H2O megamasers at cosmological distances, etc.. Picking just two of these, the GBT's superb spectral line and continuum capabilities in the frequency range 67-116 GHz are far ahead of any telescope in the world. The excellent performance of the GBT's active surface will allow the high GBT sensitivity to be exploited to its maximum. The Argus spectrometer and Mustang-II camera make the GBT an outstanding complement to the Atacama Large Millimeter Array for a wide range of studies in the 67-116 GHz frequency range. At lower frequencies, the GBT is a critical part of the Nanograv collaboration, aiming to probe fundamental physics by detecting gravitational waves via their effects on pulsar timing. Based on new theoretical models, this is likely to achieve an indirect detection of low-frequency gravitational waves in the next 5-10 years, simply using the present observational facilities. Further, a proposed new wideband GBT receiver would make a huge impact on such studies, by reducing systematic effects due to interstellar scattering. I note that I do not work in either of the above areas, but feel strongly that the GBT has a critical role to play in both of them. I have, however, worked in, and continue to work in, the area of searches for pulsars at the Galactic Centre: finding a pulsar orbiting around the super-massive black hole at the centre of the Milky Way would allow us to probe general relativity in the strong field regime. After a detection of such a pulsar, follow-up GBT pulsar timing studies would let us search for minute deviations from general relativistic predictions that would be the signposts to theories that unify relativity with the standard model of particle physics. We have already used the GBT to obtain the most sensitive constraints on the presence of pulsars around the Galactic Centre, and have recently carried out the deepest ever integration on the Galactic Centre for this project. In case of a further non-detection, we plan to use the wide frequency coverage of the GBT to extend these searches to even higher frequencies, to take into account the possibility that strong scattering in the medium between us and the Galactic Centre might be washing out the signals. The outstanding frequency coverage and sensitivity of the GBT imply that it will remain at the forefront of such pulsar studies for a long time to come. Another area where the GBT excels, and in which I have a strong research interest, is fundamental constant evolution, where we have used GBT observations of hydrogen, hydroxyl, and ammonia, lines from high-redshift galaxies to obtain the most stringent constraints on changes in two fundamental constants of physics, the fine structure constant and the proton-electron mass ratio. Such high-sensitivity astronomical spectroscopy is the only tool to probe evolution in the fundamental constants of physics over cosmological times, and the GBT is again at the frontier of such research. Overall, I have no doubt whatsoever that the GBT remains an outstanding telescope. Indeed, taking all factors into account, the GBT is quite simply the best single dish telescope in the world today and should retain its premier status for easily the next decade. It would be a huge loss to the international astronomy community if the GBT's scientific operations were adversely affected due to funding constraints. I hence urge you to choose "no action" in the NSF review process.	Against Closure	Email	11/24/2016	
126		Fabian	Heitsch	Associate Professor	I am writing in support of the No-Action Alternative. My background: I joined the Department of Physics and Astronomy at the University of North Carolina Chapel Hill in July 2009, ...My research is in interstellar gas dynamics, specifically the physics controlling the formation of molecular clouds and stars. My research: The interstellar medium (ISM) provides the matter reservoir for star formation in our Galaxy. All star formation occurs in over-dense regions of the ISM, called "molecular clouds" because high gas densities allow the gas to be shielded from ambient stellar radiation, thus leading to the formation of molecules. Given the observational fact that all molecular clouds form stars, star formation must begin immediately upon molecular cloud formation, meaning, these clouds are not long-lived entities but form and disperse as a consequence of large-scale interstellar medium dynamics. Thus, understanding star formation requires understanding molecular cloud formation and evolution. This evolution manifests in the dynamics interstellar gas.... I am very grateful for the generous support by the NSF for much of this work (AST-0807305, AST-1109085). Relevance of GBT for my research: While I am not using the GBT myself (though I am involved in the Green Bank Ammonia Survey [GAS, PI R. Friesen]), observational programs provide the basis for my group's research. As indicated above, the key to solving the puzzle of how stars form lies in the dynamics of the parental molecular clouds. Star formation is a multi-scale process. While the actual star is being formed out of a protostellar core (size scale of ~0.3 light years), the parental molecular cloud providing the mass reservoir necessary for gravitational collapse ranges over scales of a few to tens of light years. These scales are not separated – the gravitational potential generated by the overall cloud mass distribution connects directly to the evolution of protostellar cores. The cores themselves are not isolated structures, but are embedded in filaments, which seem to act as an intermediate stage between the parental cloud and the protostellar cores. While ALMA and the JVLA with their interferometric capabilities allow us to study the evolution of protostellar cores as the last stage before the onset of star formation in detail, gas dynamics on larger scales are much more efficiently studied with the single-dish GBT. Specifically the newly acquired 3mm band on the GBT provides invaluable insight into the gas dynamics connecting the parental molecular cloud with the filaments feeding cores. It is such observations that inform the fluid dynamics simulations of my group, investigating with highly-parallelized computer models, including magnetic fields, gravity, thermal physics and chemistry, the evolution of molecular clouds. Result of reduced GBT operations on star formation research: Reducing the GBT operations would result in a focus on high-resolution, interferometric studies without the large-scale counterpart necessary to understand the physical conditions for star formation. In a way, interferometric observations tell us about the final stages of star formation, yet, without any capabilities to investigate efficiently the large-scale dynamics leading to those final stages, our picture of the star formation process will remain woefully incomplete. Star formation is driven by gravity, and gravity is a long-range force. Therefore, understanding the gas dynamics on molecular cloud scales (i.e. the large scales feeding the protostellar cores) is crucial for our understanding of how our Galaxy forms stars. Summary: Star formation is a multi-scale process. Only by combining large-scale surveys of gas dynamics (single-dish) with small-scale (interferometric) observations, can we hope to identify the physical processes driving star formation. While computer simulations such as done by my group can help to arrive at a more complete picture, the usefulness of such simulations is strongly tied to the completeness of the observational evidence. Thus, I am strongly supporting the No-Action Alternative.	Against Closure	Email	11/24/2016	gbteis-fheitsch.pdf

Green Bank Observatory -Written NSF Public Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
127	a	Clarissa	Lynch		<p>I'm writing to support the Green Bank Observatory and to ask the National Science Foundation to keep fully supporting science at the GBO. Green Bank has had a profound impact on my life and on my appreciation for science. I grew up wanting to be a scientist and studied chemistry in college. Even with these interests, I never really learned much about astronomy, and never even heard of radio astronomy. That changed when I was introduced to Green Bank. Without the GBO I probably wouldn't even be able to give you an example of science supported by the NSF! But Green Bank has taught me about the wonders of radio astronomy and act as a visible example of NSF investment in our communities. It has also taught me about incredible feats of engineering and technical development. Everytime I see the GBT I'm reminded of the importance of science and technology in our society.</p> <p>But none of these impacts would be possible if the GBT wasn't performing cutting edge scientific research. Green Bank is too important to our communities and to the culture of the United States for NSF to consider cutting back on its investment now. I urge NSF to choose the No-Action Alternative.</p>	Against Closure	Email	11/24/2016	Clarissa_Lynch_GBO_EIS_Comments.pdf
127	b	Clarissa	Lynch		The community of Green Bank has also opened its arms to me and had a profound impact on my life over the last few years. I spread these lessons every time I talk to people about the GBO, and that happens very frequently!	Against Closure	Email	11/24/2016	Clarissa_Lynch_GBO_EIS_Comments.pdf
128	a	Adam	Leroy	Assistant Professor	<p>I am writing in response to the request for comments regarding the future of the Green Bank Observatory as part of the NSF environmental impact study. I am a faculty member at Ohio State University who regularly uses the Green Bank Telescope for scientific research and student training. I am writing in the capacity of a member of the astronomical community and a GBT user, not as a representative of Ohio State University. In this capacity, I would like to highlight the following key points regarding the GBO:</p> <ul style="list-style-type: none"> • The Green Bank Telescope is a world-leading facility at mm wavelengths. Over the last 10 years, the GBT has built its capabilities at mm-wavelengths (similar to those used by the NSF operated ALMA telescope) to the point where it is, by many metrics, now the best single dish telescope operating at these frequencies. This is a crucial frequency range for studying how planets, stars, and galaxies form – with new instruments on the telescope in the last year or two, the GBT is really the best telescope to survey interstellar molecules over large areas of the sky. No facility anywhere else in the world, even ALMA, can match this. My collaborators and I use this capability to map the immediate sites of star formation across whole galaxies, a new direction that is helping to merge two previous disparate subfields. These capabilities are summarized in a recent white paper, which I completely endorse. <p>MM-wave is a huge growth area in astronomy now, with the NSF-operated ALMA and new facilities in France, Mexico, and Japan opening new vistas and fueling rapid growth on many fronts. In many key aspects, the GBT outstrips all of these with the prospect to further improve by leaps and bounds over the next decade. More:</p> <ul style="list-style-type: none"> • The Green Bank Telescope is the ONLY large cm- and mm-wave telescope available to the U.S. community. Radio astronomy is one of the two main ways that we study the universe from the ground. Large single dish telescopes like the GBT are a crucial part of this study, their capabilities to map large areas quickly cannot be replaced by arrays like ALMA. The GBT is the best telescope at these frequencies in the world, but maybe even more important to me and my students: this is the only such facility open to the whole US community. The NSF-run national radio observatories have been an incredibly success story, allowing active radio groups to spring up around the country. 	Against Closure	Email	11/24/2016	GBTLetterAKL.pdf
	b	Adam	Leroy	Assistant Professor	<p>I use these facilities to train Ph.D. students and undergraduates at Ohio State University. Similar groups exist at dozens of universities around the country. The competing facilities in Japan, Mexico, Spain, and France are not open to the US community, and they do not represent viable paths to train students (something the GBT excels at). If the GBO closes and these become the only facilities in the world, the U.S. will lose its leadership in this area and the radio groups at universities around the country will suffer. As a big single dish facility, the GBT serves as a flexible platform for the development of new world class instruments (usually built at Universities). For my purposes, the GBT offers training to Ph.D. and undergraduate STEM students that is hard to find anywhere else right now. Most of the U.S. university radio observatories have closed, and facilities like ALMA operate in a vein similar to space missions, offering limited opportunities for such student interaction with the telescope itself. The GBT is the exact opposite, giving students direct access and indispensable hands-on training. All four of my Ph.D. students have trained and observed at the GBT and the experience has been indispensable.</p> <p>In summary: the steerable 100-m Green Bank Telescope is a tremendous facility only 16 years in to its life span (which is usually many decades for such a facility). It is a world-leading facility at mmwavelengths, one of the fastest moving fields in astronomy today. It is the only major single dish mmwave observatory available to scientists, like myself, at U.S. universities. It offers an indispensable avenue to train students in radio astronomy, one of the two major ways we study the universe from the ground. I regularly use the GBT, and my collaborators and I have major plans for the coming years. I have trained four students using the GBT. This is a vibrant facility in the first stages of its life as a major national observatory, I strongly urge the NSF to consider the "no action" option.</p>	Against Closure	Email	11/24/2016	GBTLetterAKL.pdf
129	a	Cliff	Nieuwenhuis	4-H volunteer	<p>As a 4-H volunteer leader, I am constantly reminded of the importance of STEM (Science, Technology, Engineering and Mathematics) for the future of the kids we teach. I have found that high quality programs like those available at the Green Bank Observatory are critical for sparking the imagination of the students and fueling their enthusiasm for learning.</p>	Against Closure	Email	11/24/2016	
129	b	Cliff	Nieuwenhuis	4-H volunteer	<p>Using the Green Bank telescopes are, after all, "the real thing."</p> <p>Please include me among those who see real value in keeping the Green Bank Observatory in it's position as a world leader in technology, open and operational, continuing it's important work and inspiring future generations.</p>	Against Closure	Email	11/24/2016	

Green Bank Observatory -Written NSF Public Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
130	a	Steve	Croft	Researcher/Outreach Specialist	We are the Berkeley SETI Research Center, a research group at the University of California, Berkeley, working on the Search for Extraterrestrial Intelligence (SETI). The Green Bank Observatory (GBO) and the Robert C. Byrd Green Bank Telescope (GBT) are critical resources for our team. The GBT supports six on-going research projects for our team, including the Breakthrough Listen Initiative, the Search for Extraterrestrial Radio Emissions from Nearby Developed Intelligent Populations (SERENDIP), SETI@Home and a myriad of targeted Piled efforts, including a detailed study of the mysterious Kepler star KIC8462852. To execute these programs, our group currently employs more than a dozen full time research and administrative staff at UC Berkeley, along with twice that number of students and summer interns, all of which would be drastically and detrimentally affected by any changes to GBO's operating model that impacted availability of the GBT. Our research group has also tremendously benefited from engagement with GBO staff on both science and outreach, and it would be severely detrimental to our ability to execute our research on the GBT without their continued involvement. A large fraction of our current funding comes from the Breakthrough Listen (BL) initiative, a 10- year, \$100-million project to dramatically expand the search for intelligent life beyond Earth. The GBT is one of three facilities that are lynchpins of the BL observing strategy. BL has purchased approximately 20% of the available time on GBT, in addition to time on the Parkes Telescope in Australia, and the (optical) Automated Planet Finder in California. To accomplish the BL science program, we have recently deployed hundreds of thousands of dollars' worth of equipment to GBO, in order to take advantage of the exceptional capabilities of the GBT for searches for artificial transmissionsWe were dismayed to hear that NSF is considering divestment from GBO, just as exciting projects like BL are getting going. GBO has the potential to make one of the most profound discoveries in science, the detection of cosmic company, at little to no cost to NSF. BL purchases time on the telescope directly, but the withdrawal of NSF funding would affect not just NSF programs, but programs like BL that pay their own way. The science from GBO represents excellent value for NSF and we urge them to carefully consider any options that would result in decreased access to this world-leading facility.In addition to the potential harm to the search for the answer to one of the most profound questions in science, divestment from GBO would put in jeopardy the training of researchers from undergraduates through postdocs. The loss of GBO would also mean that no US radio facilities are participating in the BL program.	Against Closure	Email	11/24/2016	bl_gbt_eis.pdf
130	b	Steve	Croft	Researcher/Outreach Specialist	Over the past year we have also built up a thriving student research program at UC Berkeley, engaging a diverse group of 10 students in analysis of GBT data, design of GBT data analysis algorithms, and training in the running of observations on the world's largest fully-steerable radio telescope. Several of these students have become experts in the GBT and its systems, and have excellent prospects for pursuing careers in radio astronomy going forward.	Against Closure	Email	11/24/2016	bl_gbt_eis.pdf
130	c	Steve	Croft	Researcher/Outreach Specialist	Breakthrough Listen represents an excellent opportunity for public engagement in science, as evidenced by the large amount of media interest around the project, and the healthy following for Berkeley SETI Research Center on social media (with over 10,000 followers on Facebook and Twitter). We are collaborating closely with GBO on public outreach efforts, which also directly reach the local community in West Virginia. This includes a GBO SETI tour which acts as a large draw for tourists coming to this remote area of the country. Were GBO to be threatened, both the direct investment from BL as well as the indirect benefits of BL to the WV community would be impacted. We urge the NSF to consider carefully these broader impacts of investment in GBO when planning the next steps in its future. We would be happy to answer any questions arising.	Against Closure	Email	11/24/2016	bl_gbt_eis.pdf
131		Richard	Wolfe		Hello and Happy Thanksgiving. I hope you will find a way to keep Greenbank Observatory open and operational, in the interest of furthering scientific learning and the inspiration and hope that only this kind of exploration can offer the human spirit.	Against Closure	Email	11/24/2016	
132			Aroshi (?)		Summary: My recommendation to NSF is to continue investment for science-focused operations of the GBT (ie the no-action alternative in the EIS). It is with great dismay that I have been watching the National Science Foundation's (NSF) steps to make a historical blunder i.e shutting down and deconstructing the Green Bank Telescope. Even a cursory look at the list of radio telescopes available round the world makes it immediately obvious --(a) the number of 100 m telescopes are very few, (b) even fewer in number are those that can operate in the mm-wave band and (c) in that class the GBT is a rare telescope that allows open access to the astronomical community all over world. Personally, I came to know of the many American astronomical facilities while I was doing my graduate work in India. And this was only because of the open access policy of these facilities. Many of my colleagues used data from these facilities for their thesis work. But more important, in my opinion, is the fact that open access provides opportunities to break what I will call the 'bandwagon effort' that is unfortunately common in Science for it makes telescope time available for radically different observational projects. Open access also helps in the development of new observational techniques and instrumentation. So I very strongly feel that the NSF should retain the GBT facility and fund it in a way to preserve the open access policy. Since its commissioning in early 2000, the GBT has been augmented with new instrumentation and its performance has been enhanced particularly in the mm-wave band. The GBT now is the largest, fully steerable, filled aperture mm-wave telescope in the world. The most important improvement in mm-wave instrumentation is the capability to increase the field-of-view of telescopes using conventional focal plane array. Such instrumentation equipped the GBT to tremendously increase its survey speed. The emerging developments to increase field-of-view can make large telescopes an integral part of the existing and up-coming interferometers. It will be an embarrassment if large telescopes do not exist when such instrumentation are available. At frequencies below 10 GHz, when telescope facilities elsewhere are being equipped with new instrumentation to make them suitable for new discoveries in the field of Gravitational wave and Fast radio bursts, the decision to close down the GBT appears to be ill-judged. These new instrumentation include phased array feed and broadband, low noise feed system. In short, my recommendation to NSF is to continue investment for science-focused operations of the GBT (ie the no-action alternative in the EIS).	Against Closure	Email	11/24/2016	

Green Bank Observatory -Written NSF Public Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
133	a	William	deWindt	Director Virginia Tech SNO, Server and Network Operations	<p>Allow me to introduce myself first. I am William S. deWindt and I am a faculty member at Virginia Tech in the TLOS division which supports a vast array of technology based services. I am also a proud graduate of the class of 1996 at Hampden-Sydney College and was lucky enough to get hired after graduating for a position in the Physics and Astronomy Department at the College. I worked with wonderful people such as Dr. Keohane and was fortunate enough to work at the HSC observatory on a number of projects all of which inspired me to become an amateur astronomer after everything I learned both in the classroom as an undergraduate and during my tenure there as a staff member.</p> <p>In closing, I have just a few points. First, for the latest trip Hampden-Sydney made to Green Bank my family donated most, if not all, of the funding to make the trip possible illustrating our commitment to education and astronomy. Second, just shutting it down would be a huge disservice to the astronomy and educational sectors. Please accept my letter and ponder it before you make your decision.</p>	Against Closure	Email	11/24/2016	
133	b	William	deWindt	Director Virginia Tech SNO, Server and Network Operations	<p>The Green Bank Observatory is a vital asset not only for astronomy as a whole but, as Dr. Keohane pointed out, also for the education of our students. Simply shutting it down would be a tremendous mistake. I agree 100% with Dr. Keohane that the only viable options are options #1 and #2 and if we must go with option #2 and I'm sure you could reach out to Virginia Tech to collaborate on keeping the facility operational. With Green Bank being so close to our Virginia Tech campus and our own observatory that makes total sense.</p>	Alternatives Consideration	Email	11/24/2016	
134	a	Gautam	Jain	PhD student	<p>My name is Gautam Jain and I am currently a finishing PhD student in chemistry at the University of Melbourne in Australia studying next generation solar technologies. I had the pleasure of visiting the Green Bank telescope (GBT) when I was an undergraduate studying astrophysics at Rutgers University with Professor Andrew Baker in 2008. I regard this trip as one of my favorite learning experiences as an undergrad. I remember we started mapping the Orion constellation with a very old-school 40 ft telescope, doing everything manually. It was such an interesting experience to do everything manually, and thus having to work in a team to map the constellation. We also got a chance to climb onto to the 140 ft. telescope which if I remember correctly had a bearing joint that was quite different from the other telescopes on the campus. I remember even watching an old documentary on how they decided to build this telescope and issues with the bearings that caused setbacks in its eventual construction. Everything about the campus from the nature, to the people, to the science made it a trip I remember very fondly to this day.</p>	Against Closure	Email	11/24/2016	
134	b	Gautam	Jain	PhD student	<p>I also have a bit more of a personal stake in the Green Bank Telescope. I worked as a summer research student under Professor Andrew Baker studying 21cm spectra (HI spin-flip transition) of isolated elliptical galaxies to better understand galactic evolution through mergers. Through the research conducted on these galaxies, follow up studies were done using the VLA on galaxies that were observed to have significant HI lines as found by the GBT. The Green Bank telescope was essential in my research then, but furthermore influenced my path into scientific research.</p> <p>Because of these reasons, I hope the National Science Foundation will still continue funding the Green Bank Telescope so future students and researchers can have similar experiences. Thank you for your time.</p>	Against Closure	Email	11/24/2016	
135		Marian	Pyles	Citizen of WV	<p>I am writing in support of full funding for the Green Bank Observatory. I am writing strictly from the viewpoint of a citizen of West Virginia. I have lived throughout the state of West Virginia for my entire life, and for it I feel passionately. My husband obtained a teaching job at Pocahontas County High School during 2013. Not knowing what we were getting into, we moved along with our then one year-old daughter to Green Bank.</p> <p>There was something special about the community right away. In addition to its beauty, there was a sense of intelligence that could be immediately felt. Coming from Charleston, we were used to pollution, constant cell phone use, and a general disregard for the land. Green Bank seemed to be a sanctuary—a quiet place where one could come to think, appreciate nature, and expand one's horizons beyond the hustle and bustle of the American life.</p> <p>While we were blown away by the beauty of the area—using the observatory for daily walks with our daughter—we quickly noticed that this was not only a sanctuary for nature, but it was a place full of amazing scientists who visited from around the world to come for research. This wasn't just some science center tucked away in the mountains of West Virginia; this was an amazing hub of learning and astronomy. As our daughter grew older and began to talk more, words like satellite and astronomy were in her vocabulary. She developed an intense interest in space and its relation to our planet that continues today, even though a job changed has moved us an hour north of the town.</p> <p>I have several points in writing all of this. To say that the Green Bank Observatory is important to the community of Green Bank and the state of West Virginia is a huge understatement. It is a source of pride for the members of the community; it is a place of reason and it is real. In a world where so much of what children see is virtual, this stands as a concrete example of science. In a world filled with propaganda, this is a place free from persuasion—an escape from the narrow confines of the norm and a gateway to thinking and observation.</p> <p>As I mentioned, my perspective as that of a regular citizen. I cannot begin to understand the capabilities the facility has to offer, but I know it is regarded as top-of-the-line. I feel the value the Green Bank Observatory brings goes well beyond the state of West Virginia and even the United States. It sparks an interest in science among youth and anyone who visits. I hope funding will continue so that this wonderful place can inspire critical thinking and a love of science for years to come.</p>	Against Closure	Email	11/24/2016	Observatory letter.docx
136			Whitmore (?)		<p>I went there on my ninth grade field trip and it made me think we can do anything. I ended up going to Marshall University in Safety. I am 60 now and thankful for that experience. Please keep them so future children can see what is possible in West Virginia. Science is needed to be observed by all.</p>	Against closure	Email	11/25/2016	

Green Bank Observatory -Written NSF Public Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
137		Jacob	Harrell	Coordination Biologist	Thank you for giving the Environmental Coordination Unit of the Wildlife Resources Section within the WV DNR the opportunity to comment on proposed changes to the Green Bank Observatory (GBO). Due to upcoming financial restraints, the National Science Foundation (NSF) has decided to explore several options for the GBO and has initiated the EIS/Section 106 consultation process for the GBO. These proposed changes could potentially have an impact on the wildlife and natural resources of the area, depending on what route the NSF ultimately chooses to take. The NSF has asked for comment concerning the direction and extent to which they should be focusing their EIS. To that effect, the Coordination Unit presents the following comments: Comment 1: The GBO property is bordered to the west by Deer Creek. The EIS should focus attention on this watershed and its many tributaries that run through the property. Deer Creek is a high quality stream currently stocked for trout with trout stockings occurring downstream of the GBO. It has historically held populations of New River Crayfish (<i>Cambarus chasmodactylus</i>), New River Shiner (<i>Notropis scabriceps</i>), Tongue-tied Minnow (<i>Exoglossum laurae</i>), and the Candy Darter (<i>Etheostoma osburni</i>). Populations of these aquatic species have also been reported to occur within the tributaries found on GBO property. These are all aquatic species with compromised statewide populations, but particular special concern is given to the Candy Darter which is currently facing a drastic decline across the state due, in part, to habitat loss and over-competition/hybridization by the more aggressive Variegated Darter (<i>Etheostoma variatum</i>). There is evidence that populations of Candy Darter are becoming more and more isolated as a result. Deer Creek is also listed as a state mussel stream. As is such, a mussel survey will need to be performed in the event that the eventual changes that NSF proposes will have an impact on the stream's mussel communities. Comment 2: Historically, WV DNR has managed special hunts within the GBO property. These hunts are widely viewed as being successful and essential to maintaining proper stewardship of the state's flora and fauna. A wealth of biological data has been collected thanks to the hunts within this area. The EIS needs to address the concern about the future of hunting within the area. In order to more aptly manage the state's deer populations, hunting should continue on the property. Comment 3: There are a number of plant species of concern that have been previously observed on the property. These include Hemlock Witchgrass (<i>Dichanthelium sabalorum</i> var. <i>thinium</i>), Bashful Bulrush (<i>Trichophorum planifolium</i>), and the Black-Girdled Bulrush (<i>Scirpus atrocinctus</i>). The EIS should involve a measure of focus devoted towards the continued presence of these plants. Comment 4: The GBO property includes a medium core forest area (250-500 acres) and several small core forest areas (less than 250 acres). The impacts of potential fragmentation of these core forest areas should be analyzed. Also, there is potential that these forested areas may include roosting trees for bats. The EIS should include focus on potential impacts to bat and migratory bird communities.	Resource Considerations	Email	11/24/2016	GreenBank Comment.pdf
138	a	Masao	Saito	Director	My name is Masao Saito, director of Nobeyama Radio Observatory, a branch of National Astronomical Observatory of Japan. Our observatory operates the Nobeyama 45-m radio telescope at mainly 15 - 2.6 mm and the solar polarimeters. My scientific background is star formation and protoplanetary disk formation. I'd like to express my opinion on Green Bank Telescope (hereafter GBT) and ask NSF to reconsider their funding. GBT with its diameter of 100 m is the largest steerable single dish telescope in the world is a perfect complement to a large radio interferometer such as JvLA and ALMA. For example, GBT can be considered as a magnifying glass and searched interesting phenomena in a large area with moderate resolution. JvLA or ALMA can be taken as microscope to look more details with very fine resolution. I here describe four notable achievement and activities related to GBT. First, GBT rapidly improved its capability significantly since 2012 when GBT was evaluated. GBT successfully installed a highly sensitive K band receiver and a 16 beam 3 mm receiver Argus. More details can be found in a white paper by Lockman et al. It is true that there still is room for improvement in daytime performance of pointing and surface accuracy under study and currently limited time can be spend on 3 mm observations. For us, GBT is a good-matching telescope and our scientific outcome is better together with GBT because the beam size of Nobeyama at 3 mm is comparable to GBT at 7 mm, and our beam size at 7 mm matches with GBT 15 mm. Thus direct comparison can be done in deriving physical conditions of excitation temperatures and column densities. As stressed again, GBT will produce an excellent guide map to be followed by JvLA and ALMA observations in the further study. In particular, ALMA band 1 at 7 mm and band 2 at 4 mm coming soon expects GBT's guide maps at the same wavelength. Second, GBT contributed significantly to various science areas including star formation in the past decade or so. In particular, molecular line study at 3 mm are important star formation studies. For example Nobeyama produced a wide-field galactic plane map in CO(1-0) and its isotopologues at 3 mm that are fundamental tracers of molecular material. These map illustrates distribution and kinematics of molecular clouds on a large scale, but we need a map of dense gas tracers within our CO maps to connect star formation and its natal gas. GBT with Argus will produce dense gas tracer maps at high resolution in HCO+, HCN, and N2H+ enabling us to investigate dense gas properties closely related to star formation on a moderate scale. GBT's impressive performance was already demonstrated in a white paper written by Bally et al. Further, Large collecting areas enable one to detect faint emission from biomolecules in the interstellar space. Third, presence of GBT motivates other single dish radio telescopes including ours to seek for performance as good as one can achieve. These atmosphere bring the large single dish community up together to the next stage required to push the border for cutting-edge science. At the same time, astronomers in GBT also have spread their knowledge and expertise in both science and technology to large single dish radio telescopes community in the world particularly a newly built 65-m Tien Ma telescope in China. We, of course, have done mutual collaboration, and have learnt things and issues with each other. These learn-together activities have deepened our understanding, improved characterization, and enhanced capabilities of large single dish telescopes world wide. In fact, GBT hosted a workshop in Sep 2016, and formed a consortium that will collaborate to improve large single dish performance in the future.	Against Closure	Email	11/24/2016	
138	b	Masao	Saito	Director	Lastly and importantly, GBT has been a crucial asset to attract young generations from all over the world to radio astronomy and to motivate them to become future radio astronomers. This healthy cycle is quite important for future radio astronomy and once broken it requires tremendous effort to recover a good cycle again. Indeed, I have met many radio astronomers who learned things at GBT in their early career, summer student, Ph.D. student, Postdocs, and so on. In concluding my remarks, GBT's leading role in the field is still very crucial in radio astronomy and I, as the director of Nobeyama radio observatory, am asking NSF to invest GBT at healthy level to continue their science operation and to provide opportunities to astronomers to explore cutting edge science with GBT's unique and superior capabilities. Such investment is very important to keep up radio astronomy in not only U.S. but also worldwide and matches with the International Astronomical Union's mission "Astronomy for the Developing World".	Against Closure	Email	11/24/2016	

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Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
139	a	Brian	Svoboda	RhD student	I am writing in support of a "no-action" position for the NSF's Environmental Impact Statement for changes to operations at Green Bank. As a PhD student in my fifth year at the University of Arizona, the staff at Green Bank and the Green Bank Telescope (GBT) have been instrumental to my thesis research in star formation throughout my time in graduate school.	Against Closure	Email	11/24/2016	
139	b	Brian	Svoboda	PhD student	To summarize the numbered paragraphs below: (1) data from the GBT has formed the core of my thesis and could not have been replicated with the VLA or Arecibo, (2) the unique capabilities of the GBT 100m at 3mm for research in star formation cannot be substituted by non-US facilities such as the LMT, NRO, or IRAM, and (3) the ground-breaking capabilities of ARGUS on the GBT make my in-progress research possible. (1) I study the earliest evolutionary phases of high-mass star formation, which involves observing the molecular cloud "clumps" that are the precursors to stellar clusters. The foundation of my research involved a blind Galactic Plane survey of over 4600 clumps discovered in the millimeter radio continuum to identify and characterize clumps without any indication of star formation activity (Svoboda et al. 2016 [1]). Data from the GBT formed the cornerstone of this work by supplying sensitive and wideband molecular line data (courtesy of VEGAS) in K-band of ammonia and the 22 GHz water maser line, forming the largest catalog of such data to date (>3200 pointings). The ammonia data provided gas kinetic temperature information essential for accurate cloud mass calculations and the water maser line for an unexpectedly sensitive indicator of star formation -- more sensitive in fact than existing mid-infrared surveys such as Spitzer GLIMPSE. Due to the effects of sensitivity, spatial filtering, and resolution, the GBT is the only instrument capable of a survey such as this. The VLA would have too poor resolution in a phased-array configuration and would filter out molecular emission on these ~1 pc spatial scales. Arecibo cannot observe above 5 GHz and could simply not observe these targets because it has an extremely limited view of the Galactic Plane. In short, the 2012 Eisenstein-Miller committee in the NSF AST portfolio review did not consider such facts when recommending to divest from Green Bank.(2) Building upon this large survey as the foundation of my thesis, my further progress research has involved targeted follow-up of the most massive starless clump candidates with the GBT at 3mm (W-band). Taken from a blind survey, these targets represent the best candidates for starless protoclusters and the initial conditions of high-mass star formation. For these cold, dense molecular sources, the J=1-0 ground-state transitions of the most abundant dense gas tracers lie in the 4 to 3mm band from 70 to 115 GHz. (3) To characterize the chemistry and stability of the substructure in these high-mass starless clumps, I have observed N2H+/HNC and their deuterated counterparts with the GBT in W-band (Svoboda et al. in prep.). The filled aperture of the GBT is essential for accurate column density calculations. We also have the good fortune of receiving a large allocation of ARGUS time to map the molecular line profile, which shows a signature of global infall, towards a sample of six high-mass starless clumps (to be executed in March-May 2017). These sources were selected from an infall survey on the ARO 12m of more than >100 starless clump candidates (Calahan, Shirley, & Svoboda in prep.), however the large 70 arcsec beam of the 12m is insufficient to determine if infall is actually present. Infall motions can only be secured through modeling spatially resolved maps, without filtering effects, and this is something only the GBT can provide in the optically thick ground state transitions. These observations are especially exciting and important because they could represent the very cusp of clustered, high-mass star formation, and are only possible through the sensitivity, resolution, and filled aperture of the GBT & ARGUS. In the near future I plan on applying for several future observing proposals to the GBT, taking advantage of ARGUS and MUSTANG, to better understand the initial conditions of high-mass star formation, that will likely form the basis of post-doctoral fellowship applications, complemented by the VLA and ALMA. It is my sincere hope that Green Bank will continue to operate at high-frequencies with continued NSF support, and that the NSF will conclude that a "no-action" in their Environmental Impact Statement is the best choice for the US astronomical community.	Against Closure	Email	11/24/2016	
139	c	Brian	Svoboda	PhD student	As clearly stated in the white-papers Lockman et al. (2016 [2]) and Bally et al. (2016 [3]), the GBT is a cutting edge and unparalleled instrument in sensitivity for this scientifically valuable frequency range for star formation. To be clear, The LMT 50m, NRO 45m, and IRAM 30m would not have the sensitivity or the resolution of the GBT 100m to reach spatial scales of high-mass starless cores (9 arcsec, <0.2 pc at 5 kpc) at Galactic distances for the 1-0 transitions. Moreover these facilities are not accessible to US astronomers such as myself. [1] Svoboda, B.E., Shirley, Y.L., Battersby, C., et al. 2016, ApJ, 822, 59 [2] Lockman, F.J., Lynch, R., Frayer, D.T., Mason, B.D., & Ransom, S.M. 2016, arXiv:1610.02329 [3] Bally, J., Blake, G., Bolatto, A., et al. 2016, arXiv:1610.09014	Against Closure	Email	11/24/2016	
140	a	Larry	Davis	President, Greenbrier Valley Chapter of Sigma Xi and Professor Emeritus at the West Virginia School of Osteopathic Medicine	The scientists and educators at the Green Bank Observatory in West Virginia contribute much to the programs of our chapter of the Sigma Xi research society. The radio astronomy observatory is located just seventy miles to the north of the West Virginia School of Osteopathic Medicine which serves as the home institution for the chapter.	Against Closure	Email	11/24/2016	
140	b	Larry	Davis	President, Greenbrier Valley Chapter of Sigma Xi and Professor Emeritus at the West Virginia School of Osteopathic Medicine	On two occasions Dr. Felix Lockman delivered scientific talks to chapter members, other medical school faculty, staff, and students. People from the surrounding community also attended these talks. He also masterminded an excellent fall visit to the facility in Green Bank by Sigma Xi members, friends, and families. This included the Green Bank Science Center tour and a comprehensive behind-the-scenes tour of the entire facility. One of the many educational programs at Green Bank is the Pocahontas County Middle School Science Fair that is organized by the people at the science center. Winners of that annual science fair come to Lewisburg to participate in the Southern West Virginia Regional Middle School Science Fair put on by Sigma Xi and the medical school in the spring.	Against Closure	Email	11/24/2016	

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140	c	Larry	Davis	President, Greenbrier Valley Chapter of Sigma Xi and Professor Emeritus at the West Virginia School of Osteopathic Medicine	<p>The following two recent papers posted on the Cornell University Library website specify good reasons that the research activities at the Green Bank Observatory should continue with NSF and many research institutions participating. Please take them wisely into consideration. New and unique capabilities of the Green Bank Telescope for studies utilizing operations in the 3mm band wavelength are unrivaled in the world.</p> <p>(1) The National Science Foundation's AST Portfolio Review of 2012 is Not Relevant to the Green Bank Telescope of 2017: A White Paper Authors: Felix J. Lockman, Ryan Lynch, David T. Frayer, Brian D. Mason, Scott M. Ransom</p> <p>(2) The Case for a Publicly Available, Well-Instrumented GBT Operating at 20-115 GHz Authors: J. Bally, G. Blake, A. Bolatto, C. Casey, S. Church, J. di Francesco, P. Goldsmith, A. Goodman, A. Harris, J. Jackson, A. Leroy, F. Lockman, A. Lovell, A. Marscher, D. Marrone, B. Mason, T. Mroczkowski, Y. Shirley, M. Yun</p> <p>At our President's Advisory Committee meeting on November 15 Green Bank Observatory support was unanimously voiced by those present. Please do all you can to keep things going full speed at the Green Bank Observatory so that the benefits stated above continue to be realized.</p>	Against Closure	Email	11/24/2016	
141	a	Glenn	Jones	Associate Professor, Columbia Astrophysics Laboratory	<p>My research activities are already being impacted by the divestment by NSF in the Green Bank Telescope (GBT), and would be severely hampered by the proposed changes. Three major aspects of my research rely on the unique features and capabilities of the Green Bank Telescope:</p> <p>(1) understanding diffuse radio emission that may confuse detection of the signature of inflation after the Big Bang, (2) probing the details of the brightest radio pulses in our galaxy from the Crab Pulsar, and (3) searching for gravitational waves using pulsars. The GBT is the single best instrument in the world for studying diffuse radio emission on degree-sized scales because of its large, unblocked aperture and its wide frequency coverage. Radio interferometers, like the Jansky Very Large Array and the future Square Kilometer Array are not able to accurately measure diffuse emission because they are not single dish telescopes like the GBT. Accurately determining the contaminating effects of diffuse polarized emission from the galaxy is crucial to cosmology experiments that seek to measure the so-called B-mode signal that is predicted to be produced by the process of inflation immediately after the Big Bang. With the reduction in open-skies telescope time available at the GBT, my collaborators and I are already finding it difficult to get the data we need to investigate this problem. The GBT is also uniquely suited for studying the details of radio emission from pulsars. There are several pulsars that are known to emit radiation across the full range of frequencies to which the GBT is sensitive. Some of these pulses of radiation are brighter than anything else in the galaxy. No one knows for sure how this emission arises, but understanding it could lead to new technologies for radio communication. No other facility provides the combination of sensitivity and bandwidth needed to study this emission in general. The bandwidth required to study this problem requires that we bring our own specialized equipment to the telescope to record the raw signals from the telescope. I can speak from personal experience how inspiring that level of hands-on activity is for young scientists and engineers. I can also attest to the fact that it is nearly impossible to access the equivalent raw signals at other facilities, for technical, logistical, or policy-based reasons. Reduced open-skies access to the GBT will directly delay studies to understand this enigmatic radio emission mechanism. Finally, I am one of over 100 members of NANOGrav, a collaboration of astronomers, physicists, engineers, and data scientists at 34 institutions across North America. We are on the verge of making the first detection of low-frequency gravitational waves from supermassive black holes - a discovery as transformational as the discovery of gravitational waves from stellar mass black holes announced by LIGO. NANOGrav uses an array of high-precision radio millisecond pulsars - precise astrophysical clocks - to search for small perturbations caused by gravitational waves. The Green Bank Observatory is absolutely critical to this effort because it provides outstanding sensitivity to these weak astronomical signals over 85% of the sky. No other facility in the world offers GBO's combination of sensitivity and sky coverage. NANOGrav also uses the Arecibo Observatory in Puerto Rico, which has higher sensitivity, but is restricted to a smaller viewing area than GBO. The GBO and Arecibo each contribute 50% to NANOGrav's sensitivity to gravitational waves. Many of the proposed changes to GBO operations would have a major detrimental impact on NANOGrav, and in turn would affect the careers of dozens of astronomers, engineers, and technicians. Many of the scientists like myself are at the early stages of their STEM careers. These changes will adversely affect the socioeconomic and cultural environment in Pocahontas County, at Columbia University, and at scientific institutions across the United States.</p>	Against Closure	Email	11/23/2016	
141	b	Glenn	Jones	Associate Professor, Columbia Astrophysics Laboratory	<p>Here are the impacts of each proposed scenario, as I see it:</p> <p>No-action alternative: Under this preferred scenario, NANOGrav could continue critical scientific activities. Our program to monitor over 50 millisecond pulsars would continue under a current contract with GBO. Importantly, surveys to find new millisecond pulsars with the GBT would also continue. These surveys, and the vital follow-up of new pulsars, are conducted under NSF open skies time.</p>	Alternatives Consideration	Email	11/23/2016	
141	c	Glenn	Jones	Associate Professor, Columbia Astrophysics Laboratory	<p>Collaboration with partners for continued science-focused operations:</p> <p>This scenario would allow NANOGrav to continue its pulsar monitoring program, but would severely impact surveys for new pulsars and the follow-up observations that identify the best candidates for NANOGrav.</p> <p>Because these programs operate under open-skies time, any reduction in NSF funding will similarly reduce the time available for our surveys. Scheduling pressure will also make it more difficult to characterize new discoveries, and will greatly reduce the impact of NANOGrav's ancillary science, which is itself some of the most impactful conducted at GBO. Thus, while this scenario would allow NANOGrav to make progress towards discovering low-frequency gravitational waves, it would slow the rate of that progress.</p>	Alternatives Consideration	Email	11/23/2016	
141	d	Glenn	Jones	Associate Professor, Columbia Astrophysics Laboratory	<p>Transition to an education and technology park, mothballing, or full deconstruction: These scenarios would devastate NANOGrav science and the careers of dozens of astronomers; they would incentivize pursuing careers outside of the US, especially for young astronomers, and would thus drain the US of important expertise in this revolutionary new area of astronomy. This would come as several countries are improving their infrastructure and instrumental capabilities in the search for low-frequency gravitational waves. The Five Hundred Meter Aperture Spherical Telescope (FAST) in China represents a huge investment on the part of the government of China in this scientific area. Changes to GBO operations that adversely impact NANOGrav will thus effectively cede US leadership in low-frequency gravitational wave astronomy to other nations. The GBO (and Arecibo) are currently the best telescopes in the world for NANOGrav science and they may very well remain so for the next decade.</p>	Alternatives Consideration	Email	11/23/2016	

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141	e	Glenn	Jones	Associate Professor, Columbia Astrophysics Laboratory	<p>In addition, the elimination of this scientific institution will remove a technology center in a region with few skilled positions. Even conversion to an education and technology center would still likely result in the export of a number of good-paying jobs to higher-tech areas of the country. The people of Pocahontas County are proud of this observatory. At the November 2016 public comment meeting regarding the future of the GBO, not a single person complained about living in the National Radio Quiet Zone, and the public was clearly supportive of continued public funding of the GBO.</p> <p>As you can see, the scientific, socioeconomic, and cultural impacts of reducing NSF funding for GBO are numerous and severe. Such action would be a huge loss for my career, the careers of my colleagues, the NANOGrav collaboration, the US astronomical community, and the people of Pocahontas County, West Virginia. I urge NSF to adopt the no-action alternative in the strongest possible terms.</p> <p>Thank you for your consideration. If you have any questions or need further information, please contact me at the address above.</p>	Against Closure	Email	11/23/2016	
142	a	Paul and Linda	Kamienski		<p>Although we attended the NSF meeting (afternoon session) at the Green Bank, WV Observatory on November 9, 2016 we did not speak at the meeting. There were a large group of people from all over Pocahontas County and from other parts of WV as well as from Virginia, North Carolina and Pennsylvania who spoke in support of the GBO and offered a wide variety of perspectives in their support. Everyone supported the first two options: a) Continued full NSF Support and b) Increased Collaboration with other parties and continued science focused operation with gradual reduction in NSF funding. Based upon sound reasoning, there was no support for the other options.</p> <p>We offer the following comments in the two categories below in continued support for GBO (options 1 or 2):</p> <p>Technical Relevance and Quality of Research & Personnel While it was pointed out that input on technical topics was not the purpose of the meeting, this issue is critically important to a sound decision on the future disposition of GBO. The NSF overview by Mr. Edward Ajhar, although very brief, indicated that GBO researchers had made significant contributions to pulsars for detecting gravitational waves and other research areas which would indicate that high quality and relevant research continues to be conducted at GBO. Other speakers indicated that the facility had unique research capabilities and was well respected by scientists worldwide, and that new capabilities were just now being fully commissioned. Some questioned how the prior 2012 study was conducted including: who provided input, who had participated and their level of subject matter expertise, or who reviewed and commented on the study results. Because this is so important, if there is any question about the validity of the prior conclusions, the study should be redone resolving any and all of these outstanding issues. Assuming that GBO has unique capabilities, providing solid research results with highly qualified scientists and therefore is a solid contributor, then options 3, 4 and 5 should not even be on the table for consideration.</p>	Against Closure	Email	11/23/2016	
142	b	Paul and Linda	Kamienski		<p>Impact on Community, County and WV Many of the speakers representing a wide variety of professions and perspectives spoke about how GBO had a positive impact on them personally, on their children, on their businesses, and overall on their community. While we were aware of many of the positive impacts GBO had on the community, we realized our knowledge and understanding did not even scratch the surface. Hosting and promoting science fair competition for local schools, promoting STEM careers, involving students of all ages in real live research programs, assisting in training of local EMS as well as machinists and other trades, direct volunteer participation in a variety of civic activities are among the contributions of the GBO personnel that make them an important, integral and invaluable part of the community. While this would be very important in any location, it is particularly valuable in rural WV. Promoting students to pursue STEM careers by exposing them to top notch people and top notch research is invaluable for the population of this rural community. (see transcripts of speakers for many specific examples).</p>	Against Closure	Email	11/23/2016	
142	c	Paul and Linda	Kamienski		<p>Options 3, 4 and 5 are realistically a step-wise approach to shutting down and dismantling the facility which would be devastating to the community, and bad for WV as well as the Country. Education of the next generation happens if top-notch research is being conducted by top-notch scientists as is done today. Without this the facility becomes an interesting but much less relevant "museum" which would eventually lead to mothballing the site. Continuing costs for maintenance would ultimately lead to dismantling.</p>	Against Closure	Email	11/23/2016	
142	d	Paul and Linda	Kamienski		<p>Currently, residents in Pocahontas County have no cell phone service and poor internet capability in large part due to the NRAO "quiet zone" in the area. They put up with this inconvenience due to the greater good that GBO provides. In options 3, 4, 5 that leads to mothballing, the quiet zone would likely be eliminated. This unique quiet zone would be difficult if not impossible to reinstate in the future.</p> <p>Therefore, NSF needs to think carefully about both the technical capability as well as the major positive impact that GBO has on the community before reaching a decision.</p>	Against Closure	Email	11/23/2016	
142	e	Paul and Linda	Kamienski		<p>NSF Funding Approach Since relevant and productive research is being conducted at GBO, and recognizing that NSF funding sources are under pressure, option 2 with increased collaboration with other third parties appears a logical alternative. However, instead of GBO being primarily responsible for finding other partners and funding, NSF should have a vital and active role in this activity in partnership with GBO. Any funding reductions from NSF should be directly tied to the amount of additional funding that this collaboration achieves in order to keep GBO funding whole in conjunction with continued good management of costs by GBO.</p>	Alternatives Consideration	Email	11/23/2016	
143	a	Jack	Shilt		<p>It would be foolish to eliminate the largest steerable radio dish from the USAs assets. The current facility and the dish prior served as invaluable resources to NASAs space program. From measuring the winds on Jupiter when Galileo's High Gain Antenna failed to enabling the success of the Huygens Probe's mission despite its communication loss to Cassini, the Green Bank facility has consistently prevented significant losses to the return from tax payer investments into space missions.</p> <p>Rebuilt as recently as the early 90s, it also has hardly been utilized long enough to return taxpayers investment into it. Around \$50M, it was constructed with adaptive optics, a cutting edge control system enabling major reconfigurations in minutes that can take other telescopes hours or days, and is unique among various radio telescope systems operating in GHz observing with its open proposal process.</p>	Against Closure	Email	11/23/2016	

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143	b	Jack	Shilt		Beyond these considerations and the unique science only it can do, the Green Bank facility is the BEST for training our next generation of radio scientists. It is the only one that continues to maintain the old technology for steering and recording radio data enabling a full break from the technology falling into a black box. Single dish data processing is easier to manage and thus instruct students on the physics not just of the observing system but also of the various astrophysical phenomena being observed. Thousands of radio students have passed through its facility giving the US a strong radio community from which to draw expertise.	Against Closure	Email	11/23/2016	
143	c	Jack	Shilt		Finally being the only radio-quiet territory in the US for performing research, its closure would eliminate entire spectral bands of research to the majority of US scientists. As every amateur radio operator knows, the electromagnetic spectrum is heavily occupied with only certain bands that they can use to communicate. If they want to listen to any astronomical phenomena, very few bands are available. The concept of being able to travel to West Virginia and have an entire spectrum in which to track whistler waves, listen to the Galactic Neutral Hydrogen Line, and data transmissions from satellites is a wealth beyond imagining to an average hammer. We call on the NSF to consider the resource that taxpayers bought and have yet to take full advantage of in the Green Bank Telescope. It's our resource.	Against Closure	Email	11/23/2016	
144		John	Makous	HS Physics Teacher	I am a high school physics teacher at Providence Day School in Charlotte, NC, where I have taught for the past 25 years. Over the past 10 years I have taken a group of physics students annually to the Green Bank Observatory to experience the excellent education outreach program this observatory offers. I am asking that in considering the future of this observatory you choose either of these options: 1. Continued NSF investment for science-focused operations (No-Action Alternative) 2. Collaboration with interested parties for science- and education-focused operations with reduced NSF-funded scope I use a "modeling" method to teach physics, in which the students develop an understanding of physics by doing physics and developing models to explain their investigations. This methodology addresses the current outcry by experts that emphasizes the need for students to develop good critical thinking and analytical skills through STEM experiences. The group of students I take to the Green Bank Observatory include my AP Physics students (mostly seniors) and some ninth graders. The program my students experience at the Green Bank facility is the epitome of a modeling method of learning, and it resonates strongly with the STEM skills training needed for today's students. My students spend four days using the equipment at the observatory to collect and analyze radio astronomy data. The courses I teach are not astronomy courses, and most of the students are very unfamiliar with astronomy going into the four day experience at Green Bank. They struggle at first, but by the end of the four days the students are able to make sense of their data and provide reasonable explanations of their observations. This is an experience that cannot be duplicated elsewhere. For most of my students this is a memorable experience that they look back on fondly. Regardless of what my students go on to study, whether it is science, engineering or business, their experience at the Green Bank Observatory provides an excellent sampling of future challenges they will be facing regarding new learning and problem-solving experiences. In considering the future of the operations of the Green Bank Observatory I urge you to make a choice that will enable the observatory to continue providing the excellent educational opportunities that my students have been able to experience, and future students will be able to experience in years to come.	Against Closure	Email	11/23/2016	
145	a	Saira	Rizwan	Student Government Association Secretary S.P.A.C.E. Club President WV SPOT Ambassador West Virginia State University	My name is Saira Rizwan and I am an undergraduate biology major studying in West Virginia State University (WVSU). I am the current student president of the Student Partnership for the Advancement of Cosmic Exploration (SPACE) club at WVSU. I am now also a WV Science Public Outreach Team (SPOT) Ambassador. I want to share my thoughts before a decision is made about the future of the Green Bank Observatory. Hearing about NRAO and NASA's jointly funded West Virginia SPOT program that is dedicated to bringing space and STEM science to West Virginia K-12 schools, I decided to apply to become a SPOT Ambassador this year. I felt it was important to go to these schools as a STEM role model and show the students that great science is for everyone and can come from anyone. As some schools may not have enough funding, these space-themed presentations and hands-on activities may be the students only exposure to a space topic in their entire K-12 career. Me along with other college students from various West Virginian higher education institutions who were accepted into the program this year, received a weekend of training (Sept. 16-18, 2016) at the National Radio Astronomy Observatory in Green Bank. There we got to tour the observatory, learn about all the different telescopes, and see the Green Bank telescope up close. Under the guidance of the Green Bank Observatory education coordinator, Ms. Sue Anne Heatherly, we even got to operate the 140-ft radio telescope and collect our own Hydrogen spectra data. At the Green Bank Science Center, we got to perform and learn different hands-on activities like the Green Bank Telescope Engineering design challenge, sizing up the moon, robotic arm, molecular structures, and design an alien. It was also a learning opportunity where we expanded our knowledge through understanding and presenting presentations about space science and astronomy topics, such as radio waves and pulsars, black holes, gravitational waves, and the search for extraterrestrial life. The training was a substantial professional development experience, and meeting Dr. Kathryn Williamson, and the extraordinary people who call the Green Bank Observatory home was an opportunity of a lifetime. I would like to see the continuation of the SPOT program, and the training especially, which is a crucial element, because it enriches education at a time when it is severely underfunded and facing even more cuts. It helps college students like me develop better public speaking skills, become more adaptable, and broaden our horizons. SPOT allows us to promote higher education, reach out to K-12 school students, be role models, and inspire students to pursue STEM and space careers. We need to keep supporting such programs.	Against Closure	Email	11/23/2016	

Green Bank Observatory -Written NSF Public Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
145	b	Saira	Rizwan	Student Government Association Secretary S.P.A.C.E. Club President WV SPOT Ambassador West Virginia State University	In addition, the 300-ft Green Bank Telescope at the NRAO Observatory, is the most powerful and state-of-the-art instrument in the entire world right now. It has helped lead radio astronomy not only in the United States, but globally, and is now the need of the hour since the recent discovery of gravitational waves. Due to it's huge size (detects lots of radio signals at a time), steerability (covers 80% of the sky at once), and the location of the facility (national radio quiet zone, in a mountain valley), the capability of the telescope is unrivaled. Scientists from all over the world request time slots to use the telescope because it is the best technology in the world! The Green Bank Telescope is a valuable science resource that should be kept open and fully-functional, and not be deconstructed. Many undergraduate and graduate students dissertations depend on the data acquired from using the Green Bank Observatory telescopes. Even the educational outreach efforts, training programs and internships for students of all ages at the facility are integral to its operations. The observatory has immensely benefited the fields of education and research. It needs to stay! Furthermore, historically, the state of West Virginia has been a pioneer in space research and exploration, and has it's roots deep in the field; be it Katherine Johnson, a NASA Langley Mathematician who calculated the trajectory for Alan Shepard's space walk and her calculations proved critical for future Apollo missions; or Homer Hickam Jr., the "rocket boy" who built and launched rockets, and was hired by NASA to train astronauts about space payloads and much more. There is also Adrian Melott, the first individual to use supercomputers to see large-scale structures of the Universe that is full of dark matter; or even the astrophysicist Kim Weaver, an expert in x-ray astronomy today, who saw the Green Bank Telescope as an inspiration to become a scientist, and ended up working at NASA. In the same regard, the Green Bank telescope may be an inspiration to countless other children and students in West Virginia who may be the next Katherine Johnson, Homer Hickam Jr., Adrian Melott, or Kim Weaver. Please do not take that away from them. Please let the observatory continue its role as a front-runner in radio astronomy, and continue to provide these educational and research opportunities to the people of West Virginia and the world. I hope to be able to return to the Observatory in the upcoming Spring semester as part of the WVSU SPACE club trip, and attend the WV SPOT annual training next year.	Against Closure	Email	11/23/2016	
146	a	Evan	Smith		I am Evan Smith, an employee of the West Virginia University Research Corporation working at the Green Bank Observatory. I've been a tour guide at the Science Center this summer and am now researching interference mitigation. The observatory has given me the chance to develop my research and science communication skills, and has been an incredibly propitious springboard for my future as an astronomer. I have also gained a very optimistic view of how people see science in the modern world, based on how well they reacted to the resources at the Science Center. I am an aspiring astronomer that has just finished an undergraduate degree in Physics and Math and hoping to move on to a Ph.D. program in the next few years. I came here in May 2016 to be a tour guide after finishing my undergraduate degree, with the hope of making connections with the scientists here that would propel my career forward, and also with the hope of landing a research job to add experience to my resume. Before starting my job as a tour guide, I had the notion that science was becoming less and less popular. I thought that people didn't care about science research and that was translating into decreased funding. I have done research at the Arecibo Observatory as well, through an undergraduate program at my university, so I indeed had first-hand experience of the ever-tightening belt of decreased funding. However, that pre-conceived assumption was completely flipped around during my summer as a tour guide. I gave tours to all sorts of people visiting the science center, and was very surprised by how excited people were about astronomy and science in general, even those I wouldn't have expected to be. The experience of being amongst all of these fascinated people and engaging them in astronomy really opened my eyes to how much people still appreciate science. I now hold a much more optimistic view of the popularity of science, thanks to my summer as a tour guide.	Against Closure	Email	11/23/2016	
146	b	Evan	Smith		After the summer, I was able to attain my original goal of coming here and was hired by a staff scientist at the observatory and a professor from West Virginia University who does a substantial amount of work here at Green Bank. I am investigating the most modern methods of interference removal in radio astronomy and so this work will hopefully directly benefit at least the next half-decade of data-taking at the observatory by cleaning away harmful interference and increasing the quality of data from the telescope. The work is very involved and I am gaining incredibly valuable experience that will help me get into a Ph.D. program so that I can continue my dream of being an astronomer. In one place: the Green Bank Observatory, I was able to hone two of the arguably most important skills of a scientist, communication and research. After the summer of guiding tours, I am very confident in my science communication skills, and my current job in interference mitigation here is greatly enhancing my research skills. Of course, there are countless testimonies in addition to mine to the educational opportunities for students from elementary school all the way to undergraduate, so let me say this as a twenty-two-year-old: The Green Bank Observatory is a great place for developing scientists of all ages, including someone like me. In order to be world leaders in astronomy, the United States needs to have world-class telescopes doing frontier-smashing science, and I know that both Green Bank and Arecibo are, in fact, doing this level of science, despite their daunting ages. I've personally done recent research at both facilities! I do not wish to see any facility mothballed on the Green Bank Observatory campus, or even at Arecibo. First-class facilities with great education programs are the first steps to leading the world in science, and the Green Bank Observatory offers exactly these qualifications. We cannot slice away financial support from such a facility.	Against Closure	Email	11/23/2016	
147		Jo	Blackwood		My husband, Edwin Neale Blackwood, and I are Professors Emeriti, University of Charleston. We both taught several years including one co-taught course in Physical Science. As part of that class, we took our students on a field trip to the GBO. As a Venturing Crew leader (coed Boy Scouts group for ages 13-21), I have also accompanied Scouting groups on tours several times. Both my husband and I have participated in professional development study programs at GBO. We have utilized the facility over the years, attending ground breaking and dedications of telescopes. It would be a terrible loss to educators to lose such a facility. On another personal note, both our sons served as tour bus drivers at Green Bank when they were in college. That experience impacted them; both have earned doctorates. Let this message be one carrying strong support.	Against Closure	Email	11/23/2016	

Green Bank Observatory -Written NSF Public Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
148		Eric	Briggs		The past week in November is auspicious for several NRAO anniversaries: the foundation of the agency in 1956 and the collapse of the 300-foot transit in 1988 to name a few. Over the past 10 years I have gained good experience in studying historic observatories. I have watched the original film about the difficult completion of the 140 foot equatorial dish at Green Bank, and from that I can tell how often we should have to replace the previous generation's largest telescopes: Not Often. I have visited the GBT just this last month for the first time and I hope to return for many more visits. Please, everyone work together on this one.	Against Closure	Email	11/26/2016	
149	a	Joseph	Kania		I would like to voice my support of continued NSF support for the Green Bank Site, in either the no action alternative or in collaboration with other parties. I first went to the Green Bank site when I was thirteen, and doing so helped reinforce my interest in radio engineering and astronomy. I am sure this is the case for many other people who like me grew up in Appalachia, a region currently suffering from economic stagnation as heavy industry and coal mining leave the area.	Against Closure	Email	11/25/2016	
149	b	Joseph	Kania		Having a cutting edge observatory that they can visit sets the minds of the today's students to the future and how they can be a part of it. If the site was mothballed or dismantled it would not be there to provide inspiration. If Green Bank is kept as an educational it could help excite about science, but that is all; it would not connect the students from the present to the future whether it is the next discovery or instrument.	Against Closure	Email	11/25/2016	
149	c	Joseph	Kania		As a radio astronomer, Green Bank represents a valuable resource. It will be an important instrument until the Square Kilometre Array is completed, and even then it will remain important for its northern hemisphere coverage. Radio Telescope Effelsberg can provide many of the services of the Green Bank telescope, however North Rhine-Westphalia has a population density orders of magnitude greater than Pocahontas County and does not have the protection of the National Radio Quiet Zone. Given the importance of a radio frequency interference free site for single dish astronomy, it would be imprudent to dismantle the site because such an environment would be nearly impossible to recreate. Either the current funding mode, or the addition of partners would allow students like me, and the wider astronomical community, to reap the benefits of the Green Bank Observatory.	Against Closure	Email	11/25/2016	
150	a	James	Crum	Certified Wildlife Biologist	The following comments are in response to the request for scoping comments needed to prepare an EIS on the future operation of the Radio Astronomy Observatory at Greenbank, WV. The only proposed alternative that would be in the best interest of the residents of Pocahontas County, the citizens of West Virginia, the people of the United States of America, and the world scientific community would be the continued full operation of the facility at full staff and operational capacity. Operation of the facility as an educational center would be significantly without the full use of operational capacity and staff. Anything less than the full NSF funding utilizing the entirety of the technology and human resources currently available at Greenbank would be unacceptable. The fiscal support for the cutting edge science has provided that attracts cooperating agencies and multiple disciplines other than radio astronomy.	Against Closure	Email	11/25/2016	
150	b	James	Crum	Certified Wildlife Biologist	For example, the facility has proven to be a leader in land stewardship. Providing the West Virginia Division of Natural Resources a proving ground for controlled deer harvest that has led to similar harvests on state park lands and served as an example of deer harvest compatibility with land uses once considered "un-hunttable." This has led to special urban controlled deer hunts across West Virginia. In summary, the Greenbank Radio Astronomy Observatory is an invaluable resource for not only the advancement of science of the heavens, but also the early natural resources associated with the facility. The fully funded operational facility provides a unique mixture of multiple discipline intellects to interact for the advancement of science - in not only astronomy but the natural resources.	Against Closure	Email	11/25/2016	
151		Katie	Rabidoux		I am writing in support of the continued operation and funding of the Green Bank Observatory. I first came to the Green Bank Observatory as a high school junior with the Grosse Pointe North High School Radio Astronomy Team. While I had been interested in astronomy since elementary school, it was my visit to Green Bank that made me think that a career as an astronomer was achievable. I chose West Virginia University for graduate school because of its close connection to the Green Bank Telescope. I obtained a significant portion of the data I used in my PhD work with the Green Bank Telescope, and I visited the site to collaborate with researchers many times throughout graduate school. I am now an assistant professor at an undergraduate-focused university, and I would like to involve my students in undergraduate research using the GBT in the future. I have appreciated and benefitted from the the Green Bank Observatory's strong dedication to working with students of all levels. The Green Bank Observatory inspired and supported me as a young astronomer, and I hope to see it do so for many more generations of students. I urge the NSF to continue its support of the Green Bank Observatory to keep skies open for aspiring radio astronomers.	Against Closure	Email	11/25/2016	
152	a	Charles	Liu		Please accept this email as an expression of my strong support for the option of "Continued NSF investment for science-focused operations (No-Action Alternative)" for Green Bank Observatory. Green Bank Observatory's impact upon me has been strong and positive since my time as an undergraduate student. The observatory, and my colleagues who have worked there over the years, have made significant contributions to the body of scientific knowledge in the world, as well as enhanced and improved my own research in the areas of starburst galaxies and colliding galaxies.	Against Closure	Email	11/25/2016	
152	b	Charles	Liu		Far beyond Green Bank Observatory's impact upon me, however, is its impact on the nation, the world, and the great state of West Virginia. Indeed, the observatory stands out in my mind as perhaps the leading center of transformative research, innovation, and technology development in West Virginia. Whenever my students or my non-scientist friends, colleagues, and acquaintances in New York City talk about West Virginia with any level of uncertainty or lack of knowledge, I am always able to tell them that one of the world's most significant radio astronomy research centers in the world is in West Virginia - that the National Science Foundation's support of that site embodies a powerful national commitment to excellence and to the future - and that Green Bank Observatory is a facility in which the residents of that state can be very proud. I firmly believe the No-Action Alternative will allow that well-deserved reputation to continue - both for the state, and for the nation's strong investment in a bright future.	Against Closure	Email	11/25/2016	

Green Bank Observatory -Written NSF Public Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
153	a	John	Lazio		<p>I am writing in response to the NSF's intent to prepare an Environmental Impact Statement and Initiate Section 106 Consultation for proposed changes to Green Bank Observatory operations, Green Bank, West Virginia. I focus most of my comments on the possibility of changes to the operational model, but one of my comments also includes potential environment effects.</p> <p>Regarding the topic of changes in the operational model for the Green Bank Observatory, consideration should be paid to the Green Bank Observatory's role in training and outreach for science, technology, engineering, and mathematics. This training and outreach takes at least two forms. First, the Green Bank Observatory has been the site of many graduate students and post-graduate researchers obtaining training in the science and technology of radio astronomy. Not all of these students and post-graduate researchers remain in radio astronomy, or even in astronomy. A significant fraction of these students and post-graduate researchers switch fields. I personally am aware of researchers who conducted work using the Green Bank Telescope and later switched fields to work in areas as diverse as Earth remote sensing, high performance computing, and and reconnaissance. Their training in radio astronomy in general, and with the Green Bank Telescope specifically, was invaluable to their later employment in these areas, and, in some cases, their work is not only commercially valuable but it is contributing to the defense of the Nation. Consequently, any change to the operational model of the Green Bank Observatory should consider the potential effect on the advanced training and future employment in the areas of science, technology, engineering, and mathematics.</p>	Against Closure	Email	11/25/2016	
153	b	John	Lazio		<p>Another consideration is that the Green Bank Observatory has had a long history of bringing students from around the state of West Virginia to the site for exposure to science, technology, engineering, and mathematics. The economy of the State of West Virginia consistently ranks near the bottom of the entire Nation. It is widely recognized that the development of science, technology, engineering, and mathematics has a considerable economic impact, with some estimates placing a majority of the United States' economic growth since World War II being due to investment in science, technology, engineering, and mathematics. A change to the operations model of the Green Bank Observatory that affects the capability to expose students in West Virginia to one of the world's leading scientific research facilities may have an effect on the entire economy of the State of West Virginia.</p>	Against Closure	Email	11/25/2016	
153	c	John	Lazio		<p>Finally, the Green Bank Telescope has been used increasingly for bistatic radar observations of near-Earth asteroids, including objects classified as potentially hazardous. While the odds of an asteroid impact in the near term are small, the potential environmental effects of such an impact could be significant. While the identification and tracking of asteroids is a responsibility of NASA, a change to the operations of the Green Bank Telescope must be done in a manner that does not preclude its use, should NASA determine it to be of value for the tracking of near-Earth asteroids.</p> <p>In conclusion, there are a number of potential environmental and operational considerations related to any change in the operational model of the Green Bank Observatory that should be considered. I would be happy to answer any potential questions that you might have regarding my comments.</p>	Against Closure	Email	11/25/2016	
154		Una	St. Clair-Moniz		<p>Please accept this message as my public submission regarding the Green Bank observatory.</p> <p>Please choose: Option 1) Continued NSF investment for science-focused ops (no-action alternative).</p> <p>Green Bank is recognized worldwide as providing high quality scientific information, which data could have multiple vital uses over time and in historical and comparable analysis. There is nothing similar to Greenbank within North America, and it would be short sighted to close down this observatory, not just for the USA but for the world as a whole. The investment to bring the observatory to where it is today would be lost if the scientific programs were abandoned or altered away from their original purpose. Possibilities, as yet unimaginable, would be incapable of existing in the future if critical investments of time, energy, knowledge, design are effectively thrown away, shortchanging all of us today, and future generations.</p> <p>We must stand guard and maintain the integrity of this ongoing science based operation, as society does not think further than how to put food on the table and gas in the car yet may need to rely on information from any number of critical scientific understandings. Please protect this amazing United States asset by continuing the functionality and funding.</p>	Against Closure	Email	11/25/2016	
155	a	Charlotte	McCullum		<p>Greenbank has been a vacation destination for me on 4 occasions in the past 2 years. Keep the observatory functioning. The important scientific work being performed here will likely contribute to very important information about the health of people on earth, through the observations of the sky around us.</p>	Against Closure	Email	11/25/2016	
155	b	Charlotte	McCullum		<p>The town depends on the observatory's existence. Greenbank is becoming increasingly popular around the world, as demonstrated by it's unique visitors and multiple documentaries featuring Greenbank and the observatory.</p>	Against Closure	Email	11/25/2016	

Green Bank Observatory -Written NSF Public Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
156		Sebastian	Stahlberg		As a science enthusiast I feel that keeping the GBT open and running is important. Knowledge and understanding of the world and universe around us is far more important than cost cutting measures and that is why I believe that the best option is the first one. Continued NSF investment for science-focused operations (No-Action Alternative) the Green bank radio telescope is an important tool that complements the other tools. A quick search reveals that the GBT was used for these discoveries and many others Unique double Pulsar Tests Einstein's Theory Star Cluster Buzzing with Pulsars Cold Sugar in Space Provides Clue to the Molecular Origin of Life Starburst-Driven Winds May Have Created Giant "Lobe" in Galactic Center Galactic Building Blocks Seen Swarming Around Andromeda Water in Lunar Craters? Scientists Discover Two New Interstellar Molecules Radio Telescopes Reveal Youngest Stellar Corpse VLBA Reveals Dust-Enshrouded "Supernova Factory" Youngest Radio Pulsar Revealed with Green Bank Telescope GBT Reveals Satellite of Milky Way in Retrograde Orbit Clouds Dominate the Galactic Halo and more https://science.nrao.edu/GBT_DiscoveriesV4.pdf	Against Closure	Email	11/25/2016	
157		Sheena	Symington		Green Bank needs to be kept open because it provides a safe place for people who are EHS. It is necessary to support these individuals in providing a low Electromagnetic Pollution environment.	Against Closure	Email	11/25/2016	
158	a	Magda	Havas		I am in support of the first two alternatives listed below with the first option being my top priority. This is a unique site that has been in operation for a long time and deserves to be protected in a way that still allows it to operate and obtain scientific information related to space research.	Against Closure	Email	11/25/2016	
158	b	Magda	Havas		It is also one of a very few locations in the U.S. that is a radio-free zone. This allows for people who have developed a sensitivity to radio frequency radiation. It also provides a potential site for research related to the effects on humans as well as flora and fauna. Expect this research will become increasingly important as more wireless devices are deployed.	Against Closure	Email	11/25/2016	
159		William	McNeel	Resident	I am writing about the Environmental Impact Statement concerning the future of the Green Bank Observatory at Green Bank, West Virginia. First, a little about myself. Native West Virginian and resident of Pocahontas County, the location of the Observatory, for most of my life (both parents were from the county). Now retired, I first taught in the schools of the county as a high school math teacher. The longest part of my working life was with The Pocahontas Times, a weekly newspaper in the county. I was editor for 25 years. My educational background includes a BS in geology and a MS in mathematics education. Of the five options being considered by the NSF for the future of the Observatory, numbers four and five are incomprehensible. I cannot believe that the National Science Foundation would even take such actions into consideration. How could you even think of mothballing or, worse, deconstructing of one of the most important facilities in the science of radio astronomy, in particular the recently constructed Robert C. Byrd Radio Telescope. That telescope has many useful years left for use by radio astronomers, both those in the midst of their careers and those studying to become radio astronomers. As for option three, I am not sure what is meant by a "technology and educational park." If the Observatory is not being used to conduct research in radio astronomy, this option is the same as numbers four and five - incomprehensible. As you might have assumed at this point, my preference is for options one or two. Being realistic about the situation in the federal budgeting process and with the result of the recent election making the future of funds for the NSF more of a concern, I think option two is the most reasonable of the five. The NSF, regardless of budget problems, must continue to fund the Green Bank Observatory to some extent. It is too important to the science of radio astronomy for the NSF to do otherwise.	Against Closure	Email	11/25/2016	
160		Melissa	Chalmers		I was only informed today concerning the public comment for Green Bank. There are many other parties I'm in contact with that would like to comment. Is it possible to keep it open for a few more days to ensure they would have a chance to send their comment to you?	General	Email	11/25/2016	
161		Michelle	Krone		I have brought 2 groups of girl scouts bank to the education program that green bank currently has in the past few years. This is an experience that is invaluable to our girls. Greenbank allows the girls to get hands on experience to explore a love of science and grow an interest in stem programs. In also allows many girls or children to learn about jobs within the science field. We love Greenbank please consider only options 1 or 2. 1. Continued NSF investment for science-focused operations (No-Action Alternative) 2. Collaboration with interested parties for science- and education-focused operations with reduced NSF-funded scope I would love to be able to expand this experience to all girl scouts in the state of Virginia. I think of all the girls that could get this wonderful experience but only if you would consider the continuation of funding.	Against Closure	Email	11/25/2016	
162		Kelsi	Taylor	Student	The GBO is important to my community and me. The GBO brings lots of tourism and puts us on the map. The GBO also supports my school and brings science opportunities. Thank you for your support so far. I hope you will continue funding the GBO.	Against Closure	Email	11/25/2016	

Green Bank Observatory -Written NSF Public Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
163		Karissa	Friel	Student	The GBO is important to my community and me because millions of people come across the world to see it and it provides jobs. Also the Green Bank School soccer teams get to have their games and their practice on the GBO property. After school students can go on nature walks and see the telescope. It is important to us. It is really cool to get up close to the GBT. I hope the community can keep it.	Against Closure	Email	11/25/2016	
164		William	Wilson	Student	The GBO is important to my school because of our soccer fields and our walks to the observatory for P.E. Our school has its Social Studies, Math and Science Fairs there. It is important to my community because a lot of people will lose their jobs if the GBO closes and most people will not be able to pay for food. I love science so much and it is so cool to have the GBO in our community. Please fund the GBO!!!	Against Closure	Email	11/25/2016	
165		Andrew	McNichols		I am writing to encourage you in the strongest possible terms to advocate for the expansion of NSF investment in science-focused operations of the telescopes managed by AUI at the Green Bank Observatory. As a young scientist, I know I am not alone among my colleagues in the hope for opportunities throughout my career to utilize the telescopes at Green Bank in my research. It would be disheartening to see public support for this singular facility wane, especially given its established, versatile record of successful discovery and advancement. The Green Bank Observatory, with its rich history, environment, and infrastructure, is a special and remarkably productive endeavor truly unique to this world. In my view, it encapsulates and enhances most of the best aspects of my country, my communities, and my home planet. To classify myself as an active supporter of the Green Bank experiment brings me great pride, and the activities and experiences gained from this Observatory are valuable not only to the scientific users in this country but to all of humanity. Indeed, I have never met a person who visited the site and returned uninspired to the world of radio frequency interference. It is important to preserve the facilities of this unique, world-leading resource for the sake of our country's scientific edification and future technological endeavors. There are few other tools available to the United States' telescope-using public which are capable of such a wide range of potentially revolutionary scientific inquiry. We must support the precious opportunity established by the Green Bank telescopes. Speaking as an impassioned private citizen and scientist, I am urging you to please increase, or at the very least do not diminish, your investment in this magnificent and necessary project. Thank you for your consideration.	Against Closure	Email	11/25/2016	
166	a	Eve	Klopf	Assistant Professor of Electrical Engineering Program Director (BSEE)	This letter is to express support for the continued federal financing of the Green Bank Observatory, which is a tremendous scientific resource for the world. This facility allows numerous scientists from around the world to take radio astronomical measurements of the galaxy around us, leading to a tremendous increase of our basic knowledge of the universe. The attitude of the staff at the Green Bank Observatory is that everyone can and should do science, and they provide a warm and welcoming environment for scientific exploration. I hope that you will support them in their dual mission of providing scientific data about the universe around us while inspiring many future scientists and engineers.	Against Closure	Email	11/25/2016	GBO_support_letter_Oregon_Tech.pdf
166	b	Eve	Klopf	Assistant Professor of Electrical Engineering Program Director (BSEE)	Additionally, it serves as a welcoming hub for scientific education with its public tours and outreach programs. I've personally had a wonderful experience interacting with staff scientists at the Green Bank Observatory. For the past couple of years, I have worked as tenure-track engineering faculty at a rural, public college in Oregon. Starting out as faculty, I was interested in becoming involved with projects that I could work on with my students, but found it somewhat difficult with my location and being limited to undergraduate lab equipment. Then, I had the good fortune to attend the NAIC/NRAO Single-Dish & NAASC Interferometry School, which is their summer workshop on radio astronomy – it was a fantastic experience, and a great way to meet a lot of wonderful people who work in the field of radio astronomy. I've kept in contact with one of the staff scientists at the Green Bank Observatory, Richard Prestage, ever since, and he's been a tremendous encouragement towards my getting undergraduate students involved with research projects. His guidance has helped me to get undergraduate students at the college where I teach involved with developing an inexpensive radio telescope, and helped me to get enough student interest to restart our campus amateur radio club – this club is currently booming, and is going to be a strong support for our department in graduating students who are prepared to work on the Internet of Things. What I've found working with undergraduate students is that a lot of them bring a tremendous interest in space, possibly from watching a lot of sci-fi as children – radio astronomy is a natural bridge between space and engineering. When you tell students that you'd like to build a radio, they're somewhat interested – when you tell them that you'd like to build a radio that can measure storms on Jupiter, or galactic hydrogen, they're suddenly very interested. Then, once you've built one radio with them, they're suddenly much more interested in other types of radios, and have possibly already started thinking about branching out into antennas, sensors, signal processing, and the Internet of Things.	Against Closure	Email	11/25/2016	GBO_support_letter_Oregon_Tech.pdf
167		JoAnn	Gladson		Please continue to fund the Green Bank observatory. There are so many people whose lives will be forever changed if it were to close. Continued NSF investment for science-focused operations (No-Action Alternative)	Against Closure	Email	11/25/2016	

Green Bank Observatory -Written NSF Public Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
168	a	Jennifer	Wood	Architect	<p>Due to time restraints I am copying you a preliminary submittal I recently sent to the architectural board because it has many science studies, references and historical information in it on EM Radiation and health effects, as well as ideas & guidelines for housing and facilities for persons suffering from EM Radiation Sickness. Some of this report is not pertinent to the current Environmental Impact Statement for GBO but in the interest of time I am attaching it to my brief comment as back up information. It is not my intention to offend any industry or government leader but to work both with scientists, industry members and others in my cause of providing areas which can be accessed by persons disabled by what is called Microwave Illness, EM Radiation Illness and many other names. It is an almost universally misunderstood condition and many sufferers have moved to the Green Bank area because of this debilitating condition. The World Health Org declared wireless devices and cell phones a class 2B carcinogen in 2011 and the recent US Gov. Toxicology report confirmed that wireless radiation is cancerous along with thousands of other studies showing various health effects. (See attached preliminary submittal.) For those of us that are ill, living in Green Bank or similar partial "quiet zones" is not a "fun life-style choice" based on cranky beliefs but a necessity and in many cases a matter of survival. I myself arrived here at death's door weighing only 77 pounds; my doctors did not think I would live. Persons with my condition are a rapidly growing population and some of us are now constantly interviewed by the media. Estimates have been that we are from 3 to as high as 20% of the world population. The need for specially built housing is extreme and smart developers that understand our needs could make enormous profits if only a few would come forward. This is happening in various parts of the world.</p> <p>The emerging scientific work regarding EMR and the public health needs a small area that could act as a "ground zero" base for epidemiology and other complex comparative studies, on health effects and the environment Perhaps a portion of this area could be used for that. Some scientists in this area have begun to read the work of various EMR scientists but there is still much to learn which will impact our future not only in GB but throughout the world. Keeping the observatory open for its present uses as well as perhaps using it for a greater variety of scientific studies (such as the effects of wireless technology on humans, animals and plant life) is one possibility. A place for international scientific conferences on this subject is another possibility. Thank you for taking the time to read my comments.</p>	Against Closure	Email	11/25/2016	GBO COPY fof SUBMITAL without email.docx
168	b	Jennifer	Wood	Architect	<p>But the Green Bank area is unique today in that it is considered the only, last "Quiet Zone" on earth. For this reason I feel it should be the first of its kind as a UNESCO world heritage site or a protected heritage site or perhaps other designation. I also want to state that the growing population of professionals with various skills that are now disabled by EM radiation sickness could contribute tremendously to creative and other projects if only they could remain in an area that is predominantly wireless-free where they can function without torturous symptoms and other handicaps.</p>	Against Closure	Email	11/25/2016	GBO COPY fof SUBMITAL without email.docx
169	a	Phil	Korngut	Scientific Researcher	<p>The technical combination of a 100m aperture, sub-mm surface rms, and sensitive bolometer arrays provided by the GBT, constitute a uniquely powerful tool for my work in the study of the pressure substructure in galaxy clusters (http://adsabs.harvard.edu/abs/2011ApJ...734...10K). The loss of such an instrument would mark a tragic decrease in the scientific capabilities for US observational astrophysics.</p>	Against Closure	Email	11/25/2016	
169	b	Phil	Korngut	Scientific Researcher	<p>In addition to its powerful observational capabilities, the GBO provides a unique platform to train the next generation of scientists, with hands-on education at a range of levels. My career would not have been possible without the extensive time I spent observing and engineering at Green Bank as a graduate student. It alarms me to think that future students would not have the same opportunities to learn the field there as I did.</p> <p>I therefore strongly support the "No-action alternative" to continue open skies observations with the Green Bank Observatory.</p>	Against Closure	Email	11/25/2016	
170		Xaq	Rzetelny		<p>I'm a former student with Rutgers University (And current NJ resident) who visited the Green Bank site as part of a student trip in my senior year. I understand the site's future is under consideration, and I just wanted to express my enthusiastic support for its funding to continue.</p> <p>I understand the Green Bank Telescope holds an important place within the scientific endeavor, and has made incredible contributions to our knowledge of the Universe. This is an exciting time for astrophysics, when we stand to learn so much. We should not slow the pace of that learning by depriving the scientific community of such a powerful tool. Doing so would force researchers to compete for already limited time at other facilities, decreasing the volume of discoveries that could be made. There are also tasks for which the GBT is uniquely suited, which other radio observatories could not perform as well or at all.</p> <p>My own visit to the site as a student was a magical experience in many ways. It was visually amazing and provided a visceral sense of astrophysics - not only by seeing the telescope, but also by getting the chance to work with other students on a smaller telescope at the site to actually make measurements ourselves.</p> <p>I now write for the website Ars Technica, where I cover new discoveries in astrophysics. I've covered fascinating work done by the GBT, so I have a sense of its import to science. I hope you'll continue funding for the site.</p>	Against Closure	Email	11/25/2016	
171		Christopher	Konen		<p>It has come to my attention that the Green Bank Observatory is under threat. I am firmly standing for the continuation of science-focused operations with NSF investments, or bearing the need for compromise, collaboration with interested parties.</p> <p>I have visited the facility several times as a high school student in an astronomy club who was truly inspired by the operations. Visiting the facility has been a catalyst for my development as I continue my pursuit in the sciences today as a university student. I also know several peers who were involved in the same group and are also continuing their careers in the scientific field. I strongly believe that future operation of this facility can help to embolden future generations of students and continue the line of tomorrow's scientists.</p> <p>Therefore, I believe that the Green Bank Observatory should continue science-focused operations. However, if a compromise is needed, collaboration with other parties is an acceptable alternative.</p>	Against Closure	Email	11/25/2016	

Green Bank Observatory -Written NSF Public Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
172	a	Jason	Hessels	Associate Scientist	<p>This letter is in response to the Federal Register Notice of an EIS evaluating the potential environmental effects of proposed changes to operations at the Green Bank Observatory (GBO). I strongly request NSF to choose Alternative 1 of its "Notice of Intent to Prepare an EIS...", namely "Continued NSF investment for science-focused operations (No-Action Alternative)."</p> <p>As background, I have been an active scientific user of the GBO for the last 15 years, and have visited the observatory many times. I currently work in the Netherlands, where I am an Associate Professor at the University of Amsterdam and at ASTRON (Netherlands Institute for Radio Astronomy), which is the Dutch version of NRAO. The GBO is a unique and world-famous scientific facility, as well as a powerful educational tool. I have been lucky to be involved in several of the GBO's major discoveries. To give a few examples:</p> <p>1) Ter5ad: the fastest-spinning pulsar known (Hessels et al. 2006, Science, 311, 1901; 306 citations). This discovery broke a 23-year-old record, and has stood for more than 10 years as the new record holder. This pulsar teaches us about the maximum spin rate that a neutron star can reach and suggests that the accretion process that spins up pulsars may be the limiting factor, as opposed to the neutron star equation of state.</p> <p>2) PSR J1614-2230: the first 2 solar mass neutron star (Demorest et al. 2010, Nature, 467, 1081; 1339 citations). Another record-breaking pulsar, this system has created an enormous flurry of activity both within the astrophysics community and the nuclear physics community because of the strong constraints it places on the neutron star equation of state. In fact, this is one of the most highly cited and impactful papers in all of astrophysics in the last few years! 3) PSR J0337+1715: the first pulsar in a stellar triple system (Ransom et al. 2014, Nature, 505, 520; 81 citations). This unique system is allowing us to test the strong equivalence principle of general relativity in a powerful, and previously inaccessible way.</p> <p>The GBO was crucial to these high-impact discoveries, and the GBO's potential for continued ground breaking science is enormous if it is appropriately funded and remains an open access instrument in which scientific programs are competitively selected based on their scientific merit. For example, in the new era of gravitational wave astronomy, the GBO is one of our most important tools for using pulsars to access the gravitational waves created by supermassive black hole binaries. This probes an astrophysical regime that beautifully complements the ongoing work done by LIGO. This is without question one of the most exciting prospects in astrophysics in the coming decade, and the GBO can play a major role in making this happen!</p>	Against Closure	Email	11/25/2016	
172	b	Jason	Hessels	Associate Scientist	<p>Besides being a cutting edge science facility, the GBO is also a critical educational tool. Through its visitor center, the GBO provides the type of educational experience that can only come from an active research facility. The telescope represents a rare opportunity for West Virginia students to come into contact with a cutting-edge scientific instrument. Keeping the GBO funded as a purely educational facility or "landmark to visit" does not make sense in my mind. The power of the facility to inspire and educate - in a way that cannot be done in a classroom - stems from the fact that there is ground-breaking research being done at the telescope. The sense that "this is where things are happening and discoveries are being made" is electrifying for students and motivates them in a way no textbook or classroom lecture can. I find this critical, because I strongly believe that improving the quality of education, challenging young students to think critically, and fostering their innate curiosity can go a very long way to building a better society.</p>	Against Closure	Email	11/25/2016	
172	c	Jason	Hessels	Associate Scientist	<p>In summary, the GBO is a landmark scientific facility and the short-term savings that could be made through closure are greatly outweighed by the long-term cultural, educational and socio-economic impact for West Virginia and the United States.</p>	Against Closure	Email	11/25/2016	
173	a	Darrell	Smith, Jr.		<p>I am writing in response to the Notice of Intent to Prepare an Environmental Impact Statement for the Green Bank Observatory published in the Federal Register on October 19, 2016.</p> <p>I am a proud West Virginian who is upset over the proposal to yet again see a government effort to reduce the advancement of our state. It is bad enough that our major industry -- Coal has been decimated by the political climate in this country. Now we are staring down at the loss of funding for a major scientific facility, the Green Bank Radio Observatory (GBT).</p> <p>It has historically hosted major world scientists. Its operations account for only 3% of the astronomy budget at NSF, and only 0.1% of the total NSF budget. Annually it hosts 50,000 visitors and 3,500 who are inspired by its science and technology opportunities. In the past 12 months, 54 different groups spent the night in Green Bank and used the 40 foot radio telescope as part of their hands-on educational experience. My granddaughter has been blessed to have had this opportunity. Discontinuing operations would negatively affect the careers of over 900 astronomers, many of whom are just entering the field, and could wipe out up to \$30 million in economic benefits for the state of West Virginia.</p>	Against Closure	Email	11/25/2016	Ltr to NSF.docx
173	b	Darrell	Smith, Jr.		<p>The GBT is one of NSF's newest large telescopes that remains at the cutting edge of astronomy. Its incredible flexibility has made ground breaking discoveries in fields as broad as quantum mechanics, the study of gravity, and the search for life beyond Earth.</p> <p>This effort by the NSF reminds me of the movie "Contact" based on the book written by Carl Sagan (a frequent visitor to the GBT) that features the same environment wherein science is overruled by a "political" decision-- ironically by the NSF.</p> <p>Reducing or eliminating the funding of the GBT hurts not only our state but our country and the world wide science community in their search for defining the fundamental structure and evolution of our universe.</p> <p>Please continue the funding of this facility.</p>	Against Closure	Email	11/25/2016	Ltr to NSF.docx

Green Bank Observatory -Written NSF Public Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
174	a	George	Miner	Professor Emeritus, Department of Physics, and Director, Chautauqua Field Center University of Dayton	<p>My primary connection to the GBO is that for the past 30 years I have brought, on an annual basis, groups of college and university faculty to Green Bank for three-day short courses on radio astronomy. Most of those years we also offered a second course on the teaching of astronomy at the college level. Many of the participants attended both courses.</p> <p>The above courses were a portion of a larger program I have run at the University of Dayton since 1980, a series involving a variety of the natural sciences. The program, called the Chautauqua Program, was initiated by the National Science Foundation in 1971. I was selected by NSF to run the Dayton Field Center in 1980, and have done so ever since. The Dayton Center was supported by the NSF directly or indirectly for 22 of the last 37 years, most recently in 2007 via the University of Massachusetts. During the 37 year period the Dayton Center offered some 400 short courses with over 10,000 participants. Approximately 750 of those participants were in the GBO radio astronomy courses, with a slightly lesser number in the GBO teaching courses.</p> <p>I am aware of some obligations of the GBO for outreach and training for future astronomers. The short courses provided for us by the GBO are right on target for these needs. The various lectures and tours are high quality presentations on the basics of radio astronomy, and on various research projects conducted on the GBT. Our participants get formal and informal interaction with resident and visiting astronomers. From evaluation forms and comments, it is clear that the participants are extremely well pleased with their Green Bank experience. In addition they often recommend the courses to their colleagues.</p> <p>Often the GBO has maybe a dozen summer students working at Green Bank. On many occasions they have joined our radio course to experience an introduction to their summer work. Thus they also gain from these excellent presentations.</p> <p>Our courses are usually offered near the beginning of summer. While I am not directly involved, I see the high level of interest from the general public. I am told that some thirty to forty-thousand members of the public take a tour of the GBO each year. I assume that this is very helpful for the public attitude toward science, an attitude that needs attention.</p>	Against Closure	Email	11/25/2016	
174	b	George	Miner	Professor Emeritus, Department of Physics, and Director, Chautauqua Field Center University of Dayton	<p>My secondary connection to the GBO is as a physicist who has been in academia for 52 years. I understand that Green Bank was established in the 1950s to provide top level telescopes for the astronomers in our country. The Green Bank Telescope is a world-class instrument that provides excellent data for the study of major topics in radio astronomy. It has a very large collection surface, an active surface, high frequency possibilities, and can see 85% of the sky. Our nation has provided for the planning, design, and building of the scope. Its track has been redone and the scope has been tweaked. It is now producing in its prime; now is not the time to shut it down. The GBT should have another thirty to forty years of top level service available for our nation. The larger expenditures are past; what remains is the simple operation. Most nations and/or observatories would love to have such a telescope. We have it.</p> <p>To be very clear, I strongly favor option one: Continued NSF investment for science-focused operations.</p>	Against Closure	Email	11/25/2016	
174	c	George	Miner	Professor Emeritus, Department of Physics, and Director, Chautauqua Field Center University of Dayton	<p>A comment on option two. What if a large unfriendly nation offered full funding of the GBO in exchange for 100% use by their astronomers? Would we consider that a success, as in we solved the funding issue? I think not. Option one is consistent with the initial plan. It achieves the initial goals. While ten million dollars a year is real money, it is hardly a major chunk of a federal budget. Let us not think small here!</p> <p>I appreciate the opportunity to comment.</p>	Alternatives Consideration	Email	11/25/2016	
175	a	Gibbs	Kinderman		<p>Recommendation: Option 2 - Collaboration with interested parties for science- and education-focused operations with reduced NSF-funded scope</p> <p>The NRAO Green Bank Observatory has been at the forefront of radio astronomy for almost 60 years, and with the operation of the GBO as a stand-alone entity into the future it still has great potential as a cutting edge scientific facility. While I realize NSF is under tremendous budgetary pressures, abandonment of funding for the GBO would be penny wise and pound foolish.</p> <ul style="list-style-type: none"> The GBT still has many years of useful life as a premier scientific tool GBO is moving as rapidly as possible to develop public and private partnerships with other institutions in a movement toward true mixed-funding operation, but it is not yet near the ability to operate on a totally self-supporting basis as a standalone. Cutting all funds in the near future could render all this positive effort moot. As government funding for scientific research continues to languish, the GBO can serve as a model of mixed funding and collaborative operation for other fields which heretofore have been exclusively NSF funded. The recent emergence of mixed public/private/international efforts in the space program are an example of this type of development. It is in NSF's interest to continue to support the GBO as it moves in this mixed-source funding direction. There may be many other NSF supported operations that could benefit from this type of development; monitoring the progress of the GBO over the next several years and reporting on its successes and failures could be of considerable value to overall NSF operations. 	Against Closure	Email	11/25/2016	NSF comments 1116.docx
175	b	Gibbs	Kinderman		<ul style="list-style-type: none"> The move of GBO into increased emphasis on STEM education opens new horizons for utilization of the facility and its unparalleled human resources into another field of significant interest to NSF. Last, but certainly not least, the GBO has helped train several generations of top notch radio astronomers. It has an extensive and dedicated "alumni cadre" throughout the world who will help the facility survive and prosper - but this valuable resource can't be brought fully into play on a crash basis. 	Against Closure	Email	11/25/2016	NSF comments 1116.docx
175	c	Gibbs	Kinderman		<p>I'm sure you have received many comments on the tremendous impact of the GBO's failure to survive would have on the surrounding community - economic, educational, cultural and social. As a Pocahontas County resident for over 35 years, manager of the county's radio station and long-time member of both the Board of Education and the public libraries board of trustees, I can second everything that has been said along these lines. Loss of the GBO would be a tragic blow to the local community, indeed. I feel it would be equally harmful to the international radio astronomy community and the continuing core mission of the NSF as well.</p> <p>NB These comments are attached as a WORD docx</p>	Against Closure	Email	11/25/2016	NSF comments 1116.docx

Green Bank Observatory -Written NSF Public Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
176	a	Kim	Hundley		<p>Green Bank Observatory is a West Virginia institution that serves many purposes. It isn't just a place where valuable research is conducted but it is a destination where families can make life long memories.</p> <p>Personally I have visited Green Bank several times. My first visit was on a date! We thought what a neat day trip to make. I fell in love and have taken my three children several times over the years and we have made some great memories at Green Bank.</p> <p>Green Bank Observatory is a special place that serves multiple purposes. It is priceless. I hope that every effort is made to keep it open. I have more memories to make there and I'd like my younger two children to get the opportunity to attend the same field trip as my oldest.</p> <p>Thank you for taking the time to read my words.</p>	Against Closure	Email	11/25/2016	
176	b	Kim	Hundley		<p>Recently my oldest son got the opportunity to visit the observatory as part of a field trip with his physics class. This experience was an eye opening one for my 17 year old. Almost two years of physics finally made sense after getting to spend time at Green Bank and see the theories he's been studying in action.</p>	Against Closure	Email	11/25/2016	
177		David	Thorne	WV Division of Natural Resources	<p>Please record these comments for the dEIS as a matter of public record. These comments represent the opinion of the Coldwater Fisheries and Stream Habitat Restoration Biologist of the Fisheries Management Unit of the WV Division of Natural Resources (DNR) Wildlife Resources Section pertaining to aquatic resources on GBO property.</p> <p>General setting: • Per USGS topographic maps, there are nearly 10.5 miles of streams on the GBO property; some are perennial, others may or may not be perennial. All streams on the property are expected to have excellent water quality and fair to excellent habitat for aquatic species. High quality springs may also be present, given the existence of known springs in the vicinity of GBO. • Actual survey data on the GBO property is very limited. In fact, the DNR fish survey database shows only a single survey from 1963 in Deer Creek within the GBO boundary. Any further inferences in this document are suppositions based on the conditions found in adjacent stream systems within the Deer Creek watershed. • Aquatic Species of Greatest Conservation Need (SGCN) as defined in the 2015 WV State Wildlife Action Plan (SWAP) for the Conservation Focus Area (CFA) encompassing the GBO include the following species that may occur within the boundary of the GBO: Kanawha Sculpin Cottus kanawhae – observed – a New River endemic species Candy Darter Etheostoma osburni – observed – a New River endemic species Tonguetied Minnow Exoglossum laurae --- observed New River Shiner Notropis scabriceps – observed – a New River endemic species Brook Trout Salvelinus fontinalis - observed Appalachia Darter Percina gymnocephala – likely – a New River endemic species Eastern Hellbender Cryptobranchus alleganiensis - likely Greenbrier Crayfish Cambarus smilax – observed – a New River endemic species New River Crayfish Cambarus chasmodactylus – observed – a New River endemic species • In addition to the SGCN, there are at least 20 other more common fishes known to be native to the Deer Creek watershed. Many more have been introduced for various reasons. • The Brook Trout is a charismatic species with a long heritage background in the Central Appalachians. It has been well---studied as an indicator of landscape changes. In the 2005 assessment for the Eastern Brook Trout Joint Venture (EBTJV), the Deer Creek watershed was rated as “Greatly Reduced” compared to its expected historical range. A finer---scale assessment from the EBTJV with more recent data considered the Brook Trout to have been extirpated from all catchments within the headwaters of Deer Creek. Each of the five proposed alternatives provides opportunity for partnership between GBO and WVDNR for best management of the natural resources occurring within the boundary of the GBO. Proposed alternatives as described in the Federal Register Notice of Intent: • Continued NSF investment for science---focused operations (No---Action Alternative) • Collaboration with interested parties for science--- and education---focused operations with reduced NSF--- funded scope (hereinafter Alternative 1) • Collaboration with interested parties for operation as a technology and education park (hereinafter Alternative 2) • Mothballing of facilities (suspension of operations in a manner such that operations could resume efficiently at some future date) (hereinafter Alternative. 3) • Deconstruction and site restoration (hereinafter Alternative 4)</p> <p>Possible opportunities for collaboration for management and conservation as well as some specific management action possibilities are offered in the table on the following pages:</p>	Resource Considerations	Email	11/25/2016	GBO draft EIS aquatic resources comments letterhead final.docx
178	a	Christopher	Salter		<p>I would like to raise a number of points in respect of the NSF-mandated Environmental Impact Statement for the Green Bank Observatory (GBO). I was a member of the scientific staff at the GBO between 1990 and 1992, a period during which Green Bank was reawakening through the promise of the Green Bank Telescope's (GBT's) arrival. The GBT was the most carefully designed telescope that I have ever encountered in a long career that has included working with a number of new telescopes. This is borne out by the voluminous memo series that documents its development and commissioning, and runs to several hundred individual documents. It could really only be considered a fully commissioned instrument by about 2003, and it seems unthinkable, not merely short-sighted, that the world's leading fully steerable radio telescope could be divested by the NSF. Despite also having a large portfolio of observational facilities, the German Max-Planck-Gesellschaft continues to fund the 100-m Effelsberg radio telescope generously.</p> <p>Given the threat of NSF divestment that also hangs over the Arecibo 305-m radio telescope, it appears that the NSF is "washing its hands" of investment in the unique properties offered by single-dish radio telescopes? I recently served as PhD examiner for a doctoral thesis concerning observations with one of the world's leading synthesis radio telescopes. From a sizable 120 hours of pulsar searching close to the Galactic plane, the candidate discovered just a single new (common-or-garden) pulsar. Pulsar searches at Green Bank and Arecibo within the past decade have discovered several hundred previously unknown pulsars. Many of these new discoveries are millisecond-period pulsars that augment the target list for the NANOGrav project, which moves ever closer to a detection of the long-wavelength (red) end of the gravitational-wave spectrum, at a cost that is infinitesimal compared to the cost of instruments such as LIGO and LISA that investigate only the blue end of that spectrum. To divest the telescopes that not only provide NANOGrav with its target objects, but which are fundamental to its observations, will surely put the success of this endeavor in jeopardy just as it nears a triumph that will bring US science the worldwide credit that will accrue from this remarkable achievement.</p>	Against Closure	Email	11/25/2016	

Green Bank Observatory -Written NSF Public Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
178	b	Christopher	Salter		<p>In addition, Green Bank plays a prominent part in the US's "global scientific image". This is nowhere truer than in the case of Very Long Baseline Interferometry (VLBI). VLBI is a truly intercontinental venture, and provides the highest angular resolution available in astronomy. Both Green Bank and Arecibo regularly participate in this venture as part of "High Sensitivity Array", (the HSA; an array formed together with the 10 telescopes of the LBO, and the Effelsberg telescope.) They also take part in numerous "Global VLBI Array" observations using radio telescopes situated around the world.</p> <p>In addition, over the past 5 years both the GBT and Arecibo have collaborated with the RadioAstron project, exploiting the Russian orbital radio telescope to achieve interferometric baselines approximately as long of the Earth-Moon distance! Why cannot such unique VLBI projects be continued without the large US single-dishes? The HSA would, of course, disappear as it relies totally on the presence of the two large telescopes to enable detection of the weakest of targets, e.g. weak radio-emitting stars, the mysterious fast radio bursts, and the properties of interstellar turbulence though the VLBI of pulsars; the LBO telescopes have diameters of only 25-m, and collect insufficient photons by themselves to allow objectives that require the highest possible sensitivity. Equally relevant, RadioAstron, (as will its orbital successors), has a very small diameter of just 10-m, and again the two huge US dishes are crucial to its exploitation.</p>	Against Closure	Email	11/25/2016	
178	c	Christopher	Salter		<p>On the level of local culture in Pocahontas County, WV, Green Bank Observatory makes an overwhelming contribution to local life. A number of teachers in the local state schools have been the spouses of GBO staff members. I, myself, well remember serving as volunteer librarian on a regular basis at the Green Bank Public Library assisting that important center of local culture in operating a regular schedule. In addition, the Observatory and its staff organize both an ambulance and fire service, both of which have saved local lives over the years. I would also add that the GBO Science Center is not only a wonderful resource for nationwide visitors but, for example through its regular star parties and special events, provides an enormous broader impact for the local population. This population, from the very young to the elderly, would otherwise be bereft of access to a unique resource.</p> <p>Summing up my remarks from above, I strongly believe that the Green Bank Observatory and the GBT represent an invaluable asset for US science. In addition, The GBO has vast importance for the local life of the isolated area that is Pocahontas County, WV. I hope that the present exercise represented by this Environmental Impact Study will not interfere with the Observatory's ability to make its remarkable scientific instrument available, as at present, to the scientists of the United States of America (and, through its long-standing "open skies" policy, to the best scientific ideas of the wider World.)</p>	Against Closure	Email	11/25/2016	
178	d	Christopher	Salter		<p>I also presume that the proposed Environmental Impact Study will fully explore the effect that loss of the Observatory would have on the flora and fauna of the area? The Observatory is that rare thing in WV, a sanctuary for the deer population. I also well remember the thrill of observing a range of remarkable salamanders on the banks of the Deer Creek stream, where it runs through the Observatory.</p>	Against Closure	Email	11/25/2016	
179		Zak	Schroeder		<p>(Comments from Zak Schroeder and Mel Light)</p> <p>I'm writing on behalf both myself and my partner, Mel, to urge you to consider continuing to fund the Green Bank Observatory. To defund, mothball, or dismantle this facility would be a loss of a valuable resource.</p> <p>From 2003 to 2007, Mel and I traveled to the Green Bank Observatory (then NRAO) with our high school radio astronomy team. The exposure to this observatory, meeting with the astronomers, and performing work on the 40ft radio telescope helped shape us into the scientist and engineer that we are today. These experiences inspired us to conduct astronomy research in high school, obtain scholarships, and pursue schooling in our respective science and engineering fields. It is also where the two of us met and started our life together, twelve years ago.</p> <p>These experiences are not unique to us, as this facility has provided years of opportunities to other students across the nation. To remove funding would be detrimental for the field of radio astronomy as well as rid generations of students of the shot to be exposed to science and engineering immersion.</p> <p>We hope that you take our concerns into consideration to determine the future of this immensely valuable observatory.</p>	Against Closure	Email	11/25/2016	
180		Alyssa	Goodman	Robert Wheeler Willson Professor of Applied Astronomy, Harvard University Edward, Frances, and Shirley B. Daniels Fellow, Radcliffe Institute http://www.cfa.harvard.edu/~agoodman	<p>As I sit comfortably at home this Friday of Thanksgiving weekend, quietly working away on the wonderful new Green Bank Telescope data you see in the screen shot below, I find myself thinking back on the incredible discoveries the Green Bank Observatory has made over my 30 years in Astronomy, and I strongly urge your group to choose "Continued NSF investment for science-focused operations (No-Action Alternative)" in your deliberations, and to allow the GBT to shine on as the unique treasure it is within Astronomy. The GBT is literally the only large (100m+) single steerable telescope that can make observations at short radio wavelengths in operation today.</p> <p>My collaborators, postdocs, students and I have all contributed to the thousands of scientific papers published based on data from Green Bank, and I am sure others have explained to you why the results are so important. In the case of the particular example shown below, the "GAS" Survey (Green Bank Ammonia Survey) data are showing that stars do not, as most people have thought, form from relatively spherical blobs of dense gas, but instead that they form in networks of filaments that are constantly forming and dissolving. The Green Bank GAS data are critical to our ability to determine the time scales and physical mechanisms that lead to star formation—and in particular to the formation of stars like our own Sun. It is not an exaggeration to say that without Green Bank, our quest to understand how our Solar System formed would be set back decades in terms of understanding the motions of the material needed to form the Sun and accompanying planets. I have visited Green Bank many times, and I know that it sits in a very special, unspoiled part of our country. I have always been impressed at just how careful NRAO has been to preserve not just the surrounding area around the facilities, but also the great relationships they have with the people of Green Bank and West Virginia—many of whom they also employ. I am proud of our country for having built and for continuing to host this premier facility. Please preserve it for science, and vote "No Action."</p>	Against Closure	Email	11/25/2016	GBT+Goodman.pages.pdf

Green Bank Observatory -Written NSF Public Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
181		Peter	Timbie		<p>We are writing this letter in response to the request for public comments on the Environmental Impact Statement and proposed changes to the operations of the Green Bank Observatory. We understand that alternatives to be evaluated in the impact statement will be refined through public input, with preliminary proposed alternatives that include the following: • Continued NSF investment for science-focused operations (No-Action Alternative) • Collaboration with interested parties for science- and education-focused operations with reduced NSF-funded scope • Collaboration with interested parties for operation as a technology and education park • Mothballing of facilities (suspension of operations in a manner such that operations could resume efficiently at some future date) • Deconstruction and site restoration</p> <p>As long-term users of the GBT we strongly urge you to pursue the first alternative, continued NSF investment for science-focused operations. The Green Bank Observatory is a unique facility that has allowed measurements that could not have been made in any other way. We'd like to share a few examples from our own work. Over the past 8 years, members of our team have used the GBT to open up a new window on the Universe. We use the unique radio signature of neutral hydrogen gas to survey the distribution of matter on the largest scales. By observing the evolution of these 3-D maps as a function of cosmic time we can learn about dark energy, the mysterious component of the Universe that causes the universal expansion to accelerate, as well as other cosmic constituents. These GBT measurements have been published in high-impact journals... and have inspired the construction of a variety of new instruments that use similar techniques to probe the epoch when the first stars formed and to survey the largest volumes of the cosmos. Without these pioneering GBT measurements, construction of these new instruments and the rapid expansion of this new field could not have been justified. The first high-redshift detection of neutral hydrogen radio emission occurred at GBT because of its unique features: it is the largest, fully-steerable, unblocked single aperture radio telescope in the world. The large size is necessary to achieve the angular resolution to map the cosmic structures. Steerability allows us to track and stare at small portions of the sky for hundreds of hours, long enough to uncover the small signal. The unblocked aperture produces a smooth angular response on the sky that makes instrument calibration feasible and the faint cosmic signal detected. Alternative approaches, using radio interferometers, are considerably more challenging to calibrate. Finally, the GBO's location in the National Radio Quiet Zone allowed us to observe at the relatively low radio frequencies where the highly-redshifted signal appears. Even 8 years after our team's initial work at GBT..., no other radio telescope has detected this signal. Observing time at GBT has allowed us to make and follow up on two serendipitous discoveries that occurred during our neutral hydrogen survey. These systems trace the constituent material for star formation; detection at different redshifts would provide a new tool for studying galaxy evolution. Their narrow linewidth could also facilitate direct measurements of the cosmic acceleration (dark energy). The GBO has been able to respond to these discoveries by providing us with follow-up observing time. The GBO has pursued cost-effective partnerships with universities and other institutions worldwide to train young researchers and develop new radio instrumentation. Our observations at GBT have been led by graduate student PIs, who have written the proposals and led the observations and analysis. They have also participated in building the next generation of tools that the field of radio astronomy requires to progress. Our team is developing a new set of low-frequency receivers for the GBT at almost no cost to the GBO. This partnership allows universities to do what they do well - to train new scientists with the skills necessary to develop innovative techniques - by having access to world-class instrumentation which no university could afford to build or operate alone. In our program over a half-dozen graduate students and over a dozen scientists, many from overseas, have trained at the GBO. The GBO and the Radio Quiet Zone are, quite simply, national treasures. We urge you to continue to make them available to the scientific community.</p>	Against Closure	Email	11/25/2016	
182	a	Christine	Marganian Goldman	Boston College Chemistry	<p>My name is Dr. Christine Marganian Goldman. I have been a member of the Chemistry Department Teaching Faculty here at Boston College for seventeen years. I write in support of continued NSF investment for science-focused operations at the Green Bank Observatory in Green Bank, West Virginia. My family members have played important roles at the Green Bank Observatory for many years. My brother, Paul Marganian, has a Master's Degree in Physics and is a Software Engineer at the telescope. Paul's wife, my sister-in-law, is Dr. Karen O'Neil, the Green Bank Site Director for the NRAO's site at Green Bank and the Assistant Director for Green Bank Operations.</p> <p>We have a family history of strong support for science and science education. My brother Paul whom I mentioned, holds a Master's degree in Physics; his wife Karen has a Ph. D. in Physics; I earned a Ph.D. in Chemistry in 1995; our father holds a Ph.D. in Chemistry; our mother holds a Master's degree in Chemistry; my husband holds a Ph. D. in Chemistry. We have all devoted our professional lives to scientific endeavors and to educating tomorrow's scientific leaders. The fact that a facility like the Green Bank Observatory in Green Bank West Virginia can attract scientists from all over the world who vie for precious telescope time and at the same time educate schoolchildren and adults tells me that it is highly deserving of continued NSF investment.</p> <p>In addition, it also serves as a national educational resource for the many who live in and visit the site in Pocahontas County, West Virginia. It is my sincere hope that the National Science Foundation will continue to invest in the science-focused operations at the Green Bank Observatory in Green Bank, West Virginia.</p>	Against Closure	Email	11/25/2016	GREENBANKOBSERVATORY.pdf
182	b	Christine	Marganian Goldman	Boston College Chemistry	<p>When I visit the website of the Green Bank Observatory, I am immediately impressed with all that the Green Bank Observatory encompasses. The services the observatory provides to the community along with the world-class science that takes place there is something to feel proud about. When I visit the GBO in person, I am even more impressed. One only need drive there, through the rolling hills of West Virginia, to be suddenly struck by the view, seemingly out of nowhere, of the majestic structure of this largest steerable telescope in the world. This telescope is not only visually majestic but is stunningly impressive in scientific capabilities.</p> <p>Indeed, the Green Bank Telescope (GBT) represents 'a unique scientific resource' as 'no other observatory has the capabilities of the GBT'. Importantly, no other telescope has 'open access to US investigators to the degree offered by GBT' (reference: 'The Case for a Publicly Available Well-Instrumented GBT Operating at 20-115 GHz').</p> <p>The GBT is also a vital component of University-Observatory-NSF Collaborations. As scientists, we know the value of scientific collaboration and the important role it plays in today's cutting-edge - research. I view the GBT as a national resource that is central to the success of future high frequency scientific observations and investigations.</p>	Against Closure	Email	11/25/2016	GREENBANKOBSERVATORY.pdf

Green Bank Observatory -Written NSF Public Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
183		Galen	Watts	Engineer, Green Bank Observatory Volunteer Firefighter, Bartow-Frank-Durbin Fire and Rescue Volunteer Production Manager, Pocahontas County Opera House Volunteer Audio Consultant, Pocahontas County High School	<p>Many comments preceding mine state the many ways some of the options for the future of the Green Bank Observatory and the Green bank Telescope in particular would negatively affect the local community, the local economy, possibly the state economy and certainly the academic opportunities of students up to the undergraduate level to be exposed to actual research and mentoring by scientists of world renown. I refer to options three, four and five - Three, the technology and education park</p> <p>- Attendees of such a park would not have the opportunity to participate in actual research with a world-class instrument. Four, mothballing of facilities - Momentum in such matters is difficult to change and realistically it is highly doubtful that the facility would ever come out of mothball status before the end of its useful lifetime. Five, the deconstruction of an instrument built with over 100 million dollars of taxpayer money - It is likely the cost of such deconstruction and site restoration would likely be more than actually operating the GBT to the end of its useful life.</p> <p>This leaves options one and two. Obviously, option one, continued full-funding by the NSF would be the most desired by all associated with the GBT and the GBO as this would keep the instrument a cutting-edge, world leader in radio astronomy for research that simply cannot be done with other, existing instruments. I suspect option one is listed simply to give those concerned false hope, as progress toward option two is already ongoing.</p> <p>Option two, reduced funding by the NSF to be covered by collaborations with non-NSF interested parties sounds quite plausible without delving in to the details. One of the details that makes option two difficult are the rules regarding non-federal use of federal facilities that, in short, make the required cost rates for use of the GBT prohibitively high. In one case already, these high rates led to a potential collaborator taking their business to a Canadian facility.</p> <p>An even more unpredictable factor is the federal budget. Potential collaborators that are federally funded typically cannot enter in to new collaborations until a federal budget is actually passed. As recent history shows, Congress has great difficulty passing federal budgets and relies on continuing resolutions. With the evolving political climate at the federal level this problem is likely to get much worse.</p> <p>So what to do? Possibly a combination of options one and two, Option 1.5, where the NSF makes minimal supplements to the Observatory's budget to insure minimum operation and prevent furloughs and layoffs, until a federal budget is passed and the GBO begins to receive funding from the new collaborators.</p> <p>I thank you for the opportunity to make these comments, and urge serious and full due consideration of all factors affecting the GBO and its communities, from local to global.</p>	Alternatives Consideration	Email	11/25/2016	
184		Jennifer	Wood		<p>Thank you for encouraging us to comment on your:</p> <p>Environmental Impact Statement and Section 106 Consultation for Proposed Changes to Green Bank Observatory Operation (from Public Meeting Nov 9,2016</p> <p>More Information to follow</p> <p>Deadline for comments today Nov 25, 2016</p>	General	Email	11/25/2016	

Green Bank Observatory -Written NSF Public Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
185	a	Natalia	Lewandowska		<p>During the summer of 2016 I attended the ""Physicists Inspiring the Next Generation"" (PING) camp for high school students. I had the privilege to meet many young students from different parts of the United States who were eager to learn as much as was possible during their time at the Green Bank Observatory. The program of the camp consisted of lectures and observations which the students carried out themselves with one of the radio telescopes of the observatory. My task was to help them with the scientific questions they had. Nowadays, most observations with professional telescopes do not offer this opportunity to observers anymore and everything related to that is carried out automatically by computers. The GBO offers therefore unique opportunities to the PING camp students. Apart from some necessary preparations, most of the questions come into mind when the actual experiment, or observations, are carried out. It was a pleasure for me to see this development also in the case of the PING students and to help them out with the questions they had. They had the opportunity to talk to professional researches and this way also to work with them. Similar to carrying out observations, this is a rare opportunity nowadays. The GBO offers such unique opportunities to the younger generations who this way get the possibility to decide on their own if they are interested in science, or not. I think it is very important to make this decision based on personal experience, rather than on opinions of other people, or prejudices. This way also students who belong to minorities get the chance to carry out research. I would like to add that I know of at least one PING student (from the group I was working with) who has become so interested in fast rotating neutron stars, commonly referred to as pulsars, that she is joining the Pulsar Search Collaboratory (PSC). This is a joint project between theGBO and the University of West Virginia (WVU) which gives high school students the opportunity to actively search for new pulsars and this way gain professional research experience. The PSC offers further unique possibilities for young students to get involved into active research at a young age. TheGBO is the pillar for both projects. Closing the facility would mean taking away crucial possibilites for younger generations to get involved in science. Gaining professional research experience is also based on a good relationship with the mentor. The researches who work at the GBO are eager to mentor the younger generations and help out with their projects, thus creating a unique work atmosphere which I did not observe in this form at other institutes. Please understand that the described forms of collaboration between researches and students are not self-evident. They are the result of curiosity, enthusiasm and the will to learn new things about the Universe even if they seem obscure at first. Research is based on asking questions and one of the essential insights which students gain at the Green Bank Observatory is that professional researches are also doing what the students do: They ask questions... and this way they never stop learning. Especially at high school level peer pressure can be extremely high, leading sometimes to the belief that asking questions is not appropriate. At the Green Bank Observatory students learn that asking questions is regarded as highly positive and crucial as a researcher. This way they might feel encouraged to pursue a career in science in the future. With the described programs the Green Bank Observatory offers unique research and educational options for students which I have so far not seen at any other observatory where I worked during my academic career. Deconstructing, or mothballing the facility would cause long period damages in both areas possibly creating the overall opinion that science is not worth pursuing. As mentioned earlier, the Green Bank Observatory is also highly involved into outreach work. The science center offers public tours, but also special tours which are related to the search for extraterrestrial life, commonly referred to as SETI tours. In the latter case the astronomers from the GBO help out as astronomers who the participants of the tour can ask questions. During the times I was the astronomer to ask I realized the participants were very eager to ask questions about different branches of astronomical research. It is crucial for an observatory to open its gates to the public in this form and to give people who are eager to learn new things the possibility to see that astronomers/researches are also normal human beings. This might encourage especially younger generations to get involved in science.</p>	Against Closure	Email	11/25/2016	eis_nlewandowska_II.pdf
185	b	Natalia	Lewandowska		<p>The Green Bank Observatory organizes also annual visits of the Garth Newel Musicians who give a free concert at the observatory. Since the musicians reside in Virginia, this is a rare opportunity for the local community to attend the concert. Let me emphasize that this is only one of numerous occasions with which the Green Bank Observatory includes local community, providing opportunities for people to attend events which otherwise they might not be able to due to various reasons. As a postdoctoral fellow at the Green Bank Observatory my science is focused on the study of fast rotating neutron stars, or pulsars. The signals which pulsars emit are usually very weak. Therefore large radio telescopes are needed for their study. In addition, with its unblocked aperture the Green Bank Radio Telescope (GBT) is able to detect very faint signals from pulsars, providing possibilities which at the present time cannot be given by any other radio telescopes world wide. Since my research is focused on a special form of irregular pulses which are only emitted by a small number of pulsars due to currently unknown reasons, I decided to continue my research with the GBT.</p>	Against Closure	Email	11/25/2016	eis_nlewandowska_II.pdf
185	c	Natalia	Lewandowska		<p>The Pulsar Search Collaboratory (PSC) mentioned earlier in this letter, uses data taken with the GBT and is therefore actively involved into one of the many research branches carried out at the Green Bank Observatory. The discoveries related to pulsars with the GBT are numerous and have influenced pulsar science all over the world. Even before the construction of the GBT crucial discoveries of pulsars were made with the 300 foot radio telescope. The Green Bank Observatory is therefore a significant pillar of pulsar research. Deconstructing, or mothballing the site would mean a serious drawback and set researches world wide back in the understanding of pulsar physics.</p> <p>I would like to add that the collaboration between the scientific, educational and outreach work works out that well at the Green Bank Observatory because all three parts are active. Turning the facility into a pure educationa one, would take awayt the possibility for students to carry out actual research.Due to the described reasons, I strongly encourage the National Science Foundation (NSF) to select the No-Action Alternative (continued NSF investment for science-focused operations) for the future of the Green Bank Observatory.</p>	Against Closure	Email	11/25/2016	eis_nlewandowska_II.pdf

Green Bank Observatory -Written NSF Public Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
186	a	Jennifer	Donovan Meyer		<p>In response to the call for input regarding the Environmental Impact Statement for the Green Bank Observatory, I am writing to express my strong support to enable the Observatory to continue its science operations. My name is Dr. Jennifer Donovan Meyer, and I am a radio astronomer residing in Virginia working to support world class radio telescopes in the United States and abroad. As detailed below, the Green Bank Observatory provides the instrumentation, protection from radio frequency interference, and essential accessibility to scientists and engineers that make it unique in the world among radio astronomy facilities. As such, I humbly request that the NSF take "no-action" rather than decreasing operations or, worse, deconstructing the Observatory.</p> <p>Many science cases uniquely served by the Green Bank Telescope (GBT) exist, but my primary interest in the Green Bank Observatory is in the capability of the GBT to detect faint gas between galaxies. A major ongoing debate in the astronomical community focuses on the way that galaxies, like our own Milky Way, come to look the way that they do in the present day universe. Observers and theorists alike predict that some kind of accretion of material onto galaxies, which must come from the space between them, is necessary to grow the massive systems that we see today, but there is still much debate over the manner in which this accretion occurs. Being able to detect this material directly is extremely difficult; the most advanced (and expensive) instruments currently available and here, the Expanded Very Large Array (EVLA) and Atacama Large Millimeter/sub-millimeter Array (ALMA) come to mind (can largely only provide observations of the smaller scale emission coming from the galaxies themselves. Sensitivity to extremely faint and diffuse material, as this intergalactic material is believed to be, requires a huge single beam, fantastic sensitivity, and very limited radio frequency interference. The only such instrument available is the GBT. Though with the EVLA and ALMA we can probe light coming from within galaxies, putting them into a larger cosmological context is impossible without being able to study the light emitted from the material between galaxies.</p>	Against Closure	Email	11/25/2016	gbo_jdonovanmeyer.pdf
186	b	Jennifer	Donovan Meyer		<p>The importance of the location of the Green Bank Telescope cannot be understated. The world we inhabit is getting louder at radio frequencies; GPS satellites, cell phones, and other sources of technological comfort increasingly drown out the faint astronomical signals that astronomers strain to record. As technological advancements all over the Earth plus those orbiting it increase their reach, the protection of the National Radio Quiet Zone (and the telescopes contained within it) will only continue to increase in value and opportunities provided for observing galaxies and other astronomical sources.</p>	Against Closure	Email	11/25/2016	gbo_jdonovanmeyer.pdf
186	c	Jennifer	Donovan Meyer		<p>Finally, the accessibility of the entire Green Bank Observatory is crucial to the creation of the next generation of radio astronomers, not to mention a scientifically literate society in an otherwise underserved area with regard to STEM. World class facilities like the EVLA and ALMA are impossible to use as hands on learning tools; the GBT, as well as the rest of the instruments available on site at the Observatory, provide this opportunity for the training of both scientists and engineers. Especially in a climate where accessible "learning" instruments like CARMA are being closed, investing in our future by maintaining the entire GBO is even more important. As a scientist, I remember traveling to the GBT as a first year graduate student for my first "real" observing run, where I could get my feet wet running a world class radio telescope with the help of the skilled operations staff. Such experiences are shared by observers ranging from West Virginia high school students to eminent scientists across many fields of astronomy. On the engineering side, just as important, university groups and engineers regularly build new instrumentation for the telescopes at the GBO to enable groundbreaking science, then apply the technology at other, less experimental, sites. If not for the kind of experience that can be gained at observatories like the GBO, the next generation of radio astronomers my generation will not be able to build the next major radio astronomy observatory in 30 years when the current facilities will have become inadequate.</p> <p>To summarize, the Green Bank Observatory is unique among world class radio astronomy facilities in the world. Among many other science cases, it provides information about light coming from faint, diffuse gas in the universe that other instruments simply cannot and will never be able to see. This sensitivity is due to its size, its construction and maintenance, as well as its location in the National Radio Quiet Zone. Finally, the accessibility of the GBT and the telescopes on the entire GBO site provide opportunities for scientists and engineers at all stages of our careers that we cannot find elsewhere. Please take "no-action" and allow the Observatory to continue its science operations.</p>	Against Closure	Email	11/25/2016	gbo_jdonovanmeyer.pdf
187	a	John	Herrold		<p>I have had the unique opportunity on several occasions to visit the Green Bank Observatory. Each time I witnessed eager young people being immersed in the learning experience associated with the science of Radio Astronomy.</p> <p>It seems to me, a now retired high school science teacher, to be an extremely unique and challenging experience for young minds. Even mine.</p> <p>So whatever your budget constraints may be, the GBT should remain active. Continuing NSF investment in this worthy endeavor is of high priority. I have been honored to witness how NRAO at Green Bank has been a major motivation to channel young minds into science careers adding to our needed pool of American science students.</p>	Against Closure	Email	11/25/2016	
187	b	John	Herrold		<p>The GBT has added pure research into science which is an invaluable asset to the body of knowledge. This is data that cannot be obtained elsewhere.</p> <p>It is also a valuable tool in keeping the public aware of the extent of this kind of pure science research. Keeping the electorate apprised of such important data has an upside we all in science want to nurture.</p>	Against Closure	Email	11/25/2016	

Green Bank Observatory -Written NSF Public Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
188	a	Karen	O'Neil		<p>I am writing in support of the Green Bank Observatory. Already you have received many letters in support of the facilities and the many programs which are run or sponsored on the site. Nonetheless I would like to list a number of the facilities and activities which could be affected by any decrease in funding to the facility. The list below is not complete, but hopefully capture at least a significant part of the way Green Bank Observatory contributes to the region. This list is broken into five categories – educational activities, economic impact, community development, radio telescopes, and site buildings and facilities.</p> <p>Educational Activities: The Green Bank Observatory has a rare combination of assets: 1) a laboratory where frontier research is an ongoing activity; 2) a professional staff of scientists and engineers who are also heavily involved in education and outreach; 3) facilities such as the Green Bank Science Center, radio telescopes, housing and food services, all available for formal and informal educational programs. The site staff use these assets to develop and present programs that would not be possible at other institutions. Green Bank is also a partner to the local school district, offering mentoring, coursework, and educational opportunities to the local youth. The Science Center is a multi-purpose building that draws 50,000 visitors each year, a remarkable number for so remote a location. Visitors experience the many interactive displays in a 4000 sq ft. exhibit hall, hear presentations about radio astronomy from the Science Center staff, and take a guided bus tour around the site. The 25,000 square foot facility also contains the Catching the Wave Exhibit Hall, 150-seat auditorium, StarLab Classroom, gift shop, and even a café. The Science Center is also used for monthly star parties, an annual 4-day Star Quest gathering of amateur astronomers, the annual meeting of the Society of Amateur Radio Astronomers, community days, and so on. It serves as the focus for school field trips throughout the year. The 40-Foot telescope is a working radio telescope outfitted specifically for use by students and teachers. It is the centerpiece of a hands-on research experience offered by the Observatory staff. Each year between 2500-3000 scouts, students and teachers visit Green Bank, typically in small groups of a few dozen students with their teachers, for sessions lasting several days. They are housed in the site “bunkhouse” and take meals in the cafeteria. They receive in-depth tours of the electronics labs, training, use of the 40-Foot Telescope, and interactions with the site staff.</p>	Against Closure	Email	11/25/2016	Oneil_Karen.pdf
188	b	Karen	O'Neil		<p>Throughout the year the Green Bank hosts numerous programs for teachers. The Residential Teacher Institutes provide a research experience for K-12 teachers and pre-service teachers through projects on the 40 Foot Radio Telescope under supervision of the Green Bank staff. Begun in 1987 and supported initially by the NSF and NASA, this program has trained over 1000 teachers in the fundamentals of research. Each year a Chautauqua Short Course Program for undergraduate college faculty is held to update their content knowledge. In the several dozen years of the program over 650 undergraduate faculty members have participated.</p> <p>The Pulsar Search Collaboratory is a unique program in partnership with West Virginia University that enables middle and high school students to participate in active pulsar research using data from the Green Bank Telescope. In a summer residential program, high school teachers and their students work with astronomers to learn how to analyze data produced by the telescope, and then form PSC teams back at their schools. Funded by the NSF, the Collaboratory has so far engaged more than 100 teachers and roughly 1,000 students from 18 states in pulsar research. Student teams have thus far discovered 6 new pulsars and three transient object, increasing their interest in science and technology and has gained national recognition.</p> <p>The Earth/Space Science Passport is a new, amazing professional development program for West Virginia science teachers to prepare them to teach Earth and Space Science. Through a two-year program, teachers learn ESS content, WV Next Generation Science Standards (WV NxGen & NGSS), engineering design, and best pedagogical practices. During the two years teachers are provided with classroom materials and activity guides to assist in the implementation of activities. Teachers attend two summer workshops (Green Bank Observatory with Earth and space science content specialists and Fairmont State University with NASA IV&V Educational Resource Center). In the first summer workshop, they participate in West Virginia field geology, the Junior Skynet Scholars program, and become GLOBE certified teachers. The second summer workshop incorporates engineering design and certifies teachers to check out NASA loaner kits on space weather and robotics. Through the school year teachers participate in monthly web meetings, present at WVSTA (West Virginia Science Teachers Association), attend a spring geology field trip, and conduct action research in their own classroom!</p> <p>SPOT, the Space Public Outreach Team, is a partnership between the Green Bank Observatory, NASA, and the West Virginia Space Grant Consortium to bring space-science into West Virginia schools! Trained college ambassadors visit K-12 classrooms with interactive presentations and hands-on activities through the West Virginia SPOT program. WVSPOT increases K-12 student and teacher awareness of and interest in astronomy and space-related STEM research, programs, and careers in West Virginia, and students gain valuable exposure to college role models. They train college ambassadors at the Green Bank Observatory in the immersive environment of the Quiet Zone. They learn in-depth astronomy and space science content knowledge, and they gain important “21st century skills,” such as science communication, public speaking, autonomy, and ability to adapt.</p>	Against Closure	Email	11/25/2016	Oneil_Karen.pdf
188	c	Karen	O'Neil		<p>The 20-meter telescope, originally built by the US Naval Observatory for studies of the Earth’s rotation, is now part of Skynet, a distributed network of robotic telescope for education. Currently, a few thousand students take advantage of the SkyNet network of telescope annually.</p> <p>Numerous opportunities also exist for visiting school and other educational groups. These activities include, but are not limited to:</p> <ul style="list-style-type: none"> • Radio Astronomer for a Day: Work in research teams investigate cosmic objects with the Green Bank Observatory’s 40-foot diameter radio telescope. During an overnight stay, participants learn how to operate the telescope and complete inquiry-based projects, becoming, in fact, radio astronomers. Research level can be varied and is geared to the education level of participants. • Solar Viewing (weather permitting): On sunny days the special H-alpha telescope can be used and participants can safely view sunspots, solar flares, filaments and plages. • Star Party: Monthly star parties take place on the star patio. Star parties can also be arranged for visiting groups staying on site, and are often included in other site events, such as the Space Race Rumpus. • Hands-on Science: There are e a variety of educational activities suitable for ages, from pre-K through adult. These include: <ul style="list-style-type: none"> o Exhibit Hall Concept Quest: Participants complete a scavenger hunt to answer science and engineering questions as they interact with the hands-on exhibits. o Be an RFI Detective: Green Bank Observatory technicians use high tech equipment to hunt down Radio Frequency Interference. Students can join in the hunt as they search the Science Center for sources of man-made radio sources. o Exploring Our Solar System: Participants investigate the size and scale of the solar system, with three hands-on activities to choose from: Pocket Solar System, Worlds in Comparison, and Moon and Earth. o GBT Engineering Design Challenge: Participants investigate engineering by designing, building and testing a support structure that can hold up a “radio telescope dish”. Best structure wins! <p>Numerous other programs exist on site, and a full description of current offerings can be found at http://greenbankobservatory.org/education/.</p>	Against Closure	Email	11/25/2016	Oneil_Karen.pdf

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188	d	Karen	O'Neil		<p>Finally, the Observatory is a partner with the Pocahontas County School System, providing a vast number of services to the local schools. Support for the local school system comes two ways – through programs which are hosted by the observatory as well as through local staff participation in school activities and planning. A few of the ways staff help the local schools include:</p> <ul style="list-style-type: none"> • School Board Members • Business Partner Scholarships - Annual donation to the PCHS Science Scholarship, Organizer and host of primary fundraiser for the William Dilley Track Scholarship • Serving on school and school board committees - Levy Committee, School Calendar committee, 10 year planning committee, 5 year strategic planning committee, Superintendent’s Advisory Committee, Local School Improvement Council (GBEMS, PCHS), Title IV Committee (GBEMS) • Providing tutoring for local students as part of their in-school lessons • Annual support and volunteers - GBEMS and PCHS Career Days, Read Aloud, Literacy Fair judges, Socials Studies Fair Judges, Science Fair help and mentoring, Math Tutors, School Treasurer (MMS) • Math Field Day - County Math Field day is hosted at the Observatory, Tutors for Green Bank Elementary Middle School • Pocahontas County Science Fair - Pocahontas County Science Fair is run and hosted by the Observatory, Mentoring for all county science fair participants • Hour of Code - Annual hour of code with PCHS is run by the Observatory • Science Bowl - Judges, moderator, scorekeeper for RESA IV bowl • High School Athletics - Observatory staff have been coaches and assistant coaches in the past for the high school soccer, basketball, and baseball teams; Timekeeper/Scorekeeper for PCHS athletics; Radio Announcer for PCHS athletics 	Against Closure	Email	11/25/2016	Oneil_Karen.pdf
188	e	Karen	O'Neil		<p>Economic Impact Over 100 people are employed at the Green Bank Observatory year round, and another 40 seasonal jobs are added each summer. Based on the most recent census, this means roughly 5% of the total work force in Pocahontas County is employed by the Green Bank Observatory. Green Bank Observatory’s employees contribute greatly to the State, from working as emergency service personnel in the region through coaching school sports, but living in Pocahontas County they directly influence the economy there on a daily basis. Green Bank’s salary base exceeds \$14 million, and State economic studies have shown that, of this amount of base wage, the average expenditure of base wage used for all living expenses is 79%. Therefore, Green Bank employees directly contribute nearly \$11.1 million to the economy. Taking into account the ripple effect, that number reaches an amazing \$17.76 million. Those familiar with Green Bank Observatory know that education and public outreach are at the center of this strong research-oriented facility, and 50,000 visitors each year come to take part in the many tourist and teaching opportunities provided by the staff. In addition to spending time at the facility, these visitors also contribute considerably to the West Virginia and Pocahontas County economies. It is estimated that the visitors to the site spend approximately \$150 per day for items such as transportation, lodging, meals, entertainment, and recreation. The Observatory guests, therefore, spend roughly \$7.5 million dollars per year in West Virginia for their visits. But the effect doesn’t stop there. Every dollar a tourist spends in West Virginia creates a ripple of economic activity. The multiplier used in West Virginia is 1.6 to estimate the total impact of tourism dollars. Employing this multiplier increases the annual contribution of Observatory’s visitors to roughly \$12 million. Combined, it is easy to see that the Green Bank Observatory contributes a staggering \$29.76 million to the County and State economies.</p>	Against Closure	Email	11/25/2016	Oneil_Karen.pdf
188	f	Karen	O'Neil		<p>Community Development The Green Bank site has tight links to the local community, the region and the State. In addition to the mentorship experiences offered to local secondary school students, the site staff has significant outreach into the community. Staff members often teach STEM classes in the local schools, mentor science and math students, serve as science fair mentors and judges to the county and are on county and state educational committees and boards. Site facilities are used for community meetings and by organizations such as the Boy Scouts and National Forest Service, and are a vital part of the county emergency services plan. Below is a partial list of the various community activities in which Green Bank Observatory staff actively participate, broken into two main categories – emergency services, and local and community organizations.</p>	Against Closure	Email	11/25/2016	Oneil_Karen.pdf

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188	g	Karen	O'Neil		<p>Community Organizations: Observatory staff serve on a wide variety of community organizations and boards. These include, but are not limited to:</p> <ul style="list-style-type: none"> • Pocahontas Dramas, Fairs and Festivals Board • Opera House Foundation • Pocahontas County Convention and Visitors Bureau • Pocahontas County Chamber of Commerce • First Citizens Bank Board of Directors • Pocahontas County Parks and Recreation • Pocahontas County Prevention Coalition • Providing sound and lights for Pocahontas County Opera House • Pocahontas County Democratic Executive Comm. • Northern Pocahontas Community Wellness Board • Elkins YMCA Board of Directors • 4-H Foundation • Allegheny Mountain Radio • 8 Rivers Amateur Radio Club • National Weather Service, Cooperative Observer • Air Weather Association • Boy Scouts Scoutmaster, volunteers • Pocahontas County Youth Soccer – coaches, board members, schedulers, referees • Pocahontas County Youth Baseball League, volunteers • Adopt-A-Highway Program, volunteer • ExploreWV Geocaching, volunteer • Dunmore Community Center, volunteer • Pocahontas County Drama Workshop • Elkins Pilots Club • Durbin 5K Run • Seneca Woodlands Women's Club 	Against Closure	Email	11/25/2016	Oneil_Karen.pdf
188	h	Karen	O'Neil		<p>Emergency Services: Green Bank Observatory staff are members of the local emergency services crews, serving in the following capacities:</p> <ul style="list-style-type: none"> • Deputy Fire Chief • Treasure • EMTs • Firefighters • Ambulance Drivers • County Search and Rescue • Local Emergency Planning Board members • Amateur Radio Emergency Services – Pocahontas County • Amateur Radio Civil Emergency Services <p>Green Bank Observatory also provide the helipad for medical evacuation services within Northern Pocahontas County. The Observatory also provides water for the emergency tanker truck for the fire departments in the northern half of the county.</p>	Against Closure	Email	11/25/2016	Oneil_Karen.pdf

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188	i	Karen	O'Neil		<p>With over fifty years of experience in radio astronomy and uniquely located within the National and West Virginia Radio Quiet Zones, the Green Bank Observatory is home to seven large radio telescopes ranging in size from 14m – 100m in diameter. The site also has significant infrastructure which allows for the installation of any instrument which may benefit from the radio quiet location of the site, as well as an excellent test range for receivers and other hardware and a large anechoic chamber outfitted for testing antenna beam patterns and radio emissions from all types of equipment. The primary function of the Green Bank site is for scientific research of all types. As a result, the facility telescopes have been used in a wide variety of ways, including satellite tracking, spacecraft tracking, atmospheric studies, monitoring of astronomical and planetary phenomenon, and educational programs. A full description of the telescopes, and their uses, is below.</p> <p>13.7m Telescope: The 13.7m diameter telescope was built in 1995 as a tracking station for NASA's Very Long Baseline Interferometry (VLBI) satellites. With an aperture efficiency of 38% at 15 GHz the telescope is designed to work well at the common up and downlink frequencies for satellite systems. As a tracking station the 43m transmitted a maser referenced timing tone to the orbiting satellites and also received astronomical data sampled by the orbiting space crafts. Per the preference of the NASA mission, the tracking stations recorded the received data on wideband magnetic tape and ship it to correlators for further processing. Once the NASA VLBI mission was complete the telescope found subsequent use monitoring the sun for solar activity, offering publicly available research quality dynamic spectra of the sun during daylight hours. ... The by far most sensitive of the telescopes in Green Bank, the 100m Robert C. Byrd Green Bank Telescope is the largest fully steerable telescope in the world. The telescope's unblocked aperture and excellent surface result in an extremely sensitive telescope from 0.1 through 100 GHz. While its primary purpose is radio astronomy research, the GBT is designed to enhance many types of scientific pursuits. The telescope's high sensitivity allows it to receive direct communications from small spacecraft exploring the solar system. Recent use of the telescope for this activity includes monitoring the direct signal from NASA's Mars Phoenix lander as it entered descended through the Martian atmosphere to successfully land. The telescope is also often used as a receiving station for the planetary radar experiments performed with the Arecibo 305m telescope and Goldstone 70m antenna. The 100-m telescope is the main telescope for the facility, and is under operation currently for a variety of scientific experiments. Reber Telescope: This telescope was constructed by Grote Reber in 1937 in his back yard in Wheaton, Illinois (a suburb of Chicago). He built the telescope at his own expense while working full time for a radio company in Chicago. The mirror, made of sheet metal 31.4 feet in diameter, focuses radio waves to a point 20 feet above the dish. The cylinder contains the radio receiver which amplifies the faint cosmic signals by a factor of many million, making them strong enough to be recorded on a chart. The wooden tower at the left is used for access to the receiver. The telescope is registered with the National Registry of Historic Places and received an award in 2016 from the West Virginia Division of Culture and History as one of the primary landmarks within the state. Jansky Antenna: The Jansky Antenna replica serves two different functions. First, of course, it provides visitors to the site with a working demonstration of the antenna used by Karl Jansky when his scientific endeavors first created the field of what is now known as radio astronomy. Secondly, at least once a year SARA, the Society of Amateur Radio Astronomers, use the Jansky antenna for their own studies of the Universe.</p>	Against Closure	Email	11/25/2016	Oneil_Karen.pdf
188	j	Karen	O'Neil		<p>Site Buildings and Facilities Below is an incomplete list of the buildings on site and their various uses.</p> <p>Jansky Laboratory: This houses the majority of the scientific, software, and engineering staff as well as administrator for the Green Bank Observatory. It includes a full electronics laboratory, the anechoic chamber, conference facilities, and a large auditorium. It also includes much of the equipment required to run the site telescopes and the site telescopes' control rooms.</p> <p>Residence Hall, Dormitory: The site dormitory and residence hall provides housing for the astronomers, engineers, and many school groups and organizations which take advantage of the site educational programs and workshops. The occupancy is high, typically 65-85% annually.</p> <p>Cable Building, Warehouse, Metrology Lab, Interferometry Control Building: These buildings provide storage space for the equipment and projects on site, materials purchased for site use, etc. They also house the equipment used for the smaller science projects on site, such as the HERA and LoFASM experiments. They are in use daily.</p> <p>Science Center: The Science Center houses the exhibit hall, classrooms, gift shop, café, and basement workshop which are in use by both the general public and the education groups and programs hosted on the site.</p> <p>Works Building: The works building hosts the Green Bank Machine shop, carpentry shop, plant maintenance division, etc. and is of importance to the site activities.</p> <p>85-1 Control Building: This is an historic building and is used regularly by the education and public outreach group for their SETI tours.</p> <p>40foot Control Building: This hosts the instruments required for the 40ft telescope and is the room in which the students run the 40ft telescope for their educational projects.</p> <p>Indoor-Outdoor Test Facility: This facility is used regularly for the testing of receivers and similar instruments for all Green Bank Telescopes as well as for the testing of receivers planned for other radio telescopes around the country and the world.</p> <p>Paint Shop: Painting of all components takes place within the paint shop, as well as the painting of other instruments on site.</p> <p>Farm Buildings: The original farm buildings on site are used as storage facilities for that equipment which can handle some weathering but which remains of potential use to the facility. This has allowed for the storage of, e.g. receivers for mothballed telescopes which can then be brought out from storage when a new contract is agreed upon for the use of that telescope.</p> <p>Residences, Town House: With the exception of the Hannah House, which is used only in the summer months, the site residences are used year round both by local staff and visitors staying for anywhere from a week to a few months to work on site. Occupancy is typically 90-100%, with a waiting list not uncommon for their use.</p> <p>Recreation/Picnic area: The picnic and recreation area is the only such facility for central Pocahontas County. It is used by not only the Observatory for staff morale activities, but also by community groups throughout the county, including the local Lions Clubs, the county soccer, baseball, and other sports teams, boy scouts, etc. It is also used by county residents for large family reunions. When not reserved by groups, the facility is also used as a playground, soccer field, and driving range by individual county residents.</p> <p>Pool: The Green Bank Observatory pool is the only semi-public pool within 100 miles. Employees and retirees of the Green Bank Observatory and their families have learned to swim in the pool. It is also used by the county wellness organization for swim training, local triathalons, swim meets, etc. Finally, it provides the primary location for the training of lifeguards in the county, as it is one of only two pools in the county with sufficient depth for the testing of lifeguards.</p> <p>In summary, while the Green Bank Observatory is a vital part of the scientific community within West Virginia, the United States and the World, it is also a vital resource to the citizens of West Virginia and Pocahontas County.</p>	Against Closure	Email	11/25/2016	Oneil_Karen.pdf

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Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
189	a	Elizabeth	Adams	Postdoctoral Fellow	<p>This letter is in response to the Federal Register Notice of an EIS evaluating the potential environmental effects of proposed changes to operations at the Green Bank Observatory. I strongly request NSF to choose Alternative 1 of its "Notice of Intent to Prepare an EIS...", namely "Continued NSF investment for science-focused operations (No-Action Alternative)."</p> <p>The Green Bank Observatory is a world-class facility due to its location in the National Radio Quiet Zone. This provides a unique environment in which sensitive experiments can be carried out.</p>	Against Closure	Email	11/25/2016	
189	b	Elizabeth	Adams	Postdoctoral Fellow	<p>The flagship telescope, the 100m Green Bank Telescope, is only beginning to reach full scientific potential. The new receiver, ARGUS, provides competitive and complementary scientific abilities to ALMA. Importantly, as Green Bank is located in the Northern Hemisphere, it can observe systems not visible to ALMA.</p>	Against Closure	Email	11/25/2016	
189	c	Elizabeth	Adams	Postdoctoral Fellow	<p>The Green Bank Observatory also plays a key role in the local community, from providing employment to training the next generation of scientists to supporting Health and Safety for the community.</p> <p>In summary, I believe the continued scientific operation of the Green Bank Observatory has a strong positive impact.</p>	Against Closure	Email	11/25/2016	
190	a	Olivia	Harper Wilkins	NSF Graduate Research Fellow	<p>In this letter, I want to share my story with you in support of the Green Bank Observatory, its scientists and staff, its telescopes (including the Robert C. Byrd Green Bank Telescope, or GBT), and the wider radio astronomy community. Throughout my life and especially my academic career, I have been profoundly influenced by the science at Green Bank, and I know that I am not alone. Whether from other people who have seen the GBT for themselves or from those who have read about the National Radio Quiet Zone, Green Bank has opened up an area of public outreach unmatched by most other institutions. The broader impacts of Green Bank have no limits; I can talk about Green Bank anywhere—in Pennsylvania (where I grew up), in California (where I am now), even in Germany (where I lived last year)—and people often have some knowledge of the Pocahontas County research facility. For those who do not, after learning about it, they are always amazed and eager to learn more about radio astronomy. This widespread interest in radio astronomy and science generally rooted in Green Bank is why I write you today.</p> <p>I was six years old the first time my family traveled through the Blue Ridge Mountains in West Virginia. Rising above the tall trees that filled the landscape were massive satellite dishes. Even at six, I knew there was something peculiar about these white giants. I remember crudely outlining two or three of the large dishes in my sketchpad, imprinting the awe-inspiring image in my mind. Twelve years later, my family returned to the area to investigate the complex that had caught my gaze so many years before.</p> <p>This recollection of experiencing seeing the GBT for the first time opens every personal statement I have written in recent years because it is the story of how I fell in love with radio astronomy. It is a story that, even 17 years later, is at the core of who I am as a scientist. Green Bank is inspiration, not only for the general public as I mentioned before, but for me on a very personal level. Both the personnel and telescopes in Green Bank have rooted me in astrochemistry research and have encouraged me to be active in public outreach.</p>	Against Closure	Email	11/25/2016	LetterToTheNSF_Re-GBObs.pdf
190	b	Olivia	Harper Wilkins	NSF Graduate Research Fellow	<p>After my initial visits at Green Bank, I was eager to learn more. As a chemistry and mathematics undergraduate, Green Bank did not seem a likely place to pursue summer research. And yet, they gave me a chance. In 2013, I worked in Green Bank as the only summer student without a physics, astronomy, or engineering background. It was in Green Bank that I learned invaluable skills, like how to write computer programs for data analysis. It was also in Green Bank that I learned to appreciate international collaborations and global outlooks, and by the end of the summer, I was convinced I wanted to study abroad (and see some more radio telescopes) in England the following spring.</p> <p>It was also in Green Bank that I first learned of a small but growing discipline called astrochemistry from a talk by Anthony Remijan of the National Radio Astronomy Observatory. I was so intrigued that there was a field that incorporated by interest in astronomy with my skills in chemistry that I knew then I had found my scientific calling. I stopped by Jay Lockman's office near the end of my summer in Green Bank to ask him about how I could stay in my field, and Jay gave me resources to connect with astrochemists and learn more about the field. Using these tools, I contacted several scientists, including Karin Öberg at the Harvard-Smithsonian Center for Astrophysics, where I worked in a more astrochemistry-oriented research project, learning more about the chemistry of space.</p> <p>After my summer at Harvard, I pursued a Fulbright in Germany to do research at the Universität zu Köln, working on the premier astronomy molecular database in the world. Again, this experience was rooted in the connections I made in Green Bank.</p> <p>Now, I am an NSF Graduate Research Fellow at the California Institute of Technology, where I plan to continue my astrochemistry pursuits. Alongside this, I plan to engage in public outreach, especially at the high school level, to share radio astronomy and astrochemistry with the public. During and after my time in Green Bank, I have given various talks to groups of high school students and collegiate audiences, all of whom are mesmerized by radio astronomy, the field of discovering the invisible universe, using Green Bank as a proxy.</p> <p>But my drive to engage in public outreach is more than equipped by my experiences in Green Bank; my public outreach involvement is deeply inspired by it. Of every observatory and science center I've visited, Green Bank is the most involved in teaching its visitors about astronomy, and particularly radio astronomy. The people there are passionate about the field and are excited to teach people about the GBT. I will never forget my first visit to the Green Bank Science Center. Although I was 18, I felt as excited as a small child would. The science exhibit had everything I could possibly dream of seeing in the way of astronomy, there were captivating demonstrations (including one with liquid nitrogen and a balloon), and there was a phenomenal tour of the site including a close-up view of the GBT.</p>	Against Closure	Email	11/25/2016	LetterToTheNSF_Re-GBObs.pdf

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190	c	Olivia	Harper Wilkins	NSF Graduate Research Fellow	<p>I hope I have convinced you that Green Bank Observatory is more than the telescopes and the scientific discoveries; it is inspiration. While the GBT has been essential to the discoveries of many complex organic molecules in interstellar space (most notably the recent discovery of propylene oxide, the first chiral molecule in space), it has also been essential to the development of people's interest in astronomy (like me) and science generally.</p> <p>I implore you to consider not only the intellectual merits of Green Bank Observatory, including the GBT, but also to consider its broader impacts. Green Bank is crucial not only to furthering our understanding of the universe but to inspiring others to learn and be passionate about it as well.</p>	Against Closure	Email	11/25/2016	LetterToTheNSF_Re-GBObs.pdf
191	a	Robert	Minchin	Group Lead for Radio Astronomy and REU Program Manager, Arecibo Observatory	<p>As manager and co-PI of the NSF-funded Research Experience for Undergraduates (REU) program at Arecibo Observatory, I see many applications for our REU program every year. A significant fraction of these applicants mention that they have been inspired to an interest in radio astronomy, and to major in physics or astronomy at college, by an experience of Green Bank Observatory during their time at high school or earlier in their college career. The outreach work done by the Green Bank Observatory (GBO) is intimately linked to, and informed by, the research carried out there. Programs such as the NSF-funded Pulsar Search Collaboratory, which gives local high school students research experience, could not occur if the GBO were not an active research institute as well as a major educational center.</p> <p>This would not simply impact high school and undergraduate education. We are fortunate at Arecibo Observatory to employ, in the radio astronomy group that I lead, a scientist from West Virginia who was inspired to his career by the GBO. Had it not been for this, the scientific community would have been robbed of a productive scientist who has been active recently in cutting-edge investigations of fast radio bursts.</p>	Against Closure	Email	11/25/2016	
191	b	Robert	Minchin	Group Lead for Radio Astronomy and REU Program Manager, Arecibo Observatory	<p>It cannot be doubted that if the GBO were to cease to be focussed on science, its impact on education would suffer, affecting not only the inspiration of local students to study science but also the productivity and social diversity of the scientific community. This impact would fall disproportionately on the lower-income population of West Virginia, making this a matter not just of education but of environmental justice.</p>	Against Closure	Email	11/25/2016	
192	a	Joe	Swiggum	Postdoctoral Research Associate Center for Gravitation, Cosmology, and Astrophysics	<p>I am writing to submit a formal comment on the proposed changes to the operation of the Green Bank Observatory (GBO).</p> <p>As a graduate student, I spent a significant amount of time in Green Bank at the observatory working on my own research, but also mentoring high school students as part of a program called the Pulsar Search Collaboratory (PSC). The PSC is an outreach program that trains high school students to analyze pulsar survey data to make their own discoveries and inspires them to pursue science, technology, engineering, mathematics (STEM) and related career paths. The program started in 2008 and over the first five years, the PSC had involved more than 2,500 high school students and 100 teachers! Now PSC students are trained online, but can still visit the observatory for a week in July. The PSC inspired many high schoolers to come to WVU and get a degree in Physics or Engineering, because the gender ratio of PSC participants is equal, this also served to improve that of WVU's Physics & Astronomy Department. New pulsars discovered by PSC students have also proved interesting – a wide, double neutron star system, a nearby millisecond pulsar, a rotating radio transient, a disrupted recycled pulsar, a long-period nulling pulsar and several others. Results coming from these discoveries inspire students with the lasting effect their hard work has on the field of astronomy; use of the Green Bank Observatory – the most sensitive, fully steerable telescope in the world, situated in a radio quiet environment – and support from its staff are essential to produce these results.</p>	Against Closure	Email	11/25/2016	jks_nanograv.pdf
192	b	Joe	Swiggum	Postdoctoral Research Associate Center for Gravitation, Cosmology, and Astrophysics	<p>I am also one of over 100 members of NANOGrav, a collaboration of astronomers, physicists, engineers, and data scientists at 15 institutions across North America. We are on the verge of making the first detection of low-frequency gravitational waves from supermassive black holes — a discovery as transformational as the discovery of gravitational waves from stellar mass black holes announced by LIGO. NANOGrav uses an array of high-precision radio millisecond pulsars - precise astrophysical clocks — to search for small perturbations caused by gravitational waves. The Green Bank Observatory is absolutely critical to this effort because it provides outstanding sensitivity to these weak astronomical signals over 85% of the sky. No other facility in the world offers GBO's combination of sensitivity and sky coverage. NANOGrav also uses the Arecibo Observatory in Puerto Rico, which has higher sensitivity, but is restricted to a smaller viewing area than GBO. The GBO and Arecibo each contribute 50% to NANOGrav's sensitivity to gravitational waves.</p> <p>Many of the proposed changes to GBO operations would have a major detrimental impact on NANOGrav, and in turn would affect the careers of dozens of astronomers, engineers, and technicians. Many scientists like myself are just beginning their STEM careers. These changes will adversely affect the socioeconomic and cultural environment in Pocahontas County, at University of Wisconsin–Milwaukee, and at scientific institutions across the United States.</p>	Against Closure	Email	11/25/2016	jks_nanograv.pdf
192	c	Joe	Swiggum	Postdoctoral Research Associate Center for Gravitation, Cosmology, and Astrophysics	<p>Here are the impacts of each proposed scenario, as I see it:</p> <p>No-action alternative: Under this preferred scenario, NANOGrav could continue critical scientific activities. Our program to monitor over 50 millisecond pulsars would continue under a current contract with GBO. Importantly, surveys to find new millisecond pulsars with the GBT would also continue. These surveys, and the vital follow-up of new pulsars, are conducted under NSF open skies time.</p>	Alternatives Consideration	Email	11/25/2016	jks_nanograv.pdf
192	d	Joe	Swiggum	Postdoctoral Research Associate Center for Gravitation, Cosmology, and Astrophysics	<p>Collaboration with partners for continued science-focused operations: This scenario would allow NANOGrav to continue its pulsar monitoring program, but would severely impact surveys for new pulsars and the follow-up observations that identify the best candidates for NANOGrav. Because these programs operate under open-skies time, any reduction in NSF funding will similarly reduce the time available for our surveys. Scheduling pressure will also make it more difficult to characterize new discoveries, and will greatly reduce the impact of NANOGrav's ancillary science, which is itself some of the most impactful conducted at GBO. Thus, while this scenario would allow NANOGrav to make progress towards discovering low-frequency gravitational waves, it would slow the rate of that progress.</p>	Alternatives Consideration	Email	11/25/2016	jks_nanograv.pdf

Green Bank Observatory -Written NSF Public Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
192	e	Joe	Swiggum	Postdoctoral Research Associate Center for Gravitation, Cosmology, and Astrophysics	Transition to an education and technology park, mothballing, or full deconstruction: These scenarios would devastate NANOGrav science and the careers of dozens of astronomers; they would incentivize pursuing careers outside of the US, especially for young astronomers, and would thus drain the US of important expertise in this revolutionary new area of astronomy. This would come as several countries are improving their infrastructure and instrumental capabilities in the search for low-frequency gravitational waves. The Five Hundred Meter Aperture Spherical Telescope (FAST) in China represents a huge investment on the part of the government of China in this scientific area. Changes to GBO operations that adversely impact NANOGrav will thus effectively cede US leadership in low-frequency gravitational wave astronomy to other nations. The GBO (and Arecibo) are currently the best telescopes in the world for NANOGrav science and they may very well remain so for the next decade.	Alternatives Consideration	Email	11/25/2016	jks_nanograv.pdf
192	f	Joe	Swiggum	Postdoctoral Research Associate Center for Gravitation, Cosmology, and Astrophysics	In addition, the elimination of this scientific institution will remove a technology center in a region with few skilled positions. Even conversion to an education and technology center would still likely result in the export of a number of good-paying jobs to higher tech areas of the country. The people of Pocahontas County are proud of the observatory. At the November 2016 public comment meeting regarding the future of the GBO, not a single person complained about living in the National Radio Quiet Zone, and the public was clearly supportive of continued public funding of the GBO. As you can see, the scientific, socioeconomic, and cultural impacts of reducing NSF funding for GBO are numerous and severe. Such action would be a huge loss for my career, the careers of my colleagues, the NANOGrav collaboration, the US astronomical community, and the people of Pocahontas County, West Virginia. I urge NSF to adopt the no-action alternative in the strongest possible terms. Thank you for your consideration. If you have any questions or need further information, please contact me at the address above.	Against Closure	Email	11/25/2016	jks_nanograv.pdf
193	a	Lee and Diane	Gage		We are writing to support the Green Bank Observatory and the No-Action Alternative. The National Science Foundation should continue to vigorously support the GBO and science in our society. We only visited Green Bank for the first time in the last year, but it had such an impact on us that we felt compelled to show our support when we heard that NSF was considering decreasing its funding for the observatory. Our visit taught us more about astronomy, and radio astronomy in particular, than we had ever learned before.	Against Closure	Email	11/25/2016	
193	b	Lee and Diane	Gage		It gave us a greater appreciation for the ways that science and technology can impact us, and even more importantly how it can impact rural parts of our country, like West Virginia, that are struggling and need our help. The NSF should work for the common good and should be investing in our communities, especially those communities that are most in need. This is especially important in our country today, because we can all appreciate the wonders of the universe that the Green Bank Observatory uncovers. Places like the Green Bank Observatory unite us, and what greater mission can there be?	Against Closure	Email	11/25/2016	
193	c	Lee and Diane	Gage		It also educates us about science and improves science literacy, which are even more important in our society today. For all these reasons we believe that NSF should continue to fully support science at the Green Bank Observatory.	Against Closure	Email	11/25/2016	

Green Bank Observatory -Written NSF Public Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
194	a	Richard	Prestage	Scientist, GBO	I am a Staff Scientist working at the Green Bank Observatory (GBO). I am writing to you to vigorously urge that the National Science Foundation select the No-Action Alternative (continued NSF investment for science-focused operations) for the future of GBO. There are a host of reasons why this is by far the best alternative for the NSF, and the US and world astronomy communities, and many of those have been made by others more eloquent than I. So as well as supporting those arguments, I would like to emphasize here just two explicit areas where the GBO is currently a world leader, but where these capabilities would be lost were an alternative option chosen: large antenna metrology and control, and radio astronomy instrumentation development. Large antenna metrology and control: When the GBT was delivered to NRAO in 2000, as required in the specification it was only capable of working at frequencies up to 10 GHz (wavelengths longer than 3cm). Since then, due to the talent, effort and dedication of NRAO – and primarily GBO – staff, the antenna performance has been extended up to 115 GHz (wavelengths as short as 2.7mm). ...This last technique has been implemented for routine, real-time operation, allowing us to measure and remove in real time large-scale thermal deformations in the antenna, a capability not available at any other radio telescope. These capabilities have been documented in published, refereed papers in the astronomical and antenna engineering literature, as well as numerous presentations at major conferences organized by URSI, IEEE and SPIE.1 As a result of our capabilities, GBO staff have been asked to consult with many other large telescope projects, including the 100m Effelsberg Telescope in Germany, the 50m US/Mexican Large Millimeter Telescope (LMT), the 64m Sardinian Radio Telescope (SRT), and the Chinese 500m Spherical Aperture Telescope (FAST), 65m Tian-Ma Telescope and planned 110m Qitai Telescope (QTT). The techniques developed at GBO, and elsewhere, coupled with computing advances in the areas of finite element modeling, computational fluid dynamics and multi-sensor fusion, are allowing a new round of major gains to be made in antenna performance. Perhaps more importantly, the increased precision requirements of radio antennas, and the increased size of optical “extremely large” telescopes (ELTs), means that the radio and optical techniques for telescope metrology and control now have considerable overlap. In recognition of this, I organized and chaired an international workshop “Metrology and Control of Large Telescopes”2 held just this September in Green Bank. The workshop boasted over fifty attendees, from essentially every large radio telescope, as well as US and European ELT projects, and the US and ESA Deep Space Network (DSN) antenna operations groups. The outcomes of the workshop included the recognition that the GBO is indeed a world leader in this field, and that both the US and European DSN groups are now actively researching use of some of the techniques we have developed. Large radio antenna construction began in the US in Green Bank, over fifty years ago. Many critical innovations, including for example the key concept of homology3, now used in every scientific and commercial antenna of any size, were developed here. We have developed skills and expertise which are unique in the world, which would benefit aAll future large radio and optical telescopes, and we have a proven track record of sharing this expertise with the community. Should any option other than the No-Action Alternative be chosen, this expertise will be lost. Once lost, it will never be recovered.... The GBT boasts state of the art single-pixel heterodyne receivers, which lead the world in performance, at all frequencies from 300 MHz to 115 GHz. The GBT is equipped with frontends including multi-pixel feed-horn arrays, a phased array feed, a multi-pixel bolometer array, and continuum, spectral line, pulsar, VLBI, radar and SETI backends. The newest GBT backend, VEGAS, is built upon a state of the art heterogeneous computing platform, and is capable of processing 10 GHz of instantaneous bandwidth, with dual-polarization inputs. ...Again, if any option other than the No-Action Alternative is chosen, these capabilities will be lost to the US astronomy community. While these skills can be mastered working with the GBT, they will be vital for the construction of the next generation of telescopes, such as the ngVLA. Given the major decline of the University Radio Observatories, without facilities such as the GBO, the US will lose the next generation of instrument developers, and thus will cede leadership in this field to other countries. I urge you to weigh these arguments along with the many other cogent reasons why the No-Action Alternative should be selected. Please do not hesitate to contact me if you would like further information.	Against Closure	Email	11/25/2016	Richard_Prestage_GBO_EIS_Comments.pdf
194	b	Richard	Prestage	Scientist, GBO	Numerous Astronomy and Engineering undergraduates, graduate students and post-docs have been intimately involved in the development and construction of these instruments, and as such, they provide an outstanding example of the broader impact of the GBO. In addition, while they are pushing technology development at their home institutions, collaboration with GBO has taught these students innumerable skills in the areas of software development, quality control, and the construction of common-user instrumentation required to reliably operate in a production environment. Perhaps most importantly, the GBT is one of the last US telescopes available where students and other young researchers can, themselves, install their instrument on a telescope, and be directly responsible for the characterization and commissioning of that instrument.	Against Closure	Email	11/25/2016	Richard_Prestage_GBO_EIS_Comments.pdf
195	a	Megan	DeCesar	NANOGrav Physics Frontier Center Postdoctoral Fellow	I am writing to submit a formal comment on the proposed changes to the operation of the Green Bank Observatory (GBO). I urge the NSF to choose the no-action alternative for this excellent research, education, and outreach facility. I am a NANOGrav Physics Frontiers Center postdoctoral fellow at Lafayette College, Pennsylvania; my interest in the future of the GBO includes, but also extends beyond, the gravitational-wave science made possible by the GBO. I am very passionate about the education and outreach that is made possible by this observatory, and I am very concerned about the impact that choosing any other alternative would have on (1) the local economy in Green Bank, WV, (2) the scientific environment of the many institutions that use the GBO for research as well as EPO activities, and (3) the future role of the US in leading the world in ground-breaking scientific research.	Against Closure			

Green Bank Observatory -Written NSF Public Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
195	b	Megan	DeCesar	NANOGrav Physics Frontier Center Postdoctoral Fellow	As an undergraduate student, an education and research opportunity at the GBO provided my first exposure to radio astronomy. I use the GBO extensively in my research, starting in graduate school and continuing through my current position. As a postdoc, I also use the GBO to educate new STEM students through student research, as well as educating high school students through outreach related to GBO studies of pulsars and neutron stars. I come from a small town in rural Pennsylvania, and consider myself lucky to have discovered that I could have a career in a STEM field despite limited resources in my home town. I was very interested in astronomy, and took advantage of an opportunity to attend the "ERIRA" program at the GBO, and then to begin doing research as a sophomore in college, which together cemented my desire to be an astrophysicist. Without these experiences I may not have continued as a STEM student, simply because I did not feel that I "belonged" until I started doing research—a common experience for students, especially those from underrepresented backgrounds. For this reason, I know first-hand how important it is to provide research opportunities for high school and college students. I also know how important astronomy is for bringing students into STEM fields, whether they ultimately continue to work in astronomy or go on to be employed in other STEM fields. The projects that my collaborators and I work on, using the GBO, are excellent for involving many students from all backgrounds in STEM research, giving them a feeling of belonging and increasing the likelihood that they will continue on with STEM careers. First of all, a lot of outreach, both for the public and for students, is done at the GBO. For example, several years ago I taught at a 10-day-long GBO astronomy summer school for undergraduate students, some of whom are still involved in radio astronomy; and currently, the most influential outreach/education programs in which I am involved are related to large pulsar surveys being done with the GBO. These programs include: Pulsar Search Collaboratory (PSC): This program began as a way to engage West Virginia students from rural high schools in STEM research. The students were given their own data in which to search for pulsars, and found eight pulsars so far (one student was even honored for his discovery by attending a White House Star Party!). The PSC has now grown to include thirteen institutions to date, thus providing opportunities for a larger number of high school students to get involved in astronomy research, as well as for undergraduate students to do outreach—undergraduates go into the high schools to talk about astronomy and recruit students for the program. The PSC requires that 50% of the high school students are female, and has already had a significant effect on the number of women entering STEM majors in college. I am currently working to involve Lafayette College in the PSC. Green Bank North Celestial Cap (GBNCC) pulsar survey: I am a member of the GBNCC pulsar survey, which has found over 140 new pulsars to date and has provided a means for students at various levels of skill and experience to do STEM research. Undergraduate students learn to run observations and to search for pulsars. The more advanced undergraduates are learning how to time pulsars, and are becoming more involved in other aspects of GBNCC as well as NANOGrav. Roughly ten undergraduates learned to time pulsars at UW-Milwaukee last year (through a new program run by Joe Swiggum), and I have started several undergraduates on pulsar timing at Lafayette College (while we have a smaller pool of students, I am working toward a similar timing program as at UW-Milwaukee). Other pulsar searches: I am leading several new pulsar searches, two of which will be done with the GBO, which will be used to teach PSC students to search for pulsars and undergraduate students to both search for and time pulsars. Several new student projects, beyond searching and timing, are expected to come out of these search programs. One of the projects is a targeted search for millisecond pulsars, which is directly related to NANOGrav's science goal of gravitational wave detection. Without continued support for astronomy with the GBO, these opportunities for introductory-level student research—so important for bringing underrepresented students into STEM fields— will be lost.	Against Closure	Email	11/25/2016	GBO_NSF_EIS_MDeCesar.pdf
195	c	Megan	DeCesar	NANOGrav Physics Frontier Center Postdoctoral Fellow	I believe that this aspect of NANOGrav is of crucial importance for our field, and it is one of the biggest reasons that I personally feel it will be a real loss if NANOGrav can no longer do its science with the GBO—if that happens, we will be working full-time on trying to find other possible telescope resources, and work toward inclusive practices that has begun in the collaboration will almost certainly be pushed aside. Many of the proposed changes to GBO operations would have a major detrimental impact on NANOGrav, and in turn would affect the careers of dozens of astronomers, engineers, and technicians. Many of the scientists, like myself, are just beginning their STEM careers. In addition, education and outreach programs like those I mentioned above will take away opportunities for many high school and college-age students to participate in professional-level STEM research which has been so successful in encouraging students from underrepresented backgrounds to enter STEM majors in college. These changes will adversely affect the socioeconomic and cultural environment in Pocahontas County; at my former institution, the University of Wisconsin- Milwaukee; at my current institution, Lafayette College; and at scientific institutions across the United States. I am one of over 100 members of NANOGrav, a collaboration of astronomers, physicists, engineers, and data scientists at 34 institutions across North America. We are on the verge of making the first detection of low-frequency gravitational waves from supermassive black holes — a discovery as transformational as the discovery of gravitational waves from stellar mass black holes announced by LIGO. NANOGrav uses an array of high-precision radio millisecond pulsars - precise astrophysical clocks — to search for small perturbations caused by these gravitational waves. The Green Bank Observatory is absolutely critical to this effort because it provides outstanding sensitivity to these weak astronomical signals over 85% of the sky. No other facility in the world offers GBO's combination of sensitivity and sky coverage. The GBO is also a crucial facility for finding new millisecond pulsars, which is absolutely necessary if we are to make a gravitational wave detection in the next few years ² . NANOGrav also uses the Arecibo Observatory in Puerto Rico, which has higher sensitivity, but is restricted to a smaller viewing area than GBO. The GBO and Arecibo each contribute 50% to NANOGrav's sensitivity to gravitational waves.	Against Closure	Email	11/25/2016	GBO_NSF_EIS_MDeCesar.pdf
195	d	Megan	DeCesar	NANOGrav Physics Frontier Center Postdoctoral Fellow	A very important aspect of NANOGrav is that it has become active in combating abuses of power, especially sexual harassment, within our collaboration, which is slowly starting to influence the larger pulsar community and will eventually influence the even larger astronomy community. The pulsar community has had real problems in this area in the past, with many young women having been sexually harassed. In recent years, NANOGrav senior personnel contacted the people who were known to behave in this way and told them in no uncertain terms that this needed to stop. Since then, I have not experienced any further harassment, nor have any of the other women with whom I've spoken. NANOGrav developed an anti-harassment policy and elected several member advocates, to whom any of us can talk if we experience or witness an abuse of power of any kind. One or more serious cases are being investigated, initially through the collaboration's member advocates, and now formally through individual universities' Title IX offices. We also hold 1-1.5 hour long seminars about these issues at every NANOGrav collaboration meeting, which has allowed collaboration members to have meaningful conversations about these issues.	Against Closure	Email	11/25/2016	GBO_NSF_EIS_MDeCesar.pdf
195	e	Megan	DeCesar	NANOGrav Physics Frontier Center Postdoctoral Fellow	Here are the impacts of each proposed scenario, as I see it: No-action alternative: Under this preferred scenario, NANOGrav could continue critical scientific activities. Our program to monitor over 50 millisecond pulsars would continue under a current contract with GBO. Importantly, surveys to find new millisecond pulsars with the GBT would also continue. These surveys, and the vital follow-up of new pulsars, are conducted under NSF open skies time.	Alternatives Consideration	Email	11/25/2016	GBO_NSF_EIS_MDeCesar.pdf

Green Bank Observatory -Written NSF Public Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
195	f	Megan	DeCesar	NANOGrav Physics Frontier Center Postdoctoral Fellow	Collaboration with partners for continued science-focused operations: This scenario would allow NANOGrav to continue its pulsar monitoring program, but would severely impact surveys for new pulsars and the follow-up observations that identify the best candidates for NANOGrav. Because these programs operate under open-skies time, any reduction in NSF funding will similarly reduce the time available for our surveys. Scheduling pressure will also make it more difficult to characterize new discoveries, and will greatly reduce the impact of NANOGrav's ancillary science, which is itself some of the most impactful conducted at GBO. Thus, while this scenario would allow NANOGrav to make progress towards discovering low-frequency gravitational waves, it would slow the rate of that progress.	Alternatives Consideration	Email	11/25/2016	GBO_NSF_EIS_MDeCesar.pdf
195	g	Megan	DeCesar	NANOGrav Physics Frontier Center Postdoctoral Fellow	Transition to an education and technology park, mothballing, or full deconstruction: These scenarios would devastate NANOGrav science and the careers of dozens of astronomers. They incentivize pursuing careers outside of the US, especially for young astronomers, and would thus drain the US of important expertise in this revolutionary new area of astronomy. This would come as several countries are improving their infrastructure and instrumental capabilities in the search for low-frequency gravitational waves. The Five Hundred Meter Aperture Spherical Telescope (FAST) in China represents a huge investment on the part of the government of China in this scientific area. Changes to GBO operations that adversely impact NANOGrav will thus effectively cede US leadership in low-frequency gravitational wave astronomy to other nations. The GBO (and Arecibo) are currently the best telescopes in the world for NANOGrav science and they may very well remain so for the next decade. In addition, the elimination of this scientific institution will remove a technology center in a region with few skilled positions. Even conversion to an education and technology center would still likely result in the export of a number of good-paying jobs to high-tech areas of the country. The people of Pocahontas County are proud of the observatory.	Alternatives Consideration	Email	11/25/2016	GBO_NSF_EIS_MDeCesar.pdf
195	h	Megan	DeCesar	NANOGrav Physics Frontier Center Postdoctoral Fellow	At the November 2016 public comment meeting regarding the future of the GBO, not a single person complained about living in the National Radio Quiet Zone, and the public was clearly supportive of continued public funding of the GBO. As you can see, the scientific, socioeconomic, and cultural impacts of reducing NSF funding for GBO are numerous and severe. Such action would be a huge loss for my career, the careers of my colleagues, the NANOGrav collaboration, the US astronomical community, and the people of Pocahontas County, West Virginia. I urge NSF to adopt the no-action alternative in the strongest possible terms. Thank you for your consideration. If you have any questions or need further information, please contact me at the address above.	Against Closure	Email	11/25/2016	GBO_NSF_EIS_MDeCesar.pdf
196	a	Greg	Black		I'm writing in strong support of option 1, the "No-Action" option, in the EIS for the Green Bank Observatory. The GBO continues to produce cutting edge, important scientific results, which I'm sure others have already described in better detail than I could. The recent and continued investment by non-government groups in new receivers and equipment for the instruments is evidence for its relevance and importance to current science, and the expectation of contributions for future advancements. Reducing or removing a start-of-the-art astronomical facility like the GBO with the unique sensitivity, spectral, and sky coverage capabilities of its instruments from the US scientific portfolio would have a lasting negative impact on US as well as global science, and reduce the potential that could be achieved from the significant investment that has already been made there. If history is any guide, with less than two decades of operation of the GBT so far, important research and achievements are still to come from the GBT. As scientific understanding progresses, the studies performed at the GBT in the future may very likely include advances and discoveries in areas that aren't even anticipated at this point in time. In addition, many other existing and likely future observing facilities are designed with the intent to operate cooperatively with other facilities, such as the GBT, and the importance of any single facility cannot be considered in isolation.	Against Closure	Email	11/25/2016	
196	b	Greg	Black		For context, I have been a past user of the facility and the GBT in particular, and spent time on-site as a post-doc. While I've moved into a different area of work since then, I keep aware of progress in the field and as a resident of WV I'm also aware of the important and pro-active STEM role that the GBO fills in the state and region. Thank you for the thoughtful consideration of this issue and working to maintain a strong US astronomical program.	Against Closure	Email	11/25/2016	
197		Lawrence	Rudnick	Distinguished Teaching Professor Minnesota Institute for Astrophysics School of Physics and Astronomy University of Minnesota	I am writing in strong support of the "No Action Alternative" for the Green Bank Observatory, allowing it to remain as a premier resource for scientific discovery through internationally competitive research proposals. Since the bulk of my own scientific career is behind me (having first observed at Green Bank in 1973), my support is not self-serving but in the interests of seeing the fantastic discoveries that have been made at the Observatory continue into the future. I just finished service as the Chair of the Time Allocation Committee that provides advice to the Director of the GBO as to which proposals are the most meritorious. As an outside panel, we contribute our best unbiased judgements based on the forefront scientific questions. The choices we make are hard ones, with lots of exciting science left on the cutting room floor because of competition for precious telescope time. With the decreasing time available for "open skies" observing, we are losing important opportunities to answer science questions that keep us all up at night. We are also losing critical opportunities for training future generations of skilled observers who will go on both in astronomy but into a wide range of technical professions where their problem-solving skills will benefit all of society. You have received extensive documentation on the unique capabilities of the GBO that will be very hard, if not impossible to recover in the foreseeable future worldwide. From the standpoint of leveraging the enormous investments already made in high-end electronics, trained personnel at the observatory and around the country and world, and even the steel, it makes enormous sense to me that the NSF should preserve this unique resource for open-skies observing. I don't know how many more projects I personally can do at the GBO, but I'm looking to the future, and hoping that the students that we have trained over the decades will continue to be able to make inspiring discoveries and technical achievements that will benefit us all.	Against Closure	Email	11/25/2016	

Green Bank Observatory -Written NSF Public Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
198		Darren	Honaker	Scout Master Stonewall Jackson Area Council Southern District Boy Scout Troop 2	<p>Boy Scout Troop 2 of Clifton Forge, Virginia visited the Green Bank Observatory in September 2016. The Boy Scouts of Troop 2 earned the Astronomy Merit Badge which was taught by the Green Bank Observatory. The mission of the Boy Scouts of America is to prepare young people to make ethical and moral choices over their lifetimes by instilling in them the values of the Scout Oath and Law. In addition to instilling good character qualities of our nation's youth, the Boy Scouts strive to promote our scouts to STEM (Science, Technology, Engineering and Mathematics) activities to encourage our youth to follow careers in STEM.</p> <p>The Green Bank Observatory provides our youth with a unique opportunity to study astronomy. The adult leaders of Boy Scout Troop 2 could not have given the scouts of Troop 2 the opportunity to earn the Astronomy Merit Badge without the help of the Green Bank Observatory. I can report to the National Science Foundation that after our trip to the Green Bank Observatory, the scouts of Troop 2 can identify constellations. The scouts understand the purpose of a star wheel which aids identifying constellations as the night sky changes. No member of Troop 2 could identify a constellation prior to visiting Green Bank Observatory.</p> <p>During a Troop 2 campout after our visit to GBO, Scouts that completed the Astronomy Merit Badge from GBO instruction taught other scouts astronomy including identifying constellations and the Milky Way. Green Bank Observatory is a treasure. I sincerely hope the National Science Foundation will continue to support the Green Bank Observatory such that GBO can support the Boy Scouts and Girl Scouts of America.</p> <p>If you have any questions or concerns. You can contact me by e-mail at Darren.Honaker@ieeee.org.</p>	Against Closure	Email	11/25/2016	Troop 2 - Green Bank Observatory.pdf
199	a	John	Nobile		<p>It would be foolish to eliminate the largest steerable radio dish from the USA's assets. The current facility and the dish prior served as invaluable resources to NASA's space program. From measuring the winds on Jupiter when Galileo's High Gain Antenna failed to enabling the success of the Huygens Probe's mission despite its communication loss to Cassini, the Green Bank facility has consistently provided a fail-safe back-up, averting significant space mission failures and consequent losses of the tax payers' investments in space missions.</p> <p>Rebuilt as recently as the early 90s, it has hardly been utilized long enough to return the taxpayers' investment in it. Costing around \$50M, it was constructed with adaptive optics, a cutting edge control system enabling major reconfigurations in minutes that can take other telescopes hours or days. It is unique among various radio telescope systems operating in the GHz spectrum observing with its open proposal process.</p>	Against Closure	Email	11/25/2016	
199	b	John	Nobile		<p>Beyond these considerations and the unique science only it can do, the Green Bank facility is the BEST resource for training our next generation of radio scientists. It is the only one that continues to maintain the old technology for steering and recording radio data enabling a full break from the technology falling into a black box. Single dish data processing is easier to manage and easier to use to instruct students on the physics not just of the observing system but also of the various astrophysical phenomena being observed. Thousands of radio students have passed through its facility giving the US a strong radio community from which to draw expertise.</p>	Against Closure	Email	11/25/2016	
199	c	John	Nobile		<p>Finally, being the only radio-quiet territory in the US for performing research, its closure would eliminate entire spectral bands from research by the majority of US scientists. As every amateur radio operator knows, the electromagnetic spectrum is heavily occupied with only certain bands that they can use to communicate. If they want to listen to any astronomical phenomena, very few bands are available. The concept of being able to travel to West Virginia and have an entire spectrum in which to track whistler waves, listen to the Galactic Neutral Hydrogen Line, and data transmissions from satellites is a wealth beyond imagining to an average ham radio operator.</p> <p>We call on the NSF to consider the resource that taxpayers bought and have yet to take full advantage of in the Green Bank Telescope. It's our resource.</p>	Against Closure	Email	11/25/2016	
200		Debra	Nieuwenhuis	Water's Edge Scientific LLC	<p>I am writing this letter in support of continued NSF investment in the Green Bank Observatory and Science Center (GBT). As amateur astronomers and 4-H leaders, my husband and I have directly benefitted from the GBT both through in-person visits and remotely through its affiliation with the Skynet Junior Scholars program. Our 4-H club, like many others, promotes participation in STEM programs for youth. Thanks to the Internet, facilities such as the GBT provide our youth with opportunities to learn radio astronomy remotely. This enables the educational reach of GBT to stretch far beyond the borders of West Virginia. As part of our interest and involvement in the 4-H astronomy program, we have personally traveled from Wisconsin to WV to visit the GBT. The facilities for research and education at the site are unique and provide a great background for radio astronomy. The GBT provides a unique opportunity for professionals and students alike to participate in educational programming and research. Please continue to provide funding for this valuable facility.</p>	Against Closure	Email	11/25/2016	

Green Bank Observatory -Written NSF Public Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
201	a	Richard	Fleming		<p>Hello, this is Richard Fleming. I live in Chelsea, Alabama. I have been following the happenings at NRAO in Green Bank since I retired from NRAO in October 1998. I recently was reading about the Green Bank Observatory public comment period concerning future operations and funding by NSF, among others I offer the following facts and observations concerning the meaningful impact and contributions NSF/AUI/NRAO has had on Pocahontas County and the people there. These observations easily extend to the State of West Virginia, the USA and scores of foreign countries.</p> <p>I am an electrical engineer and project manager. After graduating from college I spent some time as a naval officer on active duty, an engineer for a NASA contractor in the space race and joined NRAO in Green Bank, WV as a radio astronomy electronics engineer.</p> <p>After about 6 years as an engineer I became the Business Manager in Green Bank. I served as the business manager for about 23 years before retiring in 1998. I returned to Alabama to join my two grown children and a handful of grand kids.</p> <p>So, how does this background fit into the importance of the Green Bank Observatory? I was there for 28 years and personally saw the observatory and the county grow. The observatory employed more than 100 people.</p> <p>Since the observatory is situated in a rural setting the employees at the observatory come from local people and technical/professional people from many other areas. The observatory was very careful in selecting professional staff by a two part interview procedure. We found that this yields a well-informed future employee who is very likely to stay at the observatory and contribute to the science effort and serve the community.</p> <p>I was one of the many I know that stayed for a long time. My wife and I raised two very happy and smart children who finished college with advanced degrees and have been married to the same persons for over 25 years. I am proud of this and contribute a lot of this to living in a great environment such as NRAO/Green Bank.</p> <p>During my time at NRAO I participated in Cub Scouts, Boy Scouts, youth soccer, school committees, volunteer fireman and EMT and more. My wife was a Girl Scout leader and taught school for many years. We benefited from these community organizations and the community was better for it as well.</p> <p>During the growth period at the observatory a private medical clinic and dental clinic was established in the community and is operating today. There are now two service stations, a general store, a branch bank and a Dollar Store.</p> <p>I have seen the benefits to the community and the operation of the observatory as they worked and grew together. The NSF can be justly proud of this relationship between advancing science with community support.</p> <p>Thank you for reading my comments.</p>	Against Closure	Email	11/25/2016	
201	b	Richard	Fleming		<p>Other documents are available listing the scientific importance of the telescopes in Green Bank as well as the tens of thousands of visitors from all over the USA and many foreign countries. The impact to science education alone is humongous. The Green Bank Observatory is very famous and well known. The impact to the community and county is huge and there are no negatives to the arrangement. This national science center is world known and extremely important to the community and employees.</p>	Against Closure	Email	11/25/2016	
202	a	Elizabeth	Ferrara	DeputyLead Scientist Fermi Science Support Center	<p>I am writing to submit a formal comment on the proposed changes to the operation of the Green Bank Observatory (GBO). I am a high-energy astrophysicist at the University of Maryland in College Park, Maryland. I regularly utilize the GBO's unique capabilities to search for low-frequency electromagnetic counterparts to gamma-ray sources of unknown origin. There is no other observatory with sufficient sky coverage, frequency coverage, and scheduling flexibility in the northern hemisphere that could replace the GBO in my observing portfolio.</p> <p>I am one of over 100 members of NANOGrav, a collaboration of astronomers, physicists, engineers, and data scientists at 34 institutions across North America. Together, we are on the verge of making the first detection of low-frequency gravitational waves from supermassive black holes – a discovery as transformational as the discovery of gravitational waves from stellar mass black holes announced by LIGO. NANOGrav uses an array of high-precision radio millisecond pulsars – precise astrophysical clocks – to search for small perturbations caused by gravitational waves. The Green Bank Observatory is absolutely critical to this effort because it provides outstanding sensitivity to these weak astronomical signals over 85% of the sky. No other facility in the world offers GBO's combination of sensitivity and sky coverage. NANOGrav also uses the Arecibo Observatory in Puerto Rico, which has higher sensitivity, but is restricted to a smaller viewing area than GBO. The GBO and Arecibo each contribute 50% to NANOGrav's sensitivity to gravitational waves.</p>	Against Closure	Email	11/25/2016	GBO_EIS_Letter_ECF.pdf
202	b	Elizabeth	Ferrara	Deputy Lead Scientist Fermi Science Support Center	<p>Many of the proposed changes to GBO operations would have a major detrimental impact on NANOGrav, and in turn would affect the careers of dozens of astronomers, engineers, and technicians. Many of the scientists are just beginning their STEM careers. These changes will adversely affect the socioeconomic and cultural environment in Pocahontas County, at University of Maryland, and at scientific institutions across the United States.</p>	Against Closure	Email	11/25/2016	GBO_EIS_Letter_ECF.pdf
202	c	Elizabeth	Ferrara	Deputy Lead Scientist Fermi Science Support Center	<p>Here are the impacts of each proposed scenario, as I see it:</p> <p>No-action alternative: Under this preferred scenario, NANOGrav could continue critical scientific activities. Our program to monitor over 50 millisecond pulsars would continue under a current contract with GBO. Importantly, surveys to find new millisecond pulsars with the GBO would also continue. These surveys, and the vital follow-up of new pulsars, are conducted under NSF open skies time.</p> <p>Collaboration with partners for continued science-focused operations: This scenario would allow NANOGrav to continue its pulsar monitoring program, but would severely impact surveys for new pulsars and the follow-up observations that identify the best candidates for NANOGrav. Because these programs operate under open-skies time, any reduction in NSF funding will similarly reduce the time available for our surveys. Scheduling pressure will also make it more difficult to characterize new discoveries, and will greatly reduce the impact of NANOGrav's ancillary science, which is itself some of the most impactful science conducted at GBO. Thus, while this scenario would allow NANOGrav to make progress towards discovering low-frequency gravitational waves, it would slow the rate of that progress.</p>	Alternatives Consideration	Email	11/25/2016	GBO_EIS_Letter_ECF.pdf

Green Bank Observatory -Written NSF Public Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
202	d	Elizabeth	Ferrara	Deputy Lead Scientist Fermi Science Support Center	<p>Transition to an education and technology park, mothballing, or full deconstruction: These scenarios would devastate NANOGrav science and the careers of dozens of astronomers. They incentivize pursuing careers outside of the US, especially for young astronomers, and would thus drain the US of important expertise in this revolutionary new area of astronomy. This would come as several countries are improving their infrastructure and instrumental capabilities in the search for low-frequency gravitational waves. The Five Hundred Meter Aperture Spherical Telescope (FAST) in China represents a huge investment on the part of the government of China in this scientific area. Changes to GBO operations that adversely impact NANOGrav will thus effectively cede US leadership in low-frequency gravitational wave astronomy to other nations. The GBO (and Arecibo) are currently the best telescopes in the world for NANOGrav science and they may very well remain so for the next decade.</p> <p>In addition, the elimination of this scientific institution will remove a technology center in a region with few skilled positions. Even conversion to an education and technology center would still likely result in the export of a number of good-paying jobs to higher-tech areas of the country. The people of Pocahontas County are proud of the observatory.</p>	Alternatives Consideration	Email	11/25/2016	GBO_EIS_Letter_ECF.pdf
202	e	Elizabeth	Ferrara	Deputy Lead Scientist Fermi Science Support Center	<p>At the November 2016 public comment meeting regarding the future of the GBO, not a single person complained about living in the National Radio Quiet Zone, and the public was clearly supportive of continued public funding of the GBO.</p> <p>As you can see, the scientific, socioeconomic, and cultural impacts of reducing NSF funding for GBO are numerous and severe. Such action would be a huge loss for my career, the careers of my colleagues, the NANOGrav collaboration, the US astronomical community, and the people of Pocahontas County, West Virginia. I urge NSF to adopt the no-action alternative in the strongest possible terms.</p> <p>Thank you for your consideration. If you have any questions or need further information, please contact me at the address above.</p>	Against Closure	Email	11/25/2016	GBO_EIS_Letter_ECF.pdf
203		Marg	Friesen		<p>I am responding regarding possible actions for the Green Bank Observatory.</p> <p>I support the first listed option: Continued NSF investment for science-focused operations (No-Action Alternative).</p> <p>This facility provides unique, invaluable scientific information and merits the ongoing support of the National Science Foundation.</p>	Against Closure	Email	11/25/2016	
204	a	James	Cordes	Professor of Astronomy Cornell University	<p>I am an astrophysicist who relies on the Green Bank Observatory (GBO) for research on neutron stars, gravitational waves, and fundamental physics. More important are the collaborations I am involved with that involve scientists across the U.S., Canada, and Europe (including the U.K.). Members of these range from undergraduates getting their first taste of research, Ph.D. students, post-doctoral researchers, faculty at universities, and researchers at institutes such as the Jet Propulsion Laboratory. The research enabled by the GBO includes high-visibility, long-term efforts in gravitational wave detection in the nanohertz band. A discovery in this band would parallel this year's Nobel-worthy discovery of black-hole mergers with the Laser Interferometer Gravitational-Wave Observatory and is as necessary for an understanding of the universe as radio waves complement visual observations for electromagnetic astronomy. The nanohertz band requires sustained monitoring of 50 to 100 millisecond pulsars with samples obtained at least once a month for more than ten years. Loss of the GBO would be a major blow to the NANOGrav project (North American Nanohertz Observatory for Gravitational Waves) and its leading role in the worldwide effort to detect nanohertz gravitational waves. It would jeopardize the fulfillment of the large investment already made in telescope time for this project and diminish the status of U.S. astronomy in this area. The greatest benefit to the nation is the first option listed on the NOI web page: Continued NSF investment for science-focused operations (No-Action Alternative) with the clarification that "Continued NSF investment" includes increases in investment in new instrumentation that exploits the unique aspects of the telescope. Current political discussions across the U.S. are placing high value on infrastructure investment in order that the U.S. economy be optimized through modern bridges, railroads, and airports; it must also include science infrastructure. Science is the basis for better lives for all and basic research is the foundation for new technology. The premise of the Proposed Changes to Green Bank Observatory operations is diametrically opposed to this. Infrastructure investment is for the benefit of future citizens and those who choose to be scientists. Indeed entirely new telescopes are needed that the proposed divestment is allegedly going to enable; but the divestment process may very well destroy facilities that someday soon we would want to have again, not the very least because we see our foreign competition doing so. The current situation emanates from a problem in the budget of a division of a federal agency. Solving this should not be at odds with what is best for the nation.</p>	Against Closure	Email	11/25/2016	GBO_JMC2016Nov.pdf
204	b	James	Cordes	Professor of Astronomy Cornell University	<p>Another new area is that of enigmatic radio bursts, lasting only a millisecond or so, that originate from outside our galaxy but are not understood. They may be caused by entirely new physical processes or by known kinds of objects that exist in unusual astrophysical circumstances. Either way, the bursts themselves are unique probes of the intergalactic medium and their host galaxies. They were barely known at the time of the 2012 Portfolio Review. The GBO has been central to studies of these bursts and, if anything, should be enhanced with new instrumentation in order to fully exploit this area of exploration and discovery.</p> <p>A third broad area where the GBO is important is in fundamental physics, including the most powerful tests of General Relativity through monitoring of a double-pulsar binary system and through precise determinations of the masses of neutron stars, which constrain the properties of nuclear matter in ways that are completely inaccessible to terrestrial laboratories. The Portfolio Review (as summarized in the Supplementary Information for the NOI) stated about the Green Bank Telescope: "...its capabilities are not as critical to New World New Horizons [astronomy and astrophysics decadal survey] science goals as the higher-ranked facilities." This statement does not reflect the current scientific situation and is not consistent with any complete reading of NWNH, which placed high value on gravitational wave astronomy and astrophysics as well as on studies of the time-domain. The GBO is central to both of these.</p>	Against Closure	Email	11/25/2016	GBO_JMC2016Nov.pdf
205		Sumitra	Joy		<p>Please accept my public submission regarding the Green Bank observatory.</p> <p>Please choose: 1) Continued NSF investment for science-focused ops (no-action alternative).</p> <p>Green Bank is too important to limit, mothball or close.</p>	Against Closure	Email	11/25/2016	

Green Bank Observatory -Written NSF Public Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
206	a	Viraj	Pandya		<p>I am writing to express my support for continued funding of the Green Bank Observatory (GBO) by the NSF. I had the privilege of visiting the GBO during the spring of 2013 as part of a class field trip led by Prof. Andrew Baker at Rutgers University. That was during a time when I had no idea that astronomy was even a viable career path for me (I got my B.A. in mathematics and economics, not physics or astronomy). More than three years later, I now find myself as a graduate student in the Department of Astronomy & Astrophysics at UC Santa Cruz, where I have the honor of being a Regents Fellow, Osterbrock Fellow, and NSF Graduate Research Fellow.</p> <p>My non-traditional journey toward graduate school was not an easy one, and the trip that I took to GBO with Prof. Andrew Baker's class helped me understand that I might actually one day be able to become a professional astronomer. In fact, as one of the first two post-baccalaureate students in astronomy at Princeton University, it was my experience with radio astronomy at the GBO and in Prof. Andrew Baker's class that compelled me to become Principal Investigator of two observing programs with the Jansky Very Large Array (16A-382 and 16B-315). In the future, I hope to use GBO facilities for my own research and outreach, and I therefore do not want to see the GBO be shut down or be turned into a museum.</p>	Against Closure	Email	11/25/2016	
206	b	Viraj	Pandya		<p>Of the five different options that you are considering for future NSF funding, I support options (1) and (2): the so-called "No-Action Alternative" and "Collaboration with interested parties for science- and education-focused operations with reduced NSF-funded scope." Both of these options would allow professional astronomers to continue to use GBO facilities (and the Green Bank Telescope in particular) for their research. Continued NSF support would also allow non-traditional students, perhaps those like me who are still confused about whether astronomy is even a viable career path for them, to visit the GBO and gain some hands-on beyond-the-classroom observing experience.</p> <p>As someone who has a degree in economics, I understand that the NSF must carry out cost-benefit analyses to split their limited resources among different research and outreach facilities. However, as a person who also has a background in scientific outreach and research, I think it would send a sad message to the astronomical community, and the world of science more broadly considered, if an institution as iconic and venerable as the GBO had to be shut down or be turned into a museum.</p>	Alternatives Consideration	Email	11/25/2016	
207		Jolie	Jones		<p>Please accept my public submission regarding the Green Bank observatory.</p> <p>Please choose: 1) Continued NSF investment for science-focused ops (no-action alternative).</p> <p>Green Bank is too important to limit, mothball or close.</p>	Against Closure	Email	11/25/2016	
208	a	Jaime	Pineda		<p>I need to express my strong support for your committee to choose "Continued NSF investment for science-focused operations (No-Action Alternative)" in your deliberations. This is the only option that would ensure the next generation of American astronomers to be adequately trained in important science and technical skills. I have been a user of the GBT since my years as a PhD student. It is thanks to the observational training obtained at the GBT that I gained enough expertise to get my first big breakthrough: The direct observation of the transition between subsonic and supersonic turbulence (Pineda et al. 2010, http://adsabs.harvard.edu/abs/2010ApJ...712L.116P). Without the visits, observation preparations, and discussion with the GBT staff I would not be the scientist I am Today. Moreover, the new instrumentation available (KFPA and VEGAS) has allowed us to carry out the first part of the "GAS" Survey (Green Bank Ammonia Survey, for which I am one of the co-PI), which has shown how stars are formed in the pockets of subsonic turbulence inside filamentary networks. The first round of papers are about to be submitted to the journals. The Green Bank telescope data are crucial to our ability to study the physics regulating star formation. Although I have access to Effelsberg, it is impossible to carry out the same science than the GBT, because the mapping speed of the GBT is more than 10x faster than Effelsberg and at higher angular resolution, showing the great importance of GBT in star formation in particular. Please support the open sky science with the GBT, and vote "No Action."</p>	Against Closure	Email	11/25/2016	Jaime_E_Pineda_GBT_Letter.pdf
208	b	Jaime	Pineda		<p>Every time I have visited Green Bank, I have always been greatly impressed by the fantastic relation between NRAO and the local community, and by the committed effort to support and train students.</p>	Against Closure	Email	11/25/2016	Jaime_E_Pineda_GBT_Letter.pdf

Green Bank Observatory -Written NSF Public Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
209	a	Danielle	Holstine		<p>I am writing in regards to the proposed scope changes to the National Science Foundation's continued funding of the Green Bank Observatory. I understand there are five proposed options: two that continue funding and operating the GBO through the NSF or partnerships and three that close it down in varying degrees of severity. In short, I find it appalling to consider any of those latter three options. The impact of closing the GBO is catastrophic on a global scale and that impact is something I will expand upon below.</p> <p>Let's first consider the local impact. I grew up in Pocahontas County and, for most of my life, lived within steps of the Observatory. From a social standpoint, the Observatory provided a resource for us, as children, that is rare to come by in this day and age: a simultaneously safe and educational place to spend our time. I would spend hours with my sisters and friends riding our bicycles down past the telescopes, stopping to watch as one would shift to its next point of observation. We spent just as much time in the old Tour Center, what has now become a world-class Science Center and visitor's complex, learning about radio astronomy and what our families did while there.</p> <p>The Observatory also provides resources to the community such as facilities to hold Red Cross swimming lessons. I took those lessons when I was young and then became a Red Cross swimming instructor once I got older, passing on the knowledge I had learned and teaching the next generation how to swim. Pools are few and far between in Pocahontas County, but local swimming holes are common. It's vital that kids learn how to swim in a safe and controlled environment before venturing into a creek or river with friends. Without the Observatory opening its doors to the community to provide the proper facilities for those lessons, access to Red Cross instruction would be completely gone for many.</p> <p>Expanding our impact bubble from the very local to a broader state-wide (or beyond) perspective, the Observatory provides educational benefits for people throughout the state of West Virginia and beyond. As a host of the Governor's School for Math and Science, as well as the host of events like star parties and festivals throughout the year, the Observatory touches the lives of students and adults from all around. Visitors are welcomed and taught the ropes of astronomy. Local teens are given opportunities to work at these events or in seasonal roles throughout the Observatory. Combine all those visitors with all the visiting astronomers mentioned above and the Observatory has a significant economical impact to the local community as well. Add the benefit of employing local high-school students and that economic impact grows.</p>	Against Closure	Email	11/25/2016	
209	b	Danielle	Holstine		<p>As I got older, the educational impact that the Observatory had on me shaped who I am today. As students, we were invited to use the 40' telescope to observe gases in space and I was able to connect the dots between textbook knowledge and practical application of scientific concepts like the Doppler effect. In high school, I spent 40 hours doing ""on the job"" training at the Observatory, where I wrote a computer program for the very first time. It was because of that mentorship that I decided to major in Computer Science when I went to college. That's right, the Observatory encouraged a woman to enter a STEM field, something that is desperately lacking today. But that reaches beyond the local impact, so we will return to that point shortly.</p> <p>Beyond the hard-skills of education, though, the Observatory offered an opportunity to build soft-skills that I find to be incredibly unique, especially here within the United States, in that it drew astronomers from all around the world. Growing up there, I had exposure to people not only from different places within the United States, but people from different countries all around the world! I was introduced to different cultures and learned the importance of sharing in those cultures. This paid off in spades when I attended a graduate program whose population was less than 50% American. I was already comfortable with being open around people whose backgrounds were different from my own and again, in a day and age where we are quick to speak and slow to listen, those skills could not be more valuable.</p>	Against Closure	Email	11/25/2016	
209	c	Danielle	Holstine		<p>Let's expand our lens even further. As I mentioned above, I decided to major in computer science solely because I had spent a week programming a simulation for the Green Bank Telescope in high school. I was the only female student in the Computer Science department at my college. However, I spent a summer internship during college at the Observatory writing a program for collecting and displaying Radio Frequency Interference and both of my bosses at the Observatory, programmers themselves, were women. The director of the GBO is a woman. It's huge to have successful role models of women in science and engineering and the Observatory is a beacon for women who are interested in any STEM field. To shut it down would be yet another slap in the face for any woman in this country considering these fields of study.</p>	Against Closure	Email	11/25/2016	
209	d	Danielle	Holstine		<p>Today, all we hear about is how the United States is falling behind in STEM fields. That we aren't training enough people and have a shortage of solid American engineers, which is especially crucial in the Defense industry where American citizens are necessary to help ensure the safety of our country. The Observatory provides a place to train those people. It provides a place of employment for those people. I find it absolutely absurd that we would shut down a scientific research facility of such importance located on American soil in favor of funding facilities outside our own country. In a day when it is so hard to find and train Americans in STEM, shutting down access to a scientific facility like the Observatory sounds unjustifiable.</p> <p>Expanding to the global scale, now, I've already touched shortly on the visitors that come to the Observatory, but the tourists from other countries are only part of the story. The Observatory provides a vital scientific resource for researchers around the world. The first signal from Cassini as it flew past Titan was received by the Green Bank Telescope and relayed to NASA. NASA! SETI continues to make use of the Observatory's instruments. Russian Universities make use of the telescopes to expand humankind's knowledge of the sun. That's right - this research isn't just about a single person, a single entity, a single country. It's about humanity. The more we understand space, the more we will understand ourselves.</p> <p>Closing the Green Bank Observatory, mothballing a precise scientific instrument like the Green Bank Telescope, will mean closing the doors on humanity's understanding of our radio universe. I have provided but a brief glimpse into the impact that the Green Bank Observatory has had on my life. There's so much more to be said, but I have highlighted a few points that I feel demonstrate the necessity of the GBO locally and beyond. And so I will repeat, the impact of closing the GBO is catastrophic on a global scale and that's a catastrophe we can ill afford.</p>	Against Closure	Email	11/25/2016	

Green Bank Observatory -Written NSF Public Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
210	a	Aaron	Evans	Professor, University of Virginia Astronomer, National Radio Astronomy Observatory	<p>this email is in response to the Notice of intent to prepare an Environmental Impact Statement (81 FR 72124) for the Green Bank Observatory (GBO). I support the "no action" option - the 100m Robert C. Byrd Green Bank Telescope (GBT) is a unique facility, and it provides opportunities for education and hands-on training in radio astronomy - an area of astronomy that NSF has invested in in terms of international projects, but which has seen the closure of multiple facilities within the U.S. in recent years.</p> <p>The size and "steerability" of the GBT make it a unique and powerful instrument. Further, it complements radio interferometers which, by definition, lack information at zero spacing. My colleagues and students have submitted emails in response to 81 FR 72124 focussing on specific science, so the main point I want to stress here is that there are a number of astrophysical phenomena which can be explored over the wavelength range covered by the GBT. More importantly, due to the optically thin nature of radio wavelengths, certain astronomical objects can only be studied using radio diagnostics.</p> <p>The GBO is also a unique in terms of its strength in EPO. Much time and effort have gone into making the GBO visitor center top-notch, and the amazing engineering accomplishment which is the GBT itself is breath-taking to visitors. I can remember the first time I drove out to Green Bank to see the telescope - the telescope is so large that when you first see it on your drive, you have the sense that you are much closer to the telescope than you actually are. Then when you arrive at the telescope, you are in awe of its actual size. I point this out by way of stressing the important role astronomy plays as a gateway to STEM - everyone is, to varying degrees, fascinated with astronomy. The GBT will have a lasting impression on anyone who visits the site. Indeed, I have seen many telescopes as a professional astronomer, and even I was taken aback - and inspired - by the GBT.</p> <p>It is also worth stressing that the GBO has been a regular part of astronomy REU programs at the University of Virginia and NRAO. In particular, visiting the GBO and observing with the GBT has been an important component of our summer programs which have strong participation from undergraduates enrolled in Historically Black Colleges and Universities.</p>	Against Closure	Email	11/25/2016	
210	b	Aaron	Evans	Professor, University of Virginia Astronomer, National Radio Astronomy Observatory	<p>The U.S. is reaching a crisis point in terms of educating the next generation of professional astronomers. The construction and operation of ALMA by NSF and its international partner organizations has provided a major step forward in radio/submillimeter astronomy - this international collaboration was essential to building a ground-breaking facility no single country could afford to build and operate. However, a casualty in this endeavor has been the falling number of radio facilities where students are able to conduct observations on-site and learn to problem-shoot technical issues that may arise. Further, radio telescopes like the GBT provide a platform on which new instrumentation or techniques developed by a small group of people (perhaps a professor and a student) can be tested. The U.S. is ultimately in danger of having no radio/(sub)millimeter facilities in North America where students can be educated. The decommissioning of CSO and CARMA have been major blows to the education of tomorrow's professional radio astronomers. The community cannot afford to lose the GBO as well.</p> <p>The NSF really needs to consider how it will support the growth of radio and submillimeter astronomy in the U.S.. It is not enough to pay for the construction and continuing operation of international facilities such as ALMA - NSF needs to provide the U.S. the means of inspiring the K-12 students through phenomenal technical and scientific instruments such as the GBT, and the tools necessary for college and graduate students to receive hands-on training. If these two issues are neglected, then the most likely future is that the U.S. will continue to fall behind in radio astronomy, and the next generation radio telescopes will serve as scientific tools primarily for astronomers residing in partner countries.</p>	Against Closure	Email	11/25/2016	
211	a	Rachel	Beaton	Postdoctoral Research Associate Observatories of the Carnegie Institution for Science Pasadena CA	<p>Email: I am writing in response to the call for comments in support of the Green Bank Observatory. In the attached documents (a Word Document and a PDF), I express my thoughts on this matter focusing on the influence the Green Bank Observatory and its staff have had on my personal career as an observational astrophysicist. I apologize that this letter has arrived late on the day of the deadline and hope that it is not too late to be included for consideration. I read for the first time in a reminder this morning (on the West Coast) that there may have been a time cutoff for comments of 4pm on the East Coast and did not have sufficient time to accommodate this deadline. If I am too late, then I hope this letter could be used in other ways to promote the extraordinary work at the facility. Please do not hesitate to contact me if you have questions or there is a problem with the submission.</p> <p>Letter: I am writing to express my support for the continued operation and full funding of the Green Bank Observatory as a science and education focused operation in Green Bank, West Virginia. In this letter, I will use my own experiences as an example to demonstrate the impact this facility has had on my career as an observational astrophysicist. Having grown up in a rural, socio-economically depressed area of South-Central Virginia, it is unlikely that I would have been prepared to pursue this career had it not been for the astronomers at the Green Bank Observatory.</p>	Against Closure	Email	11/25/2016	Beaton_GBTLetterofSupport.docx

Green Bank Observatory -Written NSF Public Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
211	b	Rachel	Beaton	Postdoctoral Research Associate Observatories of the Carnegie Institution for Science Pasadena CA	One month ago, I accepted the Robert J. Trumpler award from the Astronomical Society of the Pacific for a dissertation 'unusually important' to astronomy for my graduate research conducted at the University of Virginia. This is the highest award given in the United States for dissertation research and one of only a handful of awards given to early career researchers. The journey that led to this accomplishment started sixteen years ago with an email blast sent from my high school research methods teacher at the Central Virginia Governor's School for Science and Technology (Lynchburg, Va) to all the astronomers in the Central Virginia region (largely focused on the University of Virginia Astronomy Department and the National Radio Astronomy Observatory headquarters in Charlottesville, Va). That email only received one reply, which came from a Green Bank Observatory staff astronomer. In the months after the email was answered, I pursued my Junior Research Project supervised remotely by this same staff astronomer. The results of that project took me as far as the Intel International Science and Engineering Fair (Intel ISEF), where I my project represented the best high-school student research conducted that year from South-Central Virginia. My research project paled in comparison to some of the first-rate (even publishable) work being conducted by students who had the privilege to grow up in a more technically literate area and these students spent much longer on their projects working in close company with their scientist mentor. Regardless, I remained proud of what my mentor and I had accomplished via short-term remote mentoring and, as had occurred throughout my high school experience when I compared my opportunities to those of students in more urban areas, my eyes were more open to the disadvantages of my K-12 education imposed due to physical location. To even be eligible to attend the Central Virginia Governor's School for Science and Technology, I had to register for school in a different county and I traveled nearly 60 miles one way each day to attend to this specialized school for STEM education for my junior and senior year. Far from despondent in this realization, I was overwhelmingly thankful for the opportunity I had been given by an astronomer being willing to work with me at all.	Against Closure	Email	11/25/2016	Beaton_GBTLetterofSupport.docx
211	c	Rachel	Beaton	Postdoctoral Research Associate Observatories of the Carnegie Institution for Science Pasadena CA	While I did not place at the Intel-ISEF, I came home with something far more valuable; I found amongst those rows of posters a deep love for science and a sense that scientific research was that to which I would devote my life. While I had inklings that science was my passion, this was my first chance to be so fully immersed in research as a potential career. That fall, I wrote my application to the University of Virginia where I would eventually obtain a B.A. in Astronomy-Physics and Mathematics (2007), a M.S. in Astronomy-Physics (2008), and a Ph.D. in Astronomy-Physics (2014). While student loans paid the bulk of my tuition, I worked as a research assistant in astronomy from my first semester in college to pay my living expense, having been hired over older students due to my high school experience. In short, I owe my career to a scientist in Green Bank who affirmatively answered an email to support a high school student. That same astronomer, F. Jay Lockman, asked me to write today to demonstrate my support for the Green Bank Observatory, which I do without hesitation. While our specific charge for submitting comments is to speak to the research capabilities of the Green Bank facilities (which I will do), I would be amiss to not take a moment to express the impact of these facilities on the people who do or will do that research. Green Bank is a unique community. The scientists who choose to live there, deep within the National Radio Quiet Zone (NRQZ), choose to do so because they love their research and they are willing to make a sacrifice of convenience to pursue that love. They are also individuals who are willing to work and inspire young astronomers in rural areas, where access to the facilities necessary to do cutting-edge research (and thereby to learn from cutting-edge researchers) is severely limited due to proximity. The scientists in Green Bank send their children local schools and participate in their local community at a level that I have not seen at other observatories across the globe; these efforts do not stop in Green Bank itself, but rather extend broadly across all of rural West Virginia and Virginia. Indeed, while visiting schools across southern Virginia for science outreach events and in my own personal travel, the Green Bank Observatory is the most recognizable astronomical observatory behind the Hubble Space Telescope. An entire generation of high school students across the rural counties of West Virginia and southern Virginia, including myself, have been given access to the Universe through the educational and outreach programs initiated by motivated scientists in Green Bank. Many of these programs were funded as the broader impacts components that accompany larger scientific endeavors (an example being the Pulsar Search Collaboratory). If the Green Bank Observatory is given completely to commercial or classified pursuits, such programs would most likely decline in concert with the astronomical research activities.	Against Closure	Email	11/25/2016	Beaton_GBTLetterofSupport.docx
211	d	Rachel	Beaton	Postdoctoral Research Associate Observatories of the Carnegie Institution for Science Pasadena CA	As someone who considers herself equally a scientist and an educator, I believe strongly that the most innovative and inspiring outreach programs accompany the most innovative and inspiring research. Moreover, I believe that the greatest impact on the attitudes and motivations of students is made by putting innovative and inspiring physicist-educators as directly into the classroom as is feasible. As a graduate student at the University of Virginia, realizing the impact of a single motivated scientist at Green Bank on my own development, I worked to promote broader access to astronomy in rural communities through the 'Dark Skies, Bright Kids!' program and via founding a continued partnership between University of Virginia graduate students, National Radio Astronomy Observatory astronomers, and high school students at the Central Virginia Governor's School for Science and Technology (my alma mater in Lynchburg, VA). The latter program mimics the event described at the opening of this letter and provides the access and mentoring required for five high school students to complete high-level astronomy research projects each year. The bulk of these projects directly use data from the Green Bank Telescope, most notably the PRIMOS astro-chemistry program that works to understand how molecules crucial to life on Earth form in interstellar environments (where the material that formed our solar system was formed) and the Megamaser Cosmology Program (MCP) that uses the environments around supermassive black holes at the centers of galaxies to measure the expansion rate of the Universe. The mentoring program was directly inspired from my own experiences and I was honored to have been a scientist-educator for the Second Astronomy Night at the White House in 2015 in recognition of my education and outreach activities (one of only two full-time scientists, the other also being a NRAO astronomer). The first high school student I mentored is now a second year graduate student in the Department of Astronomy at the University of Virginia and is a prestigious Jefferson Graduate Fellow. Thus, that email answered in Green Bank sixteen years ago continues to reach rural high school students and encourage their participation in the scientific community.	Against Closure	Email	11/25/2016	Beaton_GBTLetterofSupport.docx

Green Bank Observatory -Written NSF Public Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
211	e	Rachel	Beaton	Postdoctoral Research Associate Observatories of the Carnegie Institution for Science Pasadena CA	<p>After my high school project, my path in astronomy has largely led me away from radio frequency observations. I did however spend eleven years in Charlottesville, Virginia pursuing my degrees and I can speak directly to the impact of the Green Bank Observatory in the astronomical research undertaken by my mentors and peers. The large, steerable, single-dish facility is unique amongst international facilities; these aspects permit very sensitive observations over the full sky visible from West Virginia in short amounts of time that is not replicated by other multi-dish facilities. In particular, the sensitivity permits time-domain applications, most notably searches for and the timing of millisecond pulsars (e.g., GUPPI) that allow astronomers to probe the extreme physical conditions of matter. The setup of the focal plane permits the development of new technologies, most notably the the MUSTANG instrument that can be considered a hybridization of radio and optical based technologies that permits detailed study of the distribution of matter in the Universe on large galaxy cluster scales (it is effectively a "camera" that uses radio detectors unlike traditional radio-frequency instrumentation that effectively have only 1 pixel). In a society increasingly reliant on consumer technologies that rely on radio-frequency transmission, the existence of the National Radio Quiet Zone (NRQZ) makes Green Bank a unique in its reduced reliance on ex post facto radio frequency interference (RFI) removal techniques. For all of these reasons, the current and future capabilities of the Green Bank Observatory are not matched by other facilities either in the United States or across the globe.</p> <p>As an astronomer that largely relies on optical and near-infrared facilities, the NSF has already divested from numerous small-aperture telescopes previously under the care of the National Optical Astronomy Observatory (NOAO). This divestment includes the bulk of the facilities on which my dissertation work was based. While the loss of these facilities has deep consequences for access to such facilities for institutions without privately funded facilities, many of the specific technical capabilities are feasible elsewhere (though largely on privately funded facilities with dramatically less 'open' application policies). Thus, the loss to the body of knowledge produced by the scientific community is somewhat mitigated by the existence of comparable facilities (i.e., the investigations can happen, just pursued by a different set of scientists). This is simply not the case for the Green Bank Observatory, whose full capabilities are unmatched by any other current facility, private or public. For technical reasons, multi-aperture facilities that boast similar (or even larger) total collecting areas are simply not comparable in sensitivity to the Green Bank telescope owing to how the signals from these distinct telescopes are combined. For many scientific experiments -- including all of those on which I have participated directly with Green Bank observations and those that most strongly inform my own work -- these technical differences are sufficient to make the projects infeasible with any other telescope.</p>	Against Closure	Email	11/25/2016	Beaton_GBTLetterofSupport.docx
212	a	Robert	Strong	<p>Director: Near Earth Object Foundation http://www.neofoundation.org/</p> <p>Director: SMART-Center http://www.smartcenter.org/</p> <p>Curator SMART Centre Market 30 22nd Street Wheeling, WV 26003 http://www.smartcentermarket.com</p>	<p>I am astounded and bewildered that we are even having this conversation. As far as the proposed changes for the Green Bank Observatory Operations I ask that you DO NOT Negatively Change the present Funding.</p> <p>Please choose the 1st action: Continued NSF investment for science-focused operations (No-Action Alternative)</p> <p>The Green Bank Observatory Complex at Green Bank, West Virginia is without a doubt one of the shining jewels in the crown of the National Science Foundation, and there is little doubt that the Green Bank Telescope (world's largest fully steerable radio telescope) is THE largest and shiniest of these jewels.</p> <p>The six-decade long commitment to the Green Bank Observatory by the National Science Foundation towards fundamental, pure, basic scientific research is the hallmark of a civilized country's responsibility to the future of basic science and to citizen scientists and professional scientists domestic and international. This commitment is not just to equipment, instrumentation, staff, and facilities – this commitment should be given to the flagship of NSF astronomical research. The National Science Foundation needs to take the Green Bank Observatory seriously as a permanent funding line item rather than gradually cut it off. Basic science never ever pays for its way in the world. Everybody knows that – why would the Green Bank Observatory be any different?</p> <p>It is unnecessary to reiterate the scope and scale of importance that the Green Bank Observatory has for the pride of both West Virginia and the rest of the Nation. Please consider beyond what is best for the next fiscal year, or a quick fiscal fix to ease a faceless bureaucratic bean-counter in some nameless office in Washington, DC. Do the right thing and leave the Green Bank Observatory Complex just as you found it. If you must change anything, anything at all – please increase funding to the Green Bank Observatory.</p>	Against Closure	Email	11/25/2016	
212	b	Robert	Strong	<p>Director: Near Earth Object Foundation http://www.neofoundation.org/</p> <p>Director: SMART-Center http://www.smartcenter.org/</p> <p>Curator SMART Centre Market 30 22nd Street Wheeling, WV 26003 http://www.smartcentermarket.com</p>	<p>This commitment is additionally to a way of life that only comes from living in the shadow of the Green Bank Observatory Complex as a world-class astronomical research facility. It would be difficult to impossible to estimate the inherent scientific and cultural "value" of the Green Bank Radio Quiet Zone that surrounds the Green Bank Observatory facility and the Green Bank community. Equally, it would be difficult to place a dollar value on the value-added nature of having a world-class radio-quiet-zone to do radio astronomy in within driving distance of two-thirds of the population of the United States.</p>	Against Closure	Email	11/25/2016	

Green Bank Observatory -Written NSF Public Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
213	a	J.T.	Arbogast	FILMMAKER + PERFORMER + DIGITAL STRATEGIST	<p>I am writing to voice my support for the continued NSF investment for science-focused operations in the Green Bank Observatory.</p> <p>While I grew up in Pennsylvania, most of my family still resides in Pocahontas County. My mother and father met at Green Bank High School and, growing up, most of my summers and all holidays were spent back "home" in Cass, WV.</p> <p>I grew up in the 80s at a time when space exploration was hugely popular. Every kid wanted to be an astronaut. And, as a child, I always thought of the observatory as this incredibly special and secret place in my family's backyard with "a telescope the size of a football field". It wasn't until it came up as part of the discussion in my 5th grade science class that I began to realize just how famous it was.</p> <p>I remember so many moments...seeing the flashing light at the top of the scope at night or noticing the position change or taking bike rides with my cousin down to the base of the telescope...each time looking up into the sky and thinking, "I wonder what they're hearing today?" At a time when more and more devices are forcing our children to look downward into a small screen, it's more important than ever to provide opportunities for them to look up...to think beyond the world that they see in front of their eyes.</p> <p>Having had the chance to really get to know the team over there as an adult and hearing about the incredible things that they are doing, meeting some of the visiting scientists from around the world who chose this place to advance their research because of the tools and technology at their fingertips. I think that speaks volumes to the GBO's importance to the global science community.</p> <p>Therefore, it is my opinion that the NSF must continue funding the Green Bank Observatory to allow for the continued groundbreaking research and discoveries by some of the world's greatest minds, for the continued growth and prosperity of a community nestled away in the mountains of West Virginia, and for the continued inspiration of every young person who sees that telescope for the first time and asks the question, "I wonder what they're hearing today?"</p>	Against Closure	Email	11/25/2016	
213	b	J.T.	Arbogast	FILMMAKER + PERFORMER + DIGITAL STRATEGIST	<p>But, it's more than that. The Green Bank Observatory is a vital part of the local community and the impact that closing this facility would have on the region from the loss of jobs, Health and Safety, educational programs, community organizations and development would be devastating.</p>	Against Closure	Email	11/25/2016	
213	c	J.T.	Arbogast	FILMMAKER + PERFORMER + DIGITAL STRATEGIST	<p>Not to mention the economic impact of losing one of the areas most popular tourist attractions. Revenues generated from tourism in the state of West Virginia would suffer as over 45,000 people visit, purchase tickets, food, and fantastic gifts and educational resources in the gift shop – all purchases providing additional tax money to the bottom line for West Virginia's income. It is estimated that the Green Bank Observatory contributes close to \$30 million to the local and state economies.</p>	Against Closure	Email	11/25/2016	
214	a	Gregory	Gallagher	Writer, Filmmaker & Executive-Producer	<p>To Whom It May Concern - As a partner with the legendary Jean-Michel Cousteau and his Ocean Futures Society program called "Ambassadors of the Environment", we aim to inform and educate the next generations about how our world works, and more specifically, how to stay healthy and happy while we do this tricky work.</p>	Against Closure	Email	11/25/2016	
214	b	Gregory	Gallagher	Writer, Filmmaker & Executive-Producer	<p>Science is a complex and controversial domain, filled with a variety of heroic standard-bearers, dedicated troops, and charlatans financed by business interests ignorant of the larger picture for the planet's citizenry.</p> <p>It is absolutely critical therefore to continue science-based operations, keeping the Green Bank operational, and the important work already underway.</p> <p>Our children's children depend on our good sense and smart moves going forward.</p>	Against Closure	Email	11/25/2016	

Green Bank Observatory -Written NSF Public Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
215	a	James	Moran	D. H. Menzel Professor of Astrophysics, Harvard University, emeritus	I write in support of option 1 (Continued NSF investment for science-focused operation) or option 2 (collaboration with interested parties for science and education focused operations with reduced NSF-funded scope) in the NSF notice about the GBO issued on October 19, 2016. I believe I can bring a rather broad perspective to this issue having been involved in astronomical research, albeit mostly radio astronomy for more than fifty years, chair of the Astronomy Department of Harvard University for five years, and a member of the National Academy of Sciences. I understand the dilemma that the NSF faces in trying to provide the best instruments available for astronomical research while dealing with the burden of operational expenses, which requires redundant and less productive facilities to be phased out. However, in this case I firmly believe that the funds saved by divesting the 100-m telescope of the Green Bank Observatory (aka the GBT) is not a cost effective move in the attempt to maximize the impact of astronomical research in the United States. The GBT is often called the largest fully steerable telescope in the world. However, that description does not begin to convey the value of this technological marvel. It was only commissioned in the year 2001 and it still the most modern telescope in its wavelength range. It has two unique features among large telescopes. It has an off-axis optics system, which is a tour-de-force of mechanical innovation that provides a completely unblocked aperture. This feature allows the formation of a beam of extremely low sidelobe level that make the telescope unique in its ability to reject unwanted emission and achieve exceptionally high dynamic range in its image formation. The second feature is its laser metrology and the motorized independent control of its panels, which makes it one of the highest gain radio telescopes ever built, with beamwidths as small as 8 arcseconds. The GBT has not come close to its peak productivity because of the rapidly developing technology applicable to its detector systems. The synergy among the groups developing this technology is truly remarkable. Perhaps the most important of these technologies is the development of multipixel detectors by university groups. Unlike CCD technology at optical wavelengths, the mechanical and electrical difficulties of producing multipixel systems are only slowly being overcome at radio wavelengths, and with devices of much smaller scale. The 200 element system developed by a consortium led by the University of Pennsylvania and funded by the NSF-ASTI program, although small by CCD standards, makes the telescope x200 times faster than the single pixel telescopes available just a decade or so ago. This type of instrumentation will eventually be applied to interferometric arrays such as ALMA and JVLA, but it is technologically so complex that its implementation on such large instruments is at least a decade away. Until that time it is essential to have some large single apertures to complement these arrays. I would also like to mention that I am supportive of the concept that telescopes should deliver "user ready data products", but I also firmly believe that the US needs to maintain a pipeline of astronomers who really understand instrumentation. The GBT lends itself to this purpose much more readily than the major interferometric arrays, and the connection to the university instrumentation community is clearly in evidence, as mentioned previously. I strongly recommend that every effort be made to keep the GBT available as much of the time as possible for cutting edge astronomical research.	Against Closure	Email	11/25/2016	GBT_NSF_2016.pdf
215	b	James	Moran	D. H. Menzel Professor of Astrophysics, Harvard University, emeritus	I strongly endorse the white paper "The NSF's AST Portfolio Review of 2012 is Not Relevant to the GBT of 2017" by Lockman, Lynch, Frayer, Mason and Ransom. I will not repeat the cogent arguments made in that document. It demonstrates that the GBT has very broad applications, and is clearly in high demand and well oversubscribed. However, two areas particularly resonate with me, both involving black holes. Studying black holes has received several recent boosts from new types of observations: the detection of gravitation waves from merging black holes with LIGO, and the promise of being able to image the supermassive black hole (SMBH) in the center of our galaxy with the Event Horizon Telescope. In the first case, LIGO's fantastic discovery opens up just one "frequency range" of this new window on the universe. The GBT is a critical element of the network of telescopes doing pulsar timing which can be expected to detect gravitational waves from the stochastic background and, hopefully, the single event mergers of SMBHs in the relatively near future, and therefore anchor the field at "nanofrequencies." Thus there is a good chance that the GBT will have an important role in this nascent field of gravitational wave astronomy. Secondly, though the EHT will image nearby SMBHs on the scale of their event horizon, the global millimeter VLBI array (GMVA) will play an important role in figuring out how jets are formed and launched on slightly larger scales. Arrays such as the GMVA are critically dependent on have a few large apertures such as the GBT because the coherence times are so short that detection requires these large apertures to achieve adequate signal-to-noise ratio on baselines involving smaller apertures.	Against Closure	Email	11/25/2016	
216		Barb	Payne		This is my public submission regarding the Green Bank observatory. Please choose: 1) Continued NSF investment for science-focused ops (no-action alternative). Green Bank is too important to limit, mothball or close.	Against Closure	Email	11/25/2016	
217		Melissa	Chalmers		Please take my public submission regarding the Green Bank observatory. 1) Continued NSF investment for science-focused ops (no-action alternative) Green bank is too important to limit, mothball or close.	Against Closure	Email	11/25/2016	
218	a	Erica	Harvey	Professor of Chemistry	I am writing to express my support for keeping the Green Bank Observatory functional with NSF support. I teach Physical Chemistry at Fairmont State University. My upper-level chemistry students and I have been making 4 day research field trips to [then] Green Bank NRAO in the spring for the past 10 years, as part of CHEM 4412 Physical Chemistry II (Quantum Chemistry). We study the rigid rotor system and read about the types of spectroscopy available in the radio region of the spectrum. This culminates in the trip to Green Bank, where the students are able to join students from Glenville State University and team up on research projects to apply what they have learned. We were there one year when a team of researchers from Harvard was finding the first anions in space! Year after year, the chance to interact formally and informally with professional scientists from around the world and world-class scientific staff from Green Bank NRAO has been inspirational for my students and for me. A majority of my students are first generation college students, and most of them had no idea such careers even existed – including the professional support staff careers. We have no astronomy major at our college, so for many of my students this also is a first and treasured introduction to astronomy.	Against Closure	Email	11/25/2016	

Green Bank Observatory -Written NSF Public Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
218	b	Erica	Harvey	Professor of Chemistry	<p>On a personal level, my own children got their first exposure to astronomy from a homeschooling trip to Green Bank when they were 8 or 10 years old. They came back enthusiastic, as did their father (also a chemist). The Science Center that Sue Ann Heatherly has put together is really world-class example of informal science education, and tells the story of radio astronomy and the research in a way that is compelling to people of all ages and levels of science understanding. My students and I spend hours there each time we visit, and I learn something every time. Likewise, the tours of the site are always great. My entire extended family gets Christmas and birthday presents from the gift shop there, and many of my former students are still sporting geeky-cool tshirts they got on their trip.</p> <p>The degree to which this facility gives a different type of pride to West Virginia, a state which has not always been the most science-friendly, is very hard to put a dollar value on. My students from years past recall this trip as one of the highlights of their undergraduate career. I will be heartbroken if this treasure of West Virginia is no longer available.</p>	Against Closure	Email	11/25/2016	
219		Giles	Novak	Professor of Physics and Astronomy Northwestern University	<p>I am writing to express my support of the "No-Action" option for the Environmental Impact Statement for changes to operations at Green Bank with respect to the Green Bank Telescope.</p> <p>The Green Bank Telescope is the world's largest steerable radio telescope, and is at the cutting edge of a number of very exciting areas of astronomical research. For example, observations using this telescope may be able to follow up on the discovery of gravitational waves that the NSF's LIGO experiment made earlier this year. Gravitational waves were predicted by Albert Einstein about 100 years ago, so the LIGO discovery was truly historic. Gravitational waves can alter the propagation times of the exquisitely regular radio pulses from neutron star "pulsars", and such pulses can be observed by the Green Bank Telescope. I could provide many other examples of important work that will become possible if this precious national resource is allowed to continue operations.</p>	Against Closure	Email	11/25/2016	GBT.pdf
220		Miller	Goss		<p>I am writing about your EIS statement concerning the Green Bank Observatory. I am a former Assistant Director of the National Radio Astronomy Observatory and Director of the Very Large Array and the Very Long Baseline Array from 1988 to the end of 2001. Previously I had been a Professor of Radio Astronomy at the Kapteyn Astronomical Institute of the University of Groningen (Netherlands) in the 1980s. My PhD had been received from the University of California, Berkeley, in 1967. In the intervening years, I had worked at the CSIRO Division of Radiophysics in Sydney, Australia (Parkes) and the Max Planck Institute in Bonn (Effelsberg). I retired from the National Radio Astronomy Observatory in 2016 and am now an active member of the staff of NRAO in Socorro, New Mexico, with an emeritus appointment.</p> <p>I have been a user of Green Bank since the 1970s, with frequent use of the Green Bank Three-element interferometer, the 300 foot, the 140 foot and recently the Green Bank Telescope (GBT). My opinions about the continued use of the GBO are guided by compelling arguments for the maintenance of the current status of the GBT and the prospects for its future use. The GBT is and will remain the most successful large single dish radio telescope for some decades, well into the 21st century. From my point of view there are many reasons for this viewpoint. The most important are four-fold: (1) The demonstrated success as a high frequency instrument, up to 110 GHz, with multi-pixel receivers, (2) A key element in high frequency Very Long Base Line Interferometry (e.g. observations of the radio sources associated with the million solar mass black hole at the center of the Milky Way and high frequency observations of radio sources associated with black holes at the centers of external galaxies), (3) the use of the GBT as the key component of the NANOGrav community for pulsar timing at radio wavelengths (the connections with LIGO and the spectacular detection of gravitational waves published in February 2016) and (4) the successful technological collaborations between the GBO and a number of collaborations with US university groups in the NSF AST-ATI program.</p> <p>In summary, I strongly support the continuation of NSF support for the Green Bank Observatory, that is the No-action Alternative. The GBO will remain a vibrant part of the US astronomical community for many years.</p>	Against Closure	Email	11/25/2016	NSF.GreenBank.EIS.from.WM.Goss.25nov2016.docx
221	a	Deborah	Kopald		<p>"Continued NSF investment for science-focused operations (No-Action Alternative)"</p> <p>Green Bank Observatory needs to be kept open for exploration of the cosmos.</p>	Against Closure	Email	11/25/2016	
221	b	Deborah	Kopald		<p>A radio free quiet zone is also necessary for those who cannot tolerate wireless signals. It is the only "control area" left in the nation.</p>	Against Closure	Email	11/25/2016	

Green Bank Observatory -Written NSF Public Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
222	a	Donald	Campbell	Professor of Astronomy	<p>Pulsar timing and gravitational waves: It is widely accepted that precision timing of selected pulsars has the potential to detect gravitational waves in a different frequency regime than the one that LIGO is sensitive to. The NSF Division of Physics (with a contribution from Astronomy) has provided significant funding for the North American Nano-Hertz Gravitational Wave Observatory for this purpose, a portion of which is "buying" time on the GBT. While the Arecibo telescope is more sensitive than the GBT, its restricted sky coverage means that the GBT is also a critically needed component of the North American Pulsar Timing Array (PTA). The PTA is important not just for its use to detect gravitational waves (the NANOGrav program) but also for detailed studies of the physics compact objects.</p> <p>Fast radio bursts: The 64 m Australian Parkes radio telescope has been a major player in the detection and study of the enigmatic Fast Radio Bursts (FRBs) and the GBT has capability for a similar, or larger, role in the northern hemisphere. However, this capability would be greatly enhanced by the addition of a multi-beam system at cm-wavelengths. The 7-element FLAG L-band phased array system being developed by Brigham Young University in conjunction with the GBO would satisfy this need greatly enhancing the GBT's role in the study of FRBs.</p> <p>Planetary radar astronomy: For the past 20 years or so the GBT has been a critical resource for solar system studies primarily through bi-static radar observations in conjunction with the NSF Arecibo and NASA Goldstone planetary radar systems. Current Arecibo-GBT studies are concentrated on 70 cm wavelength studies of sub-surface structures on the Moon plus some near-Earth asteroid (NEA) observations. Goldstone-GBT radar speckle interferometric observations provide instantaneous, high precision measurements of the spin state of some planets and satellites (e.g. Mercury, Venus, Europa) providing information about their internal structure. For Mercury these measurements led to the confirmation that it has a liquid outer core (Margot et al, Science (cover), Volume 316, Issue 5825, pp. 710, 2007) resulting in considerable publicity for the GBT. Similarly Goldstone-GBT bi-static radar studies of near-Earth asteroids can in many instances significantly improve the quality of astrometric and characterization observations for these scientifically interesting and potentially hazardous objects.</p> <p>The NSF needs to find a means by which the GBT can continue as a critically needed telescope for the nation's astronomers.</p>	Against Closure	Email	11/25/2016	GBO EIS statement Nov 25 2016.pdf
222	b	Donald	Campbell	Professor of Astronomy	<p>Astronomical community access: The Green Bank 100 m telescope (GBT) is the largest fully steerable single dish radio telescope in the world and its collecting area combined with high quality instrumentation is a valuable resource for astronomical observations. Into the future, at least 50% of the time should be available to the general astronomical community. Currently, the expectation is that NSF funding will be reduced to about 20% of the current budget and it is being stated that this means only 20% of the observing time on the telescope will be available to the general astronomical community. Every effort should be made to shed unnecessary parts of the sprawling Green Bank Observatory in order to minimize costs and maximize the time available for astronomical observations with the GBT.</p> <p>Breakthrough SETI funding: As I understand, the Breakthrough SETI funding is only a five year commitment. What are the plans for compensating for the loss of this funding at the end of this period?</p>	Alternatives Consideration	Email	11/25/2016	GBO EIS statement Nov 25 2016.pdf
223	a	Rachel	Osten	Associate Astronomer with Tenure Deputy Mission Head, Hubble Space Telescope Mission Office Space Telescope Science Institute	<p>I write concerning the NSF's review of possible changes to operations at the Green Bank facility in Green Bank, West Virginia. The Green Bank Observatory is at the forefront of astrophysics, observing at wavelengths spanning low frequencies to high radio frequencies. It would be disastrous for science to lose this facility. Crucially, since the NSF's portfolio review in 2012, the Green Bank Telescope now routinely operates in the 3mm band. This had not been completed at the time of the review, and is a significant enhancement of the GBT's capabilities which are unparalleled elsewhere. In the intervening years, results from the NSF's ALMA observatory have been pouring in, invigorating mm to sub-mm astronomy. The high frequency science that the GBT does extends what ALMA can do in unique ways because of its large single-dish, off-axis design, as well as the frequency range. ALMA is essential for deep probes of small-field regions of the sky, while the GBT can survey larger regions to pick out interesting objects. The GBT is incredibly sensitive to low-surface brightness phenomena, and can fill in the short spacing information at 3 mm needed for a complete interpretation of ALMA's interferometric data. The 3mm spectral region is rich with molecular lines, important for understanding the building blocks of life. This is fundamental to understanding how to answer the age-old question "How did we get here?". As the high frequency instrumentation and operations have only recently been able to proceed in earnest, and they are heavily oversubscribed indicating significant interest, it would be premature to ramp down this critical capability at this time.</p>	Against Closure	Email	11/25/2016	GBT_NSF.pdf
223	b	Rachel	Osten	Associate Astronomer with Tenure Deputy Mission Head, Hubble Space Telescope Mission Office Space Telescope Science Institute	<p>The GBT is the only large national observing facility that allows for university-based instruments to be installed, providing a vital opportunity for hands-on experience which is disappearing in the U.S. The high frequency receivers currently on the GBT, namely MUSTANG-2, ARGUS, and PHAROS, were built by collaborations between university groups and the GBT.</p>	Against Closure	Email	11/25/2016	

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Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
223	c	Rachel	Osten	Associate Astronomer with Tenure Deputy Mission Head, Hubble Space Telescope Mission Office Space Telescope Science Institute	<p>Another scientific area in which the GBT excels is pulsar observing. With the discovery in 2015 of gravitational radiation from inspiralling black holes, the need to observe and understand sources of gravitational radiation is more compelling than ever. The GBT is an important component of detecting nano-Hz gravitational radiation through a pulsar timing array of millisecond pulsars. Because of its sensitivity and location in the National Radio Quiet Zone, the GBT is a foundational component of this North American Nanohertz Observatory for Gravitational Waves. These gravitational waves are distinct from those measured in the kilohertz frequency range by ground-based gravitational wave interferometers like LIGO, and the millihertz frequency range to be probed by future space-based gravitational wave missions. They arise from supermassive binary black holes in the early stages of inspiral, and possibly more exotic sources which would reveal new physics frontiers. The GBT's extensive sky coverage is needed to detect these correlated signals. Losing the GBT as well as possibly the Arecibo Observatory would cause the US to cede its ability to remain pathfinders in the detection and study of sources of gravitational wave radiation. The GBT is used for a wide range of astrophysics, from observing comets, to star forming regions, to gas in and around galaxies, and answers important questions about how the universe works. Bally et al. (2016 arXIV:1610.09014) details some of these areas. Its existence is also important for the purpose of training the next generation of radio instrumentalists.</p> <p>It is also important to have US investment in national observatories centered in the northern hemisphere. Many of the current and future large telescope projects are moving to the southern hemisphere, because of advantageous observing conditions (the high, dry site of the Atacama desert is necessary for ALMA; the LSST is being built on Cerro Pachón). Being able to study all parts of the observable universe is key to overcome cosmic variance; science happens in the northern hemisphere sky too. There are political as well as scientific implications to having a growing number of sensitive forefront observatories funded in whole or in part by the U.S. physically located in other countries. With the uncertain forecast for U.S. scientific funding in the incoming administration, it would seem common sense to be able to demonstrate the benefits to local communities as well as the U.S. and larger scientific communities of having these facilities working.</p> <p>In summary, I advocate for the NSF to continue its investment for science-focussed operations of the Green Bank Observatory.</p>	Against Closure	Email	11/25/2016	
224		Bill	Shillue		I am a current engineering staff member of the National Radio Astronomy Observatory (NRAO). I spent three years working in Green Bank for NRAO at the facilities which are now called the Green Bank Observatory (GBO). Since that time I have worked at other NRAO sites, but in the last three years I have once again had the opportunity to work in collaboration with staff members of GBO, and have work on the site for extended periods. I have always found the technical staff of the GBO to be exceptionally competent and professional, and I have also benefited from the skill and expertise of the machine shop and maintenance staff. My opinion is that the Green Bank Telescope (GBT) is a unique and world-leading instrument and constitutes a unique and important national asset for the accomplishment of ground-breaking science. An instrument of this quality and capability is just entering the most productive part of its lifetime. I therefore urge continued support of the site and the GBT for science operations.	Against Closure	Email	11/25/2016	
225	a	Paul	Brook	Postdoctoral Research Fellow North American Nanohertz Observatory for Gravitational Waves	<p>I am writing to submit a formal comment on the proposed changes to the operation of the Green Bank Observatory (GBO).</p> <p>Last year, I completed my PhD in Astrophysics at the University of Oxford in England. I had previously spent time in West Virginia and had visited the GBO. These visits led to me deciding that I would like to continue my career at West Virginia University. I started work in the Astrophysics department of WVU in March of this year, and it's great to be part of such a dynamic and burgeoning group. The reason the group is so strong is in no small part due to having such fantastic telescopes in the state. I know that I am one of many scientists who are drawn from all over the world to West Virginia, for similar reasons. I am also one of over 100 members of NANOGrav, a collaboration of astronomers, physicists, engineers, and data scientists at 34 institutions across North America. We are on the verge of making the first detection of low-frequency gravitational waves from supermassive black holes — a discovery as transformational as the discovery of gravitational waves from stellar mass black holes announced by LIGO. NANOGrav uses an array of high-precision radio millisecond pulsars - precise astrophysical clocks — to search for small perturbations caused by gravitational waves. The Green Bank Observatory is absolutely critical to this effort because it provides outstanding sensitivity to these weak astronomical signals over 85% of the sky. No other facility in the world offers GBO's combination of sensitivity and sky coverage. NANOGrav also uses the Arecibo Observatory in Puerto Rico, which has higher sensitivity, but is restricted to a smaller viewing area than GBO. The GBO and Arecibo each contribute 50% to NANOGrav's sensitivity to gravitational waves.</p>	Against Closure	Email	11/25/2016	nano_template.pdf
225	b	Paul	Brook	Postdoctoral Research Fellow North American Nanohertz Observatory for Gravitational Waves	Many of the proposed changes to GBO operations would have a major detrimental impact on NANOGrav, and in turn would affect the careers of dozens of astronomers, engineers, and technicians. Many of the scientists are just beginning their STEM careers. These changes will adversely affect the socioeconomic and cultural environment in Pocahontas County, at West Virginia University, and at scientific institutions across the United States.	Against Closure	Email	11/25/2016	
225	c	Paul	Brook	Postdoctoral Research Fellow North American Nanohertz Observatory for Gravitational Waves	<p>Here are the impacts of each proposed scenario, as I see it:</p> <p>No-action alternative: Under this preferred scenario, NANOGrav could continue critical scientific activities. Our program to monitor over 50 millisecond pulsars would continue under a current contract with GBO. Importantly, surveys to find new millisecond pulsars with the GBT would also continue. These surveys, and the vital follow-up of new pulsars, are conducted under NSF open skies time.</p>	Alternatives Consideration	Email	11/25/2016	

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Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
225	d	Paul	Brook	Postdoctoral Research Fellow North American Nanohertz Observatory for Gravitational Waves	Collaboration with partners for continued science-focused operations: This scenario would allow NANOGrav to continue its pulsar monitoring program, but would severely impact surveys for new pulsars and the follow-up observations that identify the best candidates for NANOGrav. Because these programs operate under open-skies time, any reduction in NSF funding will similarly reduce the time available for our surveys. Scheduling pressure will also make it more difficult to characterize new discoveries, and will greatly reduce the impact of NANOGrav's ancillary science, which is itself some of the most impactful conducted at GBO. Thus, while this scenario would allow NANOGrav to make progress towards discovering low-frequency gravitational waves, it would slow the rate of that progress.	Alternatives Consideration	Email	11/25/2016	
225	e	Paul	Brook	Postdoctoral Research Fellow North American Nanohertz Observatory for Gravitational Waves	Transition to an education and technology park, mothballing, or full deconstruction: These scenarios would devastate NANOGrav science and the careers of dozens of astronomers. They incentivize pursuing careers outside of the US, especially for young astronomers, and would thus drain the US of important expertise in this revolutionary new area of astronomy. This would come as several countries are improving their infrastructure and instrumental capabilities in the search for low-frequency gravitational waves. The Five Hundred Meter Aperture Spherical Telescope (FAST) in China represents a huge investment on the part of the government of China in this scientific area. Changes to GBO operations that adversely impact NANOGrav will thus effectively cede US leadership in low-frequency gravitational wave astronomy to other nations. The GBO (and Arecibo) are currently the best telescopes in the world for NANOGrav science and they may very well remain so for the next decade. In addition, the elimination of this scientific institution will remove a technology center in a region with few skilled positions. Even conversion to an education and technology center would still likely result in the export of a number of good-paying jobs to highertech areas of the country. The people of Pocahontas County are proud of the observatory.	Alternatives Consideration	Email	11/25/2016	
225	f	Paul	Brook	Postdoctoral Research Fellow North American Nanohertz Observatory for Gravitational Waves	At the November 2016 public comment meeting regarding the future of the GBO, not a single person complained about living in the National Radio Quiet Zone, and the public was clearly supportive of continued public funding of the GBO. As you can see, the scientific, socioeconomic, and cultural impacts of reducing NSF funding for GBO are numerous and severe. Such action would be a huge loss for my career, the careers of my colleagues, the NANOGrav collaboration, the US astronomical community, and the people of Pocahontas County, West Virginia. I urge NSF to adopt the no-action alternative in the strongest possible terms. Thank you for your consideration. If you have any questions or need further information, please contact me at the address above.	Against Closure	Email	11/25/2016	
226	a	Cornelia	Lang	Department of Physics & Astronomy	I am writing to express my endorsement for continuation of NSF support for the Green Bank Observatory, which lies in the United States National Radio Quiet Zone in West Virginia. The Robert C. Byrd Green Bank Telescope (dedicated in August 2000) is a world class observing facility with opportunities for scientific researchers and staff, students, technical staff and the general public. The Green Bank Observatory is currently playing a major role in several international projects, including the search for gravitational waves using pulsar timing experiments. Many students at US institutions (including universities and high schools) are involved in this ground-breaking work which may be able to confirm other detections of gravitational waves (using an independent method) in the years to come. This research is possible because of the support that the Green Bank Observatory gets from the NSF. There is always a cost to maintaining such a state-of-the art research facility. However, the investment in such a facility leads to ongoing and transformative scientific research. I urge the NSF to continue funding and supporting the scientific endeavors at the Green Bank Observatory at the current level with no changes as this facility provides significant contributions to the landscape of scientific discovery in the US.	Against Closure	Email	11/25/2016	
226	b	Cornelia	Lang	Department of Physics & Astronomy	Investment by the NSF should be maintained to support the operations and scientific work of the staff of the Green Bank Observatory as this is a national facility that is used by many researchers in the US to carry out truly groundbreaking astronomical observations. Many users of the Green Bank Observatory are from colleges and universities who currently don't have observing facilities of their own. In this way, the Green Bank Observatory is an incredible resource for colleges and universities who can use data from the Green Bank Observatory to help train the next generation of students for scientific and technical careers.	Against Closure	Email	11/25/2016	
226	c	Cornelia	Lang	Department of Physics & Astronomy	It also is an important asset to the surrounding rural community, as it represents a source of jobs and technical training for many in the region.	Against Closure	Email	11/25/2016	
226	d	Cornelia	Lang	Department of Physics & Astronomy	In addition, the radio-quiet nature of the surrounding area is critical to making observations in important wavelength ranges that are elsewhere not nearly as highly protected. The scientific capabilities of the Green Bank Observatory are unique and are a significant contribution to the portfolio of the American astronomical community.	Against Closure	Email	11/25/2016	

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Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
227	a	Andrew	Baker	Department of Physics and Astronomy Rutgers, The State University of New Jersey	I am writing in support of the continued operation of the Green Bank Observatory (including the Green Bank Telescope) as a scientific and educational facility. I am an associate professor on the faculty of the Department of Physics and Astronomy at Rutgers, The State University of New Jersey; the focus of my research and a significant fraction of my teaching is the use of radio telescopes to probe interstellar matter in distant galaxies, in order to understand how they form and evolve over cosmic time. The GBT has been an important facility for my research: its enormous collecting area, full steerability, and radio-quiet site allow it to observe distant, faint targets far more efficiently than any of its peers (e.g., the Effelsberg 100m Radio Telescope in Germany, which I know from personal experience to be inferior). The telescope is also crucial to U.S. leadership in radio astronomy because it can host guest instruments, giving university-based groups a platform for the development and deployment of novel instrumentation. A case in point is the ultra-wideband "Zpectrometer" for which I was a Co-PI (University of Maryland Professor Andy Harris was PI); this has allowed the GBT to determine "blind" CO redshifts for tens of distant galaxies too dusty to be localized with optical telescopes, and has supported the publication of more than 20 papers (as well as multiple Ph.D. theses) since 2010. Losing the GBT's scientific capability would be an especially damaging blow in a wavelength regime that has little overlap with NASA and DOE funding priorities, and where capacity lost at NSF is therefore capacity lost forever.	Against Closure	Email	11/25/2016	
227	b	Andrew	Baker	Department of Physics and Astronomy Rutgers, The State University of New Jersey	Green Bank has also played an important role in my spring semester "Observational Radio Astronomy" lab course, required for all undergraduate astronomy majors at Rutgers. Since 2008, I have brought 121 undergraduates (plus eight graduate students as teaching assistants and/or drivers) on three-day, two-night field trips to Green Bank as the course's capstone experience. Students enjoy a tour of the observatory's facilities, including a visit to the GBT control room and a close look at the GBT itself, and undertake a hands-on observing project with the 40-foot teaching telescope under the guidance of the observatory's education director. Student feedback every year has been overwhelmingly positive, and in many cases the trip has inspired or reinforced students' interest in pursuing graduate work in astronomy, physics, or another STEM field. For the Green Bank Observatory to turn into a non-research facility would deprive future Rutgers students of this sort of life-changing experience.	Against Closure	Email	11/25/2016	
227	c	Andrew	Baker	Department of Physics and Astronomy Rutgers, The State University of New Jersey	I'd like to close with two observations about the recommendation by the 2012 Portfolio Review Committee (PRC) that the GBT be divested or closed. First, the PRC's assessments of which technical capabilities are "critical" and ""supporting"" for tackling the science questions of the Astro2010 Science Frontier Panels (SFPs) clearly diverge from those articulated in the SFPs' own reports. A key GBT-relevant example comes from the Cosmology and Fundamental Physics panel, which identified gravitational wave astronomy as its area of discovery potential and co-ranked a pulsar timing array and fast "electromagnetic" followup of gravitational wave events as "needed capabilities," while the PRC mysteriously ranked a pulsar timing array as "supporting" and specifically *optical* followup as "critical." Second, the PRC's desire to boost the success rate of proposers to "aggressively funded" AAG and ATI programs would (if the GBT loses its funding) be realized by extinguishing a wide swath of radio-wavelength science and instrumentation research. These internal and external contradictions suggest that the PRC's conclusions should not be viewed as engraved on stone tablets. I urge NSF to maintain science-focused and education-focused activities at the Green Bank Observatory, via collaborative partnerships as necessary, in order to ensure that this vital element of the U.S. research infrastructure is not lost.	Against Closure	Email	11/25/2016	
228		John	Jardine Goss		Radio astronomy plays a vital and necessary part of studying the universe. The Green Bank facility is unique and can make significant contributions on an international level to 21st century astronomy. It must remain operating.	Against Closure	Email	11/25/2016	
229		Dennis	Lynch		I'm writing in regards to the NSF environmental impact statement for the Green Bank Observatory. I strongly urge the NSF to choose the No-Action Alternative and to continue to support full science operations for Green Bank. Science has always been a passion of mine, but it was usually something I experienced from afar. I would watch documentaries on television or read books or newspaper articles about discoveries being made by people who work in far-off labs using equipment that I would never be able to see. That changed when I first visited Green Bank. I met world-famous astronomers and talked to them about their science. I got to see one of the best scientific instruments in the world just a few hours from where I live. Being able to tour the observatory and actually climb the Green Bank Telescope was a once in-a-lifetime experience that brought science home for me in a way that I had never experienced before. It has given me a greater appreciation for science and educated me about radio astronomy — a field I didn't even know existed before hearing about the Green Bank Observatory. I can't believe that the NSF would consider closing down such an important place. It's hard for me to imagine how many other people would lose out on the experiences that I've had, but it would surely negatively impact our society as a whole. It is for these reasons that I NSF should continue to fully fund the Green Bank Observatory.	Against Closure	Email	11/25/2016	Dennis_Lynch_GBO_EIS_Comments.pdf
230	a	Anna	Scaife	Reader and Head, Interferometry Centre of Excellence Jodrell Bank Centre for Astrophysics University of Manchester	I am writing to express my concern over the NSF Division of Astronomical Sciences' portfolio review committee's recommended divestment of the Green Bank Telescope (GBT) from the AST portfolio. I would particularly like to highlight the potential damage that such a divestment would cause to the US science community, as well as to the wider global community. It is for this reason that I strongly support the first of the potential alternatives to be evaluated by the EIS: Continued NSF investment for science-focused operations (No Action Alternative). The GBT is a unique scientific facility, not simply in terms of its sensitivity but also in terms of its flexibility - its frequency coverage, its availability as a testbed for new instrumentation, its polarization capabilities, its spectral and time domain capabilities. Historical investment in the GBT has not only provided the world's most sensitive single-dish radio telescope, but it has provided a wide-reaching and high impact astrophysical laboratory. If any of the alternatives evaluated by the EIS were accepted barring the first, it would be a tragedy for both the US and global scientific communities. It has been a privilege for me to use the GBT in the past and I sincerely hope that the proposed EIS will recognise the importance of continued science operations at the Green Bank Observatory.	Against Closure	Email	11/25/2016	

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Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
230	b	Anna	Scaife	Reader and Head, Interferometry Centre of Excellence Jodrell Bank Centre for Astrophysics University of Manchester	The stated reason for divestment, that 'its capabilities are not as critical to New World New Horizons science goals as the higher-ranked facilities', is short-sighted and misleading. The very goals identified by such reviews are built on a strong and persistent foundation of ongoing scientific research that is underpinned by key instruments such as those provided by the Green Bank Observatory and in particular the Robert C. Byrd Green Bank Telescope (GBT).	Against Closure	Email	11/25/2016	
230	c	Anna	Scaife	Reader and Head, Interferometry Centre of Excellence Jodrell Bank Centre for Astrophysics University of Manchester	Furthermore, the results of this investment extend beyond the hardware of the telescope itself - the National Radio Quiet Zone is a fantastic resource for radio astronomy, as are the scientific and technical staff of the observatory. Expertise such as this cannot be hired over night, but requires sustained specialist training over long periods. Once gone, this expertise is incredibly difficult to regain.	Against Closure	Email	11/25/2016	GBT_LoS_Scaife.pdf
231		Ann	Barton Brown		The Green Bank Observatory provides students, visitors and scientists with a much needed opportunity to study science, learn how to think critically and expand their intellectual horizons. It is the education component that makes for a healthy future for Americans. It supports and enriches the community around it and is a source of much needed pride for West Virginians. Please keep it funded Thank you,	Against Closure	Email - Scanned	11/23/2016	
232	a	Joe	Igoe	KF5VIK (Amateur Radio) ARRL STX ARES District 14 NE Unit - Emergency Coordinator TX State RACES ID 16-201-L	It would be foolish to eliminate the largest steerable radio dish from the USA's assets. The current facility and the dish prior served as invaluable resources to NASA's space program. From measuring the winds on Jupiter when Galileo's High Gain Antenna failed to enabling the success of the Huygens Probe's mission despite its communication loss to Cassini, the Green Bank facility has consistently provided a fail-safe back-up, averting significant space mission failures and consequent losses of the tax payers' investments in space missions. Rebuilt as recently as the early 90s, it has hardly been utilized long enough to return the taxpayers' investment in it. Costing around \$50M, it was constructed with adaptive optics, a cutting edge control system enabling major reconfigurations in minutes that can take other telescopes hours or days. It is unique among various radio telescope systems operating in the GHz spectrum observing with its open proposal process.	Against Closure	Email - Scanned	11/23/2016	
232	b	Joe	Igoe	KF5VIK (Amateur Radio) ARRL STX ARES District 14 NE Unit - Emergency Coordinator TX State RACES ID 16-201-L	Beyond these considerations and the unique science only it can do, the Green Bank facility is the BEST resource for training our next generation of radio scientists. It is the only one that continues to maintain the old technology for steering and recording radio data enabling a full break from the technology falling into a black box. Single dish data processing is easier to manage and easier to use to instruct students on the physics not just of the observing system but also of the various astrophysical phenomena being observed.	Against Closure	Email - Scanned	11/23/2016	
232	c	Joe	Igoe	KF5VIK (Amateur Radio) ARRL STX ARES District 14 NE Unit - Emergency Coordinator TX State RACES ID 16-201-L	Thousands of radio students have passed through its facility giving the US a strong radio community from which to draw expertise. Finally, being the only radio-quiet territory in the US for performing research, its closure would eliminate entire spectral bands from research by the majority of US scientists. As every amateur radio operator knows, the electromagnetic spectrum is heavily occupied with only certain bands that they can use to communicate. If they want to listen to any astronomical phenomena, very few bands are available. The concept of being able to travel to West Virginia and have an entire spectrum in which to track whistler waves, listen to the Galactic Neutral Hydrogen Line, and data transmissions from satellites is a wealth beyond imagining to an average ham radio operator. We call on the NSF to consider the resource that taxpayers bought and have yet to take full advantage of in the Green Bank Telescope. It's our resource.	Against Closure	Email - Scanned	11/23/2016	
233		Melissa	Spry		I think it is a shame these coal miners work all their lives, gives the mines the best years of their lives, and now they just want to throw them out to the wolves. They shouldn't have to worry about their pension and insurance at their age	General	Email - Scanned	11/23/2016	
234		J.	Gonzalez		My father took me and my brothers and sisters to the observatory about once a year growing up and while I haven't been in a few years now, it's always held a special place in my heart. WV doesn't have a lot of employment opportunities, and while I'm also not a scientist, having this place in my home state always kept my interest and let me know that in America, I'm supposed to be able to do whatever I want. When I found out that there was a solid chance it was going to be closed down, I almost cried. I spent a lot of time here and hoped to be able to share the tradition with my children and grandchildren. We live in very, very uncertain times. Please, on all that is sacred, do not cut off funding or close down the Green Bank Observatory. I and many other Americans love this place with all our hearts and would be devastated to see it go.	Against Closure	Email - Scanned	11/23/2016	

Green Bank Observatory -Written NSF Public Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
235		Philip	Edwards		<p>We note with concern the current environmental evaluation of the Green Bank Observatory which includes the option of closing the site. The R.C. Byrd Green Bank Radio Telescope (GBT) is the premier single-dish radio telescope, exemplifying the synergy between fundamental science and cutting edge technologies. It has produced a number of high impact results, most notably in the areas of astro-chemistry and pulsar astronomy. It is also a critical element of Very Long Baseline Interferometry (VLBI) arrays, both ground-based arrays and space VLBI. The Russia-led SVLBI mission RadioAstron, launched in 2011, is advancing our understanding of active galactic nuclei, interstellar medium, and cosmic masers.</p> <p>The RadioAstron satellite has an apogee height of -300,000 km, fifteen times greater than previous space VLBI observations, and it has made a number of detections on baselines greater than 20 Earth diameters, in contrast to the expectations of many astronomers. Clearly these ground-breaking detections require the most sensitive radio-telescopes on the Earth, and the GBT is critical to the ongoing success of the mission.</p> <p>RadioAstron is also reliant on the use of the Green Bank 140-foot as a dedicated tracking station antenna - one of only two for the mission. This is operated by NRAO under contract with Roscosmos and loss of this capability would seriously impact the efficiency of the mission.</p> <p>On behalf of the RadioAstron International Science Council we express our resolute support to continuing operational status of the GBO.</p>	Against Closure	Email - Scanned	11/23/2016	RISC-GBO-letter-signed.pdf
236	a	Kenneth	MacLeod	Amateur Radio Operator K15PM	<p>It would be foolish to eliminate the largest steerable radio dish from the USA's assets. The current facility and the dish prior served as invaluable resources to NASA's space program. From measuring the winds on Jupiter when Galileo's High Gain Antenna failed to enabling the success of the Huygens Probe's mission despite its communication loss to Cassini, the Green Bank facility has consistently provided a fail-safe back-up, averting significant space mission failures and consequent losses of the tax payers' investments in space missions.</p> <p>Rebuilt as recently as the early 90s, it has hardly been utilized long enough to return the taxpayers' investment in it. Costing around \$50M, it was constructed with adaptive optics, a cutting edge control system enabling major reconfigurations in minutes that can take other telescopes hours or days. It is unique among various radio telescope systems operating in the GHz spectrum observing with its open proposal process.</p>	Against Closure	Email - Scanned	11/23/2016	
236	b	Kenneth	MacLeod	Amateur Radio Operator K15PM	<p>Beyond these considerations and the unique science only it can do, the Green Bank facility is the BEST resource for training our next generation of radio scientists. It is the only one that continues to maintain the old technology for steering and recording radio data enabling a full break from the technology falling into a black box. Single dish data processing is easier to manage and easier to use to instruct students on the physics not just of the observing system but also of the various astrophysical phenomena being observed. Thousands of radio students have passed through its facility giving the US a strong radio community from which to draw expertise.</p>	Against Closure	Email - Scanned	11/23/2016	
236	c	Kenneth	MacLeod	Amateur Radio Operator K15PM	<p>Finally, being the only radio-quiet territory in the US for performing research, its closure would eliminate entire spectral bands from research by the majority of US scientists. As every amateur radio operator knows, the electromagnetic spectrum is heavily occupied with only certain bands that they can use to communicate. If they want to listen to any astronomical phenomena, very few bands are available. The concept of being able to travel to West Virginia and have an entire spectrum in which to track whistler waves, listen to the Galactic Neutral Hydrogen Line, and data transmissions from satellites is a wealth beyond imagining to an average ham radio operator.</p> <p>We call on the NSF to consider the resource that taxpayers bought and have yet to take full advantage of in the Green Bank Telescope. It's our resource.</p>	Against Closure	Email - Scanned	11/23/2016	
237	a	Jack	Burgess	Arizona Delegate to NaPonal Youth Science Camp '16	<p>I was a 2016 Arizona Delegate to the National Youth Science Camp. As part of the camp we got to visit the Green Bank Observatory and receive a lecture, tour the facilities, and see the exhibits. We spend camp in the National Radio Quiet Zone, and it was a great experience to come and see what the zone exists for.</p> <p>I greatly enjoyed our trip to the Green Bank Observatory, and I learned a lot as well. The lecture was very interesting, and it was special to get a chance to see into the inner working of such a great tool of science.</p> <p>I'm sure that my fellow campers would share a similar story; The GBO is a very popular out-of-camp experience. Some kids even got to stay at the GBO overnight and learn how to work the telescope! I hope that the Green Bank Observatory remains open for research, so that it can continue to teach and inspire us.</p> <p>I know that my visit to the Green Bank Observatory expanded my universe.</p>	Against Closure	Email - Scanned	11/23/2016	
237	b	Jack	Burgess	Arizona Delegate to NaPonal Youth Science Camp '16	<p>I very much hope that the observatory remains open for research, as the telescope allows for us to learn about the cosmos around us and the nature of our universe. Why halt the pursuit of knowledge when there is so much unknown, so much to learn? I appreciated the "open skies" program we heard about, which allows for community engagement from all over.</p>	Against Closure	Email - Scanned	11/23/2016	

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Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
238		Tim	Conklin		I am a former summer student of the NRAO Research Experiences for Undergraduates (REU) in Green Bank, WV over the summers of 2010 and 2011. I have also worked on 2 other projects at the site as an undergraduate student at Rutgers University and as a graduate student at the University of Massachusetts. In total I have spent about 7 months in Green Bank working at the telescope site and the REU program has been one of the biggest contributing factors to my professional success outside of astronomy. While most of the focus should be on the science aspect, the teaching and outreach aspect should not be overlooked. The REU program I was involved in has enabled over 1000 students to get involved in research for nearly 60 years, there are countless projects for high school students every year, and the other telescopes on the site are used by students from middle school to graduate school. During my time in Green Bank two thirds of the REU projects were actively using telescope data and the other third were site related engineering. These outreach efforts exist in their current form because the GBT is an active research telescope. Without the telescope, these programs are likely to drastically change or end completely. It is my hope that the telescope will continue to operate in its current capacity.	Against Closure	Email - Scanned	11/23/2016	
239	a	Camille	Beasley	Florida Department of Environmental Protection	Thank you for the opportunity to comment. As a delegate of the National Youth Science Camp and a lover of all things science, I would be incredibly saddened to see the Green Bank Observatory mothballed or deconstructed. Every year, the delegates of the Camp take a field trip to the Observatory to learn about both its construction and the research done there. Imagine being a student just beginning to fully discover their passion for science, looking up at the world's largest fully steerable radio telescope --- in fact one of the largest moving structures on land! It really is awe---inspiring --- a marvel of engineering and an icon in the field of astronomy. Though I ultimately chose a career in ecology, touring this facility played a large role in sparking a lifelong interest in astronomy, a field that is becoming increasingly important as we look to the stars for potential explanations and solutions to the issues that we face on Earth.	Against Closure	Email - Scanned	11/23/2016	
239	b	Camille	Beasley	Florida Department of Environmental Protection	It may be that the GBO is no longer the most modern of facilities, but that fact that its scientists rallied to secure enough outside funding to make up the gradually decreasing NSF funding demonstrates it has not outlived its usefulness. While I understand that budgets are tight these days, I ask that the NSF please do not shut down or dismantle the GBO, or at the very least, not the Robert C. Byrd Telescope. Whether the decision is made to fully fund, partially fund, or create an educational park (I'm very strongly in favor of allowing continued research), I believe the GBO is a treasure of the scientific world and a source of inspiration, and to lose it simply because of budget constraints would be a tragedy. I very much hope you will avoid the mothballing or deconstruction options and find a way to preserve this marvelous facility, for the sake of its dedicated scientists and for aspiring scientists of the future, as I was 10 years ago.	Against Closure	Email - Scanned	11/23/2016	
240	a	J. Bruce	McKean		I am writing to comment on the proposed changes to the Green Bank Observatory Operations. I retired from NRAO Green Bank in 2011 after working thirty-six years for NRAO. I was an accountant and programmer in the NRAO Fiscal Division and then moved to the Management Information Systems Division when the administrative computer operations were pulled out of Fiscal. For many years I was a one---man operation handling both the programming and hardware updates of the IBM computer in Green Bank. I was technically under the Charlottesville, VA office, but our division was always located in Green Bank, and then some staff were added in Socorro, NM. I traveled often to Charlottesville, Tucson, Socorro and the Brookhaven Labs in New York. Our internal auditors were located at Brookhaven until AUI lost the contract to operate at that DOE site after 50 years of operation. After previously teaching junior high math while working on a graduate degree at Ohio University, I was hired by the Ohio Division of the North American Coal Company and given extensive training by IBM in both programming and hardware. I then worked for a division of Quaker Oats in their MIS division until taking a job at NRAO. I immediately loved the rural atmosphere, beauty and trails in the WV mountains. Employees have always worked together at Green Bank for the betterment of science and the community. Very quickly I was asked to be the volunteer treasurer of the county library system and a member of the county library board. Six new libraries would be built in the county since I arrived here, and our county system would be voted the top rural library system in the US in 2003. The county system was first run out of the Green Bank Library, and the head librarian and many board members and supporters were connected to NRAO. The entire county has benefited from the doctor and dentist office, fire department and rescue squad, and the first swimming pool that were all started at NRAO with NRAO employees and buildings. The community changed in such a positive way with the diversity and giving of NRAO employees. I lived in NRAO housing on---site for three years, and my neighbors were all from foreign countries. My children played with friends who did not speak English, and it was a great experience for them. Our county had the top French program in West Virginia, and our students traveled regularly to Quebec, France and to two other locations to live with French---speaking families. The people who came here to work from around the world introduced so many things to the community that still continue----- classes, concerts, huge annual picnics and EMT training, to name just a few. The many state and National forest and park employees use NRAO for their meetings. Spouses of employees have contributed so much to this community. My wife was a high school librarian at Wheeling High School, one of the top schools in West Virginia, and she eventually opened a new school library at the local elementary/middle school, and it was commended every year by the state. Her library looked out on the GBT, and her library was alive and fun. Another spouse, Mali Minter, went from being a lawyer to teaching Spanish here, and she took her students to foreign countries regularly and supported the students in so many ways. So many county leadership positions will be lost if NRAO closes.	Against Closure	Email - Scanned	11/22/2016	
240	b	J. Bruce	McKean		The NRAO airstrip that current county resident and former governor and US Senator, John D. Rockefeller IV (Jay), funded when NSF funds could no longer support the air strip that was often the only way to get injured residents to a major hospital. The site has also become a shelter and emergency hub when major storms affect electric power.	Against Closure	Email - Scanned	11/22/2016	

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240	c	J. Bruce	McKean		<p>My three children grew up here and had many opportunities at NRAO due to the close NRAO investment in the community and schools. Our son was offered one of the two slots for WV at the National Youth Science Camp that has always hosted US and foreign high school students in the county until a recent move to Tucker County, WV. Our son ended up taking one of the WV full---month DOE science experiences in Environmental Studies at a Washington State National laboratory. Our son would go on to study chemical, civil and environmental engineering at Princeton University and was an NRAO tour guide each summer and fall at the Green Bank site. He traveled the world consulting with Booz * Allen * Hamilton and also spent Time working for Homeland Security and at the White House. Our oldest daughter, now teaching science in NC, combined pre---med studies and environment science at Denison University and the University of San Francisco and was an NRAO life guard for many years. Our youngest daughter graduated from Marietta College in graphic design and journalism and did her graphic design internship at NRAO Green Bank while also life---guarding and teaching swim lessons at NRAO.</p> <p>This NRAO site has the best education programs and science center of any observatory, and part of that is due to former Senator Robert C. Byrd. We are one of the top tourist attractions in WV bringing money and jobs to this state. Amateur astronomers from around the country come here to use the telescopes. Students and teachers come here to study astronomy. I talked to a teacher from VA this summer who had a group of minority and low--- income students studying here with a National program, and the teacher was so impressed with the site and facilities and hospitality.</p> <p>Green Bank has always hosted college students year---round, and building sites in Chile are not as easily accessible for US students. It is so important to be hands on with learning. I listened to West Virginia University student after student speak at a previous meeting emphasizing how different Green Bank is in that regard, and how it helped them.</p> <p>I have always thought that a WV or US School of Science could be housed at this site as an expansion of the current education program already in place. Sue Ann Heatherly was a science teacher in Pickens, WV when she worked with Senator Byrd to expand the education program here. Two of my children were selected for Governors Honors Academies held at various colleges in WV, and NRAO has hosted those type programs. Green Bank does so much more to teach science to the public.</p>	Against Closure	Email - Scanned	11/22/2016	
240	d	J. Bruce	McKean		<p>The National Radio Quiet Zone is unique and a big plus to study radio astronomy with minimal interference. The locals have accepted ""no cell phones"" for many years because they value NRAO. The quiet zone has attracted people to move here to live due to health issues they suffer due to power lines and cell phone tower emissions. These people have also contributed to this community.</p>	Against Closure	Email - Scanned	11/22/2016	
240	e	J. Bruce	McKean		<p>The historical telescopes on this site must remain as a museum/ tourist attraction forever. Just as the Civil War battlefields in the area continue to draw visitors to this area, so do the historical telescopes. Local people gave up their farms and homes for this site to become a world center for radio astronomy, and the NSF should give back to their offspring.</p>	Against Closure	Email - Scanned	11/22/2016	
240	f	J. Bruce	McKean		<p>NRAO Green Bank was previously facing elimination in the past when the Green Bank Director was Dr. George Sielstad. His wife was a top---notch high school English teacher and added to the community as so many spouses have done. Dr. Sielstad worked to bring outside money here to save the operation, and he attracted close to ten outside public and private sources of money. The Green Bank Telescope was one of his successes of his efforts plus the addition to the Jansky Lab and some Naval contracts. Hard work with help from the state and Senator Byrd brought the first radio astronomy site back to life, and it should continue. So much has been invested and is in place here.</p>	Against Closure	Email - Scanned	11/22/2016	
240	g	J. Bruce	McKean		<p>I plead with you to not eliminate this valuable research center. So much will be lost for so many. Snowshoe Ski Resort attracts people from all over the Eastern US, and they regularly visit NRAO for the tours, trails, food and programs. Any reduction at NRAO will impact people far beyond this county and state.</p>	Against Closure	Email - Scanned	11/22/2016	
241	a	John	Saunders		<p>I have close family that are lifelong residents of Pocahontas County, and a few of those are in Green Bank. While the GBO is in fact an absolute critical employer in that area of the country it's sooo much more than that! It's an institution, with historical significance akin to any memorial of the Civil War, or the home Wilma Lee Cooper!</p>	Against Closure	Email - Scanned	11/22/2016	
241	b	John	Saunders		<p>"We" need to figure out a way to allow this institution to provide enough value that it can remain open. Perhaps Donald Trump can reach across the aisle and get together with Joe Manchin, and work something out?</p>	Alternatives Consideration	Email - Scanned	11/22/2016	
242		Rachel	Shepard	Marlinton Presbyterian Church	<p>I am writing to share my support for Green Bank Observatory. It is an asset to Pocahontas County, West Virginia, the United States, the science community, and the world. I understand that it may change, but I hope that the observatory will continue to operate as a telescope as well as a tourism spot. I hope it will continue to employ as many people as possible. Please move forward with the people of Pocahontas County in mind.</p> <p>Many thanks for all your hard work in discerning the future of the GBO. We appreciate your involvement and help.</p>	Against Closure	Email - Scanned	11/22/2016	
243	a	Laura	Steiner Christy		<p>I am writing to express my concern that the Green Bank Observatory may cease to exist in its current form. My family and I have been visiting the site for many years, since before the current information/science center opened. We have enjoyed the beautiful and serene setting, the awe--- inspiring experience of seeing the telescopes up close, and reading about the incredible discoveries made there. The science center has been a wonderful addition to this facility and, no doubt, has sparked an interest in science for many children who have visited, including my own son.</p> <p>My hope is that the National Science Foundation will continue its current level of funding, so research can be continued at this facility instead of having to be moved to sites outside of our country. While I am not opposed to the addition of more private funding to the current NSF support, I am concerned that competing motivations from different funding groups could jeopardize the main mission of the site, namely scientific exploration and education.</p>	Against Closure	Email - Scanned	11/22/2016	

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243	b	Laura	Steiner Christy		While I understand that the NSF is not primarily expected to be an economic engine for any community, what the NRAO has brought to West Virginia is immeasurable. It has brought money and jobs, of course, but also National exposure for WV in a positive way that we residents rarely experience. As residents of a state frequently at the bottom of every favorable ranking, we are very proud to have an internationally renowned science facility within our borders. When out---of---state (and out---of---country) visitors leave, they take with them positive images of our state and people. We will lose greatly if this ceases to exist. In closing, I hope that the NSF will find a way to continue support of this wonderful facility.	Against Closure	Email - Scanned	11/22/2016	
244	a	Jeff	Thrash	KF5ZAF	It would be foolish to eliminate the largest steerable radio dish from the USA's assets. The current facility and the dish prior served as invaluable resources to NASA's space program. From measuring the winds on Jupiter when Galileo's High Gain Antenna failed to enabling the success of the Huygens Probe's mission despite its communication loss to Cassini, the Green Bank facility has consistently provided a fail-safe back-up, averting significant space mission failures and consequent losses of the tax payers' investments in space missions. Rebuilt as recently as the early 90s, it has hardly been utilized long enough to return the taxpayers' investment in it. Costing around \$50M, it was constructed with adaptive optics, a cutting edge control system enabling major reconfigurations in minutes that can take other telescopes hours or days. It is unique among various radio telescope systems operating in the GHz spectrum observing with its open proposal process.	Against Closure	Email - Scanned	11/22/2016	
244	b	Jeff	Thrash	KF5ZAF	Beyond these considerations and the unique science only it can do, the Green Bank facility is the BEST resource for training our next generation of radio scientists. It is the only one that continues to maintain the old technology for steering and recording radio data enabling a full break from the technology falling into a black box. Single dish data processing is easier to manage and easier to use to instruct students on the physics not just of the observing system but also of the various astrophysical phenomena being observed. Thousands of radio students have passed through its facility giving the US a strong radio community from which to draw expertise.	Against Closure	Email - Scanned	11/22/2016	
244	c	Jeff	Thrash	KF5ZAF	Finally, being the only radio-quiet territory in the US for performing research, its closure would eliminate entire spectral bands from research by the majority of US scientists. As every amateur radio operator knows, the electromagnetic spectrum is heavily occupied with only certain bands that they can use to communicate. If they want to listen to any astronomical phenomena, very few bands are available. The concept of being able to travel to West Virginia and have an entire spectrum in which to track whistler waves, listen to the Galactic Neutral Hydrogen Line, and data transmissions from satellites is a wealth beyond imagining to an average ham radio operator. We call on the NSF to consider the resource that taxpayers bought and have yet to take full advantage of in the Green Bank Telescope. It's our resource.	Against Closure	Email - Scanned	11/22/2016	
245	a	Bill	Hagebusch	KE5ZVF President Texas Emergency Amateur Communicators	Beyond these considerations and the unique science only it can do, the Green Bank facility is the BEST resource for training our next generation of radio scientists. It is the only one that continues to maintain the old technology for steering and recording radio data enabling a full break from the technology falling into a black box. Single dish data processing is easier to manage and easier to use to instruct students on the physics not just of the observing system but also of the various astrophysical phenomena being observed. Thousands of radio students have passed through its facility giving the US a strong radio community from which to draw expertise.	Against Closure	Email - Scanned	11/22/2016	
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246	a	Elizabeth	Jensen	Planetary Science Institute, Associate Researcher ACS Engineering & Safety, Ltd., Chief Engineer Referee PAC, Treasurer	Beyond these considerations and the unique science only it can do, the Green Bank facility is the BEST resource for training our next generation of radio scientists. It is the only one that continues to maintain the old technology for steering and recording radio data enabling a full break from the technology falling into a black box. Single dish data processing is easier to manage and easier to use to instruct students on the physics not just of the observing system but also of the various astrophysical phenomena being observed. Thousands of radio students have passed through its facility giving the US a strong radio community from which to draw expertise.	Against Closure	Email - Scanned	11/22/2016	

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246	c	Elizabeth	Jensen	Planetary Science Institute, Associate Researcher ACS Engineering & Safety, Ltd., Chief Engineer Referee PAC, Treasurer	<p>It would be foolish to eliminate the largest steerable radio dish from the USA's assets. The current facility and the dish prior served as invaluable resources to NASA's space program. From measuring the winds on Jupiter when Galileo's High Gain Antenna failed to enabling the success of the Huygens Probe's mission despite its communication loss to Cassini, the Green Bank facility has consistently provided a fail-safe back-up, averting significant space mission failures and consequent losses of the tax payers' investments in space missions.</p> <p>Rebuilt as recently as the early 90s, it has hardly been utilized long enough to return the taxpayers' investment in it. Costing around \$50M, it was constructed with adaptive optics, a cutting edge control system enabling major reconfigurations in minutes that can take other telescopes hours or days. It is unique among various radio telescope systems operating in the GHz spectrum observing with its open proposal process.</p>	Against Closure	Email - Scanned	11/22/2016	
247	a	Kenneth	Braunstein	KE5AKC General Class Amateur Radio Operator	Beyond these considerations and the unique science only it can do, the Green Bank facility is the BEST resource for training our next generation of radio scientists. It is the only one that continues to maintain the old technology for steering and recording radio data enabling a full break from the technology falling into a black box. Single dish data processing is easier to manage and easier to use to instruct students on the physics not just of the observing system but also of the various astrophysical phenomena being observed. Thousands of radio students have passed through its facility giving the US a strong radio community from which to draw expertise.	Against Closure	Email - Scanned	11/22/2016	
247	b	Kenneth	Braunstein	KE5AKC General Class Amateur Radio Operator	<p>Finally, being the only radio-quiet territory in the US for performing research, its closure would eliminate entire spectral bands from research by the majority of US scientists. As every amateur radio operator knows, the electromagnetic spectrum is heavily occupied with only certain bands that they can use to communicate. If they want to listen to any astronomical phenomena, very few bands are available. The concept of being able to travel to West Virginia and have an entire spectrum in which to track whistler waves, listen to the Galactic Neutral Hydrogen Line, and data transmissions from satellites is a wealth beyond imagining to an average ham radio operator.</p> <p>We call on the NSF to consider the resource that taxpayers bought and have yet to take full advantage of in the Green Bank Telescope. It's our resource.</p>	Against Closure	Email - Scanned	11/22/2016	
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248		Kelly	Banton	County Commission Assistant	<p>We are writing in response to the Notice of Intent to Prepare an Environmental Impact Statement for the Green Bank Observatory. The Greenbrier County Commission is the administrative and governing body of Greenbrier County, WV which is Pocahontas County's southern neighbor.</p> <p>We feel that the Green Bank Observatory is a major asset to Pocahontas County, neighboring counties and to the State of West Virginia. In addition to the scientific aspects of the Observatory, it is also a key employer to the region, a vital participant of educational advancement to the local children and every visitor that walks onto the grounds, along with being a growing tourist destination.</p> <p>It is our intention to support of the continued operations and full NSF funding (NO-Action Alternative) of the Green Bank Observatory facility in Pocahontas County, WV which has proven its endless assets to the State of WV and the United States in scientific research, education, and economic benefits.</p>	Against Closure	Email - Scanned	11/22/2016	SKMBT_C35161122101200.pdf
249		Mark	Morgan	Resident	<p>Nearly everyone I know is shocked and confused about the recent decision by the National Science Foundation to even consider downgrading the Green Bank National Observatory. Why?</p> <ol style="list-style-type: none"> 1) it brings in a tremendous amount of tourism and related revenue to the state and local community. 2) it has one of the largest movable telescopes in the world and the facility is capable of collecting extraordinary data. 3) huge investments have been made into this facility by local government, state government and federal government. 4) it is not an obsolete facility. 5) shutting down this facility will have devastating financial and cultural consequences for Green Bank, Artovale, Pocahontas County and the State of WV. 6) most of its employee will suffer greatly, and their lives and livelihood will be severely upset, possibly some will never recover. <p>The above are just a few reasons I ask that there be a "Continued NSF Investment for Science" at the Green Bank Facility, and that "Collaboration with Interested Parties for Science" also be utilized!</p>	Against Closure	Email - Scanned	11/22/2016	

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Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
250		James	Allman		<p>I graduated from Elkins High School in 1965. From elementary school through high school, in the mid--1950s, our country strove to encourage our students to enter science and engineering. West Virginia was also losing our best and brightest students. I vowed to go into engineering and stay in West Virginia which I have done.</p> <p>While I am a graduate Civil Engineer, I have always had a great interest in science and astronomy. The Green Bank Observatory has always been a great asset for West Virginia and a major asset to our country through space research and science. It also brings some valuable academia and science investment to a state that is short changed on scientific endeavors. I am sure this valuable scientific observatory can be used not just to provide an economic investment to a rural county and state that real needs this scientific investment, but can also can also continue to provide invaluable scientific research for America.</p> <p>Please find a way to maintain Green Bank Observatory to allow it to continue to provide the this valuable research for America and provide a valuable economic asset to rural West Virginia. Thank you for your full support of this facility.</p>	Against Closure	Email - Scanned	11/22/2016	
251		Chris	Bochenek	Student, California Institute of Technology	<p>My name is Chris Bochenek. I am a current first year astronomy graduate student at the California Institute of Technology, and I would not be where I am today without the Green Bank Telescope (GBT).</p> <p>I spent two summers participating in the NSF funded Research Experience for Undergraduates (REU) program at the National Radio Astronomy Observatory (NRAO). Each summer, the NRAO allows students to apply for reserved Time on the GBT. During my first summer, I applied for and received this Time to observe a newly discovered pulsar to get a better measurement of its position. This experience was invaluable to me. It taught me how to evaluate an idea and show that it is reasonable, and how to write a good proposal. Furthermore, I learned from start to finish how astronomers get data that is vital to our work, and gave me confidence to know I could get through this process. These skills and knowledge will serve me well throughout my career.</p> <p>My entire second summer at the NRAO was spent analyzing GBT data. I used a decade of GBT observations to try to understand how light is blocked during the eclipses of some pulsars. From this work, I found some interesting new clues to the story of eclipsing pulsars and presented this work at the 227th Meeting of the American Astronomical Society. Learning about the algorithms and statistical techniques needed to handle the large data sets in modern astronomy was also crucial to my development.</p> <p>I sincerely believe that the training I received at the GBT and from working with GBT data prepared me to be a successful astronomer. When applying to Caltech, I sold myself on the skills I learned because of the GBT. My application would not have been successful without these experiences.</p> <p>Without the GBT operating at the forefront of science, fewer students like me, especially those interested in pulsar astronomy, will not have the opportunity to develop the skills needed to succeed in science. Traveling to Green Bank to observe on the telescope made a big impact on me and my confidence in my ability to pursue science, and it would be a loss for future generations to not be able to have that same experience.</p> <p>I implore the NSF to continue to fund both science--focused and education--focused operations at the Green Bank Observatory. As it should be evident, these operations have had a large impact on my career and it would be a shame for future generations not to have the same opportunities I did. In addition, my work with GBT shows that there is still much frontier science that the GBT can do and should do. Mothballing the GBT or turning it into a technology and education park leaves so much untapped scientific impact and impact on the careers of young scientists. If I proposed to use a GBT that was part of a technology and education park, it would not have given me the same confidence to pursue science as a GBT that is a world--class facility. Finally, deconstruction and site restoration completely removes any potential for the GBT to have an impact on young scientists and should not be considered given the enormous impact I know the GBT has had and can continue to have.</p>	Against Closure	Email - Scanned	11/22/2016	
252	a	Jerry	Reasner		Beyond these considerations and the unique science only it can do, the Green Bank facility is the BEST for training our next generation of radio scientists. It is the only one that continues to maintain the old technology for steering and recording radio data enabling a full break from the technology falling into a black box. Single dish data processing is easier to manage and thus instruct students on the physics not just of the observing system but also of the various astrophysical phenomena being observed. Thousands of radio students have passed through its facility giving the US a strong radio community from which to draw expertise.	Against Closure	Email - Scanned	11/22/2016	
252	b	Jerry	Reasner		Finally being the only radio--quiet territory in the US for performing research, its closure would eliminate entire spectral bands of research to the majority of US scientists. As every amateur radio operator knows, the electromagnetic spectrum is heavily occupied with only certain bands that they can use to communicate. If they want to listen to any astronomical phenomena, very few bands are available. The concept of being able to travel to West Virginia and have an entire spectrum in which to track whistler waves, listen to the Galactic Neutral Hydrogen Line, and data transmissions from satellites is a wealth beyond imagining to an average hammer.	Against Closure	Email - Scanned	11/22/2016	

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252	c	Jerry	Reasner		<p>It would be foolish to eliminate the largest steerable radio dish from the USAs assets. The current facility and the dish prior served as invaluable resources to NASAs space program. From measuring the winds on Jupiter when Galileo's High Gain Antenna failed to enabling the success of the Huygens Probe's mission despite its communication loss to Cassini, the Green Bank facility has consistently prevented significant losses to the return from tax payer investments into space missions. Rebuilt as recently as the early 90s, it also has hardly been utilized long enough to return taxpayers investment into it. Around \$50M, it was constructed with adaptive optics, a cutting edge control system enabling major reconfigurations in minutes that can take other telescopes hours or days, and is unique among various radio telescope systems operating in GHz observing with its open proposal process.</p> <p>We call on the NSF to consider the resource that taxpayers bought and have yet to take full advantage of in the Green Bank Telescope. It's our resource. Let me also add that as Time has gone by over the last few years, since President Clinton, actual real science has taken the backseat to other projects. I am one of those people who believe that since there are galaxies older than ours, and even within our own galaxy, there are million of suns many of them much older than our sun, and of the millions of suns, they are probably more planets. to me, the chances of an intelligent life form some place in either our or another galaxy are very high. Should there be such a civilization and if they have developed to the place where we are now, the chances of such a civilization being able to send and receive radio signals are very good. If we take any any asset where we may be able to receive a radio signal from a distant galaxy, to me that would be a grave mistake.</p> <p>I have worked in the field of electronic communications for over 50 years. First while in the Air Force, then at Los Alamos National Laboratory, then with Motorola in both digital and RF disciplines. Since I retired I currently help people with their Internet needs, and I am an Extra Class Ham Radio Operator. I teach Technician Class Ham Radio classes a couple of Times a year.</p> <p>Please feel free to contact me should you desire.</p>	Against Closure	Email - Scanned	11/22/2016	
253		Janet	Gunther		Please save the observatory for future generations to have this wonderful educational experience.	Against Closure	Email - Scanned	11/22/2016	
254		Kathryn	Devine	Associate Professor of Physics	<p>I am a physics professor at The College of Idaho, a small, liberal arts institution. Since 2013, I have used the GBT with my students to obtain data. Because of support from the NRAO, I was able to take two undergraduates to Green Bank to be involved in observing and data calibration. Several other undergraduates have sat in on remote observing from the C of I campus. Nearly a dozen undergraduates have been involved in my research using GBT data, and at least six of these students are or will be co---authors on peer---reviewed journal articles resulting from our work. The research experience for my undergraduate collaborators has been crucial to their further career progress, and has helped them obtain internships, scholarships, and graduate school opportunities. The College of Idaho has extremely limited funding to support faculty and student research. The Time---allocation model of the GBT, in which Time requests are judged on scientific merit but do not require a financial contribution from the researchers' institution, made our projects possible.</p> <p>I hope to see the unique science available through the GBT continue, and for the GBT's focus to remain on astronomical research. I also hope that small colleges such as mine can remain competitive for Time on this phenomenal instrument. Thus, I want the NSF to continue its investment for science---funded operations of the GBT (the "No---Action Alternative"). However, I am sympathetic to the pressures of allocating a limited budget and the need to focus resources on the science goals identified in the New Worlds, New Horizons report. As such, I also reluctantly support reduced NSF---funded support and increased collaboration from external parties, as long as these external parties are also research driven and astronomical research will remain the primary objective of the GBT. I do not support a model in which external parties divert the GBT toward commercial activities, eroding the science staff and infrastructure at Green Bank and undermining the ability of the instrument to function for research.</p>	Against Closure	Email - Scanned	11/22/2016	
255		Madelyn	Frick		<p>I have visited Green Bank as a parent chaperone several Times and have enjoyed it as much as the students have. It is a beautiful thing to see the excitement and dedication toward learning this trip inspires. These are smart young women and men who work together throughout the night to experience science in action. The intelligent need places to exercise their minds.</p> <p>Please choose option 1 or 2. Don't let this opportunity slip away.</p>	Against Closure	Email - Scanned	11/22/2016	
256	a	D.J.	Pisano	Associate Professor WVU	One of the projects that is funded by the NSF is to develop a new type of radio camera, called a phased-array feed, for the GBT. This is type of engineering project that cannot be done on an array like the VLA nor can it be done by US scientists and engineers on foreign single-dish telescopes due to the added costs and relative inaccessibility of these telescopes. These types of cameras are being developed in Australia and the Netherlands as well, but without the GBT as a test bed, the scientific and economic benefits of this technology would remain overseas.	Against Closure	Email - Scanned	11/22/2016	gbo_leber_pisano.pdf
256	b	D.J.	Pisano	Associate Professor WVU	In considering the five alternative funding options for the Green Bank Observatory, I can say that any option that takes away from scientific observation (deconstruction, mothballing, or converting it to a technological and educational park) would be devastating for astronomical research at WVU. Our connection to Green Bank is what makes WVU a premier institution for radio astronomy; without it, there would be little professional reason for any of us to remain in West Virginia. While WVU currently purchases some time on the GBT, giving us guaranteed access to the telescope, the amount of funding available to WVU and other universities and colleges is not sufficient for us to do the science that we are currently doing through the NSF open skies access. It is better than closing the site, but it is still a poor option. By reducing the amount of open access time on the GBT only radio astronomers at wealthy universities and colleges will be able to access the telescope. This limits the scientific impact of the GBT, but also limits the number and diversity of students who can benefit from the scientific training available in Green Bank. This will severely restrict the socioeconomic benefits of the site for underrepresented groups and disadvantaged students. As such, the no-action alternative will have the most benefit for the local and broader community in West Virginia and throughout the US.	Against Closure	Email - Scanned	11/22/2016	gbo_leber_pisano.pdf

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256	c	D.J.	Pisano	Associate Professor WVU	<p>My involvement with the Green Bank Observatory dates back to 1995, when I spent 10 weeks as a summer student conducting a research project using the old 140-foot radio telescope. At the time, the Green Bank Telescope was still under construction. While I was already planning to become an astronomer, that summer experience in Green Bank (one of three different summer research experiences I had) helped make me a radio astronomer. I have maintained the scientific connections I made that summer through the present day. I am currently an associate professor of Physics and Astronomy at West Virginia University in Morgantown, WV where I have been resident since 2009, and my students and I still actively work with the scientists in Green Bank. Most summers my students and I spend about one month in residence at the Green Bank Observatory contributing our time and money to the local community. Since arriving in Morgantown in 2009, I have employed five graduate students and four undergraduate students in conducting research using GBT data. These students and I have had over 1900 hours of GBT time since 2009 mostly studying how hydrogen gas is acquired by galaxies. This GBT time has comprised critical portions of all five students' PhD theses and led to over \$1.3 million in NSF funding. I can say without exaggeration that neither my students nor I would be at WVU or in the state of West Virginia in the absence of the Green Bank Observatory. In addition, the science we are doing is not currently feasible with any other radio telescopes in the world. With the closure of the GBT (and potentially Arecibo), US astronomers will be deprived of the ability to study faint hydrogen gas as we will have limited access to the radio telescopes in other countries.</p> <p>In addition to the scientific and economic impact of the GBO, I am actively involved in the educational programs ongoing there. I have been a lecturer and mentor for middle school students participating in the Governor's Schools for Math and Science every summer since 2009. I have brought WVU undergraduate students to Green Bank to use the 40-foot radio telescope (also used by about a thousand school kids every year), and I am using the Green Bank 20m radio telescope as part of an educational activity for middle school students in and around Morgantown. All of these activities give students the opportunity to do real science as part of an open-ended, inquiry based project. Furthermore, by interacting with real scientists from all over the world, these students can see the diverse range of people who can do astronomy. That these activities occur where the first astrophysical molecules were discovered, These activities have helped inspire these students to pursue studies in STEM fields; I have seen graduates of the Green Bank educational programs in my classes and as Physics majors at WVU. These educational activities would either not exist or be severely compromised without GBO and the two educational telescopes.</p>	Against Closure	Email - Scanned	11/22/2016	gbo_leber_pisano.pdf
257		Joey	Aloi		<p>Please keep the Green Bank Observatory open. It has economic importance for West Virginia and Pocahontas County. It gives poor children in the coalfields something to aspire to. And if we lost the National Radio Quiet Zone, there'll be nothing like it on this side of the Mississippi for years to come. Quiet spaces are important.</p> <p>More importantly, Central Appalachia is in a state of economic transition. The extraction industries that have been central to the region's economy for the past hundred years are disappearing through automation, globalization, and technological change. This period of transition has been devastating already, causing many people to flee the state and many communities to dissolve. Now more than ever, Appalachians, and especially West Virginians, need the hope and inspiration that Green Bank offers - ----- the hope that there is a future in education, that school matters and that, even in West Virginia, the mysteries of the universe are accessible through these telescopes.</p>	Against Closure	Email - Scanned	11/22/2016	
258		Al	Wooten		<p>I am an astronomer, a member of the NRAO scientific staff and the faculty of the University of Virginia,</p> <p>The [GBT] stands alone as the highest achievement in the long history of American telescope construction. It provides the largest collecting area in the world with unmatched sensitivity and directivity for frequencies up to 116 GHz. As it is of fairly recent construction, its capabilities at the highest frequencies have only recently been realized. That has occurred in part through the dedication of highly talented staff who have brought the cutting edge of technical achievement to the remote area in which it is located. That remote location itself is part of the observatory's uniqueness as it sits in the heart of the National Radio Quiet Zone and West Virginia Radio Astronomy Zone, an area specifically designated to the sensitive radio astronomy operations carried out at the [GBO]. Since the (NSF) Astronomy Division's outdated Portfolio Review of 2012, the [GBT] has provided the US millimeter astronomy community with the world's most powerful tool for exploring thermal emission from molecules in cool sources such as emerging galaxies and star forming regions in the northern hemisphere. The [GBT], an instrument of tremendous scientific productivity, provides US astronomers with their only current access to the supramillimeter sky outside of the venerable ARO installation on Kitt Peak. The [GBT] enables productive use of ALMA by astronomers in the United States as well as providing sensitive access to the northern sky. Two of ALMA's partner communities, at ESO and at NAOJ, have access to an array of facilities (IRAM Plateau de Bure, IRAM 30m, APEX, OSO and in fact part of ARO for ESO, ASTE and the NRO 45m for NAOJ) which are in practice unavailable to US astronomers. US users of the GBT at 3mm have submitted over 200 ALMA proposals in the past three cycles. ALMA Time is very difficult to obtain and demonstration of concepts through ancillary data obtained with the GBT is an important factor in obtaining Time. The GBT's collecting area and spectral line sensitivity are similar to that of ALMA. Its 8" beam size offers resolution comparable to that of ALMA. American access to telescopes has diminished with the closure of CARMA and the reduced funding of ARO though currently the Smithsonian Array operates at higher frequencies. The relative productivity of US astronomers in publishing ALMA data is lagging—they have authored 29% of ALMA papers compared to the 42% from ESO. Closing the [GBT] would further jeopardize our communities' competitiveness. The [GBT] stands at the threshold of an era in which its already unparalleled capabilities might be enhanced a hundred or thousandfold by array receivers. The GBT hosts instruments constructed through collaboration with the US community, enhancing US technical prowess and providing student training in advanced technology. Recently, the MUSTANG bolometer array, built by a collaboration including the University of Pennsylvania, NIST, NRAO, GBO, the University of Michigan and Cardiff University was upgraded to 200 single--- polarization, feedhorn coupled bolometers with an instantaneous 2.5' field of view, well---matched to ALMA's 90 GHz field of view of about 1'. ARGUS, built by a collaboration of Stanford, Cal Tech, Maryland and NRAO provides 16 beams of about 8" size for spectroscopy from 80---116 GHz, again well---matched to the ALMA field of view.The [GBT] offers unique and powerful scientific opportunities to investigators and empowers American use of other facilities, funded by NSF, NASA or privately, to reach high levels of productivity.</p>	Against Closure	Email - Scanned	11/22/2016	

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259		Thomas	Troland	Physics & Astronomy Department University of Kentucky Lexington KY	<p>As a user of the Green Bank facilities since 1969, I wish to offer my thoughts regarding the future of the Robert C. Byrd Green Bank Telescope.</p> <p>The GBT is a unique instrument for radio astronomy in terms of frequency coverage, unblocked collecting area, and sky coverage. The telescope has been remarkably productive during its still relatively short lifetime, and it is supported by a dedicated staff of scientists, engineers and other personnel. Indeed, the infrastructure of the GBT resides as much in the human expertise at the site as in the hardware.</p> <p>I understand that the NSF is under significant budget pressure, given a variety of astronomy projects it currently funds and wishes to fund in the future. Yet the partial or complete loss of GBT capabilities would be very detrimental to the scientific community.</p> <p>The GBT is the premier instrument of its type in the world. It is in the prime of its operational lifetime. It represents decades of human effort in design, construction, commissioning and continuing development. The GBT also represents a very large investment of NSF funds over the years. It would be very regrettable to invest such human and financial resources and not reap the full rewards of the facility.</p> <p>Of the alternatives described in the Federal Register document, the first (No---Action Alternative) is by far the best. The second alternative (Collaboration with interested parties) risks a substantial dilution of the availability of the GBT for pure science purposes, depending upon which interested parties, if any, can be identified.</p> <p>Therefore, I urge the NSF to make every possible effort to support the GBT so that it can continue making major contributions to astronomical research at radio frequencies.</p>	Against Closure	Email - Scanned	11/22/2016	
260	a	Mark	Reid	Senior Astronomer Smithsonian Astrophysical Observatory	<p>This letter is in regard to the NSF solicitation for input regarding the environmental impact statement for proposed changes to the Green Bank Observatory Operations and, more generally, the future of the 100-m telescope. The Robert C. Byrd Green Bank (GBT) 100-m telescope is the largest, best performing radio antenna in the world. It has produced and is producing some of the most important results in radio astronomy. Also, it is the only radio telescope located in a Federally controlled radio quiet zone.</p>	Against Closure	Email - Scanned	11/22/2016	gbt_support.pdf
260	b	Mark	Reid	Senior Astronomer Smithsonian Astrophysical Observatory	<p>The Senior Review committee that recommended divesting NSF support made an ill-advised conclusion for two reasons. Firstly, it was given a charge that Decadal Survey recommended new initiatives must be funded, even if it meant throwing away multiple telescopes that were built under previous Decadal recommendation. My reading of New Worlds, New Horizons is that that Decadal committee would not agree with this approach.</p> <p>Secondly, the Senior Review is now out of date and current events have significantly added to the scientific potential of the GBT. In particular, the astounding discovery of gravitational radiation by LIGO has opened up a new window to physical processes in the Universe. The GBT is critical to this venture, as the nano-GRAV pulsar timing array will provide a new, unique, and complementary window for gravitational radiation.</p> <p>Given the \$100M NSF investment in the GBT and the reasons given above, I strongly recommend continued relatively modest support for the operation of the telescope for the U.S. astronomy community.</p>	Against Closure	Email - Scanned	11/22/2016	gbt_support.pdf
261		Sarah	Francke	Director of Operations, ABCWV	<p>West Virginians value the science, STEM jobs, public education opportunities, and tourism revenue provided by the Observatory. The Observatory is state treasurer and leader in cosmic research (the nature of gravitational waves, interstellar chemical processes to determine the building blocks of life, planetary formation, stellar evolution, etc.</p> <p>The cosmos need this. Much more needs to be done in regards to making this a matter of public awareness.</p>	Against Closure	Email - Scanned	11/22/2016	
262		Randall	Ridenour	Orbital ATK Director, Structures and Large Caliber Programs Tactical Subsystems	<p>I have been a longtime advocate of the Green Bank Observatory, visiting and learning about the research being performed there for the past 25 years. I introduced my daughters to the field of radio astronomy at Green Bank during our visits and can say that what they learned and observed there helped to shape their interests in science, technology and engineering. They both are engineering students at West Virginia University and to this day feel strongly about the science that they learned while visiting the observatory. I'm sure that many children have been motivated in the same manner as my daughters. I believe that the research performed at Green Bank and the resulting data is invaluable to furthering our understanding of the universe. The knowledge that is being acquired today will likely be needed in the future to sustain mankind's existence. For all of these reasons, I ask that you continue to fund the Green Bank Observatory and the research activities that take place there.</p>	Against Closure	Email - Scanned	11/22/2016	

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263	a	Xavier	Siemens	Chair, NANOGrav Director, NANOGrav Physics Frontiers Center Associate Professor Center for Gravitation, Cosmology, and Astrophysics Department of Physics	<p>Human and Cultural Importance of the Green Bank Telescope</p> <p>We are writing to comment on issues related to human and cultural environment. Any option that NSF pursues that is incompatible with continued science--focused operations at Green Bank will put in serious peril 1) the ongoing science and engineering training of students from high school through postdocs, discussed further below, 2) the research and careers of our more than one hundred students and scientists in NANOGrav, 3) US leadership in low---frequency gravitational wave astronomy and high precision pulsar science, and 4) a new scientific discovery as profound as the one announced by LIGO earlier this year.</p> <p>Over the past decade NANOGrav has involved a diverse group of hundreds of US high school and undergraduate students in Green Bank Telescope observations of pulsars and gravitational wave astronomy. The Green Bank Telescope has played a particularly inspiring role in training underrepresented West Virginia high--school and undergraduate students through the Pulsar Search Collaboratory based at West Virginia University. Over 2000 high---school students, 50% of them female, have participated in the program over eight years, and several of these have gone on to be involved in NANOGrav research at undergraduate institutions.</p> <p>Currently more than 50 NANOGrav undergraduate and graduate students form a critical part of our group of Green Bank Telescope observers. The excitement of our students in personally operating the Green Bank Telescope has propelled many of them into careers in physics, astronomy, engineering, and other STEM fields. With Green Bank's continued science---focused operations, over the coming years hundreds more students will continue doing cutting edge research by operating the most sensitive steerable radio telescope in the world in our search for gravitational waves, a truly valuable research and educational experience for them.</p>	Against Closure	Email	11/25/2016	NANOGravGBOEISNOIResponse.pdf
263	b	Xavier	Siemens	Chair, NANOGrav Director, NANOGrav Physics Frontiers Center Associate Professor Center for Gravitation, Cosmology, and Astrophysics Department of Physics	<p>We are the North American Nanohertz Observatory for Gravitational waves (NANOGrav), a collaboration that involves over 100 students and scientists from 15 institutions in the US and Canada. The US portion of NANOGrav is largely funded by the National Science Foundation's NANOGrav Physics Frontiers Center. Using the Green Bank Telescope and the Arecibo Observatory, our collaboration is doing gravitational wave astronomy: we are leading the search for low---frequency gravitational waves produced by the mergers of supermassive black holes at the centers of galaxies. These low---frequency gravitational waves have periods 11 orders of magnitude longer than those discovered by LIGO and announced earlier this year. By regularly monitoring millisecond pulsars with our telescopes, we are building an observatory, much like LIGO, that will open a window onto a completely new part of the gravitational wave spectrum. We are now at a time when we have reached unprecedented sensitivities and are exploring astrophysically relevant parts of galaxy evolution parameter space. A detection could therefore happen soon. The Importance of the Green Bank Telescope</p> <p>The Green Bank Telescope is the most sensitive steerable radio telescope in the world. Lack of access to this instrument will delay the first detection of gravitational waves in the regime accessible to pulsar timing, and significantly hamper efforts to maximize astrophysical studies using these waves once they are detected. Given the unprecedented sensitivity of NANOGrav, and LIGO's recent gravitational wave discovery-----which was appropriately announced with much fanfare by both LIGO and NSF, and has already received several major scientific prizes-----we were surprised to learn about NSF's decision to continue divestment in the GBT, thus triggering the need to develop a scoping notice for an Environmental Impact Statement. The scientific context has changed profoundly and the scientific merits of this facility need to be re-examined. Other telescopes, particularly the FAST telescope now under construction in China or the proposed SKA phase 2 telescope in southern Africa, have been suggested as possible replacements for the Green Bank Telescope for our gravitational wave science program (though they would not contribute to the educational mission described above). While in the future these facilities may offer more raw sensitivity than the Green Bank Telescope, they will not be able to observe the full northern hemisphere sky, and their suitability ultimately depends on the instrumentation and observing programs implemented at those facilities. In addition, we will not know for several years whether these international facilities will be available to scientists from the United States; these new radio telescopes are not expected to operate under "open skies" policies. Given the timescales for building and commissioning these new instruments, as well as our need for overlapping observations to link existing data sets to data collected with the new instruments, it is critical that Green Bank continue to operate in the coming years. Green Bank's status among US and world radio facilities should be re---evaluated when the new facilities are in full operation and when it is understood whether U.S. scientists and their international collaborators have access to them. If you have any questions or would like to reply to our letter please contact the NANOGrav Management Team (nano---mt@nanograv.org).</p>	Against Closure	Email	11/25/2016	NANOGravGBOEISNOIResponse.pdf
264	a	Justin	Richmond-Decker		<p>You have no doubt been reading through mountains of wonderful feedback about the positive effect the Green Bank Observatory has on the people and the community. Well, I agree with all of it. The Observatory has not only had a hugely beneficial impact on my own life, but the lives of many people I meet and know in my daily life. I don't know of another place that does such wonderful science, while at the same time being so welcoming and inclusive to all people who pass through.</p> <p>I believe that the most important aspect of an organization is how it treats individuals; human beings. And I believe that two of the most important things you can do for a person is to bring them joy and bring them knowledge. And the Green Bank Observatory does that for every single person who sets foot on site. The Green Bank Observatory not only offers excellent employment opportunities for adults, and excellent research opportunities for students, but it also offers excellent tours and events for the public, as well as educational programs for young children.</p> <p>Personally, I have worked on the Space Race Rumpus committee for two years. This is an annual biking festival hosted by the Observatory, which has over the past five years raised tens of thousands of dollars to benefit local nonprofit organizations, supplying food to those who need it, and funding the county's wellness center. This is only one example of the many things the Green Bank Observatory does annually to the great benefit of the local community, as well as any people from afar who take part. And this is to say nothing of the top notch science and engineering that it does, which I'm sure many others have discussed in depth.</p> <p>Now let me change my attitude a bit, and discuss the NSF considerations. I am disappointed that the NSF decided to even decrease funding for the Green Bank Observatory. But, that the thought of actually shutting down the Green Bank site even entered anyone's mind, let alone became a major point of discussion, is absolutely unconscionable.</p>	Against Closure	Email - Scanned	11/22/2016	

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Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
264	b	Justin	Richmond-Decker		<p>I understand that the NSF has budget constraints, like any organization. It seems there were recommendations made to cut funding to the Green Bank site, and instead funnel this money into "newer" "fancier" telescopes. There was some perception that the type of science the Green Bank Telescope does is becoming outdated and dropping in popularity, and being replaced by demand for newer types of telescopes. For example, I know the NSF is happily pouring a bunch of money into the AIMA site, in Chile. Now, AIMA I'm sure is a fine telescope, and worthy of funding, but to say that it is MORE worthy of funding than Green Bank, because it's somehow better for the country's scientific endeavors, is absolutely 100% wrong.</p> <p>Demand for telescope time on the GBT is not decreasing at all, nor is the GBT becoming outdated. It is the most sensitive fully steerable radio telescope in the world. No other device on Earth can see so much of the sky with such power. And as we continue to develop new receivers, spectrometers, and everything in between, the capability of the telescope only improves. The GBT is an example of a fully functioning, already built telescope, which can continuously upgrade itself, and keep working for years to come. The opportunity cost for defunding something like this is immense. Basically, the NSF is considering scrapping a scientific behemoth that it spent hundreds of millions of dollars to build and develop, a behemoth that is still currently doing exactly what it was designed to do, and doing it better than ever.</p>	Against Closure	Email - Scanned	11/22/2016	
264	c	Justin	Richmond-Decker		<p>Now, moving on from that, let us consider the aspects of defunding the Green Bank Observatory that don't involve the great science it does. Appalachia, including rural West Virginia (including Pocahontas County), is essentially the poorest region of the United States. This is an area that is struggling, and has been struggling for many decades.</p> <p>Besides farming subsidies, it seems that rural areas tend to be largely neglected by the federal government, who tends to create jobs in cities, or encourage people to urbanize. This does nothing to improve the quality of life for rural communities, and in fact makes it worse. Not only is this region deficient on money, but we are hugely deficient in quality education. Pocahontas County, though still struggling, has one of the best school systems in the state, in large part helped out by the Green Bank Observatory. AIMA (in Chile), on the other hand, employs some American scientists and engineers, but it does not boost tourism or educational outreach within the United States, nor does it bring money or knowledge into the hands of the general American people, least of all its rural citizens.</p> <p>Here we have a beautiful, cutting-edge bastion of scientific research, which brings millions of dollars annually into the state of West Virginia, and provides wonderful educational programs, not only for the locals but for people from anywhere. This is something that is providing a huge benefit to the American people who most need that benefit. And the NSF is considering getting rid of that benefit. That would be just absolutely atrocious. In a time when our country's poorest people are so concerned that the federal government is doing nothing to help them, this kind of thing certainly feeds that problem.</p>	Against Closure	Email - Scanned	11/22/2016	
264	d	Justin	Richmond-Decker		<p>Cut funding to the Green Bank Observatory, and you get rid of free telescope time that benefits science students all over the country, as well as compromising our status as a forerunner in the American scientific endeavor. That's no good. Get rid of the Green Bank Observatory entirely, and you get rid of one of the most iconic and profoundly beneficial things in West Virginia. You get rid of a learning opportunity for thousands of students every year. You get rid of hundreds of jobs, thousands of tourists, and millions of dollars that come into the state of West Virginia. You get rid of people's livelihood. You leave this county a shell of its former self, and you disgrace your entire country by carelessly removing one of its most marvelous feats of human achievement. This is more than just a place for science. It is an institution, in both the literal and figurative sense.</p> <p>The only right choice for the NSF is to continue funding the Green Bank Observatory as it has in the past. The wrong choice for the NSF is to decrease funding to the Green Bank Observatory, and force us to be funded by external partners, basically making us a business observatory. To stop operations of the Green Bank site is not a choice at all for the NSF, because that would go against everything the NSF should stand for.</p> <p>Thank you for reading, and I sincerely hope the NSF will listen to how overwhelmingly laud this Observatory is by everyone it touches, and that they will make the right choice.</p>	Against Closure	Email - Scanned	11/22/2016	
265		Mike	Brown	Mike Brown Scoutmaster Troop 81	<p>My name is Mike Brown, and I am the Scoutmaster of Boy Scout Troop 81 in Crimora, Virginia. I wanted to let you know what an incredible STEM resource that the Green Bank Observatory is to the Boy Scouts of America. I brought my son Mason, who was a Cub Scout at the time, with a group of 10 Boy Scouts from Troop 81 four years ago because he was really into astronomy. He, and I were both blown away by the overnight program for Scouts at Green Bank Observatory. Since that trip he became a much better science student. He has been to McCormick Observatory three times, has attended several star parties through "dark skies/bright kids", and attended a workshop where he built his own telescope.</p> <p>We brought another group of 13 Boy Scouts from Troop 81, including Mason, back to Green Bank Observatory on November 11-13th to work on their Astronomy Merit Badge, and the program that Sue Ann presented was even better than it was 4 years ago. Please find a way to continue funding Green Bank Observatory so that more Boy Scouts, and Girl Scouts can experience the STEM program.</p>	Against Closure	Email - Scanned	11/22/2016	

Green Bank Observatory -Written NSF Public Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
266	a	Jennifer	Weston	Postdoctoral Researcher Green Bank Observatory	<p>I am writing to express my support for the continued funding of the Green Bank Observatory.</p> <p>I am a newly minted astronomy PhD, and recently moved to West Virginia after accepting a postdoctoral position at the Green Bank Observatory. In the eight months that I have been here, I have seen the great impact that this facility has not only in the groundbreaking science that comes out of the telescope, but also on the community that surrounds it.</p> <p>As a young scientist at the beginning of her career, access to facilities such as the Robert C. Byrd Green Bank Telescope (GBT) is particularly important to me. The 100m telescope is unique in its sensitivity and its steerable nature which enables it to view 85% of the sky. The GBT's open sky access has led to new finds in pulsar research, star formation and evolution, black holes and gravity, galaxies, astrochemistry, and many other fields of astronomy. New capabilities are still being added to this telescope so that even more will be discovered in the future.</p> <p>Additionally, the training which Green Bank staff often provides for new observers helps with accessibility to radio astronomy and new opportunities in continuing research. Before coming to the Green Bank, all my observations with radio telescopes had been remote, performed by others -- being able to personally undertake my observations was a new and exciting experience even after years of working in radio astronomy throughout graduate school. The GBT is a draw to scientists like myself, who might not be able to get this experience anywhere else, and is an encouragement for us to come to this region and get an excellent start to our careers.</p>	Against Closure	Email - Scanned	11/22/2016	
266	b	Jennifer	Weston	Postdoctoral Researcher Green Bank Observatory	<p>Green Bank also offers public outreach and education unique to this part of the country that is irreplaceable. In addition to the many school groups and families who visit the science center each year, Green Bank provides opportunities for students which are unique to this facility, including hands on telescope training on some of the older telescopes on the observatory grounds. This includes the PING: Exploring the Cosmos summer camp, which gives 9th grade students, particularly from under-represented groups in STEM, the opportunity to stay the telescope and do their own observations and research. At a time when STEM education is under threat, programs and opportunities like this one are critical in helping young people grow and learn.</p> <p>The Green Bank Observatory has been at the heart of radio astronomy and the heart of the West Virginia community for almost 60 years. Continued funding would secure that place for many years to come.</p>	Against Closure	Email - Scanned	11/22/2016	
267		Stephanie	Haden	lifelong West Virginian who wishes to remain here and raise my family	<p>Would like to take a moment to remind the NSF that we West Virginians value the science, STEM jobs, public education opportunities, and tourism revenue provided by the Observatory. Please avoid at all costs any cuts or reductions to this facility.</p>	Against Closure	Email - Scanned	11/22/2016	
268		Mary	Fuller		<p>This letter is to request the GBT still have funding from the NSF. I believe there is an impact study for the NSF funding ongoing now.</p> <p>I am a 44 year veteran teacher. Have been teaching at a high school in Allegany County Maryland for the last 35 years. I bring my Honors and AP chemistry classes to the GBT to use the 40' radio telescope, annually. This is the only field trip I take my students. My school is in Appalachia. We are a consolidated clientele of farmers, coal miners, urban kids, and rocket scientists from ATK. Many of our students are from broken homes with no apparent income. Our school has over 69 % free and reduced lunch students. I get a STEM grant to pay for a school bus to drive us the 2 ¼ hour ride to Green Bank. For some of my students this is the only time they have left Cumberland. We spend a weekend in the Dormitory. We collect satellite information over a two night data collecting period. The students analyze the data, organize a spreadsheet with their combined results and try to explain what they have found. I have had such positive feedback from my participants. One girl went on to major in astrophysics at Pitt after she graduated. One student is now a college chemistry professor at Barnard in NY. One student is working with NOAA after he received his PhD in atmospheric physics. None of these students were the children of the Rocket scientists though. They were the children of the blue collar workers in our community. Because of the freedom to investigate on their own and use the radio telescope on the Green Bank site, they developed a desire to push themselves out of their comfort zone and try something they thought beyond their abilities. I would hate for this opportunity to be denied to my students. I know without the NSF funding, we would not be able to afford the trip.</p> <p>I have seen many of my students list this trip to Green Bank as the single most worthwhile lab experience of their high school. They felt independence like nowhere else. They have used it on their application to colleges. Funding is being cut everywhere. Our school district is hard hit because we are a rural area in the outermost counties of Maryland. We have a very limited tax base with many of our citizens being retired or in nursing homes. I would be very sad to see this one opportunity that I can afford to my students taken away by yet another cold budget cut. Please consider the impact the education component at the NRAO has on students before writing off the funding. I greatly appreciate your consideration.</p>	Against Closure	Email - Scanned	11/22/2016	GBT and NSF.docx

Green Bank Observatory -Written NSF Public Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
269		Yurii	Pidopryhora		<p>It really saddens me to hear about all this recent turmoil around the Green Bank Observatory. You see, unlike many other scientific tools, radio telescopes have very long productive age. For example, the flagship of German radio astronomy, the 100 m. Effelsberg telescope went into operation in 1972. The biggest British dish is even older: 250 ft Mark I Lovell telescope at Jodrell Bank was completed at the very dawn of radio astronomy in 1957. A couple more examples: the Australian dish of the Apollo lunar landing fame, 64 m. Parkes saw its first light in 1961, the Dutch Westerbork array (WSRT) came to the stage in 1970. And nobody would even think of shutting down these invaluable instruments, on the contrary, millions of dollars are spent year after year by the governments of the corresponding countries to upgrade these and many other lesser dishes born in 1960-1980, and to keep them honed to serve at the very cutting edge of modern science. Not just that, everybody is very PROUD to have these telescopes, they are considered no less than national monuments. So to even consider shutting down or limiting the operation of the 100 m Green Bank Telescope (GBT) which went into the operation in 2001?! This sounds like something Attila the Hun would do. While you are at it, why don't you go to the Metropolitan Museum and start burning paintings, I am sure that this can save some space and free some money too! Or maybe blow up the Statue of Liberty? After all it is pretty much useless, it only occupies some very expensive place! I am resting my argument here, below I will just describe my own experience with the GBT, so maybe you will understand why I am so emotional concerning this whole matter.</p> <p>In 2004-2006 I spent 3 years living and working in Green Bank as a predoctoral fellow. In many ways these years were the best in my life and have determined the course of my entire academic career. In the beginning of my PhD dissertation work I wrote two successful observational proposals for the use of the GBT with myself as the principal investigator. In total we were granted about 150 hours of observation for my project and so I was lucky to spend a lot of time in the GBT control room just after it went operational. It is an amazing instrument. Since then I worked in many radio astronomical observatories around the globe and had some experience with pretty much every major radio telescope in existence, but it has never felt like that time with the GBT. As the result of these observations we have discovered something incredible: a huge super bubble of hydrogen comparable in size with our whole Galaxy, with millions of solar masses of gas locked in its enormous structure. There is no interstellar Guinness book of records that I know of, but this thing may just be the largest Galactic object in existence. If it were visible to the naked eye, it would have completely dominated our night sky. Right now it is known as the Ophiuchus super bubble and it took its place in the pantheon of important astronomical discoveries of the 21st century. We have published our findings in the Astrophysical Journal (v. 656, p. 928, 2007) and presented them at the annual meeting of the American Astronomical Society in 2005. The story has been picked up by the media and produced a news splash of 100+ newspaper, magazine articles and TV programs in many countries all over the world. But my point is, we were able to detect this gigantic new thing in the area of the sky previously covered by many other instruments in various surveys over decades. Nobody saw anything special there before we used the GBT. We have discovered the Ophiuchus super bubble because the GBT is THAT good. I hope that reason wins over greed and political games, and the Green Bank Observatory together with its collection of priceless tools and unique community thrives for many more decades and produces cornucopia of amazing results.</p>	Against Closure	Email - Scanned	11/22/2016	
270		E. Janney	lockman		<p>I urge to you continue funding for the Green Bank Observatory and the science that is being conducted there, not only for the sake of exploration and discovery but also because of the educational benefits to the community.</p> <p>I grew up in Green Bank and attended Green Bank Elementary Middle School, then later Pocahontas County High School. Throughout my entire education, the Observatory provided a constant supplement to my rural, public school education. Whether it was through field trips to the facility to learn about pulsars, lectures by astronomers, engineers and educators that encouraged us to dream of careers in STEM or simply supplying the community with employees who volunteered their free time to coach soccer, judge the science fair or even teach calculus, my public school education would not have proven as rich without the presence of the Green Bank Observatory.</p> <p>The reach of the Green Bank Observatory goes far beyond that of its facility and the Radio Science Community. The GBO is a major pillar of the economy in Green Bank and Pocahontas County and every child who has passed through the school system there, as well as other members of the community has been impacted in at least one positive way by its presence.</p>	Against Closure	Email - Scanned	11/22/2016	
271		Devaky	Kunneriath		<p>I am writing this email to express my support for continued NSF investment for science-focused operations at Greenbank Observatory. I am a radio astronomer and the impact that Green Bank observatory has had on radio astronomy cannot be overstated. I believe continued NSF investment in the observatory will be beneficial to the astronomy committee for many years to come.</p>	Against Closure	Email - Scanned	11/22/2016	
272	a	Daniel	Froideveux	M.F.A. Director/Cinematographer	<p>When we began filming in March of 2012, we were welcomed by the staff at the NRAO, in particular Michael Holstein and Dr. Karen O'Neil, who were tremendously generous with their time, and gave us great access to the facilities. We later conducted extended interviews with Dr. Karen O'Neil and Dr. Felix J. Lockman that were very informative, and provide the informational backbone for our film. The resulting footage from our tours of the facilities and the telescope itself is at once beautiful, and incredibly instructive. The telescope is both an engineering marvel and an architectural structure of tremendous beauty. Through the NRAO's public education programs, people the world over are invited to learn about the complex science of radio astronomy, and I expect that films like ours will only increase the public appetite to visit this unique and fascinating place.</p>	Against Closure	Email - Scanned	11/22/2016	GBT_letter_to_NSF.pdf
272	b	Daniel	Froideveux	M.F.A. Director/Cinematographer	<p>I am writing to express my support for the continued operation of the Robert C. Byrd Green Bank Telescope. As a documentary filmmaker from Canada, my perspective is informed by the tremendous value of the NRAO, and the Green Bank Telescope as an opportunity for public education about radio astronomy.</p> <p>I am currently completing a documentary film titled The Quiet Zone, which examines both the unique science of radio astronomy, and the positive effects of the National Radio Quiet Zone for a community of people who believe that they have an illness brought on by a hyper-sensitivity to certain frequencies of electromagnetic radiation.</p> <p>While the science on the existence and causes of the electro-sensitive community's medical condition remains unclear, the positive effects of the presence of the GBT for the community are irrefutable. For many people, the existence of a unique environment which fore.es people to unplug is gaining increasing recognition as a benefit for everyone. Personally, I don't believe that a clear causal relationship between EMF and illness needs to be established in order to make a strong argument that in a society that is constantly connected there is great value in having an area that is federally protected from the permeation of wireless communications.</p>	Against Closure	Email - Scanned	11/22/2016	GBT_letter_to_NSF.pdf

Green Bank Observatory -Written NSF Public Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
272	c	Daniel	Froideveux	M.F.A. Director/Cinematographer	<p>Finally, during our time in Green Bank, it became clear that the NRAO has had a profoundly positive effect on the community: attracting business from the international scientific community, promoting tourism in the area and creating a myriad of jobs for the local economy. We met wonderful people who worked at the observatory from service workers in the cafeteria and gift shop, to the highly skilled operators of the telescope. Everywhere we met locals who would talk to us about the observatory with a great sense of pride.</p> <p>Since returning from multiple trips to the observatory and the surrounding community, friends and colleagues from around the world have expressed interest in visiting the area.</p> <p>For all of these reasons, I urge you to consider extending the mandate of the Green Bank Radio telescope for astronomical research.</p>	Against Closure	Email - Scanned	11/22/2016	GBT_letter_to_NSF.pdf
273		Jonathan	Keohane	Associate Professor of Physics and Astronomy	<p>I am a professor at Hampden-Sydney College who teaches courses in both astronomy and physics. I have been bringing my students to the National Radio Astronomy Observatory at Green Bank for a hands-on, multi-day, field trip for the past decade. I am very concerned about the future of the observatory, and the impact that it will have on the future of American astronomy.</p> <p>As a field trip destination for a 200-level astronomy course, the Green Bank Observatory cannot be beat. This is because of the unique combination of (1) a world class radio observatory, (2) an analog telescope that the students control themselves, and (3) a location within driving distance from many colleges and universities.</p> <p>This past spring, my students spend almost a week in Green Bank. During that time, they (1) mapped the neutral hydrogen in the Galactic plane using the 40 foot antenna, (2) applied a galactic rotation model to these data, (3) toured the control room for the Byrd 100 meter telescope, and (4) worked with pulsar data from the Byrd telescope. While we may have done some of these things back at school, the simple act of being at the observatory made for a completely different experience for the students.</p> <p>As I understand it, the NSF is considering the following five possibilities for the site:</p> <ol style="list-style-type: none"> 1. Continued NSF investment for science-focused operations (No-Action Alternative) 2. Collaboration with interested parties for science- and education-focused operations with reduced NSF-funded scope 3. Collaboration with interested parties for operation as a technology and education park 4. Mothballing of facilities (suspension of operations in a manner such that operations could resume efficiently at some future date) 5. Deconstruction and site restoration. <p>Given these alternatives, only the first two are viable for our continued use of the facilities.</p>	Against Closure	Email - Scanned	11/22/2016	
274		Sarah	Wheeler	Federal Relations Associate, Federal Research Relations	<p>Email: Attached you will find 6 PDF letters of support for Green Bank Observatory in response to NSF's request for comments prior to GBO's Environmental Impact Statement. Hardcopies of these letters were also mailed to Elizabeth Pentecost's attention.</p> <p>Please let me know if you need anything else regarding the letters of support, or if the PDFs will not suffice for submission.</p> <p>Letters: Each letter inserted individually.</p>	Against Closure	Email - Scanned	11/22/2016	
275		Mark	Whittle	Professor of Astronomy	<p>I write out of deep concern about the future of the Green Bank Observatory and the Green Bank Telescope, and in particular the possibility that its use by the astronomical community may be significantly reduced. In my opinion this will have a significant and negative impact: on a number of critical astronomical research areas; on the vibrancy of the radio astronomical community (both national and international); on the training of the next generation of radio-literate research astronomers; on the development and implementation of innovative new radio receivers; and on the sustainability of a continuing cohort of engineering staff who design and support the US radio astronomy observatories.</p> <p>My perspective has been recently shaped as current Chair of the NRAO Science Review Panel (SRP) for Active Galaxies, and as member of the NRAO Time Allocation Committee (TAC). As such, I have witnessed close up the number and breadth of proposals to use all the NRAO facilities (VIBA; JVIA; GBT; GMVA). I have been impressed and somewhat surprised to learn that in many ways the GBT is the most sought after instrument and has some of the greatest pressure on its time. Frequently, as the TAC goes down the proposals ranked by the SRPs, it is the GBT that hits its allocation limit first, and many excellent programs asking for its time must be rejected. The range of science being requested is not only very broad, but some of the most interesting and transformative science is represented. One thinks of the imminent detection of gravitational waves from supermassive black holes using the Pulsar Timing Array; or measuring the most accurate black hole masses using maser disks; or witnessing the event horizon of the Milky Way black hole; or the sensitive SZ mapping of the intercluster gas in high-redshift clusters. I could go on, but heres a final example: One of the categories that receives the highest pressure is when the GBT is a crucial element in a global array of telescopes (that can include the Russian RadioAstron satellite), providing the highest angular resolution currently achievable. It's the GBT's great sensitivity that make it a necessary element in these projects, many of which would be impossible without it. I use this example in part because it highlights the international impact that the GBT has.</p> <p>While my own experience of using the GBT and being aware of its impact on research through seminars and the research literature, is of course limited and specific to my own interests, I believe my perspective from the NRAO TAC gives me a much broader and clearer view of the crucial place that the GBT occupies within the radio astronomy community, and in the wider astronomy community. I can say, without any hesitation, that the GBT has played, and hopefully will continue to play, a fundamentally important role as one of the USA's and World's, premier instruments for scientific research.</p>	Against Closure	Email - Scanned	11/22/2016	

Green Bank Observatory -Written NSF Public Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
276		Jeb	Bouchard		<p>I live in the small, rural state of Vermont. I know how important access to resources are. GBO provides their small town with the means to sustain their elementary school. It provides jobs for local, highly educated people. It offers research and science and understanding of the universe. There is no price tag for this. The greater GBO community rely heavily on the continued operation of GBO.</p> <p>Please consider maintaining full operations and continuing to invest in science- focused operations.</p>	Against Closure	Email - Scanned	11/22/2016	
277		Christopher	Handy	1st Lt, USAF Flight System Test Engineer	<p>My name is Christopher Handy and I'm currently a Test Engineer for the United States Air Force. When I was in college, I was a part of a trip to the observatory that was sponsored by a radio astronomy course I took. Having visited the site and seen it, I felt that it wouldn't be right if I didn't voice my opinion that this site should NOT be deconstructed or mothballed. Mothballing a facility is never as simple as the statement makes it sound. At my current duty station in Tennessee, we are currently bringing several facilities out of mothball status and the cost of doing so is very high compared to what routine maintenance would have cost over the mothball period. As far as deconstructing, this option would waste a great opportunity to support universities in their coursework and research. It would also miss the mark on the governments push in STEM investments which has been a crucial area that the Air Force has focused its activities. I have no doubts that the National Science Foundation has as much or a greater focus than we do on this area.</p> <p>Ultimately, I think the best option would be to continue investing for science focused operations but knowing full well that the budget for scientific research has been cut over the last few years, the next best option would certainly be to focus on STEM education with interested parties.</p> <p>Thank you for your time in the matter and I wish you a happy Thanksgiving!</p>	Against Closure	Email - Scanned	11/22/2016	
278		Sharon and John	Clouse		<p>I was introduced to the Green Bank Observatory (GBO) about 5 years ago when a family member, Loren Anderson, became affiliated with West Virginia University (WVU). Loren is an Assistant Professor of Physics and Astronomy at WVU and has observed at GBO for hundreds of hours, producing over ten peer-reviewed publications. As I am sure you are well aware, he is not alone in his use of the GBT and scientific contributions he has then made. It is crucial that we continue to support scientific endeavors such as GBO and I urge you to maintain full operations and continue to invest in science-focused operations.</p> <p>I would also like to stress is the impressive impact the GBO makes in the hills of Pocahontas County, WV. This region is an oasis of inquisitive, bright, and hard-working people who are proud to contribute to this world-class instrument. It is also unique as a radio-free zone, located within a relatively short distance of many urban areas (4 hour drive time to Washington, DC). Loren has worked each summer at GBO and brought his family to stay at the campus facilities located there. The summer scientific community is rich and they have made friends with numerous families who call the GBO-area their home. We understand without the facility, the town will no longer be able to support an elementary school.</p> <p>West Virginia is clearly struggling and it is frequently listed as one of the states failing its residents in terms of education, poverty, and health. Despite those challenges, residents are also an incredibly proud group, made more so by the superb contributions we can make by supporting this facility in its continued full operation.</p> <p>As you consider your options for the GBO, I strongly encourage you to maintain full operations and continue to invest in science-focused operations. The scientific community, county, and state rely on this facility for a great deal and many of us would suffer without it.</p>	Against Closure	Email - Scanned	11/22/2016	
279		Hannah	Dalporto		<p>I am a West Virginian with great interest in the Greenbank Observatory. The Observatory is an undisputed national and state treasure, and an incredible resource to science. We all value the science, STEM jobs, public education opportunities, and tourism revenue provided by the Observatory. I hope you will consider my voice when reevaluating the funding this important landmark and resource should receive.</p>	Against Closure	Email - Scanned	11/22/2016	
280		Barbara	Weaner		<p>I heard that once again the Greenbank Observatory is threatened with closure. I hope this will be reconsidered.</p> <p>My children benefited from school visits to the Observatory, and I have had patients employed there. The small community of Greenbank relies on the station for commerce and employment. The station has benefited scientific exploration. The telescopes are expensive and it would be a huge loss to make them defunct.</p> <p>Is there a creative solution that can come up with a way that the station could stay open? Has alternative funding been sought? Can you partner with business or education (Universities or colleges)?</p> <p>I know these are financially strained times, but science is important.</p>	Against Closure	Email - Scanned	11/22/2016	

Green Bank Observatory -Written NSF Public Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
281	a	Tracy	Clark	Research Astronomer Remote Sensing Division US Naval Research laboratory	<p>The 100-meter Green Bank Telescope (GBT) at the Green Bank Observatory (GBO), the largest steerable single-dish telescope in the world, is a highly valuable and unique astrophysical resource to the scientific and academic community. The high frequency capabilities of the GBT are key to a wide range of critical scientific investigations. In particular, the high frequency system on the GBT is highly valuable as a complement to the AIMA interferometer. In addition, GBT's rapid sky scanning and large field of view serve as a critical source finder for high-resolution AIMA follow-up.</p> <p>The scientific output and future impact of the GBT is very high. I am therefore writing in support of the "No-Action Alternative" to continue the current methods of science operations at the GBO, including the Open Skies policy which leads to time allocations to the highest quality scientific studies.</p> <p>The GBT is a dynamic and evolving instrument. The high-frequency science case shown in Bally et al. (2016) [https://arxiv.org/abs/1610.09014] outlines the latest upgrades that are recently commissioned and/or still being commissioned. These continued enhancements keep the GBT at the forefront of scientific investigation and continually expand its impact on astrophysics. I have most recently been involved in collaborations that will engage the MUSTANG-2 back end for studies of galaxy cluster pressure substructure at high angular resolution compared to other cosmic microwave background instruments.</p>	Against Closure	Email - Scanned	11/22/2016	
281	b	Tracy	Clark	Research Astronomer Remote Sensing Division US Naval Research laboratory	<p>The GBT also serves a powerful role as an educational and training instrument for the new generation of instrumentalists and observers. The GBO itself, including the visitor's center, is a powerful resource for attracting STEM interest across the State of West Virginia and beyond. Recently there have been millimeter/submillimeter facilities that have been privatized or completely shut down, seriously reducing the facilities available for training the current and future generations of high frequency researchers.</p> <p>The scientific productivity of the GBT and the educational/outreach role of the GBO are both shining examples of how nationally funded facilities can meet the NSF AST mission of supporting forefront research, ensuring scientific excellence to the U.S. community, supporting new instrumentation, and providing a broad understanding of science to a diverse community. The power of the GBT to excel across the board on NSF mission requirements clearly reveals its importance to the U.S. community.</p>	Against Closure	Email - Scanned	11/22/2016	
282		Emily	Brown	Director of Applied Research Knowledge Management & Development Dept.	<p>I am writing today to voice my support for the continued operations of the Green Bank Telescope in Pocahontas County, WV. This telescope is an important research tool that is a major driver of the local economy as well as the state's scientific community. It has supported the development of major discoveries about space, and is an important research facility for thousands of students.</p> <p>In addition to the contributions that the Green Bank Telescope has made toward science, it also contributes to the WV economy, helping to diversify it as fossil fuel and other extractive industries become increasingly fragile.</p> <p>West Virginia is the recipient of millions of dollars in federal funding to combat poverty and health problems in the state. Yet, these programs have not made much of a difference in moving the state forward. For real change to take place in Appalachia, the economy must shift into the 21st century. There is already some movement toward funding this at the federal level.</p> <p>At the International Economic Development Council, I work with the Partnerships for Opportunity and Workforce and Economic Revitalization (POWER) Initiative that is being driven by the Economic Development Administration. This innovative, new multi-million dollar, multi-agency program aims to empower communities to adapt to the changing energy landscape and reposition their economies for a prosperous future.</p> <p>It would be a shame if, while other departments were supporting economic change in West Virginia, the National Science Foundation cut funding to a project that has a long history of successful research endeavors and an established presence as an economic driver in the state. Please consider the continued funding of the Green Bank Telescope.</p>	Against Closure	Email - Scanned	11/22/2016	image001.jpg
283		Andrew	Jordan		Seriously, don't do it. You'll be throwing away so much industry and education for West Virginia. People love this thing. Don't do it!	Against Closure	Email - Scanned	11/22/2016	
284		Nathan	Stano		<p>I am writing in response to the call for public comments on the fate of the Green Bank Observatory site.</p> <p>As a student, I was privileged to be part of one of the few student radio astronomy groups in the country. Part of that group's program was an annual trip to Green Bank each spring. This was an incredible opportunity to meet the researchers there and to see the work being done in radio astronomy. These trips were a big part of creating a passion for science and scientific research that endures to this day. It is critical not only that the research that takes place be allowed to continue, but that it be allowed to inspire young people in their pursuit of science.</p> <p>I would strongly hope that either of the following options be chosen:</p> <ol style="list-style-type: none"> 1. Continued NSF investment for science-focused operations (No-Action Alternative) 2. Collaboration with interested parties for science- and education-focused operations with reduced NSF-funded scope 	Against Closure	Email - Scanned	11/22/2016	

Green Bank Observatory -Written NSF Public Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
285	a	Ken	Kellermann		<p>I write to support the "Continued NSF Investment for science focused operations" in Green Bank (No – Action Alternative.). I am a long time member of the NRAO Scientific Staff, and for 20 years lived with my family in Green Bank.</p> <p>A large fully steerable radio telescope was part of the original plan for the NRAO. Although endorsed by the 1964, 1970, and 1980 decade reviews of astronomy, the construction of a 100-m class filled aperture radio telescope was always deferred by the higher priority VLA and VLBA projects until funds became available in 1989. The resulting unique capabilities of the Green Bank Telescope are well documented, and as a result if its extraordinary sensitivity, frequency coverage, and low side-lobe level includes unprecedented investigations of pulsars, interstellar molecules, as well as Galactic and extragalactic neutral hydrogen.</p> <p>Very Long Baseline Interferometry was invented in Green Bank, and for decades, the 140-ft radio telescope was the focal point of national and international VLBI. For half a century, joint VLBI observations between Green Bank and radio telescopes in Russia, have provided the highest resolution astronomical ever achieved in astronomy. Of particular note has been the many exchange visits between Russian and Green Bank scientists which have continued until today through the depths of the Cold War which have surely led to a better understanding between Russian and American people.</p>	Against Closure	Email - Scanned	11/22/2016	GBO.docx
285	b	Ken	Kellermann		<p>But, I want to call attention to the collateral impact of the NSF facilities in Green Bank of which the GBT is the centerpiece of Observatory operations.</p> <p>The National Radio Quiet Zone and the West Virginia Radio Astronomy Zoning Act, which were created following the establishment of NRAO in Green Bank, over half a century ago, are unique resources which can be compared with other protect national resources such as national parks. Although other radio quiet zones have since been established to protect radio observatories in other countries, none are able to grandfather the proliferation of radio emissions established over the past 50 years. Once abandoned, it will never be possible to return to the radio quiet levels which are currently found in Green Bank.</p>	Against Closure	Email - Scanned	11/22/2016	GBO.docx
285	c	Ken	Kellermann		<p>The Green Bank Observatory is one of the largest employers in eastern West Virginia, and arguably the major employer of highly skilled labor which brings not only badly needed financial resources but also unique intellectual resources to the local community. While I lived in Green Bank, my wife as well as spouses of other staff members taught in the Green Bank and Pocahontas schools. Others provided multiple volunteer services to the local community. Thirty-five years after leaving Green Bank, we and other former Green Bank staff still support the Pocahontas County Library system.</p>	Against Closure	Email - Scanned	11/22/2016	GBO.docx
286		Ann	Comstock Halverson		<p>I was introduced to the Green Bank Observatory (GBO) about 5 years ago when my son-in-law, Loren Anderson became affiliated with West Virginia University (WVU). Loren is an Assistant Professor of Physics and Astronomy at WVU and has observed at GBO for hundreds of hours, producing over ten peer-reviewed publications. As I am sure you are well aware, he is not alone in his use of the GBT and scientific contributions he has then made. It is crucial that we continue to support scientific endeavors such as GBO and I urge you to maintain full operations and continue to invest in science-focused operations.</p> <p>I would also like to stress is the impressive impact the GBO makes in the hills of Pocahontas County, WV. This region is an oasis of inquisitive, bright, and hard-working people who are proud to contribute to this world-class instrument. It is also unique as a radio-free zone, located within a relatively short distance of many urban areas (4 hour drive time to Washington, DC). Loren has worked each summer at GBO and brought his family (my daughter and granddaughters) to stay at the campus facilities located there. The summer scientific community is rich and they have made friends with numerous families who call the GBO-area their home. We understand without the facility, the town will no longer be able to support an elementary school.</p> <p>West Virginia is clearly struggling and it is frequently listed as one of the states failing its residents in terms of education, poverty, and health. Despite those challenges, residents are also an incredibly proud group, made more so by the superb contributions we can make by supporting this facility in its continued full operation.</p> <p>As you consider your options for the GBO, I strongly encourage you to maintain full operations and continue to invest in science-focused operations. The scientific community, county, and state rely on this facility for a great deal and many of us would suffer without it.</p>	Against Closure	Email - Scanned	11/22/2016	
287		Brian	Spragg		<p>Please don't shut down the Green Bank Observatory!</p>	Against Closure	Email - Scanned	11/22/2016	

Green Bank Observatory -Written NSF Public Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
288		Charlie	Figura	Professor of Physics and Astronomy Director, Wartburg Platte Observatory	<p>I'm writing in support of Continued NSF investment for science-focused operations (the No-Action Alternative) for the Green Bank Observatory.</p> <p>As an astronomer and educator, I recognize that the Green Bank Telescope (now a part of the Green Bank Observatory) is a vital part of astronomical research and astronomical education in the United States and in the world.</p> <p>It's easy to get distracted, I think, but some of the newer telescopes that have come on line or are coming on line: it's easy to think that AIMA or FAST replace the GBT's technologies, that it has now become obsolete. The GBT, however, has several vital aspects that make it an irreplaceable astronomical tool.</p> <ol style="list-style-type: none"> 1. The GBT is able to conduct significant astronomical research at a wide range of radio bands, and is the most sensitive telescope at short wavelengths (<10cm) 2. The GBT plays a heavy role in education at the undergraduate and graduate levels. Research faculty involve undergraduates in research projects, GBO hosts undergraduates for summer research opportunities, and graduate students work with faculty and complete their own degrees using the GBT. <p>As a researcher and educator at a small liberal arts and sciences institution, I feel the potential loss of services at the GBT very strongly. The Observatory plays a vital role in both my research and in student education, and as an open-use facility provides opportunities to faculty and students associated with small institutions that cannot maintain significant research instruments of their own.</p> <p>As the GBO struggles to obtain funding, opportunities for research and education are lost. Within the past month researchers (myself included) have been notified that as part of the divestment and outside investment in the observatory, allocated research time has been cut and capped. As we project the potential loss of NSF funding, these cuts will hamstring the Observatory's role in education and research, and the pipeline for new astronomers will be severely constricted. None of the remaining single-dish facilities in the United States can compete with the GBT in terms of research capability.</p> <p>I strongly urge the NSF to maintain funding in the GBT. Letting support for this facility decrease or lapse will restrict or terminate its use, and severely impair radio astronomy research and education in the United States for years to come.</p>	Against Closure	Email - Scanned	11/22/2016	
289		Elaine	LeRose Ridenour		<p>I am originally from West Virginia, and as a child, was fascinated with learning about the Green Bank Observatory. I remember reading about Green Bank in second grade, and how I couldn't wait to visit it in person. As an adult, I finally had the opportunity to visit the Green Bank Observatory several times with my husband, and we have taken both of our daughters to tour Green Bank many times, beginning when they were very young. It is one of our favorite spots in West Virginia; a real hidden gem for the state. Green Bank encourages people to use their love of math and science to dream big. I have a degree in engineering, and both of our daughters are also studying engineering in college. I feel that our visits to the Green Bank Observatory fueled their passion for engineering. Please do not shut down the Green Bank Observatory.</p>	Against Closure	Email - Scanned	11/22/2016	
290	a	Ardis	Herrold		<p>I am writing a letter of support and input regarding your decision regarding the facilities at the Green Bank Observatory site. I am an educator with 38 years of classroom experience at the high school and university levels. Professionally, I am a past president of both the National and Michigan Earth Science Teachers Associations, and have been involved in astronomy education and outreach and teacher training throughout my career. From this perspective, I wish to share the value and impact that the Green Bank Observatory has had, and continues to have, on teachers, students and the public.</p> <p>My first encounter with NRAO- Green Bank was back in the late 80's, when I attended a two-week teacher workshop there. We were immersed in a research experience, learned how to collect data with the forty-foot telescope, and worked alongside scientists and engineers. Of the many quality NSF-funded teacher training programs I have been a part of, this was without a doubt one of the top two. What I learned there affected the way I taught for the next 30 years.</p> <p>I was so impressed with the program and staff at the observatory, that I formed a unique after school club - the Radio Astronomy Team (RATs). We built our own radio telescope and began making the 500 mile trip to Green Bank once a year, to learn about radio astronomy and use the radio telescopes there. Over the years, this club has had about 300 members, many of who went on to careers in science, computing, and engineering. Today they work in such places as NASA Goddard, Space X, and the Max Planck Institute for Radio Astronomy. One was even hired as a mechanical engineer to assemble the AIMA radio telescopes. At our club anniversary celebrations (of 20 and 25 years), the most common reflection offered was that involvement in the Radio Astronomy Team and their experiences at Green Bank emerged as the single most defining element of what influenced them to go on their chosen careers.</p> <p>Science drives science, but education is where science begins. The impact of scientists and engineers working with the next generation is often poorly estimated. What has energized many teachers and students who have come to Green Bank over the years is not simply the world-class education programs routinely conceived and implemented there - it is the synergy of being in a place where research is conducted, science dialog is a daily routine, and discoveries are generated.</p>	Against Closure	Email - Scanned	11/22/2016	
290	b	Ardis	Herrold		<p>Students and teachers aside, the general public is welcomed and encouraged to make use of the observatory facilities through the Visitor Center, and annual events such as the Green Bank Star Quest star party. I have had opportunity to see these interactions firsthand, having worked two summers at the observatory through the Research Experiences for Teachers program. There is no better way to build support for radio astronomy research and to demystify what it is about than to invite open inspection and participation in events at the facility. And Green Bank is much more visited than NRAO-Socorro, so its impact is greater.</p>	Against Closure	Email - Scanned	11/22/2016	

Green Bank Observatory -Written NSF Public Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
290	c	Ardis	Herrold		<p>As for funding the GBT to continue science research, I could not have been more perplexed when the announcement came that the NSF would reduce funding for its science operations. Yes, ALMA is the newest research initiative, but that doesn't change the fact that the GBT is still capable of cutting-edge science. Would we defund Hubble once Webb is in orbit? Why not get the most out of our investment and use both as long as possible?</p> <p>The engineers and machine shop personnel at Green Bank are also skilled at creating new instrumentation in radio astronomy, and it would be devastating to lose such expertise.</p> <p>I urge the NSF to continue to invest in science operations at the Green Bank site, and in fact, to restore funding to previous levels, as much as is possible. Thank you for taking the time to read this entire letter, and thoughtfully considering what I have communicated.</p>	Against Closure	Email - Scanned	11/22/2016	
291		Joseph	Trotto		<p>Please know that citizens care about the Green Bank Observatory with its accomplishments, the livelihood it provides for locals, and the scientific impact across the globe.</p> <p>Now more than ever we must support these endeavors. Thank you for the consideration.</p>	Against Closure	Email - Scanned	11/22/2016	
292		Shae	Krispinsky		<p>I am emailing in support for continued funding for Green Bank Observatory in West Virginia. Please keep the observatory, and please keep funding it to make sure its existence stays secured.</p>	Against Closure	Email - Scanned	11/22/2016	
293	a	Clark	Abadon		<p>I'm writing in to support the maintenance of full operations of the Green Bank Observatory! This observatory has a long and distinguished history of scientific exploration and discovery. Scientists from around the world use this instrument to explore and explain our place in the universe and the cosmos. This observatory continues to provide observations and data that inform how our part of the galaxy evolved and how it may evolve in the future. This is strong, solid and profoundly important basic science which needs the continuing support of scientific research dollars.</p> <p>My son-in-law, Loren Anderson, is an Assistant Professor of Physics and Astronomy at West Virginia University. My wife and I have had the great pleasure of experiencing the scientific outputs the GBO. He has observed for hundreds of hours, producing over ten peer-reviewed publications. As I am sure you are well aware, he is not alone in his use of the GBT and scientific contributions he has then made.</p> <p>As you consider your options for the GBO, We strongly encourage you to maintain full operations and continue to invest in science-focused operations. The scientific community, Pocahontas County, and the State of West Virginia rely on this facility for a great deal and many of us would suffer without it.</p>	Against Closure	Email - Scanned	11/22/2016	
293	b	Clark	Abadon		<p>This region of West Virginia also is significantly supported through the establishment and use of this telescope. West Virginia has many rural areas that are struggling to find solid footing for the families that have lived here for generations. The funding for the Green Bank Observatory provides important jobs and careers for the residents of Pocahontas County. These are jobs tailor made for rural communities. The jobs pay well, have good benefits and are environmentally benign. Indeed, modern jobs to that support rural and proud families.</p>	Against Closure	Email - Scanned	11/22/2016	
294	a	Robert	Anderson		<p>Here are some adverse cultural impacts I have not heard addressed yet.</p> <p>Pocahontas County, WV, is a remote area isolated by mountains. It becomes more isolated in winter. Travel to other areas can be increased by 50 to 100%. This means that a one-hour commuter in summer may travel a 90 minute to 2 hour commute in winter. The scientific and engineering staff have several persons, roughly 25% of the total site staff, who moved here from out of county and out of state. If the NSF decides on a significant change in operations, this group would relocate out of the county to find work in their fields, and being well educated, they could. There would be a significant adverse impact on the economy, culture, and educational involvement in the county, which others have addressed.</p> <p>The remaining 75% of the staff are local residents, consisting of craftsmen, technicians, clerical and support staff. Many only have a high school education or some college education. Finding a full-time job in the county would be nearly impossible as few opportunities exist. Younger staff would also have to relocate outside the county because of the long commutes. As real estate sales move slowly, taking 2 to 5 years sometimes, the breadwinners would likely work away and come home on days off, putting hardships on families. Older, less mobile staff would likely draw unemployment for many years and/or work at seasonal part time jobs. Some may lose their homes or farms as a result.</p> <p>Finally, roughly 65% of the county is federally or state-owned land. Tax Revenues are limited. The Observatory makes payments in lieu of taxes which are a not insignificant portion of county revenue. Loss of this revenue would have a major impact on funding for schools, senior citizen programs, and recreational and cultural activities.</p> <p>All of these aspects, based on your criteria, would have a "severe adverse" impact on all but the first and second alternatives under consideration. In contrast, the possible positive impacts of a partial or total site closure and restoration to a green field are minor: there is only a small hazardous waste stream, small air and water impacts, and the majority of the site (80 to 90%) is already either natural woodlands or fields maintained according to the State's Division of Natural Resources management plans.</p>	Against Closure	Email - Scanned	11/22/2016	
294	b	Robert	Anderson		<p>Because of commute times to these events, many leave mid-day and return after midnight. Most significantly, observatory staff and family members are role models that encourage young people to seek college or community college education. There is tremendous family, community and peer pressure to not pursue education; Pocahontas County has a high dropout rate as a result, and staff role modeling allows students to have a vision of something better than part-time work and welfare. In all aspects of community life, and especially in local churches, observatory families are active, seldom passive, participants.</p>	Against Closure	Email - Scanned	11/22/2016	

Green Bank Observatory -Written NSF Public Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
294	c	Robert	Anderson		<p>The Observatory provides infrastructure to attract and retain staff in this remote area. This includes site housing and the recreation facilities. These also benefit the community; staff can have family reunions, wedding receptions, and church picnics there, and the swimming pool is not only used by staff families, but the county teaches swimming lessons there, often with volunteer help from observatory staff and family members. The tennis courts, hiking and biking trails also give social and physical activities to observatory summer students and staff. The nearest similar pools and courts are an hour away, which makes them impracticable.</p> <p>Observatory staff and their families are very involved in the community. It is difficult for schools to get many longtime residents involved in school activities. Observatory staff members and family members provide unpaid mentoring in mathematics and sciences, are frequently the ones called on for science, social studies, and math fairs, and are often the one ones who are willing to chaperone school groups and sports teams on away trips.</p> <p>And yes, I am an Observatory staff member. We have lived here over 14 years. Our children were in first grade when we moved here, and we have seen both the advantages and disadvantages of raising them here, and have seen the day to day positive influences the presence of the Observatory and Observatory families have in this community.</p>	Against Closure	Email - Scanned	11/22/2016	
295		Rebecca	Ozbolt		<p>Dear national science foundation members, I would like to voice my concern about the possibility that this observatory may close. Not only is it the largest employer of that region, a large attraction for tourists and students (bringing about \$30 million to the poorest state in the union annually), it is THE FIRST national astronomy observatory and the first national laboratory open to all scientists from around the world. It would be a shame from every angle I look at the matter to stop funding this observatory and risk the shutdown of the facility. Please, please, please give it a chance!</p> <p>Thank you for your consideration.</p>	Against Closure	Email - Scanned	11/22/2016	
296		Emily	Wight		<p>Please continue supporting the Green Bank Observatory! It is key for continued education and employment future for West Virginia.</p>	Against Closure	Email - Scanned	11/22/2016	
297					<p>PLEASE DO NOT LET THIS HAPPEN!</p>	Against Closure	Email - Scanned	11/22/2016	
298		Andrew	Blackwood	Executive Director	<p>Since its inaugural session in 1963, the National Youth Science Camp (NYSCamp) and the Green Bank National Radio Astronomy Observatory (now the Green Bank Observatory) have maintained a very close relationship. Each summer, some of the nation's top-achieving, recently-graduated science and mathematics students attend the NYSCamp which is held less than 15 miles from the Green Bank Observatory. Countless astronomers, physicists, engineers, mathematicians, computer programmers, and technicians from the Green Bank Observatory (GBO) have presented lectures, led directed studies, and facilitated tours. The GBO introduced radio astronomy to more than 5,300 students through the NYSCamp and made astronomy accessible and exciting. While the vast majority pursue STEM careers outside astronomy, their exposure to the field through the GBO has broadened their understanding of basic research.</p> <p>For a decade starting in 2005 and funded with a grant from EPSCoR, the National Youth Science Foundation (NYSF) partnered with the GBO to plan and deliver the West Virginia Governor's School for Mathematics and Science (GSMS) to rising high school freshmen from across West Virginia. Resident professionals at the GBO served as the STEM experts as small groups of students partnered with a teacher and a student mentor, pursued real-world STEM research. As a result, these GSMS students are better equipped to pursue further education and careers in STEM.</p> <p>We believe the work being done at the GBO and the valuable stimulation it provides to the many students who are able to experience it's important scientific work make the facility an important part of America's accessible scientific community that is deserving of continued NSF support.</p>	Against Closure	Email - Scanned	11/22/2016	NSF - GBO letter_V02_20161122_ANB.pdf
299	a	Jaime	Simmons		<p>Good basic research should exist because that is the hallmark of a civilized society. I feel that I understand this more than most, having spent most of my working life in the State Archives library. Why should we repeatedly have to explain to our funding sources why we should continue to exist. Let me tell you that although my own formal exposure to science was minimal, my trip to Greenbank, several years ago I might add, was SO memorable, that it has stirred me to write this letter.</p> <p>I understand that because of reduced funding, the NSF is considering several options for its stable of resources, one of which is to dismantle the Greenbank Observatory. The goal, presumably is to use the decreasing resources in these uncertain times to make grants in other areas of study. The State of West Virginia should be considered an expert in the unintended consequences of reduced funding. In an effort to balance our state's budget, we have drastically reduced the allocation of funds used to award grants to market attractions within our state. Many of our otherwise dependable tourism venues experienced dramatic decreases in traffic as a result of the loss of these advertising dollars.</p>	Against Closure	Email - Scanned	11/22/2016	
299	b	Jaime	Simmons		<p>So in my clumsy attempt to list all the worthwhile and indeed existentially necessary research projects the scientists and astronomers do here, I might fail to mention a key discovery. I will leave such letters to better qualified people. If the greater threat is to reduced monies allocated to the NSF budget, why in the name of all that is good would you snuff out one of your biggest marketing opportunities on the east coast?? Every year, thousands of people come to GBT, many of them children, and are forever changed by their experience. Consider that most will never have another opportunity to see raw, basic science "in the wild" again in their lives. These people go home and vote for representatives who determine your budget.</p> <p>I am old enough to remember the Cold War, Sputnik and the "race to space". While I applaud and support the collaboration of observatories around the globe, I look back at West Virginia's Centennial Year, when GBT took pride of place on the anniversary logo. The average citizen had become hungry for news of achievements in all fields of science. Now, 50 years later, when we know enough about the heavens, to know that we need to know more, I feel we have lost our focus. I believe that the discoveries made with the help of the Greenbank facilities continue to produce citizen soldiers in the war to increase basic knowledge in a broad range of scientific disciplines. Please consider the law of unintended consequences as you make your determination for the future of this still very necessary and highly relevant facility.</p>	Against Closure	Email - Scanned	11/22/2016	

Green Bank Observatory -Written NSF Public Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
300	a	Paulo	Freire	Research Associate Max-Planck-Institut fur Radioastronomie	<p>My name is Paulo Freire. I am writing to express my concern regarding possible changes to the current operation model of the Green Bank Telescope (GBT) as a result of the Environmental Impact Study. I have subscribed another letter on this topic (from the group using GBT measurements of the "double pulsar" system to test general relativity), but I feel the need to express my concern individually. I have been involved with several research projects with the GBT for more than a decade; these focus mostly on pulsar topics. During this time, the GBT has proved to be an exceptional research instrument, with many qualities that make it unique and (for the next decade at least) scientifically irreplaceable. The GBT is the most sensitive fully steerable radio telescope in the world; this makes it the best choice for pulsar observations for a very wide range of sky positions (with the exception of the restricted area that can be observed with Arecibo). It has an excellent suite of very low temperature, broadband receivers, an unblocked aperture and some of the best pulsar instruments available today. Furthermore, it is located in an extensive radio quiet zone, which make its observing bands uniquely clean and suitable for pulsar surveys. These qualities are reflected on the scientific results, both in discovery of new pulsars as in their follow-up. The GBT discovered pulsar J0348+0432, this was later found to be the most massive neutron star currently known (see Antoniadis et al. 2013, Science, 340, 448). It has also measured the mass of PSR J1614-2230 (previously discovered with the Parkes telescope) via Shapiro delay (Demorest et al. 2010, Nature, 467). Both results had a major impact on many areas of astrophysics, hinted by their very large number of citations (currently 812 and 1335 respectively); this impact has been greater on studies of the equation of state of dense nuclear matter and the study of the strong nuclear force. The GBT also had a major impact on the study of gravitation, particularly from studies of the "Double Pulsar" system, J0737-3039 (Kramer et al. 2006, Science, 314, 97-102), which allow a set of five independent tests of general relativity. In one of these tests, the amount of energy loss from gravitational waves has been verified with a precision that is now two orders of magnitude better than for the Nobel-Prize winning Hulse-Taylor binary (Kramer et al., in preparation) - and Einstein's general relativity (GR) still passes the test! The GBT is the ideal telescope to study this system: apart from its high sensitivity and location in a quiet zone, its location allows the observation of two full complete orbits per day (the 100-m radio telescope at Effelsberg is further North and can see only part of a single orbit.) These studies allow a unique study of the nature of gravitational waves, providing information that cannot be obtained with UGO and Virgo - but complements and completes their results, allowing a more complete picture.</p> <p>Needless to say it, the GBT, together with the Arecibo telescope, is vital to the North American effort to detect very low frequency gravitational waves (NANOGrav, http://nanograv.org/) produced by supermassive binary black holes as part of the process of hierarchical galaxy mergers. Still in the topic of tests of general relativity, the GBT has also discovered the fist millisecond pulsar in a triple system (Ransom et al. 2014, Nature, 505, 520). This system will improve (by more than 4 orders of magnitude) current tests of the strong equivalence principle, one of the fundamental features of GR. This tests promises to be the most stringent test ever of several wide classes of alternative theories of gravity. There have been many other successes in the pulsar field coming from the GBT - it would make no sense to list them all here. However, there is a fundamental reason why I am emphasizing scientific results here: the GBT is a scientific instrument. Science is and should be the main reason for its existence.</p>	Against Closure	Email - Scanned	11/22/2016	GBT_environmental_impact_concern.pdf
300	b	Paulo	Freire	Research Associate Max-Planck-Institut fur Radioastronomie	<p>It is because of the great science that the GBT and NRAO contribute to all the other things they do so well: foster international scientific cooperation, help train the next generation of astrophysicists (many of my outstanding colleagues were trained with data from the GBT), inspire young people to pursue STEM careers - particularly in West Virginia - and for the general public the intangible benefit of our collective improved understanding of the workings of the Universe. Reducing the access to the telescope would be especially harmful for many important tests of gravity theories and detection of gravitational waves that rely on long-term observations. It would also greatly disrupt the pulsar community in North America and abroad. If the GBT does not continue to be the world-class, cutting-edge research facility that it is now, its main reason for existence will be gone. Then, inevitably, its power as a tool to educate and inspire will be diminished. We urge the NSF to consider these concerns and we hope that the GBT can be funded at a sufficiently high level to ensure a full "open skies" policy as an investment into the future.</p>	Against Closure	Email - Scanned	11/22/2016	GBT_environmental_impact_concern.pdf
301		Naomi	McClure-Griffiths	Professor, ARC Future Fellow	<p>I am writing to express my strong support for the Green Bank Telescope (GBT). The Green Bank Telescope is one of the world's best radio astronomy facilities. It is reaching the height of its productivity with new instrumentation and as a result has an outstanding international reputation.</p> <p>In my own research, the GBT is unsurpassed in its ability to measure weak signals of atomic hydrogen emission in and around the Milky Way. I have a current grant (\$650k from 2016 – 2019) from the Australian Research Council to study the gas distribution in the center of our own Milky Way Galaxy. The GBT is critical to this research and the grant was accepted under the assumption that the GBT would continue to be operated as a scientific research facility. There is no other telescope in the world that can do this research as well as the GBT.</p> <p>I hope that the US National Science Foundation will continue to invest in the Green Bank Telescope for science-focused operations. I fully expect the GBT to continue to be an valuable asset to the world's astronomers for many years to come.</p>	Against Closure	Email - Scanned	11/22/2016	GBT_support_2016.pdf
302		Holly	Compton		<p>As a lifelong resident of WV the green bank observatory has been a unique feature to our state and something I am proud of. Please continue your investment in the green bank facility. I want to share the amazing experience the facility offers and bolster the love of science and discovery with my children for many years to come.</p>	Against Closure	Email - Scanned	11/21/2016	

Green Bank Observatory -Written NSF Public Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
303		Anthony	Minter	N/A	<p>Appalachians are a generally poor, rural, disadvantaged population. Opportunities for students to experience anything related to Science, Technology, Engineering and Math (STEM) are few and far between in Appalachia. I know this firsthand as I grew up in the rural mountains of Southwestern Virginia. The few opportunities that gave me any exposure to STEM were precious as gold and were beheld with wonder and amazement. They certainly played a significant role in my determination to overcome the disadvantages of growing up in a technology poor area.</p> <p>The Green Bank Observatory is one of the few National Science Facilities located in Appalachia that is easily accessible to thousands of disadvantaged students. The Green Bank Observatory provides experiences for students of all ages: including programs for elementary school students, middle school students, high school students, college students and postgraduate students. Many thousands of students visit Green Bank each year to take use the GBT, the 20 meter and the 40 foot telescopes and to interact with the scientists. It is the ability to use the telescopes and interact with the scientists that provides the students with the motivation to seek out careers in STEM. If science is reduced at any level, these educational programs will be diminished at a time when the economy of Appalachia is experiencing a huge downturn and will result in Appalachian children being put at a further disadvantage.</p> <p>The students who visit Green Bank Observatory and participate in the education programs are exposed to all aspects of STEM. They see how engineering, software, and math are used to make the telescopes work. They are able to observe with the telescopes while they do mini science projects. They interact with engineers, software programmers and scientists as they work on their projects. These interactions show the students that the engineers, programmers and scientists are just ordinary people who have chosen to do interesting things with their education. They learn that yes, they too can do these same things and that they can have a career in a STEM related field.</p> <p>The Green Bank Observatory educational outreach is very successful. Many students from rural Appalachia have learned that they wish to have a career in STEM and most importantly, learn that it is achievable for students from their region. The reason these programs are so successful is because it takes place at a site where cutting edge science is happening. This cutting edge science makes it necessary to have engineers, programmers and scientists on site. The interaction of these professionals with the students provides a very unique opportunity for the students to learn about STEM and to find out that they are capable of working in a STEM field. The genuineness of these experiences - seeing research being done by real STEM professionals and taking part in that research using the telescopes themselves - affects the students at much deeper levels than other programs.</p> <p>I was lucky enough to be one of the early students to go through a program at the Green Bank Observatory in 1988. Being able to see the active science research occurring in Green Bank and talking with the scientist in Green Bank had a profound affect on my career decision. I now have the privilege of being one of the scientist in Green Bank with whom the students interact.</p> <p>If the science done at Green Bank Observatory is decreased at any level then access to the telescopes for the rural Appalachian students will also be decreased. It would be a disservice to the rural Appalachian student socio-economic class to reduce the science being done in Green Bank which would reduce their opportunities to learn about STEM education.</p> <p>Also, if the science being done at the Green Bank Observatory is decreased, the STEM staff would be decreased or could even go away.</p> <p>I urge the National Science Foundation to not reduce the amount of science being done at the Green Bank Observatory as this would create unrepairable damage the educational programs at Green Bank Observatory and would further repress the STEM educational opportunities available to rural Appalachians.</p>	Against Closure	Email - Scanned	11/21/2016	N/A
304		Sergey	Galkin	Aerospace Engineer	<p>It has come to my attention that as a result of an ongoing Environmental Impact Study, there is a possibility that the funding of the Green Bank Observatory by National Science Foundation may be reduced. As a former student and a participant, I strongly urge you to reconsider that decision.</p> <p>Green Bank Observatory is a world class research facility and is a vital part to further our understanding of the solar system as well as the rest of the universe. Additionally, the experience that it provides to students and its activities of educational and public outreach provide a lot of excitement and inspiration. Green Bank is one of the rare facilities that allows participants to develop hands-on skills, as well as conduct live observations of actual celestial objects and gather relevant data. I can personally attest that my trip to the Observatory has provided numerous learning opportunities and inspired me to pursue a career in a STEM field. It is an indispensable facility, and the loss of its functionality in the scientific, educational, and outreach fields will certainly deal a major blow to the astrophysics and engineering communities.</p> <p>It is due to the statements listed above that I strongly urge you to consider maintaining the current levels of support for scientific and educational programs at Green Bank Observatory (Option 1), or to seek collaboration with interested parties for science- and education-focused operations (Option 2). Thank you very much for your consideration. Please feel free to reach me at elkibravo@gmail.com if you have any questions.</p>	Against Closure	Email - Scanned	11/21/2016	
305	a	David	Stark	IPMU Postdoctoral Fellow	<p>I am writing in response to the NSF's recent announcement to conduct an Environmental Impact Statement for the Green Bank Observatory (GBO). I would like to take this opportunity to share my opinions on the GBO. I am strongly in favor of the NSF continuing funding to GBO (No-Action Alternative).</p> <p>From a personal viewpoint, the 100m Green Bank Telescope (GBT) was instrumental in my PhD thesis, where I conducted a census of atomic hydrogen gas in galaxies within a closed volume of the nearby universe. This survey enabled unbiased exploration into galaxy evolution, particularly in a relatively unexplored mass regime, and with an understanding of galaxy environments that is hard to beat. Our survey was made possible by the high sensitivity and movable dish of the GBT, and all our efforts have born fruit. Several papers using this data set discussing unique results have been released (http://adsabs.harvard.edu/abs/2016arXiv161006932S, http://adsabs.harvard.edu/abs/2016ApJ...824..124E, http://adsabs.harvard.edu/abs/2015ApJ...810..166E), with several more in preparation.</p> <p>Furthermore, the GBT's new capabilities in the 60-115 GHz regime are extremely exciting and valuable. These are described in detail in https://arxiv.org/pdf/1610.09014v2.pdf, but key strengths I think are worth emphasizing are (1) it would be very complementary to ALMA, and (2) the potential for new receivers that can map wide areas rapidly would be extremely valuable and unique (I know of no other telescope capable of doing this). Instead of divesting from GBT, I would encourage the NSF to fund these new receivers to go on the telescope.</p>	Against Closure	Email - Scanned	11/21/2016	

Green Bank Observatory -Written NSF Public Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
305	b	David	Stark	IPMU Postdoctoral Fellow	<p>Lastly, the GBT has been a fantastic tool for education. While conducting my own survey with the GBT, I was able to introduce at least 7 people in our research group (from students to postdocs) to radio astronomy through the GBT, where they actually got to use the telescope. These experiences are not limited to my own university. One of the reasons this works so well is that the hardworking staff at the GBT have built the infrastructure to make observing manageable and training relatively easy. It would be a shame to lose such a great resource.</p> <p>I hope you consider these arguments, and those of my colleagues. The GBO is an invaluable resource to the scientific community which we should not lose.</p>	Against Closure	Email - Scanned	11/21/2016	
306	a	Robert	Stricklin, Jr.	Retired CMOS IC Sensor Developer Senior Member IEEE Member American Physical Society (APS) Member of APS Division of Gravitational Physics Texas Rancher	<p>Please accept my comments regarding the Environmental impact regarding the Green Bank Observatory aka Green Bank Telescope (GBT).</p> <p>Asteroid Defense Measures</p> <p>The GBT is a tool to protect the environment and human life. A real and continuing threat to the environment is the impact of asteroids. Geological records reveal a history of past impacts with the impact results to the earth documented.</p> <p>Recently the GBT coordinated with other radio telescope installations including Goldstone Ca. and Arecibo in Chili have demonstrated the ability to observe and map asteroids passing near earth. This is a demonstrated ability to gather information on any asteroid or heavenly body currently on a path to impact earth. With orbital mechanics data, physical measurements gathered from GBT a determination of the threat could be determined. If warranted, an effort can be undertaken to protect earth. If we can learn the details of the threat early enough taking action to prevent a disaster is possible.</p> <p>Some may argue the potential devastation created by an asteroid is all in God's hands. My view is that God expects us to take action to protect ourselves and especially to protect the weak from devastation.</p> <p>The potential of the GBT to provide information and facts on asteroids as a real threat to human life and earth's environment is critically important to US government and all. This capability must be maintained just as a military capability must be maintained. We cannot count on other facilities, which may be decommissioned due to cost saving measures or natural disasters.</p>	Against Closure	Email - Scanned	11/21/2016	
306	b	Robert	Stricklin, Jr.	Retired CMOS IC Sensor Developer Senior Member IEEE Member American Physical Society (APS) Member of APS Division of Gravitational Physics Texas Rancher	<p>Astronomical Research</p> <p>The GBT has provided over 50 years of astronomical data about our universe. Lists of some of the more important discoveries are presented at https://science.nrao.edu/GBT_DiscoveriesV4.pdf. There is no reason to believe this contribution cannot continue. Helping to understand the details of planetary development and evolution of heavenly bodies contributed to our ability to deal with issues here on earth.</p> <p>The time available to collect data using the GBT has been oversubscribed. Every year proposals have been reviewed and decisions are made about who will benefit from the observation time available. The capabilities of the GBT are on a path of continuous improvement with new improvements in research capability being demonstrated every year of GBT operation. Many of these advancements are made in concert with other telescopes.</p> <p>The GBT plays a role using interferometer techniques by coordinating data collection with other telescopes all over the world. Eliminating the GBT contribution will reduce the overall world capability.</p>	Against Closure	Email - Scanned	11/21/2016	
306	c	Robert	Stricklin, Jr.	Retired CMOS IC Sensor Developer Senior Member IEEE Member American Physical Society (APS) Member of APS Division of Gravitational Physics Texas Rancher	<p>Economics</p> <p>The GBT contributes to employment directly and indirectly of a large number of people locally and in other areas. These include the staff at GBT in West Virginia, NARO facility in Charlottesville, VA, vendors in the area and across the world, research scientist located in other government sponsored institutions like NASA, JPL, and university professors and students in the US and around the world. Many people routinely travel to the GBT to work on projects, celebrate, and to learn.</p> <p>We cannot afford to stop the funding of this facility instead we should be looking for ways to continue to improve the capability of GBT. Closing or eliminating funding for the GBT will be devastating to the employment around the GBT facility, which is already depressed.</p> <p>Submitted with respect for the process.</p>	Against Closure	Email - Scanned	11/21/2016	

Green Bank Observatory -Written NSF Public Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
307		Kathlene	Eckert	Student, Universit of Pennsylvania	<p>My name is Kathleen Eckert and I am a postdoc at the University of Pennsylvania. I am writing to express my opinion that the GBT should remain an active research instrument for the astronomical community (option "no action"). The GBT was critical for performing my PhD work at the University of North Carolina and has contributed to the creation of an unprecedented catalog of galaxy gas content for the RESOLVE survey (database website http://resolve.astro.unc.edu/pages/database.php). My PhD work involved using this catalog to create accurate galaxy gas mass estimators for application to larger galaxy surveys, and to analyze the distribution of galaxy mass as a function of their mass in stars + gas. These works led to two published papers so far:</p> <p>http://adsabs.harvard.edu/abs/2015ApJ...810..166E http://adsabs.harvard.edu/abs/2016ApJ...824..124E</p> <p>In my new position at the University of Pennsylvania, I have also become aware of higher frequency capabilities of the GBT, including the Mustang instrument, which will provide the ability to detect galaxy clusters and map their gas on astrophysical scales. Such measurements are important to understand dark energy and the growth of large scale structure in the universe. Thus with MUSTANG, the GBT provides a unique facility that complements other cosmology focused projects such as Planck and the Dark Energy Survey.</p> <p>The GBT is critical for the larger astronomical community, and maintaining it as an active research facility is vital to the health of the fields of astronomy and cosmology.</p>	Against Closure	Email - Scanned	11/21/2016	
308		Sean	Brown		<p>Please consider keeping the Greenbank Observatory operating with full NSF funding, the telescope is a great asset to scientific research and to West Virginia.</p> <p>I, as a graduate of West Virginia University's college of engineering and member of both space exploration and astronomy club was always inspired by the GBO. I know that I was not the only student to feel this way, it was an incredibly proud feeling to have students and friends at the university working on advanced research with data sourced from the GBO.</p> <p>The benefits to the local economy and prestige of the state are also not to be overlooked, West Virginia as a state has supplied many natural resources necessary in the technological advancement and growth of this country but is often considered poorly educated and backward. The GBO and the work done there is a powerful symbol to the young people of the state and surrounding region that more is possible if they study and work hard.</p> <p>I ask that the NSF consider fully funding the GBO, and if that is not possible as a secondary request to consider a public private partnership to save the facility despite the changes that will entail.</p>	Against Closure	Email - Scanned	11/21/2016	
309		Anja	Baudler	Resident	<p>closing the GBO would mean:</p> <ul style="list-style-type: none"> - the total ruin for a thriving community (including my own family - my husband would lose his job, my child would lose his home and his place in the school since we would be forced to move away) - a big loss for Pocahontas County and West Virginia's tourism market (since the GBT has become an important WV landmark and tourist destination) - a terrible loss for West Virginia's universities and other scientists from around the world who work with the GBO's one-of-a-kind instruments and technology for their important astronomical scientific research that already has and could lead to more groundbreaking discoveries in the astronomical field which would otherwise never have been/never be possible. New instruments utilizing brand new technologies are still coming online for the GBT as we speak, so I really don't understand were the desire to shut down or divest a relatively inexpensive facility like this comes from. <p>It would also mean the end of the unique Radio Quiet Zone, that is a wonderful sanctuary from the modern "wireless" lifestyle and has become a safe haven for numerous people from around the globe who were seeking this place out to cure their health issues related to electromagnetic radiation (Electrohypersensitivity or EHS).</p> <p>I strongly suggest to consider the "No-Action Alternative".</p>	Against Closure	Email - Scanned	11/21/2016	
310		Randy	Thomas		<p>I do not like cuts at all.....But, we must weigh all our options! I have some questions because I am not that failure with Green Bank!</p> <ol style="list-style-type: none"> 1) State or Federal funded? 2) How many employees? 3) Budget to Operate and Maintain yearly? 4) Actual need and age of facility? <p>Thank you in advance for your reply to my questions!</p>	General	Email - Scanned	11/21/2016	
311		Susan	Peyton		<p>The Green Bank Observatory is a great learning center and must be preserved for today's and future generations.</p>	Against Closure	Email - Scanned	11/21/2016	

Green Bank Observatory -Written NSF Public Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
312		Marian	Pospieszalski	Ph.D., Fellow IEEE Scientist/Senior Research Engineer	<p>This email is in strong and enthusiastic support of continued NSF investment for science---focused operations (so called: No---Action Alternative) for the Green Bank Observatory.</p> <p>The NRAO, since its founding more than 60 years ago, has been providing what one could call general purpose instruments to world---wide scientific community. At NRAO's birth in 1956 so little was known about the radio Universe that pointing any telescope with any receiver on it to any position in the sky was bound to discover something new. Many groundbreaking discoveries later AUI/NRAO is operating four general purpose instruments: ALMA, VLA, GBT and VLBA. These instruments, although quite often erroneously treated as instruments with separate scientific missions (especially by the AST Portfolio Review of 2012), in fact are strongly dependent on each other. The combinations of some or of all of these instruments constitute another powerful instruments, as for example of High Sensitivity VLBI (GBT+ VLA +VLBA), ALMA Bands ## 1, 2 and 3 plus GBT, GBT as a receiving antenna for bistatic planetary radar, and more. The Green Bank Telescope plays a unique and important role not only as a stand---alone instrument but also, as indicated by the above examples, as necessary and important complement to other instruments. GBT because of its unblocked aperture, excellent surface accuracy and placement in the National Radio Quiet Zone may map diffuse objects that no other telescope in the world can even detect. Its large collecting area, constituting almost total collecting area of ALMA (for the first three bands) and more than half of the total collecting area of VLA, make it the most powerful survey instrument in the world without which any interferometer is highly disadvantaged. Similarly, GBT's collecting area and unmatched system noise allow for detection and monitoring of temporal radiation that no other telescope in the world can equal (for example, pulsar observation of nano---Hz gravitational radiation).</p> <p>As of last October, NRAO has undergone a dismemberment, apparently for funding reasons at the level of several M\$ a year which already has destroyed to a large extent a synergy between these four NRAO's general purpose instruments. Further removing the GBT from the list of instruments available to American scientific community would do untold damage to progress in many areas of pure science as it is well documented in two White Papers by F. J Lockman et al and J. Bally et al. Moreover, GBT's continued availability might prove to be of extreme societal impact. It is well known that the GBT bi---static radar observations are essential in determination of the structure and precise orbits of near---Earth objects, a question very much in focus of US and word---wide scientific community</p> <p>In determination of the future of the GBT the question of what is possible next in the broad area of radio astronomy instrumentation should be also considered. The estimated cost of next general purpose instrument will certainly exceed \$ 1 billion in the current dollars and given the foreseeable funding scenarios might not be feasible. The example of an interNational project already underway (the SKA in its many forms) is not very encouraging. It seems, these are Times of some uncertainty as to the future course of development of radio astronomy instrumentation. The scientific returns of the GBT in the next several years might help to keep in focus what questions are scientifically important. Consequently, a diminished scientific role of this unique and extremely well performing instrument would be especially troublesome at this Time.</p> <p>In conclusion, continued NSF investment for science---focused operations for the Green Bank Observatory is the only sensible and cost effective in terms of scientific outcome Alternative.</p>	Against Closure	Email - Scanned	11/21/2016	
313		Tatiana	Vinogradova	Russian poet	<p>you know, to say I was astonished when visited the place for the first Time --- is to say nothing. Science and Nature co---exist here in perfect harmony. People all over the world need such places for not only their intellectual development, but also for their spiritual formation. How one can even think about closing it?! It's disaster! I have no words for this malicious decision.</p> <p>Well, I'd better place here my poem about the GBO instead. (It was written both English and Russian during my second visit to the Space Place. You can also read it here, in one of the famous Russian poetical journals, page 65 hbp://www.sreda1.org/sreda---2016---01)</p> <p>SONG OF FALL FOLIAGE (Ode to Green Bank Observatory)</p> <p>Green Bank Observatory is lost in the heart of the Appalachians in the heart of silence and woodlands, in the heart of autumn, amidst of Undisclosed Eternity where Miracle and Mystery are born again and again and again. Scarlet torches of maples faded away. Waving hillsides and vales are waiting for winter lace. In autumn the essence of being uncovers itself. Rational grid of branches reveals through chaos of flying fall foliage, splendid, perishable foliage, rustling about fundamentals. The trees of radio telescopes are also naked. They present the skeleton of existence: but yet intersecting steel boughs are trying to reach for the sky, while reflectors – the crowns of telescope---trees are flickering, full of blazing star foliage – splendid, perishable foliage, rustling about fundamentals.</p> <p>There are many of them growing in Green Bank, those tall and small autumn trees of the Universe, beautiful, man---made, sophisticated, –</p> <p>from the apple tree of Jansky Antenna to sequoia of GBT.</p> <p>But what is the most important thing in the observatory? It is people! They try to decode milky whisper of galaxies. Here, in the heart of autumn, in the heart of ancient Indean mountains these wonderful people work day and night trying to cognize Miracle and Mystery again and again and again.</p>	Against Closure	Email - Scanned	11/21/2016	

Green Bank Observatory -Written NSF Public Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
314		Kathryn	Stauffer		<p>The Green Bank Observatory is very important to me because I suffer from EHS.</p> <p>A year ago my whole world was turned upside down because I could not shield myself from the ever encroaching Electro Smog in our small town in Illinois. I was forced from my home to live in the country. A temporary arrangement, and it was far from perfect, with two cell towers and many local house hold Wifi.</p> <p>After 3 visits to Green Bank area I was able to secure a small home for myself. I moved here in September 2016. I left everything. Like many of us who have run here, this whole thing has hurt me financially too. We who suffer with EHS need some place on this earth to exist. It is our earth too. This has truly become a human rights issue.</p> <p>Still, for today, I am so grateful to have found this space in Green Bank to live. I am grateful to the Observatory for being here and working to keep the space exploration and education going.</p> <p>My hope is that the EHS community and the Observatory can be of service to each other by working together to keep this beautiful telescope in operation in Green Bank. It is a win, win for all!</p>	Against Closure	Email - Scanned	11/21/2016	
315	a	Carole Ann	Bradley	Stanford University Class of 2014, B.S. Product Design (Mechanical Engineering) Stanford Solar Car Team 2011	I am writing to you in support of the Green Bank Observatory and highly encourage the NSF to continue its funding of NRAO/GBT. Not only is it an irreplaceable piece of equipment, it is also a huge point of pride and education for West Virginians....At Green Bank, I was able to discover the unknown through hands on projects using radio telescopes, projects that challenged me both academically and philosophically. In the afternoons, we were able to explore the fossil---rich banks of the surrounding streams and caves. . The friends that I made while at Green Bank are some of my closest friends, friends who, although lived throughout the state, encouraged me to pursue higher education. My idyllic experience at Green Bank is easily one of the most influential experiences of my life	Against Closure	Email	11/21/2016	
315	b	Carole Ann	Bradley	Stanford University Class of 2014, B.S. Product Design (Mechanical Engineering) Stanford Solar Car Team 2011	Please understand that closing NRAO at Green Bank will influence more than the scientists, the fragile local economy, and the people who flock to Green Bank for its ideal tranquility. It will impact future generations of West Virginia youth who desperately need a STEM resource that can only be found at Green Bank. If anything, funding for Green bank should be increased. With a future being more and more shaped by technology, it is even more important to encourage young women and young West Virginians to enter a STEM field. The world needs the skills of engineers, chemists, scientists, and those who code and our country, especially West Virginia, cannot survive without putting its students' education at the forefront.	Against Closure	Email	11/21/2016	
315	c	Carole Ann	Bradley	Stanford University Class of 2014, B.S. Product Design (Mechanical Engineering) Stanford Solar Car Team 2011	<p>The Green Bank Observatory ignited my interest in math and science, which helped me and many of my peers achieve higher educational goals that I never knew were possible. Growing up as a low---income, minority female student in West Virginia, STEM (science, technology, engineering, mathematics) education certainly did not seem like a high priority. I was fortunate enough to be in the first class of the WV's Governor's School of Math and Science held at Green Bank (co---sponsored by NSF), under the leadership of the wonderful Sue Ann Heatherly and Dr. Blackwell. My experience with the radio telescopes and the friendships I formed at that camp forever changed my life.</p> <p>Scientists know that one unique event does not tell the whole story, however, much research has shown that STEM exposure young girls in middle school shapes future education/career goals. These studies have shown that young girls lose interest in STEM around 7th/8th grades. The loss of interest is not due to lack of interest and certainly not due to lack intelligence; instead, many girls see the issue as a choice between social pressures (fitting in/femininity) and pursuing STEM. These social pressures are something that I most definitely experienced as a young woman but my Green Bank friends were always there to support me. With their friendship, I never felt like I was an isolated "nerd" --- I had found people who had the same passions and dreams. They were friends who encouraged me as we struggled through similar experiences miles away. My 8th grade experience at NRAO was a critical path component which led me to study Engineering at Stanford University, an experience that should be supported and funded for many generations of West Virginia students.</p> <p>I challenge you to find another similar educational outreach program (both within West Virginia and nation---wide) that has a more impressive diversity and higher education attainment than the sixty person 2005 Class of WV Governor's School of Math and Science at the Green Bank Observatory. Without looking at a full list of alumni, here's a quick look of schools attended:</p> <p>West Point (Female) Harvard University (Minority/ female) Princeton University (Minority/ female) Harvard Medical School (Minority/ female) Princeton University, Mathematics University of Colorado Boulder, Mathematics, Ph.D Stanford University, Engineering (Minority/ female) UC Berkeley, Electrical Engineering/ Computer Science (Minority/ female) Georgetown University Haverford College (Minority/ female) WVU, Chemical Engineering WVU, Physics WVU, Electrical Engineering UPenn (Minority) WV School of Osteopathic Medicine (Minority) Rhode Island School of Design</p> <p>If you should happen to have any more questions about the impact of NRAO please do not hesitate to reach out to me at (510) 734 ---7628. The Green Bank Observatory holds more than a beloved place in my heart --- it holds the key to many young students' futures.</p>	Against Closure	Email	11/21/2016	

Green Bank Observatory -Written NSF Public Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
316	a	Dave	Cohen		<p>I am responding to the NSF proposal that includes the possibility of mothballing or dismantling the Green Bank Observatory.</p> <p>I am a member of the board of directors of SARA (the Society of Amateur Radio Astronomers). We hold our annual Eastern conference at the GBO every July. I also mentor high school and college students in radio astronomy. We have taken several annual field trips to the GBO.</p> <p>I can think of several good reasons why the GBO should be allowed to remain in operation:</p> <p>--- The GBO is the most accessible observatory to the general public. If science in general, and radio astronomy in particular, is to remain relevant in the United States, it had better be widely accessible. Thousands of people tour this observatory every year. Many schools send students to use the 40-foot student radio telescope. They also generously allow adult groups like SARA members access to the dish as well. I can attest to the fact that the student dish is heavily used, as our group had to apply for Time on the dish six months in advance.</p>	Against Closure	Email - Scanned	11/21/2016	
316	b	Dave	Cohen		<p>The GBO employs approximately 150 people, of a wide range of skill levels. There are scientists, astronomers, cafeteria personnel, electricians, etc. Since they also hire locally, the GBO provides a major economic benefit to Pocahontas County, where the median household income is only \$26,000 a year. The loss of this facility would have a severe impact on the local community.</p>	Against Closure	Email - Scanned	11/21/2016	
316	c	Dave	Cohen		<p>If the 40-foot student telescope were decommissioned, there would likely be no hands on radio telescopes for high school education anywhere in the United States.</p> <p>The 20 meter telescope is the only publicly remote access radio telescope radio telescope. It is part of the Skynet program developed by the University of North Carolina and Green Bank. It is a powerful instrument that is an important part of their astronomy curriculum. It is also in heavy demand --- I have had personal experience waiting in queue to get access to the dish.</p> <p>--- Other countries are building up their radio astronomy capabilities, are we are considering tearing a large piece of ours down. China has just built the largest fixed radio telescope in world. The GBT still has the advantage of being a steerable dish, and it is exquisitely sensitive. The staff at GBO are still improving the function of the GBT. Shutting down the the GBO would be a clear sign to the rest of the world that we are a nation in decline, that science is no longer a priority here. That is a sad statement to make, especially right now.</p>	Against Closure	Email - Scanned	11/21/2016	
317		Dave	Cohen		<p>My visits to the GBO have been some of the most profound moments of my life. The quiet, beautiful surroundings and the lack of light pollution make this a peaceful and comforting place. It is wonderful to walk its expansive grounds and see the wildlife and the massive radio telescopes in peaceful coexistence. I have walked the long road through the facility many Times --- someTimes it allows deep personal reflection when I am alone, and other Times pleasant conversation with friends. I imagine that there are others who feel the same way as I do.</p> <p>Personally, I would be deeply saddened by loss of this National treasure, and very disappointed in a country that was once a leader in the pursuit of knowledge.</p> <p>I thank you for taking the the Time to read this; I sincerely wish the best for the GBO and the people that work there.</p>	Against Closure	Email - Scanned	11/21/2016	
318	a	Jason	Ray	Electrical Engineer	<p>My name is Jason Ray, and I'm a life-long resident of the Green Bank area, and a current employee of the Green Bank Observatory (GBO) as an electronics engineer, with 15 years of service as of this writing.</p> <p>Growing up in the Green Bank area, I was always fascinated with the Green Bank Observatory. Going to school so close by allowed my classmates & I to make several visits through the years where we learned about science, electronics, liquid nitrogen, computer programming, and all sorts of other exciting astronomy related topics. When I entered Pocahontas County High School, I learned that a series of vocational electronics classes were available, and I took them for three years. As a senior in high school, I spent 40 hours of mentorship time working in the electronics lab at GBO.</p> <p>All of this exposure to science and electronics inspired me to continue my higher education towards a degree in electrical engineering from the West Virginia University Institute of Technology, which at the time was located in Montgomery, WV.</p> <p>During my time at WVUIT, I spent my first summer (1996) as an REU summer student at GBO, working on an electronics test setup used to test up & coming GBT equipment. During the remainder of my time in college, I participated in the co-op program, working a total of five additional semesters at the GBO, doing exciting research work with lasers.</p> <p>Upon graduating from college in 2001, I was offered a full time position at GBO and I jumped at the chance to continue working at this amazing facility.</p> <p>As you well know, GBO does a lot of educational programs, working to train the next generation of scientists and engineers. Soon after I began working full time at NRAO I wanted to "pay it forward" and immediately became involved with many aspects of education. The educational opportunities given to me by GBO had such a great positive affect on my life that I felt honored to return the favor to the next generation of students. Through the years I've participated in many educational endeavors including - mentoring local high school students, REU summer students, working on other projects like the "hour of code" event we do each year, providing electronics lab & telescope tours for student groups, and numerous other things.</p> <p>For the past two years I have supervised two different groups of WVU electrical engineering seniors who chose to do their capstone project in collaboration with GBO to upgrade a critical system for the GBT. This offered them a very unique opportunity to participate in a real-world project. As of this writing, there have been four other (different) groups of WVU senior engineering students doing projects with other GBO staff engineers.</p> <p>Given how few technological opportunities there are in WV, I think it would be a very bad decision to pursue any options other than #1 (no action alternative) or #2 (collaborations with reduced NSF funding). Even option #3 (education park) would be detrimental because one of the most intriguing things for students visiting GBO is the fact that they get to be involved in an actual working research environment - scientists are here studying things, engineers, technicians, and machinists are building things, and the telescopes are moving around making real discoveries. Simply visiting a campus of classrooms and telescope statues wouldn't have nearly the positive effect. My WVU students have all told me that the main reason they chose my project is that they are able to contribute to something "real".</p>	Against Closure	Email - Scanned	11/21/2016	EIS letter 2016.pdf

Green Bank Observatory -Written NSF Public Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
318	b	Jason	Ray	Electrical Engineer	<p>Another negative impact to the community would be the inevitable flood of houses for sale on the real estate market, in conjunction with the major reduction in workforce (GBO employees) to purchase houses.</p> <p>There would also be considerable impacts to the state of WV. From an education perspective around 3,500 students (mostly from WV and some from VA as well) per year visit Green Bank to participate in our educational programs. Also, there would be a negative impact from a tourism perspective, as around 50,000 people visit Green Bank each year. That is a lot of people that may not visit WV, or at least may not pass through as much of WV on their trip.</p>	Against Closure	Email - Scanned	11/21/2016	EIS letter 2016.pdf
318	c	Jason	Ray	Electrical Engineer	<p>Any options other than #1 or #2 would have a very negative impact on the community in Pocahontas County due to the reduction in population because of employees required to move away to find comparable employment. Losing these employees from GBO also means losing their countless other contributions to the community, some examples include – volunteer firefighters & EMS personnel, soccer, football, baseball, & tee ball coaches, school fair judges, school tutoring, mentoring high school students, boy scout & girl scout volunteers, electronic repairs for local schools (scoreboards, audio equipment, computing equipment, and other things), and many other things, too many things to list here.</p> <p>Along with the employees’ contributions to the community, the spouses of employees contribute just as much, if not more. Many of them are full time school teachers, EMS workers, and they volunteer in the schools and in many other capacities in the community.</p>	Against Closure	Email - Scanned	11/21/2016	EIS letter 2016.pdf
318	d	Jason	Ray	Electrical Engineer	<p>I would like to also encourage you to fund the GBO as much as possible to ensure that “open skies” is still available for science purposes. This is very important for universities and their students who cannot afford expensive telescope time, but would like to pursue research that requires a large telescope with open skies access. Currently, the GBT is oversubscribed by a factor of four! Any new funding sources that are attained for the GBT directly reduces the precious open skies time that is already in high demand.</p> <p>From a science perspective, do not underestimate how important the GBT is to the scientific community. The 2012 portfolio review trivializes the impacts of the GBT to the worldwide scientific community, and the proposed recommendations to achieve the science are flawed in many ways. More details of this can be found in the NRAO response to the portfolio review (NRAO Doc. #: PRC-2012.08). To summarize, the GBT has many capabilities that CANNOT simply be replaced by other existing telescopes, for a variety of reasons. Some of the GBT projects would take 1 to 2 orders of magnitude longer time to do on other telescopes. The unique sensitivity, large size, pointing accuracy, and sky coverage enables world class research on star formation, pulsar discovery, pulsar timing, astro-chemistry, radar experiments, just to name a few. If the GBT were to go away, scientists would have to rely on other telescopes to do their science. Many of these telescopes do not have an “open skies” policy, and they are also quite oversubscribed to begin with, making it that much more difficult for scientists to get time on them. It’s a major problem that snowballs quickly when you consider observing time required, telescopes available, and telescope time available.</p> <p>The US is currently the world leader in radio astronomy. However, other countries (China, South Africa, and the Australia to name a few) are investing heavily in the area of radio astronomy. If the NSF allows world-class instruments like the GBT to be taken out of service, it won’t be long until the US is no longer a world leader in the field. American students looking to enter this field will be required to go to other countries to get their education, experience, and their jobs.</p> <p>In closing, I would like to thank you for your time and I’m hopeful that you take all of the comments you receive seriously and only consider options #1 (no action) or #2 (collaborations) for the future of the Green Bank Observatory.</p>	Against Closure	Email - Scanned	11/21/2016	EIS letter 2016.pdf
319		John	Cannon	Macalester Astronomy	<p>I write to strongly urge that the National Science Foundation chooses alternative #1 of its "Notice of Intent to Prepare an Environmental Impact Statement and Initiate Section 106 Consultation for Proposed Changes to Green Bank Observatory Operations... ", namely "Continued NSF investment for science-focused operations (No-Action Alternative)."</p> <p>As a scientific user of the Green Bank Telescope for over 5 years, I can attest to its continuing importance for studies of galaxies. Its enormous collecting area (the largest of any fully steerable radio telescope in the world) has been and continues to be crucial in studies of faint objects, such as low-mass galaxies. The facility is less than twenty years old; it remains in the prime of its scientific life, uniquely able to make important and impactful scientific discoveries.</p> <p>While many radio astronomers (including myself) use multiple-dish interferometers for high angular resolution observations, there remains an important need for large single dish facilities such as the Green Bank Telescope. This is the only type of radio telescope capable of mapping faint neutral hydrogen emission in nearby galaxies; such observations are critical for our understanding of how galaxies interact gravitationally, and in fact have demonstrated that our understanding of the local environments of nearby galaxies is incomplete. As a dramatic example, I used the Green Bank Telescope to observe DDO68, a well-studied local galaxy that harbors extreme physical properties in its interstellar medium. These new Green Bank Telescope observations confirmed the existence of a previously unknown, lower-mass system that is interacting with DDO68 (Cannon et al. 2014, Astrophysical Journal Letters, 787, L1). Signatures of these interactions can often times only be studied with the Green Bank Telescope; optical and interferometric radio observations do not provide the same discovery potential.</p> <p>I have co-authored multiple peer-reviewed scholarly manuscripts that stem from Green Bank Telescope observations that involve Macalester College undergraduate students. This unique instrument plays a critical role in the professional and scientific development of these students. The telescope thus remains a unique, powerful, flexible, and pedagogically central instrument for the 21st century.</p>	Against Closure	Email - Scanned	11/21/2016	
320	a	David	Nice	Associate Professor Physics Department, Lafayette College	<p>I wish to strongly encourage you to pursue any option which maintains the continued scientific operation of the Green Bank Observatory.</p> <p>The Green Bank Telescope, the largest facility of the GBO, is the premiere single-dish radio telescope for all portions of the sky not visible from Arecibo. It is still a young instrument (in operation less than two decades) and it is still doing tremendous cutting edge science. Indeed, in the field with which I am most familiar, observational pulsar and gravitational research, it has only been a "fully capable" telescope for about six years, in the sense that its data-recording instrumentation has only been capable of using the full telescope signal over that period. It really is "almost new." It could be further strengthened by modest refinements in instrumentation, such as wide-bandwidth receivers, allowing it to remain a leading-edge instrument for decades to come.</p>	Against Closure	Email - Scanned	11/21/2016	gbo_eis.pdf

Green Bank Observatory -Written NSF Public Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
320	b	David	Nice	Associate Professor Physics Department, Lafayette College	The GBO has the unique advantage of being in the National Radio Quiet Zone. As an observational astronomer who has worked at many different facilities, I can attest that this is an important advantage to the Green Bank Observatory that, as a practical matter, could not be replicated anywhere else. The GBO contributes tremendously to the surrounding Appalachian communities. There are no other modern, leading-edge engineering or scientific facilities anywhere near Green Bank. Its educational facilities have a huge impact on everyone from local high schoolers to undergraduates to graduate students to postdocs at leading research institutes.	Against Closure	Email - Scanned	11/21/2016	gbo_eis.pdf
321	a	Thomas	Plumly		I am writing with concern about the Notice of Intent to Prepare an Environmental Impact Statement for the Green Bank Observatory published in the Federal Register on October 19, 2016. I wanted to express that I think it is extremely important that the full funding and operation of the Green Bank Observatory continues in the future. I am a retired educator and coach who taught in Pocahontas County Schools for forty---one years with thirty---seven of those years being at Green Bank Elementary. I know firsthand what the Observatory has done for the School System and the betterment of students. I know many others have mentioned the obvious support of Science Fairs, Math Field Days and many other such activities but what I want to address is the health and safety it provides to so many students as well as adults that are often overlooked. First of all the Green Bank Observatory is the Emergency Shelter for all Green Bank Elementary Middle School students in case of Emergency Evacuation. Without this planned shelter I do not believe there would be another quick alternative in a crisis. I know the Observatory has also been declared a certified Red Cross Facility and I can recall numerous times when they have opened their doors to those in need when the power has been out in the county for long periods of time and it was critical for residents requiring oxygen on a full time basis.	Against Closure	Email - Scanned	11/21/2016	Observatory Letter of Support.docx
321	b	Thomas	Plumly		In a society in which obesity is growing in children at an alarming rate exercise is critical. The Green Bank Observatory has allowed the AYSO Soccer League to use their property for years. For this reason most residents probably assume the soccer fields belong to the Pocahontas Board of Education. Should the Observatory not exist the soccer fields would not exist nor would this space be available for physical education classes or recess. Students from this county as well as surrounding counties have used these fields for years. The Observatory has built and maintained goals for the AYSO for many years. Most of the Coaches and Referees for AYSO Soccer are Observatory personnel or spouses and this also applies to Little League Baseball. The Observatory has often helped in moving dugouts and other equipment for baseball as well. Green Bank Observatory personnel were responsible for the planning and the erection of new bleachers and the sound system for the Pocahontas County Football and Soccer Stadium. Observatory Property is often used for Bike--- A--- Thons for Green Bank Elementary School as well as organizations like Muscular Dystrophy. Without the Green Bank Observatory Pool most children on this end of the county would never be able to take swimming lessons. The Observatory has always opened the pool to the Local Parks and Recreation Commission to give swimming lessons to the entire community. I attended the public meeting held at the Observatory so I am aware of the concern voiced for health and safety by the local Fire and Rescue Squad but I wanted to take the time to mention the above items which although are more subtle to health and safety they are very important to our students and community. Please consider the continued NSF investment for Science---focused operations (No ---action Alternative) or option one for the Green Bank Observatory.	Against Closure	Email - Scanned	11/21/2016	Observatory Letter of Support.docx
322	a	Tony	Beasley		Thank you for this opportunity to comment on the scope of the Environmental Impact Study (EIS) being undertaken for the Green Bank Observatory. - To what extent are the potential impacts of process timing on the alternatives being considered? The cost of partnership with GBO right now would not involve major refurbishment or upgrade – the site has been well-maintained. An organization attempting to join/manage GBO a few years after NSF lowers their funding may find a back log of technical work that would make it cost-prohibitive to partner. To what extent can NSF guarantee its behavior/performance in this process so that the proposed alternatives are realistic? The critical socio-economic impacts of some of the alternatives to the local area also will vary depending on the timing of any transition. Identifying alternative 1 as preferred, but then starving the site of funding and letting it run down to make that alternative impractical would violate the underlying assumptions of this process. I would like to see this timeliness issue discussed in detail in the EIS.	General	Email - Scanned	11/21/2016	

Green Bank Observatory -Written NSF Public Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
322	b	Tony	Beasley		<p>The Green Bank Observatory plays many important roles in the scientific, technical, educational and local communities. The flagship instrument on site – the Green Bank Telescope – is an important part of the astronomical infrastructure of the United States, and has continued to improve in the (only) fifteen years since its opening. For more than five decades the National Science Foundation has supported research and education on the Green Bank site, with many outstanding scientific results, and many more discoveries to be made. The infrastructure developed in Green Bank (telescopes, labs, administration, accommodation) is significant, and results from important long-term investment by the NSF and the U.S. taxpayer. To support this investment, a National Radio Quiet Zone has been established surrounding the Observatory, the first of its kind in the world and a key resource for the country.</p> <p>Of the five preliminary alternatives to be considered in refining the Environmental Impact Statement regarding GBO/GBT, the first two allow future use of the site for astronomical research. These are superior choices, and the first alternative is my preferred option. As all the alternatives are explored in the EIS document, in addition to the standard areas of investigation required I recommend the following issues be considered:</p> <p>- Alternative #2 – it is often discussed in the astronomy community that radio telescopes managed by organizations whose primary mission is non-astronomical have had difficulty producing significant results in astronomy. As a result, the impact of this alternative may be much worse on longer timescales in terms of social impacts than initially appears; the EIS should discuss relevant examples to adequately describe the potential impacts here.Reducing the Observatory's ability to perform leading-edge science would be a hugely negative impact.</p> <p>In closing let me suggest that it is incumbent upon NSF as the manager of these facilities to find a way to continue the important work of GBO. NSF has done an outstanding job creating the GBO, and while the stresses on NSF/AST to explore these divestment scenarios are significant, this facility has tremendous local and national public benefit, and a bright future. The scope of this EIS is important, so thank you for the opportunity to comment, and I intend to also comment on the draft EIS. I assume the NSF will release all environmental studies associated with the site early enough so the public can review and assess all aspects of the impacts.</p>	Against Closure	Email - Scanned	11/21/2016	
323		Dennis	Smith		In neighboring KY, we have little effect on Greenbank or Pocahontas County or its economy but the importance of the research done there is enormous and needs to continue. Although I resist tax use, I would like to see a concerted effort to fund this and any finances raised by charging for its use returned to fund it. I fully support military and space/discovery programs.	Against Closure	Email - Scanned	11/21/2016	
324	a	Lauren	Bennett		<p>I am writing in support of continued funding by the National Science Foundation for the Green Bank Observatory.</p> <p>The Green Bank Observatory is a vital part of this county's economy. It is one of the largest employers in the county. The majority of those employees reside in Pocahontas County with their families. They own homes, support local businesses and have children in the school system. Closure of the site would be a huge loss to the local economy as these folks moved away for other employment. It would especially be a huge loss to this rural school system in terms of not just students but many teachers (GBO spouses) as well.</p> <p>Additionally, Pocahontas County relies heavily on tourism. The Green Bank Observatory brings in approximately 50,000 visitors a year, many of whom spend money on food, gas, lodging and other recreational activities in the county. Without this additional tourism income, many local businesses would not be able to stay in operation. Additionally, it would mean a loss in hotel-motel tax which would affect many amenities such as county parks and recreation, libraries and arts organizations. Closure of the GBO would be a huge economic loss to Pocahontas County.</p> <p>Please continue to fund and operate the Green Bank Observatory.</p>	Against Closure	Email - Scanned	11/21/2016	GBO letter of support.docx
324	b	Lauren	Bennett		<p>The Green Bank Observatory is an incredible educational asset to the county, state, country and world. Telescopes are available to scientists worldwide. Students come to study at West Virginia University from around the country and world because of the opportunity to use the Green Bank Observatory for their research. High school and college students have the opportunity to work side by side with scientists and engineers in mentorship programs.</p> <p>Approximately 3,000 elementary, middle school and high school students visit the Observatory each year, getting a hands-on view of science that's hard to acquire in the classroom. In addition, the Observatory offers a variety of scientific outreach programs for schools, organizations and the community. Just recently, 4H clubs in the county were invited to study drones in a special program at the Observatory.</p>	Against Closure	Email - Scanned	11/21/2016	GBO letter of support.docx
324	c	Lauren	Bennett		<p>The Green Bank Observatory is an irreplaceable asset to this community. As director of Pocahontas County Parks and Recreation, I have worked with the Observatory for over 25 years. We have used their swimming pool to offer swimming lessons and lifeguarding classes to the community. We have used their shelters for outside classrooms, especially for art classes, their recreational facility for general "playground" programs and some of their open space for soccer fields. We have used their trails for interpretive hikes and for walking programs. And we have continually used the old tour center for a variety of fitness classes, such as yoga, zumba, ballroom dance, ballet and a creative movement program for preschoolers.</p> <p>Most importantly, the people who work at the Observatory are an integral part of this community. They are volunteer firemen and EMT's. They are coaches and scout leaders. They run sound systems and lighting for concerts and theatrical performances. They serve on many community boards and organizations. They, along with the facility, serve as an important link in any response to a natural disaster or other emergency.</p> <p>Their engineers have helped with designing our community wellness center and the local library, and offered technical assistance throughout the construction process. Their scientists have done "star talks" at campfire programs and offered a variety of programs at 4H camp.</p> <p>Their electricians re-wired an old school annex so that it could be used for a community fitness center. When the Opera House was being restored, two engineers from the Observatory helped to determine its structural integrity. Machinists have helped fabricate special replacement parts and built soccer goals. Add to this all the other community organizations that folks from the Observatory have assisted and the list would be endless.</p> <p>I cannot imagine what Pocahontas County would be like if the Green Bank Observatory was closed. I do know that the loss to the community would be devastating.</p>	Against Closure	Email - Scanned	11/21/2016	GBO letter of support.docx

Green Bank Observatory -Written NSF Public Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
325		Asher	Wasserman		<p>I am a graduate student at the University of California, Santa Cruz. I'm writing to you today about the proposed options for the Green Bank Observatory. While I was a student at Rutgers University, I had the fortunate opportunity to visit the observatory as part of a class trip. This visit was a formative experience in my scientific education, and it played a role in my decision to pursue a career in astronomy.</p> <p>Through the financial support of the NSF, the astronomical community has had access to one of the best sites for radio astronomy in the world. The Green Bank Telescope is a truly unique facility, and so I strongly encourage the No---Action Alternative, which would provide continued NSF investment in science---focused operations at Green Bank.</p>	Against Closure	Email - Scanned	11/21/2016	
326		Homer	Hickam	Author, Rocket Boys/ October Sky www.homerhickam.com	Please add my name to those concerned citizens who want to save the great National asset of the Green Bank Observatory in my home state of West Virginia.	Against Closure	Email - Scanned	11/21/2016	
327	a	Amanda	Griffith		<p>I am writing to express concern that NSF may reduce funding for or deconstruct the Green Bank Observatory and ask that funding continue to support this unique resource in West Virginia. Because it is large and fully steerable, the GBT has unique capabilities that are not available at other observatories in operation today or even planned for the future. With its large 110m dish, GBT is able to hear incredibly faint radio waves emibed from the universe that smaller radio dishes wouldn't be able to capture. The 305m Arecibo radio telescope in Puerto Rico can capture similar faint radio waves, because it is not steerable, it can only observe about 33 percent of the sky, compared with GBT's ability to observe 80 percent.</p> <p>Additionally, the recent discovery of gravitational waves has put pulsar research at the forefront of modern astronomy. GBT is a crucial tool for this line of work analyzing radio waves emibed from pulsars. Because of it's steerability, GBT has a tremendous advantage over Arecibo and the FAST telescope in China of providing researchers the ability to observe a large number of extremely well---Timed pulsars.</p>	Against Closure	Email - Scanned	11/21/2016	
327	b	Amanda	Griffith		<p>GBT provides up to 140 jobs, draws 50,000 visitors per year and is estimated to bring in approximately \$12 million in tourism dollars per year. I live in WV and have visited this attraction several Times. Just this summer, my family and I vacaPoned at nearby Snowshoe. My husband and I drove our sons (who are 3 and 1) to the observatory one afternoon to look at the huge telescopes. I thought about how great a resource this facility is for our state and how excited I will be to bring my children back to visit when they are older to foster their interest in STEM education.</p> <p>GBT is an irreplaceable research and education tool in a state that desperately needs more STEM resources. I have seen the abacks and the anti---science concepts that are slowly creeping into mandated curriculum in our state. Our teachers and students from the elementary school level to 12 state colleges and universities that make up the WV NASA Space Grant need this great resource.</p> <p>Please fully---fund the GBT. Our children need a resource that will foster their interests in STEM education. Without a clear path to 21st century jobs, children of WV will have nothing to replace the coal mining jobs that are quickly disappearing and WV will continue to be one of the poorest states in the nation.</p>	Against Closure	Email - Scanned	11/21/2016	
328		Michael	Kramer	Director --- Max- --Planck---Institut für Radioastronomie, Bonn, Germany Professor for Astrophysics --- University of Manchester, UK Professor (Hon---Prof.) -- University of Bonn, Germany	<p>On behalf of an international collaboration (listed below) using the GBT routinely for groundbreaking research, I would like to express our concern regarding possible changes to the current operation model of the Green Bank Telescope (GBT) as a result of the Environmental Impact Study. To put our comments in context, let me briefly explain how we use the instrument with one specific example: In 2003 an international collaboration consisting of Australian, British, German, Italian, and US astronomers discovered the so-called Double Pulsar. Using the GBT, and including further international experts from Canada, France etc., our observations provide the most precise tests of strong-field gravity. In an upcoming publication we show that even in the era of gravitational wave detection with UGO, the Double Pulsar still provides complementary and partly more precise tests than possible with gravitational wave detectors today and for the foreseeable future. The GBT is the ideal instrument for the study of pulsars in general and for this specific source in particular, as the telescope has sensitive wide-band receivers and its unique location in a radio-quiet zone is also far-enough South to cover two full complete orbits of this exciting binary system in one day. (In comparison, our own 100-m radio telescope at Effelsberg is further North and can see only part of a single orbit.) For the Double Pulsar and other interesting systems, we have routinely won observing time in an open, competitive peer-reviewed process that follows the so-called "open skies" policy. We truly believe that an open competition for observing time is the best way to produce excellent science, and so we are very worried about a possible restriction of "open skies" at the GBT. We believe that instruments are best used when access is determined by excellence and not by available funding. Scientific successes with the GBT have a direct positive impact on the US community and society as a whole, even if some projects are led by non-US colleagues. This impact starts with a positive influence on young people to follow a STEM career, the education of students being directly involved in cutting-edge science, and goes beyond the very close interaction between US and non-US colleagues in obtaining and disseminating the obtained results. For instance, it is easy to produce a list of more than 50 publications from other groups in the US that were directly triggered by our research with the Double Pulsar. Hence, reducing the access to the telescope endangers the science produced with the GBT as a superb instrument with a global importance for astronomy as a whole. We urge the NSF to consider these concerns and we hope that the GBT can be funded at a sufficiently high level to ensure a full "open skies" policy as an investment into the future.</p>	Against Closure	Email - Scanned	11/21/2016	GBT_Support_pulsar.pdf

Green Bank Observatory -Written NSF Public Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
329		Daniel	Reichart	Director of the Skynet Robotic Telescope Network Director of PROMPT and Morehead Observatory Professor of Physics and Astronomy University of North Carolina at Chapel Hill	<p>I have been an acPve user of, and contributor to, Green Bank's educational facilities since 1991.</p> <p>For the past 25 years, I have taken undergraduate groups to Green Bank for a week--long crash course on radio astronomy. We have used both the 40--foot and, more recently, the 20---meter. Regarding the 40---foot, we bring our own data acquisition and analysis software, which we have written over the years, and push this telescope to its limit. For a detailed description of the projects that students complete each year: http://skynet.unc.edu/erira/about-erira/</p> <p>We have even published data from this telescope in the ApJ, with another paper, using both the 40---foot and the 20---meter, in preparation.</p> <p>Regarding the 20---meter, I was the PI on the \$1.8M MRI--R2 award that funded its refurbishment and integration into the Skynet Robotic Telescope Network. To date, thousands of students (as well as a few researchers) have used the 20---meter remotely, through Skynet. Tens of thousands are expected to do so in the coming years, as educational programs continue to be designed around this unique resource, and implemented.</p> <p>I find the 20---meter effort particularly important, because for many students, this will be their only introduction to radio astronomy, at least observationally. Far fewer students are able to travel to the remote locations that host radio telescopes, and no radio telescope has an interface that is as easy for students to use as the 20---meter on Skynet.</p> <p>This effort has already led to new educational programs, such as Skynet Junior Scholars (for middle and high school age students) and Project Intro Astro (for undergraduates), with even larger efforts currently in development.</p> <p>Personally, I hope that options 1 and 2 are considered most seriously.</p> <p>In the event of option 3, I would encourage NSF to retain both the 40---foot, for hand---on education, and the 20--- meter, for remote education to potenPally far larger numbers, through Skynet.</p> <p>In the unfortunate cases of 4 or 5, I would encourage NSF to consider relocaPng the 20---meter to an active NRAO site, so this effort can continue to develop. Or to identify a similar radio telescope already at an active NRAO site that could be integrated into Skynet in its stead.</p>	Against Closure	Email - Scanned	11/21/2016	
330	a	Lynn	Mabhews	MIT Haystack Observatory	<p>As the National Science Foundation embarks on its Environmental Impact Statement process for the Green Bank Observatory, I am writing to strongly urge you to adopt the "No---Action Alternative" that will maintain this world---class facility for science---focused operations.</p> <p>The Green Bank Telescope has already for several years been producing exceptional scientific results across nearly every sub---field of astronomy and astrophysics, and this telescope only continues to grow in importance. The combination of Sensitivity and frequency coverage of the GBT are unique, as is its location in the Radio Quiet Zone. For example, my own personal research has used the GBT for a project involving the study of mass loss from dying stars that would not have been possible with any other telescope in the world.</p> <p>Not only has new instrumentation continued to make the GBT even more cutng edge, the relevance of this single---dish telescope, with its excepPonal mapping speed and surface brightness Sensitivity, is only heightened in the era of new state---of---the---art interferometers such as the Jansky VLA, ALMA, and the SKA precursors. In short, loss of the GBT to the North American community would severely undermine US radio astronomy and be a setback for astronomy as a whole.</p>	Against Closure	Email - Scanned	11/21/2016	
330	b	Lynn	Mabhews	MIT Haystack Observatory	<p>Finally, it is also important to emphasize that the Green Bank Observatory is far more than just the GBT. The location of a public observatory in a radio quiet zone becomes increasingly valuable as radio frequency interference further encroaches on scientifically important portions of the electromagnetic spectrum at other sites. Further, the observatory and its staff have an enormous positive impact on their surrounding community. Through its education and outreach initiatives, the GBO continues to inspire children and adults--many from underserved communities--and shares with them the excitement of scientific discovery. However, such programs can only be meaningful if the GBO remaining an active observatory, engaged in research and open to the general science community.</p>	Against Closure	Email - Scanned	11/21/2016	
331		Ben	Forrest	Graduate Student Dept. of Physics and Astronomy Texas A&M University	<p>I am a current student at Texas A&M University pursuing my Ph.D. in Physics (astronomy track).</p> <p>During my undergraduate career at Rutgers University, I had the excellent opportunity to take a field trip to GBO. There we took radio data and completed an analysis project, as well as toured the facilities and saw the GBT control room.</p> <p>This trip was an important factor in my decision to pursue astronomy in graduate school.</p> <p>I am strongly recommending the continuation of funding for the GBO as both a research and education facility. The incredible resources available here still have a multitude of uses that can further scientific endeavors and inspire future generations of scientists, policy makers, and the general public.</p>	Against Closure	Email - Scanned	11/21/2016	

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Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
332		Patrick	Miller	Director, InterNational Astronomical Research Collaboration iascsearch@hsutx.edu 1-325-670-1393	<p>I am writing in regards to the recent NSF review of its support for the Green Bank Observatory.</p> <p>I strongly favor either of the following options by the NSF: 1. Continued NSF investment for science---focused operations (No---Action Alternative) ---or--- 2. Collaboration with interested parties for science--- and education---focused operations with reduced NSF---funded scope</p> <p>My students and I have made extensive use of the educational programs offered through the GBO. In June 2013 as a faculty member on sabbatical leave, I abended a NASA Chautauqua event organized by Sue Ann Heatherly. From that event and experiencing the GBO and the use of its 40---o transit dish, I developed a 2---week upper division workshop for university students. This has been offered at GBO in May 2014, May 2015, and May 2016...and I hope again in May 2017.</p> <p>I have had students from Hardin---Simmons University and Cisco Community College (both in Abilene, TX) parPcipate. I've had students from Jackson State University (Jackson, MS) parPcipate, and in September 2016 in a separate workshop I had students from the Universidade Estadual do Norte Fluminense (Campos dos Goytacazes, Brazil) parPcipate. Also abending in May 2015 was Jason Kessler, who at the Time was the Executive Director of the NASA Asteroid Grand Challenge.</p> <p>The students spend two weeks on site at GBO where they work with the 40---o transit dish and the online 20---m sidereal dish. They tour the facilities from top to bottom including journeying to the top of the GBT. This is truly an exceptional educational opportunity for these students.</p> <p>The GBO is a research and educational facility that is a treasure for our nation. It merits the full support of the National Science Foundation, as it continues to conduct world leading scientific study and unparaleled educational opportunity for students.</p>	Against Closure	Email - Scanned	11/21/2016	
333		Phillip	Naudus		<p>I am writing to urge you to either continue investing in the Greek Bank Observatory, or collaborate with interested parties to allow the observatory to continue its current science and education focus.</p> <p>During my graduate education in physics, I served as a teaching assistant for undergraduate radio astronomy, in which the class visited the Green Bank Observatory. Even though I was helping to teach the students the necessary science they needed to understand in order to operate the telescope and analyze the data they had collected, I learned an incredible amount myself, as this was my first visit to an observatory. In fact, of all my experiences during my graduate education, the trip I made to this observatory was the one that made the most profound impression on me.</p> <p>Since graduating from Rutgers, I have taught science classes to high school students (Kang Chiao InterNational school, Taipei, Taiwan), as well as middle school students (LOGAN Hope, Philadelphia, PA). The hands---on training I received during my graduate education in physics has transformed my educational philosophy, allowing me to elevate the education of my students, as I teach the next generaPon how to internalize scienPfic principles rather than memorize a series of facts. While there were many facets of my education beyond my visit to this observatory that helped to mold me into the teacher I am today, the Green Bank Observatory had a large impact on the way I understand and teach science.</p>	Against Closure	Email - Scanned	11/21/2016	
334		Cheoljong	Lee		<p>My name is Cheoljong Lee, and I am a graduate student at UVa studying interstellar gas and dust in the nearby galaxies. I believe that the GBT has great capabilities in providing high quality dataset that scientists can use to study atomic gas and dense gas in detail, and so I would like to support for the GBT to continue its operations for science.</p>	Against Closure	Email - Scanned	11/21/2016	
335		Michael	Strzelczyk		<p>My name is Michael Strzelczyk. I am an alumni of Rutgers University in New Brunswick, and I visited the NRAO in April 2016. While I have always been passionate about astronomy, the trip sparked a lifelong fascination in many of my fellow student after being offered this rare opportunity.</p> <p>The loss of the GBT would greatly concern me. This telescope provides vital data for scientific discovery and it is a National scientific landmark, keeping the United States in the frontier of radio astronomy. I have personally used data sets from observations, which yielded invaluable experience that helped me in my academic career. De--- funding this observatory is an extreme measure that is unsustainable in any period of Time, with inevitable consequences for the telescope. I encourage you to appeal the decision and continue funding scientific operations at the telescope.</p> <p>I thank you for your consideration and look forward to continued funding and observations from the Green Bank Telescope.</p>	Against Closure	Email - Scanned	11/21/2016	

Green Bank Observatory -Written NSF Public Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
336	a	Amanda	Kepley		<p>I am writing in response to the Notice of Intent to Prepare an Environmental Impact Statement for Green Bank Observatory (GBO). I would like to voice my strong support for maintaining GBO operations at their current level.</p> <p>Last week I received the exciting news that my team had been awarded almost 200 hours of time on the Green Bank Telescope (GBT) to understand how galaxies transform dense molecular gas into stars. This will be the largest survey of its kind: no other telescope has the capabilities and available time necessary to perform this survey. It is the culmination of years of work by myself and others. This survey is supported by two NSF grants: one to the team building the instrument for the GBT and one to my collaborators to fund the analysis.</p> <p>However, without NSF funding for GBO operations, and specifically the GBT itself, we will not have the telescope necessary to collect the data.</p> <p>This project, and many other GBT projects, needs maximum flexibility in the telescope schedule to leverage good weather conditions. Any reduction in science time on the GBT due to reductions in NSF support would severely limit our ability to make the most of excellent 4mm weather necessary. For this reason, I strongly support maintaining GBO operations at their current level. The other options suggested in the EIS NoI, including collaboration with interested parties of science- and education-focused operations with reduced NSF-funded scope, would negatively impact my survey and the other key science done with the GBT. I encourage you to review two whitepapers that summarize other important scientific projects that would be affected by changes in GBO operations: arXiv:1610.02329 and arXiv:1610.09014.</p>	Against Closure	Email - Scanned	11/21/2016	gbt_support_letter.docx, gbt_support_letter.pdf
336	b	Amanda	Kepley		<p>Reductions in science operations will severely threaten the small neighboring communities surrounding the GBO. I lived and worked on site at the GBO for two years and have seen first-hand the impact that the observatory has on the local community. The GBO is a major area employer (second only to Snowshoe, the local ski resort). Residents are employed across the observatory as everything from machinists to engineers.</p> <p>Finally, the Green Bank Observatory provides excellent science outreach to an underserved population in rural West Virginia. The GBO Visitor's Center is a major tourist attraction (and deservedly so). As an observer, I have visited many telescope visitor centers, and the GBO Visitor Center is, by far, the best visitor center I have ever seen. The quality of both the exhibits and the programs sets the standard for what observatories should provide.</p>	Against Closure	Email - Scanned	11/21/2016	gbt_support_letter.docx, gbt_support_letter.pdf
336	c	Amanda	Kepley		<p>The GBO and GBT occupy a unique niche in the radio telescope landscape. They are one of the few facilities left in the United States where students can get hands on experience with the telescope and where university groups can test new instrumentation on a state-of-the-art facility. As a graduate student and postdoc, I have had the tremendous opportunity to learn how radio telescopes work and to experiment with the GBT to try out new ideas. Through these experiences, I developed increasingly rare instrumental expertise and decided that I wanted to pursue a career as a staff scientist at an observatory. Both the current GBT backend, VEGAS, and ARGUS, the instrument my survey will use, have been built as part of NSF-funded observatory/university collaborations. Without full NSF funding for science operations, this unique resource will no longer be available for students and universities.</p> <p>...</p> <p>The GBO student programs are also outstanding. They attract students from West Virginia and neighboring states. I've had the opportunity to mentor some of these students and they regularly astonish me with their enthusiasm and creativity. Part of the excitement of visiting the GBO is that it is a working observatory, not a museum. Visitors experience science in action. They can run across everyone from bleary-eyed observers to maintenance workers installing a new receiver or repairing the telescope track. Any reduction in NSF support would remove this key aspect of the GBO outreach experience.</p> <p>In closing, I would like to reiterate my strong support for the NSF maintaining full science operations for the Green Bank Observatory. The GBO is an observatory at the height of its scientific capabilities that supports its surrounding communities and encourages the next generation of scientists. Without NSF funding, the GBO will become a shell of what this fantastic facility is today.</p>	Against Closure	Email - Scanned	11/21/2016	gbt_support_letter.docx, gbt_support_letter.pdf
337	a	Felix J.	Lockman		<p>I strongly support Option 1: "Continued NSF investment for science-focused operations" for the Green Bank Telescope and the Green Bank Observatory for the following reasons: (note: specific references supporting the matters discussed here can be found in the two attached documents, also available at https://arxiv.org/abs/1610.02329 and https://arxiv.org/abs/1610.09014).</p> <ol style="list-style-type: none"> 1. The Green Bank Telescope is a national icon, like the Space Shuttle or the Statue of Liberty. It stands for pure research into the nature of the Universe. The Green Bank Telescope and its science are the subject of news articles almost weekly in print, radio, TV, and the internet (see http://greenbankobservatory.org/news/), It was featured in legendary Film Director Werner Herzog's Documentary about the Internet "Lo and Behold: Reveries of the Connected World". It will be the centerpiece in three films now under production including "The Quiet Zone" by Brooklyn Castle Productions, and the "Digits" documentary series by Partisan Pictures. The Telescope will be the focal point of a "Great Course" on radio astronomy produced by The Teaching Company. Its image was chosen for the graphic on U-Haul rental trucks in West Virginia. There are numerous other examples. Option number 2, which would essentially commercialize a majority of the Telescope's functions and remove them from scientific research, would be like turning the Statue of Liberty into a casino. 2. The Green Bank Telescope is a rare visible symbol of the work of the National Science Foundation. Most of the Foundation's budget — more than \$7 billion each year — goes for projects that are totally invisible to the tax-paying public. This is perfectly reasonable of course, for the money goes to labs in university buildings, or facilities deep underground, or to the South Pole or remote mountain tops. But the Green Bank Telescope is one of the few fruits of the NSF's labors that is visible to anyone. Indeed, it is seen up close by the 40,000 - 50,000 visitors that come to the Green Bank Observatory every year. The Observatory Science Center is a year-round facility that provides a variety of programs http://greenbankobservatory.org/visit/science-center/. The Observatory hosts star parties and the annual meeting of the Society of Amateur Radio Astronomers. Every day it publicizes the work of the NSF. Located an easy drive from Washington, D.C., the Observatory should be visited by every Congressman wondering what the NSF does with its money. The Green Bank Telescope should be the symbol of the NSF, not something that it is trying to discard. 	Against Closure	Email - Scanned	11/21/2016	GBT_EIS_final.pdf, GBT_White_Paper_1610.02329v1.pdf.gz, Bally_GBT_White_Paper_1610.09014v2.pdf.gz

Green Bank Observatory -Written NSF Public Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
337	b	Felix J.	Lockman		<p>3. The Green Bank Telescope is the focal point of some of the most successful NSF programs in STEM education. It serves a rural disadvantaged population that has few positive role models for STEM careers. The Pulsar Search Collaboratory and Science Teacher Training are just two of the NSF-funded educational programs that have reaped benefits beyond the region. The smaller telescopes at the Observatory are successful tools for education because they take advantage of the scientific and technical staff to provide unique, hands-on experiences for students. I have personally watched school children become fascinated with science after simply seeing the Green Bank Telescope. They realize that they could become scientists or engineers. The thought that they could grow up to actually use the Telescope for their own research is an extremely powerful motivation for education. This, of course, requires that the Telescope is actually used for research, and is not simply a demonstration model. Today's kids are quite good at sniffing out a fake from the real thing. For the Green Bank Observatory to continue its role in STEM education it must continue as a research instrument available to all qualified scientists.</p> <p>4. The Green Bank Telescope is an increasingly rare example of a facility that can be used to develop new instruments and new scientific techniques. The U.S. scientific community has been very successful at getting funding from the NSF and other sources to build new instrumentation to be used, or demonstrated, on the Green Bank Telescope. Examples include University of California Berkeley development of the VEGAS spectrometer, University of Pennsylvania development of the MUSTANG family of bolometers, Stanford University development of the Argus 3mm camera, the joint Brigham Young University and West Virginia University development of beam-forming technology, the University of Maryland development of the Zpectrometer broadband spectrometer, the University of Massachusetts prototype phased array receiver, and so on. Without the Green Bank Telescope to use as a testbed, development of these new technologies would be strangled to the detriment of the technological base of the United States.</p> <p>8. The Green Bank Telescope is a rare facility that is both world-class, and allows and actually encourages hands-on use by graduate students. The Green Bank Observatory holds regular schools for early-career professionals and graduate students to introduce them to radio astronomy and train them in the use of the Telescope. As access to the Telescope is allocated strictly by the merit of the proposed research, graduate students can have full use of the facility, and develop their own programs with assistance from the scientific and technical staff. The staff can make changes in the hardware or software to facilitate specific experiments. Many PhD dissertations are produced each year using data from the Telescope. If a significant fraction of the Telescope's time is lost to science, it will make it more difficult or impossible for thesis research to be performed.</p>	Against Closure	Email - Scanned	11/21/2016	GBT_EIS_final.pdf, GBT_White_Paper_1610.02329v1.pdf.gz, Bally_GBT_White_Paper_1610.09014v2.pdf.gz
337	c	Felix J.	Lockman		<p>The [GBT] is one of the few facilities available for scientists to develop new observational techniques and new experimental methods. A prime example is the development of "HI Intensity Mapping" by scientists at Carnegie-Mellon University and colleagues elsewhere. This new technique is now the basis for an entirely new telescope being built in Canada. There are other examples in pulsar science. Access to a world-class telescope for hands-on science is increasingly rare at all wavelengths, and the [GBT] is one of the few remaining open facilities. Its removal from active research would severely impact the ability of American scientists to devise new creative strategies and techniques in observational astronomy. 5. The [GBT] offers merit-based access to a world-class facility. The NSF-funded open skies time is allocated on merit. It is not restricted to the rich, or to scientists from wealthy institutions. A recent feature in the international science magazine Nature (2016, Vol 537, p 466) asks "Is science only for the rich?" and notes the large barriers to higher education and STEM careers for students from the lowest income-bracket families in the US. Any reduction in "open skies" time on the GBT directly restricts access to world-class facilities for scientists from smaller universities and liberal arts colleges. The second option under consideration here would strike directly at those in the U.S. who depend the most on NSF-funded public facilities. Choice of the second option will restrict access to this first-rate telescope to those who are either rich, or come from the wealthiest institutions.6. The [GBT] serves perhaps the most diverse group of scientists of any telescope. It has a broad impact far outside the NSF AST division. As documented in the attached articles, the more than 1,000 scientists who are currently active users of the Telescope come from departments of physics, chemistry, planetary science, solar studies, etc., in addition to astronomy departments. Scientific programs cover research into fundamental physics, the nature of the chemical bond, astrometry and heliophysics. It is used to study near-Earth asteroids and occasionally track interplanetary spacecraft. This broader impact is not well served by the current NSF administrative structure, which reflects a more traditional definition of disciplines and does not capture the dynamic cross-disciplinary nature of much current astronomical research. 7. There is a world-class scientific and technical staff at the [GBO], created and sustained by the NSF open-skies funding. Over the many decades of operation of radio telescopes at Green Bank, the Observatory has built up a world-class scientific and technical staff. ...The staff supported through the NSF open skies time developed the breakthrough in GBT control that gives it excellent performance in the 3mm band. If a significant fraction of the Telescope's time were diverted to commercial or other use (Option 2), those groups buying time would no doubt have their own scientific and engineering staffs, located elsewhere, working for their own purposes. The Green Bank staff would be greatly reduced and dispersed, leading to a loss of technical leadership and reducing if not eliminating the support provided to scientists using the remaining available time on the Telescope...9. Adoption of any but Option 1 will effectively cede U.S. leadership in astronomy at radio wavelengths to Europe and Asia. There are vigorous programs in radio astronomy in Europe building new telescope like LOFAR, expanding existing telescopes like NOEMA, and developing new instrumentation for the IRAM 30-meter. In China the FAST radio telescope has just been finished, and plans for a large single dish, like the Green Bank Telescope, are going ahead. Many nations are participating in the Square Kilometer Array, now under construction in Australia and South Africa. Reduction of NSF support for the Green Bank Telescope will essentially cede leadership in critical areas of research to other countries. These are areas of science that have originated and been developed in the U.S. This will likely contribute to a brain drain of talented scientists and engineers from the United States.</p>	Against Closure	Email - Scanned	11/21/2016	GBT_EIS_final.pdf, GBT_White_Paper_1610.02329v1.pdf.gz, Bally_GBT_White_Paper_1610.09014v2.pdf.gz
337	d	Felix J.	Lockman		<p>10. The capabilities of the Green Bank Telescope are unique worldwide; none of the research programs it performs can be done either at all, or more efficiently, elsewhere. The Telescope has unique capabilities that make it either the only instrument, or by far the most efficient instrument, for virtually all of the research it now performs. The location of the Telescope in the National Radio Quiet Zone allows experiments to be done that cannot be performed elsewhere in North America. It has a flexibility that can not be matched by telescope arrays, and can be easily modified to take advantage of new developments, either technical or astronomical. Any diversion of its usage away from NSF-sponsored open skies time will terminate entire areas of scientific research. There is no substitute for the Green Bank Telescope's capabilities in the 3mm band, and no telescope either existing or planned that could match them. The Telescope is highly oversubscribed and already has much more demand for its open skies time than can be met. The Telescope is crucial for U.S. scientists both on its own, and in support of research done with the JVLA and ALMA. Its NSF-funded open skies time should be expanded, not reduced.</p> <p>For these reasons I strongly support Option 1, full support by the NSF for the scientific program of the Green Bank Telescope.</p>	Against Closure	Email - Scanned	11/21/2016	GBT_EIS_final.pdf, GBT_White_Paper_1610.02329v1.pdf.gz, Bally_GBT_White_Paper_1610.09014v2.pdf.gz

Green Bank Observatory -Written NSF Public Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
338		Huib	Jan van Langevelde	Director, JIVE	<p>The R.C. Byrd Green Bank Radio Telescope (GBT), the largest steerable radio dish in the world, is one of the most advanced operational scientific instruments in our field. It is a landmark of the synergy between fundamental science and cutting edge technologies. In our profession - the scientific study of compact celestial radio sources- the GBT has played and is playing a crucial role as a key element in the most sensitive global Very Long Baseline Interferometry (VLBI) experiments. The participation of the GBT in VLBI studies will be in high demand for many year, decades even, especially with the advent of new survey instruments and many more sensitive VLBI elements.</p> <p>For example, the networks that include the GBT, are playing a key role in observations of enigmatic transients sources, such as the Fast Radio Bursts, on which we have a number of high profile publications in preparation. Moreover, starting in 2011 the GBT has been a component in the most sensitive experiments with the Russia-led Space VLBI mission RadioAstron. Experiments with this mission have succeeded in advancing the understanding of the phenomena of active galactic nuclei, interstellar medium, and cosmic masers.</p> <p>The science mission of the GBT is far from being completed and exhausted. With the continuing progress of analogue and digital electronics, it will definitely remain a prime science facility for several decades to come. It will remain unsurpassed for many observations, even when new additions come into operations such as ALMA, FAST, ngVLA, and SKA. In fact, there will be new synergies for researching any new discoveries that will be done by these facilities.</p> <p>Denying the GBT to progress further will have detrimental effect on the development of the world radio astronomy in the coming decades. Moreover, we believe that even de-scoping GBT operations will send a wrong message to the communities well beyond our immediate professional realm.</p> <p>On behalf of the Joint Institute for VLBI - European Research Infrastructure Consortium and the worldwide professional VLBI user community we express our resolute support to continuing operational status of the GBT as the world's prime radio astronomy facility.</p>	Against Closure	Email - Scanned	11/21/2016	GBT support by JIVEv3.pdf
339		Thomas	Galligan	STEM 7 Math Spring Ridge Middle	<p>I teach at the Spring Ridge STEM Academy. Each year, for the past 7 years, we have taken our seventh grade students to the Green Bank Observatory. At the Observatory, they have the opportunity to use a 40' radio telescope. The students have a chance to collect and interpret real-life data. This makes a tremendous impact on their interest and effort. Without this opportunity, they don't really think people do this kind of work. On occasion, we have shared the telescope with college students and this also impresses the students. The educational staff at the Observatory helps the students make sense of the data they collect.</p> <p>I understand that the National Science Foundation is considering how to make best use of the Observatory. I would recommend Option 1 or Option 2.</p> <p>Thank you for providing this amazing opportunity for our students.</p>	Against Closure	Email - Scanned	11/21/2016	
340		Leonid	Gurvits	Head of Space Science, Senior Astronomer JIVE - Joint Institute for VLBI European Research Infrastructure Consortium	<p>This letter expresses in brief my personal view on the situation around the Green Bank Observatory as stated in the "Notice of Intent To Prepare an Environmental Impact Statement and Initiate Section 106 Consultation for Proposed Changes to Green Bank Observatory Operations, Green Bank, West Virginia and Notice of Public Scoping Meetings and Comment Period" of 2016.10.19. I feel I am in the position to share this my opinion as a professional who has been relying on the premier observational facilities in Green Bank for nearly four decades.</p> <p>The R.C. Byrd Green Bank Radio Telescope (GBT), the largest steerable astronomy facility in the world, is still a very young science instrument. It is delivering the most advanced results both in the "single dish" regime and as the key participant of the most sensitive Very Long Baseline Interferometry (VLBI) experiments. Other radio telescopes in Green bank, most noticeably the 140-ft antenna, albeit more than 30 years older, are still offering cutting edge experimental opportunities, e.g. as the Earth station of the only currently operational Earth-Space VLBI system RadioAstron. All these GBO facilities are very far from exhausting their scientific potential in the most advanced (called "transformational" nowadays) areas of radio astrophysics.</p> <p>Anything less than the suggested option 1, "Continued NSF investment for science- focused operations (No-Action Alternative)" will have immediate strong detrimental effects. Firstly and quite obviously, divestment and de-scoping of the GBO operations will result in an abrupt termination of fundamental research in a broad variety of astrophysical and cosmological areas. Fundamental research is not an activity that generates revenues on a short timescale. However, fundamental research is undeniably a key component that enables the progress of mankind. Secondly, a suggested discontinuation of the full support to the GBO will send a wrong message to the public at large, especially the younger generation. This latter effect is arguably even more destructive as it will have long-term negative consequences. I do not believe the scientific community and public at large are prepared to endorse these two highly detrimental effects.</p>	Against Closure	Email - Scanned	11/21/2016	Acrobat.pdf

Green Bank Observatory -Written NSF Public Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
341	a	J.T.	Jezierski	Legislative Assistant	<p>Senator Shelley Moore Capito Statement for Public Meeting on the Future of the Green Bank Observatory November 9, 2016</p> <p>Ladies and Gentlemen, fellow West Virginians,</p> <p>I am sorry I am unable to attend today's meeting. Though I am not there, I am glad you all are, particularly the team from the National Science Foundation. They will see how important and impactful the work of the Green Bank Observatory (GBO) is to our world, to West Virginia, and to Pocahontas County. There are many impressive facts and figures that one can recite about this facility. But to be here, to see the structure in person, and to hear your stories - that is worth more than any statistic. It was my pleasure to experience this just a few weeks ago when I visited GBO. You cannot help but be inspired and excited for our future by seeing this unique equipment or meeting the men and women who make it work.</p> <p>We are gathered to talk about the future of the Green Bank Observatory. But we are also here to talk about the future of scientific research in the United States. I have long advocated for the continued operation of this facility, supporting robust levels of funding and research. Doing so will not only employ West Virginians, but it keeps people inspired, whether current researchers or the thousands of students who come through here wanting to become researchers. We have to invest in science research in our nation. The promise of discoveries are beyond our imagination if we make the right investments.</p> <p>Whether on the Appropriations Committee, where I am a member, or working with my partners in this effort, Sen. Manchin, and Rep. Jenkins, I will consistently convey my support for Green Bank. I look forward to reconnecting with Director Cordova to discuss the significance of the Observatory. I know there is a process to write this Environmental Impact Study, and I plan to be involved every step of the way.</p>	Against Closure	Email - Scanned	11/11/2016	Senator Capito Statement re GBO Public Meeting.pdf
341	b	J.T.	Jezierski	Legislative Assistant	<p>Since its inception in 1957, Green Bank has advanced countless scientific and educational initiatives while becoming a staple of this community. The roughly \$8 million annual investment in this facility from the National Science Foundation generates nearly \$30 million every year for the local economy. This premier scientific research facility represents a source of pride and achievement for the Mountain State. Notwithstanding the abundance of scientific achievements to its credit, Green Bank attracts approximately 40,000 students, teachers, and other visitors annually for facility tours from throughout West Virginia and our nation. The Science Center offers students unique interactive opportunities that meet national and state science and engineering standards. National publications and researchers across the country have recognized Green Bank's many contributions.</p> <p>I recognize the challenges presented by a limited federal budget and support any and all efforts to reduce waste and inefficiencies. However, investment in Green Bank does not fall into either of those categories. Every dollar invested here is spent wisely. Meanwhile, Green Bank has been a responsible partner with the National Science Foundation in recognizing the budgetary challenges we all face. Green Bank has been extremely aggressive and forward-thinking to partner with educational institutions such as West Virginia University and other organizations, such as the Breakthrough Foundation, to balance government investment with private funds.</p> <p>There are many quantifiable impacts of this facility on this community, and we know your study will factor and measure them all. As you complete your study, we ask that you please not overlook the less-easily measured impacts. Green Bank is not just looking toward the stars to discover new worlds, but looking toward students in West Virginia and across our nation to discover new scientists, astronomers, researchers, and teachers. May their discoveries continue to inspire us all.</p>	Against Closure	Email - Scanned	11/11/2016	Senator Capito Statement re GBO Public Meeting.pdf
342		Eric	Faustino Jimenez-Andrade	IMPRS PhD Student Argelander-Institut für Astronomie	<p>My name is Eric F Jimenez-Andrade and I'm a PhD student at the Argelander-Institute for Astronomy in Bonn (Germany).</p> <p>I am writing in strong support of continued full science operations of the Green Bank Observatory.</p> <p>I would like to concur with the points raised in the support letter sent by Dr. Karim (from my department) on November 7 2016.</p> <p>Being in the early stages of my career, I would like to stress that my longterm science goals will hugely benefit from the unique capabilities offered by the Green Bank Observatory.</p>	Against Closure	Email - Scanned	11/21/2016	

Green Bank Observatory -Written NSF Public Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
343		Jonathan	Romney		<p>I write to comment on the Environmental Impact Statement (EIS) concerning the facilities of the Green Bank Observatory (GBO). I do so as a private citizen, but am proud to say I was a staff member at the National Radio Astronomy Observatory until September 30, 2016. I am now affiliated with the long Baseline Observatory, where I am the only member of the scientific staff working full time in support of the Very long Baseline Array (VIBA). My comments arise from that perspective, and address in particular the participation of the GBO's Robert C. Byrd Green Bank Telescope (GBT) as an affiliate in the VIBA's High Sensitivity Array (HSA).</p> <p>The HSA combines the VIBA's excellent network of ten 25-meter diameter telescopes with several much larger telescopes, including the GBT, the phased Jansky Very large Array (VIA), the Arecibo Observatory in Puerto Rico, and the 100-m telescope operated by the Max-Planck-Institut fuer Radioastronomie in Bonn, Germany. The four large telescopes provide extremely valuable enhancement of the VIBA's sensitivity, and the GBT and VIA additionally augment the VIBA's coverage of the (u,v) plane on the continental scale.</p> <p>As examples of the scientific results to which the GBT has made invaluable contributions of this sort, I cite the following:</p> <p>The Megamaser Cosmology Project (MCP):</p> <p>https://safe.nrao.edu/wiki/bin/view/Main/MegamaserCosmologyProject I worked closely with this project team while the VIBA's then-new instrumentation upgrade was being commissioned, and the control of that system at the GBT was being worked out. The project went on to detect maser spectral lines from water molecules in a number of galaxies at cosmological distances, and to measure their velocities as a function of angular offsets from the galaxy centers. These observations yielded an extremely precise value for the Hubble constant. The GBT contributed substantially to the HSA sensitivity, and the angular measurement accuracy, that made these results possible.</p> <p>The RadioAstron Space VIBI Mission: This exploration of extremely compact and thus high-brightness radio emission from active galactic nuclei combines a space radio antenna in an extreme, elliptical orbit (with apogee of 300,000 km), with the largest ground-based radio telescopes, including the GBT. It has detected emission from AGNs on baselines exceeding 20 Earth diameters, challenging theoretical limitations on brightness temperature.</p> <p>These two examples, among many others in other fields of astronomical science, warrant a finding in the EIS in favor of the No-Action Alternative: Continued NSF investment for science-focused operation.</p>	Against Closure	Email - Scanned	11/21/2016	
344	a	Sara	Anderson	Assistant Professor	<p>For the past five years, I have enjoyed visiting the Green Bank Observatory (GBO). My husband is an Assistant Professor of Physics and Astronomy at West Virginia University, and our family has had the great pleasure of experiencing both the scientific outputs and the community of the GBO. My husband, Loren Anderson, has observed for hundreds of hours, producing over ten peer-reviewed publications. As I am sure you are well aware, he is not alone in his use of the GBT and scientific contributions he has then made.</p>	Against Closure	Email - Scanned	11/20/2016	
344	b	Sara	Anderson	Assistant Professor	<p>What I would also like to stress is the impressive impact the GBO makes in the hills of Pocahontas County, WV. It is an oasis of inquisitive, bright, and hard-working people who are proud to contribute to this world-class instrument. Our daughters have made friends with numerous children who call the GBO-area their home. We understand without the facility, the town will no longer be able to support an elementary school.</p> <p>West Virginia is clearly struggling. We frequently are listed as states failing its residents in terms of education, poverty, and health. Despite those challenges, residents are also an incredible proud group, made more so by the superb contributions we can make by supporting this facility.</p> <p>As you consider your options for the GBO, I strongly encourage you to maintain full operations and continue to invest in science-focused operations. The scientific community, county, and state rely on this facility for a great deal and many of us would suffer without it.</p>	Against Closure	Email - Scanned	11/20/2016	
345		Stacey	Smith		<p>I'm writing to tell about how my 2 teenage boys used this unique facility. They are in Boy Scouts and had the unique opportunity to spend a weekend there. They say it was really interactive and they saw results of oxygen clouds using the radio telescope which was really cool. It was an awesome way for them to earn their astronomy merit badge! It would be a shame if future scouts did not have this same opportunity. Please choose option 1 or 2 below.</p> <ol style="list-style-type: none"> 1. Continued NSF investment for science-focused operations (No-Action Alternative) 2. Collaboration with interested parties for science- and education-focused operations with reduced NSF-funded scope 	Against Closure	Email - Scanned	11/20/2016	

Green Bank Observatory -Written NSF Public Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
346		Carolyn	Thomas	President, West Virginia Science Teachers Association	<p>On behalf of the more than 250 members of the West Virginia Science Teachers Association, I am writing to express our support for continued National Science Foundation investment in the Green Bank Observatory. The opportunities and experiences presented by the presence of the Green Bank Observatory in West Virginia inspire and engage science teachers and students across the state.</p> <p>Many of us participate in professional development programs offered through the Green Bank Observatory which truly connect the universe with our classrooms. Teachers who participate bring rich experiences and understanding of inquiry and engineering practices back to the classroom.</p> <p>It is exciting not only for our students, but also for us, when we can visit Green Bank Observatory to participate in research on pulsars and radio waves. The outreach programs expand the scope of the scientific learning to schools throughout the state which otherwise might not be able to visit the Observatory. Anecdotally we also find that students who participate in programs at Green Bank Observatory are more likely to pursue STEM courses of study and career preparation beyond high school.</p> <p>The Green Bank Observatory, along with the top notch scientists and educators associated with it, is a powerful contributor to promoting STEM education in West Virginia and is a point of considerable state pride. We respectfully ask that you continue to support and build the scope of the Green Bank Observatory.</p>	Against Closure	Email - Scanned	11/20/2016	
347		Max	O'Ganian		<p>The GBO is important to students throughout Pocahontas county. It provides important educational resources for students and teachers throughout the county. it provides a place to hold many events including Science Fair and Math Field Day. It can provide the perfect place for many educational trips the schools have. For many people it is an excellent place to meet.</p> <p>Please help insure the future of the GBO,</p>	Against Closure	Email - Scanned	11/20/2016	
348		DeAnna	Vanover		<p>Please choose option 1 for the observatory. My son's boy scout troop visited the observatory this year as a camping trip. We were able to send 8 boys and 2 adults to the observatory for a two night stay at the bunk house and to earn their astronomy merit badge. The boys had a great time and what I feel like was an experience of a life time. I am hoping to be able to take a group of scouts every year for this experience. This is an experience the boys will never forget.</p>	Against Closure	Email - Scanned	11/20/2016	
349		Willie	O'Ganian		<p>The Green Bank Observatory is doing great at keeping people active and learning because it has things like the Pocahontas County Science Fair and the annual open house. People also like to visit the science center.</p> <p>Please keep the observatory open and funded.</p>	Against Closure	Email - Scanned	11/20/2016	
350		Juergen	Ott		<p>I am an astronomer and have been a user of the Green Bank Observatory for many years. I consider this facility vital for the radio astronomy community worldwide. In particular, the revolutionary design of the Green Bank Telescope and its outstanding performance due to careful maintenance and upgrades is unmatched. The GBT has been a prime instrument for a large variety of astrophysical subjects such as gravitational wave searches, cosmology, star formation, and galaxy evolution. Radio Interferometers such as the VLA and ALMA by definition cannot image very extended, and usually faint emission. Only the GBT can provide such measurements across all radio wavelengths and I am personally involved in many science topics where the GBT is the only instrument that can achieve our aspired goals.</p> <p>Over the last few years, the GBT has just about reached a new level in radio instrumentation. The GBT is now the prime telescope to work with radio "cameras", moving away from observing single positions of the sky at a time to entire near-instantaneous images. The GBT also conquered 3mm wavelengths and is the largest telescope to reach this regime where abundant lines of molecules reside - opening the sky to study the chemistry of the Universe. Long term use of the GBT also promises to detect gravitational waves from the entire universe where LIGO just opened the door by observing individual objects.</p> <p>Over the last few years the GBT just started to explore its full potential. As mentioned above, new cameras, just installed, will revolutionize entire astronomy fields. I cannot imagine US astronomy without this crucial instrument. It is extremely untimely now to divest or even reduce GBT capabilities or observing time. In fact, to close or reduce GBT operations at this time would be a terrible service not only to the astronomy community but also to the tax payers. Telescope construction is costly and commissioning is difficult. But once that is achieved, a telescope can be enormously productive. The GBT is exactly in the first years of productivity after construction and has still at least two decades for excellent and outstanding discoveries.</p> <p>I also think that the US reputation for astronomy is at stake. Shutting down a forefront telescope will resonate on a level that maybe was only surpassed by the infamous super-collider defunding. This event made US scientists spectators rather than leaders in a field where the large Hadron Collider overseas now produces Nobel award winning science. It would be very sad and terrifying to see a similar story happen again in radio astronomy.</p>	Against Closure	Email - Scanned	11/20/2016	
351		Marilyn	Kipley		<p>I am writing in support of continued NSF investment for science-focused operations at the Green Bank Observatory. It is essential to science in this nation and the economy of WV and Pocahontas County.</p> <p>Thank you for your kind consideration.</p>	Against Closure	Email - Scanned	11/20/2016	

Green Bank Observatory -Written NSF Public Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
352		Tom	Shepard		<p>I am a scout leader from Fishersville, Virginia. Our troop recently visited the GBO and had a truly fantastic learning experience. Our scout troop participated in the Astronomy Merit Badge, for which the staff prepared meals, made accommodations available, and provided a wonderful instructor that spent the entire weekend working with the scouts. I can say that keeping a group of young teenagers and pre-teens occupied all day long is a difficult task, however the staff set up a program that kept everyone busy until bed time and provided adequate time to complete the merit badge, which is lengthy. We had expert instruction, hands on teaching with the visitors center displays, computer lab access, a behind-the-scenes tour of the GBT control room, and access to the 40ft telescope with which the scouts were able to conduct experiments by aiming the telescope and detecting sound waves. We learned that without facilities like the GBO there is no way that astronomers could see into and study our universe as far as they can now. This weekend meant so much to us that we are doing what we can to spread the word about the merit badge program in scouting and promoting the GBO as a great learning experience and place to both visit, and perhaps one day, work.</p> <p>This event brought astronomy alive to the scouts and parents. Without the GBO, this would have been at best a classroom style merit badge, if we had even tried to attempt to teach it, and an unexciting one at that. Keeping STEM alive means that we have to make it an adventure, and the trip we took our scouts on this past weekend is something they will remember for the rest of their lives! Having a facility like the GBO nearby is invaluable to us and the general public! Without the ability to bring STEM alive, we as a society will stop focusing on these professions and will result in a stagnation of imagination and invention, ultimately resulting in a decline in our economy as a nation and a fall from the powerhouse status our country currently enjoys.</p> <p>I urge you to keep the GBO open and fully funded. I see anything short of that a major disservice to science and exploration, as well as a significant blow to our society as a whole.</p>	Against Closure	Email - Scanned	11/20/2016	
353		Ann	Kepley		Continued NSF investment for science-focused operations (No-Action Alternative)	Against Closure	Email - Scanned	11/20/2016	
354		Jotina	Hamrick		I am writing to say I hope there is some alternative to shutting down the observatory. I think it would be a great opportunity to have some kind of education/technology program. The location is one of the most remote parts of the county and there is no doubt that students could benefit from the facility being used in that way. It is my sincere hope that some solution can be found. The local economy as well as the education of many are on the line if the doors close completely. I am hoping the future of the GBO stays bright and growing.	Against Closure	Email - Scanned	11/20/2016	
355	a	Natasha	McMann	Graduate Research Assistant Fisk-Vanderbilt Master's-to-PhD Program	<p>I am writing to submit a formal comment on the proposed changes to the operation of the Green Bank Observatory (GBO). I am from Pocahontas County and any change to the current operations of the GBO would deliver a devastating blow to the economy of Pocahontas County, West Virginia, and the United States. If it wasn't for the GBO, I would not be where I am today. After graduating college with my first Bachelor's degree, I didn't know what I wanted to do as a career. I had just recently decided to not pursue the career path of minister. In 2010, I started a tour guide position at the GBO. Within a few weeks, I was in love the GBT, the GBO, and astronomy. After my second season as a tour guide, I decided that I would return to school and pursue a career in astronomy. Because of the relationship between West Virginia University (WVU), and the GBO, I was able to talk with Dr. Maura McLaughlin. In the fall of 2012, I started as a physics undergraduate at WVU. I graduated in May with a B.S. in physics and a minor and astronomy. I accepted a position in the Fisk-Vanderbilt Master's-to-PhD Bridge Program. I am currently working on a Master's in Physics at Fisk University and will hopefully "bridge" over to a PhD astrophysics program at Vanderbilt or another PhD granting institution. I am continuing my work with pulsars in my current program.</p> <p>Because of my experience with the GBO, I am now a graduate student who has a passion for public outreach in science and astronomy. I have gone to Germany twice to do research, received a NASA Space Grant Scholarship as an undergraduate, and developed international research relationships all because of my time at the GBO. It truly changed my life.</p>	Against Closure	Email - Scanned	11/20/2016	letterToNSF.docx, letterToNSF.pdf

Green Bank Observatory -Written NSF Public Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
355	b	Natasha	McMann	Graduate Research Assistant Fisk-Vanderbilt Master's-to-PhD Program	<p>I am one of over 100 members of NANOGrav, a collaboration of astronomers, physicists, engineers, and data scientists at 34 institutions across North America. We are on the verge of making the first detection of low-frequency gravitational waves from supermassive black holes—a discovery as transformational as the discovery of gravitational waves from stellar mass black holes announced by LIGO. NANOGrav uses an array of high-precision radio millisecond pulsars - precise astrophysical clocks—to search for small perturbations caused by gravitational waves.</p> <p>The Green Bank Observatory is absolutely critical to this effort because it provides outstanding sensitivity to these weak astronomical signals over 85% of the sky. No other facility in the world offers GBO's combination of sensitivity and sky coverage. NANOGrav also uses the Arecibo Observatory in Puerto Rico, which has higher sensitivity, but is restricted to a smaller viewing area than GBO. The GBO and Arecibo each contribute 50% to NANOGrav's sensitivity to gravitational waves.</p> <p>Many of the proposed changes to GBO operations would have a major detrimental impact on NANOGrav, and in turn would affect the careers of dozens of astronomers, engineers, and technicians. Many of the scientists like myself are just beginning their STEM careers. These changes will adversely affect the socioeconomic and cultural environment in Pocahontas County, at Fisk University, and at scientific institutions across the United States. Here are the impacts of each proposed scenario, as I see it: <u>No-action alternative:</u> Under this preferred scenario, NANOGrav could continue critical scientific activities. Our program to monitor over 50 millisecond pulsars would continue under a current contract with GBO. Importantly, surveys to find new millisecond pulsars with the GBT would also continue. These surveys, and the vital follow-up of new pulsars, are conducted under NSF open skies time. <u>Collaboration with partners for continued science-focused operations:</u> This scenario would allow NANOGrav to continue its pulsar monitoring program, but would severely impact surveys for new pulsars and the follow-up observations that identify the best candidates for NANOGrav. Because these programs operate under open-skies time, any reduction in NSF funding will similarly reduce the time available for our surveys. Scheduling pressure will also make it more difficult to characterize new discoveries, and will greatly reduce the impact of NANOGrav's ancillary science, which is itself some of the most impactful conducted at GBO. Thus, while this scenario would allow NANOGrav to make progress towards discovering low-frequency gravitational waves, it would slow the rate of that progress. <u>Transition to an education and technology park, mothballing, or full deconstruction:</u> These scenarios would devastate NANOGrav science and the careers of dozens of astronomers. They incentivize pursuing careers outside of the US, especially for young astronomers, and would thus drain the US of important expertise in this revolutionary new area of astronomy. This would come as several countries are improving their infrastructure and instrumental capabilities in the search for low-frequency gravitational waves. The Five Hundred Meter Aperture Spherical Telescope (FAST) in China represents a huge investment on the part of the government of China in this scientific area. Changes to GBO operations that adversely impact NANOGrav will thus effectively cede US leadership in low-frequency gravitational wave astronomy to other nations. The GBO (and Arecibo) are currently the best telescopes in the world for NANOGrav science and they may very well remain so for the next decade.</p>	Against Closure	Email - Scanned	11/20/2016	letterToNSF.docx, letterToNSF.pdf
355	c	Natasha	McMann	Graduate Research Assistant Fisk-Vanderbilt Master's-to-PhD Program	<p>In addition, the elimination of this scientific institution will remove a technology center in a region with few skilled positions. The GBO was my only hope of returning home to raise a family while having a successful astronomy career. Even conversion to an education and technology center would still likely result in the export of a number of good-paying jobs to higher tech areas of the country. The people of Pocahontas County are proud of the observatory.</p> <p>At the November 2016 public comment meeting regarding the future of the GBO, not a single person complained about living in the National Radio Quiet Zone, and the public was clearly supportive of continued public funding of the GBO.</p> <p>As you can see, the scientific, socioeconomic, and cultural impacts of reducing NSF funding for GBO are numerous and severe. Such action would be a huge loss for my career, the careers of my colleagues, the NANOGrav collaboration, the US astronomical community, and the people of Pocahontas County, West Virginia. I urge NSF to adopt the no-action alternative in the strongest possible terms.</p> <p>Thank you for your consideration. If you have any questions or need further information, please contact me at the address above.</p>	Against Closure	Email - Scanned	11/20/2016	letterToNSF.docx, letterToNSF.pdf
356		Steven	White		<p>Let me first state the obvious, the Green Bank Telescope is a premier instrument with unique capabilities that has no equal anywhere else in the world. The Green Bank Observatory supports this unique instrument and provides a location for students, amateur and professional astronomers, technicians and engineers to congregate, share ideas and accomplish common goals. I know because I have dedicated thirty years of my career as an engineer in the pursuit of science at the observatory. I stood by Senator Byrd as Turkey in the Straw flowed from his fiddle strings and echoed through the valley and off the GBT. You see the GBT has a pulse, it vibrates, it sings with the flow of Helium through its lines, it has life and inspires. Senator Byrd had a vision and knew the importance of the site not only to the local economy of Pocahontas County, for the pride of the state of West Virginia, but to the entire nation as a leader in the pursuit of science. Faced with many setbacks during the construction, only through perseverance from the staff and the constant reminders of its importance from the radio astronomy community was it completed. The GBT was meant to be. Now, operating at full potential, it is being faced with reduced funding and consequently less open sky availability for discoveries. How this myopic and uninformed decision came to be I will never fully understand. A tragedy is in the making for a national treasure in a time of divisiveness, desperate for unity with the GBO being a prime example. Can the observatory survive with reduced funding and outside partnerships, possibly? But marketing and seeking funding other than scientific pursuits is not part of our DNA. The facility operates under the guise of openness and cooperation that inspires our young people to pursue science and educates the public. Is this not one of the primary missions of the National Science Foundation? There is only one viable option and that is the no action initiative. The GBO staff collaborates with leading researchers in the field of digital signal processing which advances pulsar research enabling investigations into fundamental physics theorems. The GBO uniquely engages women in this area of engineering and fundamental research. The seed was planted many years ago when Dr. Martha Haynes was appointed as director for the site. This original appointment has fostered many opportunities as evident by the number of women pursuing science as post-doctoral scientists and engineers. As an example, Sara Stanchfield from the University of Pennsylvania is currently building state of the art instrumentation to deploy on the GBT. This will allow her to probe a unique window into the fundamental properties of the universe. This process is necessary for the accumulation of data for a doctoral thesis and also promotes interactions with individuals equipped with diverse skill sets. This experience is invaluable for future endeavors in science and technology.</p> <p>Experiences like hers are repeated many times over and are paramount to the mission of the National Science Foundation. Therefore, the divestiture of the GBT is effectively a divestment in the future of our nation's brightest minds.</p>	Against Closure	Email - Scanned	11/20/2016	EISletterNov20.pdf

Green Bank Observatory -Written NSF Public Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
357		Katy	McClane	Concerned citizen	I'm sad to hear that the telescope and its discoveries in Greenbank,WV might be dismantled. Please keep this important discovery tool, as well as the economic vitality it brings to the area.	Against Closure	Email - Scanned	11/20/2016	
358	a	Yekaterina	Gilbo	BS Physics 2017 Astronomy Club Treasurer	<p>I am an undergraduate physics student at the University of Virginia, and I urge you to continue investing in the GBO for science-focused operations. I would like to attest to the life-changing impacts of the Green Bank Observatory on student lives.</p> <p>Five years ago, I first learned about pulsars during the GBT Pulsar Search Collaboratory Camp for high school students. The experience opened my eyes to American opportunities that most students do not know about; the source of public data from NASA, from NRAO, from NIH, and many other facilities. By teaching me how to analyze pulsar radio data, the GBO endowed me with a passion for science and a confidence that I could learn about our world through real time telescope, satellite, or human genome data; that students could make discoveries too, and that the textbook problems and lectures were only stepping stones for the work to be pursued in problems of engineering and science directly impacting our futures, our societal progress, and our curiosity-driven humanity.</p> <p>After the GBO bolstered me with STEM skills and encouraged my curiosity, I started exploring questions that I had, which led me to an internship at NASA's Goddard Space Center. I would never have ended up with the confidence and strength that led me to such a crucial experience for my life's passion and my career hopes – without that initial experience at the GBO.</p> <p>I continue to learn about important skills on academics and life from my GBT mentors and the wondrous telescopes and center in Green Bank as I have visited GBT five times in total. I felt that the GBT learning experience was so inspiring to students, that I helped make it our biggest annual event for the UVA Astro club, for students of all majors and backgrounds.</p> <p>Those nights mapping black holes (Sagittarius X or Cygnus A) and more with the 40ft. telescope did not only propel me (and others) to apply my newfound astronomy knowledge to my broader interest of biology (as I then worked a summer at the NIH Radiology Dept. using the astronomy programming language of IDL to study imaging of tumors), but also taught me a lot about how science can pull kids out of poverty, out of drugs, out of alcoholism, out of many difficult circumstances. Having done the PSC for two years and continuing to stay involved after going to college, I have met several students (and now my friends) who now have jobs in STEM and who have told me, they felt they had no future before their empowering experience at the GBO.</p>	Against Closure	Email - Scanned	11/20/2016	
358	b	Yekaterina	Gilbo	BS Physics 2017 Astronomy Club Treasurer	<p>As someone who emigrated from Russia to the US, I know how unique the GBO is for student education and for student empowerment. The GBO makes science accessible, and opens it up to students from minority group, from low socioeconomic statuses, to students with low self-esteem who do not believe science can ever accept them—until they glimpse a different perspective after spending a night using a real radio telescope, seeing the pulses of a neutron star and having done all of that completely without the aid of a scientist or a teacher (after training).</p> <p>The GBO is an American treasure for science and for education, for creating a better future for all of us. I truly thank you for your time, NSF reader, and urge you to continue to support the GBO and through GBO, the students of future generations.</p>	Against Closure	Email - Scanned	11/20/2016	
359	a	Denise	McNeel		<p>I am probably the only Pocahontas County resident who, on a clear day, could see the Jodrell Bank telescope from the end of the road where I was born and had Sir Bernard Lovell speak at my grammar school speech (prize) days. So, I have had a long appreciation of the importance of radio astronomy.</p> <p>We are truly blessed to have had NRAO operating in the county for so long. As an entity, they are the best neighbors imaginable and the employees, their spouses and children enrich our communities. I go to church with one employee, sit on the County library Board with two other employees, enjoy the music of two more, go to a concert sponsored by the Observatory's staff and get invited to special science events. They are our neighbors ...and we are blessed.</p>	Against Closure	Email - Scanned	11/19/2016	
359	b	Denise	McNeel		<p>The financial contribution to our county is huge. Not only does the observatory offer well- paying jobs and bring children to add to our school population, but Science is promoted here. Education is promoted --and tertiary education normalized. Students can see science in action, become aware of the possibility of a career in science and accept early the importance of science.</p> <p>The educational programs offered by the Observatory are exceptional and the opportunity to see science in action, with actual enormous telescopes in operation, is a rare opportunity to learn just how exciting and groundbreaking scientific research can be.</p> <p>I volunteer at the local historical museum and I never fail to encourage our visitors (from many states, and a few from overseas) to do the tour. And, I might add, for many of our visitors, the Green Bank Observatory is THE destination which has influenced their choice of a location to travel to. How far would all those visitors, from multiple states, have to travel to be able to see and learn about radio astronomy with instruments being used for research, right before their eyes? And then, to have programs, exhibits and interactive science activities-what an opportunity, over and over again, to influence current and future taxpayers to fund science research and facilities!!!! Funding for science may well become more stringent in the future. For a long time, there was no admission fee at NRAO (unlike Jodrell, I might add!). What an advertising ploy that was; "See your tax dollars at work!" But visitors are willing to pay and be influenced at the same time to support scientific research. All those visitors are served by congressmen and senators, who decide on the funding allocations.</p> <p>So, please keep the Green Bank telescope operating and promoting science through its tours, its visitor center and active telescopes. Give this facility help in seeking out other users of telescope time. Every time you close down a huge expensive facility like this one, the taxpayers and lawmakers question the amount spent, just thrown away. For your own credibility's sake, when you ask for millions (billions?) more for research, you will need to justify your decision over a facility such as the Green Bank Observatory, which has years of usefulness for the advancement of vital knowledge.</p>	Against Closure	Email - Scanned	11/19/2016	
360		Lawrence	Matson		Unfortunately, I just received notification of a comment period now. My abbreviated comment is simply that the historical, educational, and scientific benefit of this site exceeds the costs as well as benefits of other expenditures currently being made. Deconstruction would be a very poor option.	Against Closure	Email - Scanned	11/19/2016	

Green Bank Observatory -Written NSF Public Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
361	a	Spencer	Wolfe	Department of Physics and Astronomy West Virginia University	<p>First, the review conducted in 2012 does not accurately reflect the current state and capabilities of the GBT. The GBT is conducting significant observations at millimeter wavelengths, and will be a critical compliment to the AIMA telescope. Unrivaled mapping of molecules will provide deeper insights into a number of processes, such as how organic molecules develop in new forming stars. With the direct detection of gravitational waves by LIGO, gravitational radiation has now been pushed to the forefront of modern astrophysical research. The NANOGrav collaboration relies heavily on the GBT to conduct observations of pulsars to detect and further characterize nano- Hz gravity waves.</p> <p>Other areas of scientific study with the GBT include astrochemistry, star formation, galactic evolution, the solar system and tests of fundamental physics. Indeed, these studies are too numerous to write here. A simple review of the available literature makes that clear. The GBT is doing groundbreaking research that was not realized at the time of the 2012 review and has not yet reached its full potential, especially at mm wavelengths.</p> <p>Second, the GBT is still an unparalleled instrument in radio science. Interferometers such as ALMA, the JVIA and even the future Square Kilometer Array will still need large single dishes to recover faint, diffuse, extended emission from astronomical sources of interest. While there are larger and more sensitive telescopes available, the GBT's design makes it the preferred instrument. Dishes like the Arecibo telescope or FAST can only view one swath of the sky at a time, while the GBT can view the entire sky. Its design and construction also removes significant amounts of contamination from stray sources, which provides much higher quality data products than more traditionally designed apertures....Third, if GBT operations cease, then US scientists and students will be forced to go elsewhere to conduct single dish science. The other options are Germany, Puerto Rico, Australia, China , etc. The US would simply have no significant part in large, single dish science. This would be unfortunate and, in my opinion, unacceptable. I believe mothballing the facilities or deconstruction of the site is not an option. We would be putting an end to an instrument that has not even reached its full potential and has more people applying for time to use it, year after year.</p> <p>Fourth, I believe that collaboration, either with reduced NSF scope or as a technology park is not the best way to proceed. These options will likely lead to a diversion of GBT operations to those interested in commercial, or classified activities. The infrastructure needed to support astronomical research would be severally crippled or would disappear entirely.</p> <p>As I stated above, I believe the only reasonable option is to continue NSF investment for science operations.</p> <p>lastly, let me finish by saying that this issue is personal to me. I used the GBT to conduct radio frequency observations for my Ph.D. dissertation on neutral gas in and around local Group galaxies. I can say first hand, how remarkable this instrument is, both in its capacity and in its scientific impact. My very first publication as a first author was printed in Nature (Wolfe et al. 2013, Nature, 497, 224) which is quite an achievement, and it was accomplished using data taken with the GBT. This is because the GBT is the only instrument, still to this day, that can reliably and repeatably observe incredibly faint neutral gas around other nearby galaxies. It is very easy to use the telescope and operations have been running long enough that scheduling efficiency is generally maximized.</p> <p>The infrastructure and staff at Green Bank are also incredibly helpful when it comes to dealing with observations, data collection and data analysis. All the pieces of the puzzle to conduct and publish groundbreaking research are already there.</p>	Against Closure	Email - Scanned	11/19/2016	
361	b	Spencer	Wolfe	Department of Physics and Astronomy West Virginia University	<p>Further, the GBT sits in the National Radio Quiet Zone, which limits the amount of radio frequency interference due to terrestrial sources. In a world where everything is becoming wireless and flooding more and more frequency bands, having a sensitive telescope in such a place will become even more important.</p>	Against Closure	Email - Scanned	11/19/2016	
361	c	Spencer	Wolfe	Department of Physics and Astronomy West Virginia University	<p>My name is Dr. Spencer Allen Wolfe, a radio astronomer and former student of the Department of Physics and Astronomy at West Virginia University in Morgantown, West Virginia. I am writing this to comment on the NSF's review process to create an Environmental Impact Statement for changes to operations at Green Bank (Federal Register, Vol. 81, No. 202, pg. 72124-72125).</p> <p>I believe that of the five proposed alternatives mentioned in the above notice, only the first (Continued NSF investment for science-focused operations, No-Action Alternative) is acceptable for a number of reasons.</p> <p>...Also, I am a native West Virginian. I can tell you that me and my fellow members of the Mountain State feel a great sense of pride for the GBT. We are well aware of its importance and impact on astronomy, particularly for the US. Even in grade school, I knew about the GBT and visited Green Bank on a few occasions. The primary reason I decided to pursue astronomy as a graduate student was because of the opportunities the GBT provided to West Virginia University. Indeed, the Physics and Astronomy department at WVU owes a great deal to the GBT and its accomplishments. It would be unfortunate if WVU, and West Virginia, were to lose such a valuable resource.</p> <p>The GBT is a groundbreaking instrument, whose proficiency has been proven and its full potential not yet realized. It stands at the forefront of many areas of astronomical research, with even more pivotal discoveries yet to be made. It is a significant asset to US science and astronomy, and even more so here in West Virginia. I urge you to keep investing in the GBT for science and research. There is no other instrument of compare, and there won't be for the foreseeable future.</p>	Against Closure	Email - Scanned	11/19/2016	
362	a	Nicole	Gugliucci	Assistant Professor, Dept. of Physics Saint Anselm College	<p>I am writing to you today in response to the call for public comments on the Environmental Impact Statement and future of the Green Bank Observatory, as stated in https://www.federalregister.gov/documents/2016/10/19/2016-25213/notice-of-intent-to-prepare-an-environmental-impact-statement-and-initiate-section-106-consultation.</p> <p>I am an astronomer and an assistant professor at Saint Anselm College, a small liberal arts college in New Hampshire. I did my graduate work in astronomy at the University of Virginia and the National Radio Astronomy Observatory, which, until recently, included the Green Bank Observatory (GBO). The highly sophisticated scientific instruments in Green Bank and the presence of the site as a Radio Quiet Zone were crucial to my training as a graduate student and development as a professional scientist. I've worked with the Green Bank Telescope, searching for water megamasers that are helping astronomers uncover the basic properties of the Universe, and used the site to prototype a new array, the Precision Array For Probing the Epoch of Reionization, an important project that is unlocking the secrets of the earliest galaxy formation.</p> <p>I don't need to expound, however, on the scientific importance of the instrumentation at Green Bank since an excellent job of that has already been done by Bally et al. (2016 - https://arxiv.org/pdf/1610.09014v2.pdf) and Lockman et al. (2016 - https://arxiv.org/pdf/1610.02329v1.pdf).</p>	Against Closure	Email - Scanned	11/19/2016	

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Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
362	b	Nicole	Gugliucci	Assistant Professor, Dept. of Physics Saint Anselm College	<p>What is most important about GBO is not just that important science is being done, but how the science is being done and how it is being used to train the up and coming STEM professionals of the future. Green Bank gives young astronomers a unique experience in being able to travel to a radio telescope and take the data on site, interact with the scientists, engineers, and technicians who keep the observatory running every day, and steep themselves in the history of the science that has been done at that facility. This is an experience that one does not get in radio astronomy anywhere else in the United States except, perhaps, at the Arecibo Radio Observatory in Puerto Rico. For those of us lucky enough to live close to the observatory and work there on a weekly basis, the impact of that depth of education is immeasurable. I would not be educating students of New Hampshire today in physics and astronomy had I not gotten these chances to connect with scientists and science itself on such a fundamental level.</p> <p>As a new professor at a liberal arts college, I get the chance to build an astronomy program that will expand the appreciation of science and Universe to a wide range of students with interests in a wide range of disciplines. I also get to share the unique experiences of observing the Universe with the sophisticated technology of Green Bank with my students. Just this year, I am mentoring a young woman, a chemistry major who is likely to go on to pharmacy school, in an astrochemistry project featuring data from the Green Bank Telescope. For a small college with limited resources, access to the data and the ability to apply for new data-taking opportunities is invaluable. Without Green Bank, we'd lose significant capabilities for single dish radio astronomy for our students, and lose the ability to pass on the important research and critical thinking skills that are not just needed for professional astronomer, but for young people going into STEM careers of all kinds. And, despite what some in our current political climate think, we still do need to train more STEM professionals into the workforce.</p> <p>I look forward to building an astronomy program that brings together important scientific and engineering skills that I learned in a hands-on way while at the Green Bank Observatory. However, our small-scale efforts at building local radio receivers and instrumentation for small projects would be perfectly complimented with research experiences using large, sophisticated, cutting edge telescopes such as the Green Bank Telescope. The Universe really would be closed to student like mine, at small colleges, community colleges, and similar institutions across the nation, if it weren't for the "Open Skies" policy of our federally funded observatories. The Green Bank Telescope is an important and unique tool in that package, and losing that would hurt astronomical progress AND science education which ever increasingly relies on active learning experiences.</p>	Against Closure	Email - Scanned	11/19/2016	
362	c	Nicole	Gugliucci	Assistant Professor, Dept. of Physics Saint Anselm College	<p>Finally, on a personal note, the people of the Green Bank Observatory were among the most welcoming and wonderful folks I've met in my scientific career. Every new visitor was welcomed with good food and hospitality and whatever support resources were needed for their work. Students coming for a visit, a workshop, or to do science found an incredible community and endless wonders of science, engineering, and history at the site. There is no place like it, and I look forward to driving my own students down in one of our college vans so that they, too, can experience the unique setting of Green Bank and, potentially, one day decide to join our ranks as astronomers.</p> <p>With all of this in mind, I wholeheartedly support continued NSF investment for science-focused operations (No- Action Alternative) for the Green Bank Observatory. Its functions as a scientific institutions are invaluable and its capacity for educating the next generation of STEM professionals would be severely diminished without its scientific prowess. I understand that the National Science Foundation has a host of difficult decisions to make with regards to funding the future of astronomy, science, and science education in this country, but the Green Bank Observatory is one aspect of the nation's scientific toolkit that we, I believe, cannot afford to lose.</p>	Against Closure	Email - Scanned	11/19/2016	
363		W. Hunter	Lesser		I strongly urge the continued operation of Green Bank Observatory. Whether funded by NSF, private entities or a combination of the two, it is an important symbol and source of pride for all West Virginians. The mothballing or dismantling of GBO would have far-reaching repercussions. Thank you.	Against Closure	Email - Scanned	11/19/2016	
364		Barbara	Carter		This email is to express my wishes for continual funding of the Greenbank Observatory. I highly objective ti any decrease in the use of the facility. Keep it going America.	Against Closure	Email - Scanned	11/19/2016	
365		Colleen	Anderson	Mother Wit Writing and Design P.O. Box 525 Charleston, WV 25322 304-342-1213 www.motherwitdesign.com	Please add my name to the list of those advocating for saving the Green Bank Observatory. West Virginia needs this wonderful facility!	Against Closure	Email - Scanned	11/19/2016	

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Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
366		Phil	Appleton	Caltech/IPAC-Herschel Senior Research Scientist Project Scientist and Task lead -NASA Herschel Science Center	<p>As a Caltech scientist who is (now) very dependent on US national facilities for radio and sub-mm astronomy, I would like to strongly urge the NSF to continue funding the GBT for science operations into the distant future. I list below the scientific reasons I feel compelled to write this message. I also find it surprising that, in an era when other nations (particularly China) are actually building up radio astronomy resources, many US facilities (whether public or private) are either under threat of closure (GBT, VIBA, Arecibo) or are already closed and dismantled (a good example of the latter is Caltech's recent closure of the CARMA and CSO facilities). All of this leads to the feeling within the US astronomical community, that we are in decline in US radio astronomy science, rather than continuing to lead with innovation and new instrumentation. My own background was originally in Radio Astronomy in the UK (Jodrell Bank, U. of Manchester), but my primary science interest has been in mid and far-IR space astronomy with Spitzer and Herschel. I currently lead the management of the NASA Herschel Science Center at Caltech, as well as being very active in IR and sub-mm/mm astrophysics. I am closely involved with new initiatives, such as the NASA Origins Space Telescope concept (a large single aperture far-IR telescope study), and have scientifically advocated for such an instrument in space. Progress in astrophysics requires a broad wavelength approach, and radio astronomy- especially mm-wave astronomy, is a vital part of my work. Having open access to telescope time at GBT is very important.</p> <p>Why Continue Funding science at the GBT in the era of JVIA and AIMA? General Science Considerations: I strongly support the idea that the pulsar timing research done at the GBT will be a crucial aspect of the future gravitational wave astronomy discoveries. ... We will leave it to the Chinese to make the future discoveries with their newly-supported effort in radio astronomy. 1) The GBT is developing a new exciting capability in mm-wave astronomy (ability to work in the 3-mm molecular rich wavebands-Argus instrument). The huge collecting area of GBT combined with new detector technology is opening up a new window for GBT work that greatly complements the exciting capabilities of AIMA- especially for spectral-line work. I have been conducting research on warm and cold molecular gas in nearby galaxies- especially galaxies undergoing strong shock-excitation. I am very excited to hear about the new 3-mm capabilities which allow exploration of very extended CO emission to be quickly built-up with rapid mapping. AIMA, with its amazing sensitivity to compact emission, will miss much of the extended emission- for example in the compact group Stephan's Quintet- we find that interferometers miss about 70% of the very low surface brightness turbulent gas in the shocked intergalactic filament. which make observations on spatial scales that are well matched to the new 100GHz mm-capabilities of GBT for redshifted CO. Clearly no other facility in the US has this capability, nor the power. 2) large single dish facilities still have a very important role to play in detecting faint sources of HI in the universe. Our team has been conducting observations of HI in galaxies in regions of the em-spectrum where radio-frequency interference (RFI) would normally destroy all hope of detecting signals (with redshifts up to 0.1). The radio-quiet environment of GBT, although still affected by RFI, makes it possible to consider observations on the edge of the normal 20cm radio-frequency band. Furthermore, studies of very extended HI in the Galaxy and nearby galaxies are very important. I hope we don't lose this capability. In conclusion, I hope that the NSF will strongly consider the importance of the GBT -with its fully-steerable capability- and its important role in the future of both gravitational wave astrophysics, and its new mm capabilities which complement the AIMA facilities. With the loss of mm- and sub-mm facilities (like CARMA and CSO) our ability to stay competitive in these regions of the EM spectrum is important. Young people need to feel inspired by science, and have the opportunity to get involved in building instruments and the Green Bank Observatory offers such an opportunity through its close geographical location to many east-coast Universities and to NRAO headquarters.</p>	Against Closure	Email - Scanned	11/19/2016	
367		LuAnn	Creager	Registered Representative Financial Services Specialist Good life Financial	<p>As a financial professional in our community I am expressing my concerns about the National Science Foundation considering closing the Green Bank Observatory.</p> <p>The Green Bank Observatory is an essential part of the community's economic stability. My business Good life Financial (www.good-life-financial.com) and other local businesses would be negatively impacted by the loss of jobs and income for community members currently working at the Green Bank Observatory. Good life Financial has employed several spouses of employees at the Observatory and would lose that pool of educated employee candidates should the Observatory close.</p> <p>I have also volunteered as a Girl Scout leader in the Green Bank community for 12 years. My Girl Scouts have benefited from volunteers from the GBO leading career seminars, science demonstrations, photography seminars, mushroom identification sessions, swimming lessons, and cooking demonstrations. We have hiked on the Observatory property to complete nature badges and had lunches and ice cream at the tour center. These types of educational and fun activities would not be possible without the folks at the GBO.</p> <p>Please consider the significant impact the closing of the GBO will have on our community's people and businesses before making your final decision.</p>	Against Closure	Email - Scanned	11/19/2016	
368		Mark	Scott		I am writing to issue an objection to the reduction in funding and potential future closing of the Greenbank Observatory. The observatory has been vital to space exploration among other things. It sits perfectly situated in the quiet of rural Pocohontas county and is the major source of economic development for that area. For these reasons I ask that you thoughtfully consider not reducing the funding or closing the Greenbank Observatory.	Against Closure	Email - Scanned	11/19/2016	
369	a	Linda	Nielsen		I am writing in response to recent information indicating that you are seeking comments on the future of the Green Bank Observatory. For the last twenty years, I have included a stop at the Green Bank Observatory as part of a travel and education program for seniors. Although our main program topic is the history of railroading, our participants always include the tour of NRAO as one of the highlights of the trip. Many participants indicate that they wish they could have spent more time at the facility. Indeed, it is often hard to get some to leave the museum in time to board the bus! The educational component of this facility is tremendous and an asset to the community and to the State of West Virginia.	Against Closure	Email - Scanned	11/19/2016	
369	b	Linda	Nielsen		<p>In addition, I am aware of the exciting scientific projects that are conducted at this facility. This provides opportunities for the scientific community and well as amateurs. Frequently I pick up newspapers and find articles about a recent scientific discovery made in part through research at the NRAO. Youth that visit this facility have the opportunity to work with scientists to develop and carry out hands-on experiments. I don't think it is possible to measure the tremendous impact this has upon instilling a love of science in our younger generation.</p> <p>Please strongly consider keeping this facility open for continued science-focused operation and an education based facility. Therefore, I support options one and two from the list of options NSF is considering.</p>	Against Closure	Email - Scanned	11/19/2016	

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Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
370	a	Jennifer	Scott	Associate Professor Department of Physics, Astronomy, and Geosciences Co- Director Baltimore Project ASTRO	I am writing to express my support for continued NSF investment in science and education at the Green Bank Observatory. For the past two years, I have taught an Astrophysical Techniques class for junior and senior level astrophysics students at Towson University near Baltimore, Maryland. Most of the course curriculum is designed around student projects and access to observing facilities at the GBO is a critical part of the learning experience for students in the course. Each year we have made a class field trip to use the 40-foot telescope at GBO to take spectra of the 21 cm emission from the Milky Way disk, to map the Galactic Center, and to take continuum measurements of other sources of interest to the students. It is a truly unique experience for students to travel as a class and work together to take their own data. The learning that Sue Ann Heatherly and the rest of the staff facilitate is irreplaceable and makes a deep impression on these students. For some, it is the first time they have been to a site dark enough to see the Milky Way in the sky! Upon returning to campus, they work together to analyze the data and I am building up a database of their observations over time. I hope to continue this for many years into the future...In light of both the educational and research value of the facility as well as its economic value to the region and the sheer uniqueness of the US National Radio Quiet Zone I urge you to consider only options: 1. Continued NSF investment for science-focused operations (No-Action Alternative) or 2. Collaboration with interested parties for science- and education-focused operations with reduced NSF-funded scope as you proceed with deliberations on the future of NSF funding at Green Bank.	Against Closure	Email - Scanned	11/19/2016	
370	b	Jennifer	Scott	Associate Professor Department of Physics, Astronomy, and Geosciences Co- Director Baltimore Project ASTRO	My own research is not in the radio regime but my students and I have come to recognize the unique part that the GBT plays in radio astronomy. The Bally et al. white paper "THE CASE FOR A PUBLICLY AVAILABLE, WELL- INSTRUMENTED GBT OPERATING AT 20-115 GHZ" lays out the compelling case for this. Indeed it seems without the science operations at the GBO there is no strong case for maintaining the current size of the US National Radio Quiet Zone. There is no going back on a decision to abandon science operations at this facility.	Against Closure	Email - Scanned	11/19/2016	
371		Keith	Payea	Director, Society of Amateur Radio Astronomers	I would like to encourage you to continue to support the Green Bank Observatory. Rather than focus on the obvious current scientific merits of the facility, I would like you to consider another aspect of its importance to our country. Much attention is being paid to Science, Technology, Engineering and Math (STEM) education for our nations children. One piece of that puzzle which is too often missing is inspiration. Anyone who has ever visited Green Bank will tell you how awe inspiring the entire facility, and particularly the 100M Robert C. Byrd Green Bank Telescope is to them. I have visited both Green Bank and the VIA facilities and somehow, the VIA just doesn't have the same impact. I hope that all of you who are involved in this important decision have visited Green Bank and just watched the other visitors to see the impression it makes on them. Combine its scientific relevance, its ability to inspire, and its proximity to the large population centers of the East Coast, and you have a truly unique facility which deserves your support.	Against Closure	Email - Scanned	11/19/2016	
372	a	Lara	Baudler	Resident	The Green Bank Observatory has impacted my life and the lives of every community member in countless positive ways. I cannot imagine my life without this astounding scientific facility. Without the GBO, my family would never have found the beautiful, rural town of Green Bank and come to appreciate it the way we do. I was blessed to be able to grow up in a place held so pristine by the Radio Quiet Zone. GBO is at the center of the Radio Quiet Zone. Mothballing or deconstructing the Observatory would mean the end of the Radio Quiet Zone. This is like closing a unique nature preserve or a national park. Through the unique quiet zone, I was able to gain perspective on our society today. The quiet zone allows the area to be more protected from dangers in the outside world and gives a unique perspective on what the world outside the quiet zone looks like today. An environment such as the one created by the quiet zone, exists no where else in the entire world.	Against Closure	Email - Scanned	11/19/2016	
372	b	Lara	Baudler	Resident	Endless memories exist because of the GBO. As a child, I benefited tremendously from what the GBO has offered. I gained a passion for the scientific world and was continuously encouraged to learn new things. Through annual celebrations that incorporated science in intriguing ways, my appreciation for science was able to continuously grow. I met wonderful people from all over the world at such gatherings, I would never have encountered otherwise. The GBO is a focal point of our community and aids tremendously in uniting us. In a way, the Observatory is the glue to our community. Concerts, Open houses, Star parties, and events like the Space Race Rumpus allow the community to get together and flourish. Additionally, the county relies on the GBO as a source for income and is extremely important for the county's infrastructure. Without the GBO, many people in the community will be jobless and forced to move away, causing the local real estate market to crash. It is one of the largest sources of tourism in Pocahontas County and attracts many people to the area. The surrounding area will lose many community members and the percentage of tourists will dwindle. The GBO has not only supported individuals in the community, but in the public school system as well. The public schools in Pocahontas County have benefited tremendously through the help of the GBO. Countless occasions/events only took place through the support, infrastructure and organization of the GBO. Donation based funding has made new school facilities possible. The collaboration that exists between the observatory and the schools is remarkable and a truly wonderful relationship. Many fantastic events would not exist if it weren't for the continuous support from the GBO. Additionally, the GBO is a valuable location for students and future scientists to explore their passion by using the telescopes and facilities for their studies. I have learned to appreciate the nature and beauty of the surrounding environment and hope it can be preserved in the future. I have seen so much wildlife flourish on the GBO property. It would be an utter shame to damage this delicate ecosystem. The pristine natural environment on the observatory properties benefits tremendously from the GBO's continuous protection.	Against Closure	Email - Scanned	11/19/2016	

Green Bank Observatory -Written NSF Public Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
372	c	Lara	Baudler	Resident	GBO is also an important symbol in the world's scientific community. Due to the massive positive impact that GBO has on the county, environment, and community members within as well as the scientific community in general, preserving the facility is imperative. By ensuring that funding is continued, our valuable community can continue to thrive. Our community could not exist without the support and stability provided by the GBO. Therefore, continued NSF investment for science-focused operations (the No-Action Alternative) seems to be the most beneficial option for everyone. It is imperative that the Green Bank Observatory stays up and running!	Against Closure	Email - Scanned	11/19/2016	
373		Angela	Gyorko		Blank email; Subject line is: Preserve the station! WV residents supports continued full funding!	Against Closure	Email - Scanned	11/19/2016	
374					My husband and I have visited a few times and plan to go back with our grandson. Please don't close this wonderful facility! We WV citizens are very proud of Green Bank. If funding must change I would vote for collaborating with interested parties for science and education focused operations with reduced NSF funding.	Against Closure	Email - Scanned	11/19/2016	
375		Bryar	Huff		Hi my name is Bryar. I am a thirteen year old boy from Nutter Fort, West Virginia. We need the Green Bank Telescope because it provides information about space and is the main pulsar telescope. The telescope is important because it is the only one in the world that has the needed resolution, sky coverage, and sensitivity, it also can map gas with extremely low densities, and can take pictures of the Sunyaev-Zel'dovich Effect. The telescope is used to discover interstellar chemical processes, image the Universe as far back as the beginning, detect pulsars, and even discovered that the Milky Way is made mostly of carbon based molecules. Green Bank also works with observatories in Puerto Rico and California. Because of Green Bank scientist can study the highest matter densities. Surprisingly without Green Bank chirality would have never been found in interstellar space. Some discoveries include the abundance of acetamide, a collapse in molecular cloud core, high velocity clouds around the Andromeda galaxy, stellar evolution ,two solar mass, millisecond pulsars in gamma rays, Hydrogen signals, the expansion rate of the Universe, measurement of CO, masers, and chemical processes in space. When I visited Green Bank I was inspired to work there in the future. Without Green Bank the United States would fall behind in the discovery of space. There are many more discoveries to be made that might never be discovered without the Green Bank Telescope.	Against Closure	Email - Scanned	11/19/2016	
376		Kim	McBride	Kentucky Archaeological Survey 1020A Export Street University of Kentucky	Continued NSF investment for science-focused operations (No-Action Alternative) Collaboration with interested parties for science- and education-focused operations with reduced NSF-funded scope Collaboration with interested parties for operation as a technology and education park Mothballing of facilities (suspension of operations in a manner such that operations could resume efficiently at some future date) Deconstruction and site restoration The purpose of the public scoping process is to determine relevant issues that will influence the scope of the environmental analysis, including identifying viable alternatives. At present, NSF has identified the following preliminary resource areas to analyze potential impacts: Air quality, biological resources, cultural resources, geological resources, solid waste generation, health and safety, socioeconomics, traffic, and groundwater resources.	General	Email - Scanned	11/19/2016	
377		Kim and Steven	McBride	Kentucky Archaeological Survey 1020A Export Street University of Kentucky	We write to give our whole-hearted support for the Green Bank Observatory, and hope it can remain fully funded for science-focused operations. We have conducted archaeological research in the Green Bank area for over 30 years, and the Observatory has been an important partner for us, letting us give public lectures in their auditorium, letting students at Science Camps participate in the excavations, providing tours for our excavators, and such. On many occasions Observatory staff have themselves assisted us in our endeavors. This facility is crucial to the economic, scientific and intellectual well-being of the greater Green Bank area and we hope you can find a way to continue its operations.	Against Closure	Email - Scanned	11/19/2016	
378		Ralph	Adkisson		At least offer options to keep it online. Please do not close the observatory. Subject line: Keep Green Bank Observatory	Against Closure	Email - Scanned	11/19/2016	
379	a	Fred	King	Vice President of Research West Virginia University	I write regarding the Environmental Impact Statement assessment for the Green Bank Observatory announced on October 28, by the National Science Foundation. I serve as the Vice President for Research at West Virginia University and as a member of the State of West Virginia's Science and Technology Council and offer my comments from those perspectives. I want to state from the beginning that any reduction in the operations at the Green Bank Observatory would not only be devastating to the local community and its economy, but would also significantly reduce the opportunity for students from kindergarten to graduate school to engage in scientific discovery. These are significant impacts to a region where its citizens are already struggling in so many ways. I believe it is important to make clear that this is a choice of where the Division of Astronomical Sciences at the National Science Foundation chooses to invest the tax dollars of which it is steward. In 2013, the budget for the operations at Green Bank, West Virginia was on the order of \$14M while the budget for the operations at Atacama, Chile was on the order of \$33M, which I suspect is significantly more today. Furthermore, it is also my understanding that the Green Bank user community was not represented on the panel that undertook the portfolio review of facilities that recommended divestiture. A faculty member from the University of Pennsylvania called this review flawed at the hearing on November 9 in Green Bank. These realities raise the question as to whether or not a decision on the future of the Green Bank Observatory will be based, in part, upon a portfolio review that some members of the Astronomy community view as flawed. I do not question the scientific value of ALMA, but believe that the Green Bank Observatory also offers important scientific value, as well as training the next generation of U.S. scientists and providing jobs locally.	Against Closure	Email - Scanned	11/18/2016	

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379	b	Fred	King	Vice President of Research West Virginia University	<p>I want to put in context the interest that West Virginia University has in the future of the Green Bank Observatory. Our University has made significant investments in our astrophysics program since the commissioning of the new telescope in 2001. Chief among these was our investment in people.</p> <p>When the telescope was commissioned, we essentially had one astrophysicist working in our Physics Department and occasionally collaborating with the folks in Green Bank. At the time of the commissioning we saw a tremendous opportunity to achieve synergy between the University and the Green Bank Observatory to enhance research and educational opportunities for students in the region and beyond (at the time we simply did not foresee that such a new facility would be up for divestiture within the next 15 years). Working with NRAO leadership at that time, we jointly pursued a strategy to realize this opportunity (clearly NRAO also did not see this divestiture coming either).</p> <p>The initiative started with an advertisement in Science to recruit faculty to the University in the area of astrophysics who could collaborate with researchers at Green Bank. I remember the issue of Science that contained the advertisement as it focused on Einstein and his development of the theory of relativity. The issue also contained an article by Duncan Lorimer on double pulsar systems. Little did I know that Duncan would be an applicant for the position that we advertised in that journal. In fact, Duncan and his wife, Maura McLaughlin, also an astronomer, ended up as finalists for the position. We decided to hire them as a team and begin growing our program with their leadership. Since that time they have started their family here and are active members of the local communities both in Morgantown and Green Bank, engaged not only as faculty and scientists, but as parents and citizens.</p> <p>Following their recruitment we continued to grow the program, using State and University resources. We have added DJ Pisano, Loren Anderson, and Sean McWilliams to our Physics and Astronomy faculty, as well as Zack Etienne in our Math Department. We have also engaged faculty in signal processing in our Department of Computer Science and Electrical Engineering. All of this done to grow a research focus area at our University tied closely to the Green Bank facility. These efforts culminated in the creation of the West Virginia University Center for Astrophysics and the renaming of the Department of Physics as the Department of Physics and Astronomy.</p>	Against Closure	Email - Scanned	11/18/2016	
379	c	Fred	King	Vice President of Research West Virginia University	<p>Of course as you grow faculty you also grow student impact. Over the last decade, 6000 undergraduate students have taken the intro Astronomy course as an elective. For some of those it opened a new career path in STEM that they had not previously considered. In no small part, this was because they could easily travel to the Green Bank site and experience the thrill of scientific discovery there. The number of students graduating with undergraduate degrees in Physics has tripled during this time and the diversity of students pursuing a physics degree has doubled. Ten students have completed Ph.D.'s in this program and 9 are currently in the pipeline. These graduates have gone on to hold faculty positions at Universities, to serve as staff at observatories, or to translate their skills in signal detection and processing into positions in industry. The Green Bank Observatory has significantly impacted education in STEM at West Virginia University.</p> <p>Perhaps one of the most significant broader impacts that I am aware of is how the Pulsar Search Collaboratory, a joint West Virginia University-Green Bank Observatory initiative, has engaged K-12 students and their teachers. If you have not already done so, I recommend that you view the documentary, Little Green Men, available on the web - http://www.lgmfilm.com/. It provides a great overview of the Pulsar Search Collaboratory's effort to engage students and their teachers in the quest to discover new pulsars. It is a fabulous example of hands on science. More significantly, you hear from the students how it has profoundly impacted their lives. Many of them, particularly those from more rural areas and potential first generation students, have come to see that they can be a part of the scientific enterprise. Some have discovered new pulsars, but that is less important than the confidence and skills that they all are developing as participants and future members of the Nation's STEM workforce.</p> <p>It is also clear that those who spend time at the Observatory are inspired with a sense of awe at the phenomenal engineering accomplishment that is the Green Bank Telescope. To date, more than 2000 students have participated in the program. In terms of diversity, roughly 50% of these students come from underrepresented groups. From a workforce development perspective, 99% are either in college or plan to attend. Of those, 68% now plan to pursue post-secondary education in STEM or STEM related area. To date we have had roughly 20 students attend West Virginia University and 8 major in Physics and Astronomy.</p>	Against Closure	Email - Scanned	11/18/2016	
379	d	Fred	King	Vice President of Research West Virginia University	<p>The Green Bank Telescope is certainly a point of pride for the State of West Virginia. It profoundly impacts our efforts to grow technology and a STEM workforce across the state and Appalachian region. The educational outreach provided both within West Virginia and regionally continues to change lives for students who come from rural and underserved areas.</p> <p>Recognized as a National Landmark where the first parabolic radio telescope built by Grote Reber, its scientific import compares to that of other National Landmarks such as Oak Ridge and Los Alamos National Laboratories. It is worth remembering that Green Bank, West Virginia, has been the home of radio astronomy in the United States since the National Radio Astronomy Observatory was founded there in 1956. Since that time, the Green Bank Observatory has been the site of some of the most significant scientific discoveries in Astrophysics. The Observatory is an important historical landmark for the U.S. scientific community.</p> <p>I think that we would all agree to the tremendous scientific research and educational impact of the Green Bank Telescope and the historical contributions to astrophysics that have emanated from this facility since its founding. What may be less obvious are some of the other broader impacts of the facility.</p>	Against Closure	Email - Scanned	11/18/2016	

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379	e	Fred	King	Vice President of Research West Virginia University	<p>Locally, there is a significant economic impact. High-wage, high-skill jobs are few and far between in Pocahontas County. The Green Bank Observatory is the third largest employer in the county and a significant contributor to the local income tax base. With over 100 full time employees and 40 additional summer employees, the Green Bank Observatory accounts for roughly 5% of the workforce in Pocahontas County, West Virginia and a majority of the higher wage jobs. Estimates put the combined impact on the local and state economy at nearly \$30M per year. Equally important is the social impact of the staff of Green Bank on their local community. At the hearing on November 9, we heard from numerous citizens, not employed at the Observatory, about this impact. Whether serving in the local PTA or on the local ambulance crew, it is clear that the Observatory employees shape their community and make it a great place for all to live. This quality of life would simply not exist absent the Observatory and its employees. Green Bank would end up as so many rural communities have once the local anchor of the society and economy is lost.</p> <p>Born in a small town in the coalfields of southwest Virginia, I appreciate the inspiration that a facility such as the Green Bank Observatory can provide to young people. I also understand the economic devastation that can occur when a key driver of the local economy is lost. I cannot emphasize enough, how important it is to have such a powerful symbol of scientific and engineering achievement as the Green Bank Observatory located in a rural region where many lack much in the way of opportunity. I fully appreciate the scientific value of the ALMA site in Chile, however, it does not offer hands-on science training opportunities that the GBO currently offers our budding U.S. science students. At a time when the U.S. is lagging way behind other countries in federal research and development investments, NSF's offshoring research, educational outreach, as well as jobs, is of concern I believe the Green Bank employees understand that their jobs are in jeopardy while ALMA is creating great job opportunities in Chile.</p> <p>As West Virginia and the surrounding region work to diversify the economy and grow in the technology sector, the loss of the observatory as a symbol of the power and impact of STEM in our region of the United States would be tremendous. But the real loss would be to future generations of American citizens in this region who may not have the same opportunities and inspiration that the presence of the Green Bank Observatory, the contributions of its staff, and its outreach programs have provided for nearly 60 years.</p>	Against Closure	Email - Scanned	11/18/2016	
380		Vance	High		My experience as a NSF Fellow at Greenbank was the most influential of my life. I went 'into' teaching full bore to get my students to evaluate decisions with objectivity. Now the earth's population needs objectivity more than ever with issues like global warming, an extinction event. Please continue funding for the GBT.	Against Closure	Email - Scanned	11/19/2016	
381		Mary Alice	Milnes		Please don't close the Greenbank Observatory. It serves us well with it's unique capabilities.	Against Closure	Email - Scanned	11/19/2016	
382		Marilynn	Cuonzo		<p>Green Bank has been home to an observatory that for 60 years has explored the outer reaches of our universe. Eliminating the observatory would hurt the local economy, but far worse the dismantling of such a facility will have light years of ramifications that would extend far beyond West Virginia.</p> <p>You are well aware that the observatory is still heavily used by astronomy facilities. Green Bank's equipment remains capable of adding much to our knowledge of the unknown outer space.</p> <p>Shutting down Green Bank observatory would only amount to closing a window on our universe.</p> <p>Please consider the consequences of such a closing or a decrease funding to our country and the entire world.</p>	Against Closure	Email - Scanned	11/19/2016	
383		Kazuhiro	Hada	National Astronomical Observatory of Japan (NAOJ), Mizusawa VIBI Observatory	<p>As an active user of the Green Bank Telescope (GBT), here I would like to describe the impact of the possible GBT shutdown or reduction of available time on studies of active galactic nuclei (AGN) and high-energy astrophysics.</p> <p>The GBT has played a major role in understanding the physics of black holes, AGN, relativistic jets and the associated high-energy Universe. In particular, very-long-baseline-Interferometry (VIBI) observations in concert with the GBT can image the innermost regions of relativistic jets near the central supermassive black holes at an unprecedented angular resolution and sensitivity. Indeed, our research group has recently performed a joint VIBA+GBT observation of a nearby active galaxy M87, and for the first time resolved and imaged the base of a black-hole jet at a scale just 10 times that of the black holes's event horizon (Hada, K., et al., The Astrophysical Journal, 817, 131, (2016)). This has allowed us to provide some important insights into how an active black hole produces powerful outflows of material despite the existence of the strong gravity, a longstanding mystery in black-hole/high-energy astrophysics. Without the help of the superb GBT sensitivity, our study was impossible to achieve. It should be emphasized that this study with the GBT has just opened a new window on studies of black- hole/AGN accretion and ejection. To better understand the kinematics, acceleration and magnetic-field structures of the relativistic jets, it is indispensable to continuously monitor these objects with VIBI plus GBT. In this respect, the shut down or the reduction of our GBT time will have dramatic impact on the future progress of this kind of study and the wide-reaching astrophysical research community in a broader context.</p> <p>Therefore, I strongly hope that the NSF will continue to support the GBT.</p> <p>References: Hada, K., et al., "High-sensitivity 86GHz (3.5mm) VIBI observations of M87: Deep imaging of the jet base at a resolution of 10 Schwarzschild radii", The Astrophysical Journal, 817, 131, (2016) See also https://public.nrao.edu/news/tip-sheets/2016-feb-tip-sheet</p>	Against Closure	Email - Scanned	11/19/2016	

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384		Harvey	Liszt		<p>This is not an objective or dispassionate opinion. My credentials notwithstanding, the opinion expressed here is my own.</p> <p>As a scientist, tenured NRAO staff member, Green Bank observer, former Project Scientist for the Robert C. Byrd Green Bank Telescope and technical advisor to the legal team that successfully defended in a \$30,000,000+ arbitration arising from the construction of the telescope over three+ years 1997 - 2000, I am disgusted that the National Science Foundation would contemplate options for the future of the Green Bank Observatory and Green Bank Telescope that did not maintain, indeed enhance, their use as basic research facilities.</p> <p>My actual opinion of the last option, deconstruction, is unprintable but I would be happy to provide and indeed elaborate upon it, on request.</p> <p>The Green Bank Telescope is an iconic scientific instrument of unparalleled scientific productivity that is the envy of the world. The success of Green Bank Observatory observations, over more than 50 years, is a testament to the dedication of several generations of NRAO and GB staff who have made substantial personal sacrifices to live and work in a remote area that is specially dedicated, through the National Radio Quiet Zone and West Virginial Radio Astronomy Zoning Act, to protection of the radio astronomy operations they enable.</p> <p>The NSF's act of disinvestment of Arecibo Observatory, Green Bank Observatory and the long Baseline Observatory that has resulted in the current EIS process is a testament to a feckless and disruptive stewardship of American radio astronomy, an abrogation of responsibility and a vast squandered opportunity.</p>	Against Closure	Email - Scanned	11/19/2016	
385		Edward	Montiel	Postdoctoral Scholar, Department of Physics, UC--Davis/NASA Ames Research Center	<p>I am writing to you urging that the option of "continued NSF investment for science-focused operations (No-Action Alternative)" be taken in regards to the Green Bank Observatory (GBO) & the AST portfolio. I support the findings and conclusions laid out in the two white papers made recently available: https://arxiv.org/abs/1610.02329 & https://arxiv.org/abs/1610.09014.</p> <p>I was able to observe with the GBO during my final year of graduate school at Louisiana State University to begin follow-up on one of the components of my dissertation. The GBO was the only facility in the world that has the necessary angular resolution, sensitivity, and most importantly at which I could apply for time.</p> <p>I was fortunate to visit the Green Bank site twice in 2016. First, to attend an observing school in January hosted by the observatory. While there I learned the background of radio observing, how to observe with the GBT specifically, and met other students who were members of projects scheduled for observations. The majority where from West Virginia University, which has its own special relationship with the GBO. While I was at the end of my graduate school career, I cannot imagine the effect on the number of undergraduates and graduates research development an NSF divestiture would have.</p> <p>My second visit was in late March/early April to perform the bulk of my observing and to give a lunch talk on my dissertation topic. While there I got to see first hand how efficiently and dedicatedly the GBO is run by both the science and support staff. The dynamic scheduling employed by the GBO is unique among ground-based facilities and ensures that every possible second is spent towards the advancement of our scientific knowledge.</p> <p>Again, I would like to reiterate my support for the NSF AST to take "No-Action" in regards to the GBO. The facility remains a critical asset for US astronomy and to the thousands of early-career scientists like myself.</p>	Against Closure	Email - Scanned	11/19/2016	

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386		Timothy	Robshaw	Dominion Radio Astrophysical Observatory	I am writing to strongly state my opinion that the NSF should choose alternative #1 of its "Notice of Intent to Prepare an EIS", namely "Continued NSF investment for science-focused operations (No-Action Alternative)." I was trained over many years as a graduate student at the Green Bank Observatory. While many of my peers were conducting radioastronomical research that never required them to leave their desk, the Green Bank staff actively engaged me in the commissioning of the telescope and allowed me to develop a hands-on knowledge of all working aspects of a radio telescope. This knowledge has allowed me to travel to observatories around the world in order to pursue difficult measurements that require a detailed understanding of the instrumental response of a large single-dish telescope. Ultimately, the training I received at the Green Bank Observatory is directly responsible for my being hired as a permanent staff member at the Dominion Radio Astrophysical Observatory, operated by the National Research Council of Canada. To make a succinct case for the Green Bank Telescope's---and hence, Green Bank Observatory's---continued support, I'd like to describe why it is so unique. A telescope's collecting area dictates its ability to see faint light from the distant reaches of the universe. The 100-meter Green Bank Telescope possesses the largest fully-steerable collecting area in the world, but more importantly, it was designed with an aperture that is completely unblocked. That is, radio waves that are reflected from the large 100-m surface end up being collected and amplified by a factor of billions without having to encounter any metal supporting structures that would add impurities to the cosmic signal. This is a novel design---all other large single-dish telescopes have their signals contaminated because of their standard designs making very sensitive measurements of weak cosmic signals prone to instrumental errors. There are experiments that can only be reliably conducted using such a telescope and I will describe a couple of them below. By choosing to shutter the Green Bank Observatory, the NSF would make an active decision to black out a substantial window to the universe. I would first like to address claims that have been made in our community that the 100-m Effelsberg telescope in Germany could provide similar capabilities to the GBT. This is a completely misguided and false statement for the following four fundamental reasons: (1) its aperture is significantly blocked; (2) the Effelsberg telescope is situated in a deep valley and therefore has a limited sky coverage compared with the GBT; (3) the frequency spectrum in central Europe is highly contaminated by interference that blocks out entire windows to the universe; (4) the receivers at the secondary focus of the Effelsberg telescope are situated off of the symmetry axis of the telescope and suffer a considerable instrumental response when compared with the clean optical design of the GBT. To draw attention to a particular topic that can only be studied at the Green Bank Observatory, I will briefly describe a physical phenomenon called the Zeeman effect. Hydrogen is the most abundant element in the universe---the space between the stars in our Milky Way galaxy is filled with atoms of hydrogen. These atoms emit radio waves at 1420 MHz on the radio dial and the study of these radio waves allows us to map the structure of the Milky Way. When one of these interstellar hydrogen atoms emits a 1420 MHz radio wave while in the presence of a magnetic field, a fingerprint is stamped on the radio wave which imprints both the strength and direction of the magnetic field at the location where the radio wave originated. This fingerprint can be detected here on Earth by using only the largest unblocked antennas. There is only one single option for reliably mapping the magnetic field throughout our Milky Way at high spatial resolution in this fashion: the Green Bank Telescope.... I am beginning a large-scale, low-resolution survey of the Zeeman effect in Galactic hydrogen using a small 26-m telescope in Canada. Our ultimate goal would be to provide the Green Bank Observatory with a world-class receiver and waveguide feed to be installed on the GBT in order to follow up features of interest at high spatial resolution, allowing us to answer fundamental questions about how magnetic fields shape the dynamics and structure of our galaxy...The study of cosmic magnetism in our Milky Way and the broader universe would be directly affected by a decision to close the Green Bank Observatory. I will allow my colleagues to provide more examples of the unique observational astrophysical endeavors that are in peril by the NSF's potential decision.	Against Closure	Email - Scanned	11/18/2016	
387		Billy Joe	Peyton	Professor of History WV State University Institute, WV	Please consider continued funding for the Green Bank Observatory in West Virginia. It is an important research center for world-class scientists, teachers, and students, as well as one of the most historic radio astronomy facilities in the world. Moreover, the Robert C. Byrd telescope remains a viable, relevant and modern instrument in the 21st century. In conclusion, please consider continued funding for the Green Bank Observatory, an important center for scientific endeavor. WV needs it, and the scientific community needs it.	Against Closure	Email - Scanned	11/18/2016	
388		Brian	Mason	Scientist, NRAO	I am writing this letter in response to the public comment period for the planned environmental impact statement and proposed changes to Green Bank Observatory operations. I am a radio astronomer; a long-time user of NRAO facilities (since my thesis work at the University of Pennsylvania); and an employee of NRAO since 2002. For the first decade of my employment with NRAO I worked primarily with short-wavelength instrument development programs on the GBT. I have since shifted my main focus to AIMA and at present manage a team of scientists who support AIMA software development, though I continue to support new millimeter cameras on the GBT with a modest fraction of my time. I also have a strong research interest in GBT millimeter wave capabilities. The GBT is a unique, relatively new, and highly valuable asset to the world-wide scientific community and an essential component of the (remaining) US Radio/Millimeter/Submillimeter research infrastructure. I therefore **strongly support the "No-Action" alternative of continued NSF investment for science-focused operations** , including operation at the highest frequencies and with "Open Skies" access for world-wide scientific researchers. The range of exciting science that the astronomical community has recently done and plans to do in the coming decade is summarized in two recent preprints (on which I am a co-author) at https://arxiv.org/abs/1610.09014 and https://arxiv.org/abs/1610.00239 . These range from mapping the dynamic context of star formation in nearby molecular clouds; to astro-chemistry; to fundamental physics with precise pulsar timing measurements; to high-resolution imaging of colliding clusters of galaxies in the early universe. Key strategic assets the GBT offers include: *An amazingly precise (250 micron RMS), 100-meter diameter reflector. *An unblocked aperture that greatly improves image quality and reduces the amount of unwanted, interfering radiation scattering into the data. *A suite of receivers covering a factor >300 in frequency (300 MHz to 115 GHz). *One of the radio-quietest operating environments within the continental United States. *A highly flexible, cutting edge platform for instrument development and validation. *One of the few remaining radio or millimeter wave telescopes where the next generation of students can "get their hands dirty" building and using new instrumentation. *Two new millimeter wave cameras funded by the NSF (ARGUS and MUSTANG-2), which have been built and are beginning to be used for science. *Excellent complementarity to current and near-future radio and millimeter facilities (AIMA, Jansky VIA, and Next-Generation VIA): the frequency coverage and high surface brightness sensitivity of the GBT makes it the perfect telescope to fill in the big picture that will be missed by these super-high resolution interferometers. *A vital and very successful Education & Public Outreach program associated with the site and telescope. In conclusion, I urge you to maintain the US position of leadership in radio and millimeter astronomy by continuing to operate and develop further our existing, cutting-edge facilities, in particular the Green Bank Telescope.	Against Closure	Email - Scanned	11/18/2016	

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Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
389	a	Lauranne	Lanz	Postdoctoral Scholar Dartmouth College	<p>I am writing to express my strong support for the continued NSF investment for science-focused operations of the Green Bank Observatory. In addition to the unique properties that enable the Green Bank Telescope to make crucial contributions to our understanding of the universe, the observatory has important broader impacts both locally and at universities across the world. These will all be greatly affected negatively without continued NSF support of science-focused operations.</p> <p>During my first postdoc at the California Institute of Technology and continuing into my current postdoc at Dartmouth College, the Green Bank Telescope (GBT) has played an important role in developing my scientific skills as well as the questions I am investigating regarding the evolution of galaxies with a specific focus on the relation of the activity of the central supermassive black hole and formation of new stars in their host galaxies. The gas contents of galaxies provide crucial insights into these processes and measuring them requires both high frequency observations to probe the molecular gas and low frequency observations to measure neutral gas, capacities that are now available and in development at the GBT.</p> <p>One of the first proposals that I had accepted is to search for neutral gas in distant ($z > 0.1$), massive spiral galaxies whose existence is a challenge to our current paradigm of galaxy formation and evolution. Our current understanding posits that mergers between large galaxies, needed to grow the most massive galaxies, disrupt the spiral structure of galaxies and yield large elliptical galaxies. Simulations of such interactions suggest that only very gas rich galaxies could reform disks, so our measurement of the gas contents of these massive spiral galaxies are necessary to test this hypothesis and show us where the limits of our understanding currently lie.</p> <p>These observations are only possible because of the unique characteristics of the GBT. First, due to their distance, the neutral gas signature of these galaxies is very faint. We therefore require the sensitivity that only a large, filled- aperture telescope can provide. These observations are also critical for determining whether more expensive facilities such as AIMA or ngVIA can provide observations with higher spatial resolution for different science goals in a reasonable timeframe and to provide short-spacing data necessary to ensure interferometric observations do not resolve out significant fractions of the gas content....Third, the steerability of GBT enables much larger coverage of the sky. As part of my research, I work with two samples of galaxies, Superluminous Spiral Galaxies (93 galaxies) and Shocked Poststarburst Galaxies (1067 galaxies), whose gas contents will provide important insights into their formation and evolution. Due to its steerability, GBT is able to observe these samples drawn from the Sloan Digital Sky Survey (SDSS) in their entirety. In contrast, stationary dish telescopes such as Arecibo and China's FAST are limited to observations within 20 degrees of zenith and therefore can observe much lower fractions of such samples (50-70%).</p>	Against Closure	Email - Scanned	11/18/2016	
389	b	Lauranne	Lanz	Postdoctoral Scholar Dartmouth College	<p>The GBT has also played an important role in expanding my scientific skills into radio wavelengths. I attended the 2015 NAIC/NRAO Single Dish School as well as the 2016 GBT Remote Observing Training School. These schools provide a very good complementary education first in the understanding of radio astronomy and its techniques and second in the practical aspects of observing with the GBT. They fully prepared me to observe with confidence my approved proposal remotely this fall. Additionally, these schools had participants from a large range of professional levels, from students to senior astronomers, indicating that, in an era where multi-wavelength synergy is critical for deep exploration of astrophysical questions, this kind of school (and therefore this observatory) has an impact on a large range of the community.</p> <p>In addition to its value as a scientific resource, the GBT is also having a broader impact on my career trajectory as an early-career astronomer by enabling me to recruit and advise students, primarily for two reasons. First, one of the draws of astronomy is observing with telescopes. I personally chose astronomy over particle physics when applying to graduate school in part due to a summer spent at the Kitt Peak National Observatory where I got to spend time observing with four different telescopes. Complex observatories like AIMA and JVIA simply provide astronomers with data files of their observations. While likely safer for those telescopes, it removes some of the magic of being an astronomer that is retained by user-controlled telescopes like the GBT even if done remotely. This also reduces the opportunities of students to learn how to problem-solve on the fly either when things go awry during an observation or when determining the necessity of changing targets based on observing conditions. Second, interferometric observations have a much steeper learning curve at the start due to the relative complexity of the observations and the data reduction involved. In contrast, single dish, spectral line observations (such as those taken in my approved project) are generally simpler in both the theoretical understanding and practical analysis. Starting in January, I will be advising a freshman undergraduate in using such observations to measure the neutral gas contents of galaxies.</p> <p>At this point in my career, I have not yet obtained a permanent position. One type of institution to which I am applying are primarily undergraduate institutions that seek to engage their students in research. Maintaining high- level research at such institutions is in part dependent on the availability of open-skies time at observatories such as the GBT. Without NSF support of science operations at the Green Bank Observatory, my research possibilities, especially at radio wavelengths, should I find a position at such an institution, would be greatly constrained. As a graduate student at Harvard University and an undergraduate at the University of Maryland, my experience was greatly enriched, scientifically, academically, and personally, by their observing resources. Open-skies access to telescopes like the GBT plays an important role in leveling the playing field for students at institutions with fewer resources.</p>	Against Closure	Email - Scanned	11/18/2016	
389	c	Lauranne	Lanz	Postdoctoral Scholar Dartmouth College	<p>Second, the unique placement of the GBT in the National Radio Quiet Zone is critical for observations of redshifted neutral hydrogen emission. Although the specific galaxies observable are constrained in part by the interference environment, such interference would be significantly worsened without the radio quiet zone, making these observations impossible. In the current period of expanding use of the wavelength coverage for non-scientific purposes, a radio quiet zone would be very difficult to re-establish, should it disappear with the scientific operation of the GBT.</p>	Against Closure	Email - Scanned	11/18/2016	

Green Bank Observatory -Written NSF Public Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
389	d	Lauranne	Lanz	Postdoctoral Scholar Dartmouth College	<p>The important contributions of the GBT to its local community is well illustrated by events that took place during my two visits during the 2015 and 2016 schools. During summer 2015, the New Horizons probe arrived at Pluto. GBT held a public outreach event attended by people who drove several hours to come, showing the important draw of the GBT as a means of informing and exciting the public about space. I also saw a local class of school children on tour of the observatory, indicating its use as a teaching tool for local teachers.</p> <p>Second, as part of the schools, we visited the machine shop on site at the observatory. It was fascinating to see the inventiveness and care of the machinists. I asked our guide about his training and he described the apprenticeship he had as a young man, the relative difficulty today to find people with the technical background necessary for such positions, and his concerns that these skills may be lost without a new generation. The Green Bank Observatory is actively engaged in seeking to form alliances with local technical schools and community colleges to create such non-academia-focused training programs. Given the current level of unemployment in West Virginia and the similarities to professions that formed an important part of the state economy such as the coal industry, this kind of outreach to the local community has the potential for an important and broad impact.</p> <p>I hope the paragraphs above demonstrate my strong sense that the GBT's properties of a large, steerable, filled aperture in a radio quiet zone provide a unique resource for astrophysics that should continue to be supported by the NSF with funding for science-focused operations (the first EIS option) to provide access to the US community regardless of the size and resources of their institution, as well as its important broader impact both through outreach and through training across a broad range of capabilities and skill sets.</p>	Against Closure	Email - Scanned	11/18/2016	
390	a	Joshua	White		<p>I am writing in response to the Notice of Intent to Prepare an Environmental Impact Statement for the Green Bank Observatory available in the Federal Register on October 19, 2016.</p> <p>I want to document my enthusiastic support for the sustained functioning and full funding of the Green Bank Observatory as a science and learning focused operation in Green Bank, West Virginia. Our family is a very common one. We enjoy spending time together- hiking, visiting exciting places, watching science-fiction movies, swimming and relaxing by a winter fire. I think I speak for a lot of families when I say that we were floored when we discovered the multitudinous opportunities at the Green Bank Observatory.</p> <p>My parents discovered this place in the 90s, shortly after they had married. They, as a lot of people, discovered this place by chance. When they stumbled upon it, however, the science center had not yet been built and so they enjoyed the walking path along the telescopes and the trees. It was beautiful then, even when they knew very little about it. About 10 or so years later, my older sister and I got to visit the observatory, now with an even more blossoming future than before, newly equipped with a science center, gift shop, and public tours.</p> <p>My sister and I were both smiling kids who were eager to learn more by the time we had exited the museum, and we as a family took a walk around the biggest fully maneuverable telescope of any kind in the world.</p> <p>This story of discovery and enchantment about the Green Bank Observatory is quite universal, as I have observed.</p> <p>My 16 year old sister grew up mostly with a book or paintbrush in her hands. She's always enjoyed art, and has been a creator of such her whole life. I have grown up my 14 years with either a Gameboy or computer mouse in my hands ninety percent of the time. I've always enjoyed computers and animation, and have attempted to make such things my entire life. As we've gotten older, we have improved our work. My sister is a beautiful painter and seamstress. My computer skills have (arguably) gotten better and I have been dabbling in new ways of animation.</p> <p>One of the magical things about Green Bank is that it has a place for virtually any ability. My sister, as a seamstress, is now creating and selling dolls to raise funds for the GBO, and has found an intense passion for science and astronomy. I entered a GBO video contest and won first prize for my animation, and received contact information for potential future work as an animator. I hope to provide, at some point, educational animations to the observatory and others. These are opportunities that I have never seen before in any organization, and are experiences neither of us will forget.</p>	Against Closure	Email - Scanned	11/18/2016	
390	b	Joshua	White		<p>Also, in addition to these amazing things, we've been so privileged to be able to participate in the Radio Astronomer for the Day program, which has made us both very interested in the field of radio astronomy. There was something just so neat about seeing this big box of wires and switches turn the faintest of signals into hard-copy data! That moment of truth when you calibrated the telescope just right and see the printer produce the magic of radio waves onto the chart was a sensation that every aspiring scientist should feel in their start as an astronomer. There have also been many other opportunities for us at the GBO. The "Skynet Junior Scholars" program, along with an RFI project that my sister, in cooperation with an Oregon Tech student, worked on with the mentoring of Dr. Richard Prestage, have provided us with invaluable education as high-school students.</p>	Against Closure	Email - Scanned	11/18/2016	
390	c	Joshua	White		<p>This facility has multiple parts- educational value, top-of-the-line scientific equipment and research, creation of jobs and support for the West Virginia economy- which work together like gears in a watch, bits of circuitry in a computer, and peanut butter on bread; you take one away, and the entire structure is bound to stop functioning. Such a loss to West Virginia, which is suffering from a declining coal industry, would break the hearts of our family in addition to all the others who have been touched by this facility, not to mention the workers and scientists who would be out of jobs. The people of West Virginia need something to be proud of, and this facility will deliver such pride for years to come. I hope that I'll be able to pass this wonder on to the next generation in the same way my parents did for me and my sister.</p>	Against Closure	Email - Scanned	11/18/2016	

Green Bank Observatory -Written NSF Public Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
391		Helen	Kirk	Research Associate Herzberg Astronomy & Astrophysics Program	I am writing to you in response to the request for comments about the NSF's future plans for the GBO. I am presently a Research Associate with Herzberg Astrophysics at the National Research Council of Canada; the thoughts I express here are my own and not reflective of a policy position by the NRC. I have the privilege of being involved in two large programs using the GBT: the Green Bank Ammonia Survey (GAS) which only recently finished obtaining data, and the ongoing KEYSTONE survey. These two surveys, in addition to others I am not involved with, highlight the power of the GBT to make a significant impact on the field of star formation with the current instrumentation suite on the GBT. Indeed, many years of continued operations would be needed to fully take advantage of the present suite of instrumentation. Both GAS and KEYSTONE use the KFPA on the GBT to map the presence of NH ₃ (ammonia) emission within star-forming molecular clouds in our galaxy. NH ₃ emission is one of the most powerful probes of cold, dense, star-forming gas that we have available; for a combination of chemical and physical reasons, it uniquely allows the measurement of both the temperature and density of the emitting gas, for the coldest and densest condensations where star formation is actually occurring. What we have been learning in the past decade, in part thanks to observations from Herschel, is that larger-scale observations (i.e., mapping full molecular clouds to a reasonable resolution) provides essential information to understanding the context in which stars form. The current instrumentation suite on GBT provides access to this large-scale molecular cloud context (particularly gas kinematics and temperatures), in a way that no other facility in existence is presently able to do. One key question that can be answered with large-scale kinematic data include the role of filaments in supplying mass to both individual and clusters of stars (which is suggested but untested from Herschel continuum data), and there is a long list of other important topics. Surveys like GAS and KEYSTONE are just beginning to scratch the surface of what can be done with the KFPA. Even more importantly, the new ARGUS detector, which allows for higher spatial resolution spectral mapping of N ₂ H ⁺ and HCO ⁺ , has only just been commissioned. HCO ⁺ is a key tracer of infall motions, another key component to understanding filamentary accretion, and there has been very little opportunity to exploit this significant capability of the GBT. The current capabilities of GBT are essential for making progress on understanding how stars form. These capabilities will not be available elsewhere to (North) American astronomers if the GBT were to close: the areal coverage of these observations are not feasible to complete with interferometers, even an array as sensitive as AIMA. It's also important to note that this large-scale context is a key component of interpreting (and knowing where it is important to obtain) higher-resolution observations such as those with the JVIA and AIMA. Loss of access to quality single-dish facilities will impact the ability of American astronomers to do the best science that they can from AIMA and the JVIA. (In Canada, we have been having a similar concern as our involvement in the JCMT diminishes.) The recent papers by lockman et al. and Bally et al. also make it clear that for a very modest investment in tested technologies, new instrumentation and facility improvements could easily be implemented to provide truly revolutionary advances in the already impressive capabilities of the GBT. In my view, it would be extremely unfortunate and short-sighted to diminish or halt entirely the ability of American astronomers to pursue unique, world-class science with state-of-the-art instrumentation only recently made available on the GBT, which would at the same time also undermine astronomers ability to fully exploit the exquisite interferometric data coming in from AIMA and the JVIA. I therefore strongly urge the NSF to consider maintaining their current level of support of the GBT, so that radio astronomers in the USA have the tools available to maintain their research excellence on the world stage.	Against Closure	Email - Scanned	11/18/2016	
392		Adri	Persad		I worked as the Education and Public Outreach Intern at the Green Bank Telescope for ten weeks last summer. It was a great experience for me to be immersed in the events at the facilities while I was there, and I was able to learn a lot about the many discoveries that happened during the last few decades the observatory has been operating. Pulsars were discovered, the hydrogen of the universe was mapped, and the lunar surface was imaged. These discoveries, among others, have been huge contributions to the scientific community, and it would be an unnecessary mistake to eliminate the potential for more groundbreaking discoveries. Moreover, as a member of the Science Public Outreach Team (SPOT) of West Virginia, which is heavily tied with the GBO, the telescopes at Green Bank are something we can point to as a prime example that living in West Virginia doesn't rule out the opportunity for scientific advancement. I've lived my whole life in West Virginia, and it's not a state that seems to offer many opportunities. Being able to show that there is a world-class scientific research facility in West Virginia is huge, and the message it sends is powerful. It would be a terrible thing to be asked by a student what the telescope was doing currently as a presentation was being given, and to have to reply that the facilities had been shut down for lack of funding or destroyed entirely, despite the past successes and promises held by the future research of the telescope. On top of that, during the course of my internship, I was involved in many of the outreach efforts made by the GBO. At the beginning and middle of my time there, I was able to give lessons on the use of the 40 foot telescope to many different groups, and every one of them was amazed by the science that was able to be performed by both the researchers there and themselves. The visitor's center had people coming in and out of it every day, with guests diverse as to be so young and so old they could barely walk, and participating enthusiastically in the tours and the multitude of exhibits. Later on, there was an impressively well-run summer camp for scientifically-minded groups underrepresented in the community that I had the privilege to be a part of. It was an incredibly rewarding experience for both myself and the 20 children, some of whom came from a rough background where quality scientific education can be hard to come by. Many of the children told me that they hadn't really known about or cared about radio astronomy before they arrived there, but that after their two weeks there they had developed a major appreciation and possible career interest in it. In short, the Green Bank Observatory is a place where advanced science can be performed, and there's no other facility like it on Earth. The public outreach performed there is unlike that done anywhere else, and serves invaluable in educating the public about the otherwise arcane science carried out in the state and around the world. Removing that sort of a facility from the map would be a huge mistake.	Against Closure	Email - Scanned	11/18/2016	SPOT letter.docx

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Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
393		Nipuni	Palliyaguru		<p>I am writing to you to let you know about my experience working with the Green Bank observatory. I received my PhD from West Virginia University in 2015 where I worked in the field of pulsars. located only about three hours away from West Virginia University, my fellow graduate students and I have made numerous visits to the site to get telescope training, to attend summer schools, to take data or simply to just stay at the site and work on research problems. Being at the telescope, and understanding the engineering marvel were definitely highlights of my grad school years. The basics I learned about radio astronomy and observations at the single dish and interferometric summer schools held at GBO have become very useful in the research I am currently engaged in, which is the follow-up of LIGO gravitational wave sources with the VIA.</p> <p>I have used GBT data for multiple projects that utilize single-pulse studies of millisecond pulsars and rotating radio transients during my PhD. Single pulse tests may ultimately become important for gravitational wave detection with pulsars because the pulse-to-pulse jitter (which is a single-pulse phenomenon) plays an important role in the pulsar noise budget. I have worked on developing methods using single pulses that could potentially be used to overcome jitter noise. Furthermore they can shed light on pulsar emission mechanisms (to differentiate between millisecond and normal pulsar emission mechanisms). These single-pulse tests are possible because of the unprecedented sensitivity of the telescope and the large bandwidths made available for pulsar data taking.</p> <p>I fervently wish the GBO can be kept operational because there are lots of students like me who have gained so much from it. On a broader note, now that LIGO has detected gravitational waves from binary black holes, the detection of low-frequency gravitational waves with pulsars is imminent. Having the GBO around, will help with such large, ground-breaking discoveries that would change the future of science and how we view the universe.</p>	Against Closure	Email - Scanned	11/18/2016	
394		John	Saunders		<p>Don't close the NRAO, for the love of God...don't do it!! Senator Byrd is spinning in hi grave. This is THE single institution that's put WV on the world-wide map! Remember last year when that news crew came all the way from Germany?? Closing the observatory would be the most short sighted decision since banning ramps in the public school kitchens! NOOOOOOOO! Don't do it!</p>	Against Closure	Email - Scanned	11/18/2016	
395	a	Jacob	Sheets		<p>The Green Bank Radio Astronomy Observatory Site was opened in 1956 in the midst of the Cold War Space Race. While part of its reason for existing at all may have been coupled with the aim of beating the USSR into space, the Observatory also had the larger questions in mind. Was there life out there somewhere? What are other stars like? What might other celestial bodies and planets be made of? The results of these questions led to breakthroughs not only in our knowledge of the Universe, they sped our technological development in the fields of receivers, transmitters, and computers.</p> <p>My grandparents were a local family who were instrumental in the early days of the Observatory's success. My grandmother Beatrice was hired as the first secretary on-site, and my grandfather Jamie served as the local driver who shuttled scientists from across the globe to and from the various airports. Through them, my father was able to learn about cutting edge science, and meet astronomers from other countries who would have never given West Virginia or Green Bank any thought. This contact with the outside global community certainly contributed to my family's outlook on the world, as it also impacted the way Green Bank as an Appalachian town looked at itself. It was now an important center of research; it wasn't just a small logging town with no stop-lights and few prospects for growth. New families moved into the area, and locals could find a new place to work besides the family farms and the logging companies. The immediate economic and social advantages that the observatory brought to the community were and still are astounding.</p>	Against Closure	Email - Scanned	11/18/2016	
395	b	Jacob	Sheets		<p>Today, that impact remains essential not only to Green Bank, but to the state of West Virginia. In addition to the world-leading scientific work being done, the Observatory employs a large part of the workforce in the area. These are steady, secure jobs, that support families who have children in the local school system. When the Observatory hires new scientists they also bring their families, adding children to the school system, which directly impacts those employed by the school system. During the summer months, high school students are able to find jobs at the Observatory, vastly increasing their options from the few that are available.</p> <p>The tourism impact of the Observatory has also been significant more recently. Since the Science Center has opened, thousands of visitors now have a reason to stop in Green Bank instead of passing through to Cass Railroad or Snowshoe Mountain. The visitors who stop are amazed by the Observatory, and always learn something about the Universe. Perhaps more importantly, they learn about their misconceptions they may have had about West Virginia. I worked as a Tour Guide for a summer, and visitors are often surprised that an Observatory is located in the middle of the mountains. The social impact that this carries is enormous. It leaves a positive impression of West Virginia on visitors' minds, and to put a price on that is impossible, especially at a time when the State overall is trying to attract new business. The economic benefits of the tourism traffic are clear as well. Once visitors take the tours, they often ask about other activities including the local art co-operative, State Parks, and restaurants. Without the Observatory, Green Bank and Pocahontas County overall would be severely harmed. There would be fewer employment opportunities, reduced class sizes in the local schools, no reason for tourists to even think about stopping in the area and, most crucially, the notion that the United States is a leader in scientific research would be drastically diminished. As a concerned citizen who grew up near the Observatory, it must be funded.</p>	Against Closure	Email - Scanned	11/18/2016	

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Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
396	a	David	Frayner	Scientist, Green Bank Observatory Adjunct Professor of Physics & Astronomy, West Virginia University	<p>Thank you for soliciting public input associated with the NSF Environmental Impact Statement and Section 106 Consultation for Proposed Changes to the Green Bank Observatory Operations. I strongly encourage the NSF to choose option (1): Continued NSF investment for science-focused operations (No-Action Alternative). For the EIS sub-contractors hired by NSF, my letter makes two cases for the continued NSF support of the GBO: Section (1) STEM educational value, and (2) Astronomical Research from 20-115 GHz. I also discuss some of the budget issues in Section (3) which are outside the scope of the EIS, but I would appreciate these opinions being passed along to the appropriate parties within NSF. Thank you.</p> <p>(1) STEM Educational Value</p> <p>I have been a PhD astronomer for 20 years carrying out astronomical research primarily at radio, mm, sub-mm, and infrared wavelengths. In previous decades, there were many options within the US for obtaining hands-on research experience with public-access radio/mm facilities, including the CSO, FCRAO, NRAO-12m, NRAO-140ft, OVRO, BIMA, and CARMA. All of these facilities were once NSF supported, and none exist anymore. The only remaining US radio/mm facility with public access that permits hands-on observing is the GBT. Hands-on observing is key for training the next generation of scientists. The technical experience gained is crucial for supporting the success of future facilities.</p> <p>The NSF's new Strategic Plan, Investing in Science, Engineering, and Education for the Nation's Future: NSF Strategic Plan for 2014 - 2018 highlights the importance of STEM education. The GBO does an amazing job at STEM education and the training students ranging from middle-school to postdocs in astronomical research. I would challenge anybody to find an organization that does a better job with the hands-on astronomical research experience than the GBO. I have worked at many places, and the GBO is by far the best, hands down. The success of the GBO on this front is spectacular given it makes due with a shoe-string budget. I encourage the NSF to continue to support the STEM activities at the GBO.</p>	Against Closure	Email - Scanned	11/18/2016	
396	b	David	Frayner	Scientist, Green Bank Observatory Adjunct Professor of Physics & Astronomy, West Virginia University	<p>(2) Astronomical Research from 20-115 GHz</p> <p>As part of this process, it appears that the NSF does not want to consider the scientific merits of the GBT or discuss the issues associated with the 2012 Portfolio Review, but I need to put a few comments on the record even though I realize that these will likely be ignored by the NSF. Every astronomer I have talked to about this review has said that the process was deeply flawed, including members on the committee that carried out the review who shared their frustrations about the process with me and others off the record. The 2012 Review implied that the Bonn telescope could carry out the science being done by the GBT at high frequency (e.g., >20 GHz). Nobody with any knowledge on the subject would consider this claim credible, including our colleagues at Bonn who found this claim absurd and irrational. The 2012 Review also claimed that the VIA could be used in phased-array mode to replace many of the science programs currently being done with the GBT. Anybody with knowledge of the capabilities of the VIA and GBT would know that this is not practical (e.g., GBT Memo 294 from the NanoGrav group: https://library.nrao.edu/public/memos/gbt/GBT_294.pdf). When discussing the science being done by the VIBA, the 2012 Review highlighted the importance of the "HSA" (High Sensitivity Array, i.e., the GBT used with the VIBA.) The GBT is crucial for providing the necessary sensitivity for the HSA. In short, the GBT is unique and no current facility or any planned facility would be able to come close to matching its capabilities into the foreseeable future. As stated within the recent GBT High-Frequency community report:</p> <p>"No other observatory has the capabilities of the GBT, and none has open access for US investigators to the degree offered by the GBT. Adequately instrumented, the GBT would be a pillar for 20 -- 115 GHz science in the US and the world."</p> <p>Representatives from NSF-AST have basically stated to the astronomical community that the 2012 Review report represents all of the needed input from the scientific community (i.e., this box has been checked off for NSF bureaucrats). I urge the NSF-AST to reconsider and to take into consideration the advice from scientists all over the world. For the NSF to blindly accept the recommendations of the 2012 Review with the knowledge of its shortcomings is not responsible. I understand the review process is complex, but it is possible to carry this out in a fair way. In contrast to the flawed 2012 Review, the 2006 Senior Review was much more balanced and well-reasoned in their conclusions. Although some could argue about the merits of some of the recommendations within the 2006 report, most felt that the 2006 process was reasonable and fair. The same cannot be said for the 2012 Review. Nobody I have talked to outside of the NSF has defended the 2012 Review process. Everyone believes that it was a "flawed" process.</p>	Against Closure	Email - Scanned	11/18/2016	

Green Bank Observatory -Written NSF Public Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
396	c	David	Fraye	Scientist, Green Bank Observatory Adjunct Professor of Physics & Astronomy, West Virginia University	<p>Irregardless of the many shortcomings within the 2012 Review, many would claim that the recommendations of the 2012 Review with regard to the GBT are no longer applicable. This argument has been put forward in a recent white paper published on astro-ph, which states:</p> <p>"The National Science Foundation (NSF) Astronomy Division's Portfolio Review of 2012 is no longer relevant to the Green Bank Telescope (GBT) of 2017 for two principal reasons, one instrumental and the other astrophysical: 1) The GBT has begun significant operations in the 3mm band, giving it unrivaled capabilities for spectroscopy and continuum studies over 67-116 GHz. It is now an instrument that is unique worldwide and is a critical complement to AIMA for the U.S. scientific community. These capabilities had not been implemented at the time of the review. 2) The detection of gravitational radiation by LIGO in 2015 places the GBT's work on pulsar observations of nano-Hz gravitational radiation at the forefront of modern astrophysics.</p> <p>The paper also argues that "In the era of AIMA and LIGO, other countries have bolstered their mm-wave and cm-wave facilities; it is critical that U.S. scientists have ready access to a large filled aperture to remain at the forefront of research." And</p> <p>"The National Academies study New Worlds, New Horizons: A Midterm Assessment highlighted the importance of measuring gravitational waves, constraining the equation-of-state of nuclear matter, determining the mass of supermassive black holes, determining H_0, and understanding the physics of star-formation, as key science goals for astronomy. All of these key areas are currently being advanced using the GBT."</p> <p>The GBT is currently being used to carry out key science programs for astronomers from all over the world (the GBT userbase is approximately 1000 and has been growing with the new instrumentation at high frequency). The loss of the GBT is not replaceable, and decreasing the amount of time available for science would drastically affect the progress being made at high-frequency with the GBT given the scheduling constraints necessary to accommodate the low-frequency "paying" customers. In "the good old days", when the NSF was funding GBT operations at the 95% level, the over-subscription rate at high-frequency for the GBT ranged from 4--10, depending on the IST range. If for example, the NSF funding goes down to 25%, one could naively expect the over-subscription rate to increase by a factor of about 4. However, things would actually be worse than this due to the additional scheduling constraints. It is estimated that another factor of two decrease in available high-frequency time would result in this scenario pushing the over-subscription rates to 30-80. In other words, high-frequency NSF supported science on the GBT would basically stop, or at best be on life support -- few users are going to invest effort in writing observing proposals for a 1/50 chance of getting time. The only realistic possibility for high-frequency programs would be from paying customers, which would be challenging for the current high-frequency user community given how astronomers are funded in the US. This is key justification for supporting option (1). I do not believe any of the other options would be healthy for future science operations on the GBT. Our user community has not yet come to terms to with what will happen if the NSF only funds the GBT at less than the 50% level (e.g., option 2). Our observers will become frustrated with the GBO/NSF, and the GBT userbase will drastically decrease initiating a cycle of decline for GBT science (fewer users --> less support from NSF --> fewer users --> less support from NSF....). I, likely many other astronomers, care deeply about the science enabled by the GBT. If the NSF values science, then option (1) is the most reasonable choice.</p>	Against Closure	Email - Scanned	11/18/2016	
396	d	David	Fraye	Scientist, Green Bank Observatory Adjunct Professor of Physics & Astronomy, West Virginia University	<p>(3) Budget Considerations</p> <p>I also encourage the NSF to think outside the box in dealing with their budget challenges. While I have been at NRAO (since 2009), I have seen significant increases in management and administration costs from NRAO-HQ, at the expense of telescope operations. The NRAO/AUI management claim that this has been necessary to comply with NSF polices. If this claim is true, then the NSF could reduce the "red-tape" to save money across the board within the organizations they oversee. For example, within NRAO/AUI, we could save more than 5 million dollars per year by decreasing management and administration costs associated with NRAO-HQ/AUI without decreasing any useful functionality for the AIMA, VIA, GBT, and the VIBA observatories, as well for CDI (based on my assessment of the budget provided within the NRAO Program Operation Plan and public AUI tax records). The priorities of an organization can be gleamed by following the money.</p> <p>Analyzing the public tax filings of AUI over the last 30+ years shows a disturbing trend. Thirty years ago many of the highest paid NRAO/AUI employees were the top scientists and engineers within the organization, but now the highest paid employees are just the managers and bureaucrats (many of which have no contact or association with the telescopes we operate). I urge the NSF to look for savings from excess management and administration costs both internally and within the organizations for which they provide oversight, and to use these savings to invest in our facilities and to strengthen the NSF grant programs.</p>	Alternatives Consideration	Email - Scanned	11/18/2016	
397		Caroline	Simpson	Professor, Department of Physics CP 217A	<p>I'm writing to express my strong support for continued science operations with the Green Bank Telescope (GBT). As a large filled-aperture instrument operating at a wide range of frequencies, it is an essential and unique tool for cutting-edge research in the United States, and in the world. For astronomers such as myself, working at universities that don't have their own astronomical research facilities, access to a publicly available instrument such as the GBT is what allows me to continue to perform research, train graduate students, and inspire undergraduates to pursue careers in STEM. My two most recent Ph.D. students used the GBT for work that has resulted in published papers for both of them. The GBT data taken by one, Dr. Trisha Ashley, formed a large part of her Ph.D. dissertation and allowed her to finally answer a long-standing question in dwarf galaxy evolution. The GBT is the only instrument in the world that is capable of making the kind of observations required to do such research.</p> <p>I trust that a careful and honest assessment of the GBT's current science capabilities will result in the decision to let it continue science operations. It is an invaluable asset for U.S. astronomers.</p>	Against Closure	Email - Scanned	11/18/2016	
398	a	Aditya	Togi	Department of Physics & Astronomy University of Toledo	<p>The new radio interferometer facilities such as the Atacama Large Millimeter Array (ALMA), Very Large Array (VLA), which provides high resolution but subjected in filtering out the light flux distributed over large spatial scales and this calls the need for a single dish radio telescope like GBT. The implementation of new state of the art facilities such as Argus camera, MUSTANG-2, and their involvement in the NANOGrav project makes GBT a unique modern tool and no less compared to other radio facilities in the world. Moreover, with new radio telescopes coming up in different countries it is important for United States to maintain and improvise their current radio astronomy facilities.</p>	Against Closure	Email - Scanned	11/18/2016	GBT_NSF.pdf

Green Bank Observatory -Written NSF Public Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
398	b	Aditya	Togi	Department of Physics & Astronomy University of Toledo	<p>Letter: I, Aditya Togi, am a recent Ph.D. graduate student from the Department of Physics and Astronomy, University of Toledo, Ohio. My area of research is primarily focused on studying dust and gas properties in galaxies.</p> <p>The Robert C. Byrd Green Bank Telescope (GBT), a facility at the Green Bank Observatory did play a major role in my Ph. D. career path. I attended the NAIC-NRAO school on single dish radio astronomy at the Green Bank Observatory in July 2015. The school was focused on learning/improving observation skills in radio astronomy by doing tutorials along with hands on experience on a radio astronomy project. In our project we estimated the atomic gas mass limit in Hydra II, a newly discovered dwarf galaxy of our Milky Way, which was published in Astronomy and Astrophysics, a popular refereed astronomy journal. In the same batch another group performed high-resolution observations on a recently discovered near Earth asteroid using radar signals, which led to a press release. Along with scientific studies the observatory is also involved in training young fresh minds of the nation on the engineering aspects of the telescopes and is helping in passing the technical knowledge to the next generation....</p> <p>The radio telescopes of the Green Bank Observatory along with the GBT has proven helpful in my career path in learning and improvising my radio astronomy observation skills. The new development and state of the art facilities of the Green Bank Observatory will not only be useful in scientific aspect of our understanding the universe but also in training our young minds to prepare for the new technical challenges of future. With this I strongly recommend and request National Science Foundation (NSF) to allow continue the science operation at the Green Bank Observatory and opt for "no action"</p>	Against Closure	Email - Scanned	11/18/2016	GBT_NSF.pdf
399		Andrew	Harris	Professor, University of Maryland Department of Astronomy	<p>The Green Bank Telescope, with its size and surface accuracy, is unique in the world. Its enormous collecting area and ability to observe from decimeter to millimeter wavelengths allows it to explore astronomical objects from the Solar System to the early universe. As the remaining federally-funded single-dish telescope available for general use, it plays a critical role in developing new instrumentation. Ensuring U.S. community access to the scientific results and instrumental development that the Green Bank Telescope (and, preferably, other observatories with broad capabilities and uses) offer is essentially to keep U.S. science not only competitive but to rebuild U.S. radio astronomy's capability leadership in the field. Considering the environmental impact of a proposal to change a telescope's role in the national scientific infrastructure is an excellent approach, as it combines the impact on the scientific community with other considerations. I would like to add two perspectives to the discussion of scientific impacts: one at the international and national level, and one reflecting my own research.</p> <p>For the broader view, I bring perspective from my participation over the past few years as a member of the visiting committee (Fachbeirat) of the Max Planck Institute for Radio Astronomy, Chair of the APEX Telescope Review Committee, Chair of the Scientific Advisory Committee for the CfA's Submillimeter Array (SMA), and Chair of NASA's science advisory committee for the SOFIA observatory. These committees have reported on facility health and futures to the President of the Max Planck Society, Director General of the European Southern Observatory, Director of the CfA, and other key decision and funding authorities. It is clear that almost all new technical developments in U.S. radio astronomy are being eclipsed by research in other nations. In many cases foreign scientists are reaping the benefits of ideas that started in the U.S. but could not be realized here. This is especially obvious in the production of large focal plane arrays for continuum imaging, in development of receivers and imaging focal plane arrays at THz frequencies, and in the push to construct large arrays at low frequencies. A serious drag on U.S. efforts to maintain competition here is the lack of facilities where U.S. scientists can try out new ideas on interesting astronomical projects; we are almost at the point that any instrumental development requires building a telescope as well as the detector system. This approach works well for experiments such as those common to measurements of the Cosmic Background Radiation (where the U.S. is leading), but it does not work at all well for simpler projects, such as exploring new technologies that may be prototypes for inclusion in much larger instruments.</p> <p>As a concrete examples, the Effelsberg 100 meter telescope, which is constantly being upgraded, is a highly productive scientific instrument on its own, but has also been a key factor in the MPIfR's ability to lead and join other projects. Projects at the IRAM 30m telescope provide direct advantages in applying for ALMA time as well as spurring instrument development of immediate relevance to ALMA. Statistics from the APEX review showed that APEX -- a single, modest-diameter telescope -- was cited in 22% to 30% of ALMA proposals in the ESO database. As a community, the U.S. has done an excellent job of highlighting the capabilities of ALMA and the VLA, but the unfortunate byproduct seems to have been to diminish the perceived need for complementary capabilities available with other instruments. At a personal level, the Green Bank Telescope has been an important part of my research, along with a number of graduate and undergraduate students, and colleagues across the country....In conclusion, the growing trend of reducing the number and capabilities of instruments available to the Nation's astronomical community is increasingly excluding U.S. scientists from opportunities available from the interplay of data and instrumentation available from a broader approach to science. Ecosystems flourish with diversity, but wither with monoculture. The Green Bank Telescope is a key part of the U.S. diversity in science and technology.</p>	Against Closure	Email - Scanned	11/18/2016	envlmpact16.pdf
400		Casey	Law		<p>I am a professional astronomer based at the University of California, Berkeley and I am writing to express my support for continued science operations at the Green Bank Observatory.</p> <p>I would not be where I am today as an astronomer without the GBO. My professional training and doctoral thesis made great use of the Green Bank Telescope. The staff there dedicated so much to supporting me, the astronomical community, and the public.</p> <p>One peculiar point relevant to radio telescopes in particular is that instruments and computing define a great deal of an observatory's science capabilities. The GBO has invested in novel and powerful science instruments in the last few years (such as high frequency, wide-band, and multi-beam receivers). This has helped transform it into a new telescope that serves a wide-ranging and vital needs in astronomy. With continued investment and allocation of significant time to astronomical research, the GBO will continue to play that role.</p>	Against Closure	Email - Scanned	11/18/2016	

Green Bank Observatory -Written NSF Public Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
401	a	Hanna	Sizemore	Research Scientist Planetary Science Institute (PSI)	<p>I'm a researcher at Planetary Science Institute (PSI), and I spoke at the public scoping meeting for the EIS on proposed changes to Green Bank Observatory operations. I am writing now to reiterate my support for the following options: Continued NSF investment for science-focused operations (No-Action Alternative, PREFERRED) Collaboration with interested parties for science- and education-focused operations with reduced NSF-funded scope</p> <p>As I noted in my spoken comments, I'm a native of Pocahontas County and I received my early education in the local school system. NRAO-GB / GBO has been an invaluable partner to Pocahontas County Schools for more than 40 years. I benefited directly from this partnership as a high school student, when I was given the opportunity to do a research mentorship with a staff scientist at the observatory. The technical instruction, academic and professional advising, and exposure to the international research community I was given at Green Bank as a teenager have benefitted me throughout my career. Mentoring from staff scientists at GB *and* teaching by observatory spouses in the local schools were vital to my becoming a first generation B.A., M.S., and Ph.D. like 2/3 of PSI scientists, I work remotely from our Tucson, AZ headquarters. I have an adjunct position at GBO and work primarily from a shared office in the Jansky lab. Being an adjunct at NRAO-GB / GBO has enabled me to live in rural WV while continuing my career with PSI. (Persistent major problems with broadband internet access in the area would have made working from a home office near GB untenable; working in close proximity with GBO scientists and engineers also benefits my work in numerous small ways on a daily basis.)</p>	Against Closure	Email - Scanned	11/18/2016	
401	b	Hanna	Sizemore	Research Scientist Planetary Science Institute (PSI)	<p>Being physically located at GBO has given me unique opportunities to give back to the local community. My children are enrolled in local schools (which are in dire need of students to retain current levels of state funding). I served two years on the local school board. I've participated in many EPO activities as an individual and with GBO staff. In a community this small, I think it's also important that I've been able to bring my income from NASA grants into the local economy. GBO enables all of these things; it is unlikely I would live or work in Pocahontas County if the observatory were not here.</p>	Against Closure	Email - Scanned	11/18/2016	
401	c	Hanna	Sizemore	Research Scientist Planetary Science Institute (PSI)	<p>Personally, GBO has helped me strike a surprising compromise between being a part of the rural community where I grew up and being a part of the international space science community. The benefits that the observatory has brought to me individually are a microcosm of the benefits it provides to the local community as a whole. The observatory is an indispensable source of jobs, population, education, and community organization. Removing the observatory from Green Bank would be devastating to a rural area that is already economically depressed. It would also significantly narrow the academic and professional options for bright young people from WV who might one day contribute to STEM fields.</p> <p>I want to emphasize that federally funded facilities like GBO provide conduits of people, ideas, and money between rural areas of the US and the larger national and international communities. The benefits of these conduits flow both ways. At a time when the major economic and political schisms between rural and urban America are so prominently on display, removing any of these conduits may have long-lasting negative effects on American society and science leadership.</p> <p>Public/private partnerships (option #2 above) that maintain science activity at GBO are preferable to any alternatives that would end active research at Green Bank. However, this option would likely diminish the availability of open observing time on the GBT and might result in reductions to science staff. It would also make access to the telescope much less democratic and merit based. Only continued federal funding of the observatory with an intact science staff and substantial publicly competed observing time truly preserves the the vital role of GBO in the local community and the science community.</p>	Against Closure	Email - Scanned	11/18/2016	
402	a	Scott	Ferris		<p>My name is Scott Ferris. I proudly tell people, "I'm a West Virginian: born, raised, and educated." My secondary education is from West Virginia University where I achieved a B.S. in physics, focusing on general relativity. Although my studies were theoretical by nature, the quality of my department, professors, fellow students, and overall experience were undoubtedly linked to the experiments, funding, and educational programs offered by and through Green Bank.</p> <p>First and foremost the Governor's School for Math and Science at Green Bank was one of the most memorable and formative experiences of my early education. Being immersed in that community of learning and experimentation was eye opening. Using the GBT for one observation instead of the 40 ft dish we had used for all other observations changed my perspective in many ways. First, how lucky I was to use such equipment, secondly the power of human ingenuity and technological progress, and most influentially was the feeling I got when we saw the clear resolution of the gases we were studying. It was as if we were the first people to see that patch of space clearly, like cresting a hill and be the first to see a great river or ocean; we made a discovery. I have always looked to the sky with wonder and awe. As a child I found God in the stars. As a teen, I found a passion and career in the stars thanks to Green Bank.</p> <p>Although I am currently taking a break from science and academia to enjoy WV's natural resources by being a river guide on the New River and working as a snowboard instructor at Snowshoe Mountain (very close to Green Bank). Many of my friends I made at that camp went to work at Microsoft, Tesla, and NASA. I hope they all took time to write you as well. I am sure everyone looks fondly at those two weeks.</p>	Against Closure	Email - Scanned	11/18/2016	
402	b	Scott	Ferris		<p>In addition to the direct impact Green Bank has made on my life, there are many indirect impacts. While a physics student at WVU the physics department grew a considerable amount. Moving to a newly renovated building and adding an astronomy department as part of the growth. This expansion was made possible by funding associated with pulsar research. The Green Bank Observatory makes this research possible. One of my favorite teachers of all time, Duncan Lorimer, would likely not be at WVU if not for Green Bank and the services it allows. He is not alone in that category. Through his efforts and efforts of his colleagues to get high school students analyzing pulsar data, I saw an increase in the undergraduate enrollment of the physics department with a majority from WV. As a state that is ranked very low in education, getting students into research and into a scientific field is a major accomplishment.</p> <p>In summary, I am one of many West Virginians who have been positively influenced by Green Bank Observatory. The time I spent there at the Governor's School or Math and Science changed my life and sparked my interest in physics. My physics studies at WVU were made possible in great part to the existence the Observatory. Closing Green Bank would mean closing opportunities for the bright, exceptional West Virginian's who already have to struggle in one of the worst education systems in the nation. Please keep the Green Bank Observatory functional for the sake of science, discovery, education, West Virginia, and the future.</p>	Against Closure	Email - Scanned	11/18/2016	
403		Brittany	Hudnall	N/A	Email is completely unreadable, random characters	General	Email - Scanned	11/18/2016	N/A

Green Bank Observatory -Written NSF Public Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
404		Phillip	Ward		<p>The Director of the NSF had this to say Aug.25,2010:</p> <p>"The Robert C. Byrd Telescope will be the workhorse of the Green Bank Observatory for decades to come".</p> <p>Several million taxpayer dollars built and have maintained this very useful facility for many years.</p> <p>It would be foolish to take it out of service and possibly demolish this wonderful astronomy facility. I am in favor of and recommending the No-Action Alternative.</p>	Against Closure	Email - Scanned	11/18/2016	
405	a	Paul	Baker	Postdoctoral Fellow Center for Gravitational Waves and Cosmology West Virginia University	<p>I am writing to submit a formal comment on the proposed changes to the operation of the Green Bank Observatory. I am a postdoctoral fellow in the Center for Gravitational Waves and Cosmology at West Virginia University (WVU). I primarily work as a member of the North American Nanohertz Observatory for Gravitational Waves (NANOGrav) alongside over 100 colleagues spread across North America, several of them at WVU. The Green Bank Observatory (GBO) is absolutely critical to our effort to detect low frequency gravitational waves. No other facility in the world offers GBO's combination of sensitivity and sky coverage. The closure of GBO to full scientific operations would devastate the North American low frequency gravitational wave community.</p> <p>Any of the proposed changes to GBO operations would have major detrimental impacts on NANOGrav, and in turn the careers of dozens of astronomers, engineers, and technicians in West Virginia and throughout these United States. I am just beginning my career in astrophysics, so the closure of GBO would directly impede my own scientific career. I currently rely on funding from the Center for Gravitational Waves and Cosmology (CGWC). The CGWC is funded by several grants (including an NSF Physics Frontier Center grant) tied to radio astronomy at GBO. Grants tied to GBO observations also fund dozens of WVU graduate students and five additional postdocs, beyond myself. Without GBO and these funds the CGWC would cease to operate. I insist that you quantify the full monetary and economic loss to West Virginia University and the state of West Virginia, as a result of any reduction in scope of GBO.</p> <p>Of the five proposed scenarios only the no-action alternative is acceptable to me. Only in the no-action scenario is the open skies time maintained. Open skies time is necessary for NANOGrav to survey and characterize new pulsars, and for astronomers around the country to have the most access to GBO. The other scenarios present too great a cost to myself, my colleagues, the state of West Virginia, and the culture of science in the United States of America. Let us consider the impact of each of the proposed scenarios:</p> <ul style="list-style-type: none"> • No-action alternative: Under this preferred scenario, NANOGrav would continue critical scientific activities. Our program to monitor over 50 millisecond pulsars would continue under a current contract with GBO. Additional surveys to find new millisecond pulsars with the GBT would also continue. Dozens of graduate students would continue to receive the highest quality education at institutions around the country, like WVU. The careers of young scientists would continue uninterrupted, continuing the United States' full contribution to astrophysics. • Collaboration with partners for continued science-focused operations: This scenario would allow NANOGrav to continue its pulsar monitoring program, but would severely impact surveys for new pulsars and the follow-up observations that identify the best candidates for NANOGrav. The reduction in NSF funding would directly reduce the open skies time available for our surveys. Scheduling pressure would also make it more difficult to characterize new discoveries, greatly reducing the impact of NANOGrav's ancillary science, which is itself some of the most impactful conducted at GBO. Thus, while this scenario would allow NANOGrav to make progress towards discovering low-frequency gravitational waves, it would slow the rate of that progress. The reduction in open skies time would also cut off many astronomers who use GBO without the backing of a large collaboration like NANOGrav or Breakthrough Listen. This vastly reduces the breadth of science conducted at GBO and in the United States. 	Against Closure	Email - Scanned	11/18/2016	GBO_letter.pdf
405	b	Paul	Baker	Postdoctoral Fellow Center for Gravitational Waves and Cosmology West Virginia University	<ul style="list-style-type: none"> • Transition to an education and technology park, mothballing, or full deconstruction: These scenarios would devastate NANOGrav science and the careers of dozens of scientists, including myself. The GBO and Arecibo are currently the best telescopes in the world for low frequency gravitational wave science, and they have the potential to remain so for the next decade. Other countries, including China, are increasing their investment in single dish radio astronomy. Changes to GBO operations will effectively forfeit US leadership in low-frequency gravitational wave astronomy. <p>Under these scenarios I would strongly consider continuing my scientific career in Europe or Australia, where I could continue working on low-frequency gravitational wave astronomy with the European Pulsar Timing Array or the Parkes Pulsar Timing Array. I expect many of my colleagues would feel the same draw to pursue science elsewhere. This loss of young talent would drain the US of expertise needed to continue the highest quality science and train the next generation of technically adept Americans. In addition, the elimination of this scientific institution will remove a technology center in West Virginia. Even conversion to an education and technology center would likely result in the export of a number of good-paying jobs in Pocahontas County and at WVU in Morgantown to other states.</p> <p>The scientific, economic, and cultural impacts of reducing NSF funding for GBO are numerous and severe. Such action would be a huge loss for my career, the careers of my colleagues, the NANOGrav collaboration, the United States astronomical community, and the people of Pocahontas County, West Virginia. I urge NSF to adopt the no-action alternative in the strongest possible terms.</p> <p>Thank you for your consideration. If you have any questions or need further information, please feel free to contact me directly.</p>	Against Closure	Email - Scanned	11/18/2016	GBO_letter.pdf
406		Maxwell	Stout	Inactive Attorney Emeritus State Bar of Texas	<p>Before decommissioning the Green Bank Observatory, every effort should be made to sell the facility.</p> <p>Australia might be interested in having a northern hemisphere complement to its Parkes Radio Telescope. The Europe Union has facilities in the southern hemisphere that could be complimented by the Green Bank Telescope. The issue is to have someone take over the expense of operations and maintenance, not the entire loss of the GBT.</p>	Against Closure	Email - Scanned	11/18/2016	

Green Bank Observatory -Written NSF Public Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
407		Eric	Murphy		<p>I am writing to *strongly* support the continued NSF investment for science-focused operations (i.e., the No-Action Alternative)</p> <p>The statement that has been made: "The GBT is the world's most sensitive single-dish radio telescope at wavelengths shorter than 10 cm" is unequivocally true. However, the idea that its capabilities are not as critical to New World New Horizons [astronomy and astrophysics decadal survey] science goals as the higher-ranked facilities is completely false, as this assessment was made prior to the incredible and un- paralleled receiver developments at higher frequencies, making the GBT the fastest, most sensitive 3mm single-dish instrument for spectroscopic and continuum studies in the world. It is truly unrivaled and one of the primary reasons that US radio astronomy remains at the bleeding edge of scientific and technological developments world-wide. With these capabilities, the GBT is a critical complement to ALMA, an essential resource for the ALMA 2030 development plans that benefit the world-wide astronomical community, and likely the best resource for address short-spacings for the next-generation VLA, which will be the world's preeminent radio telescope even in the SKA1 era.</p> <p>Furthermore, with the recent detection of gravitational radiation by LIGO in 2015, the GBT's work on pulsar observations of nano-Hz gravitational radiation places it at the forefront of modern astrophysics. Thus, the GBT exhibits a huge breadth of scientific capabilities spanning fundamental physics, chemistry, planetary studies, along with Galactic and extragalactic astrophysics. Included in these are a number of key science goals identified by the National Academy study "New Worlds, New Horizons: A Midterm Assessment", namely: understanding of gravitational waves, the equation-of-state of nuclear matter, the mass of supermassive black holes, the value of H₀, and the physics of star-formation.</p> <p>To conclude, rather than divesting from this exceptional resource, it is imperative to maintain GBT operations for the U.S. and to instrument it in an optimal manner, enabling it to become an extraordinary complement to existing and future radio interferometers such as a next-generation VLA. In the era of ALMA and LIGO, other countries have invested significantly in their mm-wave and cm-wave facilities. If the US wants to remain a leader in this area of astrophysics where the discovery space is so large, it is critical that U.S. scientists have ready access to a large filled aperture. As such, the GBT will remain a pillar for 1-116 GHz science in the US and the world.</p>	Against Closure	Email - Scanned	11/18/2016	
408		George	Miley	Royal Netherlands Academy Professor Emeritus Vice President International Astronomical Union Professor of Astronomy	<p>This letter is in response to the above-mentioned notice of intent regarding proposed changes to the status of the Green Bank Telescope. I am writing as a member of the international scientific community, as a multi- wavelength astronomical researcher and someone who is not a user of the GBT.</p> <p>The GBT is a unique facility for pursuing several fundamental areas of research. Its large aperture, highly sensitive versatile receivers and wide sky coverage makes it the best facility in the world for studying pulsars and an outstanding observing platform for detecting and studying astrophysical molecules.</p> <p>Furthermore, the GBT is a crucial element of the North American Nanohertz Observatory for Gravitational Waves (NANOGrav), the pulsar-timing array that provides a complementary window on gravitational waves to LIGO and space-based interferometry. The discovery by LIGO of gravitational waves during the past year has established gravitational wave studies as one of the most exciting areas of modern science and Nobel Prize material. The LIGO work has strengthened radically the already compelling case for keeping the GBT operational. In my view the GBT has the potential to do paradigm-changing science for at least another decade.</p> <p>I realize that the NSF Division of Astronomical Sciences is facing a difficult budget situation and recognize that difficult decisions have to be taken. However, it would be a great shame if the GBT were to be removed from the arsenal available to US scientists for pursuing fundamental science and a considerable loss to world science. I respectfully urge the NSF to adopt the "No-action" alternative given in the Notice of Intent, namely Continued NSF investment for science-focused operations.</p>	Against Closure	Email - Scanned	11/18/2016	GBT_NSF_miley.pdf
409		Faith	Bailey	Journalist, Balkan Investigative Reporting Network	<p>My name is Faith Bailey, and I'm from West Virginia. Pocahontas County is where I head every holiday season to visit family and to escape into the peaceful quiet of our rural mountains.</p> <p>My West Virginian upbringing is important to my identity--it shaped my experiences as a college student in Baltimore, a Fulbright in Kosovo, and my current work as a journalist in the Balkans. Growing up, my peers and I lacked many educational and economic resources, so the Green Bank Observatory was always something special to be proud of. I still love to visit with my younger brothers, who are interested in STEM and get so excited by the observatory's emphasis on kid-friendly education.</p> <p>I hope that you see how important the observatory is to West Virginians and that you fund the annual budget and keep GBO in WV!</p>	Against Closure	Email - Scanned	11/18/2016	
410	a	Helene	Courtois	Astrophysicist - Full Professor Vice-President International Relations of University Lyon 1	<p>I write in order to support vigorously GBT fully operational capacity. In my science no other instrument of this quality/sensitivity/dish size/ fully steerable/ in a radio quiet zone, exists in the world that can provide us with the necessary data. The instrument is also a top % telescope in the world because of the quality of the support provided to the astronomers by the staff. I have never seen anywhere else in the world such a high quality of support and staff.</p>	Against Closure	Email - Scanned	11/18/2016	

Green Bank Observatory -Written NSF Public Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
410	b	Helene	Courtois	Astrophysicist - Full Professor Vice-President International Relations of University Lyon 1	<p>GBT is a major tool for understanding where we live, where we come from and where we are going, literally. Those are not small questions for the general humanity.</p> <p>My job is to create a cartography of the motions of our and other galaxies in the nearby universe. Only with GBT data were we able to create this first modern map, that as lead to a new address in the universe with the identification of our supercluster laniakea. In the search for understanding gravitation, the cartography of the motions of galaxies allow to test the concept of dark matter in trying to localize it *directly*.</p> <p>Our video with this cartography is since 2 years the top-1 video of the « Nature Journal » youtube channel. With 4 millions of views, our astronomy video is the science that the general public watches most, before biology, chemistry, robotics, medicine, .. As you will see in the next few months we are at the point of releasing another major step in understanding our place in the Universe.</p> <p>We would not have been able to build this new knowledge without GBT.</p>	Against Closure	Email - Scanned	11/18/2016	
410	c	Helene	Courtois	Astrophysicist - Full Professor Vice-President International Relations of University Lyon 1	<p>As Vice-president for international affairs of the University of Lyon 1 and full professor in astronomy. I teach science since 20 years. I want to add that I am very admiring of all the work done by GBT staff to promote science to the young people and to the girls.</p> <p>I cannot imagine that NSF, in any manner, would not continue to support a fully operational GBT for all that it brings to the international and the USA community, and to the general humanity.</p> <p>In all my public and science talks I show a photo of the GBT, you can check directly on this video (minute : 17:21) of a talk I gave at the French academy of Sciences two weeks ago. https://www.youtube.com/watch?v=1g3gD5-uP6A</p> <p>I also have it in photo and praise it in my book for the general public « Voyage on the galaxy flows » https://www.amazon.fr/Voyage-sur-flots-galaxies-laniakea/dp/2100738909</p> <p>Even if I haven't come to Green Bank since a few years I am literally in love with this instrument, don't break my heart.</p> <p>Please do not hesitate to contact me if I can help raise awareness that you have in hand one of the most beautiful technological and scientific jewel.</p>	Against Closure	Email - Scanned	11/18/2016	
411		Martin	Sommer		<p>My name is Martin Sommer, and I am writing to you as a scientist at the University of Bonn (Germany). I have recently learned of the plans to shut down science operations of the Green Bank Observatory, and would like to express my strong opposition to these plans. I am strongly supporting the continued full scientific operation of GBT, for these reasons:</p> <p>The GBT offers the largest collecting area, and thus, in conjunction with superb modern receivers, the best sensitivity in a wide range of radio and millimeter wavelengths in the world. In particular, the instrument has been used, and continues being used, for detailed studies of the intra-cluster medium in clusters of galaxies, a crucial field of research aimed, among other things, at sensitively calibrating masses of clusters of galaxies, used for precise cosmological measurements in turn aimed at understanding the very structure of our universe.</p> <p>My own longterm science goals will hugely benefit from the unique capabilities offered by the Green Bank Observatory.</p>	Against Closure	Email - Scanned	11/18/2016	
412		Heather	Persing		<p>Please keep the GBT. It means so much to our struggling state, and it inspires young West Virginians to study STEM fields. If I had not had exposure to things like the GBT, I never would have studied Mechanical Engineering (especially as a female).</p> <p>I hope you also consider how crippling financially shutting down the GBT could be for the area.</p> <p>I've looked forward to taking my son to see to the GBT, knowing it will broaden his view of the universe, encourage his interest in science, and deepen his appreciation for his state. Please don't take that opportunity away from him (and so many other kids like him).</p>	Against Closure	Email - Scanned	11/18/2016	
413		Reinhold	Schaaf		<p>My name is Reinhold Schaaf and I am a staff member at the Argelander-Institute for Astronomy in Bonn (Germany).</p> <p>I am writing in strong support of continued full science operations of the Green Bank Observatory. I would like to concur with the points raised in the support letter sent by Dr. Karim (from my department) on November 7 2016.</p> <p>I would like to stress that my longterm science goals will hugely benefit from the unique capabilities offered by the Green Bank Observatory.</p>	Against Closure	Email - Scanned	11/18/2016	
414		Steven	Stetzler		<p>I am writing to implore you to not defund the Green Bank Observatory. The GBO had a great impact on me as a student and as a scientist, inspiring me to continue with Physics and explore Astronomy. We as a nation, and as a community of scientists, require nationally funded telescopes in order to thrive. It would be an incredible loss to have the GBO lose its NSF funding.</p>	Against Closure	Email - Scanned	11/17/2016	

Green Bank Observatory -Written NSF Public Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
415		Dick	Manchester	CSIRO Fellow	<p>I am writing in support of maintaining operations and, in particular, access on the basis of scientific merit (the "Open Skies" policy) at the Robert C. Byrd Green Bank Telescope (GBT) in West Virginia.</p> <p>As a foreign-based scientist, I have benefitted from this policy, being co-investigator on several highly rated, and in one case continuing, programs on the telescope. My research area, pulsars, benefits hugely from access to a large, fully steerable, filled aperture telescope with top-class instrumentation. With its high data rates, pulsar research is best done on "single-dish" telescopes. It is very difficult to achieve the required data rates on array telescopes. This is especially true for pulsar searches which are virtually impossible on array telescopes like the JVLA. Furthermore, compared to array telescopes, single-dish telescopes can easily be adapted to meet the needs of new and unexpected directions in future science.</p> <p>As well as pulsar science, which tends to be best done at relatively low radio frequencies, the GBT is the only 100-m-class single-dish telescope in the world that can operate efficiently at high frequencies, in the range of 50 - 115 GHz. As such it forms an extremely valuable survey instrument, revealing sources for follow-up on array telescopes such as the JVLA and ALMA. Such wide-area surveys are essentially impossible with array telescopes.</p> <p>Currently, the GBT is the world's leading 100-m-class facility. It has an outstanding outreach program bringing the excitement of science to school children and the general public.</p> <p>To deprive the community, both scientific and general, of access to such an outstanding and world-leading facility at the prime of its life would be a crying shame.</p> <p>I recognise the budgetary pressures on the NSF, but continued access for the best scientific projects through merit-based processes on the world's leading 100-m-class telescope seems to me to be such a high priority that any departure from this should not be countenanced.</p> <p>I trust that the NSF will recognise this and continue its support of peer-reviewed scientific operations on the GBT for the foreseeable future.</p> <p>Please note that the views expressed above are my own and that they do not necessarily represent those of CSIRO Astronomy and Space Science.</p>	Against Closure	Email - Scanned	11/17/2016	GBT_NSF.pdf
416		Mary Margaret	Serpento		<p>I was shocked to read reports that the National Science Foundation is considering closure of the Green Bank Observatory in West Virginia. Radio astronomy may not make the headlines that orbital telescopes do, but the basic research capabilities are critical. And unique. The electromagnetic spectrum extends farther than human vision can see. Please keep the Green Bank Observatory open and operational.</p> <p>There are more things in heaven and earth, Horatio, Than are dreamt of in your philosophy. - Hamlet (1.5.167-8), Hamlet to Horatio</p>	Against Closure	Email - Scanned	11/17/2016	
417		Blake	Williams		Please keep the Observatory running!	Against Closure	Email - Scanned	11/17/2016	
418	a	Mara	Boggs	State Director	<p>On behalf of TechConnect West Virginia, I write in strong support of the continued full operation of the Green Bank Observatory in Green Bank, West Virginia and would ask that you share this letter with Dr. France Cordova and the entire leadership team at the National Science Foundation.</p> <p>TechConnect West Virginia is a coalition of professionals dedicated to growing and diversifying West Virginia's economy by advancing innovation-based economic development and entrepreneurship. With members representing education and research, private industry, and the public sector, the organization serves as a forum and facilitator to enhance awareness, spur collaboration, and raise the discussion of issues needed to strengthen the state's innovation ecosystem. We believe it is imperative to maintain and utilize the enormous investment by the Federal Government in the facilities at the Green Bank Observatory for both scientific and economic reasons.</p> <p>From the initial establishment of the National Radio Quiet Zone in 1958 and the construction of the Green Bank Observatory in 1960, the Green Bank site has produced a wealth of scientific knowledge about the nature of the universe. The Robert C. Byrd Green Bank Telescope, dedicated on August 25, 2000, has been called a "marvel of the space age" by National Geographic. It can do in hours what other radio telescopes take weeks to achieve, in terms of gathering and analyzing cosmic signals from distant stars and galaxies.</p> <p>We hope the nation will stand with the Green Bank Observatory and with West Virginia by continuing to offer the maximum support possible to one of the most unique scientific research facilities in the world. Rather than discuss the unthinkable potential closure of this national treasure, we urge our country's scientific experts and elected leaders to work together to find a solution to not only preserve, but also enhance, the Green Bank Observatory.</p>	Against Closure	Email - Scanned	11/17/2016	11-9-16 TCWV letter of Support to NSF for Green Bank Observatory.pdf
418	b	Mara	Boggs	State Director	The quiet zone is one of only two such places in the United States that allow for the type of research conducted as part of the North American Nanohertz Observatory for Gravitational Waves, or NANOGrav Collaboration, working to detect gravitational waves and explore pulsar timing in an effort to ultimately open a new window on the universe. Scientific experts working on the NANOGrav project have concluded that the Green Bank Telescope simply cannot be replaced by other telescopes in conducting this research because of accessibility, sensitivity and flexibility, and its location in a radio free quiet zone.	Against Closure	Email - Scanned	11/17/2016	
418	c	Mara	Boggs	State Director	As an inspiration to generations of students, the Green Bank Observatory has also contributed to the nation's need for highly-skilled scientists and engineers. Most recently, the discovery of pulsars by high school students in the Pulsar Search Collaboratory has attracted worldwide notice, including the White House. As America competes across the globe to develop the next generation of leading scientists, the Green Bank Observatory must be positioned to continue to play a crucial role.	Against Closure	Email - Scanned	11/17/2016	

Green Bank Observatory -Written NSF Public Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
418	d	Mara	Boggs	State Director	While there is a cost to maintaining this state-of-the-art research facility, it represents a sound and significant investment on the part of the Federal Government on American soil. Supporting its maintenance in order to further scientific inquiries is responsible stewardship of taxpayer dollars. Because of its accessibility to the general public, the Green Bank Observatory has also led the way in educational tourism, providing a much-needed boost to the local economy. While it has been a tourism attraction since the state's centennial celebration in 1963, that boost is needed now more than ever, as West Virginia's traditional economy undergoes its most significant transition in more than a century. With an annual economic impact of \$30 million, the Green Bank Observatory stands as a cornerstone of economic diversification in a state seeking exactly these kinds of solutions.	Against Closure	Email - Scanned	11/17/2016	
419		Bairavi	Sundaram	Parkerburg High School	I haven't personally visited the Green bank Telescope but a few students on our school's academic teams have and they said their entire experience was very well worth it. Once they came back from visiting the facility they seemed to have an increased interest in not only the idea of astronomy and the search for pulsars but also just science in general. It was this trip that helped encouraged our school to start a pulsar search collaboratory, which currently has a multitude of enthusiastic members. It is for reasons such as this that I would be thoroughly disappointed if the Green bank Telescope were to be deconstructed or torn down. If this facility were to be diminished, a part of scientific exploration goes with it. In the state of West Virginia, we do not have that much of an emphasis on education and removing the telescope would just continue to send that message to students who are interested in the subject. It is essential that we as a state keep the Green Bank telescope to keep encouraging students to have an interest in things relating to science and potentially even make West Virginia a more encouraged state academically.	Against Closure	Email - Scanned	11/17/2016	
420		Jerry	Wang	Parkerburg High School	I won't pretend that I have a personal connection with the Green Bank Telescope, however that does not mean that I would not be very disappointed to see it torn down. The state of West Virginia has an abundance of nature, but a troubling shortage of interest in science. Our education has ranked consistently in the bottom ten, and the lack of many programs and facilities that promote STEM fields does help the situation. This is why I insist that the Green Bank facility is allowed to continue operations. I remember when my brother participated in the West Virginia Governor's School for Math and Science, and their class was able to travel to the observatory and actually use it to look into space. He called my parents and told them how great of an experience it was, and how lucky he was to have been able to do it. This kind of enthusiasm is exactly what other bright students throughout the area need: a symbol of learning and a source of pride. I care a lot about my state, and I want to see it genuinely excel. And our excellence will start with the sciences.	Against Closure	Email - Scanned	11/17/2016	
421		Louis	Costanzo, III		Please be advised that I believe that you are being short sided in considering the closure of the Green Bank facility. This facility ponders valuable information to many researches, scientist etc in our world. There are few places where such study is possible because it has intentionally been isolated. In addition, The Green Bank employs people in our state. Your consideration of maintaining The Green Bank is appreciated.	Against Closure	Email - Scanned	11/17/2016	
422		Victoria	Kaspi	Director, McGill Space Institute Professor of Physics Lorne Trottier Chair in Astrophysics & Cosmology McGill University	This letter is to express strong support for continuing full science operations at the Green Bank Telescope. This is in response to the review process to create an Environment Impact Statement. The GBT is a fully functioning, young major facility with a sizable user base worldwide and particularly here in Canada. There is no existing telescope in the world with the combination of the GBT's sensitivity, frequency flexibility, steerability and low-radio-interference environment. The premature closure being considered would represent a waste of substantial capital costs and an enormous loss to science. My research program has long had the GBT at its core and with huge success. Specifically we have used the GBT for timing of pulsars for detection of nanohertz gravitational waves (as part of the NANOGrav collaboration), for constraining the nature of matter having supra-nuclear density, for unique, new tests of Einstein's theory of General Relativity, for discovering a new class of millisecond radio pulsar/low-mass X-ray binary transition objects, and for discovering the first millisecond pulsar in a triple system. Overall I have published over two dozen refereed papers since 2004 using the GBT, including many of very high impact (at least 5 in Science, one in Nature) having several hundred citations. There has been no slow-down in either our publication rate or in the rate of high impact discoveries. Together with my MSc student Pragya Chawla we are in the middle of a crucial GBT paper related to Fast Radio Bursts which will have very important impact on this blossoming field. Indeed I note that the importance of the GBT to FRB science was amply recently demonstrated by Masui et al. 2015, Nature, 528, 523. It is therefore of great importance to me and to my large research group that Green Bank be permitted to continue to function; I cannot believe that the GBT in terms of cost per any-measure-of-science-impact does not compete favourably with practically all other world-class facilities. I respectfully point out that it would also be, in our opinion, a violation of the spirit of U.S./Canada agreements on radio astronomical collaboration. The 2003 North American Partnership in Radio Astronomy (NAPRA), signed by both Canada and the U.S., guaranteed Canadian access to NRAO radio facilities in exchange for significant Canadian contributions to the JVLA and ALMA, all of which have been successfully provided by Canada as agreed. These included a \$20M expenditure by the Canadian government for development and construction of the JVLA correlator, as well as approximately \$20M in contributions to ALMA construction. The availability of the NAPRA funds were announced in our government's 2003 Budget speech and were provided specifically with the understanding that Canadian astronomers would have access to JVLA and all existing NRAO telescopes. An NRAO divestment from the GBT would therefore be a major blow to the spirit of the NAPRA agreement. My participation and leadership in GBT-related science plays a key role in multiple related Canadian endeavors, such as the development of cyberinfrastructure in preparation for the Square Kilometer Array via a \$2M grant from Canada's CANARIE organization. This enabled the creation of CyberSKA, a web-based portal to a wide variety of radio astronomy project applications that are currently being used by hundreds of radio astronomers both in Canada and worldwide. Additionally, Canadian radio astronomers have been awarded significant supercomputing resources from Compute Canada, specifically for processing of GBT data. Canadian astronomers have even made a significant cash contribution toward infrastructure at NRAO for archiving and rendering accessible GBT data. Finally, all these projects have significant Canadian undergraduate, graduate student and postdoc involvement which would also be undermined should the GBT be unavailable. The proposed disruption of science operations at the GBT would therefore be a major blow to many Canadian astronomical research efforts and investments.... Nevertheless I believe strongly that the GBT is doing unique and world-leading work for relatively low cost; it would be strongly detrimental to multiple high-impact areas of science – including many of key importance in Canada – if its science operations were curtailed.	Against Closure	Email - Scanned	11/17/2016	nsf_gbt2.pdf

Green Bank Observatory -Written NSF Public Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
423	a	Anne	Barth	Executive Director, TechConnect	<p>On behalf of TechConnect West Virginia, I write in strong support of the continued full operation of the Green Bank Observatory in Green Bank, West Virginia and would ask that you share this letter with Dr. France Cordova and the entire leadership team at the National Science Foundation.</p> <p>TechConnect West Virginia is a coalition of professionals dedicated to growing and diversifying West Virginia's economy by advancing innovation-based economic development and entrepreneurship. With members representing education and research, private industry, and the public sector, the organization serves as a forum and facilitator to enhance awareness, spur collaboration, and raise the discussion of issues needed to strengthen the state's innovation ecosystem. We believe it is imperative to maintain and utilize the enormous investment by the Federal Government in the facilities at the Green Bank Observatory for both scientific and economic reasons.</p> <p>From the initial establishment of the National Radio Quiet Zone in 1958 and the construction of the Green Bank Observatory in 1960, the Green Bank site has produced a wealth of scientific knowledge about the nature of the universe. The Robert C. Byrd Green Bank Telescope, dedicated on August 25, 2000, has been called a "marvel of the space age" by National Geographic. It can do in hours what other radio telescopes take weeks to achieve, in terms of gathering and analyzing cosmic signals from distant stars and galaxies.</p> <p>We hope the nation will stand with the Green Bank Observatory and with West Virginia by continuing to offer the maximum support possible to one of the most unique scientific research facilities in the world. Rather than discuss the unthinkable potential closure of this national treasure, we urge our country's scientific experts and elected leaders to work together to find a solution to not only preserve, but also enhance, the Green Bank Observatory.</p>	Against Closure	Email - Scanned	11/17/2016	11-9-16 TCWV letter of Support to NSF for Green Bank Observatory.pdf
423	b	Anne	Barth	Executive Director, TechConnect	<p>The quiet zone is one of only two such places in the United States that allow for the type of research conducted as part of the North American Nanohertz Observatory for Gravitational Waves, or NANOGrav Collaboration, working to detect gravitational waves and explore pulsar timing in an effort to ultimately open a new window on the universe. Scientific experts working on the NANOGrav project have concluded that the Green Bank Telescope simply cannot be replaced by other telescopes in conducting this research because of accessibility, sensitivity and flexibility, and its location in a radio free quiet zone.</p>	Against Closure	Email - Scanned	11/17/2016	
423	c	Anne	Barth	Executive Director, TechConnect	<p>As an inspiration to generations of students, the Green Bank Observatory has also contributed to the nation's need for highly-skilled scientists and engineers. Most recently, the discovery of pulsars by high school students in the Pulsar Search Collaboratory has attracted worldwide notice, including the White House. As America competes across the globe to develop the next generation of leading scientists, the Green Bank Observatory must be positioned to continue to play a crucial role.</p>	Against Closure	Email - Scanned	11/17/2016	
423	d	Anne	Barth	Executive Director, TechConnect	<p>While there is a cost to maintaining this state-of-the-art research facility, it represents a sound and significant investment on the part of the Federal Government on American soil. Supporting its maintenance in order to further scientific inquiries is responsible stewardship of taxpayer dollars.</p> <p>Because of its accessibility to the general public, the Green Bank Observatory has also led the way in educational tourism, providing a much-needed boost to the local economy. While it has been a tourism attraction since the state's centennial celebration in 1963, that boost is needed now more than ever, as West Virginia's traditional economy undergoes its most significant transition in more than a century. With an annual economic impact of \$30 million, the Green Bank Observatory stands as a cornerstone of economic diversification in a state seeking exactly these kinds of solutions.</p>	Against Closure	Email - Scanned	11/17/2016	
424	a	Geoffrey	Hempelmann	Legislative Assistant	<p>We write to express our support for the invaluable and irreplaceable work of the Green Bank Observatory in Green Bank, West Virginia. This asset has advanced our scientific knowledge for decades and has become a staple of the community, inspiring generations to pursue careers in science and research.</p> <p>The Green Bank Observatory continues to be of critical importance to the scientific community in the United States and the world. Scientists use data from the Green Bank Observatory to further their research in cutting-edge fields such as gravitational waves, pulsars, star formation, and even the search for intelligent life in our galaxy and beyond. Green Bank must remain operational to continue to make the scientific discoveries that are motivating the next generation of scientists from West Virginia and the United States.</p>	Against Closure	Email - Scanned and Letter-mailed	11/17/2016	WV House Delegation Green Bank EIS Comments.pdf
424	b	Geoffrey	Hempelmann	Legislative Assistant	<p>One need look no further to see this than the educational programs at the Green Bank Observatory. Each year, thousands of students and teachers partake in their educational, hands-on programs. One of these programs is the Radio Astronomer for a Day Program, where students participate in a real-life research experience using radio telescope sat the Green Bank Observatory.</p> <p>The Green Bank Observatory is directly responsible for exposing countless children in West Virginia to careers in science, technology, engineering and mathematics (STEM) fields. Many of these students are from underprivileged areas and a significant percentage are female. One of the National Science Foundation's key objectives is to expose underrepresented and female students to careers in STEM, and Green Bank does just that. Green Bank is giving 3,000 to 5,000 students each year a chance to explore a career in science and research, an opportunity that cannot simply be replaced in a classroom or at home.</p> <p>The impact is also felt at West Virginia University, where about 6,000 undergraduate students have completed the introductory course in astronomy since the commissioning of the telescope in 2001. Due to the heightened interest in astronomy, WVU has increased its astronomy faculty.</p> <p>These faculty have successfully pursued a number of competitive NSF grants, including both the PIRE and Physics Frontier Center grants using the Green Bank Observatory. The Pulsar Search Collaboratory outreach project, a collaboration between WVU and the Green Bank Observatory, has engaged more than 2,000 pre-college students in hands-on science, and about 50 percent of these students come from underrepresented groups. Without Green Bank, many of these students would never be exposed to the type of hands-on work a researcher in the field does daily - and exposed to STEM fields.</p>	Against Closure	Email - Scanned and Letter-mailed	11/17/2016	WV House Delegation Green Bank EIS Comments.pdf

Green Bank Observatory -Written NSF Public Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
424	c	Geoffrey	Hempelmann	Legislative Assistant	<p>The Green Bank Observatory' s impacts expand far beyond educating our youth. At peak season, the facility becomes the largest private employer in Pocahontas County, West Virginia, employing about 140 people. These employees are responsible for a \$17 million economic impact in the county and state. Because Green Bank is in West Virginia, 50,000 people visit the beautiful mountains of Pocahontas County. These visitors spend time in our state, eat meals at our restaurants, s hop our small businesses, and stay overnight. The tourists contribute an additional \$ 12 million every year to the local economy. At a time when West Virginia is hurting economically, Green Bank is contributing more than its share, adding \$30 million to the local and state economy.</p> <p>West Virginia needs places like Green Bank. The Green Bank Observatory is a shining beacon for our future and hope in our state. It is creating job opportunities for West Virginians, giving out students unparalleled looks into careers in STEM, and enabling cutting-edge scientific research. The Green Bank Observatory must remain fully operational so that future generations of West Virginians and Americans ca n be inspired to look toward the stars and make discoveries that will redefine what we know about our universe.</p>	Against Closure	Email - Scanned and Letter-mailed	11/17/2016	WV House Delegation Green Bank EIS Comments.pdf
425		Geoff	Heberlein		I know Science is a hard field to invest in, but we are starting to see the effects of our country not putting the money into getting more people to follow jobs in science. Our grip on high tech jobs is slipping bad. We have to stop the hemorrhage while we still can. The facility is still used a lot and is doing great research and now is not the time to throw in the towel. With China surging hard onto the scene we need to do everything we can to keep America first. We need to lead before we end up like the Roman Empire. A power of the past	Against Closure	Email - Scanned	11/17/2016	
426	a	Bruce	Randall		<p>I am a member of SARA (Society of Amateur Radio Astronomers) and visit there once a year for the SARA conference.</p> <p>The options apparently range from keeping operation normal to total closing of all. I would like to see all operations there continue. I would be very disappointed if any instruments were torn down.</p> <p>The GBT is a world class instrument. There is no other instrument in the world that can do the science research that it can. It is the largest fully steerable radio telescope in the world. A priority should be made on keeping this instrument operational. I suspect partial funding could be available from both governments and research organizations around the world.</p> <p>Please consider your decision carefully. The GBT is a unique, cutting-edge instrument unlike any other in the world. The history, research, education and support provided by this institution is unlike anything else.</p> <p>Fully funding the GBO may not be possible, but partially funding it until the staff can build a consortium of interested researcher institutions surely is.</p>	Against Closure	Email - Scanned	11/17/2016	
426	b	Bruce	Randall		<p>The 40 ft. telescope that is a rather old instrument has trained many young people on how to use a scientific instrument. Its usage seems to run quite heavy as the SARA group is often competing with various high school and college groups for the use of this telescope. I believe this telescope has decades of use as an educational tool and along with the GBT should be a high priority. It is an important training tool for our future scientist and engineers.</p> <p>The other instruments on site need to be mothballed if funding cannot be found for them. In no case should an instrument be destroyed!</p> <p>The visitors center supplies needed science education to the American public. It seems many visitors happen onto the observatory while traveling through and then proceed to learn something about the science of the universe. They also have a good time while learning something.</p>	Against Closure	Email - Scanned	11/17/2016	
427		Fred	Giggenbach		<p>5 possible management scenarios: I choose option number 1.</p> <p>My public comment is for the Observatory to remain funded by the NSF as it has been in the past. It is a great asset to the local community and a leader in scientific advances.</p>	Against Closure	Email - Scanned	11/17/2016	
428		Joshua	Douty		<p>I would like to express my support for the NSF continuing to fund in whole or in part the GBT.</p> <p>The GBT is a shining beacon of science and technology in a state that is in desperate need. At the very least the NSF should continue to work with WVU and the WV state government to continue partial funding. I feel the science being performed at this site cannot be understated.</p>	Against Closure	Email - Scanned	11/17/2016	
429		Dave	Cohen		<p>A lot of good feedback here. I am giving a lecture to our Radio Astronomy club at a local high School, and will ask them to write a response as well. I am also planning my own response. I'm not sure if there will be an official SARA response, although there certainly should be. I would be happy to write one, as long as the officers are okay with that. I already crafted an official response to the FCC on behalf of SARA (on an unrelated topic). I guess it went okay.</p> <p>I'm at SARA's disposal on this one, I just need the "GO" command.</p>	General	Email - Scanned	11/17/2016	

Green Bank Observatory -Written NSF Public Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
430	a	Don	Latham		<p>The Green Bank Telescope (GBT), is presently the largest fully steerable radio telescope in the world. It cost 96 million dollars to build and has been in operation for only 13 years, hence is in excellent condition. The staff has continuously improved and maintained the facility.</p> <p>The telescope and grounds should be kept alive for several reasons:</p> <ul style="list-style-type: none"> -as a working telescope for scientific use, -as a working telescope for amateur use. (Kitt peak and the 100 inch are optical telescopes that function well this way), and -as a resource for public education involvement, through on-line and in situ programs. <p>Destruction or mothballing this outstanding facility would simply be a disservice to the nation and to the scientific community.</p> <p>I think I am asking for a truly deliberate action in the case of the GBT rather than a fund-grabbing operation. Interesting that Areceibo is under consideration as well.</p>	Against Closure	Email - Scanned	11/17/2016	
430	b	Don	Latham		<p>Surely there is a way to accomplish these ends using cooperation between NSF and the citizens it serves. In particular, two of the alternatives listed in the EIS can certainly be combined, that is are not mutually exclusive:</p> <p>Collaboration with interested parties for science- and education-focused operations with reduced NSF-funded scope Collaboration with interested parties for operation as a technology and education park.</p> <p>There are public groups ready to assist in operations with labor and funds.</p> <p>There is always the possibility for international cooperation, especially in the scientific community.</p>	Alternatives Consideration	Email - Scanned	11/17/2016	
431		John	Wickline		<p>I would ask that you please consider keeping the Greenbank telescope fully functional and working. Not only does it provide jobs for the region, but it serves as an inspiration for students across our state to dream big and reach for the stars. My son visited there as part of a field trip in the fourth grade, and he is now pursuing a science degree. I would hope there are countless others who visited there and are now studying ways to search the stars.</p> <p>These jobs are ones that cannot leave the United States for foreign lands. To teach our future astronomers, we need science teachers. We need engineers to design and build telescopes, biologists, geologists, etc. Space exploration and study once launched America to the forefront under Kennedy. We can do it again and do it even better because we now know the technology exists.</p>	Against Closure	Email - Scanned	11/17/2016	
432	a	Daniel	Keeney		<p>I ask that, beyond questions raised as to compliance with the intent and purpose of the public scoping process, you reconsider any thoughts to close the Green Bank Observatory, which is and has been of such importance to all.</p> <p>Beyond the direct benefit to science, the greater concern for society should be the inspiration of our children: Have considered the GBO's impact upon them? As to the unimaginable possibility that the National Science Foundation might actually erase this treasure from our world? The impact upon places of historical importance are obvious: Green Bank Observatory IS one, in and of itself.</p> <p>The NSF may choose to close Green Bank, or even dismantle it and perform site restoration, effectively erasing much more than a treasured monument of historical significance. After all ... it is still being useful and productive, even as I type today.</p>	Against Closure	Email - Scanned	11/17/2016	Save-Green-Bank-Observatory.pdf
432	b	Daniel	Keeney		<p>""The purpose of the public scoping process is to determine relevant issues that will influence the scope of the environmental analysis, including identifying viable alternatives.""</p> <p>Insufficient time has been given for the public to even become aware that the NSF may close, or even dismantle, the GBO (i.e. the same reporter at the Charleston [WV] Gazette that covered the October 18 changes did not report of your October 19 filing until 10 days before these meetings were to take place).</p> <p>Please do see: http://slatyfork.us/Save-Green-Bank-Observatory (also attached .pdf copy of this page)</p> <p>On October 19, the National Science Foundation (NSF) filed notice in the Federal Register¹ that it was initiating the public scoping process² for a ""Draft Environmental Impact Statement"" regarding the Green Bank Observatory (GBO), as not reported until October 31 by the same reporter.</p> <p>Dr. Karen O'Neil, Director of GBO, explained this to be a ""standard part of the divestiture recommendation process,"" and ""...was not aware that [they] would need to go through this [process with the NSF]."" None of us were.</p>	General	Email - Scanned	11/17/2016	Save-Green-Bank-Observatory.pdf
433	a	Kelsi	Boyd		<p>I'm a young business owner in West Virginia. I recently left my job as a research analyst in order to start up my own "green" company. More so, I've been helping other young individuals engage in entrepreneurship to help bring diversity to our state. You see, being a woman in West Virginia isn't easy. There are a small group of individuals in my community that share the same beliefs and appreciation for science as I do. We are in desperate need of creative individuals with innovative ideas to help stimulate our economy. As much as we need to prove to ourselves that we are and can be a progressive society, we need others to acknowledge this, too. The GBT supports a forward way of thinking. For many, it provides jobs, but for the rest of us, it serves as a symbol and a reminder of how far we have come. I'm asking that you please not take this away from us, because we are already struggling.</p>	Against Closure	Email - Scanned	11/17/2016	

Green Bank Observatory -Written NSF Public Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
433	b	Kelsi	Boyd		We need to encourage the state's youth to engage and participate in STEM fields. If you take this away, it will be another loss that will contribute to the region's overall sense of defeatism. Right now, we need to be inspired, and we need to direct our children towards a brighter future. The GBT can help us do that.	Against Closure	Email - Scanned	11/17/2016	
434		Brian	Kent	NRAO Scientific Staff	<p>As options are considered for "Section 106 Consultation for Proposed Changes to Green Bank Observatory Operations", I wish to voice my experience with Green Bank, underscoring its importance with the forefront of scientific research and STEM initiatives.</p> <p>As a West Virginia native and WVU undergraduate I as given the opportunity to be an NSF Research Experiences for Undergraduates (REU) student in 2002 at Green Bank. Working with the scientific staff afforded me valuable and practical research experience that inspired me to become a professional scientist and astrophysicist. It started me on a path of technical knowledge and understanding that has served me well throughout my early career, becoming an NRAO scientist and using our nation's astronomical facilities, including the Green Bank Telescope.</p> <p>Green Bank is an state-of-the-art institution for cutting edge research and development and source of pride for the state of West Virginia and the United States. STEM development activities are critical to the nation's infrastructure, and students MUST be provided the opportunities (as I was) to engage with working scientists, engineers and software developers outside of the classroom. Green Bank provides these opportunities to students from middle school through higher education.</p> <p>The expertise and institutional knowledge provided by the hardworking and dedicated Green Bank staff have made a huge difference in my career. No group of people are more committed to the operation and mission of a scientific facility. I must recommend the option of "Continued NSF investment for science-focused operations (No-Action Alternative)" for the future of Green Bank.</p>	Against Closure	Email - Scanned	11/17/2016	
435	a	Richard	White	Vice President, ViGYAN, Inc	<p>I am a 66-year old aerospace engineer from the West Virginia University class of 1972. I can directly trace my interest in science, space, and engineering to Green Bank.</p> <p>There are three major issues regarding Green Bank's ongoing operation - science knowledge; effects on science, technology, engineering, and math (STEM); and economic impact on West Virginia. While not all three of equal priority to NSF, they should be considered in what would be a momentous decision.</p> <p>1. This is an exciting time in astronomy and cosmology. The controversial decision to close the telescope, based on a desire to "" maintain money in the grants program [Daniel Eisenstein]"" , would appear to be shortsighted in light of the fact that grants do depend on having advanced facilities with which to conduct research. Having the world's largest steerable radio telescope meets the criterion of an important national resource. It should also be mentioned that other countries (such as China) are rapidly building/using facilities that match or exceed ours. It would be shortsighted to mothball or destroy the GBT.</p>	Against Closure	Email - Scanned	11/17/2016	
435	b	Richard	White	Vice President, ViGYAN, Inc	<p>2. Back to my earlier personal encounter with Green Bank: as a high school junior, one of the highlights of my young life (mid 60s) was a personal tour of the 140-foot ""polar mounted"" telescope, courtesy of a neighbor and his friend, a senior staffer at the observatory. I still remember the excitement of seeing the observatory and the 140- foot telescope up close; this solidified my interest in science and led to my career as an engineer. The importance of such ""big science"" facilities and projects cannot be exaggerated as we strive to interest K-12 students to pursue STEM careers. Do we really want the attendees at the WV National Youth Science Camp to see the GBT being disassembled because we "can't afford it?"</p>	Against Closure	Email - Scanned	11/17/2016	
435	c	Richard	White	Vice President, ViGYAN, Inc	<p>3. Aside from the obvious and critical economic importance of the GBT to Pocahontas County and surrounding areas, the observatory and the GBT plays a critical part in supporting West Virginia as a place for other than coal mining. Regardless of your political affiliations, it is obvious that other economic opportunities must be made available to its citizens in the future; Green Bank offers an example and a magnet for future higher-tech economic growth for the state.</p> <p>My recommendation would be some blend of options 1 through 3. While operations as originally intended (option 1) would be preferable, in light of the current fiscal environment some compromises that would keep the GBT open and functioning are acceptable. The GBT is an invaluable national asset and it is vital that it be kept open to make the discoveries of the future.</p>	Against Closure	Email - Scanned	11/17/2016	

Green Bank Observatory -Written NSF Public Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
436		Paul	Vanden Bout	NRAO, retired	<p>I am writing to urge continued support by the National Science Foundation (NSF) of the Green Bank Observatory (GBO), specifically, the 100-meter Robert C. Byrd Green Bank Telescope (GBT), for astronomical research. The NSF is to be commended for its long, strong support of radio astronomy. NSF's founding of the National Radio Astronomy Observatory initiated the development of facilities that are envied around the world. NSF and NSF alone is responsible for this achievement. Among these facilities, is the GBT - the largest fully steerable telescope in the world, with an offset feed that minimizes source confusion by providing a clean beam, and an adjustable surface that operates efficiently to wavelengths as short as two millimeters. It's site in the National Radio Quiet Zone is also unique, offering excellent protection from radio interference. The GBT is far more capable today than the time of NSF's Portfolio Review (arXiv 1610:02328). This observing power was achieved at considerable expenditure of NSF funds and effort. I suggest that it is imprudent to abandon it prematurely, long before it is superseded by facilities yet to be built.</p> <p>In my opinion, the high-priority applications for which the GBT is particularly suited are:</p> <ul style="list-style-type: none"> · The study of pulsars, which informs fundamental questions in nuclear physics, and which is a potential means for detecting gravity waves; · Global Very long Baseline Interferometry, for which it is a large aperture anchor, essential at millimeter wavelengths to the Event Horizon Telescope; · Spectroscopy at all wavelengths, providing "zero-spacing" data complementary to the interferometric data of the Jansky Very large Array and AIMA. Details on research applications can be found in arXiv 1610:02328 and arXiv 1610>09014. <p>Of the five preliminary alternatives to be considered in refining the Environmental Impact Statement regarding the GBO, the first two alternatives allow for future use of the GBT in astronomical research. The first alternative is highly preferable in that it allows for the maximum use of the GBT for astronomical research. The second alternative might allow for limited research on the top priority applications, but only if very carefully managed, for example, by NSF supporting the total operations and "selling" telescope time for non-astronomical purposes to partially offset their costs through interagency transfers. (I note that radio telescopes managed by organizations whose prime mission is non-astronomical have had difficulty producing significant results in astronomy. The prime examples are the Haystack Observatory 37m Telescope and even more the Deep Space Network 70m telescopes.)</p> <p>In conclusion, I urge NSF to adopt the first alternative. It maximizes the scientific return and continues to provide an opportunity, especially for young people, to conduct research and publish results whether or not they have an NSF research grant or any other research support.</p>	Against Closure	Email - Scanned	11/17/2016	
437		Nils	Linz		<p>My name is Nils Linz and I'm a M. Sc. student at the Argelander-Institute for Astronomy in Bonn (Germany).</p> <p>I am writing in strong support of continued full science operations of the Green Bank Observatory. I would like to concur with the points raised in the support letter sent by Dr. Karim (from my department) on November 7 2016.</p> <p>Being in the early stages of my career, I would like to stress that my longterm science goals will hugely benefit from the unique capabilities offered by the Green Bank Observatory.</p>	Against Closure	Email - Scanned	11/17/2016	
438		Brandon	Curnutte		<p>I am writing to express strong opposition to closing the Green Bank Observatory. This facility is keeping West Virginia and the United States on the forefront of discovery and closing the facility would be devastating to my home state, our great nation, and the scientific community as a whole. We would not only lose jobs, West Virginia would lose it's place among scientists and astronomers around the world. Please, do what you can to keep this facility going for the sake of our state and our nation.</p>	Against Closure	Email - Scanned	11/17/2016	
439	a	Sue	Helton	Pocahontas County Commission	<p>As you know, the National Science Foundation (NSF) is in the process of preparing an Environmental Impact Statement addressing the future of the Green Bank Observatory (GBO) located in northern Pocahontas County, West Virginia. The Pocahontas County Commission is writing this letter to urge the NSF review committee to consider retaining the existing operation of the facility. The role of the GBO is one of the components to the advancement of science, engineering and educational opportunities at the facility itself, as well as in the classrooms around the world. This Commission truly believes that educational opportunities and science research advancements offered by the GBO are deserving of future investment of this facility at the national level.</p> <p>It is the Commission's hope that the National Science Foundation will determine to continue to invest in science-focused operations at the facility (No-Action Alternative). By continuing the operation of the GBO, the National Science Foundation will assure science, engineering and educational opportunities well into the future.</p> <p>In closing the Commission wishes to express its full support for the ongoing research of science and education provided by this facility, and urges the National Science Foundation to continue to invest in the operations at the Green Bank Observatory.</p> <p>William S. Beard, Jr. President</p>	Against Closure	Email - Scanned	11/17/2016	
439	b	Sue	Helton	Pocahontas County Commission	<p>The Green Bank Observatory employs approximately 100 full-time employees (60% of whom are local residents) and significantly more employees during the summer. Its workforce contributes approximately 11 million dollars to our local economy. Additionally, the nearly 50,000 visitors/tourists to the facility each year have a great economic impact on all of Pocahontas County. The loss of this facility and the jobs it provides will have a catastrophic effect on our County as well. Suspension of operations in a manner such that operations could resume at a future date or deconstruction and site restoration will most certainly create adverse environmental impacts on our communities' abilities to survive.</p>	Against Closure	Email - Scanned	11/17/2016	letter of support for green bank observatory 11-15-16 scan.docx

Green Bank Observatory -Written NSF Public Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
440	a	Rachel	Friesen	Dunlap Fellow Dunlap Institute for Astronomy and Astrophysics	<p>I am writing in response to the announcement of a public comment period for the planned environmental impact statement and proposed changes to Green Bank Observatory (GBO) operations. I am a Canadian citizen and am currently based at the University of Toronto in Canada, but was previously employed in the United States as a postdoctoral fellow and may return to the US in the near future.</p> <p>I have been a user of the Green Bank Telescope (GBT) throughout my career. As a graduate student in Canada, my PhD thesis depended strongly on analysis of GBT observational data. I benefited greatly from the hands-on nature of GBT operations, traveling to the GBO site multiple times - first for my own training, and later to train others. This type of telescope operation is quickly becoming more rare, but is incredibly beneficial to students. Students take ownership of their scientific research from data acquisition to published article, and gain a deeper understanding of the technology that enables their science. Because of this experience, GBT users may also go on to careers building instruments, either in astronomy or in private industry.</p> <p>These observations were, and still are, simply not possible with any other radio telescope. The GBT is the world's largest fully steerable radio telescope. It can thus view a larger fraction of the sky than larger, fixed radio telescopes like Arecibo. It is located in a protected, radio-quiet zone. Because of the GBT's active surface and large and varied instrumentation suite, its sensitivity and capabilities are unparalleled, even compared with similar-sized dishes like Effelsberg. At the shorter centimetre and millimetre wavelengths, NSF-supported instrumentation development has enabled the fast, sensitive mapping of large areas of the sky in just the past few years. The promise of these new receivers and spectrometer, unavailable during previous evaluations of the GBT, has not yet been fully realized. Furthermore, at these wavelengths the GBT is a critical complement to the Atacama Large Millimeter/submillimeter Array (ALMA). The GBT is able to detect the large-scale structures that remain invisible to the interferometer, providing needed context to ALMA's exquisite high-resolution results. More generally, the GBT and the Jansky Very Large Array (VLA) share the same synergy. There is no other telescope that can provide the same complementarity to either ALMA or the Jansky VLA.</p> <p>The GBT is a very young telescope, and was completed only sixteen years ago. It has enabled many new discoveries about our universe, on topics as varied as the fundamental physics of the Universe to the formation of our own solar system. I am confident that the GBT will be instrumental in many more if open science time continues to be made available. Without NSF support at previous levels, the search for alternate funding has already decreased the amount of telescope time available to researchers. Overall, the GBT is in danger, due to the lack of available long-term funding sources other than the NSF. I request strongly that the NSF reconsider maintaining support of this unique, scientifically-important facility.</p>	Against Closure	Email - Scanned	11/17/2016	GBTletter.pdf
440	b	Rachel	Friesen	Dunlap Fellow Dunlap Institute for Astronomy and Astrophysics	<p>As a postdoctoral fellow in the USA and now in Canada, I have continued to utilize the GBT to advance my scientific goals. To date, postdoctoral fellows such as myself have been able to compete for significant amounts of GBT observing time to address key questions in astronomy. Right now, I am the Primary Investigator of one such Large Program, leading a team of approximately two dozen Canadian, American, and international collaborators, including multiple undergraduate and graduate students. I am currently searching for a permanent position as a University faculty member or research scientist at an observatory. If I am successful, it will be in no small part due to my ability to lead such a project. The cut in National Science Foundation (NSF) funding to the GBT is already impacting significantly the amount of time that is allocated to 'open-skies' science, making this kind of opportunity for early career researchers, like myself, significantly more rare.</p> <p>Astronomy makes people excited about science. The GBO has led an impressive program of Science, Technology, Engineering and Mathematics (STEM) education to the general public, and students of all ages. The GBO's efforts to bring STEM outreach to underrepresented minorities and women are wonderfully successful and sorely needed. The GBT dominates the GBO site, and is thus a cornerstone for the GBO's excellent public education programs that attract thousands of people each year.</p>	Against Closure	Email - Scanned	11/17/2016	GBTletter.pdf

Green Bank Observatory -Written NSF Public Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
441		Chelsea	Walker	Events & Group Coordinator	<p>I ask that you continue to support the GBO through options #1) continued NSF investment for science- focused operations (No-Action Alternative) or option #2) Collaboration with interested parties for science- and education-focused operations with reduced NSF-funded scope. Options #3) mothballing of facilities, #4) deconstruction and site restoration and #5) collaboration with interested parties for operations as a technology and education park, are unacceptable and would negatively affect not only the community, but the various industries that the GBO impacts annually.</p> <p>Here at the Pocahontas County Convention and Visitors Bureau, we are committed to framing Pocahontas County as an ideal tourist destination for families both looking for exciting outdoor adventures and unique, one-of-a-kind experiences. For years, the Green Bank Observatory has remained one of the most popular and sought after attractions our great county has to offer. While the predominant purpose of the Green Bank Observatory is not tourism, the Green Bank Observatory hosts over 50,000 visitors each year who spend roughly 7.5 million dollars annually. In a county where the population is sparse, with only 8,719 residents, the revenue that the Green Bank Observatory contributes to the community is exponential.</p> <p>In a rural area, we are limited on what we can market to the average tourist. We are lacking in conveniences such as shopping, cell phone service and large highways. Destinations such as the Green Bank Observatory, the Cass Scenic Railroad and Snowshoe Mountain Resort appeal to many visitors, both nationally and internationally. Removing one of these attractions, especially one as popular as the Green Bank Observatory would staggeringly impact the tourism industry in our county. As an industry that contributes over \$100,000,000 to the economy, negative impacts such as mothballing tourist attractions such as the Green Bank Observatory cannot happen.</p> <p>At the Pocahontas County Convention and Visitors Bureau, we strongly urge the National Science Foundation to support alternative actions #1 or #2. The proposed implementations #3, #4 and #5 would ergo detrimental affects to the tourism industry, businesses and even local schools here in Pocahontas County. Not only would these proposed changes affect socioeconomics, they would harm health, safety, education and cultural aspects of our community as well.</p> <p>The Pocahontas County Convention and Visitors Bureau asks that National Science Foundation continues to support the Green Bank Observatory through funding. The benefits that an entity such as the Green Bank Observatory brings to not only Pocahontas County, but the state of West Virginia is tremendous. The Green Bank Observatory hosts thousands of visitors annually, and provides families in our local community with comfortable and sound careers. I strongly urge the National Science Foundation to take into consideration all of the wonderful advantages that arise from funding a special site such as the Green Bank Observatory.</p>	Against Closure	Email - Scanned	11/17/2016	GBOletterofSupport.pdf
442		Mark	Riggs	Associate Professor Astronomy, Mathematics, Physics, and Statistics Ashland Community and Technical College	<p>As a community college faculty member in a neighboring state I strongly support the first option:</p> <p>Continued NSF investment for science-focused operations (No- Action Alternative)</p> <p>The Green Bank facility has provided many profession developmental through hosting the Society of Amateur Radio Astronomy (SARA) conferences and University of Dayton classes. The facility is also important in this area for hosting the Star Quest optical star party.</p>	Against Closure	Email - Scanned	11/17/2016	
443		Benjamin	Magnelli	Argelander-Institut fur Astronomie, Universitat Bonn EU ALMA Regional Centre (German Node)	<p>I am writing in strong support for ongoing regular, ideally internationally open-sky science operations at the Green Bank Observatory (GBO). The Green Bank Observatory constitutes an important cornerstone for my scientific strategies and those of my broader scientific community. In particular, next generation instruments like the MUSTANG-2 bolometer array, offer unprecedented survey capabilities when used in combination with this large dish.</p>	Against Closure	Email - Scanned	11/17/2016	
444		Dwayne	Shiebel		<p>I was sorry to read that the NSF would even consider to destroy the GBT. It is such a good antenna there has to be many uses for it. It would be best if the NSF would do the first option, no-action alternative. The next best would be the second option. All other options would end the GBO as we know it today.</p>	Against Closure	Email - Scanned	11/17/2016	

Green Bank Observatory -Written NSF Public Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
445		Anton	Zensus	Direktor - Max-Planck-Institut für Radioastronomie	<p>Herewith we suggest the continuation of GBO operations and we provide a justification based on its importance for mm-VLBI science. The use of the GBO in Very Long Baseline Interferometry at .millimeter wavelength (mmVLBI) is essential for high-fidelity imaging of the vicinity of black holes (BHs) and for studies of the origin of extragalactic radio jets. In VLBI the technique of earth rotation aperture synthesis is used. This requires that participating telescopes continuously observe the target source tracking on time scales of 6-12 hrs for a given VLBI experiment. Global VLBI at 3mm wavelengths provides highest angular resolution (down to 50 microarcseconds) in a spectral domain where synchrotron-self absorption becomes smaller. Therefore mm-VLBI can map compact radio sources and the jet formation in Active Galactic Nuclei (AGN) with unsurpassed spatial resolution. Spatial scales of 5 gravitational radii are reached in the case of SgrA* and M87. This allows us to probe regions in the ultimate vicinity of the nearest extragalactic Black Holes. In more distant AGN, the broad line region (BLR) is reached. The mm-VLBI imaging of the BLR facilitates a better understanding of the high- and very-high energy gamma-ray emission in AGN. At present 3 mm VLBI is performed either with the Long Baseline Observatory (LBO, former Very Long Baseline Array, VLBA) or more globally with the GMVA (Global Millimeter VLBI Array). The later combines the European telescopes with the LBO, the GBO and ALMA. Similarly to the LBO and ALMA, the GMVA is operated under open skies policy and relying on the contributions of the participating observatories. In order to operate ALMA as a 'single' VLBI telescope, the VLBI phasing capability was recently added in a large international effort (so called APP =Alma Phasing Project). The implementation of the VLBI phasing for ALMA since cycle 4 is motivated not only by adding ALMA to the mm-VLBI networks, but also by the need to further improve the sensitivity. In an interferometer optimum sensitivity can only be achieved, if the collecting area on both sides of the interferometer arm is increased. Without the large collecting area of the GBO, the investment into the VLBI phasing capabilities of ALMA would not be as beneficial as original intended and proposed. 3 mm VLBI observations are also important to complement 1mm VLBI imaging with the EHT (Event Horizon Telescope), which consists of a smaller number of telescopes and consequently will deliver VLBI images of lower fidelity than achievable by the GMVA. The combination of the VLBI maps provided by the two arrays allows to determine the spectral shape and Faraday rotation (between 3 mm and 1 mm) of the ultra-compact emission regions near the BH. In particular, polarimetry and Faraday rotation analysis will depend critically from the array sensitivity, and ultimately from the availability of the GBO. The Faraday rotation analysis will determine the particle composition (leptons vs. protons) and the magnetic field strength near the event horizon and in the jet-launching region of super-massive BHs. The future and continued participation of the GBO in 3 mm VLBI therefore is not only important due to its substantial sensitivity enhancement, but also in combination with observations of ALMA and the Event Horizon Telescope (EHT), which observes at 1 mm wavelength. In the past, the GBO has been an important partner for VLBI with different arrays, such as the Global Array (cm-VLBI), the HSA and the GMVA. At 3mm wavelength, only 8 out of the 10 LBO telescopes are equipped with 3mm receivers. Since at 3mm wavelength the sensitivity requirements are higher than at the longer wavelengths, the GBO has a particularly strong impact. It compensates for the loss of 2 LBO stations, it adds missing uv-coverage and sensitivity. The combination of the GBO with the LBO at 3 mm not only adds a VLBI station in the North-East (Hancock has no 3mm receiver), but it lowers the baseline detection limit by a factor of 5-6 over that of the standalone LBO. In combination with the sensitive European telescopes (IRAM, Effelsberg), the GBO even pushes the detection threshold down to 30 mJy, which is a factor of 3-5 better than on corresponding IRAM-LBO baselines. In combination with ALMA, the LBO offers initial fringe detection on the 30 mJy level, while the addition of the GBO yields 8 mJy, a factor of 4 better.</p> <p>VLBI imaging heavily depends on the closure phases and their accurate measurement with high enough SNR. The so-called global fringe fitting (GFF) algorithm is used to recover the station based visibility phase using a least-square fit approach on the combination of the baseline solutions over all possible station triangles. The success of the GFF depends on the sensitivity of the reference station, a role usually taken by the GBO. It allows to recover weak interferometry signals to a remote station, e.g. on any triangle between Hawaii, one continental LBO station and the GBO.</p> <p>We further note recent successful 3 mm VLBI experiments, in which the GBO, the Large Millimeter Telescope (LMT) and the VLBA (now LBO) observed for the first time non-zero closure phases for SgrA* (the BH in the center of our Galaxy). The addition of the GBO in such triangles lowers the phase noise by about a factor of 2. Another factor of 2 will be gained, when the GBT, the LMT and ALMA are combined in the near future.</p> <p>In summary, we note that the GBO is a critical element in 3 mm VLBI, whose loss would not only substantially limit present and future research on BHs, but also affect the efficient use of ALMA in mm-VLBI. Furthermore, high fidelity 3 mm VLBI with a better uv-coverage, may be essential to understand and interpret the expected results at 1.3 mm from the EHT. Since (for logistical reasons) global 3mm VLBI is performed less often than VLBI at longer wavelengths, the observing time demand for global 3mm VLBI with the GBO would be comparatively low (approx. < 170 hrs/yr). We therefore ask not to discontinue the use of the GBO in combination with the GMVA.</p>	Against Closure	Email - Scanned	11/17/2016	N/A
446		Tom	Hagen	Vice President, Society of Amateur Radio Astronomers	<p>My name is Tom Hagen and I'm Vice President of the Society of Amateur Radio Astronomers. SARA has been holding its annual conference at GBO since the 1980's and we would certainly be disappointed if GBO were no longer available for our meetings. We have had a wonderful relationship with the staff over the years and we consider access to this venue to be a great inducement for members to join SARA.</p> <p>I personally have many fond memories of GBO since I joined SARA in 2010. The opportunity to use the 40 foot telescope is truly outstanding as are the tours up to the top of the GBT. I have noticed that there is a lot of traffic to the visitor center and that the public really appreciates the opportunity to learn about radio astronomy too.</p> <p>GBO is most decidedly valuable as an educational and technological facility and it would be a shame for our country to lose this fabulous and historic place.</p>	Against Closure	Email - Scanned	11/17/2016	
447	a	Terry and Dodi	Shore		<p>We do not need to remind you of the cultural and historical significance of the Green Bank Observatory. That heritage is well established and forever will be a part of the scientific community's group memory. And while we understand that the reasons for soliciting public input on the fate of the observatory are budgetary and concern the ability of the NSF to adequately fund future science, that history must be a consideration in any determination of the value of Green Bank.</p>	Against Closure	Email - Scanned	11/16/2016	
447	b	Terry and Dodi	Shore		<p>We do hope to remind you, however, of the present significance of the facility. The Robert C. Byrd Green Bank Telescope, brought online just sixteen years ago, is just as vital to astronomical discovery today as it was when it heard its first pulsar. Its sensitivity, scalability, and versatility are unmatched in the world, and astronomers continually compete for research time on the GBT. In support of that instrument, the observatory has developed world-class engineering and operations teams, known for innovative solutions and quality craftsmanship. Then there is the unique, protected location of the campus itself. Few places on earth can compete with the NRQZ, allowing virtually unmatched clarity for radio wavelength research.</p> <p>In the New Worlds, New Horizons decadal survey, much has been made of the need to safeguard funding for new research at new facilities. We would hope that instead of relegating the Green Bank Observatory to its well-deserved place in history, you would see it as a perfect location for that new research. If new facilities are needed, construct them here! If cutting edge instruments are planned, build them here! If new ideas need development, nurture them here! Use this place. Work this place. Allow Green Bank to continue to lead and innovate the way it has for more than half a century. The foundation for the future is already laid in Green Bank. You just need to build upon it.</p>	Against Closure	Email - Scanned	11/16/2016	

Green Bank Observatory -Written NSF Public Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
447	c	Terry and Dodi	Shore		No discussion of the Green Bank Observatory can be had without consideration of its impact on the scientific mind of the public. To our knowledge, the outreach and educational achievements of the organization are unmatched anywhere. Students from grade school through university enjoy eye-opening exposure to science and the opportunity to engage in real discovery – in many cases cementing their futures in the field of astronomy. Untold future PhDs have felt their scientific curiosity quicken here, setting them on a path of discovery they otherwise would not have known was possible.	Against Closure	Email - Scanned	11/16/2016	
448		Douglas	Cook		I am writing to voice my opinion in favor of continued NSF investment for science-focused operations (No- Action Alternative) for the Green Bank Observatory in West Virginia. Some of the reasons include: · GBT is the world's largest steerable radio telescope · location, location, location- West Virginia is within 500 miles of more than half of the U.S. population (wvcommerce.org) including reasonable driving distance to Washington D.C. · Being close to population centers yet in a remote area is ideal in an age of increased vulnerability of infrastructure assets · Desperately needed economic anchor in an economically disadvantaged area (Appalachian Regional Commission data) · Too much invested in infrastructure to throw it all away Infrastructure spending was frequently mentioned in the recent Presidential campaign, including maintaining existing infrastructure. I feel confident that creative ways of funding the continued operation of the Green Bank Observatory can be secured to avoid the tragic loss of this most valuable research center.	Against Closure	Email - Scanned	11/16/2016	
449		Catherine	Lally	Jet Propulsion Laboratory Earth Science and Technology Directorate Sentinel-6 SWOT Jet Propulsion Laboratory	My name is Cathy Lally and I am a native West Virginian currently working at the Jet Propulsion Laboratory in Pasadena, California. During my previous work experience at the NASA West Virginia Space Grant Consortium, I became very familiar with the Green Bank Observatory and had the opportunity to spend a weekend there during a board of director's meeting in 2012 (see attached photo). Recently, I became aware that the National Science Foundation will be evaluating the environmental impact of the GBO which will result in operational changes at the facility. Obviously, I am concerned about the "deconstruction and site restoration" option and here is why: 1. The Observatory is crucial for maintaining STEM (Science, Technology, Engineering, Mathematics) outreach and opportunities in the state of West Virginia. 2. The Green Bank Telescope is a historical landmark. 3. The Observatory is a source of pride for the state of West Virginia. The people of West Virginia are in dire need of support from the science community. Organizations like the NASA WV Space Grant have spent countless hours on cultivating STEM opportunities for children and adults in our state. To consider deconstruction of a facility that significantly aids in that effort would be a devastating blow to the state. The sense of pride that is associated with the GBO, as well as the historical importance, is undeniable and so obvious that it does not require explanation. I understand that operational changes at the facility are inevitable. However, I implore the NSF to not pursue the route of deconstruction. Thank you for your time and consideration regarding this matter.	Against Closure	Email - Scanned	11/16/2016	GBO.jpg
450		Jamie	Cutlip	Concerned citizen	I support the options that keep GBO operational as it is an important and unique asset to our great state. Please do not consider "mothballing" or deconstructing GBO. Many people and businesses can benefit from GBO remaining operational, and the amount of knowledge that could continue to be obtained from GBO studies is invaluable. Thank you for your time and consideration in saving GBO!	Against Closure	Email - Scanned	11/16/2016	
451		Leslie	McLaughlin	Resident	I am writing this email expressing my concern regarding the funding & support from the NSF for the Green Bank Observatory. It would be such a shame to see such a wonderful facility defunded and possibly shut down. This facility has served many over the years. The shutting down of this facility would be devastating to the community of Green Bank as well as Pocahontas County as a whole. It would create a ripple effect not only for the many people and families who would lose employment but also income for the surrounding businesses and funding for the schools. This facility and site are unique in nature. Why would an organization/foundation put money into a facility and then scrap it. Where is the common sense in this? Please do not defund the GBO but let it continue to allow it to serve the community, our state, our country and the world.	Against Closure	Email - Scanned	11/16/2016	

Green Bank Observatory -Written NSF Public Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
452		Michael	Busch	Research Scientist, SETI	<p>My name is Michael Busch. I am a planetary astronomer currently based at the SETI Institute, where I study near- Earth asteroids using radar and radio techniques. As part of this work, I have been a user of the GBT for the past 8+ years. I would like to emphasize the importance of continued science-focused operations at the Green Bank Observatory for asteroid science and for addressing the asteroid impact hazard. Radar observations have provided the best available information on the trajectories, shapes, and spin states for hundreds of near-Earth asteroids. Radar transmissions from the Arecibo Observatory in Puerto Rico and the Goldstone Deep Space Network site in southern California can provide images of asteroids in radar time delay and Doppler echo frequency with spatial resolution as fine as 7.5 m and 3.75 m respectively.</p> <p>However, for some potentially-hazardous asteroids, single-station monostatic radar observations with Arecibo or with Goldstone are either not possible or not desirable. For objects passing within 1-2 lunar distances of Earth, the round-trip travel time of the radar signal is less than the time required to switch from radar transmit to radar receive at Arecibo or Goldstone. Such radar targets, which always are classed as potentially hazardous because their orbits will bring them near to Earth's orbit again in the future, can only be observed in a bistatic configuration with one antenna transmitting continuously and a second antenna receiving continuously. The GBT has been crucial as the most sensitive telescope available for bistatic radar receive observations of many asteroids. One example is the 80-m-long potentially-hazardous asteroid 2015 HM10, which was observed with Goldstone transmit and GBT receive in July 2015: https://public.nrao.edu/news/pressreleases/radar-2015-hm10 . Following the radar observations of HM10, we are now able to rule out any possibility of Earth impact by it until at least 2427.</p> <p>Bistatic radar observations have an additional advantage over monostatic observations: monostatic delay-Doppler radar images are limited in frequency resolution to one over the round-trip-travel time to the asteroid, while bistatic radar observations are limited in frequency resolution only by rotational blurring as a radar target spins. For a number of small or slow-spinning asteroids, bistatic observations with GBT receive have provided detailed geologic information when monostatic observations would only have provided a one-dimensional measurement of the asteroid's extent along the radar line-of-sight.</p> <p>The information provided by bistatic radar observations between Arecibo or Goldstone and GBT is crucial for understanding the shapes, trajectories, and spin states of individual potentially hazardous asteroids. It also is important to understanding the overall properties of the near-Earth asteroid population, with implications for models of the early solar system and of the history of the asteroid belt over the past 4.5 billion years as well as for upcoming tests of asteroid-deflection technologies (the ARM and AIDA projects). The number of known near-Earth asteroids is increasing rapidly, with more than 15,000 objects now catalogued. There is a corresponding increased need for follow-up radar observations of potentially hazardous asteroids.</p>	Against Closure	Email - Scanned	11/16/2016	
453		Erica	L.		<p>From a high school student:</p> <p>The only time I have visited the Green Bank Observatory was in elementary school, but it was still something that sticks with me. The observatory is not only important for research, but education as well. Destruction of the Green Bank Observatory would be detrimental to the younger generations of West Virginia and the entire country.</p>	Against Closure	Email - Scanned	11/16/2016	
454		Michael	O'Brien	Director, Pocahontas County Homeland Security & Emergency Management E-911	<p>I am writing this email to express my concerns of the potential shut down of the Green Bank Observatory. Since its conception in the 60s the Observatory has been a great asset to the Community and Pocahontas County. It serves a Shelter for disasters (Red Cross Certified). This facility has the infrastructure to provide such a shelter with its staffing, generators and standalone city water system. We have used this facility in the past for many disasters and it always goes flawless. Some of the things we have used the facility for in the past is a place for the disabled to plug in their oxygen concentrators or a place to house incoming power company works to restore power during a major power outage. It has served as a command center during major events most rememberable being the February 2010 Navy helicopter crash on Cheat Mtn. This facility is the only source for a pressurized fire hydrant for nearly 8 miles (saving the local residents money on their home owners insurance). The air strip serves as a secure landing zone for medical flights. Having a secure landing zone has saved hundreds of lives including my own in 2011. The facility serves as first class training center for Emergency services.</p> <p>The radio interference team is second to none they have assisted 911 on numerous occasions with finding interference causes to the 911 radio system. Many people would think having the observatory within our county would be a hindrance to radio communications for emergency services. I would be lying if I said it didn't create some challenges but the personnel in the interference department always has the attitude of let's see what we can to make this work rather than simply saying no. A shut down of this facility would be catastrophic to Pocahontas County. I plead with you to find funding options to keep the facility open.</p>	Against Closure	Email - Scanned	11/16/2016	
455		Michael	Haid	Executive Director, WV Society of Professional Engineers	<p>let the record reflect that the WV Society of Professional Engineers supports the Green Bank Observatory and is hopeful that the powers that be keep the facility operational and productive.</p> <p>This facility is a tremendous asset for so many in the region, especially the nearby National Youth Science Camp.</p> <p>The region is identified with this amazing structure and it has become a legendary landmark in the community. To take it offiine would be a travesty.</p> <p>Thank you for consideration and for adding this comment to the public record.</p>	Against Closure	Email - Scanned	11/16/2016	
456		Matthew	Okasinski		<p>I toured the Green Bank Observatory as a delegate of the National Youth Science Camp in 1986. Those were the days before smartphones and Wifi were pervasive throughout our communities. Having a radio telescope facilities within the National Radio Free Zone fosters astronomical research that can't be completed elsewhere within the country. NSF should continue funding research at the GBO.</p>	Against Closure	Email - Scanned	11/16/2016	

Green Bank Observatory -Written NSF Public Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
457		Linda	Kerr		<p>I was privileged to be a part of an NSF grant - Investigating the Universe- while I was a junior high/ middle school teacher in Warwood, WV during the 90s. I can tell you that experience changed my life and the way in which I taught my science classes throughout the rest of my teaching career.</p> <p>Thankfully, Dr. Patricia Obenauf had the foresight and knowledge to write a grant to utilize the 40 foot telescope so teachers could get an idea of what true science / astronomy entails. My students were the beneficiaries of problem-based learning, collaborative approach, failure, success, exhaustive research, contact with actual working astronomers and authors of astronomy books. My experience at Green Bank translated into every area of science I taught. My certifications include biology, earth, physical science and home economics. Because of my experience, I was one of twenty-four teachers selected statewide to teach these science hands-on methods to hundreds of others throughout our state. The ramifications of continuing teacher training at Green Bank are far reaching and should be given grave consideration concerning the state of science and math education in our country.</p> <p>Please give all aspects of utilizing The Green Bank Observatory your deepest consideration. We are on the verge of making America great again. Please be a part of that process!</p>	Against Closure	Email - Scanned	11/16/2016	
458	a	George	Seielstad		<p>The GBT's uniqueness includes: (1) coverage of the full sky above the horizon (85 percent of the celestial sphere); (2) largest collecting area, providing the greatest sensitivity over that entire available portion of sky; (3) unmatched frequency range, 0.2-115 GHz, for a telescope in the world-class category; (4) location in the National Radio Quiet Zone; (5) a history of leadership in electronics development and installation, in particular low-noise receivers, spectrometers, and time-sampling devices; (6) open access to scientists from a variety of disciplines, institutions, and nations.</p> <p>A major advantage of all filled-aperture telescopes is their versatility. Because they have a single focal plane, changes in response to new scientific developments can be installed quickly and less expensively than on multiple-element arrays. This versatility maximizes flexibility for research avenues yet to be recognized, which is perhaps the most important investment a forward-looking NSF can make. The general-purpose GBT is poised to respond to the future discoveries that radio astronomy's past has provided in abundance.</p> <p>Multiple-element arrays are vital to radio astronomical research, but the spectrum of research they conduct relies heavily on information gained from single-dish research. Surveys over large regions of sky, or over the frequency spectrum, or in the time domain are essential to providing the targets for which arrays can explore the details. In addition, low-brightness, extended emission regions are heavily resolved by arrays and best studied by single dishes. Array measurements of many such diffuse regions rely for completeness on the so-called zero-spacing (i.e., single-dish) measurement. The Green Bank Telescope fulfills another vital contribution to arrays by being the most sensitive element in international very long baseline arrays. These continue to probe the frontier of science at the extremes of gravity, today's most exciting research area.</p>	Against Closure	Email - Scanned	11/16/2016	Green Bank Telescope.docx
458	b	George	Seielstad		<p>Lockman et al. (arXiv:1610.02329v1) and Bally et al. (arXiv:161009014v2) have made compelling cases for the science that can be conducted with the GBT. Most notable is that the science spans the disciplines of physics, chemistry, and, of course, astronomy. In addition, forefront engineering is involved. The astronomical community alone therefore may not be inclusive enough to weigh the GBT's value. A particularly relevant example is the new field of observational gravitational wave astronomy. The scientific world is at the dawn of a new tool for exploring the universe and the fundamental laws that guide it. The remarkable discoveries by the Laser Interferometer Gravitational-Wave Observatory (LIGO Scientific and Virgo Collaborations, Phys. Rev. Lett. 116, 061102 (2016)) need now to be augmented by detecting waves at periods to which LIGO and forthcoming space observatories are not sensitive. Pulsar timing is the best known way to explore periods of years. Removing the GBT from international pulsar-timing arrays would not only be a serious blow to a scientific field at its inception, but not understandable either.</p>	Against Closure	Email - Scanned	11/16/2016	
458	c	George	Seielstad		<p>Among the resource areas the NSF has identified in its public scoping process for potential impacts are cultural resources. Having lived nine years in Green Bank, West Virginia, I can testify that the observatory there, and now specifically the GBT, have enormous cultural significance to the state and region. The GBT is a source of pride to many West Virginians. It is the iconic image of big science in the state. For the National Science Foundation to eliminate its support adds to a narrative of the federal government ignoring WV's residents, if not belittling them. Damage to education would be especially pronounced. The observatory in Green Bank has been open to students at all levels, significantly as a place where they can experience the true practice of science as opposed to reading or hearing about how it is done. The observatory has also been a major museum and tour site for the general public. For the NSF to consider abandoning its support for the science severely undercuts the educational experience, signaling it will no longer be as inspirational as it has been for generations of West Virginia students. The Foundation risks declaring a state and region too scientifically impoverished to deserve support.</p>	Against Closure	Email - Scanned	11/16/2016	
459		Kurtis	Brown		<p>I have become aware that the National Science Foundation is considering the future funding of the Green Bank National Radio Astronomy Observatory. Whether to continue its full operation, or to reduce or entirely eliminate the facility. I understand recent Observatory funding has been reduced 60%, and that FY 2017-2018 funding may be reduced by another 30%.</p> <p>I strongly encourage you to continue fully funding the Observatory operation and to continue its vitally important science missions to explore space and discover as yet unknown universes.</p> <p>The Radio Astronomy Observatory in Pocahontas County is not only a source of pride to all West Virginians, but also a major asset to the greater science community.</p> <p>Please give consideration to my concerns and those of many others. Thank you.</p>	Against Closure	Email - Scanned	11/16/2016	

Green Bank Observatory -Written NSF Public Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
460		Robin	Sizemore		<p>This letter is to express support for the Green Bank Observatory (GBO). In fact, I urge funding at the highest possible level.</p> <p>As a teacher, I attended professional developments at the Green Bank Observatory, and the experiences picked up where my college courses left off. The facilities, educators, and scientists at Green Bank provided information and opportunities to educators from around the country. The content and pedagogy which was included in the programs enabled each of us to return to our classrooms with a better understanding of Earth and Space Science. And the first hand experiences and details about the Green Bank Observatory, the GBT, and science phenomena gave us credibility and impressed our students- not an easy thing today when educators compete with so many other distractions.</p> <p>My students visited Green Bank for an overnight field trip. They spent time in the Education Center and were taught to use the Forty-foot telescope. Over the course of the night, teams of students traveled to the telescope to collect data. In the morning, Education Director Sue Ann Heatherly guided the students through an analysis of their data. Some of my students later described the event as the best field trip they had ever been on.</p> <p>More recently, Green Bank has been the setting for the ESS Passport, an MSP funded, professional learning opportunity which assists West Virginia educators in understanding and implementing the new Earth and Space Science standards. Participants have spoken highly of the experience. During the West Virginia Science Teachers Association Conference last month, the participants presented a Share-a-Thon session. Many great ideas were described to and demonstrated for the other educators.</p> <p>I have mentioned just a few of the many services and opportunities which have been provided at the Green Bank Observatory over the years. It is necessary to provide such opportunities for educators and students if we are to instill a love and pursuit of science and STEM careers. And that is necessary to address our local, state, and national economic, environmental, and defense needs.</p> <p>Please keep these in mind as you make decisions about funding the Green Bank Observatory.</p>	Against Closure	Email - Scanned	11/16/2016	
461	a	Kathryn	White		<p>When the first mention of the divestment of the Green Bank Observatory occurred, the citizens of Pocahontas County and West Virginia as a whole were unsure of its implications. As the plan has moved forward and realization has set in many are appalled by the inconceivable lack of foresight involved in this decision. I wish to say I fully support option one.</p> <p>I could write to you about the importance of Green Bank Observatory from many perspectives: spouse of a GBO engineer, mother of two (who have worked at, researched and received scholarship support from this site), or as a science educator at the local high school. Instead I only wish to discuss some perspective and ask a question. When you tell people you are a West Virginia native the public perception does not immediately think of adjectives like highly educated or science oriented. That is the stereotype. From my own background which includes generations of coalminers, my family has produced doctors, nurses, biologists, engineers, and computer technology specialists. Stem fields are the hope of many who come from this tremendous natural laboratory called West Virginia.</p> <p>When my husband and I attend family functions here in West Virginia inevitably my brother-in-law who is a doctor wants to know "What is it exactly you do? What are my tax dollars paying for?" My husband is patient and instead of taking offense, he replies "We do science." As he explains the significance of the work at Green Bank he does more than offer a standard uninspiring explanation. It is then that his fervor for the scientific endeavors of Green Bank help engage and educate others about the amazing work done in this small rural setting.</p> <p>The first time I met my future mother and father-in law, residents of North Carolina, they remarked on how living in Green Bank was like living at the end of the earth. I didn't take offense to this. For when you walk out into the dark of the night and look up, what is revealed is the cosmos in all her glory, how can one disagree? What individual can look at the skies and not wonder about its origins and its secrets. Standing outside, the hum of the Green Bank telescope providing night "music" for viewing the stars, I think back to that comment and I know that my in-laws were so wrong. Green Bank is not the end of the earth but the entrance to our universe and the Green Bank Telescope the tool for unlocking its secrets. The Green Bank Observatory is vital for bridging the gap between the scientific exploration and the perceptions of the public.</p>	Against Closure	Email - Scanned	11/16/2016	
461	b	Kathryn	White		<p>Finally, I come to my question, if an agency is charged with "advancing science and engineering (S&E) in the United States across a broad and expanding frontier, " Why would it ever consider removing a facility that is doing that very objective? The Green Bank Observatory is not IBM or Apple where it seeks to place the next new gadget into the hands of the public or one of the big pharmaceutical companies where development of a new drug will rake in millions for their investors. This facility provides information and research opportunities that are available for all mankind. Is this not the very reason the National Science Foundation was created? So, why would an organization that is charged with protecting, advancing and encouraging science on new frontiers seek to walk away from an instrument and facility that embodies its own mission statement? Perhaps it's time this agency took a page from the book of medicine and "first do no harm." For these reasons, I strongly ask that you select option one. Thank You.</p>	General	Email - Scanned	11/16/2016	

Green Bank Observatory -Written NSF Public Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
462		Dwayne	Cochran		<p>I grew up on the high planes of west Texas, son of a WW II veteran who came home and did the best he could to provide for his family. I once asked Dad if we were poor and he told me no, we just didn't have any money. By the eighth grade, he told me I needed to have a dream, and he encouraged all of us to go to college, an opportunity which slipped away from him with the outbreak of the war. By the time I was going into high school I was interested in science and some of us guys decided to pile into a friend's truck and go see the McDonald Observatory. I will never forget how the astronomers there made us feel welcome and asked what we wanted to see. I wanted to see the canals on Mars. They brought me up, helped me adjust the settings and let me search. After several minutes of fruitless searching they told me that the man who wrote about the canals had used the same magnification and that Jules Verne's intent was to fuel the imagination about the possibilities of space exploration. That day made such an impression, that I went on to major in plasma physics at Texas Tech University.</p> <p>In my final years, I find myself living in the great state of West Virginia. The people here have been kind and caring. But I do see a real lack of critical, empirical thinking skills necessary to pursue careers in engineering, technology, or any other scientifically based 21st century profession. The chemical plants which used to line the Kanawha River, which provide an endless supply of scientifically trained mentors, have disappeared. The political thinking here has retreated to a longing for the past with fear and suspicion of the future. The Greenbank Observatory is a world class diamond in a stable of other worthy gems. I realize that funding cuts have to come from somewhere, but in a small state like West Virginia, there is no other scientific asset which could fill the void produced by its loss. I understand that the most recent research calls into question the validity of the premise upon which the closure would be based. So, as you must then necessarily review your determination, I would ask you, in addition to continuing the tradition of outstanding discovery, to think about the impact of snuffing out the one beacon of inspiration for countless children of the Appalachian Mountains as they search for their dreams. The future of science cannot be uncoupled from producing future scientists, or at least a scientifically literate electorate. I cannot think of another part of the country where the NSF could achieve a bigger bang for the buck.</p>	Against Closure	Email - Scanned	11/16/2016	
463		Gabriel	Norris	Virginia Class of 2020 Aerospace Engineering & Astronomy-Physics	<p>I am writing this to express my deep concern at the possibility that the Green Bank Observatory might lose funding. Beyond its sentimental value for me personally, I feel that there is still quite a lot of science that Green Bank is uniquely capable of doing. As the largest, steerable radio telescope in the world, as well as being nearly as far from human-generated RFI as possible, the GBT is immensely valuable in all fields of radio astronomy, including the search for signals from intelligent extraterrestrial life and studying the composition of nebulae.</p> <p>There is yet immense knowledge that we can gain from the cosmos; please consider continuing to fund the science done at the Green Bank Observatory.</p>	Against Closure	Email - Scanned	11/16/2016	
464		Ciprian	Sufitchi		<p>Thank you for the opportunity to express my opinion about the Proposed Changes for Green Bank Observatory Operations.</p> <p>As amateur astronomer and professional in IT and telecommunications, I strongly believe that the largest fully steerable radio telescope in the world should continue its journey to empower scientists, engineers and students to work at the outermost frontiers of knowledge. This is also a mission of National Science Foundation. With its unmatched sensitivity at higher frequencies, GBT is uniquely qualified to study molecular building blocks in nebulae and other gas clouds, probe the nature of matter at extreme densities, map diffuse clouds of intergalactic gas (only detectable in radio frequencies), calibrate cosmic distance scales, only to name just a few researching areas that the telescope is involved with.</p> <p>This instrument cost \$96 million to build and has been in operation for only about 13 years, and in this short period of time the list of scientific discoveries and support given to space exploration programs have made GBT bring shades of science fiction into reality. Considering the value of scientifically research and discoveries in astrophysics, a budget of \$10 million is very small, especially compared with other NSF projects and federal budget as a whole.</p> <p>Please also consider the message the NSF and United States would send to the public by only proposing to cease operations of the largest fully steerable radio telescope in the world, at a time when the Chinese Five-hundred-meter Aperture Spherical Telescope (FAST), now the largest radio telescope in the world, has just launched. If GBT would disappear, just think about what loss would be if other possible sources of intelligent extraterrestrial signals would need to be surveyed (just like Tabby's Star - KIC 8462852), and the most sensitive steerable radio instrument is no longer around. How could we, as humanity, miss that opportunity to detect life in the Universe?</p> <p>I urge the National Science Foundation to consider continuing full support to the GBT. A part of mankind's future depends on what space has to tell us. We must continue to discover and to do that we need tools such as the Green Bank Telescope and Observatory.</p>	Against Closure	Email - Scanned	11/16/2016	
465		Denzel	Buchner		<p>I am e-mailing with regards to the funding of the Green Bank Observatory. The Observatory project is a great scientific achievement. It's thus far contributed to great scientific discovery, and will continue to do so if given the opportunity.</p> <p>It is a project that inspires the young the become scientists and engineers, and as we all know, science and technology is one of the primary drivers of the economy. It is one of the reasons that the USA is as great as it is - because it is a global leader in science and technology.</p> <p>In the short term, the Green Bank Observatory employs many people who will become jobless if the decision is made to backtrack on the funding, which will further impact the local area and economy very negatively. These employees will have to look for jobs elsewhere, and would need to relocate, which in turn will drain the local economy and put pressure on the businesses and shops in the area.</p> <p>I implore you to please vote for the Continued NSF investment for science-focused operations (No-Action Alternative).</p>	Against Closure	Email - Scanned	11/16/2016	
466		Jennifer	Kendzior		<p>Please do not dismantle this ageing but still useful radio telescope. It still has many discoveries left to give us. \$10 million is practically pocket change for a facility of this value. Sell it if you must but please don't tear it down.</p>	Against Closure	Email - Scanned	11/16/2016	

Green Bank Observatory -Written NSF Public Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
467		William	Brezinski	Graduate Student, Glass Research Group, University of Arizona, Chemistry & Biochemistry	<p>I am writing today in regards to the funding of the Green Bank Telescope – a NSF facility that does double duty as a state of the art radio astronomy lab and a platform for STEM outreach to an under served, rural part of America. If the telescope installation is lost, it is not only a blow to astronomy but also to the children who will lose their only chance to see such magnificent display of science in action.</p> <p>I grew up in Athens, West Virginia, just a few hours away from the Green Bank Observatory. I visited the site shortly after it's opening when I was just twelve years old. I can still remember the awe I felt seeing the scale of the place – it seemed to hum with an energy made of equal parts curiosity and discovery. It was something I had never felt before, at least not to that degree. It's the same energy I feel today when I step into my lab at the University of Arizona to pursue my Ph.D. in chemistry.</p> <p>That trip to Green Bank was the first – and only – exposure to a real research centre that I would have. Situated in one on the least populous counties west of the Mississippi, the observatory provides an opportunity for kids with an interest in science to see what is possible. It shows that there are opportunities beyond their small town, beyond their state, beyond even our own limited understanding of the universe. When you consider funding the Green Bank Observatory, I hope you will not only consider the science it can produce but also the scientists it will inspire.</p>	Against Closure	Email - Scanned	11/15/2016	
468	a	Alesia	Wayne	Reading Specialist, Green Bank Elementary School	<p>I am writing in regards to the proposed changes to the Green Bank Observatory and wish to state the important socioeconomic, educational, health and environmental contributions it has made to this area and my family.</p> <p>I have lived in this community for 36 years and the Observatory has played a significant role in my life. It afforded me the opportunity to work part-time, year-round for 17 years as one of the Observatory librarians while also working a full-time job as a teacher. The extra income from my Observatory job allowed me to pay for my daughter's education at an expensive, private college. She relinquished earning a six-figure income, outside of Pocahontas county, to begin her practice as a physician's assistant here in Green Bank.</p> <p>The loss of jobs from closing the Observatory would drastically affect the few local businesses in our county as well as our school student and staff populations in a negative manner.</p>	Against Closure	Email - Scanned	11/15/2016	
468	b	Alesia	Wayne	Reading Specialist, Green Bank Elementary School	<p>In recent years, I have been employed part-time as a lifeguard at the GBO swimming pool. This pool has been utilized many years for Red Cross lifeguarding classes certifying students to work as lifeguards thus allowing them to earn money for their college educations. My daughter worked 2 summers as a NRAO lifeguard to help pay for her college tuition. In addition, Lauren Bennett, Director of Pocahontas County Parks and Rec, and I have taught many children how to swim in this pool during summer swim lessons that were open to the public. The U.S. Master's Swim Club uses the GBO pool as well.</p> <p>The GBO and its employees have sponsored the annual Space Race Bicycle Rumpus to help financially support the Northern Pocahontas Community Wellness Center. Dr. Karen O'Neil, GBO Director, has served as the president of the Northern Pocahontas Community Wellness Center since its inception. The collaboration between the GBO and the NPCWC has been vital, with slow but steady progress, towards a proposed new Wellness Center building adjacent to the Green Bank School on GBO property.</p> <p>The GBO has served as the site for mini triathlons, 4th grade Bike-a-thons, the Turkey Trot 5K run/walk, Step Aerobics, Zumba, Ballroom Dance, Ballet and Yoga classes. My family, guests, and I have long enjoyed walking, running, biking, and cross-country skiing the grounds of the Observatory. The infrequent vehicular traffic and wide open spaces make it an excellent place to walk our dog, teach children how to ride a bicycle, and prospective drivers how to parallel park.</p>	Against Closure	Email - Scanned	11/15/2016	
468	c	Alesia	Wayne	Reading Specialist, Green Bank Elementary School	<p>The GBO and its employees have supported the Pocahontas County School system in major ways.</p> <p>Sue Ann Heatherly, Education Officer, and I co-authored and received a \$250,000 grant from Apple Computer several years ago. This grant funded new Apple computers for the Green Bank School. During summer months the Observatory used the computers for their summer education camps and teacher workshops. Visiting scientists from Russia, Japan, Australia, and Germany, have been invited to our school to share their country's culture with our students on numerous occasions. My daughter was fortunate enough to be involved with the weekly after-school "Hands-On Science" program staffed by NRAO employees. I attribute this program as initially inspiring her to choose a math/science track in school in order to become a healthcare provider.</p>	Against Closure	Email - Scanned	11/15/2016	
468	d	Alesia	Wayne	Reading Specialist, Green Bank Elementary School	<p>The GBO is a wonderful, environmentally exceptional place. We have watched beavers in Deer Creek, surprised bobcats on the trails, observed eagles at the deer carcass behind the Green Bank School, kept our distance from rattlesnakes, watched Canadian geese, and sighted many black bears on this property - unique opportunities few people experience in today's world.</p>	Against Closure	Email - Scanned	11/15/2016	

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Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
469	a	Bart	Wakker		<p>The GBT is a unique telescope. Discontinuing it would be a travesty and would further undermine the competitiveness of US science. Advanced radio telescopes are currently being completed in many places, e.g. ASKAP in Australia, MEERKAT in South Africa, FAST in China. Building such advanced telescopes first used to be a hallmark of US science, but now the US is behind the curve in constructing new instruments. Yet, the GBT still has unique qualities that are unmatched by any of these other telescopes. For instance, while ASKAP and MEERKAT will have higher angular resolution, their sensitivity is not even close to that of the GBT (being worse by a factor 100). The FAST telescope will have higher angular resolution and similar sensitivity, but is very limited in the amount of sky it can observe and thus will not be a generally useful instrument; it is also unfinished and it is unclear how much observing time will be available. I have read the white papers by Lockman et al. (arXiv:1610.09014) and Bally et al. (arXiv:1610.02329). While these papers list many good possible observing projects that can be executed using the GBT, they only barely touch upon the possibilities. For instance, in the past I have used the GBT myself to obtain very deep 21-cm HI spectra in the direction of quasars, in order to determine the properties of gas accreting onto the Milky Way. The formation of galaxies and the manner in which intergalactic gas flows into them is a field of research that is just beginning, now that cosmological hydrodynamical simulations are finally becoming detailed enough to make testable predictions about galaxy formation, while at the same time the Cosmic Origins Spectrograph (COS) on the Hubble Space Telescope (HST) is finally producing a large database of observations of gas around galaxies. Until very recently we did not know where to look and what to expect. Now that progress is being made, we will need a telescope like the GBT to learn more about the environment of galaxies. No other telescope in the world has the required combination of angular resolution, sensitivity, stability and (especially) lack of confounding instrumental problems - because of its construction the GBT has very low sidelobes and thus (unlike other telescopes) it does not produce a false impression; something that is especially important when looking at the limit of the possible. For the future I hope to be able to use the GBT to map individual intergalactic clouds that will be found by the ASKAP-WALLABY survey. WALLABY will map the 21-cm sky from redshift 0 to 0.1, at 16 km/s and 30 arcsec resolution. But with a detection limit of only about $N(\text{HI}) \sim 10^{19} \text{ cm}^{-2}$. It will map many galaxies and will reveal the bright spots in many interesting structures in those galaxies' halos. However, to fully understand those, and their role in constructing galaxies, many other observations will be needed. For instance absorption-line studies against background quasars, observations of ultraviolet emission lines, and also maps of the neutral hydrogen. ONLY the GBT will be capable of obtaining sufficiently deep observations (down to a factor 100 fainter than ASKAP can achieve) to map such objects after they have been found. Without the GBT we will miss a crucial factor in such studies of galaxy formation. The projects I have in mind will only be possible if the GBT remains a publicly-available observatory. Therefore, discontinuing NSF support for GBT would be a grave mistake, only resulting in the further decline of US scientific leadership. It would be a penny-wise, pound-foolish decision, whose effects will reverberate over the next few decades and result in preemptively conceding major discoveries to other countries. It is clear to me that NSF needs a broad portfolio and not restrict itself to only certain area of astronomy that are popular at present. It would be especially foolish to shut down one of the few world-class observatories that is a US-only observatory rather than an international collaboration.</p>	Against Closure	Email - Scanned	11/15/2016	
469	b	Bart	Wakker		<p>The 2011-2012 NSF portfolio review (page 107) recommends that US astronomers use the publicly available time on the similar-sized Effelsberg dish. I have personally used both Effelsberg and the GBT, and have several times run into major issues with Effelsberg data due to its very-bad sidelobes and other instabilities. On the other hand, observing the same fields with the GBT usually resolved the interpretation problems. Even upgraded, the Effelsberg telescope is no match for the GBT when it comes to observing faint extragalactic HI clouds. I therefore interpret this recommendation from the portfolio committee as based on the advertised properties of each telescope, rather than on actual experience in having used both. Looking further at the 2011-2012 NSF portfolio review, the section about research on galaxies has a large subsection on how galaxies form and evolve. At the time the COS instrument on HST had not yet produced data, nor had ASKAP been conceived. But at present it is clear that the GBT can play a unique role in specifically this kind of research. Following the recommendation to discontinue support would thus have been shortsighted and would have preemptively made some of the recommended research impossible.</p>	Against Closure	Email - Scanned	11/15/2016	
470	a	Michael	Lam	NANOGrav Physics Frontier Center Postdoctoral Fellow West Virginia University	<p>I am writing in response to the Federal Register Notice of an EIS evaluating potential environmental effects of proposed changes to operations at the Green Bank Observatory (GBO). GBO has been and remains a unique institution nationally and internationally. It remains unique on a culture, scientific, and educational level and is economically important for the State of West Virginia. You have undoubtedly received many similar letters outlining its importance in these areas.</p> <p>I started my undergraduate career at a small, liberal arts college where the opportunities for astronomy research were very limited. In the summer of 2009 after my sophomore year, I worked at NRAO Charlottesville in Virginia for a Research Experience for Undergraduates program. Not only did I use data from the GBO (the then Green Bank Telescope, GBT), our entire group was given telescope time so that we could learn how to plan our own observations, carry them out, and perform data reduction and analysis. All of the members of the program were students from around the country who were given an incredible opportunity to learn radio astronomy and truly become radio astronomers because of the GBT. Almost all of the people that I know who have gone through that program have stayed in STEM research or industry fields, several in astronomy. For me personally, with that experience in hand, I ended up going to graduate school for astronomy at Cornell University and am now a professional radio astronomer, working as a postdoctoral fellow in West Virginia for the North American Nanohertz Observatory for Gravitational Waves (NANOGrav), an NSF Physics Frontier Center.</p> <p>One of the major contributing factors for deciding to come to West Virginia was use of the GBO. Observational astronomers tend to go where telescopes exist and the entire astronomy side of the Department of Physics and Astronomy at West Virginia University (WVU) is here, as is the Center for Gravitational Waves and Cosmology, because of the GBO. It is a prime hub for NANOGrav because one of the GBO's key science goals is observing the low-frequency gravitational wave universe. Astronomical research in West Virginia happens because the GBO is here. Grant money that is spent on funding personnel such as myself trickles down into the local economy because all of us live here. Scientific outreach and education that is performed here by us happens because the GBO exists for us to be here. The GBO is the premier science facility in West Virginia and any reduction in funding to the observatory destroys opportunities for West Virginians. However, the GBO does not merely impact Pocahontas County, West Virginia and it does not merely impact US single-dish radio astronomers.</p> <p>Complete funding and open skies (option 1 of the EIS) is absolutely critical. And with improved funding, instrumentation, and support, it could continue to thrive for many years to come. I request that the NSF considers the broad impact of damaging the US single-dish radio astronomy community, and pulsar timing array astronomy especially as we are in the very recent opening of the gravitational wave universe.</p>	Against Closure	Email - Scanned	11/5/2016	miam_letter.pdf

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470	b	Michael	Lam	NANOGrav Physics Frontier Center Postdoctoral Fellow West Virginia University	The GBO is not the facility that was reported in the 2012 NSF Portfolio Review. Its upgrades, both past and continued, make it a modern institution capable of achieving a unique set of scientific goals. No other observatory can compete with its combined sensitivity and range over the Northern sky.	Against Closure	Email - Scanned	11/5/2016	
470	c	Michael	Lam	NANOGrav Physics Frontier Center Postdoctoral Fellow West Virginia University	...It has local, national, and international socioeconomic effects. It impacts scientists, students, and the general public all around the world. In close, I implore the NSF to continue funding this absolutely crucial observatory for its scientific and socioeconomic impacts. For questions or further information, please do not hesitate to contact me.	Against Closure	Email - Scanned	11/5/2016	
471		Anthony	Winston	Professor Emeritus Department of Chemistry, WVU	The dismantling, or a reduction of services of Greenbank Observatory would be a great loss to astronomy, to science, to education, to the department of physics at WVU, and to West Virginia itself. Greenbank has been a fixture of West Virginia for 60 years and astronomers come here from all over the world to work with the telescopes. I have visited the observatory many times and the tours are well filed. I hope that funding at the present level will be continued.	Against Closure	Email - Scanned	11/15/2016	
472		Norman and Ruth	Broski		We am writing to protest the demolition of Greenbank The observatory is heavily used by many people. It is a unique facility and offers many educational opportunities to old and young people alike. It is the home of the largest fully steerable radio telescope. Being that it is the largest in the world, why would we give up this honor and reputation to some other country. Something that we as West Virginia residents can be very proud to say is located in our beautiful state. We do realize that there are many things that have to be considered for public funding. With the benefits that many can enjoy at this wonderful "Greenbank", it would be a terrible waste and greatly missed by many. We do hope that strong consideration will be given to this facility. Thank you for considering our plea.	Against Closure	Email - Scanned	11/15/2016	
473		Norris	Long		My schedule prevented my personal attendance at the EIS meetings held November 9, 2016 at GBO. I am grateful to have the opportunity to voice my concerns in this manner. I believe it would be detrimental, socially and economically, to the community and Pocahontas County with the dissolution of the facility. In an area where even 30 people have a job; they spend money, they send their children to school here, they buy or own homes here. Without that employment opportunity, the community will wither and die, not unlike the coal communities of southern West Virginia. The educational value of the facility has lead to the discovery of new things in outer space. The facility is a host to thousands of visitors to the site each year. Those visitors contribute financially to the County. To lose this will affect every person living in Pocahontas County. While reflecting on the alternatives being offered, I am adamantly against the last two. I would prefer alternative #1, making no changes. Alternatives #2 & #3 would have to be considered in a smaller context. As a final statement, the NRAO has served our community well. It arrived here after the shut down of the lumber mill at Cass, and subsequent closings of the two tanneries, offering employment opportunities to many local individuals who otherwise would have had to leave the area.	Against Closure	Email - Scanned	11/15/2016	
474		Vereese	van Tonder		The Green Bank Telescope is a world renowned telescope. Observatories across the world come to Green Bank for telescope critical operations training, including safety training. If the observatory were to cease to exist then it will limit training opportunities for new Observatories across the world. Additionally all the scientific and technical staff from the Green Bank Observatory would need to move out of Green Bank in search for other job opportunities. These employees contribute greatly to the social and economic status of the area. Employees support local businesses such as the bank, farmers, and local shops. These businesses would loose the support from these employees if they were to move away. Green Bank Observatory have great educational and public outreach programs, all which cannot exist without the observatory staff. Students from across the country visit Green Bank to enrich their careers in various programs. Furthermore the Observatory is a great asset to the county and state and has a positive connotation to it. Visitors to the Green Bank Observatory contribute to local businesses such as guest houses, shops, and restaurants. Without the Observatory these businesses will loses the contributions from such customers. I sincerely hope the NSF opts for the "Continued NSF investment for science-focused operations (No-Action Alternative)" as I think this would be the best option for the local people of Pocahontas county, the people of America, and the international astronomical community.	Against Closure	Email - Scanned	11/15/2016	

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475	a	Brent	Shapiro-Albert	Graduate Student, WVU	<p>My name is Brent Shapiro-Albert and I am a first-year graduate student at West Virginia University in the Department of Physics and Astronomy. I am currently doing research in pulsar astronomy, a field that benefits greatly from the Green Bank Observatory (GBO). I would like to encourage the NSF to continue its funding for the GBO. One of the reasons I wanted to come to West Virginia and WVU was to have the opportunity to use the Green Bank Observatory. I have not had the opportunity to be trained on the telescope yet, but observing with the GBO is one of the things I was the most excited about doing coming to WVU.</p> <p>One of the things I would like to do after I graduate is have a post-doctoral research position at a large observatory like Green Bank. As I have learned more about the observatory and the impact it has on the community, I have felt more and more like it would be a great place for me work after obtaining my PhD. Having the opportunity to work with an instrument like the Green Bank Telescope everyday would be a fantastic opportunity. The amount of outreach with the community in West Virginia and with students who come from all over the state also seems unique to me. It is much easier for people to go to Green Bank than it is for them to go to, say, Arecibo, and would offer much more opportunity to inspire students to study not only astronomy but other STEM fields.</p> <p>While I have only been at WVU for a couple of months, the amount of outreach that the university has done in cooperation with the Green Bank Observatory has astounded me. The Pulsar Search Colloboratory (PSC) is a fantastic way to get high school students involved in astronomy. Not only that, they get to use one of the best instruments in the world, an experience that I would have loved to have had in high school. Until I came to WVU and learned about the PSC I always thought that you needed to be at least a graduate student to have even the chance to use a telescope like that. Additionally I have run a help center this past semester for the class taught by Prof. Kathrine Williamson. Most of these students are not STEM majors or even minors, but Prof. Williamson gives them the opportunity to use the Green Bank 20 meter telescope to take their own data via Skynet. When I was an undergraduate I had the opportunity to do something similar during a summer research project, but only a handful of students in our physics and astronomy department ever got a chance to do something like that.</p> <p>Allowing non-STEM students to take their own data and do experiments like finding the galactic rotation curve and evidence for dark matter is something unique that Green Bank can offer students. All they need is access to the internet and for thier professor to procure observing time on the 20 meter telescope. I can hardly think of a better way to inspire students to pursue STEM fields than letting them take thier own data.</p>	Against Closure	Email - Scanned	11/15/2016	
475	b	Brent	Shapiro-Albert	Graduate Student, WVU	<p>I would also like to say that I was the Public Meeting at the GBO on November 9th, from 6:00 pm to 8:00 pm and I would be remiss if I didn't mention how inspiring I found the comments from the community to be. I expected all of the students associated with WVU to strongly support continued NSF funding for the telescope, but I was impressed by how much of an impact the GBO has had on the community in Green Bank. The people who live there, whether they were directly associated with the observatory or not, have all been touched by it and had nothing but good things to say. While I do not live in Green Bank, it seemed to me the observatory kept the community alive and vibrant, and I think that the amount of support I saw from members of the community says more about the GBO's impact than I can say on my own.</p> <p>I strongly encourage the NSF to continue support for the GBO. Not only does it affect me personally, but it has had a hugely positive impact on the community in Green Bank and on the Department of Physics and Astronomy at WVU. I would like to thank the committee for allowing me the opportunity to contribute to the discussion about the Environmental Impact of the GBO and the continued support of the NSF to the GBO.</p>	Against Closure	Email - Scanned	11/15/2016	
476		Emily	Jordan	Geologist	<p>I am writing to voice my opinion in favor of the GBT funding in West Virginia. The telescope, a steerable scientific marvel, unparalleled in its field, is also a source of tremendous state pride and a beacon of inspiration for STEM students throughout Appalachia. Please consider keeping the facility funded and operational, for the good of local communities and the progression of scientific research.</p>	Against Closure	Email - Scanned	11/15/2016	
477		Dana	Balser		<p>My name is Dana Balser and I have been a professional scientist for over 20 years.</p> <p>The Green Bank Observatory (GBO) is a unique facility. It operates the worlds largest fully steerable telescope within the national radio quiet zone, and includes an active scientific staff with a science center used for education and public outreach. I advocate for the "continued NSF investment for science-focused operations" alternative for the environmental impact statement (EIS).</p> <p>Here I focus on the socioeconomic resource area. As we move into the 21st century, it is critical to increase the number of students that have careers in STEM fields for the success of the nation. Astronomy is arguably the best field to connect to young students based on several metrics: movies, news articles, enrollment in college classes, etc. For decades the GBO has inspired and trained students about science through a variety of programs. I have encountered many young students currently pursuing a STEM career who were inspired by their experience at the GBO. These were relayed to me through conversations with students, research for undergraduate (REU) applications, blogs, etc. Yet such stories are rare with other facilities. Why? I think the difference is due to several factors. First, seeing and climbing on a 100 m telescope, the GBT, is cool. There is no substitute for such a connection. Second, the national radio quiet zone combined with a remote site isolates students in a way that is rare in today's world. There are no distractions and students are focused on doing science and talking to the staff and each other. Third, a working scientific staff that is engaged with students. Students do research at the GBO and interact with active scientist. Again, there is no substitute for a young student to be engaged with a real scientist. lastly, an education program with a long history of success. The GBO has been training students for decades and they have a proven track record.</p> <p>In summary, if the NSF does not invest in the GBO for science then this important resource will be lost. I therefore strongly recommend that the NSF continue investment for science-focused operations.</p>	Against Closure	Email - Scanned	11/15/2016	
478	a	Robert	Gronan	N/A	<p>Thank you for the opportunity to comment on the future of the Green Bank Observatory (GBO). Of the five alternatives being considered, since the first is unlikely due to budget constraints, I urge adoption of the second "Collaboration with interested parties for science- and education-focused operations with reduced NSF-funded scope."</p>	Against Closure	Email - Scanned	11/15/2016	

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478	b	Robert	Gronan	N/A	<p>There is an important provision required for the success of Alternative two. That is that the observatory must attract much larger numbers of paying visitors for its operations, and I hereby propose a way that can be done.</p> <p>The National Radio Quiet Zone, in which the observatory is located, is unusual in another way that is also a function of its location. That is that it already is a relatively dark sky area within close proximity to large populated areas of the U.S. Although GBO's radio observations are not adversely affected by visible light, designation of the Green Bank region as a dark sky area would attract many more visitors, and they would of course be staying overnight in the area, contributing greatly to the local economy.</p> <p>A designation as an International Dark-Sky Association "Dark Sky Reserve" (DSR) would perfectly complement the astronomical themes of GBO. Please see http://darksky.org/wp-content/uploads/bsk-pdf-manager/IDSR_Guidelines_Oct2015_22.pdf Studies of astro-tourism have shown that this designation attracts more visitors and contributes significantly to the local economy, as is discussed at http://darksky.org/3-benefits-of-a-dark-sky-designation/ The local people around Green Bank already understand and accept the benefits of the radio quiet zone, so the relatively modest changes in visible light shielding would be accepted as worth while. However, it would require an ordinance by the Pocahontas County Commission for this to be successful.</p> <p>Look at the NASA/NOAA night satellite view of the eastern US https://www.nasa.gov/mission_pages/NPP/news/earth-at-night.html and you will see a single dark area centered on Green Bank, WV, surrounded by the bright lights of the DC/Baltimore, North Carolina, and Ohio megapoli, and within an easy day's drive of them. If this attribute of Green Bank, unique in the mid-Atlantic area, was to be utilized to advantage, it could generate the increased visitors needed to maintain the economic viability of GBO and its surrounding communities.</p>	Alternatives Consideration	Email - Scanned	11/15/2016	
479		Joseph	Schaeffer		Keep it open!	Against Closure	Email - Scanned	11/15/2016	
480	a	Svetlana	Jorstad	Senior Research Scientist IAR,	I would like to express my deep disappointment with one of the conclusions of NSF's Division of AST's portfolio review committee, which in 2012 found that the Green Bank Telescope (GBT) ""capabilities are not as critical to New World New Horizons [astronomy and astrophysics decadal survey] science goals as the higher-ranked facilities." I vehemently disagree with this statement. The GBT is the most sensitive single-dish radio telescope at short wavelengths in the world, and hence is invaluable to exploration of the universe.	Against Closure	Email - Scanned	11/15/2016	
480	b	Svetlana	Jorstad	Senior Research Scientist IAR,	<p>With recent detection of gravitational waves by LIGO, one of the main goals of the New World New Horizons science is to reveal potential sources of these waves. These potential candidates are primary sources studied with the GBT, such as black holes, neutron stars, pulsars, and supernova remnants. In addition, participation of the GBT is crucial in Very long Baseline Interferometric observations at 3mm that allow scientists to study jet properties in the vicinity of the event horizon of black holes. Furthermore, the great sensitivity of the GBT makes it a unique tool to complement space science missions.</p> <p>A facility such as the GBT is easy to destroy but very difficult to build. From five alternatives to be evaluated in the EIS, I vote for item I: Continued NSF investment for science-focused operations (No-Action Alternative).</p>	Against Closure	Email - Scanned	11/15/2016	
481		Alan	Marscher	Professor, Department of Astronomy, Boston University	<p>I am writing to express my support for continued scientific operations of the Green Bank Observatory. The GBO operates the Robert Byrd Green Bank Telescope (GBT), the most sensitive single-dish telescope at short radio wavelengths (microwaves) in the world. It is a relatively young facility that is a key component in astronomers' attempts to understand cosmic phenomena.</p> <p>My own interests are in extremely energetic objects and events in the universe. Many of these are related to black holes in galaxies. Last year, LIGO detected gravitational waves with the pattern predicted for two black holes merging in a distant galaxy. Jets of high-energy particles streaming out of the centers of galaxies with super-massive black holes at near-light speed are the most luminous long-lived objects in the universe. These and other phenomena that play a major role in the dynamics and radiation of the cosmos need to be studied at a variety of wavelengths: gamma-ray, X-ray, visible-light, infrared, and radio. By closing sensitive instruments such as the GBT, we would become blind in some of these wavelength regions.</p> <p>In my own research, I use the GBT as part of a global array of radio antennas that forms an Earth-sized telescope that probes the time-variable emission coming from the jets (mentioned above) down to the event horizon of the super-massive black holes. The high sensitivity of the GBT at short radio wavelengths is critical to such observations</p> <p>The GBT represents a major, fairly recent scientific investment by the US. It would be a tragedy to destroy such a fine facility. From five alternatives to be evaluated in the EIS, I vote for item I: Continued NSF investment for science-focused operations (No-Action Alternative).</p>	Against Closure	Email - Scanned	11/15/2016	

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482		Richard	Rand	Professor Department of Physics and Astronomy University of New Mexico	<p>Regarding the EIS for the Green Bank Telescope, I support the first proposed alternative: Continued NSF investment for science-focused operations (No-Action Alternative).</p> <p>As a professional astronomer with a focus on radio astronomy, I can clearly state that the Green Bank Telescope (GBT) is a unique resource for US astronomy, and any threat to its existence will lead to a significant reduction in forefront astronomy research productivity, hurting the ability of the US to compete in this area. Not only the quality of the dish itself, but the versatility of the instrumentation, allows the GBT to attack some of the biggest problems in astrophysics today, such as the indirect detection of gravitational waves, the process of galaxy and star formation, and the nature of black holes. It provides capabilities to address these problems which do not exist anywhere else.</p> <p>In my own research, I am part of a team of about 40 astronomers worldwide which is studying the energetic environment surrounding galaxies as clues to thier evolution. We are currently using the GBT to compliment our main data set from the Karl G. Jansky Very large Array (VLA). We cannot fully understand the structure of the galaxies we are studying from our VLA data alone - the GBT is essential to making maps which provide all the information we need. I have a doctoral student whose main task will be to combine GBT and VLA data to make the best maps possible of our galaxies. The GBT is unique in providing these necessary data.</p> <p>The GBT has also carried out other observations that directly impact my research, having to do with, among other things, whether our Milky Way galaxy is still growing by accreting gas, a vital question.</p> <p>In summary, the GBT's scientific mission must be protected because it is an indispensable asset in our search to understand the universe, and the physical processes that led to the formation of galaxies like our Milky Way and stars like the Sun. In other words, the GBT is helping us to understand how we came to be.</p>	Against Closure	Email - Scanned	11/15/2016	
483		Ben	Kessler	WVU Senior CDC/NIOSH Data Analyst	I am writing your foundation to please ask you not to shut down Green Bank Observatory. As a resident of WV, it is horrifying to see our foundations of science and knowledge crumble before our eyes. Please do not close it down. Fight for science, fight for our future.	Against Closure	Email - Scanned	11/15/2016	
484		Youngmin	Seo	NASA Postdoctoral Program Fellow Jet Propulsion laboratory, NASA	<p>As a radio astronomer working at Jet Propulsion laboratory of NASA, I would like to address my experience and my support to the Green Bank Observatory to continue its science operations.</p> <p>I study star formation in nearby molecular clouds using radio telescopes and numerical modeling, and the 100 meter Robert C. Byrd Green Bank Telescope (GBT) have been crucial to my research. In star formation, a current key issue is to understand how molecular clouds to form progressively smaller dense filaments and cores and how physical properties of a molecular cloud affects star formation in dense cores within the cloud. My Ph.D. dissertation directly targeted these questions by observing the Taurus molecular clouds. One of the practical difficulties I have faced during my Ph.D. is that I needed a telescope that can map the Taurus molecular clouds (a few degrees in the sky) and simultaneously spatially resolve dense cores (a couple of arcminutes). I found that the 100m GBT is the most efficient instrument for my study since it provides the best capability for surveying large area in the sky with a good spatial resolution. Famous interferometer telescopes such as AIMA and VLA have better spatial resolutions but they were practically impossible to use for my project since their mapping speeds are relatively slow due to their narrow field of views. With the fast mapping speed of the GBT, the observation during my Ph.D. resulted in the largest ammonia map toward a molecular cloud. Furthermore, my colleagues and I are currently carrying out a larger project that observes most of the nearby molecular clouds using the 100m GBT. This will result in the largest and most detailed maps of nearby star-forming regions along with important scientific findings. With my past experience using the 100m GBT, I strongly believe that the GBT not only has played an important role in my Ph.D. dissertation but also will be crucial to my future studies and other key studies in star formation.</p> <p>As a scientist with a foreign national working in the US, I would like to point out an aspect of national interest. I earned my Master of Science in astronomy in South Korea and worked three and half years at the Korea Astronomy and Space Science Institute. One of the difficulties I had in Korea was a limited access to high-quality data due to a small number of observatories in Korea. This has considerably limited of students to have experience with most advanced technology and high-quality data. When I came to the US for my Ph.D., I was able to use the 100m GBT and made important scientific findings which led me to get a postdoctoral position at NASA. The GBO is one of the most advanced facilities around the world with an easy access to astronomy students in the US, while AIMA and VLA are considerably over-subscribed and have relatively limited access to students. I think that an easy access for students to the highest quality data and the most advanced research facilities like the GBO has been one of the strongest advantages in nurturing the brightest minds in the US and also bringing the best researchers to the US from other countries. I believe that keeping the GBO at its full scientific capacity will absolutely contribute to making the US lead in science and technology.</p>	Against Closure	Email - Scanned	11/15/2016	
485		Jennifer	Weidman	Project AWARE Community Coordinator Department of Social & Behavioral Sciences School of Public Health West Virginia University	<p>Please reconsider your decision to defund the GBT in West Virginia. With our coal industry dying, West Virginia must move forward in a progressive direction. The STEM field and jobs can provide a sustainable future that WV so desperately needs. It's often hard to see the fruits of labor in an industry where breakthroughs can take decades to occur. But defunding this would lead to negative consequences almost immediately.</p> <p>We need to keep and fully fund the GBT!</p>	Against Closure	Email - Scanned	11/15/2016	

Green Bank Observatory -Written NSF Public Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
486		Richard	Bradley	<p>Scientist / Senior Research Engineer (NRAO)</p> <p>Research Professor of Astronomy (U. Virginia)</p> <p>Visiting Assistant Professor of EE (U. Virginia)</p> <p>Associate Editor: Radio Science Immediate Past Chair: Commission J Chair</p> <p>U.S. National Committee of the National Academy of Sciences International Union of Radio Science (URSI)</p> <p>Vice-Chair: International URSI Associate Director of the Mid-Atlantic Region</p> <p>Sigma Xi - The Scientific Research Honor Society</p>	<p>As a research engineer with the NRAO Central Development Laboratory, I am writing in support of continuing operation of the Green Bank Telescope (GBT) as an important asset for the radio astronomy community. Its unique style and functionality sets it apart from all other telescopes in its class. In addition, since the beginning of scientific operations in 2001, the GBT has consistently outperformed other telescopes with its high sensitivity and incredibly small systematic errors, thus enabling the scientific discoveries that have been well-documented in peer-reviewed journals. However, we must constantly sharpen our technological edge to maintain our scientific relevance, a value that is directly correlated with instrument capability. As a research engineer tasked with pushing the state-of-the-art in weak signal detection, major advances are only possible through harnessing the unique attributes of instruments such as the GBT - a well-designed platform for evaluating new approaches and techniques. While the GBT has already made significant contributions to the state-of-the-art in single dish astronomy, plenty of engineering challenges remain in key areas such as sensitivity, field of view, and signal processing. Improvements to the reflecting surface model through advances in controlling the movable surface panels while incorporating the laser metrology system could further enhance pointing accuracy and aperture efficiency, particularly at the high end of the frequency band. The field-of-view of the telescope can be improved by adding multiple compact feed horns or synthesizing virtual beams at the focus. Signal detection can be improved by exploring the effectiveness of novel signal processing techniques that target specific types of signals such as transients, pulsars, spectral lines, and thermal noise, all in the presence of radio frequency interference. The GBT's unique functionality and intrinsic low systematic errors make it possible to uncover subtle issues affecting new technologies that would otherwise be masked by conventional telescopes.</p> <p>The availability of the GBT for studying advanced signal detection techniques helps to stimulate our young researchers to try new ideas. For example, my University of Virginia graduate student and I developed a low noise, wide bandwidth feed that is capable of operating over a 10:1 frequency range. As a result of this work we received U.S. Patent #9,054,516 issued on June 9, 2015. As part of his Ph.D. thesis, another student studied the GBT's quadrant detector as an aid to improving feed arm modelling. The challenge of such projects helped motivate both students to perform at their very best - as a result, both students are currently employed at NASA JPL, working in areas of weak signal detection and Earth sensing.</p> <p>Within this growing spirit of nationalism, it is vital for us to maintain a strong research and development presence and the weak signal detection requirements of radio astronomy push the bounds of engineering methods and techniques. The GBT is well positioned to provide the unique platform that fosters innovation in several key areas of national interest while addressing difficult measurement problems in radio astronomy. This synergy motivates our young researchers to excel. Therefore, I strongly recommend that the GBT remain as a functioning radio astronomy facility for many years to come.</p>	Against Closure	Email - Scanned	11/15/2016	
487		Dennis	Egan	Assistant Fire Chief BFD Fire and Rescue	<p>I am writing out of concern for the proposed changes to the operation of Green Bank Observatory. The Green Bank Observatory's support for the Fire and Emergency Rescue services is essential. Without both the Observatory's explicit and indirect support it is difficult to imagine how we could maintain anything like an adequate service.</p> <p>The Observatory's explicit support includes:</p> <p>Air evacuation Landing zones – The Observatory's landing strip is regularly used as a landing site for medivac services.</p> <p>Emergency operations staging areas – In the event of a large emergency, equipment and personnel are often staged there.</p> <p>Emergency Evacuation Center – The Observatory is a Red Cross Evacuation Center. During Floods or storms the observatory has often been the only place with electricity, a must for heat or medical oxygen generators. Its facilities can handle the logistics of caring for a large portion of the area population, a service that unfortunately our county has needed several times in the last few years, once for a week following a severe derecho when the area was without power and for a couple of days following a bad snowstorm.</p> <p>Emergency equipment repair – The facilities at the Observatory can mean a piece of critical equipment can be put back in service quickly in an emergency</p> <p>Water – Without the Observatory's available water facilities during fires we would be forced to draw water from local streams, the nearest municipal water system is Durbin, about an hour's round trip in a tanker truck.</p> <p>Meeting and Training Facilities – The Observatory's classrooms are often used for training.</p> <p>In addition to the indirect support provided by the Green Bank Observatory, there are several ways the Observatory provides implicit support:</p> <p>Personnel – A significant percentage of our Fire and Rescue personnel in the county, especially on the north end are Observatory employees. These employees are especially valuable to us because of:</p> <p>Management Expertise – Management and communication skills are important to fill the officer ranks, a significant number of the Chief Officers are Observatory employees.</p> <p>Technical Expertise – Maintenance of communications radios and pagers by our volunteers who are Observatory's would be irreplaceable. This is a skill not readily available elsewhere in our area and would certainly disappear if the Observatory began downsizing.</p> <p>The Observatory's support, particularly their available water supply has a direct effect on the ISO rating and the fire insurance rates for the Green Bank area. Largely due to GBO's water availability we were able to get this area's fire rating improved. Green Bank fire insurance rates within 6 miles of the Observatory, are 15% to 20% lower due to the support from the Green Bank Observatory.</p> <p>Without the support of the Observatory and its employees our ability to provide adequate service would be severely impaired resulting in a substantial increase in risk to life and property. Thank you for your attention.</p>	Against Closure	Email - Scanned	11/15/2016	
488		Keiichi	Umetsu	Professor Institute of Astronomy and Astrophysics, Academia Sinica (ASIAA), Taiwan	<p>I write in support of the "No-Action Alternative", which would continue science operations with the Green Bank Observatory as they have been performing. The Green Bank Telescope represents the largest movable single-dish telescope in the world. As such, it is a critical resource to the research community. The community will harness its unique, sensitive capabilities to advance into the new discovery region.</p>	Against Closure	Email - Scanned	11/15/2016	

Green Bank Observatory -Written NSF Public Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
489		Mark	Morris	Professor of Astronomy, UCLA	<p>To those considering the range of proposed changes to the operations of the Green Bank Observatory:</p> <p>As a user of the Green Bank Telescope (GBT) for over 10 years, I am writing to express my strongly held opinion that the GBT is an exceptionally valuable and sensitive scientific facility that serves the US community of researchers in astronomy in a remarkably wide variety of ways. I and my students have used it to study astrochemistry, Galactic chemical evolution, and the thermal properties of molecular clouds in the Galactic center. Many of my colleagues use it for cutting-edge scientific projects in other domains, and on all cosmic scales. Others find the GBT essential for its capabilities that are complementary to those of the Jansky Very large Array radiotelescope, one of the other premier facilities available to the US community.</p> <p>During the past decade, I have worked with three students whose PhD research was based on observations with the GBT, and I am but one of many research advisors who oversee students using the GBT, so it has played an important role for training the next generation of scientists.</p> <p>The only other radiotelescope in the world that has comparable capabilities for many purposes is the Effelsburg 100-m Effelsburg radiotelescope operated by the Max-Planck Institute for Radioastronomy (MPIfR) in Germany. The scientists and government there have continued to invest in that observatory, and have reaped a rewarding scientific return by doing so (as a member of their external advisory committee, I have been able to follow the German developments closely). Retiring the (more sensitive) GBT would represent an unfortunate loss of research capability for the US community, and it would reduce our competitiveness in several important branches of astronomy.</p> <p>I sincerely hope that the NSF can find a way to maintain scientific operations at the GBT.</p>	Against Closure	Email - Scanned	11/15/2016	
490		Adam	Gellert		<p>I'd like to encourage the continuation of funding to the National Radio Astronomy Observatory in Green Banks, West Virginia. I am writing to you as a senior who attends Grosse Pointe North High School in Grosse Pointe Woods, Michigan.</p> <p>As I stumbled out into an open field, I would look up into the night sky and be filled with awe by the enormity and grace of it. At my young age, I was always intrigued by the most random of things, but this was different. Not only was it the view that amazed me, but the pondering that occurred while I tried to comprehend the complexity of the sky. It wasn't until sophomore year in high school that I tried to demystify the elusive concepts that surrounded the universe by taking an astronomy class. Although I learned a bountiful amount of information, the class made me realize that there was still much more that I wanted to learn.</p> <p>This pursuit of knowledge led me to join the school's astronomy club, being the Radio Astronomy Team. I have now been in the club going onto three years and am now president. In this time I have learned a wealth of information about astronomy in general and what it's like to be an astronomer. There is, however, one special event that has made this possible, and that is our annual trip to what used to be the National Radio Astronomy Observatory in Green Bank, West Virginia. During the three night and two day stay there, I had the opportunity to not only control the Forty-foot, but get an inside look at what it's like to work at NRAO. Being able to see what it's like to control and maintain the Green Bank Telescope and hear it from those that actually do it is truly an impressionable and irreplicable experience. It gave me the sense of awe, as I was able to meet people that were doing what they loved and working on solving the secrets of the universe. Suffice to say, the annual trip to NRAO has served as a catalyst for my decision to pursue science as my future career, as I was able to experience the joys of working with and observing cutting edge tools to advance the knowledge of society.</p> <p>My story is not the only one like this, as the Radio Astronomy Team has been going to NRAO since 1989. In those years, there are multiple stories to tell as to just how the place has changed the alumni's perception of their future. The National Radio Astronomy Observatory in Green Bank, West Virginia, serves as a beacon of STEM advancement in the middle of the Quiet Zone. It is vital to continue funding to this awe-inspiring place as to continue the stories and experiences being shaped there, just like the one I painted for you above.</p>	Against Closure	Email - Scanned	11/14/2016	
491		Rosa Martha	Torres		<p>Through this letter, we would like to express our strong concerns about the proposed NSF divestment from the Green Bank Telescope (GBT) operations. The GBT has been, and remains, a fundamental instrument for the radio- astronomy community in the US and North-America in general. The Mexican community has used it extensively for topics related to star-formation, Galactic astronomy, and black holes studies. Indeed, it participated financially in the upgrade of the GBT capabilities to carry out interferometric observations in concert with other telescopes in the US, Mexico, and the rest of the world.</p> <p>We sincerely hope that a solution can be found to guarantee the continuing operation of the telescope at a level that will not affect its important scientific legacy.</p>	Against Closure	Email - Scanned	11/14/2016	

Green Bank Observatory -Written NSF Public Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
492		Miriam	Borns		<p>While scrolling through Facebook the other day, I came upon a moving, heartfelt request from one of the TechCrunch contributors I follow regularly on science and space news. Emily Calandrelli, or @TheSpaceGal, asked her audience to write letters regarding the uncertain future of the most sensitive radio telescope in the world, Green Bank Observatory in West Virginia, her home state. I've visited the web site in the past looking for information about how to build a radio telescope that school kids can try and found out about this great resource. Someday, I hope to visit this scientific instrument with my kids to show them that the universe not only reveals its secrets visually, but also in the form of radio waves we can hear. This concept fascinates me not only because of the amount of data that can be retrieved from this form of type of observation, but also because I'm an advocate for people with disabilities in my everyday life. We all sense the world in our own way. What a wonderful resource this observatory is show people that all our senses are important when it comes to learning about our world.</p> <p>If the National Science Foundation can not fully fund the GBO or if private funding comes up short, maybe compromising with a part scientific purpose, part scientific center to the public can keep the data coming and the public educated on this gem of engineering and a STEAM symbol for the people of West Virginia. Two scientists that could be featured in your visitors center could be Robert Alexander (here is a NASA article on him Sonification of Data) and Wanda Diaz Merced (feature on scientists with disabilities listening to the Stars). I know that these two scientists study how data can be represented by sound rather than what the GBO does in capturing and focusing energy to be analyzed, but there are so many other examples out there that could be used to help provide our kids with interactive STEAM exhibits under the wise dish of this fine radio observatory.</p> <p>If other scientific sites see how successful this partnership could be, even more precious scientific resources could be saved for generations to come not just in the field of astronomy, but a full range of scientific subjects.</p> <p>Please consider the value of the GBO and it's necessity for the prosperous future of West Virginia, our nation, and the global scientific community. Thank you for your time.</p>	Against Closure	Email - Scanned	11/14/2016	
493		Nancy	Egan	Durbin Community Library	<p>Hello, I am Nancy Egan, Librarian at Durbin Community Library. Durbin is a small town 20 minutes from the Green Bank Observatory. We recently built a new library building with the help of Habitat for Humanity, who directed the raising of the walls but the follow---on volunteer labor to construct the 3,600 sq. ft. facility included the expertise of the carpenter, electrician, painter and others from the Observatory. Some of the labor donated by the Observatory but the majority accomplished outside of working hours. To have the craftsmen, educational staff, and the leadership of the administration, kept current with industry and academic standards, available for consultation for the common good of the community at large has really kept Pocahontas County a place to be proud to say we live.</p> <p>In a community which is natively suspicious of evolutionary science the availability of the educational opportunities with many of the homegrown staff promotes the understanding of cosmology and our place in the universe within the diversity of personal religious framework and works harmoniously and naturally to create understanding. Our school children are benefiting.</p> <p>Some of the other positive side---effects of the Observatory are as follows. The requirements of the Observatory influence the quality of the broadband we receive through the work of those who can advocate for local needs of the surrounding small, scattered population. The availability of healthy vegetable--- rich, reasonably priced prepared food at the Café is good competition for the local less healthy places to eat. Athletic fields for children behind school and adjacent to Observatory property are maintained. Five to ten miles of natural and paved walks on flat land for running, walking and biking, a pool for community swimming lessons during the summer, and many other benefits accrue to the community, shared in measured and structured ways.</p> <p>In conclusion the Observatory staff, opportunities of scale, and the beauty and use of the grounds all benefit the community at large. Thank you for regarding the community feedback in your decisions and planning for the future of this facility.</p>	Against Closure	Email - Scanned	11/14/2016	Green Bank Obs. feedback letter.docx

Green Bank Observatory -Written NSF Public Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
494	a	Deana	White		<p>Each time my family and I have visited, I am more and more convinced this place is magical. Bear with me -to start simply - just from using your senses you can see the beauty - the juxtaposition of the technological wonders of each decade represented by each of the telescopes against the majestic, quiet mountains. Imagine taking a walk down the Observatory Road - listening to the breeze whispering through the pines, seeing the sun reflect at different angles off the hills and the telescopes - when ever so quietly, one of the telescopes turns to its next observing target. Right there and then - in the peace and beauty of your evening stroll - it could be that the next discovery of an exotic binary pulsar system, the secret to dark matter - or even the first sign that we are not alone - could be happening. That is exciting, awe inspiring - Magic.Looking out from behind the visitors desk in the Science Center - you see people from all over - maybe nearby Virginia, or further Canada or even further Great Britain - stopping by to see just what is this place with curiosity written across their faces. They eagerly accept an invitation for a tour or a walk through and - upon returning - inevitably are smiling and excited about what they have just learned - full of praise and "I had no idea" type comments. That curiosity converted to a renewed or enhanced enthusiasm for the possibilities of scientific understanding and discovery along with their recognition of the world class facility that they just discovered- is Magic.</p> <p>During a working day, stroll through a tour, a conference, a science talk at the Jansky lab - and you will feel you are immersed in the middle of a metropolitan city - bustle aside - where diversity is all around - people from all over the world are busy conveying their thoughts, research, and ideas. While many may speak from their native lands such as Germany, China, Great Britain, Australia, South America -on and on -the language that is spoken is common, specific to their craft - one of complicated scientific terms and concepts. Yet, even though you might not understand at first - each is eager to explain and bring you along into their world. The beauty of the diversity working together and being so inclusive to those who are curious - young or old - is Magic.</p> <p>If you are of a certain age, and even if you are not, this place is hallowed grounds for those fans of Carl Sagan and Frank Drake. To visit the 'Drake' lounge where they wrote the famous Drake equation or recently hear Dr. Alex Wolscszan of PENN state, quietly talk about how he discovered the first exoplanet which just so happened to be around a pulsar - that is Magic.</p> <p>To be lucky enough to have this opportunity to give back to the Green Bank Observatory by participating in a grass roots support group of it and hear the individual stories of how this place has impacted them and their families, and the call by many to the historic place the Observatory has in our hearts as well as the excitement in its future - is Magic. And, may I just say - yesterday we had an election - and many might say we are divided - but I have to tell you the response to the importance of keeping the Green Bank Observatory fully funded by the NSF such that it can continue to remain a shining example of breakthrough discovery and excellence in education - has been bi- partisan and heartening. We all share a common goal of a better future, of learning more about the mysteries of the Universe that unlock potential advancements for us as a civilization, retaining valuable jobs in our communities, and most importantly in the engagement and bright futures of our children. That is also - Magic.</p>	Against Closure	Email - Scanned	11/14/2016	
494	b	Deana	White		<p>Seeing a group of young students gathered together around a display in the Science Exhibit Hall, receiving instruction from a staff member, participating in a STEM activity - or independently operating the 40-foot telescope - is Magic. This is not your typical COSI experience - it is beyond that - young minds are learning and being challenged to learn concepts, operate equipment, and analyze data in a way that is satisfying - by seeing real, unique results that only their decisions and actions yield. College undergraduates have the opportunity to design features that will be put into place at an actual operating facility. High school students have the opportunity through the Pulsar Search Collaboratory to analyze data that could yield fascinating new discoveries. Middle school students from all over the country representing minority and female future scientists can participate in a Physicists Inspiring the Next Generation (PING) camp each summer. There are many more unique programs available here that thousands of students have had the opportunity to participate in and regain an excitement about learning and problem solving that our more traditional methods of teaching are struggling with. This is Magic.</p> <p>To see my own daughter and son, both who have always been artistically inclined, to grow and learn from their experiences at the Green Bank Observatory - has been utter Magic. My daughter has had the amazing opportunity at 16 to work alongside an undergraduate student from Oregon Tech and under the mentorship of a highly accomplished astronomer to learn computer coding, statistical analysis, research paper protocol, and presentation skills. She has been inspired to pursue a career in engineering and science from her first visits to the Green Bank Observatory and these experiences are only increasing her enthusiasm about the field of study. My son, a computer animator and enthusiast, is encouraged by his exposure to the multiple uses of computers and coding to process and analyze the tremendous amount of data generated from observing with the GBT. The Green Bank Observatory inspires students of all backgrounds to learn about or even pursue careers in science, technology, engineering, and math. The inspiration experienced at Green Bank in turn enriches those fields by benefit of incorporating art and other talents to solve our future challenges. This - again is Magic.</p>	Against Closure	Email - Scanned	11/14/2016	
494	c	Deana	White		<p>To learn about distinguished scientists whose careers began at the Green Bank Observatory - particularly two accomplished women - one a Research Scientist with the Planetary Science Institute who works onsite on NASA projects, including the Dawn mission to Ceres and previously on the Phoenix Mars lander, and the other a Princeton educated PhD in Civil and Environmental Engineering who now works at the Delaware Geological Survey at the University of Delaware - both of whom will readily tell you the invaluable experiences they had gaining a foundation in research methodology and presentation skills as local high school students - is inspiring. The Green Bank Observatory's astronomers, engineers, software engineers, machinists, technicians, and education staff are not only at the top of their fields - they are open to sharing and mentoring what they have learned to the next generation of our problem solvers - including young people from these rural West Virginian communities and students from all over the country of different economic and ethnic backgrounds. That is Magic.</p> <p>To experience and get to know the unique family atmosphere of these communities in and around Green Bank - working and serving together - communities that are hardworking, quiet and caring, knowledgeable and talented, cooperative and respectful of all - is refreshing and yes - Magic.</p> <p>So, the Green Bank Observatory - rising in the midst of this rural, out of the way, radio quiet zone - where ground breaking scientific discovery and innovation is happening, where students are being inspired, satisfied by their contributions, and challenged to think deeper and in more complicated ways, where a community thrives from its very existence - must be fully funded by the NSF to continue to provide this magical experience.</p>	Against Closure	Email - Scanned	11/14/2016	

Green Bank Observatory -Written NSF Public Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
495		Ellie	White		<p>I would like to voice my strong support for full NSF funding and continued operation of the Green Bank Observatory. Ever since I first became interested in the fields of astrophysics and technology, the GBO has been an absolutely tremendous resource, in so many ways. As a young student from rural West Virginia, the Green Bank Observatory's education and Science Center staff have provided me with so many amazing and inspiring educational opportunities, like none other in this state and region. From starting out with the Radio Astronomer for a Day and Skynet Junior Scholars programs, to getting to participate in a summer- long radio frequency interference mitigation project under a talented and accomplished radio astronomer, all of these opportunities have continued not only to teach, but to inspire and encourage me to pursue a career in STEM.</p> <p>And I'm not the only one the GBO's STEM educational opportunities have touched. Students of all backgrounds from around the country benefit from these programs and camps every year. One particularly shining example is their Physicists Inspiring the Next Generation (PING) camp, which brings underserved minority and female students from across the country together and gives them extremely valuable exposure to a world-class research facility, and introduces them to many fields of science.</p> <p>Over the time I've been coming to Green Bank, I've started hearing stories of other young people - particularly two young women from rural West Virginia - whom the GBO has inspired to pursue careers in STEM. These two women worked on projects here at the Observatory as high school students, and went on to get their PhD's and pursue successful careers with the Planetary Science Institute and the Delaware Geological Survey. These scientists are an inspiration to me and many others, and are a great testament to the tremendous effectiveness of the GBO's educational programs.</p> <p>As a young female hoping to pursue a career in a historically male-dominated field, my experiences at the GBO have been extremely heartening - the atmosphere is very open and all-inclusive. In my time here I have had many very rewarding interactions with scientists and students, and never felt that I was treated differently because of my gender. In a similar vein, it is very unusual and exciting that the GBO is currently home to three female postdocs from around the world. Clearly, the GBO is helping grow the next generation of women scientists, from grade school to grad school and beyond.</p> <p>I see the Green Bank Observatory as playing a key role in ensuring that in the future, the scientific community will fully reflect the world's diversity and thus grow from that inclusiveness. In addition to this, the GBO is also a top-of-the-line science facility with uniquely versatile and cutting edge capabilities for research on everything from planet formation to cosmology to searching for life outside the Earth.</p> <p>Therefore, I think it is absolutely essential to the state of West Virginia, the U.S., and the entire scientific establishment that the GBO continues to receive full NSF funding for years to come.</p>	Against Closure	Email - Scanned	11/14/2016	
496		Cara	Battersby	NSF Postdoctoral Fellow Harvard-Smithsonian Center for Astrophysics	<p>I am emailing to state my support for the Green Bank Observatory. Green Bank is a treasured facility in the astronomy community. In my field of observational star formation in our Galaxy, Green Bank provides unique capabilities not offered by any other current or planned facilities, that is critically important scientifically. In my view, Green Bank continues to provide high-quality, unique observations that regularly result in high-impact publications.</p> <p>In particular, aspects of Green Bank that are valuable and not achieved elsewhere:</p> <ul style="list-style-type: none"> * The large dish size and the exquisite angular resolution it provides * The frequency ranges covered * The high-quality and flexible instrumentation, in particular, the new W-band receiver ARGUS * and the environment of the radio-quiet zone. <p>Simply put, I cannot state my regard for Green Bank and its importance for the astronomy community highly enough. I would be very happy to answer any questions you have or to give more specific reasoning and examples if requested.</p>	Against Closure	Email - Scanned	11/14/2016	
497		Jeff	DeBellis	Course Director, The Mountain Institute	<p>I was unable to attend the meetings about the Observatory last week but I wanted to send a note in support of the facility. I have worked at a variety of education non-profits within an hour's drive of Green Bank and having the Observatory here is a tremendous asset. It is part of a vibrant experiential education community in this part of West Virginia. It brings tourists to the area and it exposes kids to career options that would otherwise be quite intangible for them to understand. It is one of a number of attractions that people visit in this area. With one less thing to visit, less people will come, and other businesses in the region will suffer as well. In nearby Pendleton County, we already have one government facility that may very well get mothballed (Sugar Grove Naval Station). To have another would push us closer to the economic dark ages.</p>	Against Closure	Email - Scanned	11/14/2016	
498		Zoey	Lightbody	Grosse Point North Radio Astronomy Team	<p>The Green Bank Observatory has had a large impact on the Grosse Pointe North Radio Astronomy club, and many other clubs and organisations for a very long time. I personally as a member of the Grosse Pointe North Radio Astronomy club to tell you how important, and impactful GBO has been to us as a club. It has been an incredible and intriguing experience, as a student to have real experience with a fully operative radio telescope, and how much I would hate for other students with a passion for radio astronomy to miss out on this wonderful experience. For many students in this club this has been the educational experience of a lifetime, and I hope to one day be able to send my kids to NRAO for the amazing experiences that I had. Our clubs experiences at NRAO not only expanded our knowledge of radio astronomy, but brought us closer as a club. This decision will not only effect us as a club, but it will have a large impact on students that will be robbed of the experience of using a real radio telescope, and furthering their knowledge of radio astronomy. Not only is it an educational experience for youth interested in the field of science, but it is an exploration opportunity for the whole astronomy community, it opens up a world of opportunity beyond optical astronomy. Radio astronomy allows a graph to be made of the radio waves given off of space objects that you can't see with an optical telescope. I ask that you please take this into consideration, and I thank you for your time.</p>	Against Closure	Email - Scanned	11/14/2016	
499		Wanda	Lucas		<p>Please consider continuing funding for the Green Bank facility. Personally I would love to see increased funding as we give thought to the importance of space exploration and travel.</p> <p>Green Bank has been invaluable in the past for increasing our knowledge of astronomy and radio communications. It is still valuable for education in our local school districts as most WV students will never visit NASA. It is also a valuable tourist destination for our state and surrounding regions and thus contributes to our state economy.</p>	Against Closure	Email - Scanned	11/14/2016	

Green Bank Observatory -Written NSF Public Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
500		Robert	Welsh	Assistant Professor, Physics & Astronomy Bucks County Community College	<p>I am writing with response to comments made concerning the possibility of closing NRAO Green Bank Observatory. I began my graduate work there in 1987 and continued in 1988. I was a Research Experience Teacher during summer 2000 working under Dr. Glen Langston on the GPA survey.</p> <p>During that summer employment, I created a teaching web page dealing with the Milky Way Galaxy that is now used at both the high school and university levels. I returned to NRAO Green Bank as a high school physics teacher to enhance the opportunities for my students through the Chautauagua program. Lessons learned there are used in my classes.</p> <p>I cannot believe that the Federal government would consider closing this facility. Not only does it perform outstanding scientific research but NRAO Green Bank's educational outreach is beyond compare.</p> <p>I will do whatever is necessary to aid the continued work of this facility.</p>	Against Closure	Email - Scanned	11/14/2016	
501		Rodney	Waugh	President, Kanawha Valley Astronomical Society	<p>.... KVAS operates the Breezy Point Observatory that is equipped with a 16-inch reflector telescope on a fully go-to Astro- Physics mount. We practice outreach astronomy for any public group. We have never charged for a star party at our observatory. Our website is: www.kvas.org. We have held Astronomy Weekend at Blackwater Falls State Park for 28 years and partnered with the Central Appalachian Astronomy Club (www.caacwv.com) that is based near Clarksburg, West Virginia to hold Starquest at Greenbank for 13 years. Both events are geared toward observation and education. Speakers come in from local universities and from across the United States. The most famous speaker was Alan Bean. He came to Greenbank Starquest in 2009. He was the fourth man to walk on the moon. As a lifelong resident of West Virginia, I am very proud of the Greenbank Observatory and the research that takes place there. The employees are friendly, informative, motivated, you can almost see their love for astronomy in their eyes. I traveled to Greenbank to attend and speak at the November 9th National Science Foundation Environmental Impact Meeting. My speech was short, please read my thoughts listed below.</p> <p>Green Bank Observatory (GBO) contributes to the community in many ways. It is the largest employer in Pocahontas County, works with local emergency services, serves as an evacuation center and contributes to the county tax base. This can be a tough place to live, CB antennas are attached to the fire hydrants to aid in their location in heavy snow. As wireless is banned in the community, the Observatory works with the schools and library to wire internet so the public can have access. The Greenbank Observatory is largely responsible for the astronomy department at West Virginia University. Through the years, dozens of students have taken part in research at Greenbank.</p> <p>In my opinion, there are only 2 viable options. I prefer the first.</p> <ol style="list-style-type: none"> 1. Continued NSF investment for science focused operations (No-Action Alternative) 2. Collaboration for interested parties for science and education-focused operations with reduced NSF-funded scope. GBO could continue to work with colleges, universities, SETI, Breakthru Listen and other qualified groups that can contribute to the funding of GBO. <p>No other options are acceptable. The other three options would be a giant waste of taxpayer dollars; it would slow or stop important research and reduce America's standing in astronomy research.</p> <p>With the removal of the Cherry Grove Navy Base, the Radio Quiet Zone is now anchored to the Greenbank Observatory. If GBO were to be shut down, the 13,000 Square Mile Radio Quiet Zone would be lost. It would be very hard to replace it in the future. Science, in one form or another, accomplished by one individual or large institutions is responsible for inventing or improving every manmade object. We do live comfortable lives... If America is to remain in the lead, we must continue to promote scientific research. You just never know where the next discovery will take us.</p>	Against Closure	Email - Scanned	11/14/2016	
502		David	Thompson	Multiwavelength Coordinator Fermi Gamma-ray Space Telescope Project	<p>Since its launch in 2008, the Fermi Gamma-ray Space Telescope has continually pursued multiwavelength studies in cooperation with a wide variety of telescopes, because we learn so much more about the Universe by looking at cosmic objects in a variety of ways. Surprisingly, gamma rays, the shortest-wavelength form of light, and radio waves, the longest-wavelength form, are frequently produced in the same extreme astrophysical environments. The combination of radio and gamma-ray observations reveal where and how powerful energy releases take place throughout the Universe.</p> <p>As a specific example, the unique capabilities of the Green Bank Radio Observatory have been crucial in our cooperative studies of pulsars, the rapidly rotating neutron stars representing endpoints of stellar evolution. The overwhelming majority of gamma-ray "stars" in the Milky Way are pulsars – understanding the high-energy nature of our home galaxy is hopeless if we do not first master the pulsars. Unidentified Fermi gamma-ray sources have become prime targets for radio pulsar searches, revealing many new black widow/redback pulsars, a 'missing link' in the evolution of millisecond pulsars. We have also found a new pulsar with radio, gamma-ray, and optical emission, and millisecond pulsars stable enough to be valuable additions to pulsar timing array searches for nanoHertz gravitational waves such as the NanoGrav program. Many of these discoveries were only possible with the broad range of radio capabilities at Green Bank.</p> <p>The Fermi observatory will continue operation for at least several more years, making use of improved performance introduced last year, but it does have a finite lifetime. We look forward to continuing the ongoing cooperative projects with Green Bank, convinced that important scientific discoveries involving the synergy between Fermi and Green Bank will be made. Retaining the scientific capabilities of Green Bank is clearly essential to this process.</p>	Against Closure	Email - Scanned	11/14/2016	GBTletter_final.pdf

Green Bank Observatory -Written NSF Public Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
503		Dave	Huber	Director of Program Operations NROCKS Outdoor Center	NROCKS Outdoor Adventures, along with our parent company Endless Horizons, are very interested in the continual operation of the Greenbank Observatory(GBO). For over 30 years, Endless Horizons has focused on creating lifelong learning and growth opportunities for our Nation's youth through our operation of Summer Camps, Outdoor Learning Centers and Job Corp Centers in both Virginia and West Virginia. Throughout our endeavors, we continue to invest in our local region and its people. NROCKS Outdoor Adventures, located in Circleville WV, is an extension of this work. Since 2009 we have continued to invest and expand within Pendleton County. We would not be as successful without our regional partners such as the GBO. It is the combination of attractions and activities in our region that have set us apart as a destination experience. Without such a key player as the GBO, we will all certainly feel the consequences. Beyond the scientific significance of this site and the economic impact to the region, a closure of this facility would result in a negative impact on WV's educational system. As we have reviewed the various alternative uses, we believe the only two options that are viable are continued funding at the current level, or Option 2 - collaboration with interested parties and only a slightly reduced rate of funding from the National Science Foundation. We support the continued operation of the GBO and look forward to a successful resolution to maintain the current level of operations.	Against Closure	Email - Scanned	11/14/2016	Correspondence, GBO Support; 2016-11-14.pdf
504		William	Jordan	Branch Manager, Citizens Bank of West Virginia	I am William E Jordan, President of the Pocahontas County Chamber of Commerce and Branch Manager for Citizens Bank of West Virginia. I attended the meeting on November 9, 2016 at the GBO. I am writing this letter in support of options 1 or 2. I am very concerned with options 3, 4 and 5; this would be devastating and a huge impact to our County and economy. The GBO is a very unique and amazing place for youth and adults to visit and offer educational classes. The GBO employs around 100 full time and 40 part time people and their spouses work in the community as well. If options 3, 4 or 5 happen then not only would the employees leave, but the family would go too. It is a trickledown effect. Every business, schools, and individual will be affected. Not only is the GBO important for employment of 5% of Pocahontas County workforce, it also brings visitors to the area that stimulate the economy; they spend the night, eat, and shop locally. Pocahontas County is Nature's Mountain Playground and GBO is a very big attraction that supports the community. Scientists from all around the world do research onsite. Please consider options 1 or 2 and save our community.	Against Closure	Email - Scanned	11/14/2016	GBOIETTER.pdf
505	a	Sean	Bryan	SESE/Cosmology/Physics Arizona State University	The US is a leader in the worldwide effort to use millimeter wave observations to understand the world around us. In astronomy, millimeter waves let us see all the way out to beginning of the universe, nearby regions where stars are forming, and galaxies in between. In addition, millimeter waves have a wide range of past, current, and future remote sensing applications for both civilian and defense use. Astronomy and remote sensing compliment each other well, both in terms of technology development and training US personnel. The Green Bank Observatory and specifically the 100-meter Green Bank Telescope (GBT) are unique resources to the scientific and academic community. At centimeter and millimeter wave frequencies (20-115 GHz), the GBT is an extremely valuable complement to the AIMA interferometer, and is operated at only a fraction of the cost. As a single dish, the GBT provides faster mapping speeds and a larger field of view than AIMA, and serves as a valuable source finder for detailed high-resolution interferometric follow-up. I therefore write in support of the "No-Action Alternative", which would continue science operations with the Green Bank Observatory as they are now performed, including adhering to the Open Skies policy. The GBT is an important US resource, especially in the context of other US capabilities, as well as international teams with strong US participation. Thank you for considering continuing these important activities.	Against Closure	Email - Scanned	11/14/2016	
505	b	Sean	Bryan	SESE/Cosmology/Physics Arizona State University	Please see the high-frequency GBT science case recently presented in Bally et al. 2016, available here: https://arxiv.org/abs/1610.09014 (submitted 27 Oct 2016). As noted in this white paper, the most impressive upgrades to the GBT have only recently been commissioned or are still undergoing commissioning, keeping the GBT poised for great discoveries unique to its capabilities.	Against Closure	Email - Scanned	11/14/2016	
506		Mike, Katrina, Mica & Noa	Yoder		We are writing to express our support for keeping the Green Bank Observatory operating, and our belief in the importance of the work that the facility makes possible. Our family feels that closing the observatory would be a step backward for this field of science. Please continue to support the research emerging from this unique observatory.	Against Closure	Email - Scanned	11/14/2016	

Green Bank Observatory -Written NSF Public Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
507		Adam	Ginsburg	Jansky fellow, National Radio Astronomy Observatory	<p>The Green Bank Telescope provides a unique resource for the radio and millimeter astronomy communities. No other telescope has comparable capabilities in terms of overall sensitivity, resolution, and image fidelity in the range it covers. Some of the telescope's most powerful and unique capabilities have only just become available to the community, so the GBT's impact is likely to increase if it continues to operate. I am therefore writing in support of the 'No-action alternative' to continue science operations as they are now performed, including the open skies policy.</p> <p>Two new instruments are just now becoming available to the astronomical community: the ARGUS high-frequency heterodyne array and the MUSTANG-II bolometer array. Both of these instruments are exploring entirely new parameter space in frequency and area covered, and beyond their stated science goals (see http://www.gb.nrao.edu/argus/ and http://www.gb.nrao.edu/mustang/), they are likely to yield new and unpredicted discoveries. MUSTANG also provides a critical complement to AIMA, filling in the short-spacings in the continuum that AIMA is unable to observe.</p> <p>GBT's most important capabilities for the star formation and interstellar medium communities is its ability to perform large area surveys. With ARGUS, MUSTANG, and the KFPA, the telescope is the most efficient and capable machine at mapping large areas of the sky at millimeter and centimeter frequencies with useful spatial resolution. AIMA can never achieve similar areal coverage, and smaller telescopes can never provide the resolution needed to identify individual forming stars. These large programs (e.g., GAS, KEYSTONE, MGPS) bring together an international community and permit collaboration to answer questions critical for understanding both the origins of solar systems and galaxies. Without the open skies policy and continued science operations, such collaborations will be fractured and the US community will be left isolated and without the necessary tools to continue in this field.</p> <p>The GBT also serves as one of the last available training grounds for young astronomers to learn radio astronomy in the US. The GBT allows and encourages students to visit the telescope and learn to use it and understand its instrumentation. No other radio telescope serves this function. If the US is to continue having a role in radio and millimeter astronomy in the future, such training is needed. If anything, the capabilities and accessibility of the GBT should be expanded.</p>	Against Closure	Email - Scanned	11/14/2016	
508		Erik	Rosolowsky	Assoc. Professor • Dept. of Physics	<p>I am writing to advocate the "No Action Alternative" for the future of the Green Bank Telescope (GBT). As a radio astronomer who uses telescopes globally, I find that the GBT is the world's best single-dish radio telescope operating in the critical wavelength regime of 2.6 mm to 10 cm and provides excellent capabilities at longer wavelengths.</p> <p>The GBT serves a central role in my research program that studies the missing links in our understanding of our cosmic origins through the process of star formation. Recent upgrades to the GBT spectrometer and receiver suite provide excellent spectral line capabilities that allow for wide area mapping of this process of star formation. This flexible multi-line, multi-beam receiver capability is simply unmatched at other facilities.</p> <p>I recognize that we must operate in a constrained science funding environment. However, previous decisions that other facilities were higher priority than the GBT (e.g., Arecibo, Effelsberg) appear, from my perspective, to be wrongly decided. In my experience, the GBT is easier to use than these comparable facilities and provides better data.</p> <p>The GBT also provides a critical single-dish complement to the US and Canadian national investments in the Jansky Very large Array (VLA) and the Atacama large Millimetre/submillimetre Array (ALMA). The GBT provides the zero-spacing information that allows these interferometers to see a complete and accurate picture. More importantly, the single-dish survey capabilities of the GBT are critical for determining where the VLA and ALMA should look. Without the GBT capabilities, these observatories will become less efficient and produce less accurate data.</p> <p>I am also grateful for the NSF support for the GBT that has provided many of the central discoveries in my research career. While I completed my research training in the United States, I have since moved to Canada. As more funding opportunities become available here in Canada, I will be seeking Canadian support for the GBT, extending the beneficial relationship we have established through the North American Partnership for Radio Astronomy. The capabilities of the GBT for high quality science are simply too great to lose.</p>	Against Closure	Email - Scanned	11/14/2016	
509		Traci	Knabenshue	Sustainability Director, Facilities & Services	<p>I urge you to continue funding the Green Bank Telescope in southern West Virginia for several reasons.</p> <ol style="list-style-type: none"> 1) There seem to be many scientists in agreement that the 'movable' aspect of the telescope makes it valuable in ways that other telescopes with similar capabilities are not. 2) Researchers at WVU have been utilizing the telescope to do important and ongoing pulsar research. 3) The telescope is a shining example of STEM for West Virginia's youth and general citizens. These students need these examples in their backyard to show them the potential of STEM careers. 	Against Closure	Email - Scanned	11/14/2016	

Green Bank Observatory -Written NSF Public Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
510		Chris	Thibodeux		<p>I'm writing to express my thoughts on the Green Bank Observatory as a scientific research site.</p> <p>Specifically, with regards to the Green Bank Telescope: its astronomical capabilities are still unmatched worldwide. With an off-axis focus design, the GBT provides greater dynamic range than the similarly-sized Effelsberg Radio Telescope. With its active surface, imaging data are remarkably clear. Being fully steerable, it can quickly obtain large-scale mappings. And with its suite of receiver instruments, including its recent capabilities in the 3mm dust- continuum regime, the GBT has an impressive domain of observing frequencies. Consequently, it is capable of mapping neutral atomic hydrogen and dust emissions-and certainly myriad molecular species of relevance to galactic evolution.</p> <p>It's probably not a surprise to hear from an astronomy grad student who's stating that an astronomy facility is great, but the GBT, and the entire Green Bank Observatory, are far better than just "good enough." The telescope and the facility are a point of pride for all of West Virginia-in particular, the astronomy program at West Virginia University benefits greatly from its access to the site. The Observatory hosts a number of outreach events, and also offers Research Experience for Undergraduates program opportunities that have allowed me and many others in my field-and even in my department-to gain scientific experience and skills that are crucial to our careers as astronomers.</p> <p>To put it bluntly, the GBO excels at both scientific research and scientific outreach. My scientific career and the future careers of many up-and-coming undergraduate and graduate astronomy students will benefit hugely from the internship and research opportunities the Observatory offers. I urge the NSF to continue funding the Observatory by choosing the option of "No-Action."</p>	Against Closure	Email - Scanned	11/14/2016	
511	a	Paola	Andreani	European AIMA Regional Centre Manager European Southern Observatory Garching, Germany.	<p>this email is to support the scientific case of the Green Bank Observatory and specifically the 100-meter Green Bank Telescope (GBT), which is the largest steerable single dish telescope in the world, are unique resources to the scientific and academic community.</p> <p>As AIMA scientist I would like to stress the importance of the GBT at high frequencies (20-115 GHz), in particular as complementary facility to the AIMA array. As a single dish, the GBT provides faster mapping speeds and a larger field of view than AIMA, and serves as a valuable source finder for detailed high-resolution interferometric follow-up.</p> <p>I am writing to support the "No-Action Alternative", which would continue science operations with the Green Bank Observatory as they are now performed, including adhering to the Open Skies policy.</p> <p>Please consider the future of U.S. mm-wave and radio instrumentation as you debate the future of this unparalleled resource. Please also consider the important precedent the NSF has maintained, for the U.S. and the world, of outreach programs, cutting edge science, and the Open Skies policy that anyone with a great science case can obtain observations on the GBT.</p>	Against Closure	Email - Scanned	11/14/2016	
511	b	Paola	Andreani	European AIMA Regional Centre Manager European Southern Observatory Garching, Germany.	<p>I have read recently the high-frequency GBT science case presented by Bally et al. 2016 (https://arxiv.org/abs/1610.09014) and I am convinced that the impressive upgrades to the GBT recently commissioned or still undergoing commissioning keep the GBT at the verge of great discoveries unique to its capabilities. In addition to this, and eventually more important, the GBT is a rare resource in education and training of the next generation of astronomical instrument scientists. This is achieved primarily through outreach to the local West Virginia community and through the PI- instrumentation program.</p>	Against Closure	Email - Scanned	11/14/2016	
512		William	Cotton		<p>I would like to express my support for Greenbank option "no action" (continue current status).</p> <p>In my 45+ years as a professional astronomer I have used many world class telescopes all over the world; the GBT certainly ranks among the best. I have used the GBT to great advantage in my own research. The excellent quality of the instrument at its highest frequencies gives it unique capabilities in terms of resolution and sensitivity. At the lower frequencies, the National Radio Quiet Zone gives it a great boost. The GBT represents a very substantial investment by the NSF and the astronomical community and it would be a great shame if this resource were lost to the community.</p>	Against Closure	Email - Scanned	11/14/2016	
513		Christian	Hores		<p>Please keep the Green Bank Observatory open. It is vital to humankind's understanding of the universe.</p>	Against Closure	Email - Scanned	11/14/2016	
514		Mackenzie	Waldo		<p>Please do not close down the Green Bank Telescope. I remember learning about it in High School and had friends that got to spend a weekend there. I always hoped I would have the chance to visit so I am hoping you will consider leaving it open so that I have a chance to see it and my children do too.</p>	Against Closure	Email - Scanned	11/14/2016	
515		Mark	Sykes		<p>Blank email; Subject line is: Green Bank Observatory</p>	Against Closure	Email - Scanned	11/14/2016	

Green Bank Observatory -Written NSF Public Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
516		Philip	Meyers	Senior Astrophysicist Smithsonian Astrophysical Observatory Cambridge, Massachusetts	<p>I am writing to advocate continuing NSF support of the Green Bank Telescope (GBT).</p> <p>In the EIS to evaluate potential environmental effects of proposed changes to operations at the Green Bank Observatory (Federal Register/Vol. 81, No. 202, October 19, 2016 Notices), five alternatives are listed.</p> <p>I am writing to support the first option, the "No-Action Alternative" for continued NSF investment for science- focused operations.</p> <p>The GBT is a world-unique and outstanding scientific instrument, with great potential for advancing our understanding of fundamental physics in the areas of gravitational wave radiation, interstellar molecules, solar system studies, star formation, and stars and galaxies. Some of its outstanding accomplishments and capabilities are detailed in the white papers arXiv:1610.02329 and arXiv:1610.09014.</p> <p>As a scientific researcher for the past four decades, and as a user of the GBT, I believe it is extremely important to the advancement of our scientific understanding of the universe for the US NSF to provide the maximum possible support to the GBT.</p>	Against Closure	Email - Scanned	11/14/2016	
517	a	Thomas	Epling		<p>I wish to submit a letter of support for the continued National Science Foundation (NSF) investment for science-focused operations for the Green Bank Observatory in Green Bank, West Virginia. This letter is contingent on the assumption that the observatory continues to provide innovative and relevant scientific research opportunities for the world's scientific communities.</p> <p>I am a resident of Pocahontas County, West Virginia. I live within a half-hour drive of the Green Bank Observatory. I believe that the Green Bank Observatory is an integral part of Pocahontas County and the State of West Virginia. Beyond its value as a world renowned research facility, the Green Bank Observatory provides invaluable assets to our community economically, for safety reasons, and for education.</p> <p>The Green Bank Observatory is a huge economic asset to our County and our state. The telescope employs numerous people who have higher education and skills than many other people in our county. This employment certainly raises the economy of the region. In addition, the observatory attracts a huge number of tourists to the region, thus contributing to its economy. The employees of the observatory contribute priceless assets in the form of volunteer work to the community. They work as scout leaders, government participants, charitable and philanthropic organization members, EMT personnel, wildlife promoters, and arts enthusiasts.</p> <p>The machine shop at the Green Bank telescope is a tremendous asset for the community. Its employees are available to provide expertise and help for many residents in their times of need.</p> <p>The campus of the Green Bank Observatory provides a great recreational opportunity for residents.</p> <p>There are miles of road-ways and trails open to the public that are used for hiking, bicycling, as well as for running and cycling events. Numerous arts and entertainment events make use of the venue as well.</p> <p>The Green Bank Observatory is a tremendous asset to Pocahontas County and the state of West Virginia. I can not envision this region without its presence. I ask that the NSF continue its investment in this facility.</p>	Against Closure	Email - Scanned	11/14/2016	
517	b	Thomas	Epling		<p>The Green Bank Observatory is a critical resource for the safety of our community. Not only do its employees contribute to safety by volunteering as EMTs, but the observatory offers its facilities during weather related crises, such as floods.</p>	Against Closure	Email - Scanned	11/14/2016	
517	c	Thomas	Epling		<p>The Green Bank Observatory is a very important asset to our educational community. It provides valuable resources for science teachers in our school system. It provides a research radio telescope for the use of students. It sponsors and supports local science fairs. One student was recently featured in a local newspaper article for having participated in a science fair at the observatory, who continues to be fascinated by her project, and will likely pursue a career in science as a result. The observatory has a goal in which it states that it wants to touch the life of every student in the state of West Virginia. West Virginia ranks at the bottom of the nation in its school funding and school performance. The mission of the telescope, in light of this, is a tremendous asset for education in our state. The Green Bank Elementary and Middle School are located next to the Green Bank Observatory. Observatory employees have, on numerous occasions, provided services to the school in the form of labor and equipment.</p>	Against Closure	Email - Scanned	11/14/2016	

Green Bank Observatory -Written NSF Public Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
518	a	Judith	Clark		<p>I'm writing in support of continued NSF funding for the Green Bank Observatory. The Observatory's presence in Northern Pocahontas County forms the foundation for the welfare and quality of life of all persons living in the surrounding area. My husband & I moved to Pocahontas County in October 2008. We live in Dunmore, about 10 miles from the Observatory. Prior to moving here we had enjoyed hiking, camping and bicycling in this area each summer. Like many seasonal visitors, we didn't know any local residents. Our first friends were residents who worked at the Observatory. An Observatory employee introduced himself and told me about the Deer Creek Book Club to which all interested persons are invited. My husband and I joined and have been members of this group ever since. Many members of the Deer Creek Book Club are also active in another book club called "The Ladies Book Social" to which I belong. We attend Square Dances and Jamborees held at the Dunmore Community Center. Many of the musicians are employees at the Observatory. The same is true about the events at the Opera House in Marlinton. Performers and also the lighting and sound crews work at the Observatory and volunteer their skills at the Opera House. Below is a list of many other ways the employees and facilities at the Observatory enrich and benefit the community:</p> <p>The Observatory provides shelter for area residents who need help with water, electricity, heat and air conditioning when the community loses power. The Observatory grounds are open to hikers and bicycle riders. Maps and a pamphlet offering advice about what to do if one encounters bears or other wildlife can be found at the Tour Center. My husband & I have walked and bicycled the trails. Unfortunately we haven't yet seen any bears. This year, the Observatory grounds hosted a new project: growing potatoes as part of a West Virginia statewide program to encourage agriculture. We have sampled these potatoes and fully support this use of the beautiful property we have hiked and biked.</p> <p>The Observatory's educational department offers astronomical research opportunities to students of all ages ranging from searching for pulsars to constructing robots from Legos. The Observatory Tours and special events draw visitors from around the world, adding to needed Tourism dollars for Pocahontas County.</p> <p>The Observatory provides jobs for over 100 employees, who along with their family members help support many local services and businesses. Without the Observatory employees, those of us who also live here would need to travel at least 50 miles to shop and to receive medical and dental care. Continued below is a list of many of the services, shopping opportunities, community events and benefits that result from the Observatory's presence and that would probably disappear if the Green Bank Observatory had to close. MEDICAL & OTHER SERVICES...ORGANIZATIONS... SHOPPING... OBSERVATORY TOURIST ATTRACTIONS... OBSERVATORY EVENTS...OBSERVATORY GROUNDS USED FOR Community Events</p>	Against Closure	Email - Scanned	11/14/2016	
518	b	Judith	Clark		<p>The 13,000 square mile National Radio Quiet Zone was declared decades ago to ensure that the Observatory's radio telescopes had minimal radio interference. Today the Quiet Zone also provides sanctuary for over 50 residents who seek reduced exposure to Electromagnetic Radiation for their health. Other Electro - Sensitive persons come to Pocahontas County for respite from the ever-increasing harmful radiation in their home and work environment elsewhere. These special residents and visitors gratefully describe the relief they gain from being in the National Radio Quiet Zone. They also contribute to economy of Pocahontas County during their short stays here. Our county is almost the size of Rhode Island, yet there are only 8,607 residents. The refugees and their families make up a noticeable part of the population.</p>	Against Closure	Email - Scanned	11/14/2016	
519		Lee	Kass	Adjunct Professor, Dept. of Biology, & Division of Plant and Soil Sciences, WVU	<p>I write on behalf of the students of West Virginia University and the people of West Virginia. The Green Bank Observatory is an important economic asset for the region, our state and our country. The roughly \$8 million annual NSF investment in this facility generates nearly \$30 million every year for the local economy. West Virginia is currently depressed due to its reliance on coal production, which is no longer a viable alternative. Students come to WVU specifically to use the facilities at Green Bank. West Virginia and our nation takes enormous pride in the remarkable scientific research performed at the observatory.</p> <p>For over half a century, the observatory has contributed to West Virginia's scientific, educational and economic well-being. The observatory is the largest scientific asset in WV and an important economic engine in the region. The Green Bank Observatory, is a world class facility and the work of their talented researchers provides a window to the universe.</p> <p>The Green Bank Observatory employs West Virginians, gives our children incredible opportunities, and brings millions in investments to our state. The Green Bank Observatory is important to WV and to our country. Nestled within our nations "Quite Zone", radio astronomers can listen to remote undertones from the universe, in order to discover answers to astronomical questions. Teachers and students rely on this facility for teaching and research, from elementary to graduate school: http://greenbankobservatory.org/</p> <p>Please consider further funding for this gem of science.</p>	Against Closure	Email - Scanned	11/14/2016	
520	a	Jon	Wallace		<p>Thank you for the opportunity to give you my perspective as you consider how to move forward with GBO.</p> <p>As I understand it, the alternatives you are considering range from fully funding the maintenance and operation of the Ob, to funding its deconstruction. And while I understand that the NSF has many demands on its resources, I do not see the logic in the idea of decommissioning the GBO by turning it into a theme park, mothballing it or tearing it down. Those alternatives are in contradiction to the goals of the NSF and, quite honestly, would seem like a terrible waste of the taxpayer dollars recently invested in new telescopes.</p> <p>Part of your mission is to "provide funding for research centers, instruments and facilities that allow scientists, engineers and students to work at the outermost frontiers of knowledge." The GBO offers just that. It is home to the Green Bank Telescope (GBT), the largest, fully steerable radio telescope in the world. It cost 96 million dollars to build and has been in operation for only about 13 years. Since its construction the staff at GBO has continually invested in low-cost upgrades and improvements, making the telescope many times more powerful than originally designed. It is uniquely qualified to study molecular building blocks in nebulae and other gas clouds; probe the nature of matter at extreme densities; map diffuse clouds of intergalactic gas (only detectable in radio frequencies); and calibrate cosmic distance scales. Lastly, researchers are provided thousands of hours of open-access time each year to the GBT. For example, gravitational wave researchers are using the GBT. Their research would provide supporting evidence to the data being collected by LIGO and perhaps would offer other avenues for exploring this brand new branch of astronomy. Since the NSF has stated that funding research grants is another major priority, the GBO seems to provide a place for the NSF to fulfill two of its goals.</p>	Against Closure	Email - Scanned	11/14/2016	

Green Bank Observatory -Written NSF Public Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
520	b	Jon	Wallace		<p>"Another essential element in NSF's mission is support for science and engineering education, from pre-K through graduate school and beyond." That is a major goal for the GBO as well. Estimates of up to 65% of current astronomy knowledge were gained through the use of radio telescopes, yet few people understand radio astronomy despite its enormous contributions to our knowledge. The continued efforts of the educators at the GBO and the people they train are our best chance to get this information out. The facility hosts over 50,000 visitors and 3500 students every year. Groups ranging from students to teachers, researchers and the general public, can spend a night and use the educational telescope, or a week for an educational workshop, or participate in STEM education programs. The exceptional opportunities offered at the GBO and through outreach are among the best I've encountered as an educator and science enthusiast. The staff, especially Sue Ann Heatherly, have developed wonderful teaching and training exercises and experiences. I had the pleasure of working on one, the Itty Bitty radio Telescope (IBT) project with the GBO. As a Society of Amateur Radio Astronomers (SARA) board member, I worked with the person who developed the IBT, creating material for teaching participants how to use the IBT to teach about radio astronomy. SARA and the GBO trained dozens of people and provided IBTs for their use. Many of these people still use these devices to this day, as I do, to teach about radio astronomy.</p> <p>Even a casual visitor to the GBO can learn much about our progress in science simply by walking the grounds. The historical significance of this facility can't be matched anywhere in the world. The Ewen-Purcell horn which was used to detect hydrogen emissions for the first time; Grote Reber's scope, which got radio astronomy started after Jansky's discoveries; a reproduction of Jansky's antenna that actually works and can be used by visitors; as well as so many other items of significance.</p> <p>My experiences at the GBO have been life altering. I was a science teacher for over 32 years and, although retired, I continue to teach in schools, libraries and other venues. I started out knowing nearly nothing about radio astronomy but got inspired to include non-visual physics into my teaching and developed numerous demonstrations and labs for people to experience radio astronomy. I have trained hundreds of teachers over the years and shared these demonstrations, presentations and ideas with hundreds of people worldwide. All of this was because the people of the GBO took the time to nurture my (and innumerable others) interest in science and especially radio astronomy.</p> <p>Please consider your decision carefully. Not only is the GBT a unique, cutting-edge instrument unlike any other in the world, but the history, research, education and support provided by this institution is unlike anything else. Fully funding the GBO may not be possible, but partially funding it until the staff can build a consortium of interested researcher institutions surely is.</p>	Against Closure	Email - Scanned	11/14/2016	
521	a	J.Christopher	Howk	Department of Physics, University of Notre Dame	<p>I am writing to share my strong support for the continued availability of the Green Bank Telescope (GBT) to the worldwide astronomical community. As I understand it, the NSF is considering the future of this unique instrument, including reducing funding for its operations that would make it untenable for the Green Bank Observatory (GBO) to continue to offer it as a general use facility.</p> <p>The GBT is unique in all of radio astronomy. Not only does it represent the largest fully-steerable radio telescope (meaning it has access to the entire northern sky), but its unblocked aperture, exquisite instrumentation, and excellent site make it an incredibly powerful tool for the detection of faint radio signals.</p> <p>All of this is critical for pursuing cutting-edge science, and the GBT fills several niches that no other instrument can. As I see it, chief among these is the study of radio pulsars, a by-product of which will be (I believe) the detection of low-frequency gravitational waves that probe the coalescence of super-massive black holes in the early Universe. While LIGO may have detected gravitational waves from stellar mass black holes (a Nobel Prize-level result), it will shed no light on the more mysterious black holes found at the centers of all galaxies, the supermassive black holes that contain millions or billions times the mass of our sun. The GBT is the world's foremost instrument for studying pulsars, which are probes of the gravitational waves that probe the build-up of these most massive objects.</p> <p>In addition, the GBT fills a niche in mm-wave astronomy; as the largest-aperture mm-wave telescope, it allows the study of objects on scales that cannot be accomplished by the NSF's other (much more expensive) major mm- wave observatory, ALMA. I have also been blown away by the solar system studies (of planets, moons, and asteroids) that the GBT has enabled.</p> <p>The GBT has been very important in my own research. It provides the most sensitive and *precise* measures of the 21-cm emission from neutral hydrogen that we have available. We have used this to study the gas that is falling into the Milky Way from its halo and gas that is being ejected from the Milky Way's disk by massive supernova explosions. Understanding this circulation of material into and from the "atmosphere" of our Galaxy. Without the availability of the GBT observations, several programs we have pursued with the Hubble Space Telescope would not have been possible. Thus, the relatively small national investment in GBT operations have allowed unique studies to be pursued with an Hubble, an instrument that costs 10x more to operate, a good return for relatively little investment.</p>	Against Closure	Email - Scanned	11/14/2016	
521	b	J.Christopher	Howk	Department of Physics, University of Notre Dame	The GBT has also been critical in training graduate students. It is an instrument they can come to understand well and operate even from their apartments as they observe remotely.	Against Closure	Email - Scanned	11/14/2016	
521	c	J.Christopher	Howk	Department of Physics, University of Notre Dame	I hope the NSF can find the resources to continue to provide the GBT as an observing resource to the community. And, I find the title of the recent white paper on the GBT's status summarizes the situation perfectly: ""The National Science Foundation's AST Portfolio Review of 2012 is Not Relevant to the Green Bank Telescope of 2017"" (https://arxiv.org/abs/1610.02329).	Against Closure	Email - Scanned	11/14/2016	

Green Bank Observatory -Written NSF Public Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
522	a	Meredith	McCain		<p>It has come to my attention through the media that the National Science Foundation has opened a period of time for the public to comment on the future of the Green Bank Telescope (GBT). I strongly feel the need to comment on this because my sister and grandson and I visited Green Bank in August and were duly impressed by the GBT.</p> <p>The reason that we were willing to make the drive from Rockville, Maryland through the mountains to Green Bank, West Virginia is because we found out that it takes only a half a day's drive from the DC Metro area to reach the largest steerable single-dish radio telescope in the world!</p> <p>Our visit became important to me also because I wanted to piggyback on my daughter's trip with my grandson to Hawaii, which they took in part in order to learn all that they could about one of the world's most famous optical telescopes at the Gemini North Observatory on the summit of Mauna Kea in Hawaii. How exciting I thought it would be for my high school age grandson to see another example of a giant telescope in order to learn that, though both telescopes study the universe, they are very different from each other.</p> <p>When we arrived in Green Bank, the GBT Visitors Center expanded our education about the unique differences between these two specific telescopes with a helpful display. We also were able to listen to the sounds from three different pulsars that were recorded by the GBT.</p> <p>The Visitors Center also bused us to the telescope which was an awesome sight. We were shocked to find out even the batteries in our cell phones could actually interfere with the telescope's very sensitive ability to intercept radio waves from space. For this reason we were told by our guide, the GBT is in a federally protected area called the Quiet Zone. All this so close to the Nation's Capital!</p> <p>We were one of the 50,000 annual visitors to come to Green Bank to learn about the work of the GBT. With more public outreach in the DC Metro area alone, I am sure that this number could be greatly increased.</p>	Against Closure	Email - Scanned	11/14/2016	
522	b	Meredith	McCain		<p>We have since learned that the GBT is the birthplace of the National Radio Astronomy Observatory System (NRAO). The NRAO describes the GBT as a premier instrument for research into fundamental physics, star formation, galaxies across cosmic time, and the origins of life.</p> <p>I have watched science programs on television pertaining to other subjects of interest to GBT researchers, such as black holes and extraterrestrial intelligence. In October an article caught my eye entitled, ""The Green Bank Telescope Will Train Its Massive Dish at 'Alien Megastructure' Star"" (newsledge.com). I promptly sent it to my grandson.</p> <p>We were also impressed to learned that 3,500 students have utilized the telescope and that it is a major tool of astronomers world-wide. Nothing that I have read has led me to conclude that the GBT is not equipped with the latest and most up to date technologies, plus the GBT can be positioned anywhere over 80% of the open sky. I have read that stationary radio telescopes cannot be focused on more than 30% of the sky since they are not steerable.</p> <p>I was amazed to find out that the annual budget for the GBT is less than 10 million dollars. I am sure that this is just a drop in the bucket in the NSF's annual budget. In conclusion, I strongly feel that the National Science Foundation should return funding of the GBT to 100%, or at a minimum, fund it at 70%, in partnership with other organizations. Anything less would be wrong.</p>	Against Closure	Email - Scanned	11/14/2016	
523		Brent	Tully	University of Hawaii at Manoa Institute for Astronomy	<p>I am writing in connection with the discussion over the future disposition of the Robert C. Bird Green Bank Telescope. My standing and interest emanates from many years of usage of the facility and its products.</p> <p>My specific scientific activities involve observations of emission in the neutral Hydrogen spectral line at 21 cm from galaxies. The width of the spectral line is related to the mass of a target galaxy which, combined with optical information on its brightness, gives a measure of the galaxy's distance. The methodology has been used to estimate the size and age of the universe. Recently it has led to the identification of the Laniakea Supercluster. The discovery was highlighted by the NSF at the last General Assembly of the International Astronomical Union.</p> <p>This program involves the observations of many thousands of galaxies and is ongoing. GBT is our preferred radio astronomy facility and it is important to understand why. For unresolved targets, almost always the case with our program, the sensitivity for detection goes as the fourth power of the telescope aperture. Big is much much better. The only serious competition for GBT has been Arecibo Telescope, but that facility accesses only a limited part of the sky, is limited to integrations/day of only a few minutes, and is itself in danger of closure for lack of funding. GBT accesses all but the south celestial pole and can track sources for hours.</p> <p>Much of the progress in astronomy comes from small teams working with diverse observing capabilities. The current trend is to consolidate into a small number of major facilities with a limited range in capabilities that are exploited by large teams. GBT was built at considerable expense and is still young. The cost to maintain this important resource is small compared to the expenses of constructing the next generation observatories. It is bizarre to me to contemplate anything other than continued and decent support for this world-class telescope.</p>	Against Closure	Email - Scanned	11/14/2016	nsf_gbt.pdf

Green Bank Observatory -Written NSF Public Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
524		James	Aguirre	Associate Professor Department of Physics and Astronomy	<p>I am writing in response to the public scoping for the EIS for the Green Bank Observatory. I am strongly in favor of the No-Action Alternative of continued NSF investment for science-focused operations. The GBO and the GBT are wholly unique facilities which are enabling cutting-edge science for the entire US scientific community, and which are of enormous importance for the education of the next generation of scientists, and for the development of new technology.</p> <p>I have personally used the GBO as part of my own research, capitalizing on the NRQZ for the development of the NSF-funded Precision Array for Probing the Epoch of Reionization (PAPER), and the Hydrogen Epoch of Reionization Array (HERA). HERA is now a mid-scale NSF initiative which will be the definitive measurement of hydrogen in the early universe, all enabled by the GBO. I have also used the GBT at high frequencies for studies of star formation and as part of the team developing the remarkable instrument MUSTANG (now in version 2), which has provided unprecedented views of the dynamics and physics of galaxy clusters, as well as being a technology demonstrator with relevance to future studies of the cosmic microwave background (CMB), including the CMB S4 program. As a postdoctoral fellow, I used the GBT/GBO extensively, as have my students and those of my collaborators.</p> <p>It is important to understand that both scientifically and technically, the current GBT provides capabilities that were not considered in the 2012 Portfolio Review, particularly the ability to operate at short wavelengths with new instruments like MUSTANG-2, and that shuttering or otherwise impairing the scientific operation of the facility would deprive the US scientific community of a resource which is actively producing exciting, unique science, and which cannot be reproduced in any existing or planned facility.</p> <p>I reiterate my strong support for the No-Action Alternative of continued NSF investment for science- focused operations.</p>	Against Closure	Email - Scanned	11/13/2016	
525		Gordon	Richards	Professor of Physics Drexel University	<p>I would like to express my strong support for continued NSF-supported operations of the Green Bank Telescope. The GBT is a unique national resource that has enable the work and scientific output many researchers and their students. It also provides essential data supporting wide ranging experiments from millimeter observations of the Cosmic Microwave Background (CMB) to X-ray observations of clusters of galaxies both of which are active areas across the country and around the world.</p> <p>While we cannot keep all telescopes operating indefinitely, the GBT is still in its prime and should continue to be fully supported.</p>	Against Closure	Email - Scanned	11/13/2016	
526		Carole	Hanlon		<p>let me add my name with those who feel that supporting the work of the Green Bank Observatory is so profoundly important to the world, that the thought of its closing presents an unacceptable deprivation of humanity's quest to learn its place in the universe. Mankind was meant to explore. To snuff out that trait is unconscionable.</p>	Against Closure	Email - Scanned	11/13/2016	
527	a	Megan	Hanlon		<p>I write to you to voice my concerns over the future of the Green Bank Telescope.</p> <p>I am a native West Virginian. Science and technology have always taken a backseat in this state. Coal and oil decide almost everything. When Robert C. Byrd brought the GBT and other investments to the state it gave our children a different future. The state has long struggled to keep up with the changing times. The GBT is a tangible source of pride that West Virginia can offer more than natural resources.</p>	Against Closure	Email - Scanned	11/13/2016	
527	b	Megan	Hanlon		<p>The geographic location of the GBT is unique. The lack of development in the area is what makes this such a special place. Without electromagnetic interference, the telescope can "hear" more here than anywhere else currently in the world.</p>	Against Closure	Email - Scanned	11/13/2016	
527	c	Megan	Hanlon		<p>Countless school field trips are taken every year to visit Green Bank. Children are awed and the influence it can be to their future is without measure.</p> <p>I urge you to keep the GBT in West Virginia, and keep it operational. I putting my best effort forth in getting the word out to show support for the GBT.</p>	Against Closure	Email - Scanned	11/13/2016	
528		Justin	Fischer		<p>I urge you to continue financial support for the GBT. I have traveled to visit this research facility as a tourist with my family, and it is clear to everyone that it is not only a valuable research asset, but a shining star of hope and pride in a state that has struggled to build a positive image for itself. More STEM facilities should be located in WV, not fewer. I suggest that you reach out to physicists to see how much they value the data produced by this facility.</p> <p>Thank you for your time and consideration.</p>	Against Closure	Email - Scanned	11/13/2016	

Green Bank Observatory -Written NSF Public Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
529		Jack	Burns	Vice President Emeritus for Academic Affairs & Research CASA	<p>I am writing as a senior member of the radio astronomy community in response to the NOI to prepare an Environmental Impact Statement for proposed changes to the Green Bank Observatory (GBO) operations issued by the NSF. Of the five alternatives to be evaluated by the NSF, I strongly favor the first which states: Continued NSF investment for science- focused operations (No-Action Alternative). In my opinion, this is the only sensible course of action.</p> <p>The GBO has had a long and impactful history on radio astronomy from planetary science to cosmology. That impact continues today with the Green Bank Telescope as a leading facility to study effects in strong gravity systems around neutron stars and black holes. The Nano-Grav project was highly ranked by the last Astrophysics Decadal Survey and has been funded by the NSF's mid-scale program to test the limits of General Relativity and gravitational physics. This is just one of many such innovative programs.</p> <p>Another potential use of GBO is for a NASA MIDEX mission concept called DARE = Dark Ages Radio Explorer. I serve as PI and will be submitting a \$250 million proposal in mid- December to fly DARE in orbit of the Moon. This radio telescope requires accurate mapping of the antenna beam and we have proposed to use the GBO 140-ft telescope for this purpose. We will contracting with GBO for full-time use of the 140-ft for 2 years starting in 2023 if we are selected.</p> <p>The NSF has a major investment in the GBO which continues to be enormously productive. It will penny-wise and pound-foolish to scale back operations of the GBO when it is still at its peak. Other partnerships with agencies such as NASA will certainly present themselves over time. AUI is actively seeking such partnerships but this is a slow process requiring patience. I urge the NSF to indeed be patient and not make a regrettable mistake to pull the plug on the GBO prematurely.</p>	Against Closure	Email - Scanned	11/13/2016	
530	a	Carla	Beaudet	Engineer, National Radio Astronomy Observatory	<p>In 2012, when the Portfolio Review Committee's recommendation was first announced, my husband, also employed by the Green Bank Observatory, and I, after living in Observatory housing for 10 years, were just completing the construction of a home in Green Bank. Not only is this a home we love living in, and land we love living on, it is also a home we would never be able to sell if the Green Bank Observatory closed. There are no other electrical engineering jobs in Green Bank, nor within reasonable driving distance; if the Observatory closed, we would have to leave our home, and live again like college students in a city apartment somewhere while paying off the mortgage of a house we couldn't live in. We're both 50-something at this point in our lives; would we be too decrepit to enjoy our place by the time we managed to come back to it?</p> <p>The stress of the uncertainty has been with me since the divestment recommendation was made. These human costs, shared by a good number of Green Bank Observatory employees, are hard to quantify, but they deserve a mention.</p> <p>There are other quantifiable costs to the area that come from losing the many volunteer services of Observatory employees, and the sharing of our facilities with the community. Observatory employees volunteer:</p> <ul style="list-style-type: none"> -As Firefighters and EMTs -As Volunteer teachers of Yoga, Aerobics, Zumba, Tae Kwon Do -As Sound and lighting engineers at the Marlinton Opera House -As Soccer, Basketball and Football coaches <p>And that is by no means an exhaustive list. The Observatory partners with the Parks and Rec. office to offer swimming and dance lessons at Observatory facilities for minimal cost. This in a place where nearest municipal pool is at least an hour's drive away. The impact to the community of losing the pool and the exercise room could only be assessed by considering the cost of a municipal wellness facility to replace those services; will your EIS consider that?</p> <p>As my husband and I have been the ones doing sound and lights at the Opera House for the past 12 years, we've looked into the cost of having an outside sound company come in - about \$1500. per show, maybe 14 shows per year. These things can be quantified, and I want to see them quantified in the Green Bank EIS, if only estimated.</p>	Against Closure	Email - Scanned	11/13/2016	

Green Bank Observatory -Written NSF Public Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
530	b	Carla	Beaudet	Engineer, National Radio Astronomy Observatory	<p>Somewhat easier to quantify is the socioeconomic impact to the local community under any scenario in which the Green Bank Telescope were to cease operations. The losses need to be estimated in dollars, and these estimates need to make it into the Green Bank Environmental Impact Statement. I have read the Socioeconomics section of the draft EIS for the defunding of the Arecibo Observatory, and a number of things concern me: Under "Housing" it reads: "An indirect effect of Alternatives 3, 4, and 5 [these are the alternatives where the science operations go away] could be an increase in housing vacancies as the workforce potentially relocates over time in search of comparable employment."</p> <p>"Could be". "Potentially relocates". I do not want to see this kind of language in the EIS for Green Bank. A little research will assure you that anyone employed at the professional level and not prepared to retire will have to move to find comparable employment. This will have a significant impact on the local real estate market as it is flooded with homes for sale. This impact can be estimated, and it is your job to do so.</p> <p>In the same section, under "Population", the Arecibo EIS reads:</p> <p>"It is difficult to predict when and how many workforce personnel would relocate; therefore, the potential loss of population is addressed qualitatively in this section."</p> <p>Again, there is no excuse for not estimating and quantifying this loss. If the only costs that can be quantified are the costs to the NSF, then the EIS is designed to support a foregone conclusion. A quick, hand-waving estimate for you: The Green Bank Observatory currently has 108 permanent full-time employees, and offers an additional 40 seasonal positions, which I'll count for X, giving us a nominal 118. Maybe 10% of these employees would both choose and be able to find a way to stay in the area. That's a loss of 106 people in the Green Bank / Arbovale area whose combined population in 2014 was 303, a loss of 34% of the total population. This number is probably inflated because we don't all live in Green Bank or Arbovale, but it's easy to find out where 118 people live and adjust these numbers.</p> <p>In section 4.9, "economy, employment and income" are lumped together, but only employment and income are quantitatively addressed. It reads:</p> <p>"The direct effects of the proposed Alternatives on the employment and income of the population of the Municipality of Arecibo are quantified, while the effects on the economy are qualitatively described to account for secondary (indirect and induced) economic effects."</p> <p>Economic impacts are necessarily the indirect product of employment or lack thereof, and deserve their own section, as well as best effort estimates. I know of at least one community sponsored agriculture operation that would not likely be in business if it weren't for the Green Bank Observatory. You could ask the local branch of First Citizens Bank what the impact would be if they lost all their Observatory employee accounts.</p>	Against Closure	Email - Scanned	11/13/2016	
530	c	Carla	Beaudet	Engineer, National Radio Astronomy Observatory	<p>I cannot finish without expressing my disbelief that this is even happening. The NSF's recommendation to de-fund the GBT left a lot of people, particularly its scientific community of users, completely dumbfounded given the recent construction, innovative design, and scientific vitality of the instrument. Even since the divestment announcement, the GBT's capabilities continue to evolve; it is, in fact, just coming into its own with high frequency, multi-pixel receivers. This is no dinosaur, but rather a cutting-edge instrument with sensitivity unattainable by any array of smaller dishes. Its capabilities are absolutely unique, and in demand from the scientific community. Just not, apparently, from the majority of the scientists selected to serve on the NSF's 2012 Portfolio Review Committee.</p>	Against Closure	Email - Scanned	11/13/2016	
531		Vicki	Kossos		<p>At 60 years old, GBT is still the largest fully steerable radio telescope on the planet. Besides its scientific value, GBT is an enormous source of pride for WV and the entire country.</p> <p>No longer a WV resident, my family visits this engineering marvel as often as possible. I am proud to share GBT with my children as my parents and grandparents shared it with me.</p> <p>\$10 million annual operating costs is a bargain for such an important scientific facility. It also provides jobs, learning opportunities for local children, tourism and other investments to WV.</p> <p>Please keep it open. GBT is beloved!</p>	Against Closure	Email - Scanned	11/13/2016	
532		Barbara	Burdette		<p>The first time I visited the Green Banks NRAO facility, was back in the 70's, before the rusted foot sent the older radioscope crashing to the ground. When I got out of the car on my first visit, I viewed the incredibly beautiful area. It was in the fall so you can imagine the beauty of the leaves changing color on the trees, bright sunny crisp weather day. After emerging from the car I stood there knowing I was about to become immersed into an incredible place to visit and absorb all the information available to visitors. What was immediately evident was the quietness of the surrounding area. I could see birds flying around, children on the nearby school playground but there was no noise. Even the cars passing by on the highway didn't disturb the seemingly muted environment. It was almost disturbing.</p> <p>After the visit, which included a short film about the establishing and purpose of the facility, we were taken on a ride to the radioscope and were able to view the immense radioscope. Wow! Was I impressed and in awe that this facility was situated within the country side of West Virginia. I learned later this one and only one other existed in our country and was established here because of the unique quietness of the area.</p> <p>When the radioscope fell after one of the feet holding it in place rusted and caused the scope to fall, I cried. It was such a devastating tragic event to me. The news was not good concerning the replacement of this radioscope. When after 10 years, the news that it was to be rebuilt even bigger and better, I was truly excited.</p> <p>Those are a few of my memories of the wonderful place. Those memories cross the years from the 70's until now. I have visited the facility many, many time. I'm a substitute teacher in Greenbrier County and over the years have taken many groups of young people to Green banks. Sitting in the theater watching young people and adults move to the edge of their seats while watching a program being presented; seeing many go through the hands on museum moving to each and every exhibit, working or maneuvering what was displayed; riding the buses to the radioscope listening to the driver give a description of the area and what we were about to see; listening to the many awed voices, several from many different countries, when the scope first came into view will always be in my memory, My heart would again break as it did in the 70's if this facility would not continue, grow and improve over the coming years. If my one voice would and can make a difference for the continued funding for this fascinating facility, please let it be heard.</p>	Against Closure	Email - Scanned	11/13/2016	GreenBanks Observatory Statement.docx

Green Bank Observatory -Written NSF Public Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
533		Larry	Selvidge	Field Application Engineer Vision, Robotics, Motion & Lasers Neff Engineering	I am writing in response to an article published on Techcrunch.com regarding the possible closing of the Green Bank Telescope by the NSF. I understand that funding for an installation of this scope is daunting, and that dollars must be appropriated to the projects most likely to give a return. However, I hope the NSF will consider the impact, not only to current research, but to the people outside of the professional scientific community. I have taken several groups of young students from Indiana to visit Green Bank in the past, and plan to continue doing so. The impact this has on students considering secondary education in science and engineering is incalculable. The very presence of the facility creates an understanding that in the United States things that are almost too large and complex to be dreamed are possible; not only possible, but very real. When the function, and the results that are obtained, from Green Bank are explained, students begin to understand that these large, complex facilities are producing very usable results that they may very well use as a resource in their future endeavors. In an area of the country where facilities such as this are few and far between we cannot afford to lose one. In particular, states such as West Virginia and Indiana need these facilities to show students that after they've received their education they can remain in this part of the country and pursue rewarding scientific and engineering careers, thus boosting our economies in places that have been hit hard by economic changes. Again, I am sure this is a decision that will be thought about long and hard, and my hope is that some solution can be found to maintain this wonderful facility, not only for the scientific community, but for the entire region, and the people that need it so badly.	Against Closure	Email - Scanned	11/13/2016	
534	a	Linda	Stalnaker		<p>To put it simply, as an amateur astronomer, I am concerned and distressed over the future of the Green Bank Observatory. In this day and age of ongoing discussions about STEM education the prospect of defunding, decommissioning and/or dismantling the Green Bank Telescope are ways of taking this superb instrument out of the science toolbox. The list of scientific discoveries and support given to space exploration programs have made the largest fully steerable radio telescope in the world bring shades of science fiction into reality.</p> <p>The GBT is an enduring symbol of what the National Science Foundation does. Quoting from the NSF website: "We are tasked with keeping the United States at the leading edge of discovery in areas from astronomy to geology to zoology. So, in addition to funding research in the traditional academic areas, the agency also supports "high-risk, high pay-off" ideas, novel collaborations and numerous projects that may seem like science fiction today, but which the public will take for granted tomorrow."</p> <p>As an amateur astronomer, I have visited the Green Bank Observatory many times. I have toured the Jansky lab, been through the science center displays often, attended the Green Bank Star Quest, and even have been up on the GBT superstructure - a thrilling experience through which I saw the receivers and the nuts and bolts up close. I have used the 40-foot education radio telescope and accompanied Girl Scouts there where they earned an astronomy badge through the observatory's excellent education department.</p> <p>The times I have been at Green Bank the parking lot has been full of cars, vans, SUVs and motorcycles that have brought travelers, enthusiasts and curiosity seekers to see just what the GBT does. It is a scientific tourist attraction bringing folks to the Greenbrier Valley of West Virginia to experience up close how astronomical discoveries are made without the use of optical telescopes. The Green Bank Observatory has been a shining star in the culture of West Virginia, a state not known for its strong education and cultural achievements. As I have often said, we do great science in Green Bank, WV.</p> <p>A budget of \$10 million is the proverbial drop in the bucket when compared to the NSF budget and the federal budget as a whole. What I have seen is the money funding Green Bank is not wasted and stretched as far as it will go by the employees and scientists at the facility. Even the receivers for the GBT have been machined there to specifications reflected in the astronomical endeavors of students, post-docs, and professionals. The observatory has been a breeding ground for budding scientists including school aged children, and even some amateur astronomers, because of actual hands-on experiences that have cost them little to nothing to participate. Perhaps one of the saddest days I had was when I found out the observatory had to start charging for public bus tours and information sessions.</p> <p>Let us too not forget how Green Bank got the largest fully steerable radio telescope in the world. The tragedy of the catastrophic collapse of the 300-foot telescope in 1988 paved the way for US Senator Robert C. Byrd to push for a replacement to be built. And it was a replacement built with science in mind with its minimally non-obstructed receiving area and massive steering mechanism.</p> <p>I urge the National Science Foundation to consider continuing full support - and more - to the Green Bank Observatory and even bring it back into the fold of the National Radio Astronomy Observatory. A part of mankind's future depends on what space has to tell us. We must continue to discover and to do that we need tools such as the Green Bank Telescope and Observatory.</p>	Against Closure	Email - Scanned	11/13/2016	
534	b	Linda	Stalnaker		And let us not ignore the White Paper recently authored by Green Bank and National Radio Astronomy Observatory scientists (arXiv:1610.02329v1 [astro-ph.IM]). They have delineated how the GBT of 2012 when the NSF portfolio review was conducted is not applicable to the GBT of 2017, that the radio telescope is indeed already advancing the scientific areas NSF identified four years ago.	Against Closure	Email - Scanned	11/13/2016	
534	c	Linda	Stalnaker		The location the Green Bank Observatory is a great spot made quiet by federal law. The National Quiet Zone (that also benefited the now closed Sugar Grove naval base) helps keep the RFI in check while still allowing a modicum of civilization to exist at Green Bank. No cell phones, but life goes on and the folks there seem no to suffer by their own admission. It is not a desolate spot as compared to where other radio telescope facilities are located.	Against Closure	Email - Scanned	11/13/2016	
535		Min	Yun	Professor of Astronomy University of Massachusetts	The GBT remains the world's premier single-dish radio telescope with a strong science case as noted in recent series of white papers. Given that the new single-dish initiative recommended by the 2010 Decadal Review was not funded by the NSF, it would be prudent to maintain the current NSF investment in GBT for continued science-focused operation ("no-action" alternative) would seem the most logical course of action. Maintaining an access to major survey facilities such as the GBT is essential for maximizing the return on NSF's recent large investments on the Atacama large Millimeter/submillimeter Array (ALMA) and the Jansky Very large Array (VLA) and to maximize the scientific opportunity and productivity of the US scientific community.	Against Closure	Email - Scanned	11/13/2016	

Green Bank Observatory -Written NSF Public Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
536		Christina	Lambert		We need to figure out a way to maintain the world's largest steerable telescope. If we can fund multimillion dollar trips to the Space Station, we can save the Green Bank Observatory!	Against Closure	Email - Scanned	11/13/2016	
537		Richard and Mary Alice	Connor		We have had the opportunity to tour the Green Bank Observatory and were very impressed. The tour was conducted in a very professional and educational manner. We are from Minnesota and returned with our grandchildren so they could tour the Observatory. Because of this exposure our 14 year old grandson was so enthralled with astronomy that he has been pursuing the subject ever since. This is a tremendous research facility which stimulates young minds toward the study of astronomy.	Against Closure	Email - Scanned	11/13/2016	
538		Yara	Yousef		I am a prospective astrophysics major from the University of Virginia, and a regular participant in the events of the university's astronomy club. Naturally, I have a deep love of astronomy and the night sky. The Green Bank Telescope is a landmark for astronomical research and outreach. It is a center for renewing interest in a field that is constantly being hindered by a lack of funding and resources. It is a place where people (and astronomy clubs) can visit from all over and be reminded that our universe is incredible, breathtaking, and infinitely mysterious. It simultaneously reminds us how far we have come and how much more we have to discover. This year, the largest number of people signed up for our astronomy club's annual Green Bank trip since the trips began. So many people were interested in going that we had to set up a wait list. I know that tens of thousands of people go to visit the observatory each year. It would be an incredible shame if Green Bank had to close when there is so much growing interest in the observatory, and in the field in general. The Green Bank Telescope means so much to me and many, many others who love astronomy as much as I do, and gives those who have not been able to learn much about the universe a chance to get excited about it and all the promise it holds. I genuinely hope you will reconsider cutting all funding to it.	Against Closure	Email - Scanned	11/13/2016	
539		Deanna	Kay		I am sending my appeal for you to not shut down the Green Bank Telescope. A few years ago, I joined the Astronomy and Engineering Clubs at Howard Community College, of which I am an adjunct professor at, on a weekend trip to the Green Bank Observatory, where we partook of their educational activities. There I discovered that learning in the classroom about radio astronomy did not truly enable me to understand how radio actually works. Having the opportunity to work the telescope (reserved for the public educational activity) and being taught how to analyze the data we gathered made a huge difference in my understanding and appreciation for this science. I can only imagine the world of opportunities this activity must inspire in the younger generations who are able to take part in this! Perhaps the other aspects of the Observatory could remain despite the GBT itself being shut down. But then again, just as a shopping center dies after the grocery store in the shopping center shuts down and is never replaced, I fear that the Green Bank Observatory would likewise die a similar slow death. The loss of the Green Bank Observatory would be a tragic loss to the science of astronomy, the careers of astronomers, the learning of astronomy, the economy of West Virginia, and the benefits to the community the Green Bank Telescope and Observatory provide for them. Please find a way to keep the Green Bank Telescope running.	Against Closure	Email - Scanned	11/13/2016	
540		Brett	McGuire	NRAO Jansky Postdoctoral Fellow	It is with great pleasure that I write today to express my full and unqualified professional and personal support for the Green Bank Observatory (GBO). You will no doubt receive countless other letters detailing the myriad ways in which the Green Bank Telescope (GBT) represents one of the last bastions of American radio astronomy, produces breakthrough science that is not possible at any other facility in the world, and is uniquely positioned among all other radio facilities in one of the most radio-quiet zones on the planet. I completely agree with all of these points. What I wish to emphasize here, however, is the important role that the GBT played in my education and training. I can say with absolute confidence that the accessibility of the GBT to myself as a young scientist played a critical role in my ability to emerge as a vibrant researcher in the field of astrochemistry. I am a chemist by training. When I first entered the world of observational astrochemistry, it was observations with the GBT, guided by the GBO staff, that made a crucial impact in my understanding of the underlying principles of radio astronomy which govern the work that I now do. Without the GBT, I would not be on the successful career path I am on now, being the first chemist to receive the Jansky astronomy prize fellowship. I am now applying for faculty positions, and I look forward to taking my students to the GBO for many years to come, to train the next generation of astronomers and astrochemists. Operator-driven astronomy, such as being conducted at ALMA, has its advantages. But there is simply no substitute to the hands-on experience that comes from learning the ins and outs of a radio telescope and conducting observations. The GBO and GBT provide this unique service to American radio astronomy, and their continued operation is absolutely essential to maintaining American excellence on the global stage. Please do not hesitate at all to contact me for any reason	Against Closure	Email - Scanned	11/13/2016	

Green Bank Observatory -Written NSF Public Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
541	a	Danny	Scalise, II		<p>I am very displeased with the thought of any continuing cuts to the National Radio Astronomy Observatory in Green Bank, WV. As someone who has worked extensively within public policy, government at the local, state, & federal levels and within non-profit, I feel public administration is a strength of mine. In my opinion, the constant cuts the sciences are disheartening at best, but more likely a precursor to a society that is failing to be the beacon of scientific discovery it should be. I believe that the unique strengths of the observatory at Green Bank are the combination of educational programs, research staff in science and engineering, and the telescopes.</p> <p>Our country is not developing the vast number of STEM students it should and must look outside our borders for STEM professionals. Because of this, many young West Virginians do not have strong role models in the STEM fields, so experiential learning that can only happen at places like the Observatory is important to the development of STEM students. Students from rural areas, like much of West Virginia, get access at Green Bank to science at work in manners that are not possible at a museum.</p>	Against Closure	Email - Scanned	11/13/2016	
541	b	Danny	Scalise, II		<p>The research professionals at Green Bank make for an academic hub that is unlike any place in West Virginia or maybe even the east coast. Green Bank attracts intelligent, open minded people to rural West Virginia to further scientific discovery and they are pillars of the community.</p> <p>Furthermore, the investment in telescopes such as these is extremely large. For a government or other organization to attempt to build something similar would be too large a financial outlay. The consistent cuts to the observatory may force closure and cause the telescopes to be a relic when they are still very useful in scientific observation and discovery.</p> <p>Finally, the Green Bank Observatory is a magnet for leading scientists from around the country and the world. It assists West Virginians in overcoming the negative stereotypes associated with the Mountain State and has added a great value to the West Virginia highlands. It is ludicrous and insulting to think anyone would want this country to see such an asset go into disrepair or even worse be abandoned. Please reconsider your process and make science a priority.</p>	Against Closure	Email - Scanned	11/13/2016	
542		Lonnie	Carpenter	Mayor, City of Kenova, WV	<p>I remember as a child the trip my family took to see the Observatory and how it peaked my interest in science and the unseen wonders that may one day be understood. In those fifty years later our understanding has become somewhat better, but there are more discoveries to be made and I feel that the Observatory at Greenbank, WV has a place in those discoveries. The science program in schools depend on facilities like Green Bank Observatory which foster the science program to new heighten awareness of the possibility of a future if the student remains in Science.</p> <p>I still look to the sky with amazement and the wonder I experienced when I visited Greenbank many years ago and how Green Bank Observatory was the surrogate that instilled in me the many wonders of the universe.</p> <p>I pray that the NSF can fully fund the Green Bank Observatory for many years to come and instill in the many children who visit and rear about the discoveries to have a place in their minds and hearts a true love for the unseen wonders found close to home.</p>	Against Closure	Email - Scanned	11/13/2016	
543		Paul	Goldsmith	Senior Research Scientist, Jet Propulsion Laboratory, Professor Emeritus of Astronomy, Cornell University, Adjunct Professor of Astronomy, University of Arizona	<p>I am writing this letter to express in the strongest possible terms my support for continued operation of the Green Bank Telescope (GBT) as an astronomical research facility. It has become a cornerstone for a broad range of scientific research projects and with ongoing upgrades to instrumentation will surely play an increasingly important role.</p> <p>It is difficult to enumerate all the areas in which the GBT has made major contributions to our understanding of the universe. These are contained in a detailed "While Paper" recently submitted to the National Science Foundation (NSF). But let me dwell for a moment on the critical role the GBT plays in training young scientists. A single dish telescope like the GBT affords the opportunity for an astronomer to actually go to a research facility and learn what it means to operate a state of the art instrument. Then, he or she sees what actually happens when one writes scripts to control the telescope. Finally, there is dealing with the data. Most importantly, the observer can take advantage of the expertise of the GBT staff in near real time. This is hugely important, as learning is far faster and deeper when one can interact personally, get feedback, and then see the results. This is very different from the help that is available at purely remotely operated facilities. That is not to say that such facilities (e.g. ALMA) do not try their best to answer questions, but the whole experience is entirely different. You can get a question answered in a few minutes at the GBT that you might be too embarrassed to put in an email to a "help desk", and even after having done so, you will likely wait for days to get a response. That is just the difference between hands-on and remote facilities. Of course, expert users can use the GBT remotely, and many do, but for training the GBT really is something unique. I have used a very large range of astronomical facilities, on the ground and in space. I have no doubt that for graduate students working with me, going to Green Bank and using the GBT was a critical part of astronomical training. I had a similar experience at single dish telescopes operated by universities that have since been closed. The GBT is one of the VERY FEW facilities that offers open access to the entire U.S. community, and even supports travel for students and for their stay at the GBT. If this disappears, the entire astronomical community will suffer, since the students who use the GBT are often not pure "radio astronomers", but are often engaged in a research process that requires multi-wavelength data. The GBT is where they can have the real "hands on" experience that will be of real benefit for the rest of their scientific career. I thus urge you take "no action" and thus enable the GBT to continue as a forefront facility for research together with being a unique resource for student training.</p>	Against Closure	Email - Scanned	11/12/2016	support_letter_Nov2016.pdf

Green Bank Observatory -Written NSF Public Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
544		Randy	Tephabock		<p>...Anyway I am writing to ask that you reconsider de-funding and deconstructing the valuable telescopes at the Greenbank Observatory for the following reason.</p> <p>With its large 110-meter dish, GBT is able to "hear" incredibly faint radio waves emitted from the universe that smaller radio dishes wouldn't be able to capture. Of course larger dish telescopes, like the a stationary 305-meter Arecibo radio telescope in Puerto Rico, can do this as well. It's GBT's steerability that sets it apart. With its ability to move its large dish, GBT can cover 80 percent of the sky. Stationary single-dish radio telescopes must make do with the swath of the universe that passes directly overhead. The Arecibo Telescope can observe about 33 percent of the sky, for example. Another white paper put forward by Green Bank Observatory researchers, argued that recent discoveries in the astronomy field have invalidated the 2012 negative assessment of GBT's usefulness. In particular, the recent discovery of gravitational waves has put pulsar research, an area where GBT is well-known, at the forefront of modern astronomy. Gravitational waves are created by large cataclysmic events that create ripples in the fabric of spacetime. Once scientists proved that they could detect them, it opened up an entirely new way to study the universe.</p> <p>Dr. Sean McWilliams, an astronomer at West Virginia University who was one of the collaborators on the recent discovery of gravitational waves, told TechCrunch that the GBT is a crucial tool for his line of work. McWilliams uses the GBT and the Arecibo Telescope to analyze radio waves emitted from pulsars. By precisely recording the timing of these pulsars, astronomers can look for gravitational waves.</p> <p>"We use the GBT and Arecibo for our timing, and to achieve our science, we need the steerability of the GBT because we really need a large number of extremely well timed pulsars in order to accomplish many of our observational goals." says Dr. Sean McWilliams, Astronomer at West Virginia University.</p> <p>McWilliams noted that larger telescopes like the 305-meter Arecibo Telescope or the 500-meter FAST telescope in China can perform somewhat more precise timing of the pulsars in their line of view. But they're limited in the portion of the sky they can study.</p> <p>"This is a tremendous advantage for the GBT, and given the engineering limitations involved, it is highly unlikely that another facility that is comparable in size to the GBT and also steerable will be constructed in the foreseeable future." says Dr. Sean McWilliams, Astronomer at West Virginia University.</p> <p>With these considerations. . .please reconsider shutting down this facility. I feel it would set back research in this new important field of Gravitational Waves.</p>	Against Closure	Email - Scanned	11/12/2016	
545		Randall	Detra		<p>I have recently heard of plans to scuttle the GBT, specifically the Sen Byrd telescope.</p> <p>This seems an unacceptable solution to budget settling. This is one of the most celebrated instruments of its kind through out the world. Any speculation that it is simply duplicated capability of other scopes in the NRAO inventory is certainly not well advised. Besides the steerability, which means there is no need to wait for the rotation of the earth to line the scope up with important celestial objects, often some remarkable research is done by the cooperation of multiple installations around the planet.</p> <p>When this instrument was first put in service, the excitement was more than palpable and I am sure among most scientists as well as interested and informed public the enthusiasm remains.</p> <p>Certainly, it seems, if there is a need to spread the cost around, there would be other institutions inside and outside the United States which would be inclined to assist in the operating expenses of this fabulous instrument.</p>	Against Closure	Email - Scanned	11/12/2016	
546		David	Burhman		<p>I am writing to urge you to keep the Greenbank Observatory open. This amazing facility is a true asset for both the scientific community and the public. I personally have attended two Greenbank StarQuest weeks during the summer months and I'm constantly sending out-of-state tourists interested in astronomy up to Greenbank.</p> <p>While I understand that budgets are a reality and it may be necessary to impose certain cuts in programs being offered, certainly any solution that doesn't involve a complete shut down should be considered first. You already have a cooperative community at Greenbank and a long time established radio quiet zone.</p> <p>Please make every effort to keep this wonderful radio observatory open.</p>	Against Closure	Email - Scanned	11/12/2016	

Green Bank Observatory -Written NSF Public Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
547		Fronefield	Crawford, III	Faculty Don of Weis College House Associate Professor of Astronomy Department of Physics and Astronomy Franklin and Marshall College	<p>I am sending this letter in support of continued operations at the Green Bank Observatory (the “no-action alternative”) in response to the Environmental Impact Statement that outlines possible changes to operations. The observatory’s flagship instrument, the Green Bank Telescope (GBT), is a critical instrument for my research and for a number of my colleagues working in the area of pulsar astronomy. Pulsars have had a very rich history in terms of their scientific impact since their discovery in the 1960s, and very large radio telescopes that operate at “low” frequencies (i.e., at a few GHz or less) such as the GBT are required for their discovery and study.</p> <p>In terms of the specific impact that the GBT makes in my own work, there are two areas in which I depend on the GBT in its current form. The first area is the various pulsar search and timing programs that I participate in with a number of collaborators (including the NANOGrav search for gravitational waves, an NSF-funded Physics Frontiers Project which has seen renewed prominence with the recent LIGO direct detection of gravitational waves). The GBT and its associated instrumental capabilities cannot easily be replaced, and the “open skies” policy of the GBT is absolutely necessary for researchers such as myself at liberal arts colleges: my institution, Franklin and Marshall College, serves undergraduates only and has no access to any private facilities that would be necessary for this work to continue and has no funding on the scale needed to gain access to them. Without the GBT and Arecibo, my research (and the research being conducted by the undergraduate students I supervise) would cease. This would have a serious impact on the next generation of scientists who are being trained to use such facilities, who are working on the resulting data sets, and who are learning the basics of scientific research.</p> <p>The second major impact would be in seriously diminishing the very successful Arecibo Remote Command Center (ARCC) program, in which dozens of undergraduates from 7 institutions from around the country (including Franklin and Marshall College) use the GBT for ongoing pulsar timing and search projects. (Note that even though the ARCC name says Arecibo -- a historical artifact -- the GBT is used just as much in this program). Students operate the GBT remotely from our various institutions to time pulsars for the NANOGrav effort and to search for new radio pulsars in pulsar survey projects. Students also look through the resulting pulsar search data for new pulsars. The ARCC program was started in 2004 at the University of Texas at Brownsville and has recently expanded to include 5 liberal arts institutions (out of the 7 institutions involved!) and is therefore a valuable training ground for students. The ARCC program is also among the top 10 producers of Hispanic physics bachelor’s recipients in the nation (that’s just the ARCC program itself, not counting other non-ARCC students at the participating institutions or in their departments!). This demonstrates the value of ARCC in recruiting and engaging underrepresented groups in real science. ARCC is also a valuable attraction to students who are considering a major in physics or astrophysics at our institutions since it gives them an early exposure to research.</p>	Against Closure	Email - Scanned	11/12/2016	gbt_env_study.pdf
548	a	Arlene	Walton		<p>I have been stationed at the Green Bank Science Center for 14 seasons as an employee of the Pocahontas County Convention and Visitor’s Bureau. The GBO Science Center has been so much to so many people. To lose the GBO would be devastating to the community as well as to the visitors who come there to visit. The specific resources that would be affected by changes to the GBO operations that also would impact tourism would be socioeconomic and the cultural resources.</p> <ul style="list-style-type: none"> · GBO has a \$17 million dollar direct impact locally · GBO has a \$30 million dollar induced impact to the region · 50,000 visitors annually to GBO · The GBO is unique and is a point of pride for West Virginia · The National Radio Quiet Zone creates a significant amount of publicity for the area as well which delivers visitors to the county who not only visit Green Bank but stay in lodging, eat in local restaurants and visit other attractions. · Pocahontas County is a drive-to destination reliant on unique appeal and the GBO is a key attraction that makes our destination unique. Few other locations in the world can provide the visitor experience the GBO provides our visitors thus it creates a demand for traveling to Green Bank and Pocahontas County. Please take these factors into consideration. They are important! 	Against Closure	Email - Scanned	11/12/2016	
548	b	Arlene	Walton		<ul style="list-style-type: none"> · A key component travelers look for in a vacation destination is an educational element - GBO is a unique educational opportunity for engagement into many science and STEM aspects for all visitor demographics · GBO is an exceptional educational facility for student engagement - and the reason it positively impacts the students as a learning environment is that it is a working research facility. · The GBO Science Center, public tours and educational outreach efforts are a highly valuable component to the tourism product mix in Pocahontas County. 	Against Closure	Email - Scanned	11/12/2016	
549		Miranda	Baumann	Doctoral Student I Graduate Research Assistant Department of Criminal Justice and Criminology Andrew Young School of Policy Studies Georgia State University	<p>Please do not close this observatory!</p> <p>Ask the public for money, and we will do whatever it takes to keep it funded!</p>	Against Closure	Email - Scanned	11/12/2016	

Green Bank Observatory -Written NSF Public Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
550		Simone	Traverse		<p>I am writing to you today to ask you to please continue to fund the Green Bank Telescope at 100% (or more). I am not a scientist, I work in non-profit with cancer patients. We as a family though are big science enthusiasts. I went to a science and math academy in high school and started a bio-chem major in college. I eventually went towards non-profit, but still subscribe to Science News weekly and we read it to our kids every night. We were all very excited when gravitational waves were confirmed and made a road trip this summer from Texas to visit the Green Bank Telescope in West Virginia. It was such a wonderful experience. My 4 year old daughter wants to be an astronaut when she grows up and my 8 year old son wants to be a scientist. He was the one who asked to go once we read about it in Science News. We could not have been more pleased with our visit. We learned so much in the well laid out museum and the educational presentations. Seeing the telescopes up close was inspiring. To think that we as humans are exploring sounds from the beginning of the universe is simply mind boggling.</p> <p>We cannot afford to NOT fund this telescope. Science has no borders, and there are so many scientists across the world using this telescope to discover so much. There are no alternative telescopes that scan the same amount of sky as Green Bank. To dismantle or even de-fund something that is helping us discover so much would be a gigantic mistake and a huge step backwards.</p> <p>For the future of humanity and the future of our children, we must continue to invest in science. Especially in the face of recent gravitational wave discoveries this telescope is more important than ever. I want to be able to continue to show my children that we as a country value science, especially in this time of growing anti-intellectualism. The Green Bank Telescope is a symbol of that investment, a symbol that we still want to learn more about our world, and a symbol that we are willing to invest in discovery. If we lose our curiosity and our will to discover more, we will have lost so much as a country and as a species.</p>	Against Closure	Email - Scanned	11/12/2016	
551		Maxwell	Stout	Inactive Attorney Emeritus State Bar of Texas	<p>Please do not close the Green Bank Telescope. It holds great value to me, as a citizen of our Country. It holds great value to our Nation and to the World. We need more radio telescopes in various locations on our planet, not less. look for new funding from other sources, but do not look for closure of this unique facility.</p>	Against Closure	Email - Scanned	11/12/2016	
552		Jon	Cooper		<p>What is the threat to Greenbank? Ref Permalink: http://www.manchin.senate.gov/public/index.cfm/2016/11/manchin-capito-jenkins-provide-information-on-how-to-submit-public-comment-on-the-future-of-green-bank-observatory</p>	General	Email - Scanned	11/12/2016	
553		David	Childress	Professor Coordinator - Computer and Information Technology (CIT) Ashland Community and Technical College	<p>I wanted to lend my support to keep the Greenbank Radio Observatory open and funded.</p> <p>Furthermore, it helps to support universities and their students who can use the telescope's unique abilities to learn and discover new things in radio astronomy. Plus, it supports Science, Technology, Engineering and Mathematics (STEM) in an area that can benefit from it.</p> <p>I hope that you will continue to fully fund and support this wonderful resource.</p>	Against Closure	Email - Scanned	11/12/2016	
554		David	Childress	Professor Coordinator - Computer and Information Technology (CIT) Ashland Community and Technical College	<p>The telescope is unique in that it is fully steerable and can cover so much of the sky. In addition, it is located in an excellent spot of radio astronomy, in the mountains of West Virginia with little radio interference to impede observations.</p>	Against Closure	Email - Scanned	11/12/2016	
555		Jessica	King	Concerned citizen	<p>Please do not close the Green Bank Observatory! West Virginia is already struggling in so many areas. The educational system is failing, the economy is dying, and the people are looking anywhere for a shred of hope for our state. Take the observatory away from us, and we have very little left to be proud of. It is more than a telescope to us, more than a research facility. It represents the spirit of West Virginia and her people. It is a monument to the future, one that is hopefully better and more prosperous than the present.</p> <p>Beyond what the facility does for our state, the observatory is a center for scientific advancement and discovery. With the expansive universe being our last undiscovered frontier, we as a country and as a species need to spend more of our efforts and finances on charting the uncharted. We have a massive amount of information to glean from researching the infinite universe. To throw away such a valuable resource in scientific achievement as the Green Bank Observatory is backwards and foolish. Please reconsider withdrawing funding for the facility. We as a state need this. We as a country need this. Please, don't let us down.</p>	Against Closure	Email - Scanned	11/12/2016	
556		Gina	Ervolini		<p>Greenbank is so very important to have for us and for future generations. Please let's not see this go away.</p>	Against Closure	Email - Scanned	11/12/2016	
557		EJ	Smith		<p>As a science teacher I can tell you that this facility is a key to the future and not just for West Virginians. It is something WV can be proud of too. Please do whatever is necessary to keep it going. It is important for all of us. When you just think of what all space exploration has brought us then you understand it's importance. For example; Velcro, air conditioning, cell phones, radio and satellite communication, microwave ovens just to name a few things. Did you know the first pulsars and quasars were discovered at Greenbank? We need this facility. Please keep it funded, not just for WV but for technology as a whole. EJ Smith 34 year veteran science teacher and proud of science and proud of Greenbank, our touch of space.</p>	Against Closure	Email - Scanned	11/12/2016	

Green Bank Observatory -Written NSF Public Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
558		George	Zook		Please keep the green bank telescope open... please thank you from George Zook's brain	Against Closure	Email - Scanned	11/12/2016	
559		Manoj	Kumar		I received information that green bank observatory is to be closed.I am writing this e-mail to do my part in keeping the observatory open.I am an aspiring astrophysicist and these observatories are really important to us.They provide vital information about our information. It is a one of a kind telescope and it can't be replaced.It is an inspiration for kids to pursue science education. One day I wish to work in a observatory. So , I kindly request you to keep it open.	Against Closure	Email - Scanned	11/12/2016	
560		Neil			<p>I was just reading an article about the Observatory and its possible closing: http://www.eham.net/articles/37975</p> <p>I heard about the Quite Zone, once, and was intrigued. I just found out that the Observatory has a procession of visitors, and I'm bothered that I was never one of them.</p> <p>It's possible that increasing your advertising budget would reap increased cash influx. In Queens, NYC, I see advertisements for Myrtle Beach, South Carolina, but I never saw an advertisement for the Green Bank Observatory. Kids love that stuff. Hams love that stuff. Technofreaks love that stuff. The whole world loves Astronomy. Everyone wants their own black hole.</p> <p>Close an observatory at 6 PM?? Yes, you've been self-shot in the foot.</p> <p>You could post Green Bank Astronomy Forecasts, including which upcoming days will have perfectly clear skies, so people can plan nighttime visits that will be most dramatic and beautiful: Put a couple of 3" telescopes on the ground in back of the observatory so people can enjoy the dazzling night skies.</p> <p>One well placed TV advertisement on lawng Island would create a traffic jam in Green Bank. The advertisement can flash the world of radio-telescopes during the day, and the peaceful Jovial Moons and Saturnian Rings at night. Instead of a 10 second TV-spot that says, "It's 10 PM -- do you know where your kids are?" you could have a 10 second spot that says, "It's 10 PM -- the astral viewing at Green Bank Observatory is extraordinary. Just 10 seconds.</p> <p>And don't even mention extraterrestrials. Just tell people what to load into their GPS's, and they will come.</p> <p>You have to be ready to manage the crowds. But if you're afraid of crowds, then you're subconsciously motivated to avoid them. Maybe hire a management agency to coordinate advertising with increasing visitor attendance.</p> <p>life in the big city is exhausting. Some people have never heard of or seen the Milky Way. (I've never seen the Orion nebulae through a telescope.) People need a peaceful getaway in the countryside. It would be awful to lose the opportunity you can provide.</p> <p>Hope to visit y'all. The closest I've come to Green Bank is Winchester VA, while trying to avoid traffic jams on I-95. Wow; smack dab in the middle of the Appalachians, where a city boy can decompress. As Trump would say, "It will be such a beautiful thing. Believe me."</p>	Alternatives Consideration	Email - Scanned	11/11/2016	
561		Helge	Blucher		Please don't close the observatory. I have visited the site and I'm extremely impressed with the science that is conducted and the amazing possibilities for space discovery related to radio astronomy.	Against Closure	Email - Scanned	11/11/2016	
562	a	Brandon	Phillips		<p>My name is Brandon Phillips and I am a dentist and full time resident in Summersville, WV. I am writing to express my concerns over the possibility of defunding the Greenbank Telescope. I can't possibly put into words the devastating consequences that would result in such defunding. The local community is who first comes to mind for me. The entire Pocahontas county region is one of the more poverty ridden areas already in the state of West Virginia. This observatory brings in around \$12 million annually and the loss of that tourism income could cripple a region that is already struggling.</p> <p>In closing, I implore you to consider full funding for not only a scientific treasure, but a heavily depended on local commodity. Thank you for your time and consideration.</p>	Against Closure	Email - Scanned	11/11/2016	
562	b	Brandon	Phillips		If that isn't enough, it is well known within the astronomical community that this telescope has capabilities that others that are similar simply do not. With it being a fully steerable telescope, it can scan approximately 80% of the sky compared to the average 30% of similar telescopes.	Against Closure	Email - Scanned	11/11/2016	
563		Neil	Jorgensen		<p>I want the Green Bank Telescope to remain open and kept fully funded. When I was a young Cub Scout (now an Eagle Scout), I was taken to the telescope. It was there that I drew inspiration to engorge myself in science. I grew up dreaming about space, the stars, the planets. I took it upon myself at the age of 16 to take a 6 week college course in cosmology at Stanford. This shaped me into what I am today - a data scientist with a strong interest in space.</p> <p>Don't take this opportunity away from the future generations who will also be inspired, like I was. West Virginia, especially, needs this inspiration.</p>	Against Closure	Email - Scanned	11/11/2016	

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Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
564		Ashley	Stewart	Technology Integration Specialist and Academic Coach Ed.D. Student, West Virginia University	As a West Virginian native, resident, and educator, I am expressing my concern of the possible defunding or deconstruction of the Green Bank Observatory. Though I am a social scientist and not a physical scientist who directly benefits from the facility, I am a teacher who hears of great academic experiences that the observatory provides to young West Virginians. For many rural students, visits to Green Bank can enrich and inspire a devotion to science, as many youths do not have access to many authentic resources such as the telescope. Our state is struggling both in terms of economy and education; young people are leaving in exodus due to lack of opportunities and resources. Maintaining the Green Bank Observatory would mean maintaining a learning environment that promotes STEM education for a population in need of young scientists. I implore you to continue supporting the Green Bank Observatory and to not allocate the respective funds elsewhere.	Against Closure	Email - Scanned	11/11/2016	
565		Josh	Hereau	Senior Mortgage Planner 1st Advantage Mortgage, a Draper and Kramer company Company NMIS: 2551 I loan Officer	I think it's a travesty to consider dismantling the Green Bank Observatory. Please continue to support the project in West Virginia.	Against Closure	Email - Scanned	11/11/2016	
566		Brian	Guetzlaff		Please continue your funding (or at least actively seek private/alternate funding) to keep the Green Bank Observatory operational. Not only is it a truly unique telescope, as you are well aware, but it provides other benefits as well. The media has already covered the ways that the continued presence of this observatory benefits the people of West Virginia financially and educationally. However, it also serves as an anchor for the radio-silence zone around it. Many who live within this area deeply value the fact that they can find solace from much of the man-made radiation in today's world, and these people would almost certainly lose this shelter should the observatory be dismantled. Please seek to preserve this treasure for our nation to the fullest extent of your ability.	Against Closure	Email - Scanned	11/11/2016	
567		C.M.	Tanner		We need someone to step in to straighten the officials out here , they think they can do whatever they want, they aren't for the people of Clay it's about what they can put in there pockets!! Ever since the flood all they have done is run me around in circles!! I went to the County Commissioner to volunteer to help, he told me Clay didn't need help!! I know I need help but no one will help me!!! I came back here from Illinois, I'm disabled so is my brother!!! If you aren't in the click at Clay then it's for get you, there afraid you might find something on them!! The people of Clay needs help!!	General	Email - Scanned	11/11/2016	
568		Jerry	Hubbard	NOGPP	Keep the Green Bank Telescope open. This is basic science. It is economical for basic research. How can our nation even think of closing it?	Against Closure	Email - Scanned	11/11/2016	
569		Cara	Rose	Executive Director Pocahontas County Convention & Visitors Bureau	The Pocahontas County Convention and Visitor Bureau (CVB) is dedicated to promoting the county as a travel destination and to enhancing the tourism product for the area. Part of this commitment is to support attractions in our area and protect the tourism assets that make Pocahontas County a strong tourism destination. The Green Bank Observatory (GBO) is one of these assets. Pocahontas County is a rural, drive-to travel destination. We don't have four lane highways or shopping malls and the area has limited cell phone coverage. What we do have are unique attractions that make the destination appeal to the potential visitor. These include the Green Bank Observatory, Cass Scenic Railroad State Park, Cranberry Glades and Snowshoe Mountain Resort to name a few. We also have an abundance of recreational opportunities including single track mountain biking, skiing and snowboarding, hiking and kayaking. Just one of these can attract a visitor with a specific interest but bundled together these attractions and activities create a destination. The Green Bank Observatory is a key component to the Pocahontas County destination. The tourism industry is the largest industry in the county contributing a minimum of \$100,000,000 to the economy and the GBO is a vital component of the tourism product. The GBO Science Center, public tours and educational outreach efforts are a highly valuable component to the tourism product mix and hosts annually approximately 50,000 visitors. Few other locations in the world can provide the visitor experience the GBO provides our visitors thus it creates a demand for traveling to Green Bank and Pocahontas County. GBO tourism facts and contributions to the tourism mix are many including: •Educational enrichment: A key component travelers look for in a vacation destination is an educational element - GBO is a unique educational opportunity for engagement into many science and STEM aspects for all visitor demographics. Tourism is the conduit to reaching the general population and sharing the science and story of radio astronomy with many. • Unique: The GBO is unique and is a point of pride for West Virginia •Field Trips: GBO is an exceptional educational facility for student engagement and the reason it is so positively impactful to students as a learning environment is that it is a working research facility.	Against Closure	Email - Scanned	11/11/2016	

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Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
570		Cara	Rose	Executive Director Pocahontas County Convention & Visitors Bureau	<p>The Pocahontas County Convention and Visitor Bureau (CVB) is dedicated to promoting the county as a travel destination and to enhancing the tourism product for the area.</p> <p>Part of this commitment is to support attractions in our area and protect the tourism assets that make Pocahontas County a strong tourism destination. The Green Bank Observatory (GBO) is one of these assets.</p> <p>Pocahontas County is a rural, drive-to travel destination. We don't have four lane highways or shopping malls and the area has limited cell phone coverage. What we do have are unique attractions that make the destination appeal to the potential visitor. These include the Green Bank Observatory, Cass Scenic Railroad State Park, Cranberry Glades and Snowshoe Mountain Resort to name a few. We also have an abundance of recreational opportunities including single track mountain biking, skiing and snowboarding, hiking and kayaking. Just one of these can attract a visitor with a specific interest but bundled together these attractions and activities create a destination. The Green Bank Observatory is a key component to the Pocahontas County destination.</p> <p>The tourism industry is the largest industry in the county contributing a minimum of \$100,000,000 to the economy and the GBO is a vital component of the tourism product. The GBO Science Center, public tours and educational outreach efforts are a highly valuable component to the tourism product mix and hosts annually approximately 50,000 visitors. Few other locations in the world can provide the visitor experience the GBO provides our visitors thus it creates a demand for traveling to Green Bank and Pocahontas County. GBO tourism facts and contributions to the tourism mix are many including:</p> <ul style="list-style-type: none"> •Educational enrichment: A key component travelers look for in a vacation destination is an educational element - GBO is a unique educational opportunity for engagement into many science and STEM aspects for all visitor demographics. Tourism is the conduit to reaching the general population and sharing the science and story of radio astronomy with many. • Unique: The GBO is unique and is a point of pride for West Virginia •Field Trips: GBO is an exceptional educational facility for student engagement and the reason it is so positively impactful to students as a learning environment is that it is a working research facility. 	Against Closure	Email - Scanned	11/11/2016	
571		Cara	Rose	Executive Director Pocahontas County Convention & Visitors Bureau	<p>The Pocahontas County Convention and Visitor Bureau (CVB) is dedicated to promoting the county as a travel destination and to enhancing the tourism product for the area. Part of this commitment is to support attractions in our area and protect the tourism assets that make Pocahontas County a strong tourism destination. The Green Bank Observatory (GBO) is one of these assets. Pocahontas County is a rural, drive-to travel destination. We don't have four lane highways or shopping malls and the area has limited cell phone coverage. What we do have are unique attractions that make the destination appeal to the potential visitor. These include the Green Bank Observatory, Cass Scenic Railroad State Park, Cranberry Glades and Snowshoe Mountain Resort to name a few. We also have an abundance of recreational opportunities including single track mountain biking, skiing and snowboarding, hiking and kayaking. Just one of these can attract a visitor with a specific interest but bundled together these attractions and activities create a destination. The Green Bank Observatory is a key component to the Pocahontas County destination. The tourism industry is the largest industry in the county contributing a minimum of \$100,000,000 to the economy and the GBO is a vital component of the tourism product. The GBO Science Center, public tours and educational outreach efforts are a highly valuable component to the tourism product mix and hosts annually approximately 50,000 visitors. Few other locations in the world can provide the visitor experience the GBO provides our visitors thus it creates a demand for traveling to Green Bank and Pocahontas County. GBO tourism facts and contributions to the tourism mix are many including:</p> <ul style="list-style-type: none"> •Educational enrichment: A key component travelers look for in a vacation destination is an educational element - GBO is a unique educational opportunity for engagement into many science and STEM aspects for all visitor demographics. Tourism is the conduit to reaching the general population and sharing the science and story of radio astronomy with many. • Unique: The GBO is unique and is a point of pride for West Virginia •Field Trips: GBO is an exceptional educational facility for student engagement and the reason it is so positively impactful to students as a learning environment is that it is a working research facility. •The National Radio Quiet Zone creates a significant amount of publicity for the area as well which delivers visitors to the county who not only visit Green Bank but stay in lodging, eat in local restaurants and visit other attractions. Given the contribution the GBO makes to the tourism industry in Pocahontas County, the CVB can only support alternative actions #1 or #2: 1. Continued NSF investment for science-focused operations (No-Action Alternative) 2. Collaboration with interested parties for science- and education-focused operations with reduced NSF-funded scope <p>Any changes to the operation of GBO resulting from implementation of #3, #4 and #5 would carry consequential, damaging affects to the tourism industry - the visitor, the businesses that rely on tourism and the overall product mix that enhances the rural destination appeal. The specific resources that would be affected by changes to the GBO operations and also would impact tourism include the socioeconomic and the cultural resources. GBO contributes enormously to the economy through visitors which supports many businesses and jobs. The GBO is also a cultural phenomenon because so many visitors do not understand radio astronomy or how the area residents can survive without cell coverage. The site provides opportunity to learn and be in awe of the Green Bank Telescope and better understand cultural life in a rural environment and a National Radio Quiet Zone. In closing, the only clear actions that would have least impacts to the tourism industry are the alternatives #1 or #2. Alternatives #4 and #5 in particular would have radically negative effects on the tourism product and visitor experience in Pocahontas County. Although the primary purpose of the GBO is not tourism, the GBO does strongly impact the tourism industry. All of these benefits to tourism and the visitor will be lost if alternatives 4 & 5 are chosen. The best way to preserve these tourism benefits is for the NSF to choose alternative 1 or 2.</p>	Against Closure	Email - Scanned	11/11/2016	

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Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
572		Michael	Lucero	Masters Candidate in Biology Angelo State University	<p>I would like to start by saying was born and raised in West Virginia and I appreciate the years of support and service that the NSF has provided to the Green Bank Observatory and various other research initiatives across my home state. I understand the the Green Bank Observatory is expensive and difficult to maintain so I understand your reasons for contemplating the closure of the facility. I would just like to let you know that the effect that the Green Bank Observatory has on the state of West Virginia is immeasurable.</p> <p>In West Virginia we are bombarded by Pro- Coal propaganda from the time we are born. This propaganda, combined with the geographic isolation of the state, creates a culture that makes a young person think that the only good they can achieve in this world is to supply the energy the for the nation through coal mining. The Green Bank Observatory represents a pillar of hope for many young people in the state that they can have a purpose outside of the mines. It often times exposes people, like myself, to their first encounter with real science. The fact that this science is world changing and going on in our "backyard" shows us that being a scientist isn't just for the "smart, city people" (as many people in West Virginia see scientists) but that we too can make a positive impact. I was personally affected by the Green Bank Observatory when my parents took me to see it as a child and it has directly led to my current pursuit of a masters degree in Biology. Green Bank provided that reassurance that there was a world outside the mines and gave me the confidence to escape that pull. I know that if the observatory had that affect on me then it has had the same affect on countless other Appalachians within its proximity. I would just like for you to weigh all possibly overlooked consequences into your decision about the future of the facility. Thank you for your time and your overwhelming support of the science in West Virginia and our nation.</p>	Against Closure	Email - Scanned	11/11/2016	
573	a	Emily	Calandrelli		<p>My name is Emily Calandrelli, I grew up in Morgantown, went to West Virginia University and am writing in support of maintaining and fully funding the Green Bank Telescope. I published an article to TechCrunch's 14 million monthly readers on this topic that can be found here. I've also copied the contents of that article at the bottom of this email.</p> <p>On a more personal note, as a WVU engineering student, I remember listening to guest lectures from Duncan Lorimer, an astronomer who studied pulsars using the GBT, talk to us about the incredible capabilities of the Green Bank Telescope. As a West Virginian, the Green Bank Telescope was an icon that represented STEM leadership - an icon that tells young West Virginians that they too can participate in the act of discovery. This is no small message for the people in WV, a state often more well known for its poverty, obesity rates, opioid epidemic, and dying coal mining towns. Taking away this icon means stripping away the same hope that I was given as a West Virginian that I could grow up to be a leader in a STEM field.</p> <p>After WVU I went on to earn 2 Master's degrees at MIT and today I work with Bill Nye for his new science show on Netflix.</p> <p>As a science communicator and science literacy advocate, I implore you to keep the Green Bank Telescope in operation and fund it fully. Taking away such an excellent resource would be a blow that would strike too hard on a community already ridden with poverty and poor education.</p> <p>There's also a very important educational aspect to the GBT. Recently, to my dismay, the West Virginia board of education moved to include climate change denial and creationism in students' textbooks across the state. With this anti-science rhetoric seeping into mandated curriculum, these students need your help. They need to have outlets for science outside their classrooms.</p> <p>With all of this in mind, I hope that you'll read my article, especially the sections titled "Why are Astronomers Upset" and "Why are West Virginians Upset" and take them into consideration.</p>	Against Closure	Email - Scanned	11/11/2016	
573	b	Emily	Calandrelli		<p>There are many scientific reasons for maintaining the GBT, but I want to make sure you're aware of the economic and educational damage removing the GBT would do to, not just the town of Green Bank, but all of West Virginia. As I mention in the article below, West Virginia is one of the 5 poorest states in the country with 1 in 5 of its constituents living on food stamps. The GBT brings 100 jobs (140 in the summer) and an estimated \$12 million in tourism revenue to the surrounding community. This community, already on hard times, relies on those jobs and that money.</p>	Against Closure	Email - Scanned	11/11/2016	
574		Sara	Harper		<p>I am a WVU graduate and resident of Morgantown, WV. When I was young, I visited the Green Bank Telescope not long after it was opened. later, when I had the opportunity at Morgantown High School, I joined the science club to stay after school and search through the invaluable data that has lead to the discovery of pulsars. This was such an eye-opening opportunity for me as a student. It was something that many students felt proud and excited to be a part of. The GBT offers a unique chance to WV students to be proud of the state's contribution to science. I believe that WVU also has a group of experienced and world-renown scientists that specialize in research that is related to the GBT.</p> <p>Removing the GBT would be a terrible loss to the state, students, and public knowledge at large. WV in general has limited resources for STEM involvement and our rural environment makes it an ideal home for the GBT. I believe that removing this special resource would have a large impact on the science community, university, and K-12 education throughout the state. Please reconsider.</p>	Against Closure	Email - Scanned	11/11/2016	
575		Adrienne	Cohen		<p>Please do not close the Green Bank Telescope in WV. WV needs STEM-related jobs and technologies, and to take this away, is detrimental to the region. This isn't just to benefit West Virginians because this Telescope has technologies that others do not and it cannot easily be replaced. Keep it open and fully funded. \$12 million tourist dollars and 140 jobs is significant for this region.</p> <p>Thank you for your time,</p>	Against Closure	Email - Scanned	11/11/2016	

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576		Rachel	Neiman	Undergraduate Recruitment Specialist WVU College of Business & Economics	I want the Green Bank Telescope to be kept open and fully funded. I am a native West Virginian and I feel like our state is dying. Education, science and technology are our only hope. Please do not shut down this telescope. It is in the best interest of the people of our state and their futures if it remains fully open. Thank you for your time. I hope you will do the right thing.	Against Closure	Email - Scanned	11/11/2016	
577		Michael	Hughes	Sales & Marketing RE/MAX Snowshoe Resort	As local Realtors, RE/MAX has seen firsthand the positive impact of the NRAO on the local economy. Property values remain steady, vacancy rates are low, local businesses frequented by employees and visitors thrive. The Green Bank school system is staffed with excellent personnel and the students are bright and enthusiastic. The area would be negatively effected, as is any area where a large employer leaves. If the facility is closed, the effect would be devastating; property values will drop as the market is flooded with inventory, the local businesses that rely on employees and visitors will close, and the school will likely close. The Green Bank Observatory is an important asset, not just for the scientific and educational contributions but also to a vibrant local economy.	Against Closure	Email - Scanned	11/11/2016	
578		Brenda	Person		Knowledge, education, and innovation are what makes America great. To take away something that intrigues the public, educates them and sparks curiosity in children, would diminish the capacity for future generations to seek to understand the universe. This telescope provides astronomers with capabilities that aren't available in other technologies. Its steer-ability allows it to cover 80% of the sky. Just a personal anecdote: In my senior year of high school, I was having a really tough time and I took Astronomy as one of my electives; it was the best decision I have ever made. I researched, studied, read, and watched anything related to our universe. Most of my time was centered on planets, stars, and galaxies. The curiosity, wonder, and awe that I had for this great big place kept my mind off of the things that were out of my control. I had finally found something constructive and educational that gave me immense satisfaction. To take away something that might one day contribute to the life of someone who needs a positive escape would be doing a disservice to the public. I am still fascinated by our world beyond earth and would be tremendously disheartened to see this telescope shut down.	Against Closure	Email - Scanned	11/11/2016	
579		Julia	Chincheck		I am a West Virginia resident and a recent visitor to the Green Bank Observatory. Please fund or at least partially fund the Green Bank Telescope ("GBT"). The GBT is the most capable telescope of its kind and losing it could result in negative consequences to the State of West Virginia, for which it serves as a STEM beacon to its residents, and the field of astronomy. The GBT is the only telescope of its size that has its steerable range. It is an irreplaceable research and educational tool in West Virginia, an area in need of more STEM resources. It also provides jobs to those in the community surrounding the Observatory. Thank you for your consideration.	Against Closure	Email - Scanned	11/11/2016	
580	a	Ashley	Noland		Please do not dismantle the GBT. The GBT is both large and fully steerable and provides incredibly unique capabilities that aren't available at other observatories. It can cover 80% of the sky. I am from West Virginia, and the GBT is a symbol of innovation for our state. If you know anything of West Virginia, you know that we suffer from negative press often. Removing the GBT would cause incredible damage to our state -- we're already struggling for resources including STEM ones. The GBT offers a close place to let our children visit and see just how important STEM is to our community.	Against Closure	Email - Scanned	11/11/2016	
580	b	Ashley	Noland		Removing the GBT will cause a significant economic blow to West Virginia and could result in the loss of up to 140 local jobs. The GBT also brings in 50,000 visitors each year which equates to roughly \$12 million in tourism dollars to this region annually. Please, please do not get rid of the GBT.	Against Closure	Email - Scanned	11/11/2016	

Green Bank Observatory -Written NSF Public Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
581		Allison	Evans	NASA Aerospace Engineer Former West Virginia Resident	<p>I'm writing to convey my appreciation for the Green Bank Observatory, and to request that it remain fully funded.</p> <p>The Green Bank Observatory is a unique asset to the radio astronomy community worldwide, as well as being a fantastic opportunity for STEM outreach in the state of West Virginia. Astronomers from all over the world take advantage of the Green Bank Telescope's ability to map approximately 80% of the sky with its steerable dish and great sensitivity. This ability is unparalleled and should be preserved in order to gain more information on how stars are formed, the chemical make-up of various galaxies and nebulae, the distribution of molecular gas clouds, pulsars, and the broadening research area of gravitational waves. With the discovery of gravitational waves new measurements in radio astronomy will be needed, and the Green Bank Telescope, as a large, steerable telescope, has capabilities that no other radio telescope can replicate.</p> <p>The observatory plays a large role in public outreach in addition to being an asset to the scientific community. As a middle school student my sister attended the Science and Math Governor's Honor's Academy at the Green Bank Observatory. It was a chance that she would not have received in any other state. Thousands of tourists from astronomy clubs to school groups learn about science and our amazing universe by visiting Green Bank. West Virginia University students conduct research there, and people who might not otherwise have an interest in or knowledge of astronomy research can visit and learn. It is an opportunity that many of us who live or have lived in West Virginia are very grateful for.</p> <p>I hope that the Green Bank Observatory will remain fully funded and that it will continue contributing to scientific discoveries, our knowledge of the universe, and STEM education. Please take this letter into consideration in your decision.</p> <p>(Disclaimer: My views expressed in this letter are my own and in no way represent the views of NASA. This letter was not written on government-funded time.)</p>	Against Closure	Email - Scanned	11/11/2016	
582		Andrea	Mucino-Sanchez	Marketing Assistant The Campaign Workshop	<p>As a native West Virginian, I urge you to keep the Green Bank Observatory fully funded and open. In this time and era where facts & science seem to take a back seat, it is imperative to keep a strong symbol for science and innovation in the state. Further, West Virginia should be a priority state to invest resources in, as it is a state in dire need of STEM educational resources.</p> <p>Please keep the Green Bank Observatory open!</p>	Against Closure	Email - Scanned	11/11/2016	
583	a	Drew	Calandrelli		<p>It has come to my attention that the Green Bank Telescope located in West Virginia has come under some uncertainty regarding its future. I would like to start this by saying I am a teacher in West Virginia involved in teaching STEM topics. The Green Bank telescope is an enormous tool that has been discussed as a STEM topic close to home and we hope to continue to use this tool for years to come.</p> <p>West Virginia is falling further and further behind in topics such as math and science and we hold on to what resources we have at home to show our students not only the importance of these topics, but the importance of them here in our own backyard. Shutting down the telescope would only further many children's misguided beliefs in the state that STEM may not be all that important to them, or at the very least not important enough for our state. That we as West Virginians can survive without it or it is a job for someone else, not us. I think it is wonderful to have such an amazing piece of technology so close to us that we can show off to our students to inspire them to believe in STEM. There are not many examples of scientific advances in many parts of West Virginia, and we cannot afford to lose the ones we have.</p> <p>The Observatory is something West Virginians are incredibly proud of to have in our state. It is a beacon of hope and prosperity to many young aspiring scientists and other children with STEM related dreams that come from small town West Virginia. It shows them that even in the smallest of places like where they live that science has not left them behind and is part of who they are and where they come from. We need to Observatory in our state to stay home not only for financial reasons to the state, but educationally as well for those children that come from the state that dare to dream big and can look at the Observatory from a young age and say to themselves "I can be part of that, I can do that."</p>	Against Closure	Email - Scanned	11/11/2016	
583	b	Drew	Calandrelli		<p>Outside of just educational purposes West Virginia as a state is in dire need of this. Just last year the state had to tap into its own "Rainy Day" reserve funds significantly just to balance the budget (around \$245 million was used). That accounted for over 6% of our budget that our state couldn't cover on its own. The Observatory brings in millions in tourism to the state which would be lost if it were to close further raising that 6% difference. The state is also losing jobs at an alarming rate and the Observatory employs up to 140 citizens. These aren't just typical jobs we would lose, but higher education jobs which are lacking incredibly in the state as we have one of the lowest rates of them in the country. It would be a hit on all parts of a struggling state.</p>	Against Closure	Email - Scanned	11/11/2016	
584		Chris	Haller		<p>I want to quickly follow up on my last email, we came across your public comment period and it seems like you're collecting unstructured feedback from a broad variety of channels. Since you didn't respond to my initial email, I'm curious if you have an efficient system to capture and track comments that way? If you do, would you mind letting us know what you're using?</p> <p>If not, maybe you're open to trying an alternative to make life easier? Since launching CiviComment, we've helped many clients like the Thurston Regional Planning Council and the Department of Energy significantly reduce the time it takes them to manage public comments. We are offering a free trial version of CiviComment that will allow you to evaluate the system in your current or next public comment project at no cost. Take a look and enroll, we can get you set up quickly!</p> <p>Feel free to reach out with any questions you may have.</p>	General	Email - Scanned	11/11/2016	
585		Raymond	Godwin		<p>The Greenbank Observatory is a amazing operation, and a critical piece of the economic health of Pocahontas County. In addition to the valuable research that has been gleaned over the past many decades, and that has been beneficial to our study of our vast universe, it has been a serious player in the tourist industry. To lose the Observatory would be a punch in the stomach to the economy of that part of Pocahontas County in particular and a hard hit to the local economy of both the rest of Pocahontas County, and Randolph County, as well. The area would lose a major population of those men and women who work there and would go elsewhere to find similar work. Please do all in your power to keep this important operation working for the immediate future and beyond.</p> <p>Thank you for what you are doing to help save the Greenbank Observatory.</p>	Against Closure	Email - Scanned	11/11/2016	

Green Bank Observatory -Written NSF Public Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
586		Janet	Ghigo	N/A	<p>The history of the development of Emergency Medical Services (EMS) in Pocahontas Co, WV, is closely tied to the presence of the National Radio Astronomy Observatory in Green Bank. In 1975, the state of West Virginia passed a law developing EMS as a profession in West Virginia. The Bartow-Frank-Durbin Fire Department (BFD) established a "rescue squad" as part of the department, with the first CPR and first aid training provided to these new medical providers by an NRAO spouse, "Bunny" Vance, who was a community native. Later, formal EMT training was provided by Theresa Weimer, another community resident, married to Ron Weimer, Jr., whose father worked at NRAO. Early EMTs included NRAO employees Harriet "Harry" Waddell and Zula Taylor as well as NRAO spouses Ann Coe, JoAnn Smith, and Kathy Norrod. Advanced Life Support by the BFD was expanded beyond the services of Medic Theresa Weimer when Ron Weimer, Jr., completed MICP training along with Dwayne Barker, NRAO employee, and Dwayne's wife Rose Mary Barker, who became a paramedic. Ron Weimer, Jr., was instrumental in working with the Observatory to help the BFD in the early days of EMS to run their own dispatch tower on Cheat Mountain before the county had 911. The Observatory had their own fire trucks and an ambulance, but only employees could serve as EMTs. In 1993, the BFD put up a state-approved satellite station across Rts 92/28 from the Observatory and all fire and EMS services on campus as well as for NRAO families were turned over to the BFD, saving NSF the cost of running these services. Theresa Weimer continued to teach EMT courses, with NRAO spouses Virginia Parker and Janet Ghigo becoming EMTs with BFD, and later paramedics after Theresa Weimer taught a paramedic class in Pocahontas County. This course in 1993-94 allowed squads other than the BFD to offer Advanced Life Services. In 1997, Theresa's last EMT class coincided with the training of NRAO spouse, Janet Ghigo, as an EMT instructor. Since 1998, Janet has taught 20 EMT classes, providing an additional 200-300 EMTs to the county. These ex-students now provide the backbone of all six EMS agencies in the county with students of previous instructors having retired. The county has a demonstration of the critical importance of large employers and the ability of volunteer services to thrive. In the 1990s, the little town of Hillsboro in the southern end of Pocahontas County had a vibrant EMS system, with many members being either employees of Denmar Hospital or their spouses. When that facility closed, there was no other place in the community for the employees and their families to work - and for the past 20 years the Hillsboro ambulance service has struggled with just a few members, fortunately being backed up by the Marlinton squad and recently by the Pocahontas Memorial Hospital Squad. Both of these squads are at least 15 miles from Hillsboro, and 30-40 miles from some of the more distant homes in the area. Obviously service suffered with the increased response time. In the early days of EMS in the BFD, a majority of EMTs, medics, and drivers worked at Howe's Leather Company in Frank. Howe's employees and spouses provided another large pool of people providing volunteer EMS service. The closure of Howe's in 1995 was devastating to the communities of Bartow, Frank, and Durbin; however, this closure was just a couple of years after the Green Bank satellite of the BFD Fire & Rescue was established, and increasing numbers of NRAO employees and spouses were able to take up the slack. There has been no loss of care to the community. All fire and EMS service has been provided by volunteers since the fire department was started in 1953. Only in the past year or two has the BFD had a single paid person, primarily taking care of paperwork, and more recently has begun to pay ambulance crews a minimal amount for each run, if they want to accept pay. Many of the most active drivers and medics still do not accept pay. The county EMS Authority was restarted in 1991 to promote emergency medical services in Pocahontas County. The Authority members include representatives from each of the county EMS squads. Tom Dunbrack, an NRAO employee, represented the Marlinton squad on the first Authority and was its Treasurer. The present representative for the Marlinton squad is Jennifer Barlow, one of Janet Ghigo's students. Ron Weimer, Jr., NRAO relative, represented the newly formed Ski-Medic serving the Snowshoe ski resort. In recent years, the squad at the resort has been represented by Mike O'Brien (now County 911 Director) and Seth Morgan, both students of Janet Ghigo. Theresa Weimer's paramedic graduates Marv Turner and later Christine Rebinski have represented the Cass ambulance service on the Authority. The present Secretary and Treasurer of the Authority is NRAO spouse, Janet Ghigo, representing the BFD. Although the present representative for Pocahontas Memorial Hospital is from out of county, many of the EMTs and medics employed at the hospital started with either Theresa or Janet. Ron Weimer, Jr, and Helen Clark, NRAO spouse, have served and presently serve as the county representative to the state regional EMS organization. In the past 25 years the county Authority has collaborated to bring e-911 to the county, to promote collaboration among the EMS services in the county, and to work to assure the best service possible to all county residents. This past year county squads responded to over 1600 calls, traveling close to 100,000 miles. Paid paramedic service is now available from four of the county's six squads, along with continued volunteer service. A majority of these squad leaders and active members can trace their training back to NRAO spouses and employees. At present the Assistant Fire Chief, Rescue Chief, and Assistant Rescue Chief for the BFD are all NRAO employees or spouses. It is not the main role of NSF to provide community services, but closing the Green Bank Observatory, with the necessary movement of these employees and spouses out of the county, would be a devastating blow to the network built over the past 40 years.</p>	Against Closure	Email - Scanned	11/11/2016	Green Bank Observatory and EMS in Pocahontas County.docx
587		Rusen	Lu	Max-Planck-Institut fuer Radioastronomie Auf dem Huegel 69 D-53121 Bonn / Germany	<p>I am a user of the 100-meter Green Bank Telescope and it has been and will continue to be a very critical telescope for my research on Active Galactic Nuclei (AGN) physics. It is a pity to learn that NSF will possibly divest the Green Bank Telescope from its portfolio.</p> <p>If the Green Bank Telescope were no longer available or the time available for science operations will be significantly cut, the progress of my research will be severely affected. We use the technique of very long baseline interferometry at short millimeter wavelengths to study detailed physics close to supermassive black holes in nearby AGN (on a few to a few tens of Schwarzschild radius scales). Although this technique utilizes an array of telescopes, Green Bank Telescope always serves as the high sensitivity and high resolution anchor for the whole array, as it is the most sensitive telescope. It is unacceptable to lose such an anchor!</p> <p>So, I strongly appeal to the NSF to continue the investment on the Green Bank Observatory for science-focused operations. Please save the 100-meter telescope!</p>	Against Closure	Email - Scanned	11/11/2016	
588		Brenda	Walters		I live in Pocahontas County and am proud to have this awesome facility in our county. It not only helps the economy but in a very special way contributing to humanity and viewing our universes	Against Closure	Email - Scanned	11/11/2016	

Green Bank Observatory -Written NSF Public Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
589		Bruce	Balik	University of Washington	<p>I have watched the EIS review processes being conducted at Arecibo Observatory and Green Bank Observatory with some interest. It appears that the **process** has been fair, open, and sensible. However, the **consequences** of closing both of these facilities are very broad and deep. That option merits extreme caution beyond environmental or senior panel reviews whose charge and scope are too narrow.</p> <p>In optical astronomy various national telescopes of broad and flexible usage at NOAO have been defunded or closed. However, other larger telescopes and similar telescopes operated by NOAO and others remain to absorb some of the impact on the community.</p> <p>Radio astronomy at the national level requires both frontier special-purpose arrays designed for spatial resolution (that are not particularly flexible in application) and very versatile telescopes with large collecting area to explore the spectral and time domains. These categories, both of which are essential, do not overlap.</p> <p>The EVIA and AIMA are examples of the first kinds of tools. Arecibo and the GBT fall into the second category. Of the latter two, the GBT has by far the largest spectral and sky coverage, whereas Arecibo has the largest aperture.</p> <p>Given the budgetary constraints at NSF/AST I can accept the closure of one of the two facilities. We can limp along with the other. However, the closure of both telescopes would be a serious - indeed, grievous - error since doing so removes not just one tool but an entire category of research.</p> <p>One telescope should be kept operational. Which one?</p> <p>The GBT is (by far) the premier and most flexible instrument of its kind in the world. It's role is and will always be a vital component in a spectacularly successful field of research whose future discovery space will only grow in time. Arecibo, while an especially valuable tool for classical HI and pulsar research, will soon be eclipsed by a larger facility of the same type in China called FAST (http://fast.bao.ac.cn/en/). Thus the traditional range of discovery space at Arecibo is unlikely to be expandable - - and possibly unsustainable once FAST comes into full-time operation.</p> <p>My recommendations:</p> <ol style="list-style-type: none"> 1. The GBT should continue to be operated by the US much as it has been as a shared resource for the world. At the very least it should be made available to Chinese astronomers in exchange for guaranteed time at FAST. (Other international agreements of this type may be worth pursuing.) Of course, I would never recommend this course of action without the demonstrated enthusiasm of the radio astronomical community. 2. Closing both the GBT and Arecibo is so consequential that any such decision should be an action that only the next decadal survey should be authorized to take. 	Against Closure	Email - Scanned	11/11/2016	
590		Barbara	Jackson		<p>Please keep our Greenbank Observatory open. It is essential for our community bring in money. The facility is also a benefit for all the children that visit.</p> <p>Keep it open.</p>	Against Closure	Email - Scanned	11/11/2016	
591		Ronald	Mudry		<p>I'm writing to support the continued funding of the green bank observatory. Aside from the valuable scientific knowledge we gain by its presence, I urge you to examine the implications of eliminating the large cellular "dark" zone that it provides so close to Washington DC.</p>	Against Closure	Email - Scanned	11/10/2016	
592		Delana	Vanover		<p>It should be preserved for future studies. Who knows, someday it may aid in national defense.</p>	Against Closure	Email - Scanned	11/10/2016	
593		Candy	Weiford		<p>We live in Huntington WV and have visited Green Banks many times.</p> <p>Please reconsider closing Green Bank's. We have taken our children, our grandchildren. It is interesting, educational. This is something for future generations.</p> <p>I believe this is important to World & National Security. Important to the scientific community.</p> <p>It feeds the economy in a financially depressed area. I believe it keeps the area beautiful due to the radio black out zone. I believe with all my being it would be a mistake to close this facility.</p>	Against Closure	Email - Scanned	11/10/2016	
594		Sally	Smith		<p>Please invest in the vital scientific resource known as the National Radio Astronomy Observatory at Green Bank in West Virginia.</p> <p>In addition to nearly \$30 million in annual investment contributed to our struggling economy by Green Bank, the research is vital to our country's future scientific and environmental communication and knowledge. The exposure to science education and exploration is also an extraordinary learning and vocational experience for our regional students and work force who become inspired to expand their knowledge and to reach for the stars!</p> <p>Thank you for your support.</p>	Against Closure	Email - Scanned	11/10/2016	
595		Karen	Peterson		<p>I write to implore that you continue to fund Green Bank observatory. There is no such facility available to the scientific community on the East Coast-- there is a telescope in New Mexico, and another in Puerto Rico. The potential opportunities available to the scientific community are amazing-- and bring people to Green Bank to utilize the incredible tool available to them. West Virginia needs to consider the opportunities that the telescope and the entire campus brings to Pocahontas County, and West Virginia--particularly now, with the exciting things that Space-X and Elon Musk and other entrepreneur scientists are doing. It would be short sighted and demonstrate an enormous lack of imagination to shutter such an opportunity.</p> <p>Please continue to fund this observatory, and then think outside the box- and start marketing these tool to folks who are going to pay to use it.</p>	Against Closure	Email - Scanned	11/10/2016	
596	a	Martha	Williams	DHSc student, expected graduation December 2017	<p>My name is Martha Williams and I am a resident of Pendleton County, WV. I am originally a transplant to this state, but I have certainly fallen in love with this location. I left the area a few years ago only to return to raise my family to afford my daughter the same opportunities that I had.</p> <p>When I was in middle school we frequented the Green Bank Observatory which helped to solidify my love for science. And though I may not have entered the field of astrophysics, I can definitely say that my education path to helping people was lit by the influence of local scientists and educators at Green Bank. Even one of my high school classmates utilized Green Bank for his research while in physics at West Virginia University.</p>	Against Closure	Email - Scanned	11/10/2016	

Green Bank Observatory -Written NSF Public Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
596	b	Martha	Williams	DHSc student, expected graduation December 2017	Recently Pendleton County lost one of our largest employers when the Department of Defense decommissioned the Naval Informations Operation Command at Sugar Grove. This has caused a significant impact not only to our economic base, but also to the morale of the residents that call this area home. With the National Science Foundation considering decommissioning the Green Bank Observatory in our neighboring county, the stability of this area I love will fall into question. And the very opportunities that I wish for my daughter may no longer be a valid option in this area.	Against Closure	Email - Scanned	11/10/2016	
596	c	Martha	Williams	DHSc student, expected graduation December 2017	Ideally, I would like to see the NSF complete the "No-Action Alternative," but I do understand that with the recent budget crunches the NSF faces that may not be a viable option. I would hope that the NSF would exhaust efforts to work with other organizations to maintain the research and educational opportunities at Green Bank as well as expanding the employment chances for the local community. This would be a hybrid of the two alternatives listed: "collaboration with interested parties for science- and education-focused operations with a reduced NSF-funded scope" and "collaboration with interested parties for operation as a technology and education park."	Alternatives Consideration	Email - Scanned	11/10/2016	
597		Albert	Justice		My heart skipped a beat when I heard funding or the future somehow of the Green Bank Observatory(GBO) was in question. Jeez. And guess what? I have never been there. But my heart is there, and it is so on my bucket list. I think about it a lot, and when circumstances allow, want not only to go there but to take students there. I have had a life-long love affair with mountains, music and the night sky. That the GBO lives in my home state is actually a part of who I am, in some wonderfully woven ways. If there is a question concerning how to protect the observatory in West Virginia, it needs to be brought very clearly 'to the people.' A process that simply collects remarks and makes decisions, does not do this remarkable integral part of West Virginia justice at all! Basically, many many West Virginians are both dreamers and the night sky is part of us. I am not even sure exactly what is going on here, but I do know West Virginians want to know, and they want to be part of that process clearly. I firmly believe if this is brought before the breadth of West Virginians thoroughly, the GBO will survive for many many more generations--however that must be done.	Decision Process	Email - Scanned	11/10/2016	
598		Marilyn	Meade		Please keep funding for the Green Bank Observatory It is an important part of keeping eyes on the skies Thank you for reading my email	Against Closure	Email - Scanned	11/10/2016	
599		Tennis	Parrish	WV citizen	Please continue funding for the operation of this wonderful facility that contributes the economy and education of locals as well tourist who visit this beautiful part of WV. Please continue funding.	Against Closure	Email - Scanned	11/10/2016	
600	a	Taylor	Hogge	Graduate Student, Boston University	I am writing to you concerning the proposed changes to the Green Bank Observatory. As a frequent user of the Green Bank Telescope (GBT), I must speak up in support of future funding for the Green Bank Observatory. Many astronomers are currently using the GBT to perform important and groundbreaking science. To limit Green Bank's funding means limiting the time for crucial science that is performed each day. For many observers, the GBT is the only telescope in the world capable of helping accomplish their science goals. I personally use the telescope to survey the sky for high- mass star-forming regions. Recent upgrades to GBT hardware are crucial to observe a large portion of the Galactic plane with the necessary sensitivity and resolution. No other telescope in the world is better equipped for this task. My research and dissertation project will certainly be negatively affected by reducing the funding to this important observatory, and many other astronomers can say the same.	Against Closure	Email - Scanned	11/10/2016	
600	b	Taylor	Hogge	Graduate Student, Boston University	And the Green Bank Observatory is not only important to astronomers. The GBT stands as a monument to human ingenuity, and it is recognized as such by the many tour groups that visit the Green Bank observatory each year. Tours at the Green Bank Observatory allow the public to marvel at the impressive size of the GBT, as well as understand the important science that it performs. The public outreach performed at Green Bank is inspirational to students of all ages, and is exactly what the government should be funding to promote interest in STEM fields. The Green Bank Observatory houses a world-class telescope that performs groundbreaking science every day, while providing necessary public outreach that inspires the future generations of our country. To reduce or in any way limit the good and important things that comes out of this observatory would be an ill-advised travesty. I support the NSF fully funding the Green Bank Observatory for the benefit of citizens and scientists alike.	Against Closure	Email - Scanned	11/10/2016	
601		Charles	Freeman		Greenbank needs to continue in business, where else could you find a quite zone on the east coast. We spend billions on other countries but want to throw away opportunities in an area that would blow away without Greenbank being in business.	Against Closure	Email - Scanned	11/10/2016	
602		Christopher	Wotta		I am a PhD student in my sixth year and I am writing on behalf of the Green Bank Observatory (GBO). The GBO has been an important part of my research and training as a graduate student. It would be a significant loss would the GBO be closed or defunded. Furthermore, the availability of the GBO to All scientists is crucial. I have an interest in the future of the GBO and recommend it remain funded as-is.	Against Closure	Email - Scanned	11/10/2016	
603		Michelle	Berg		As a Ph.D. graduate student, being able to use the GBT to gain research experience has been invaluable. This telescope provides the easiest way to step into and learn about radio astronomy. The several projects I have used the GBT for are a significant part of my thesis. I think the only two options to consider moving forward would be either continued NSF funding (no-action alternative) or reduced NSF funding.	Against Closure	Email - Scanned	11/10/2016	

Green Bank Observatory -Written NSF Public Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
604	a	Ann	Schmiedekamp	Professor, Physics Penn State Univ. Abington	You are presently involved in evaluating the environmental impact of funding the Greenbank Observatory and I write because our institution will be affected. We have utilized the telescopes of the Greenbank Observatory for undergraduate research each year since 2009. Every fall, we train students in the background for radio astronomy and then the students travel to the observatory and take data. Every year the teams of students produce posters on their projects. The presence of the educational staff at Greenbank, along with the researchers on site, have provided much enrichment and assistance for our students in participating in scientific research. This has been a top rate opportunity for our students and we have seen many of them go on to internships and careers in STEM fields. Our campus, Penn State Abington, is located in the Philadelphia area and draws students from underrepresented groups in STEM fields. We are very fortunate to have had the facilities at Greenbank to offer to them.	Against Closure	Email - Scanned	11/10/2016	
604	b	Ann	Schmiedekamp	Professor, Physics Penn State Univ. Abington	I am concerned about the possibility of shuttering the lab and the GBT. This large Greenbnak telescope is one of very few large single dish telescopes in the world. I also understand that Arecibo is being evaluated also. Our students are also participating in the pulsar search collaborative and we are linking to high schools in the Philadelphia area. Shutting down the large U.S. radio telescopes will severely cripple radio astronomy in the U.S. leaving us to go outside of our country to obtain such data. Single dish radio astronomy is an ideal area for undergraduates to begin to participate in astronomical research. Our projects, in collaboration with the staff at Greenbank, have been engaging pedagogical experiences for our undergraduates. We ask you to list our undergraduate participation in the facilities at Greenbank among your considerations of the environmental impact of the observatory.	Against Closure	Email - Scanned	11/10/2016	
605		Kaustuv	Basu	University of Bonn	I wish to make an endorsement for the continuation of the scientific operations and NSF funding at the Green Bank Observatory through this email. I am a staff scientist and lecturer at the University of Bonn, Germany. My research is focused on galaxy clusters with the aim to improve our understanding of cosmology and various astrophysical processes. Through the collaboration with many of my US and European colleagues over the last several years, I have participated in multiple observational programs at the GBT. These observations were mostly focused on using the high-frequency (90 GHz) capabilities of the GBT using sensitive bolometer instruments (developed by the group of Mark Devlin at UPenn). For my field of research this high-frequency capabilities of the GBT is truly unique, setting it apart from a similar radio telescope in the Effelsberg (Germany), for example. The weather and the excellent accuracy of the telescope surface allows for a seamless operation with the bolometer receivers at this frequency, providing a collecting area (and hence sensitivity) that is unmatched by any other instrument at similar wavelengths. It will be a true loss for science if we cease the full scale NSF funded scientific operations at the GBT and close this unique window onto the universe. Even though powerful interferometers like AIMA is now in operation, for certain applications (like imaging a diffuse, extended signal) there is no replacement for a single-dish observatory, and also GBT's location in the Northern hemisphere makes it a unique compliment for AIMA. I hope my mail could be of some help in deciding for a continued NSF investment for the full-scale science operations at the GBT.	Against Closure	Email - Scanned	11/10/2016	
606	a	Jose	Rodriguez-Velez	Wildlife Biologist	I respectfully submit to you my personal opinion regarding the plan to divest, close, and/or downgrade the functions of the Green Bank Observatory (GBO). The GBO is the only such scientific tool directly accessible to the entire Eastern USA region, and surrounding Northern and Middle States. It's location, the National Radio Quiet Zone, not only ensures and guarantees suitable conditions for its operations, but makes it highly accessible to a substantial number of people from these surrounding States. The NSF intrinsic function is to protect our Nation's scientific endeavors, to promote continued social scientific interest and ensure access to the broader audience possible. It appears to me, the most likely sought out outcome for this scientific and educational facility, unique to the Eastern USA region, could contribute to a growing Nationwide disconnect between the common People, and Science/Mathematics exposure. Efforts by the NSF to divest will only contribute to more scientific isolation and disinterest amongst members of communities already disconnected with how R&D emerging technologies and visible Science work to better our lives. Communities, like Green Bank, have a voice when it comes to how Congress determines the size and manner by which tax dollars are spent. Neglecting to include or ignore the ones at the bottom could eventually render your future funding pursuits troublesome. Worth repeating, being the only facility with such an array of instruments in the entire East Coast, the GBO should be NSF public relations STAR, because it is a fantastic tool located within Federally protected land of immense biological value that can be used by NSF to bring back all aspects of Science to remote locations that border urban centers of the USA. Its location in West Virginia is crucial, for it is one of many States where Math and Science are increasingly being seen as "negative" qualities to have by the general public, because certain member of Science academia render the general public, who support with tax dollars, ignorant and below themselves. The ALMA venture will benefit the World for sure, but back here in the "woods" of the USA, those far foreign land findings will provoke very little impression, because people will not see, feel or physically have the chance to experience science at work, which would help establish a life lasting connection that will ultimately matter the most.	Against Closure	Email - Scanned	11/10/2016	New PDF 2.pdf

Green Bank Observatory -Written NSF Public Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
606	b	Jose	Rodriguez-Velez	Wildlife Biologist	<p>The NSF is risking a great deal more down the line, by transferring tax dollars to sovereign foreign Nations at the expense of USA based scientific endeavors, which, always have the capability to give favorable impressions about how tax dollars are invested on R&D ventures. An large amount of dollars has gone to ALMA alone, while a small fraction is required to maintain and operate the GBO.</p> <p>To an increasingly Nationalistic voting block, here in the USA, the tax dollars trusted to the NSF will be seen as a wasted investiture on foreign affairs that benefit no USA taxpayer. A quick look at any social network comment section will illuminate my point, look at our Presidential results.</p> <p>Be very concerned, for social animosity and voter resentment can develop quickly, starting at the local levels to expand Nationally. As a wildlife Biologist who dedicated 15 years of my life to save the endangered Puerto Rican parrot from extinction, these dollar investments in ensuring local visibility that provides engagement and lasting connections for the people paying your bills count.</p> <p>If anything, you need to ramp up the importance of facilities like the GBO and Arecibo and make them working partners with public and private schools and universities. That visibility ensures funding continuity.</p> <p>ALMA R&D foreign investments are valid, but not at the expense of perfectly usable USA land based technologies which are accessible to all and bring a real life experience to a greater number of people. The thought of NSF suggesting the waste of millions of taxpayer dollars by dismantling of these instruments to transfer technologies, science and tax dollars to Chile is offensive and so I urge you to reconsider and opt for fully funded continuity (option1), but with enhanced participation from all branches of Natural Science, converging in these remaining magnificent and pristine lands.</p>	Against Closure	Email - Scanned	11/10/2016	New PDF 2.pdf
606	c	Jose	Rodriguez-Velez	Wildlife Biologist	<p>If support is maintained at previous levels, the GBO will get to continue to provide USA soil based, "hands on" access to large swaths of bright future scientists from low and middle class America, as well as International students. The GBO facility is A+ "cream of the crop" easily accessible, and equipped to experience Astrophysics. The GBO location, within the Monongahela National Forest, makes it an ideal location for the NSF to explore R&D possibilities in Earth Science, Environmental Research and Conservation, all within the scope of NSF pursuits in the National interest. This will allow college graduates to get hands on experience utilizing top of the line instrumentation and instruction, and also, will give NSF National presence that counts and gains followers and supporters. Don't lose sight of that which can secure your financial security as an institution that must serve the interest of the public and the Nation.</p>	Against Closure	Email - Scanned	11/10/2016	New PDF 2.pdf
606	d	Mary	Willis	Elk River Touring Center, Inn and Restaurant	<p>I am writing in support of keeping the Radio Astronomy Observatory in Greenback, WV open through funding from the National Science Foundation. I understand that the facility is not actually a part of NRAO anymore, but there are many ways this facility can be used to promote astrophysics, the study of space and other scientific research.</p> <p>As a resident of Pocahontas County I regard the influence of NRAO on the county and it's residents was immeasurable. My two sons graduated from the county high school. Having NRAO close by for field trips, special programs and camps helped to 'up the bar' for our county's science program in all the schools. As everyone knows, students need to be influenced to enter the STEM programs in universities for our country to be relevant. Facilities such as GBO are excellent places to spark the interest of students and launch careers in all areas of science. Programs such as the Summer Research Program for Undergraduates or the Pulsar Research Collaborative with West Virginia University and SkyNet Junior Scholars program must be preserved for future of scientific research.</p> <p>I hope that the National Science Foundation will find funding to support all or at least a large portion of the budget to keep this important facility and the research and educational opportunities that it supports open and thriving for many years to come.</p>	Against Closure	Email - Scanned	11/10/2016	
606	e	Mary	Willis	Elk River Touring Center, Inn and Restaurant	<p>GBO is a major tourism attraction for the county. It employs over 60 people, all excellent community minded folks who are great contributors to the county. These are good paying clean jobs in addition to the associated tourism economy which will be sorely missed in the community. I have a small business in the tourism industry which is becoming the major economic driver of our area. Many of my guests visit the GBO and find it a most interesting and unique experience.</p>	Against Closure	Email - Scanned	11/10/2016	
607		Suzanne	Simmons		<p>I am writing in support of continued funding for Green Bank Observatory. The contribution the Observatory has made for over 50 years is without question, but continued funding must result in continued benefits and accomplishments. The science and technology and research opportunities in this location are not possible in other locations around the country. In today's world, wireless and cellular data and communications are nearly essential to everyone, and the ability to conduct research in a silent, radio-free environment is essentially impossible in other locations.</p> <p>Science and technology are essential to the future of our state and our country. Monies spent to continue and expand the work done at this facility will be money well spent. The payback comes in terms of the future contributions of the work done there, future discoveries, and future communication methods to and from space. Development of new technology and new research must be supported financially for the good of our country, and the Observatory at Green Bank is worth continued investment.</p>	Against Closure	Email - Scanned	11/10/2016	
608		Suzanne	Simmons		<p>Additionally, the educational contribution of Green Bank reaches far beyond the local or state level. Contact the scores of students from around the country and around the world who have attended the annual National Youth Science Camp and ask how their experiences at Green Bank influenced them in their ultimate endeavors.</p>	Against Closure	Email - Scanned	11/10/2016	
609		Sean	Harwell	M.Ed. Geoscience Grant Manager	<p>A few years ago I was introduced to the Green Bank Observatory and realized what an important role it played it played. Not only is this a place that the people of West Virginia are proud of, but a place that it sought after by other countries. The Green Bank Observatory does amazing work in the field of Astronomy and plays a huge role in getting students into the science field. The outreach program at Green Bank is on par or better than that of NASA when it comes to exposing students to science. Introducing students to this type of research at a young age fosters an interest in these fields, leading to future scientist. The Green Bank Observatory outreach program is growing larger every year, exposing more and more students to this world of science. This place is truly one of the best places for science in the United States.</p>	Against Closure	Email - Scanned	11/10/2016	

Green Bank Observatory -Written NSF Public Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
610		Karen and Richard	Watson		<p>We are writing to urge that federal funds be continued through the National Science Foundation to support and maintain the work of the Greenbank Observatory at its present location in WV.</p> <p>As life-long residents of WV, we have had occasion to visit the Observatory several times and are always amazed by the work being conducted there. We also feel privileged (and have for all these years) that such a significant scientific endeavor is being carried out right here in the mountains of WV.</p> <p>It is an iconic institution and has become a significant tourist attraction in WV, very important as we try to diversify our economy during these stressed times. More importantly, the work done at the Observatory contributes greatly to our scientific knowledge of the universe and should be continued for future generations. We urge you to continue funding this marvelous facility.Thank you for your consideration,</p>	Against Closure	Email - Scanned	11/10/2016	
611	a	Mike	Hedrick		<p>My thoughts about the impact are:</p> <ol style="list-style-type: none"> 1. The loss of a facility were young collage engineers, designers, and technicians can work with, "hands on" and learn just what it takes to build the receivers and instruments that we use on the GBT telescope, and that they will use in their future career. 2. The ability to show local students a facility that houses a variety of career opportunity, and to expose them to manufacturing and the career paths that are available, along with seeing real math and science being used, and leaving with a better understanding of why they need to learn and put to use their education, in a rural area that is not afforded many opportunity's to see a machine shop, or a technicians lab and the education that goes along with it. 	Against Closure	Email - Scanned	11/10/2016	
611	b	Mike	Hedrick		<p>3. A facility for the scientific community, in this rural area, on the east coast, and so close to so many collages, in the "National Quite Zone, that if it is ever lost, will not ever be regained " a place that can be used to prototype, try new ideas, new one of the kind receivers, or a whole new line of thought, with the infrastructure already here, the lab, the Machine shop, the Electrical shop, Carpenter shop, Plumbers shop, Mechanic shop, and with people with the ability to help and show how to learn, build and complete any project.</p>	Against Closure	Email - Scanned	11/10/2016	
612		Diane	Schou		<p>Below are comments for the NSF for support of the Green Bank Observatory from another perspective of people harmed by electromagnetic radiation (EMR) and their exposure to environments with higher levels of EMR:</p> <ul style="list-style-type: none"> • Air quality considerations: Studies to detect changes of EMR in the radio quiet zone are valuable. <ul style="list-style-type: none"> o Why do several people detect unusual EMR at the same time, yet they live a distance apart? What are thei emissions that injure some people? o Funding is requested to measure, log, and document emissions, and correlate resulting effects. o To help the observatory, 1) some persons are better than meters. 2) these people choose to live without EMR and hence are good neighbors in the environment near the Green Bank Observatory. • Safety, health, and long-term biological effects are important to study in this unique environment here.o EMR levels are increasing, injure biological systems, and there may be nowhere else that is as protected as the unique environment around Green Bank, West Virginia.o Before coming to this extra protected area many of us became injured from EMR emissions and escaped to live elsewhere in a car, tent, shed or cave. We lived without easy access to food, water, and without protection from weather. We also lived without contact to other people because of the wireless communication devices they carried (not commonly done in Green Bank).• Cities have many, many emissions, and rural areas often have stronger emissions (likely vecause EMR have to travel farther for communication systems). Then we found Green Bank, in the National Radio Quiet Zone and our health has improved here. • We feel we are an endangered species, harmed by EMR as well as are animals, plants, and other systems on earth. It would be of value to use this area as a control in tests. o Needs for EMR people include a life without injury and pain from unnatural EMR exposures. • Social economics o Before discovering Green Bank, many of us left family, friends, careers, and homes (at great financial loss) and escaped to and lived in almost primitive environments such as in cars, tents, sheds, and caves. Many of us are college educated and could contribute, but at this stage the first focus is on survival. The urgent question is will this happen to many more people soon?o Without the Green Bank Observatory, there would not be security or a support system for us to contribute to in a manner to better prepare for others to understand coping with EMR. • National Historical Preservation: Green Bank's radio observatory's protected National Radio Quiet Zone is rare both in the United States of America and in the world.o People move to Green Bank for 1) safety (much electromagnetic radiation is unnatural and man- made), 2) security because people injured by EMR find no other protected quiet zone and 3) social connections with people as this is a humane place to live (versus in a remote cave or in a car). • Recommend expanding research at the Green Bank Observatory with goals to study physical needs.o Why do many people detect EMR? Additional funding is needed to measure, log and report EMR, especially the EMR that is artificial. Perhaps the NSF would fund this as a different entity, (i.e. in addition to or other than astronomy)? o There is also a facility for sale that could become a humane refuge at Sugar Grove, WV. Could the NSF purchase this facility, and/or work with other government groups there? <p>People harmed by EMR would be good neighbors, not needing cell phones, wi-fi, or other wireless devices. And vice versa, we need the Green Bank Observatory National Radio Quiet Zone's survival and protection.</p>	Against Closure	Email - Scanned	11/10/2016	Schou comment to NSF.pdf

Green Bank Observatory -Written NSF Public Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
613		Jeffrey	Mears	Environmental Area Manager Oneida Nation Environmental Health & Safety Division	The Oneida Nation, located in Wisconsin, is not interested in participating as a consulting party at this time. I can serve as the Point of Contact for any questions. Please see my contact information listed below.	Resource Considerations	Email	11/9/2016	
614		Victoria	Kovalchuk		My name is Victoria, and I am a member of the Astronomy Club at the University of Virginia. Every year, our biggest event is a trip to the Green Bank Observatory, and it's always thrilling to visit a place that contributes so much to the astronomy and astrophysics community. The GBT plays a big role in inspiring the children of its community to pursue scientific inquiry. It also plays a big role in the astronomy clubs across the country including the University of Virginia Astronomy Club. On our trip to Green Bank, we get to explore the universe and learn about radio astronomy, even when it's cloudy! Not only that, the GBT conducts a lot of valuable research. However, I have heard that the government is planning on cutting all funding to the Green Bank Observatory. I know that this would hurt the GBT greatly and I would strongly urge you not to cut the funding to the GBT.	Against Closure	Email - Scanned	11/8/2016	
615		Joe	Mitchell	President, Mitchell Chevrolet	I am writing to express my support of continued funding for the continued operation of the Green Bank Observatory by the National Science Foundation. The Green Bank Observatory has been part of the fabric of the Pocahontas county community for many years. Community impacts include: - Exposure of students to the application of math, science and engineering that helps them discern career paths through mentorships and other activities. - Exposure of thousands of tourists annually to, scientific research activity of which many had no previous appreciation. - Enhancement of local workforce especially in education by family members of GBO employees. While most of us don't fully understand the research being conducted at the GBO we do understand the importance of the continued exploration of the universe.	Against Closure	Email - Scanned	11/8/2016	
616		Connie	Mole		I am in full support of Green Bank Observatory remaining open. I grew up less than 20 miles from the observatory and from personal experience am very well aware that the observatory is the only major STEM job opportunity to encourage children to get involved in science in the Pocahontas/Randolph area. Losing the observatory would economically damage this area beyond repair. I remember our class visiting the observatory a number of times as a child and the science I learned from those visits. It is a teaching facility as much as it is a research facility. My husband and I recently took our son to the facility for a day of science and learning about launching rockets as well as the telescopes. Please don't close this valuable resource.	Against Closure	Email - Scanned	11/8/2016	
617		Chelen	Johnson	Science Teacher and Yearbook Advisor Breck School	For the past 14 years, I have had the distinct privilege to work with astronomers and EPO staff at the Green Bank Observatory. These experiences have transformed my 32-year teaching career. When I first set foot in Green Bank in June 2002, I was not conversant with the intricacies of radio astronomy. Having been awarded a Research Experience for Teachers grant, I worked with Dr. Ron Maddalena on an eight-week calibration project. This experience allowed me to expand my high school astronomy classes to include long wavelength research, far different from the usual optical observations. The next two years, I spent my spring breaks continuing to refine calibration values for the Green Bank Telescope (GBT). Having won a sabbatical from my school, I spent the 2004-2005 academic year in Green Bank. New algorithms were developed to refine cal values to greater precision. I also worked with Sue Ann Heatherly to develop lessons for dissemination both in the state of West Virginia and across the nation. My Green Bank adventures have continued. For eight consecutive summers, 60 rising West Virginia ninth-graders were selected to gather in Green Bank for the two-week long West Virginia Governor's School for Math and Science (GSMS). The GSMS students ("govies") were challenged to delve into stream ecology, astronomy, electronics, engineering and technology much, much more deeply than offered in their schools. In addition to using the 40-foot telescope, each govie worked with an NRAO astronomer on an authentic research project, oftentimes adding their own GBT observations to enhance their research. What a thrill to watch 14-year-olds control the world's largest fully steerable object! When the ninth-grade curriculum in West Virginia changed to Earth and space science for the current school year, the observatory took on a leadership role in helping teachers master the new curriculum. Along with Fairmont State, the EPO staff at the observatory offered the Earth and Space Science (ESS) Passport to teachers across the state. I was fortunate to be a part of the astronomy education team. At the West Virginia Science Teachers Association conference held just last week in Morgantown, it was thrilling to hear ESS Passport teachers brag about passing their PRAXIS exam after our two-week intensive workshop. Having the opportunity to work with Sue Ann Heatherly through Skynet Junior Scholars, Governor's School, Pulsar Search Collaboratory and many other programs has been instrumental in my teaching success. She has positively impacted well over 10,000 lives through her astronomy education programs offered at the Green Bank Observatory for the past three decades. Heatherly is nationally recognized for her vast contributions to astronomy education. It is impossible to walk with astronomy teachers or to walk through an American Astronomical Society conference without bumping into a person (or five) who doesn't have a "SA has taught me so much" story. There is no equal to what the Green Bank Observatory has contributed to astronomy education. The cutting-edge Pulsar Search Collaboratory is a unique way for students to analyze actual data in hopes of discovering a pulsar! It is critical that these opportunities continue to be offered to our students and teachers. If our nation is to regain supremacy in STEM education, it is imperative that facilities like the Green Bank Observatory have the funding to function properly.	Against Closure	Email - Scanned	11/8/2016	

Green Bank Observatory -Written NSF Public Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
618	a	Bernadette	Lynch		<p>The STEM subjects were never presented to me in my elementary and secondary education as a viable career option. I was encouraged to be a teacher, or an office assistant, never hearing that 'you can be a scientist, an engineer, a researcher'. Yes, I am an over 50's female, and what I have experienced by following my children's careers in science and math has led me to a new found discovery that maybe science and I would have made a great partnership. The biggest influence in my new appreciation of scientific research and outreach lies within the miles of the Green Bank Observatory.</p> <p>...We cannot treat this structure as a disposable science project which some may think has met its usefulness because it has not! The GBT is one of NSF newest, large telescopes and remains at the cutting edge of astronomy. The observatory shares a balanced goal of science and outreach that has made useful discoveries and encouraged the public to understand what man's mind can accomplish and find in our universe. The influence upon young minds of a stately structure that conducts outstanding research and innovations, motivating them to find their niche in a STEM career, cannot be understated. Over 50,000 visitors and 3,500 students visit Green Bank every year to learn and be inspired by science and technology. In the past 12 months, 54 different groups spent the night in Green Bank and used the 40 foot radio telescope as part of their hands-on educational experience. These are numbers that cannot be ignored!</p>	Against Closure	Email - Scanned	11/8/2016	
618	b	Bernadette	Lynch		<p>The pride of a rural community to have such a place in their community and the economic benefits that it has realized cannot be pushed aside and slated as not necessary any longer. We are talking about human lives, human minds, that continue to contribute a significant impact in the field of astronomy. Ceasing science operations at the GBT will negatively affect the careers of over 900 astronomers, many of whom are just entering the field, and could wipe out up to \$30 million in economic benefits for the state of West Virginia.</p> <p>I am also feeling the impact of countries like China who have recently built the FAST project to promote their country in the astronomy field. Cuts to the GBT funding comes at a time when other countries are investing in radio astronomy. This threatens US leadership in this cutting edge field while on the doorstep of many new breakthroughs in science and technology. All four of my grandparents immigrated to the the USA because they believed a better life could be found in this great country. They left their roots, their family, their culture to make their new home in a country that led the world in prosperity, intellect, creativity and most importantly, freedom. Is this yet another example of how we allow our world leadership to fade? Furthermore, the GBT has historically been open to any scientist in the world. Time was awarded based solely on intellectual merit, not affiliation or citizenship.</p> <p>I encourage the National Science Foundation to look at the facts of what the Green Bank Observatory has and will continue to do to influence the advancement of mankind. Do not turn away from your monetary and labor investments that have produced so much. GBT operations account for only 3% of the astronomy budget at NSF. The GBT is an incredibly flexible telescope that has made ground breaking discoveries in fields as broad as quantum mechanics, the study of gravity, and the search for life beyond Earth. A decrease in NSF funding for the GBT will limit the amount of time available for the open science that has been the engine of discovery thus far. Please, deeply consider this heartfelt plea to retain all GBT functions.</p>	Against Closure	Email - Scanned	11/8/2016	
619		Helen and James	Fleming		<p>We have just read information on the funding of the Observatory which Sen. Joe Manchin emailed to us. Although we live in Greenbrier County now, we have lived previously for forty five years in Pocahontas County.</p> <p>My husband taught school right beside the Observatory property. It is always a beautiful sight to see the large dish telescopes there in that lovely rural landscape. The staff of the Observatory and their families were very good community members. The Observatory provides unique educational experiences for local students of all ages as well as giving older students and adults valuable experience and knowledge about this aspect of science.</p> <p>It also helps the community by bringing in tourists and professional people to visit the site and take advantage of the experience it offers. West Virginia depends on tourism as there few opportunities for employment here.</p> <p>Residents of this region always bring their visiting company to have this scientific experience. These guests, of course, are absolutely delighted with their visit to Green Bank.</p> <p>It is our hope that the Observatory will continue to be funded and to be an excellent showpiece, a pride of we West Virginians. Please present this plea to whoever can help with the cause of funding this special place that means so much to our state.</p>	Against Closure	Email - Scanned	11/8/2016	
620		Johannes	Hubmayr	Long-wavelength Project lead, Quantum Sensors National Institute of Standards and Technology	<p>This letter is in strong support of continued National Science Foundation (NSF) operations at the Green Bank Telescope (GBT). The scientific impact enabled by the GBT is important to me. Additionally, the resource has been an invaluable test bed for new technologies. Because of the GBT, we have been able to advance cryogenic sensors and readout for mm-wave observation, which have found broad application. lastly, my group and others in the mm-wave community have benefitted directly from students trained at the GBT. Graduate students whose thesis projects rely on the GBT have become valuable postdocs in my group. The GBT is a unique resource that we should continue to capitalize on.</p>	Against Closure	Email - Scanned	11/8/2016	

Green Bank Observatory -Written NSF Public Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
621		Trisha	Ashley	NASA Postdoctoral Program (NPP) Fellow NASA Ames	<p>I have been informed that the NSF is soliciting comments on the environmental impact statement and proposed changes to the Green Bank Observatory. I would like to submit my personal thoughts on this matter and attempt to convince NSF to continue to invest in the Green Bank Observatory for science-focused operations (i.e. the No-Action Alternative).</p> <p>The Green Bank Observatory has had a great impact on my career as a female astronomer. I began using the GBT as a graduate student. In graduate school I collected amazing data from the GBT and made new discoveries about the galaxy, IC 10, putting me on the map a scientist in my field. The Green Bank Observatory staff was particularly welcoming; they encouraged of diversity in the field and personally, they encouraged me to learn as much as possible about radio astronomy and the capabilities of the Green Bank Observatory facilities.</p> <p>Facilities that are open to students are increasingly rare; therefore this was a unique opportunity for me. Using the GBT as a graduate student allowed me to not only obtain amazing data for my dissertation, but it also taught me proposal writing skills, data collection skills, data analysis skills, and it encouraged me to continue in my field after graduation. As a graduate student, being given the opportunity to use a telescope like the GBT is a great honor and it motivated me to be a better scientist, work harder in my field, and continue in research related work after graduation. If graduate students are no longer able to experience observing at a facility like the GBT, then they may not be able to build the confidence to work with instruments like this in the future and they could end up feeling disconnected from the field itself. Adventures like going to the GBT, being in the operator's room, and controlling the telescope to study astronomy are the motivation that graduate students need to feel like they are achieving something and are connected to the astronomy community. NSF provides these opportunities by providing funding to operate the Green Bank Observatory.</p> <p>I have continued to collect data from the Green Bank Observatory as I begin the early stages of my career. The staff at the Green Bank Observatory has continued to help me understand the data that I have collected and continued to help me in my research endeavors. The data I have collected from the GBT and the amount that I have learned from working with the GBT are invaluable. The Green Bank Observatory is not just an observatory for seasoned researchers; it is a place where young astronomers learn new skills, gain confidence in data collectionanalysis, and are encouraged to be part of the scientific community. Please don't take that away from future young astronomers by taking away any of the funding that is so desperately needed by the Green Bank Observatory.</p>	Against Closure	Email - Scanned	11/8/2016	
622		Sarah	Stanchfield	PhD Candidate Department of Physics and Astronomy University of Pennsylvania	<p>As a graduate student at the University of Pennsylvania, I have spent the last three years building MUSTANG-2, a 90 GHz continuum instrument for the GBT. The importance of the GBT to me and other graduate students and young postdocs cannot be understated. First and foremost, clearly science capabilities of the GBT in the 3mm band do not exist on any other instrument. I will be writing my PhD on MUSTANG-2 observations of galaxy clusters, studying both the astrophysical phenomena occurring in these clusters and also using the clusters I observe as a tool to better understand cosmology. For this science to be impactful, I need to observe such a large number of clusters in a reasonable amount of time with high angular resolution, there is no other telescope on which MUSTANG-2 would be as effective as it is other the GBT. Of course, there are many more people much more qualified than I to tell you how imperative the GBT is to the scientific community. I would like to tell you why I think the GBT is so important for more junior scientists like myself, specifically those of us in the US.</p> <p>The other unique capability of the GBT which I think is even more important to younger people is the hands on experience afforded to scientists in training. The time I have spent at learning at the GBT is some of the most important of my program. There are very few other instruments of GBT caliber where students can have such ownership in their observations and science. Another important aspect of the GBT is that this is an American facilities. If scientists are forced to take their projects to other observatories (for example, the IMT) the people this will hit the hardest is students. Students often have limited funds available for travel and travel to foreign countries is often unfeasible.</p> <p>Please don't punish US graduate students and young postdocs by limiting the science capabilities of the GBT.</p>	Against Closure	Email - Scanned	11/8/2016	
623		Kathryn	Williamson	Teaching Assistant Professor Department of Physics & Astronomy West Virginia University	<p>Email: In a separate email I sent a support letter from just me, but I would also like to send a compilation of letters from students in West Virginia University's Fall 2016 Astronomy 106 course. This compilation is attached here.</p> <p>Thank you for your consideration in keeping this iconic scientific beacon for our state open and operational.</p> <p>Letters: Inserted as separate comments, listed by individual (WVU Astronomy 106 Students).</p>	Against Closure	Email - Scanned	11/8/2016	letters from WVU Astronomy Students.pdf
624		Tony	Beasley		<p>The state of West Virginia (WV) has an environmental review process – WV Division of Natural Resources. To what extent has the scope of this EIS review meet any relevant WV DNR requirements, if applicable? Issues that potentially impact Pocahontas County such as site road maintenance being returned to the state, and mitigation of the airplane runway, should be reviewed. State Road 2 runs through the site – who will maintain that in future? What consultation has the NSF performed with relevant local, county and state agencies to understand the impacts of the action alternatives identified?</p>	Resource Considerations	Email - Scanned	11/21/2016	
625	a	Danielle	Cain	WVU Astronomy 106 Student	<p>My name is Danielle Cain, and I am enrolled in an astronomy course at West Virginia University. Throughout this class, we have used the 20-meter telescope in Green Bank, West Virginia to further our learning and knowledge of the universe. The Green Bank Observatory is truly an asset to schools and scientists worldwide. There are new discoveries and research being done every day right in our backyard.</p> <p>Being from Pocahontas County, WV I see the effects that the NRAO has had in my county. The Green Bank Science Center is such an extraordinary experience for the kids in our schools every year. Going on field trips there gave us many educational opportunities that we only got because something so crucial to science was so near to us. Even if students are not as close as I was to Green Bank, they can still utilize the 20-meter radio telescope online through Skynet, gaining experience with multi-wavelength astronomy. The learning possibilities are endless for science learners worldwide with access to such a critical tool.</p>	Against Closure	Email - Scanned	11/8/2016	

Green Bank Observatory -Written NSF Public Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
625	b	Danielle	Cain	WVU Astronomy 106 Student	Not only is education a primary impact of the Green Bank facility, but they also employ a large portion of people living in Pocahontas County. The number of families that would be affected if the facility were to close is tremendous. Many people in our county would lose their jobs and may have to move away because of this. Pocahontas County is such a small, but beautiful county and we can't afford to lose more of what we have to offer. Tourism is a significant factor for the county and if the Green Bank Observatory closes this could severely damage our tourist industry and economy. I hope you take this letter into consideration and reflect on how the Green Bank Observatory affects more than what others may realize. An educational research facility of this power should be highly valued.	Against Closure	Email - Scanned	11/8/2016	letters from WVU Astronomy Students.pdf
626		Ryan	Brown	WVU Astronomy 106 Student	<p>Hello, my name is Ryan Brown and I am a current astronomy student at West Virginia University. I have recently heard of the disappointing news that the Green Bank Observatory may be closing soon. Although I am not an astronomy or science major, I am still saddened by this recent development. I have not yet been to Green Bank, but was looking forward to a trip planned later this month. I had first heard of Green Bank by my astronomy professor, Kathryn Williamson back in August when the class had just begun. She mentioned a few things about it, like what an experience it is to go. At the time, I did not read much into it other than the part of extra credit offered for going. I planned on making a solo trip and to get nothing out of it other than extra credit points.</p> <p>However, as the semester went on my mindset began to change and is certainly different today. I have realized more and more throughout the semester that I have a large interest in astronomy. I have found this out not only through my class, but watching science fiction movies such as Interstellar and Gravity, along with shows such as the Cosmos and Through the Wormhole. Science, specifically space, stars, and the unknown has really piqued my interest recently. Also, we have worked with telescopes like the 20-meter telescope at Green Bank on this online robotic telescope program called Skynet. Skynet has been so much fun for me, as we have taken pictures of stars and asteroids in class. I find it fascinating at the wealth of knowledge and resources I have in this class, including Green Bank. Despite struggling with the material, I have gotten a great deal of value I have gotten from this class, as I have recommended to many peers and friends. All of a sudden as this semester has moved along, my solo trip planned to Green Bank has turned into a trip where my friends, who are not astronomy students, and I are going with an SUV full of people, excited to see what Green Bank has to offer in person. We are not only planning our trip this semester, but also are looking forward to future adventures there next semester, as well.</p> <p>I am truly interested and enthralled with this new found interest of mine of astronomy, as my friends are too. I am certain that my friend group is a small representation of a larger group that has this exact same curiosity with astronomy and space. I am writing to you today as one of many students, teachers, and other interested parties in the hopes that Green Bank will permanently remain open. I find myself thinking about astronomy more and more in everyday life and find it very interesting and very exciting that within this great state I attend college in there is a 100 meter telescope that I can go explore at any time I get bored, fascinated, or just plan to see. Thank you for your time.</p>	Against Closure	Email - Scanned	11/8/2016	letters from WVU Astronomy Students.pdf
627		Shannon	Cawley	WVU Astronomy 106 Student	<p>The Green Bank Observatory offers one of the most unique experiences one can have here in West Virginia. For years now, children, teens, and adults have come to the observatory for a firsthand look at the amazingness that's out in the universe. The Green Bank Observatory everyday inspires many of the children that come to visit either through school or with their families, teaching them a perspective about the universe that a textbook couldn't teach. That is why I'm writing this letter. Shutting down the Green Bank Observatory would be a great mistake and tragedy to our community.</p> <p>So many programs and people rely on the information and data that these telescopes offer. The "Pulsar Search Collaboratory," is just one that utilizes the GBT to discover amazing stars called pulsars. Without this observatory, great scientists like Dr. McLaughlin and her team from WVU wouldn't have a place to conduct their gravitational wave research. Along with furthering the field of science, Green Bank allows for many outreach programs aimed toward kids. The "PING" summer camp for rising 9th graders is a great opportunity to interact with the telescopes and technology offered. I remember looking through a telescope for the first time in about 8th grade; we looked at the Andromeda Galaxy. It was such a surreal experience, almost kind of scary to realize just how minute Earth actually is and how great/vast the galaxy is. It truly gives a person perspective and humbles you in a way. This type of experience is something that every kid should have if possible, and closing this observatory would deprive many youth of such experience. The PING summer camp, along with the many other programs offered at Green Bank, is so important to the community and so I'm writing this letter to ask you all to understand the full weight of your decision. Closing this observatory down would be a great disservice to our community and youth.</p>	Against Closure	Email - Scanned	11/8/2016	letters from WVU Astronomy Students.pdf
628		Emilee	Austin	WVU Astronomy 106 Student	<p>I am a student at West Virginia University and am currently in an introductory astronomy class. Within this class we have had access to the 20 meter telescope at Green Bank remotely online through Skynet. This opportunity was eye opening for me because it was not only the first time I had used any telescope, but I was able to see things that I was not positive would actually be visible. Green Bank has helped me to understand certain aspects of astronomy that without access I cannot say I would have grasped. It was exciting to know that I was using a relatively local telescope because I felt like I was contributing to the West Virginia community in a way.</p> <p>I grew up in Northern Virginia, and the Air and Space Museum was really one of the only things that allowed for any sort of space experience. As great as the museum is and was it limited the experience to what was there. The Green Bank telescopes allow for exploration and expansion of knowledge, but it supports and encourages it as well. Having such a resource available to researchers, students, professors, and so many more people creates an environment that will promote discoveries and a desire to gain more understanding of what is actually out there. There is so much more to learn about space in general that to shut down a telescope anywhere is slowing down any progress.</p> <p>If the telescope was shut down permanently there would not only be people out of jobs, but a society out of the opportunity to explore and understand as I did and continue to. This is a rare opportunity, being able to use a scientific grade telescope was shocking when I found out; to take away opportunity is to take away knowledge in this case. If this telescope is shut down the advancements within the astronomy field could be at risk. This telescope is important to many people, and many of those people rely on it for research, education, employment, and inspiration. The Green Bank telescopes are an essential opportunity for anybody.</p>	Against Closure	Email - Scanned	11/8/2016	letters from WVU Astronomy Students.pdf

Green Bank Observatory -Written NSF Public Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
629		Adam	Haddix	WVU Astronomy 106 Student	My earliest memory of the Green Bank Telescope (GBT) is from playing on a nearby soccer field and looking up during the game and seeing this massive telescope and actually getting to see it move. My next memory is going to the observatory on a school field trip. I remember how amazed I was at everything our tour guide was telling us about the GBT and how it was one of the biggest radio telescopes in the world. That was just amazing to me -- that one of the biggest telescopes in the world is in my state. That stuck with me as I grew up and I still look at the GBT with the same amazement. Until this year I viewed the GBT as a huge tourist attraction for West Virginia, but now I actually know more about the work that goes on there (as the result of taking astronomy at WVU?), it's more than just a tourist attraction. Learning about how astronomers are using the GBT to monitor pulsars to detect changes from gravitational waves in spacetime has made me even more proud that this is all happening in my state just three hours away from where I'm from (Randolph County). I love West Virginia, I've been born and raised here and there's nowhere else I'd rather be and I'd do anything to help this great state. Taking down the GBT would just lower this states "morale", it'd put people out of work, tourism would drop, and West Virginia and the people working at and using the GBT would never get the credit for a breakthrough in space that could be just around the corner if it stays. As a very proud West Virginian I ask for you to keep the GBT up and running. It may not seem like it all the time but the people in this state really do appreciate the GBT and having it in this state. Please do not shut down the GBT.	Against Closure	Email - Scanned	11/8/2016	letters from WVU Astronomy Students.pdf
630		Noah	Wilds	WVU Astronomy 106 Student	<p>Growing up in West Virginia, I learned early in life we take pride in every part of our beloved state. When we hear someone talking about Barney Fife (Don Knotts), Jerry West, Randy Moss, or Brad Paisley, we make sure that everyone knows exactly where they are from. Anytime a movie films in the state, such as We Are Marshall and Super 8, everyone goes to see the movie whether it is something they'd normally see or not. Even if someone mentions West Virginia on TV, the radio, or in a news article, we make a big deal about it. This is just who we are and this feeling of pride and love for our state extends into the science world because we are the home to the Green Bank Telescope.</p> <p>There are two ways to look at just how important the observatory is to the state. First, as a state that isn't used to being the best at anything, we see it as an honor to be the home to one of the best telescopes in the world in addition to being the largest fully-steerable telescope. Knowing that this leads to new discoveries every year, ones that improve our future, it would be a poor decision to close the observatory.</p> <p>Another purpose of Green Bank is that it provides the future generations with a place to expand their knowledge. There are many opportunities such as a summer camp, a junior scholar program, and even an internship program that benefit our youth. When you take this away, this becomes yet another example of damaging the future of this country and taking away even more opportunities for new minds to succeed.</p> <p>There are many things that need defunded, but this is not one. Unlike most of our spending, the Green Bank Observatory has a purpose and the potential to constantly improve our world in addition to being a source of pride for the state of West Virginia, a state that needs as much hope as possible.</p>	Against Closure	Email - Scanned	11/8/2016	letters from WVU Astronomy Students.pdf
631		Kelsea	Hower	WVU Astronomy 106 Student	<p>My name is Kelsea Hower, and I am an astronomy student at West Virginia University. I grew up in Greenbrier County, West Virginia, a stone's throw from the Green Bank Radio Observatory. The observatory has become part of my heritage as I have been there countless times in my twenty short years. My grandmother was, and still is, fascinated with the skies above us, extraterrestrial life, and what else might be in the dark beyond. She instilled this fascination in myself by taking me to the observatory as often as possible. One of my visits to Green Bank was brought about by the regional math field day, where they let us tour the facility after all the exams had been taken and we were waiting for the results. Out of all the science museums and exhibits I have been to, the interactive exhibit inside Green Bank was the most educational I have ever experienced.</p> <p>The Green Bank Radio Observatory has become part of the culture in my beloved West Virginia, something for my state to be proud of and boast to the country. It is an amazing tool for students and researchers across the globe to be able to use. The telescope is an essential part of Pocahontas County and defines the town as a "quiet zone." The closing of the observatory would destroy any tourism that the small town of Green Bank receives along with extinguishing the massive outreach through science from the state. West Virginians are often misunderstood as backwards, uneducated "hillbillies" and the Green Bank Radio Observatory shatters this disillusionment. I hope that you will take this letter and the letters of my classmates while deliberating on the fate of our telescope.</p>	Against Closure	Email - Scanned	11/8/2016	letters from WVU Astronomy Students.pdf
632		Rachel	Jenkins	WVU Astronomy 106 Student	I, as a college student at West Virginia University, have used the Green Bank 20-meter telescope for my astronomy class and it helped me learn a lot more about space such as how to use a radio telescope to discover how to emission from hydrogen clouds in the Milky Way. Also, it allows people such as students or adults to be able to discover the invisible universe, including pulsars that these people haven't found for before. Finding pulsars or objects far away in space can allow students to visual how big space is. It allows students to experience what they are learning in science classes and see what they are learning in life not just in a textbook. Also, they can use very important scientific instruments that they have talked about and use it themselves. It also allows astronomers to learn more about pulsars, gravitational waves and black holes in space. It gives West Virginia a tourist attraction that allows people to learn about telescopes and how they work. Finally, it allows students and astronomers all over the world to see what is happening in space from radio telescopes with a variety of capabilities. This gives people the ability to appreciate astronomy and the science in general. The potential NANOGrav to discover gravitational waves using the Green Bank Telescope can revolutionize how we study space easier. I feel that it is important for all people to have the experiences the Green Bank Observatory provides. Gives huge contributions to science and I don't think that these experiences should be taken away from all scientists and people who just enjoy learning more about space. The Green Bank Observatory should stay open so everyone all over the world can enjoy the telescopes and engage in science.	Against Closure	Email - Scanned	11/8/2016	letters from WVU Astronomy Students.pdf

Green Bank Observatory -Written NSF Public Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
633		Adelaide	Estep	WVU Astronomy 106 Student	<p>Having lived in West Virginia my entire life, I've always considered this state incredibly fortunate to be the home of such an impactful scientific site. For years, The Green Bank Observatory has been a place where astronomers work to discover the many mysteries of space. Education is another reason why this site is so crucial to the world we live in. This is one of the few locations where schools can take their students, and future astronomers, to educate them on the subject. Not only does this site hold summer programs for astronomy, but it also includes engineering and computer science education, which is remarkably important for the future generation.</p> <p>The research performed at Green Bank is truly groundbreaking. From listening to the closest 100 galaxies outside of the Milky Way to the study of pulsars and gravitational waves, the observatory has composed many important studies over the years. There is an immeasurable amount of information about space we have yet to find; therefore, the continuation of funding for the Green Bank Observatory would be by no means a mistake. I've taken the time to write this letter because I am concerned for the education of astronomy, and this is an extremely important asset to the future studies of astronomy, technology, engineering, and computer sciences. Please reconsider the thought of taking away the observatory's funding. The loss of this technology would be a shame.</p>	Against Closure	Email - Scanned	11/8/2016	letters from WVU Astronomy Students.pdf
634		Judy	Hipelius	WVU Astronomy 106 Student	<p>The Green Bank Observatory serves many purposes. First, it supports research and discovery in West Virginia. The United States needs more research facilities and opportunities for students, college graduates, professionals, and the public to explore and learn about our extensive universe. Close the Green Bank Observatory down, and it will prohibit those chances for young learners and professional alike.</p> <p>Second, the Green Bank Observatory is the world's largest fully steerable radio telescope. That is an impressive feat, and even more of a reason to continue funding for this national landmark. West Virginians take pride in what this wonderful state has to offer, and taking away such an immense telescope would definitely impact West Virginia. I did not grow up in West Virginia, but I do know many young students travel to this facility for field trips and learning opportunities. Science and math are severely lacking in the United States; exposing young learners to museums, research facilities, and places like the Green Bank Telescope begins that thirst for knowledge and self-improvement. Many children dream of becoming astronauts in the future; seeing the Green Bank Telescope during this young age just may inspire them to do exactly that. Cutting the budget for science and math is the exact opposite of what the National Science Foundation should do. If funding for this facility is ceased, West Virginia and the United States will have yet another reason to continually fall short in science and math when compared to other countries.</p> <p>Third, real students across West Virginia have aided in new discoveries with the use of the Green Bank Telescope. A group of students discovered a pulsar back in 2012. "When you discover a pulsar, you feel like you're walking on air! It is the best experience you can ever have." --- Jessica Pal of Rowan County High School in Kentucky stated as she was interviewed. This type of student involvement is what sparks that interest in learners across the country.</p> <p>Anne Agee of Roanoke Valley Governor's School in Virginia stated she is "considering pursuing astronomy as a career choice," and "The Pulsar Search Collaboratory has opened my eyes to how fun astronomy can be!"</p> <p>Many positives stem from continuing to fund the Green Bank Telescope in West Virginia. Being the world's largest fully steerable radio telescope, Green Bank Observatory is a national landmark that West Virginians take pride in. It serves as memorable location where many residents toured at a young age. It inspires students to become future astronomers, scientists, and astronauts. It gives professional research opportunities to aspiring young learners. These are just a few of the reasons the National Science Foundation should decide to support funding for the Green Bank Telescope. I hope you find this letter explains why it is important to keep the Green Bank Telescope operational for generations to come.</p>	Against Closure	Email - Scanned	11/8/2016	letters from WVU Astronomy Students.pdf
635		Brian	Driscoll	WVU Astronomy 106 Student	<p>It has been brought to my attention that you are considering closing down the Green Bank Observatory. I believe this would be a huge mistake. When I think of what the state of West Virginia is proud of, the Green Bank facility comes to my mind. I was lucky enough to attend Governor's School for Math and Science the summer before my freshman year of high school; the program was held at Green Bank. During my time there, I learned more about astronomy, the facility, what it has to offer, and about how the facility and astronomy go hand in hand with each other. I was fortunate enough to use the 40-foot telescope during my time there, and I used the 20 meter telescope through Skynet in an astronomy course I am taking now at WVU. I would hate for the facility to be shut down and to see kids miss out on the experiences that I will carry through my lifetime. I understand changes may need to occur in regards to this facility, but I believe it would be detrimental to not only me, but West Virginia to shut down the Green Bank Observatory.</p>	Against Closure	Email - Scanned	11/8/2016	letters from WVU Astronomy Students.pdf
636	a	John	Carnell	WVU Astronomy 106 Student	<p>After recently finding out that you are considering shutting down or changing the NRAO, located in Green Bank, West Virginia, I was completely shocked. I honestly did not believe it.</p> <p>The observatory there is one of the largest radio observatories in the world; I do not understand how you could shut such an important research facility down.</p> <p>Back in 2012, I was selected to be a part of the West Virginia Governor's School for Mathematics and Science which was a two-week long academy located at Green Bank. We were divided into groups and all given projects. Each group's project had to be completed during night labs while using the 40-meter telescope. It was so awesome to be able to use actual telescopes to receive raw data to manipulate into useful situations. My group was then selected to use the Robert C. Byrd Green Bank Telescope for data recording. It was truly an unforgettable experience. I also attended seminars on the campus of the NRAO in Green Bank. They were two weeks I will never forget.</p>	Against Closure	Email - Scanned	11/8/2016	
636	b	John	Carnell	WVU Astronomy 106 Student	<p>The Green Bank telescopes have also been creating breakthroughs for science. I remember when I was there that they were being primarily used to find and study pulsars, which was a relatively new topic at the time. There are countless other things that they could study, too. Not to mention, the GBT brings a lot of pride to the state of West Virginia which is in a downturn right now. It is an honor to the citizens of West Virginia (I am one of them) to have such a prestigious science research facility in our state.</p> <p>As you can see, shutting down Green Bank will be a disaster for me, my state, and for science, especially astronomy. I recommend you reconsider this.</p>	Against Closure	Email - Scanned	11/8/2016	letters from WVU Astronomy Students.pdf

Green Bank Observatory -Written NSF Public Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
637		Natasha	Yousef	WVU Astronomy 106 Student	<p>As a West Virginia native, the Green Bank telescope has always been a source of pride for me. I was born and raised in Charleston, WV and one of my fondest childhood memories is taking an elementary school field trip to the Robert C. Byrd Green Bank Telescope. At that age, I understood very little about how that large white piece of equipment could see things in the sky that I could not see with my own eyes.</p> <p>That experience sparked in me an interest of the universe beyond the clearly visible. My education since then has been focused on the sciences and performing research on things too small to be seen with the naked eye. Remembering back to my elementary school years, I was prompted to take an astronomy class at West Virginia University, where I am learning about all the stars and planets too distant to be seen easily. I was finally able to learn how the previously enigmatic Green Bank Telescope worked.</p> <p>Unfortunately, it was also in this class that I found out the Green Bank Telescope was losing funding and could potentially be dismantled. I urge you to reconsider. It would be a shame to lose the largest steerable telescope in the world. Not only does this impact the astronomers who use the radio telescope to study distant gas clouds and stars of other galaxies, but it also hurts the curiosity of children like me who were astounded by the telescope. As more and more young people continue to leave West Virginia due to the lack of job opportunities, it is imperative that the youth of this state know what great opportunities still lie here in West Virginia. Losing the Green Bank Telescope would cause West Virginia to lose thousands of jobs and an important source of revenue. The people who live in the National Radio Quiet Zone have given up the use of anything that emits electromagnetic radiation for the sake of scientific research, but there are no complaints from the residents. Visiting the Green Bank Telescope brings inspiration to those who visit and should be appreciated for its part in scientific discovery.</p>	Against Closure	Email - Scanned	11/8/2016	letters from WVU Astronomy Students.pdf
638		Jacob	Hughes	WVU Astronomy 106 Student	<p>What a fabulous STEM opportunity we have in the great state of West Virginia! The Green Bank Observatory located in Pocahontas county offers tons of learning and research opportunities for students of all ages. From field trips for elementary students to summer camps to undergraduate internships, this science center inspires students on a daily basis. This Observatory was a trailblazer in the field of Radio Astronomy.</p> <p>The PSC (Pulsar Search Collaborative) collaboration between WVU and the Green Bank Observatory allows high school students and their teachers to do real research which builds confidence and experience that can lead to a successful future in a STEM career. Now, over 10 colleges and universities have joined the work. Over 2 and a half million pieces of data has been analyzed and many discoveries made due to these programs. Also, the impressive My Brother's Keeper program targets young men of color and females to promote interest in science!</p> <p>All of that leads me to focus on the sad losses that would happen if this observatory would close. Just think of all of the lives impacted by the loss of the opportunities that would occur. When I was in 3rd grade, I was selected to visit Green Bank Observatory with a small group of students from Raleigh County. This trip was funded through a STEM grant. I will never forget being able to observe science in action!! I enjoyed using the telescope and learning about the cool things researchers had found.</p> <p>Please don't close this amazing science center and allow the over 40,000 visitors each year to lose this experience! There is still much to be learned about science right in the backyard of West Virginia! Also, just think of the economic impact that this closure would have on our great state. This is a facility that is necessary and beneficial to budding and established scientists everywhere!</p>	Against Closure	Email - Scanned	11/8/2016	letters from WVU Astronomy Students.pdf
639		John	Kerr	WVU Astronomy 106 Student	<p>The importance of the Green Bank Facility and its program is much more than just a telescope. It is a monument to how far we have come in the recent decades when it comes to space exploration and trying to understand our neighboring stars and galaxies, including our own. To me, the most important thing is discovering what is out there for man kind and even though it will not be in my life time, we need to keep advancing towards a greater goal in the case that Earth is not habitable anymore, or if we choose to colonize other worlds! Shutting down Green Bank would be a large blow to the astronomical society as a whole. Personally, I know it is used to find out information about black holes, which I find absolutely fascinating. The possibilities are endless when looking at the massive number of galaxies, stars and planets that neighbor our great planet. In conclusion, shutting down Green Bank would be a terrible thing. It has so many great tools that help move our entire species forward. It is beneficial to everyone on earth that we keep learning and keep exploring what is out there.</p>	Against Closure	Email - Scanned	11/8/2016	letters from WVU Astronomy Students.pdf
640		Taylor	Miller	WVU Astronomy 106 Student	<p>The Green Bank Observatory is an invaluable asset to astronomy as we know it. The remoteness of its location allows for superior detection of objects such as pulsars and black holes. Particularly, it is vital to detecting millisecond pulsars, which make detecting gravitational waves much easier. Losing the Green Bank Telescope would mean the loss of way to observe at wavelengths high enough to detect these millisecond pulsars. In fact, it was responsible for the discovery of the most massive pulsar ever discovered, which equaled two solar masses. Because of its location in the National Radio Quiet Zone, it is the only instrument capable of researching Baryon Acoustic Oscillations, which can be studied to determine the rate of the universe's accelerating expansion. Loss of the Green Bank Telescope would also mean the inability to determine the distances between galaxies at high angular resolution. The Green Bank Telescope has proved to be capable of major scientific advances, and therefore, it should not be shut down.</p>	Against Closure	Email - Scanned	11/8/2016	letters from WVU Astronomy Students.pdf

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Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
641		Jacob	Baker	WVU Astronomy 106 Student	<p>The Green bank Observatory is one of the most substantial observation facilities in West Virginia for multiple reasons. The first and most important of these reasons should be to help to provide information regarding astronomy for both the educating of new generations and facilitating ground breaking research for the new pioneering frontier of astronomy. I have been to the Green Bank Observatory for a field trip. I learned about how the concept of radio frequencies operated with the massive 100 meter collecting disc.</p> <p>The importance of the Green Bank Telescope (GBT) is that it is a vital part of the research projects, it has the capabilities to spin and turn in the exact direction of interest. Allowing for a 85% accessibility to the celestial sphere which is a critical feature for researchers when they are attempting to record star movements over a long period of time. Another key reason why the GBT should not be shut down is due to its very adaptive reconfiguration that can work with new and experimental hardware that is continually improving. This will consequentially be able to continually improve the functional capabilities of the GBT and to adapt as the improving hardware evolves, allowing to prevent the GBT to become obsolete.</p> <p>The GBT shows no sign of decline due to the vast amount of new discoveries that are continually being announced on their website. Therefore, it makes no sense to discontinue the funding of an important piece of the astronomical astronomy world. The most recent of these discoveries have been a surprisingly quiet black hole that was previously thought to be a galaxy developing. The discovery was made just less than 4 months ago, and will continue to make interesting and potentially universal changing discoveries in the future. Again, the closing of such a unique and limitless source of information seems very underwhelming not only to the astronomy world, but also to the people of the surrounding area who have the most invested in the telescope and the facility. The great people of the small town are willing to make many sacrifices of amenities such as not having wireless internet and cell phones to better the functional ability of the telescope. If these people are willing to sacrifice so much to make something that does even belong to or benefit them, how can someone who is benefiting from it want to shut it down. I am pleading to not shut down shut an iconic part of my great state of West by God Virginia.</p>	Against Closure	Email - Scanned	11/8/2016	letters from WVU Astronomy Students.pdf
642		Kyle	Bird	WVU Astronomy 106 Student	<p>I have long lived in West Virginia and enjoyed the endless views of rolling mountains; however, the single most incredible feature I have seen in this state is the Green Bank Telescope. I visited the site once in elementary school and left with a sense of awe at the magnitude of technological construction. How can you not while looking at the largest movable telescope on the planet? Removing the telescope from the area will not only affect those nearby, but it is used by students and scientist far and wide around the globe to study radio and gravitational waves, capabilities that are very rare and in our own backyard in this state. Just the other day a leading researcher on gravitational waves talked to my college astronomy class about the amazing work with pulsars and gravitational waves that she has been doing in coordination with the Green Bank Telescope. Scientists are making incredible discoveries on a yearly basis and recent progress is increasing with more results being either nullified or confirming theories, so now is not the time to stop these peoples' research and life work that is helping shape our understanding of the universe.</p>	Against Closure	Email - Scanned	11/8/2016	letters from WVU Astronomy Students.pdf
643		Nicholas	Paitsel	WVU Astronomy 106 Student	<p>My name is Nicholas Paitsel. I am a student at West Virginia University. I am writing to you because I am concerned about the future operations of the Green Bank Observatory. I feel the best way to proceed is to share my experience at the observatory and how it impacted me. I was in seventh grade at Madison Middle School in Boone County when my class took a weekend trip to the Green Bank Observatory. My county school system, like too many others in West Virginia, was highly deprived of funds, resources, and quality teachers. This trip was truly an amazing opportunity for us. I remember being amazed by the sheer size of the telescope as we approached the observatory. Then, we had an in--depth tour of the facility, and a chance to visit a night lab as part of their Radio Astronomer for a Day program. We were given the chance to search for hydrogen in space using the 40--foot telescope and many people found results. The data just looked like squiggles on paper, but the researchers assured us that we could have found something amazing and informed us of all the possibilities of what it could have been.</p> <p>Our little faces lit up and our minds wondered. This was so exciting and educational for a bunch of small town boys and girls, many of who would never get a similar opportunity again. I am sure this experience has had a lasting impact on many of my classmates as it has on me. This visit to the observatory initially sparked my interest in astronomy, and now I am enrolled in an introductory astronomy course at WVU where I get to use the Green Bank 20--meter telescope online through the Skynet interface. The educational opportunity the Green Bank Observatory provides to the residents of West Virginia as well as people all over the world is colossal. It would be a huge mistake to alter the operations of this facility, and I urge you to strongly consider the negative educational impact this would have on the state of West Virginia.</p>	Against Closure	Email - Scanned	11/8/2016	letters from WVU Astronomy Students.pdf
644		Zoe	Kahle	WVU Astronomy 106 Student	<p>The Green Bank Observatory is very important in the world of astronomy. For one, the 20--meter telescope has personally helped my astronomy class at West Virginia University in our learning process. We used the telescope to find actual data and extend our learning into actual information about hydrogen gas. And secondly, just within my first semester of college, I've personally heard from another astronomer of how important this place is and all it does. Her project on pulsars and gravitational waves could be ground breaking into the knowledge of our universe. Her project will no longer exist without this place and that will simply be a disgrace. I imagine that her project is not the only one that needs this place to continue research. I imagine there are so many other people who not only care about this place but need it for their career. I may not know the full extent of this place or much knowledge on astronomy, but I know that the Green Bank Observatory is extremely important in all that it does. So finally, take time and consider, listen to the words of all the people calling out to you, and think about it.</p>	Against Closure	Email - Scanned	11/8/2016	letters from WVU Astronomy Students.pdf

Green Bank Observatory -Written NSF Public Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
645	a	Laura	Harper	WVU Astronomy 106 Student	<p>I understand that sometimes what is being funded needs to be reviewed, but I sincerely hope that the Green Bank Observatory remains in service. Looking at the current proposals for the observatory, there are options to keep it open as is or with some changes to funding or function, and then there are options to temporarily or permanently close the observatory.</p> <p>It would be a disservice to West Virginia and to science to dismantle the observatory. Even shutting it down temporarily seems unnecessary unless it is purely a funding issue; but if it's shut down, is there a guarantee that it will be opened again? So I am considering both the temporary and permanent shut downs together for the moment, even though there is a very real difference in the observatory itself being left intact or being dismantled.</p> <p>If dismantled for environmental reclamation, of course, the site can't simply be restarted. The environment is important, but there are other places in West Virginia that can be redeveloped, even if they are outside of the NSF's scope. Where else do we have a radio telescope of the level and capacity of the GBT? Why use land elsewhere and additional funds to build something comparable when this is already in use? Reclaiming land for environmental purposes is good and helps to counter some of the tree cutting and land clearing that seems to continually happen for ever more businesses and parking lots. However, environmental reclamation would be better done at places like dilapidated buildings and old strip mines. Again, I realize that other sites may be outside of the NSF's influence, but that doesn't negate the importance of the observatory remaining because of what it does accomplish.</p> <p>There are proposals to adjust the funding of the Greenbank Observatory, which already is funded in part by NSF and in part by other entities. Of course, it needs funding to continue operating; figuring out exactly who funds what amount is beyond my scope of information or knowledge. The idea of operating it as a technology and education park could help expand its impact on the state, especially on people who aren't already scientists working with the telescope, and seems to be acceptable as long as it doesn't stop the telescopes themselves from operating. Adjusting details (funding, operation, additional function, etc.) is fine to discuss. Just please do not shut down the site. Temporarily, it would halt or slow people's education in astronomy and physics, and it will halt or slow down the research being done there (like the NANOGrav program). Shut down permanently, it will take away a site that is encouraging science for the residents of a state that needs to support science education and development, and it would affect people outside of West Virginia as well.</p>	Alternatives Consideration	Email - Scanned	11/8/2016	letters from WVU Astronomy Students.pdf
645	b	Laura	Harper	WVU Astronomy 106 Student	<p>The Green Bank Observatory allows multiple people, from amateur scientists and elementary students to professionals and college students, to learn about astronomy and physics and to help expand our knowledge of the universe and how it works. It has outreach programs and internships, and it allows people off site to access the telescopes for their learning and research. West Virginia already has trouble, ranked as low in education, losing its younger generations as they leave to find better work elsewhere, and with economic difficulties such as the coal industry closing mines. We need to continue encouraging scientific endeavors for people of all ages and stages of learning.</p> <p>Some people might argue that the work itself is unnecessary, and perhaps it seems disconnected from immediate, day-to-day concerns in our lives. However, it does teach us about the universe, which we are part of, and aside from expanding our understanding of the universe, who knows what knowledge it will give us that can be applied here on Earth? The pursuit of knowledge itself is admirable, and there is always the possibility of it paying off in ways we can not foresee now. And the telescopes are used by people who aren't directly in Green Bank, including my own astronomy class at WVU (which is, I realize, already a collaborator with Green Bank Observatory).</p>	Against Closure	Email - Scanned	11/8/2016	
646		Sarah	Anderson	WVU Astronomy 106 Student	<p>It has been brought to my attention through my astronomy class at WVU that funds for the Green Bank Observatory are being threatened. The Observatory has always been something special that made West Virginia constructive in the scientific field. Green Bank has given students across the country an amazing opportunity to learn and observe our vast universe. I have personally used it several times in my astronomy course by using the 20-meter telescope through Skynet to help apply what we are taught in class to real invisible situations. Green Bank also offers a program called the Pulsar Search Collaboratory each year where students learn to analyze GBT data and are able to discover pulsars. The GBT is at the forefront of pulsar research and gravitational astronomy, as I learned from a guest speaker in class, Dr. Maura McLaughlin. Thanks to Green Bank we have now discovered the a variety of interesting neutron star systems. The hydrogen clouds surrounding galaxies and complex molecules in space are also notable discoveries. With this telescope, there is no telling what we will be able to observe in the near future. Defunding to Green Bank will lead in a halt to astronomy and a halt in humankind understanding something greater than ourselves.</p>	Against Closure	Email - Scanned	11/8/2016	letters from WVU Astronomy Students.pdf
647		Courtney	Stanley	WVU Astronomy 106 Student	<p>I am currently enrolled in Astronomy 106 at West Virginia University. I'll be the first one to tell you that this astronomy is hard, it isn't about aliens and UFO's; it's about discovering parts of outer space that we've never even thought of before. This class has taught me that there is a lot more to outer space than simply just stars and the moon. The Green Bank Observatory was a major help to our class on our learning journey to discover more about the universe. Our teacher, Kathryn Williamson, even allowed our class to use the Green Bank telescope in our class discussions and homework, so we were able to see first hand what this telescope is able to do and to what it is able to teach us.</p> <p>Not only is then Green Bank Observatory a great educational resource for my college class, it is also helpful to other education levels. Green Bank Observatory has many fun and educational things to offer, like class field trips, student science fairs and many research opportunities. Some of the research opportunities it offers are things like Skynet and Skynet Junior Scholars, an online program that allows a student to have access to what the Green Bank 20-meter telescope sees right at their fingertips! One other program they offer is Radio Astronomer for a Day, allowing students who are in the fifth grade and up to stay the night in the observatory and get some real astronomy action hands on!</p> <p>The Green Bank Observatory is a location that needs to stay around to further younger and older generations on what the universe actually holds. Education is very important -- we could have some future NASA astronauts visiting! The observatory also means something special to my Astronomy class and I as it helps us visually see what our teacher is trying to get us to understand! These are reasons that it is important that Green Bank Observatory continues to be funded. Education is so important!</p>	Against Closure	Email - Scanned	11/8/2016	letters from WVU Astronomy Students.pdf

Green Bank Observatory -Written NSF Public Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
648		Emily	Hughes	WVU Astronomy 106 Student	<p>First of all, thank you so much for the wonderful STEM opportunity we have in beautiful Pocohontas County, West Virginia! The Green Bank Observatory gives students of all ages, from elementary to college, hands-on opportunities to learn and research in many STEM fields. The great field trip opportunities along with summer camps and college collaboration affords many students opportunities that are rare. This science center is an inspiration to visitors and students 362 days a year.</p> <p>High school students and their teachers can research and study science topics. These studies build confidence and experience that inspire students to persevere and earn a college degree with a prosperous future in a STEM career. The PSC, which began as a pulsar search partnership with WVU, now has over 10 colleges and universities that have joined the effort. Millions of pieces of data have been analyzed, as well as many discoveries made due to the availability of these programs.</p> <p>What a loss for West Virginia and scientists from all over the world if this amazing center would close. The great work of initiatives such as My Brother's Keeper would set science back hundreds of years. This initiative targets young men of color and females to promote interest in science. There are many future discoveries to be made and these young scientists are just waiting for the right opportunity to research and compile data that would lead to more knowledge about our world.</p> <p>I urge you to keep the Green Bank Observatory open. Not only would the lives of scientists and future scientists be impacted, but this loss would have a huge economic impact on Pocohontas County and West Virginia! As a future elementary school teacher with a passion for science, I ask you to please continue to provide these great opportunities for students everywhere. Just think of the loss that would occur as over 40,000 visitors are denied access to these amazing learning opportunities!</p> <p>STEM opportunities are growing by leaps and bounds. Please keep West Virginia's Green Bank Observatory in the forefront of this endeavor.</p>	Against Closure	Email - Scanned	11/8/2016	letters from WVU Astronomy Students.pdf
649		Jacob	Klatt	WVU Astronomy 106 Student	<p>The Green Bank Observatory provides West Virginia students an incredible learning experience and if it were to be closed, I think it would be doing the state of West Virginia and the science community a huge disservice. As a student of astronomy at WVU and someone with a great interest in the recent discoveries regarding pulsars and gravitational waves, I would be disappointed if a facility on the forefront of these discoveries in my own state was shut down. I understand an economic analysis has to be done and the benefits and costs must be calculated, but I believe the benefits clearly outweigh the costs. West Virginia is a state with a dwindling economy and various issues on the rise, but our education has steadily improved with the help of the Green Bank Observatory. The world-class telescope at Green Bank has brought in many scientists and other professionals into West Virginia, benefiting the education system here. If Green Bank were to be shut down, the quality of astrophysics research in America would decline.</p>	Against Closure	Email - Scanned	11/8/2016	letters from WVU Astronomy Students.pdf
650	a	Jose	Rodriguez-Velez	Wildlife Biologist Green Bank, WV	<p>I respectfully submit to you my personal opinions regarding the plan to divest, close, and/or downgrade the functions of the Green Bank Radio Astronomy Observatory (GBRAO).</p> <p>The Social Environmental impact concerns regarding the most likely sought out outcome for this scientific and educational facility, unique to the Eastern USA region, could contribute to a growing Nationwide disconnect between the common People, and Science and Mathematics. Efforts by the NSF will only contribute to more scientific isolation of communities already disconnected with how R&D emerging technologies and visible Science work to better our lives. These communities have a voice when it comes to how Congress determines the size of the operational funding pie. Neglecting to include the ones at the bottom could eventually render your future funding pursuits troublesome.</p> <p>If support is maintained at previous levels, GBRAO will get to continue to provide scientists with a USA soil based, easily accessible facility to continue to conduct research. This will allow college graduates to get hands on experience utilizing top of the line instrumentation and instruction, and also, provide the most important aspects to the national interest, which are accessibility and presence for people of all walks of their life.</p> <p>Being the only facility with such an array of instruments in the entire East Coast, it serves as a fantastic tool that can be used to bring back science to a broader level of the USA population. Its location in West Virginia is crucial, for it is one of many States where Math and Science are increasingly being seen as "negative" qualities to have by the general public.</p> <p>The NSF is risking a great deal more down the line, by transferring tax dollars to sovereign foreign Nations at the expense of USA based scientific endeavors which always have the capability to give favorable impressions about how tax dollars are invested on R&D ventures. An large amount of dollars has gone to AIMA alone, while a small fraction is required to maintain and operate GBRAO.</p> <p>The AIMA venture will benefit the World for sure, but back here in the woods of the USA, those findings will provoke very little impression, because people will not see, or physically have the chance to experience science at work.</p>	Against Closure	Email - Scanned	11/8/2016	

Green Bank Observatory -Written NSF Public Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
650	b	Jose	Rodriguez-Velez	Wildlife Biologist Green Bank, WV	<p>The NSF is risking a great deal more down the line, by transferring tax dollars to sovereign foreign Nations at the expense of USA based scientific endeavors which always have the capability to give favorable impressions about how tax dollars are invested on R&D ventures. An large amount of dollars has gone to AIMA alone, while a small fraction is required to maintain and operate GBRAO.</p> <p>The AIMA venture will benefit the World for sure, but back here in the woods of the USA, those findings will provoke very little impression, because people will not see, or physically have the chance to experience science at work.</p> <p>To an increasingly Nationalistic voting block, here in the USA, the tax dollars trusted to the NSF will be seen as a wasted investiture on foreign affairs that benefit no USA taxpayer. A quick look at any social network comment section will illuminate my point.</p> <p>Be very concerned, for social animosity and voter resentment can develop quickly, starting at the local levels to expand Nationally. As a wildlife Biologist who dedicated 15 years of my life to save the endangered Puerto Rican parrot from extinction, these dollar investments in ensuring local visibility that provides engagement for the people paying your bills count.</p> <p>If anything, you need to ramp up the importance of facilities like this and make them working partners with public and private schools and universities. That visibility ensures funding continuity.</p> <p>AIMA R&D foreign investments are valid, but not at the expense of perfectly usable USA based technologies which are accessible to all and bring a real life experience to a greater number of people. The thought of NSF suggesting the dismantling of these instruments to transfer technologies, science and tax dollars to Chile is offensive and so I urge you to reconsider.</p>	Against Closure	Email - Scanned	11/8/2016	
651		Kathryn	Williamson	Teaching Assistant Professor Department of Physics and Astronomy West Virginia University	<p>As a Teaching Assistant Professor at West Virginia University and the former Public Education Specialist at NRAO in Green Bank, I am writing to express my strongest support for the Observatory to remain open and operational at its current status. Both professionally and personally, I have never been more inspired than when in Green Bank. For the first time in my life, I felt part of something truly, cosmically, larger than myself. I felt part of humanity's endeavor to understand our universe. I can hardly put the magnitude of what Green Bank means to me into words. The cutting edge science of pulsars, gravitational waves, astrochemistry, star formation, radar mapping, and now SETI. The amazing history of the struggles and triumphs of radio astronomers over the last seventy years to build new instruments, break new ground, and propel humanity's curiosity forward. The staff, the scientists, telescope operators, tour guides, machinists, engineers, and even the janitors take pride in what they do, giving the observatory their all. And perhaps most importantly, the students, teachers, and tourists who visit for educational camps, programs, and exhibits, get a chance to feel part of something bigger, receiving the message that, "you can do real science, right here, right now." The Green Bank Observatory brings people together for science, for learning, and for community.</p>	Against Closure	Email - Scanned	11/8/2016	GBO letter of Support3.pdf
652		Kathryn	Williamson	Teaching Assistant Professor Department of Physics and Astronomy West Virginia University	<p>During my time working in Green Bank, I engaged thousands of students in authentic radio astronomy experiences with the 40-foot educational telescope. Being able to use an old-fashioned chart recorder to collect my very own hydrogen emission line is what captivated me during my interview in the first place. With just a single night of such data, students can collaboratively determine that we live in a spiral galaxy, that we orbit its center in a clockwise direction, and that there must be dark matter. Perhaps even more impressive is that through the Pulsar Search Collaboratory, we have actually had students discover pulsars. It has changed their lives. They go on to pursue STEM careers at extremely high rates, and they are some of the most impassioned champions of science that I've ever seen. This is simply amazing. I have never seen any educational programs that even come close to rivaling the quality and impact of programs offered by Green Bank. And personally, despite years of studying astronomy and physics, I never truly appreciated science until I was in Green Bank. I came to Green Bank with a doctorate degree but no practical professional experience, and I left with an ability to communicate science, a drive and passion to inspire the next generation, and the skills to actually make a difference. I am sure I would have never gotten my position at WVU if not for my time in Green Bank. It launched my career forward in ways that I could have never expected. Now I still engage the hundreds of college students I teach each semester in radio astronomy projects via Green Bank's 20-meter telescope controlled remotely on line through Sky net. The 20-meter is the only radio telescope on the Skynet network, making it the only way to provide authentic, modern, multi-wavelength research experiences to a large sample of students who represent society's future politicians, business people, teachers, and parents. The following pages show the impact of this experience in students' own words.</p> <p>As you contemplate the future of the facility, please recognize the tremendous scientific, educational, and emotional importance of the Green Bank Observatory for many people, including scientists, the public, and students. I can't emphasize enough how much it means to science and to our community. Using the Green Bank 20-meter Telescope West Virginia University Introductory Astronomy Students' Quotes -</p> <p>Using the 20-meter telescope showed me how to relate my findings that I got ta real data others hove gotten. Using the telescope and being able to gather my own data and see that everyone else was using it correctly, boosted my confidence, and made me realize how doing scientific research could be so helpful. - I thought the most enjoyable thing about using the 20m was that it gave students the chance to actually see how measurements like this can be made to determine the rotation of our galaxy from the data. I thought it made learning about the topic more interesting when we did it this way, rather than by reading it from a book or the lecture slides like we did for most other topics in class. - It was an amazing experience to use such a big telescope and to actually use that data ta come up with conclusions of our galaxy. - I enjoyed everything about using the 20-meter. I have never been able to use something like that. - It was interesting to see how real astronomers get to use telescopes just like this, and to see what conclusions they make based on their findings. It was cool to see that what I had entered in, came back to me exactly how I wanted it to. I felt like o real astronomer. - It helped with applying understanding of material learned in class. Showed me how much you can learn from a single observation. - The radio telescope helped my understand how the frequencies of a section of stars relates to what direction they are moving relative to us. - It helped me understand the type of galaxy we live in. And how many spiral arms are present. - It directly reinforced what we learned in class. Not only did we learn how to apply data, but we actually obtained the data. - I understood better because I was actually interested in my own data. - The 20 meter helped me understand how radio observations work and also why they are important for understanding things in the universe. - I believe that it helped us understand how we know that our galaxy is a spiral and helped me understand how we know that the galaxy rotates counter-clockwise.</p>	Against Closure	Email - Scanned	11/8/2016	GBO letter of Support3.pdf

Green Bank Observatory -Written NSF Public Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
653	a	Anne	Smith		<p>I am writing out of concern for the proposed changes to the operation of the Green Bank Observatory. Green Bank Observatory is an essential part of the local community for its contributions in the area of pride and motivation for school children in the community. I have been a teacher at Green Bank School for 15 years, and during this time I have taught children in the middle school, grades 5-8. I would like to explain how one important area of a child's development would be impacted if the Observatory was no longer funded to the extent that it would have to close.</p> <p>Let me first state that because of the Observatory and their sponsorship and innovation, I, along with the Education Specialist at the Observatory, were selected from teachers throughout the nation, to be part of the second cohort of Airborne Astronomy Ambassadors. This unique and highly honorable opportunity allowed me to fly on SOFIA, an infrared observatory housed in a converted Boeing 747SP aircraft and flown at an altitude of over 39,000 feet. This fabulous opportunity to bring information back to my students about the science of astronomy and all of its wonders would not have been possible if the Observatory had not been here. But because it was, my students, 67% who are on free and reduced lunch, with over half having parents who have not gone to college, and some who have not finished high school, and who are just now seeing their future, were impacted in ways I didn't imagine. By sharing my experiences with them, they can now dream of one day doing something like this, of seeing these sites, and participating in these adventures. Most of my students respond best to things that are concrete and real, and things are always more real and tangible when you know someone else who did it, and has the pictures and videos to prove it. The kids were proud and excited about my journey into the stratosphere, and still talk about it to this day. This adventure did much more than allow me to do cool stuff; it allowed my students to dream. And that is the first step to successfully be what you want to be, and not what you are expected or forced to be.</p> <p>Children all need a chance to dream. To explore. To see new things and experience new information. All children, including children from the regular joes, from the drug addicts and alcoholics, from the ones being raised by their Grandmothers, or in most cases their great-grandmothers, and for the ones in foster care and those that are homeless, all need an equal chance to dream, to feel like they can do anything, to see the world through different eyes and hear a different side of the story. We are teaching innovators and exceptional thinkers, as most people who have to do so much with so little often are. The Observatory is tangible proof that things can be different, that higher education is a reality, that people can do cool things for a living. It is a unique and powerful message that our students experience every day, one that encourages them and in some cases motivates them (however, I won't give the GBT the mystical powers needed to motivate 8th graders in the spring; some things really are too far-fetched). All kidding aside, the Observatory, its generous and involved staff and the irreplaceable positive impact it has on our school system is something we cannot afford to lose, as it is something we simply cannot replace.</p>	Against Closure	Email - Scanned	11/8/2016	
653	b	Anne	Smith		<p>The Observatory gives these Appalachian children much more than freedom from cell phones and wifi. It gives them pride in their community, and pride in themselves, something that is often lacking in their lives. Recess duty is a difficult time that involves stopping 85 children from trying to do dangerous things. But as I am refereeing the "touch" football matches, and directing the soccer kids away from the building roofs, I always get a thrill of seeing all of this played out under that magnificent structure called the GBT and I am always thankful for our school business partner and generous neighbors, the staff and facility of the Green Bank Observatory. And I am going to beg you, please don't take this away from us.</p>	Against Closure	Email - Scanned	11/8/2016	
654		Anne	Smith		<p>I am writing out of concern for the proposed changes to the operation of Green Bank Observatory. Green Bank Observatory is an essential part of the local community for its contributions in many areas, but most specifically, for me, in education.</p> <p>The Green Bank Observatory has provided Green Bank Elementary Middle School with a resource like no other in the country. And I do mean, in the entire USA. To have something like the Green Bank Telescope (GBT) not only next door, but within sight of the school rooms, is an experience like no other. I have taught middle school science (6th, 7th and 8th grades) at Green Bank for 12 years. It is well known that in order to teach middle schoolers successfully, one must hook them in with interesting, hands-on, visual information that is then built on as the units progress. Using the Observatory and the GBT, my class and I have had countless conversations about the telescope, how scientists do science, all manner of space related topics, engineering discussions, cell phones, wireless technology, infrared technology, and many more topics that relate directly to astronomy and the GBT. We were one of the first 8th grade classes to learn about and participate in the Pulsar Search Collaboratory, an initiative project that uses data already collected by the GBT to search for pulsars.</p> <p>Because the property of the NRAO abuts the school property, it has been the perfect outdoor laboratory for my students. Over the years we have placed kestrel, bluebird, bat and wren nest boxes that have all been successful, created a wetland within easy access to the school that students have studied for a number of years regarding the creatures that inhabit our habitat and how habitats change over time. Because I have these students for three years, we are able to do long term studies of habitats and ecosystems that is frankly very unique to our school. For eight years our 8th grade groups have been a part of a team of scientists from WVU that have participated in a Golden Eagle census study, in which we monitored bait sites, baited with deer carcasses and using a trail camera, to add to this innovative and far reaching project. These are all real world science projects where the children act as citizen scientists and contribute to real world, authentic science data bases. None of this could have been possible without the generous and enthusiastic support of the Observatory and its staff.</p> <p>In addition to all of the above items, loss or even continued funding reduction to the Green Bank Observatory would also have a significant impact on the local school system by not allowing us to teach in a manner that is interesting, successful and productive. I cannot imagine teaching science in the way I have been doing without the presence of the GBO and all of its wonderful features.</p>	Against Closure	Email - Scanned	11/8/2016	

Green Bank Observatory -Written NSF Public Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
655		Alberto	Bolatto	University of Maryland Professor	<p>This is a letter for the environmental process started for the Green Bank Observatory. As a US scientist and an astronomer I care deeply about the quality and availability of public research infrastructure in the US, critical for not only for research but also for training of the next generations of scientists, and for education of the public. The GBO is a key part of that infrastructure.</p> <p>In my view the portfolio review recommendation of 'divestment' for Green Bank was short-sighted. The GBT has unparalleled ability to push the frontiers of astronomical knowledge. In particular, I would like to call your attention to a white paper posted in ArXiv by a group of North American astronomers from seventeen different institutions, among whom I am included. There we call for preserving the only public US single-dish observatory capable of observing at frequencies of up to 115 GHz, and we outline a number of key science cases that can only be addressed with a facility such as the GBT. In fact, it is clear that with modest further investment in high-frequency instrumentation the GBT would outperform any existing facilities in the US and abroad (https://arxiv.org/pdf/1610.09014v2.pdf). The forerunners of those instruments, led by university groups and funded by the NSF, are currently being deployed at the GBT.</p> <p>I want to also highlight the importance of preserving our ability to educate and train the next generations of scientists and leaders in research. I became an astrophysicist doing my PhD work on publicly-funded radio observatories, not only observations but also instrumentation. Single-dish facilities have a unique role in educating the future generations of instrumentalists. Because of their complexity and cost interferometers are poorly suited as testbeds of new radio instruments and new concepts in instrumentation. It is impossible to lead as a student or a postdoc cutting-edge radio instrumentation on a facility such as ALMA or the VLA: such projects are developed in single-dish telescopes. Precious few of those are US observatories, and with the demise of NSF's University Radio Observatory program the only remaining public single-dish capable of operating at mm-wavelengths is the GBT. Divesting of GBO to the point that it cannot support its high-frequency and mm-wave operation would have dire consequences for the formation of the next generations of high frequency instrumentalists, paradoxically at a time when the NSF is heavily investing in ALMA. I urge NSF to take this very seriously into account when considering its next steps.</p>	Against Closure	Email - Scanned	11/8/2016	letter_GreenBank.pdf
656		Dawnelle	Muff		<p>My kids and I love visiting the Green Bank Observatory. They are always impressed with the many telescopes on the property and the interactive visitors center. We even found out that there is a telescope on the property built by Grote Reber who is from our home town of Wheaton Illinois!!! We had never heard of Grote Reber until a visit to the Observatory, how sad our own town doesn't talk about him when the 3rd class does their presentation on important people from Illinois. We had to come all the way to West Virginia to find out this cool fact.</p> <p>The kids marvel at the idea of what it must be like to live in a area without cell phones and are fascinated with the talks given at the Observatory about studying space with radio waves and how little things like cell phones can cause problems for the scientist and researchers. Visits to the Observatory always end with discussions of hows and whys as they are trying to process what they have just learned. They are always excited about space and science after our visits!</p> <p>This is a great place to bring kids to get a real hands on feeling about space and science. It would be a shame to loose it.</p>	Against Closure	Email - Scanned	11/8/2016	
657	a	Natalia	Schmid	Professor, Advanced Engineering Building, Room 354 Department of CSEE	<p>My name is Natalia Schmid. I am Professor of Computer Science and Electrical Engineering at West Virginia University (WVU). The intention of my letter is two-fold. First, I want to present the Green Bank Telescope (GBT) as a world renowned hub in science, engineering, and education. Second, I would like to raise the question of maintenance of the GBT.</p> <p>My personal acquaintance with GBT first happened three years back, when our departmental Chair and I took an exploratory trip to Green Bank. With very successful new hires in the Department of Physics and Astronomy, WVU had just announced Radio Astronomy (having in mind the GBT, the great resource that we have in West Virginia) as a "Mountain of Excellence" (one of five selected by WVU). The result is that radio astronomy has become a main focus of the university. The trip to Green Bank was a great success. My own, initial involvement with the Green Bank Observatory (GBO) developed over three years into a broader collaboration between the Department of Computer Science and Electrical Engineering, the Department of Physical and Astronomy and the GBO. For myself this collaboration resulted in two new projects recently funded by NSF.</p> <p>I truly believe that GBO and WVU have formed a unique and highly productive team. Engineering researchers are in need of new data, which GBT provides, while GBT is in need of new research ideas that the Department of Physics and Astronomy as well as the Department of CSEE bring to the table. Green Bank is a very special place. It is home of one of scientific marvels of 21st century, the GBT, and each of us acknowledges this. This radio telescope is special not only due to its exquisite performance, but also due to its very special placement in terms of educational activities, real world experience, new scientific data and unique opportunities to collaborate with real world specialists in radio astronomy. The GBO's researchers and engineers are collaborating not only with WVU. The GBT is truly a scientific hub. Nearly every group in the world working on radio astronomy and cosmology is engaged with the GBT. One recent collaboration, initiated two years back, is known as the Software Enabled Radio Astronomy (SERA) project. This project involves multiple groups working on Digital Signal Processing for radio astronomy within the United States as well as groups from Europe, Asia and Africa. The multifaceted focus of the project is on the development of new DSP solutions for beamforming and radio interference removal supporting state-of-the-art data collecting radio astronomy equipment such as phased array feeds. It also places a focus on education, bringing newly developed engineering and DSP concepts to graduate and undergraduate students, to teachers in high schools and to high school students. Over the past two summers, while visiting and working with my colleagues at GBO, I have had a chance to observe (and even be a part of) many unique educational and social events happening around the GBT: where the best in country engineering and astronomy graduate and UG students are working on their summer projects with their world renowned supervisors from the GBT; where you are invited to join a group of high school teachers in listening to a series of lectures on radio astronomy and cosmology. High school students come for a two-three week visit to Green Bank later in the summer. They are excited when they learn that they will be allowed to be a part of an observing team and will be the first to work with newly collected data. There is absolutely no doubt that the GBT is a really special platform for education.</p>	Against Closure	Email - Scanned	11/8/2016	

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657	b	Natalia	Schmid	Professor, Advanced Engineering Building, Room 354 Department of CSEE	The second point of this letter is more of a question. What is it about NSF (and probably the US in general) that it always spends huge amount of money on building new and great pieces of equipment (and GBT is one of these examples), but then has no funding to support and maintain them after they are built? This happens nowhere else in the world. As an example, the Parkes 64m Radio Telescope is a very old telescope (over fifty years old), but it is still in service. It is well maintained and is up to date in terms of its scientific abilities. This has been achieved by equipping it with new multi-horn receivers and new phased array feeds. It generates incredible amounts of high quality data and serves many radio astronomy groups in the world. Why cannot the GBT - which is significantly more capable - serve the same purpose? I hope that you will decide to pursue the "no-action" alternative proposed for the GBO - "Continued NSF investment for science-focused operations". This will allow the GBT to retain its status as the pre-eminent single dish radio telescope in the world, and continue to play an active and vibrant role in science, research and education.	Against Closure	Email - Scanned	11/8/2016	
658		Cathy	Mitchell		As a retired science educator in Pocahontas County I can assure you of the importance of the Green Bank Observatory to our community. Whether supporting science fairs by teaching and modeling the processes involved in developing a project, mentoring high school students at the facility through a schools to work program, supporting the county's 4-H program by hosting the National Youth Science Day, providing science based continuing education for teachers or providing general education and tours for the public, The Green Bank Observatory is a vital part of our county.	Against Closure	Email - Scanned	11/9/2016	
659	a	Michelle	Holstine		I am writing in response to the hearings being held at the newly appointed GBO on November 9, 2016. I wanted to make my voice heard on the decisions being processed. I grew up in Green Bank, WV, starting when i was 3 years old. I did not know then that i grew up in what most would consider, an "odd" place. To me, the mountains were my playground, the woods were my safe place, and waving hi to everyone as you pass them on the road was completely normal. It wasn't until i moved to a completely different state that I realized what a special place Green Bank truly was. I was not raised thinking i was being held at some disadvantage because i did not have cell service or WiFi. Going to Green Bank Elementary Middle School and looking out our classroom window to see the beauty that are these telescopes was mystifying. We played under the shadow of one of, if not the, greatest scientific achievement in space exploration that can be achieved by staying grounded, the Robert C. Byrd Green Bank Telescope. Growing up there and moving away has not only taught me how special it is, but also has shown me just how impactful the knowledge of what is in our backyard can be. Now, people are more concerned about their next Starbucks order, or what WiFi password they should use, when in reality, the GBO is attempting to locate life in space. LIFE. This is something some people only see on TV, and being raised in the midst of that has helped me have an idea of the much bigger picture. I encourage the funding of the GBO, and hope the right decision is made. Thank you.	Against Closure	Email - Scanned	11/8/2016	
659	b	Michelle	Holstine		What i have come to find out, if this Observatory were to be completely shut down, is that \$95,000,000 dollars over 50 years will have been for absolutely no reason. The GBO employs 140-150 people in the busy summer months, and about 100 people generally. It also brings 50,000 people a year in as tourists. 50,000. To put that in perspective, the population of Green Bank is approximately 200 people. Not only are they able to learn and explore, they also bring much needed revenue into Pocahontas County. Whether tourists come as a focal point to their trip, or pass the GBO and think it looks neat, that is 50,000 a year that keep our tiny town on the map.	Against Closure	Email - Scanned	11/8/2016	
660		Sherry	Radcliff	Director of Finance/Treasurer Pocahontas County Board of Education	I am a long-time resident of Pocahontas County and I am writing to express my support of the Green Bank Observatory (GBO) as a science-focused operation. I am the Director of Finance/Treasurer of Pocahontas County Schools and worked in the banking business 25 years, so I understand the economics of businesses. Green Bank Observatory is a good financial and educational partner of our education system, as well as a viable networking piece of our tourism county. Green Bank Observatory provides economic stability to approximately one-hundred GBO families. This in turn assists our rural county's economic stability. If Pocahontas County would lose Green Bank Observatory as an employer, Pocahontas would suffer financially, approximately \$11.15 million in salaries would vanish. GBO employees would leave our county for other jobs; taking their children from our school system and tax dollars would decrease-a major funding source for the Pocahontas Schools. This would leave a large void for many businesses too. Pocahontas County Schools need students and we need the Green Bank Observatory! Secondly, the tourism aspect of not having the annual 50,000 visitors to the Green Bank Observatory would have a negative impact of county economic stability. The tourism dollars equates to about \$7.5 million if they only spend \$150 a day. I believe the tourism dollar impact to be much more than \$7.5 million. As I remember a few years ago when this same study was going on it was to take Green Bank funds to another country, Chile. Is that what the plan is now? Please support American jobs and Pocahontas jobs- Pocahontas Schools! I thank the National Science Foundation for the past financial support of the GBO and I encourage you to continue to support Green Bank Observatory as employer of Pocahontas County. This is the place where you can trust your dollars are being spent wisely. Where employees and citizens take pride in jobs and the place they live. Where people want to work. Pocahontas citizens have found a way to live in a quite zone. I can be reached at 304.799.4505, extension 2225, if you would like to talk further.	Against Closure	Email - Scanned	11/8/2016	GBO letter.PDF

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661		Ashley	Yu		<p>My name is Ashley Yu and I am a 2016 graduate from the University of Virginia. During my five years at UVa, I was involved in the Astronomy Club. We did sunrise and sunset hikes, went stargazing, and even took trips to the Air & Space Museum.</p> <p>Today and always, I will treasure my opportunities and experiences. The National Science Foundation's decision to cut off funding to the Green Bank Telescope negatively impacts today's citizens and future leaders. Without the continued support of NSF funding, students and researchers become threatened to lose access to this rich Astronomy resource.</p> <p>Thank you for your time and consideration.</p>	Against Closure	Email - Scanned	11/8/2016	
662		Aina	Palau Puigvert	Instituto de Radioastronomia y Astrofisica Universidad Nacional Autonoma de Mexico	<p>Through this letter, we would like to express our strong concerns about the proposed NSF divestment from the Green Bank Telescope (GBT) operations. The GBT has been, and remains, a fundamental instrument for the radio- astronomy community in the US and North-America in general. The Mexican community has used it extensively for topics related to star-formation, Galactic astronomy, and black holes studies. Indeed, it participated financially in the upgrade of the GBT capabilities to carry out interferometric observations in concert with other telescopes in the US, Mexico, and the rest of the world.</p> <p>We sincerely hope that a solution can be found to guarantee the continuing operation of the telescope at a level that will not affect its important scientific legacy.</p>	Against Closure	Email - Scanned	11/8/2016	
663		Michael	Rosolina		<p>I am writing in support of the Green Bank Observatory which is a major asset to West Virginia and to the science and education community at large. I would like to see continued funding of the GBO by the NSF at a full or partial level.</p> <p>As a retired public school educator I know first hand the positive impact that the GBO has on students. This facility is too valuable not too support and maintain to the maximum.</p>	Against Closure	Email - Scanned	11/8/2016	
664		Miguel Angel	Trinidad	Departamento de Astronomia Universidad de Guanajuato Apdo.	<p>Through this letter, we would like to express our strong concerns about the proposed NSF divestment from the Green Bank Telescope (GBT) operations. The GBT has been, and remains, a fundamental instrument for the radio- astronomy community in the US and North-America in general. The Mexican community has used it extensively for topics related to star-formation, Galactic astronomy, and black holes studies. Indeed, it participated financially in the upgrade of the GBT capabilities to carry out interferometric observations in concert with other telescopes in the US, Mexico, and the rest of the world.</p> <p>We sincerely hope that a solution can be found to guarantee the continuing operation of the telescope at a level that will not affect its important scientific legacy.</p>	Against Closure	Email - Scanned	11/8/2016	
665		Todd	Ensign		<p>I work at the NASA IV&V Facility in Fairmont, and have been collaborating with the outstanding education department at the Green Bank Observatory for over a decade. This program is invaluable to the citizens of West Virginia both as an economic engine and a hub for innovative science education. I believe that the NSF should continue funding this program in full, or seek to identify and build collaborations that can result in funding lines which would reduce the NSF's investment. The philosophy of spending billions to establish a research facility, but failing to fund the actual science research is fundamentally flawed. Our federal dollars are not best spent by abandoning a fully functioning and productive research telescope simply to spend those dollars building a new telescope somewhere else. Following that model, we will waste tax dollars in construction, simply to abandon that new telescope, in favor of yet another site. This does not further science, nor is it an approach that helps the mission of the NSF.</p> <p>I implore you to find ways of encouraging all NSF funded research facilities to identify external funding sources, contracts for research with industry, education, and government as a means of reducing your ongoing investments. But, do not pull funding from our national laboratories and telescopes simply to shift those dollars to building another site that you will then mothball or decommission.</p>	Against Closure	Email - Scanned	11/8/2016	
666		Deidre	Hunter		<p>A few hours before I received the email about the public scoping meetings concerning Green Bank, I gave a guest lecture in an observational astronomy class for undergraduate and graduate students at NAU. My lecture was on radio astronomy. When I told them about side-lobes, I said that the Green Bank Telescope has a unique design that makes it exceptionally sensitive, and told a story about another astronomer on a different telescope who "detected" highly extended gas around a galaxy that turned out not to be real and instead was Milky Way emission picked up in the side-lobes of his beam. I said that, in fact, the GBT is the premier single dish radio telescope in the world. And then I told the students that, sadly, NSF had decided to close down this exceptional telescope just when it was hitting its stride, or at least no longer make it available to astronomers like me or like them.</p> <p>If this "scoping" means that NSF is still considering whether to close GBT down, on behalf of myself and future astronomers like the students I spoke to, I request that GBT continue to serve as the premier single-dish instrument in the world and to be publicly accessible so that today's and future astronomers can do exceptional science with it.</p>	Against Closure	Email - Scanned	11/7/2016	
667	a	Patrick	Gibson	Building Construction Instructor Mentorship Facilitator	<p>This letter is in support of continued funding for the Green Bank Observatory.</p> <p>As a resident of Pocahontas County, I understand the impact the GBO has in our area. There is the obvious economic influence from being a major employer. The tourism impact due to the Science Center and GBT is of extreme importance. This is due to national and international acclaim. Our school systems are effected in multiple ways, too.</p>	Against Closure	Email - Scanned	11/7/2016	

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667	b	Patrick	Gibson	Building Construction Instructor Mentorship Facilitator	<p>As a teacher at Pocahontas County High School, I know firsthand of the Observatory's positive attributes to the school system. Many employees are volunteers within our schools as coaches, workers, consultants and assistant teachers. The GBO is a business partner of the high school. We have used the expertise of the GBO employees on many occasions to assist us with our projects. Several PCHS graduates are now employed at the Green Bank site. I personally know many of them and know they are proud to be a part of the GBO. They love the jobs they do, and represent the organization with respect and dignity.</p> <p>For the past several years, I have been the senior mentorship facilitator for PCHS. As students went out to complete mentorship requirements, many were placed, and welcomed, at the Observatory site in Green Bank. I had students investigate careers in Carpentry, Culinary, Engineering, Computer Programming, Business, Electricity, Welding and several other areas. Each student was placed with a mentor and shown various aspects of the job they thought they wanted to pursue for a lifetime career. It is rare that all of these opportunities are available at one location.</p> <p>On a larger scale, the GBO is a vast resource for students in general, from all grade levels including kindergarten through college graduates. From across West Virginia, and surrounding states, elementary, middle and high school students visit the site and view the GBT and science center with awe. Local high school students have the opportunities I described previously. National and International college students use the site facilities for their studies. The next innovative discovery by a student, or seasoned scientist, could come from the Green Bank site, if it continues to receive funding, and is left intact. I would view the possibility of missed opportunities of discovery as an atrocity.</p>	Against Closure	Email - Scanned	11/7/2016	
667	c	Patrick	Gibson	Building Construction Instructor Mentorship Facilitator	<p>Total divesture of the GBO would mean devastation to Pocahontas County in several ways. Business would suffer due to the economic impact. The housing market would be inundated with vacant homes in the case of employees having to relocate. As many of our school personnel have ties to the GBO, several of our schools would feel the effects of losing knowledgeable, qualified and caring teachers due to relocation of their spouses. A decline in the school system, no matter the reason for the decline, has a serious impact on the attraction of the area for future residents. Tourism would be adversely affected without the GBO drawing visitors, (local, national and international visitors) to our beautiful area.</p> <p>Losing any part of the GBO funding or site will have a far reaching impact on many levels. A careful decision must be made with consideration that it is not just dollars being considered, but that the decision has a countywide, statewide, and national impact. The livelihood, neighborhoods, and mere existence of many are dependent on the continuation of the Green Bank Observatory's operation.</p>	Against Closure	Email - Scanned	11/7/2016	
668		Betty	Schwimmer		<p>Please help save the Green Bank Observatory!</p> <p>In addition to its scientific projects, it is an important educational center and tourist draw for the area.</p>	Against Closure	Email - Scanned	11/7/2016	
669	a	Courtney	Curran	Educator/Parent/Community Member	<p>I am writing this letter to support the Green Bank Observatory. I am a resident of Dunmore and a teacher at Pocahontas County High School.</p> <p>This facility is a great asset to our community in many ways. As a teacher I see professionals come to the high school to meet with classes and help with projects, this is a valuable learning experience for the students of Pocahontas County. I have taken groups of students to the GBO to tour the various jobs that are available for the students in the future and have had many students complete their mentorship there.</p> <p>My son is a student at Green Bank Middle School or is a business partner with the GBO. Without their support there would many activities that could not take place at his school. This past year he participated in the science fair and math fair and both were held at the GBO. What a wonderful opportunity for the students in the small rural area.</p>	Against Closure	Email - Scanned	11/7/2016	
669	b	Courtney	Curran	Educator/Parent/Community Member	<p>As a community member I visit the GBO many times throughout the summer when I have family in visiting. I enjoy just going to the science center to grab a bite to eat, look at the goodies in the store and walk through the cool center with my son and many other children that are always tagging along.</p> <p>I am asking that the funding and support continue for this wonderful facility. Without it this County would be in a bad shape. Please keep the GBO up and running so the future generations will get to experience all this place has to offer.</p> <p>Thanks for your time.</p>	Against Closure	Email - Scanned	11/7/2016	

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670		James	Di Francesco	Senior Research Officer National Research Council of Canada	I am writing today to respond to the announcement of a public comment period for the planned environmental impact statement and proposed changes to Green Bank Observatory operations. Please note that I am writing as a user of the Green Bank Telescope (GBT), not as a representative of the National Research Council of Canada. ...The GBT is a technical marvel. Its modern design makes it the most important single-dish radio observatory on the planet. Other observatories may be larger (e.g., Arecibo and FAST) but are limited to a narrow fraction of the sky. Others may have similar frequency coverage (e.g., Effelsberg) but have smaller sizes, blocked reflectors, much poorer surfaces, or narrower frequency ranges. In addition, the GBT is located in a large, nationally recognized radio-quiet zone, unlike other observatories. Finally, the GBT has modern instrumentation such as focal- plane arrays (e.g., KPFA and ARGUS) and spectrometers (e.g., VEGAS) that make it a powerhouse for large-area mapping of the sky. Such instruments were not available during earlier evaluations of the GBT. The above capabilities make the GBT unique. The GBT draws scientists from around the world to address major issues facing astronomy, topics from the composition of Solar System objects to the processes of star- and planet formation to the rate of the expansion of the Universe. The GBT is particularly adept at observing higher frequencies (15-100+ GHz) for which there is simply no counterpart for its mapping capability. Such data are also critical for interferometers such as the Jansky VLA, ALMA, and the upcoming SKA. Though such facilities may have larger surface area in aggregate, they cannot detect emission over large scales that the GBT can. In particular, the GBT + Jansky VLA is a very potent pair of observatories whose data can be combined to reveal the distribution of sky emission both at high resolution and over large scales. Utilization of the Jansky VLA itself would be diminished without the availability of the GBT. The GBT is also an important educational tool. Graduate students use the facility and get direct hands-on experience with astronomical observing, a skill that is becoming increasingly rare in the evolving astronomical observatory operations model. These students include my own, all five of which (so far) have used the GBT for their dissertations. Though I am based in Canada, these students include Americans and Canadians that have worked or are now working in the U.S. In addition, the GBT provides an important berth for new receiver technology, e.g., the great leap made between single-pixel receivers and the focal-plane arrays now available. Hence, the GBT is a key facility for proving technical concepts, propelling technological innovation forward. Moreover, thousands of students from primary school to college visit the facility every year and are inspired to learn about STEM. ... The GBT is a cornerstone in the U.S. astronomical observatory landscape, providing unparalleled views of the universe. Given the GBT's unique capabilities, low operational cost, continued scientific importance, and broad educational relevance, I ask that the National Science Foundation (NSF) please consider maintaining its earlier levels of support. Removal of NSF support places the GBT in an extremely delicate, if not precarious, position; there simply is no other means for long-term support of this vital facility. Moreover, NSF support allows the broader national and international community access to the GBT's unique capabilities. Such wide access effectively promotes the highest level of competition for observing time, ensuring that only the best projects are conducted and making the telescope as scientifically productive as possible. Again, there is no viable alternative to the GBT, so its community cannot simply go elsewhere to get similar data. First light for the GBT was in August 2000, just over sixteen short years ago. Over that period, it has produced impressive scientific discoveries. Nevertheless, there remain vast reaches in the universe yet to be explored by the GBT. Reduction of NSF support for the GBT at present will prevent its promise from being fulfilled.	Against Closure	Email - Scanned	11/7/2016	nsf.eis.pdf
671		Louise Ann	Rinehart	KA8ZGY	The Green Bank Observatory has provided educational program from many throughout the work which brings together learning of not only science, etc. as well as many years of friendship. The world's largest fully steerable radio telescope (Robert C. Byrd Green Bank Telescope) is part of this facility. The facility provides many programs and tours for vacationers, scientists and observers from throughout the world as well as jobs within the State of West Virginia. It would be in the interest of the US Government and NSF to continue to fund the Green Bank, and to visit the facility as a learning and pleasure trip. Please do not change the facility. Yes, I have visited the facilities more than once.	Against Closure	Email - Scanned	11/7/2016	
672		Warren	Brown	Smithsonian Astrophysical Observatory	Green Bank Observatory is a high-impact scientific observatory that should have continued science- focused operations. I am an optical astronomer, best known for my discovery of hypervelocity stars and now for merging low mass white dwarf binaries. My understanding of radio astronomy largely comes from what I read on astro-ph everyday. Green Bank Observatory produces a large quantity of interesting papers, second only to ALMA, and Green Bank Observatory will be increasingly important in the era of gravitational wave detections from pulsar timing. Thus I urge continued science-focused operations.	Against Closure	Email - Scanned	11/7/2016	

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673		Samantha	Gray	Hedgesville High School	<p>Three years ago, my parents drove me to Green Bank for the first time. I was unsure if I would be able to make it two weeks away from home, at a math and science camp with no familiar face but my own.</p> <p>Yet soon those unfamiliar faces became family, and my nerves were forgotten among the experiences Green Bank gave me. In those two weeks, I was able to not only use the 40-ft telescope, but the GBT as well - and it was because of those hands-on experiences that my love for astronomy grew beyond merely loving the mystery of it all - because now I was solving these mysteries. There is honestly nothing more inspiring than seeing data that you collected on that data sheet or on that computer and knowing that you were the one to find that data. That this was real, tangible, that there was physical proof in your hands. It made me realize that even at the age of thirteen - and sixteen now - I had more potential than I knew. I had maneuvered the Green Bank Telescope to study the cosmos above - that made me realize I was capable of so much more than I had initially believed.</p> <p>I took this new-found passion to my school's pulsar search team. I had a need to find more data and to make more discoveries. Green Bank had instilled in me a yearning for discovery and a greater appreciation for astronomy and the sciences in general, and I was not about to let that fade away. The Governor's School for Math and Science gave me two weeks to study data and use the telescope - but the Pulsar Search Collaboratory gave me the opportunity to study the sky through data from the GBT to find pulsars throughout the entire school year.</p> <p>The opportunities Green Bank gives to students is something incredible and should not be taken for granted. Because of what they do, they have made students realize their love for astronomy and, for some, have even led them to a career they never thought they would pursue. There are so few opportunities to work hands-on like this, with real data and real equipment, and this can be a real eye-opener to many. It's one thing to study and learn about something in your daily science class. But to actually be able to apply your knowledge and explore the endless expanse of the universe surrounding us, right from your school computer lab or laptop at home, is a brilliant opportunity that, if taken away, may prevent students from realizing their true passions and developing important science skills such as reasoning and interpretation of data.</p> <p>It was at Green Bank that I not only made discoveries, but also made friends. Green Bank, perhaps most importantly of all, brings people together. Whether they be students, teachers, or scientists, Green Bank allows for people of all kinds to collaborate and bond over astronomy. This is something we simply cannot lose.</p>	Against Closure	Email - Scanned	11/7/2016	
674	a	Elizabeth	Wasiluk	Earth and Space Science Instructor Hedgesville High School	<p>I am a teacher who has worked with students on the pulsar search collaboratory for the last eight years. Students involved in the collaboratory have had a unique educational experience by using three different radio telescopes on site at the Green Bank facility. They also do not have to be at the site to use at least two of the telescopes and I have seen students use the telescopes to gather data and create winning science fair projects.</p> <p>Because of the dorm facilities on-site, it makes the site a great place to fire students interest in science and outer space as well as do cutting edge research. Many of my students who have participated in the pulsar search collaboratory have gone on to careers in science at university at later dates.</p> <p>In the twenty-eight years I have taught in West Virginia, I have not seen students so excited and fired up about science, as when participating in this program. If the observatory is closed, great scientific tools will go to waste and students will have no place to go to participate in a program where they can make important scientific discoveries.</p> <p>Studies made at Green Bank using the program have attracted many high school girls at a time when we are concerned about keeping female students interested and involved in science.</p>	Against Closure	Email - Scanned	11/7/2016	
674	b	Elizabeth	Wasiluk	Earth and Space Science Instructor Hedgesville High School	<p>Having a world class observatory in Pocahontas County is a great tourism draw to the area. Thousands of people from around the world visit it each year and are turned on to science. In return, these people visit Cass railroad as well as the Snowshoe resort. Closing down the science center at the National Radio Astronomy Observatory will impact these other sites as well, creating an economic downturn in a area that can not afford to lose revenue.</p>	Against Closure	Email - Scanned	11/7/2016	
674	c	Elizabeth	Wasiluk	Earth and Space Science Instructor Hedgesville High School	<p>The Green Bank Telescope is still collecting a great deal of data and making new discoveries each year. It is also used to make follow up observations that are critically needed...Closing down the National Radio Astronomy Observatory would have a many faceted effect on students, scientists, science done in the United States in general as well as tourism and the economic livelihood of Pocahontas County. I would strongly urge you to continue funding the National Radio Astronomy Observatory at Green Bank, at current levels if at all possible.</p>	Against Closure	Email - Scanned	11/7/2016	
675	a	Linda	Simmons	Pocahontas County Chamber of Commerce Liaison	<p>The Pocahontas County Chamber of Commerce supports continued funding of the Green Bank Observatory utilizing National Science Foundation's continued investment for the science-focused operations, while including collaboration with interested parties for science education-focused operations. This effort will enhance continued funding for the Green Bank Observatory.</p> <p>The Green Bank Observatory is host to over 50,000 visitors per year providing a unique view of the universe. This results in added local economy for the county. Education and outreach are at the center of this strong research-oriented facility. When tourists visit, they spend time at the facility and contribute to the economy of Pocahontas County as well as the State of West Virginia. It is estimated that visitors spend \$150.00 per day for goods and services including transportation, food, recreation and lodging. This amounts to around \$7.5 million per year spent in Green Bank and West Virginia during visits from tourists.</p> <p>Pocahontas County is sparsely populated with 8,719 persons. The tourism industry is one of the county's largest economic industries. The Green Bank Observatory provides research-based information and knowledge to students, visitors and scientists around the world.</p> <p>The Green Bank Observatory employs over 100 people year round with an additional 40 seasonal jobs during the summer months. According to the most recent census, around 5% of the total work force in Pocahontas County is employed by the Green Bank Observatory.</p>	Against Closure	Email - Scanned	11/7/2016	

Green Bank Observatory -Written NSF Public Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
675	b	Linda	Simmons	Pocahontas County Chamber of Commerce Liaison	Employees working at the Green Bank Observatory are actively engaged in their communities and county. They serve as volunteer coaches for sports and serve as leaders of various youth organizations such as scouts, 4-H and church youth groups. Many are involved with service organizations including Rotary, lions Clubs, Women's Clubs, and many sit on boards such as Senior Citizens, Chamber of Commerce, the Snowshoe Foundation, and the Convention and Visitor's Bureau. Many are involved as volunteers with local fire departments, a community "Backbone" in times of floods, fires and other natural disasters.	Against Closure	Email - Scanned	11/7/2016	
675	c	Linda	Simmons	Pocahontas County Chamber of Commerce Liaison	Scientists from the Green Bank Observatory are involved in activities such as the annual educational Eighth Grade Luncheon held at Snowshoe Mountain each year. In 2016, local scientist and employee at Green Bank Observatory, Hanna Smith Sizemore, served as the guest speaker during the luncheon. She explained her role as a scientist and told the students if you set your goals high, are determined and are willing to work diligently, you can accomplish phenomenal things such as becoming a Scientist at the Green Bank Observatory. Then, you may be able to live and work in a wonderful, familiar environment, a place that has been your home during your entire life. In conclusion, the Pocahontas County Chamber of Commerce respectfully encourages the National Science Foundation to continue supporting the incredible work taking place at the Green Bank Observatory.	Against Closure	Email - Scanned	11/7/2016	
676	a	Gregory	Boso	Senator for the 11th Senatorial District State of West Virginia	Removing the GBO will have catastrophic impacts to community organizations and emergency services as well. The community recognizes and appreciates the intrinsic value of over \$30 million contributed annually through community endeavors in various forms by the GBO and its professional and technical staff. Staff members volunteer as emergency first responders serving in capacities ranging from Deputy Fire Chief and firefighters to search-and-rescue team members and emergency medical technicians, each vital to the sustainability of the emergency response system within the local communities proximal to this Pocahontas County site. The GBO staff and research professionals serve in numerous community and educational endeavors. Losing their much-appreciated philanthropic contributions will compromise the delicate balance of community within the region that was, and is, protected for generations as part of the GBO and NRQZ.	Against Closure	Email - Scanned	11/7/2016	Green Bank Observatory EIS.pdf
676	b	Gregory	Boso	Senator for the 11th Senatorial District State of West Virginia	This region has experienced little investment development, apart from that made by the National Science Foundation and associates of the GBO, in industrial, commercial or residential sectors. Absence of independent private investment most likely is directly attributable to limitations imposed by the National Radio Quiet Zone (NRQZ) and its inhibition of wireless communication technologies. Severe disadvantage to the region is further exacerbated, economically, by federal regulatory impacts imposed on unrelated industries prominent in the region.	Against Closure	Email - Scanned	11/7/2016	Green Bank Observatory EIS.pdf
676	c	Gregory	Boso	Senator for the 11th Senatorial District State of West Virginia	The National Science Foundation is in the process of preparing an Environmental Impact Statement addressing the future for the Green Bank Observatory located in Pocahontas County, West Virginia. I am writing to urge the review committee to strongly consider retaining the current operation of the facility as it now exists, which is the "No-Action Alternative". The role of the Green Bank Observatory should truly be a fundamental component to the advancement of Science, Technology, Engineering and Math (STEM) education at the facility as well as in distant classrooms. I'm certain you'll agree with me that these educational opportunities and the future science research advancements are worthy of future investment at the national level...It is my sincere hope that the National Science Foundation will select the "No-Action Alternative" outlined in the Environmental Impact Statement scoping statement. Continuing the normal operation of the GBO will assure the research mission in astrophysical science continues revealing marvels in nature, affecting life and nature, and extending to the cosmos. Furthering this endeavor will continue inspiring youth to move into Science Technology, Engineering and Math (STEM) endeavors and to appreciate the Art (STEAM) in the marvels of our infinite universe. I stand available to assist in the future as you move through finalization of the EIS. Moreover, I remain supportive of your work and future science ongoing at this critical piece of research infrastructure.	Against Closure	Email - Scanned	11/7/2016	Green Bank Observatory EIS.pdf
676	d	Gregory	Boso	Senator for the 11th Senatorial District State of West Virginia	Nestled within the Deer Creek basin, tributary to the Greenbrier River, this national treasure's scientific research viability has been protected since the 1950's when the National Radio Quiet Zone was established to protect the facility from radio interference. Astronomical research at this facility is well document and the Robert C. Byrd Green Bank Radio Telescope (GBT) utilization is highly competitive with uptime research approaching nearly 75%. Thus, the research conducted, particularly in radio bandwidth ranges not included in the capabilities of other radio telescope facilities has justified the essential scientific need for this radio astronomy observatory installation. Productive, efficient functionality of the GBT is well documented. Scientific research, for instance, into those gravitation waves originating from black holes is ongoing and unique to the capabilities of the GBT. This is a new, revolutionary astronomical field originating in this superb, United States based observational tool! Moreover, lead, international researchers recognize the unique, robust capabilities of this monumental scientific instrument as they seek to understand the planetary, pulsar and galaxy interrelationships. This facility is impacting the world!	Against Closure	Email - Scanned	11/7/2016	Green Bank Observatory EIS.pdf
676	e	Gregory	Boso	Senator for the 11th Senatorial District State of West Virginia	Green Bank Observatory (GBO) is a vital component to Pocahontas County's and West Virginia's survivability. Though GBO employs around 100 people full time with over 60% from Pocahontas County and 140 during the summer months, 40,000 visitors per year to the facility has tremendous economic impact on Green Bank and to this region of West Virginia. Losing the facility and the associated economic impact of non-resident visitors participating in the GBT science will be catastrophic to the community and region. Additionally, the economic contributions by international scientists, as they conduct leading edge research at the GBO, extends to the region that has supported this important operation for decades...Economic impacts resulting from any closure alternative, partial or complete, will, in my professional opinion, result in adverse environmental impacts. I have grave concerns pollution arising from abandonment of properties, much as has been experienced in the southern West Virginia coal fields, will most likely increase in the Deer Creek valley affecting insect and wildlife populations, as well as aquatic biota, during their lengthy decay.	Against Closure	Email - Scanned	11/7/2016	Green Bank Observatory EIS.pdf

Green Bank Observatory -Written NSF Public Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
677	a	Sonja	Phillips	Teacher of Orthopedically Impaired students DIM Data Coordinator & ESY Coordinator Technology Integration Specialist	I would like to have a moment to respond to the unfortunate consideration of the closing of the Green Bank Observatory in Pocahontas County, West Virginia. Since its construction in 1956, a symbiotic relationship has developed between the surrounding community and the GBO. The establishment of The Quiet Zone around the Green Bank Telescopes has created an oasis of tranquility in the already peaceful and serene setting of the Monongahela National Forest which, of course, is within "Almost Heaven, West Virginia".	Against Closure	Email - Scanned	11/7/2016	
677	b	Sonja	Phillips	Teacher of Orthopedically Impaired students DIM Data Coordinator & ESY Coordinator Technology Integration Specialist	Many West Virginia students regard field trips to Green Bank as a highlight of their school years. My own children have visited multiple times - with my oldest daughter expressing the desire since age 6, to "help live on Mars". Now that my daughters are in young adulthood, I had expected the next generation would be raised visiting such magnificent places as the Green Bank Observatory who would continue to inspire such aspirations.	Against Closure	Email - Scanned	11/7/2016	
677	c	Sonja	Phillips	Teacher of Orthopedically Impaired students DIM Data Coordinator & ESY Coordinator Technology Integration Specialist	This amazing resource cannot be replicated. The projects which GBO have been an integral with range from working with students from multiple universities, teachers from surrounding areas, researchers scanning the skies, and communicating with space-bound vehicles. There are also multiple pieces of equipment that are unique to GBO, as well as the location being remarkable. Packing up these sensitive instruments and carting them elsewhere, just isn't a feasible option.... I realize that priorities and fundings shift over time. However, being able to look - and to listen - towards the future must be preserved. Given the on-going investments, not only by the National Science Foundation, but the people of the state of West Virginia as well, the return on this investment must be honored not only to those who currently populate this planet but those who will be sent forward to that future. I appreciate your time and energies towards the efforts to allow Green Bank Observatory to operate with continued National Science Foundation funding.	Against Closure	Email - Scanned	11/7/2016	
678	a	Alexander	Karim	Argelander Institut für Astronomie EU ALMA Regional Centre (German Node) Universität Bonn	let me please add that the Green Bank Observatory constitutes an important cornerstone for my scientific strategies and those of my broader scientific community. My institute receives funding from the national funding body in Germany (Deutsche Forschungsgemeinschaft, DFG) to allow my graduate students to work with upcoming Green Bank data to be taken with the newly commissioned MUSTANG-2 camera. However, such pilot efforts should not render our long-term strategy we envision with the GBO obsolete, they merely just mark a start for our ambitious future campaigns.... Letter: I am writing in strong support for ongoing regular, ideally internationally open-sky science operations at the Green Bank Observatory (GBO). The observatory is unrivalled world-wide and offers unique opportunities for my science. Particularly, next generation instruments like the MUSTANG-2 bolometer array, offer unprecedented survey capabilities when used in combination with this large dish. Such new developments, being available right now and not having been before, are the reason why I (as a science user) can in all honesty still call the GBO a cutting-edge facility. No other present-day antenna will offer a combination of dish size and site that would allow for the angular resolution at high GHz-frequencies the GBO can. Even when reaching its final 50m dish size and if eventually being equipped with a surveyor operating around 100 GHz, the LMT in Mexico will come with an angular resolution penalty — compared to the GBO — that will hinder the most direct exploration of the very high-redshift universe on large scales. Furthermore, the GBO has a long-standing history of being a very accessible instrument for a wide community, quite different from the LMT in its current form. With the advent of the next generation large-area panchromatic survey capabilities (offered, e.g., by LSST, EUCLID but also a next generation VLA or even Square Kilometer Array) my research area, galaxy formation and evolution, is facing a transformational era that will eventually boost our understanding about the growth of matter on large scales. It is hence literally shocking to see the recently started accelerated de-scaling or even decommissioning of leading (sub-)millimetre observatories (e.g. JCMT, CARMA). Moreover, new initiatives, particularly to invest in future new single dish observing capabilities (e.g. the CCAT project) are being stopped before even started, right in front of our eyes. With no new space-mission for far-infrared observing capabilities on the horizon, the highly important view onto the dust-enshrouded early universe on large scales is being dramatically hindered. A view on the redshifted thermal dust emission is, however, absolutely critical for my field, not only in a complement to the upcoming optical/near-infrared large area surveys. The GBO with MUSTANG-2 reaches a survey speed already now that is superior to ALMA at comparable frequencies. In fact, in terms of observing efficiency, it is the ideal complement to ALMA as it will serve as vastly important discovery machine to allow for the detailed follow-up studies ALMA was build for.	Against Closure	Email - Scanned	11/7/2016	GBO_support_letter_AKarim.pdf
678	b	Alexander	Karim	Argelander Institut für Astronomie EU ALMA Regional Centre (German Node) Universität Bonn	Email: please find enclosed my letter in support of continued NSF operations of the Green Bank Observatory. I hope that my inputs will find consideration in the shortly upcoming public hearings and the subsequent evaluation/decision processes. The GBO has been an excellent observatory for hands-on student training (incl. some of my own graduate student). I hence support giving (graduate) students preferred access in future regular operations. A modern observatory should also have good visibility towards a larger public. However, I would like to strongly discourage the usage of a world-leading observatory as a pure educational site, let alone an amusement park. Science and its high technology facilities serve the public best when focussing on breaking the frontiers of our very understanding of how nature works. This can only be achieved by using the facilities for research, not by making them silent monuments or even tearing them down.	Against Closure	Email - Scanned	11/7/2016	GBO_support_letter_AKarim.pdf

Green Bank Observatory -Written NSF Public Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
679		Chris	Haller	Founder	I just noticed you are still collecting public comment via email. Would you be interested to use our CiviComment app for free in your next project to evaluate if it makes your job easier? Simply upload a PDF, collect comments directly on the PDF and generate reports, all automatically. Sign up for a free trial project of CiviComment or reach out with any questions you may have.	General	Email - Scanned	11/7/2016	
680		Anne	Smith		I am writing out of concern for the proposed changes to the operation of Green Bank Observatory. Green Bank Observatory is an essential part of the local community due in part for its contributions in the area of health and safety. West Virginia has the second highest obesity rate in the nation, at 35.6%. Pocahontas County is near that percentage as well. This leads to 1.6 times higher medical costs, including preventable health care costs, for our population. One of the keys to reducing obesity is to create an environment that makes the healthy choice easy and affordable. The GBO does just that in the following ways: Provides an exercise room, including weight machines, free weights, treadmills and elliptical machines to some residents of the county. Provides an outdoor pool that is used by the county and that offers free swimming lessons through the Parks and Rec department. Have staff that are instrumental in creating an exercise center for the residents of Pocahontas County, and that are on the Northern Pocahontas County Wellness board that is actively seeking to open a wellness center with an indoor pool that will be accessible to all citizens of Pocahontas County. (estimated cost: over 3 million dollars). Provide space for both the Parks and Rec center and Observatory staff to offer classes in yoga, ballroom dance, modern dance, Zumba, step aerobics and hot yoga. Arranges and organizes 5k runs and triathlons on Observatory grounds for fundraisers and to promote health and wellness. Provides the community with a free, safe, easy and accessible place to walk, bike ride, and run on the grounds of the Observatory. An average of three people a day use the Observatory grounds for some form of fitness or exercise. Provides safe space for 4th grade bike-a-thon fundraiser. These last two reasons are really the most important. 31% of children in Pocahontas County live in poverty, and finding affordable, and most importantly safe places for play and exercise are not as common as one might think. The Observatory, though its staff and physical plant, provide both of these services in abundance. I believe that the loss or even continued funding reduction to the Green Bank Observatory would have a significant impact on the health and well-being of our community by removing personnel, facilities and land use that is currently used to promote and sustain the health and well-being of all our community members.	Against Closure	Email - Scanned	11/7/2016	
681		Willard	Wright	W8N8G ARRL District 9 DEC	In regards to public comments for the future of Green Bank Observatory...I strongly urge NSF to continue funding for Green Bank's science-focused operations so the facility may continue to serve our worldwide scientific community as it has done for over half a century. So much knowledge has been gained about our universe over the years thanks to this operation...and there is infinitely more to be learned. I also know of so many young people who have been inspired to pursue science careers thanks to visiting Green Bank. The facility is, of course, a tremendous asset to Pocahontas County and the State of West Virginia. It provides jobs directly and indirectly. But most of all it is an asset to our entire world. The studies done there are a benefit to all citizens of the globe. Indeed a black hole would be created in our world if the facility were changed or closed. Please, keep the Green Bank Observatory as is! Thank you for your kind consideration.	Against Closure	Email - Scanned	11/7/2016	
682		Suxan	Ackerman		I am a person who frequently visits your area of West Virginia and have heard about the work that is being done there at the Greenbank Observatory by WVU professors to further their research. I respectfully request that it remain open and viable if at all possible. It is filling a unique position in your beautiful area, and its value to researchers is hard to quantify. Please save this facility! Thank you for listening to feedback and for making an informed decision	Against Closure	Email - Scanned	11/7/2016	
683		Julia	Williams	Adult Education Instructor Pocahontas County Career Center	I am the Adult Education Instructor for Pocahontas County. I think that the observatory is a vital part of our county. Our children greatly enjoy the Science Center, the Science exploration days and all of the unique experiences that the observatory has to offer. I take my children and their friends to the observatory at least 3 or 4 times a year. It is always very exciting and very educational. No matter how many times you have been there in the past, you can always learn something new. My children have gotten many ideas for the Science Fair by visiting the observatory, and I love it that they often host the Science Fair as well. The Green Bank Observatory is not only a great place for our children to play and learn it is also a very educational place for adults as well. I have learned many things from my visits that I can bring back to the classroom and teach my adult education students. I believe that it is extremely important to keep the observatory up and running. I do not believe that cuts should be made at the observatory. It is a major part of our community and our children's education.	Against Closure	Email - Scanned	11/7/2016	
684	a	David	Mitchell		As a native of Pocahontas County, WV, I am writing to encourage the continued funding of the Green Bank Observatory (GBO) by the NSF. The GBO is a local employer in Pocahontas County, primarily employing highly educated individuals who lift up the community around them. The GBO presents many educational opportunities for local children, I certainly gained from my experience there during my high school mentorship program. I was able to shadow many individuals from electronics technicians to machinists to engineers and astronomers during the summer prior to my senior year of high school. It was a very valuable experience, one that I would hope is available to local students for years to come.	Against Closure	Email - Scanned	11/7/2016	
684	b	David	Mitchell		It would be very unfortunate to see the GBO shut down, as it would greatly impact the local economy, and perhaps cause the collapse of the local community. It is a large part of the tourism economy in this part of WV, with many people coming from out of state to see the largest fully steerable radio telescope in the world. The government funding of science should be a priority, as we have many challenges that must be faced now and in the future. The GBO has the ability to significantly contribute to solving the problems we face in society today. Please continue the full funding of the Green Bank Observatory.	Against Closure	Email - Scanned	11/7/2016	

Green Bank Observatory -Written NSF Public Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
685		David Michael	Myers		I suggest a free-market solution to the "problem of Greenbank's future." It seems to me that it would be most appropriate to pu the Greenbank property up for sale to the highest bidder with a stipulated minimum bid. Said minimum bid-price should be based upon more than one (several, if possible) assessment by competent real- estate assessors from the area. If widespread and timely notice such as in FedBizOpps, Fed Biz Ops, FedBizOps, Fed Biz Opps (formerly known as "CBD --- Commerce Business Daily") URL: http://cbd-net.com/ would notify many who would be highly interested in developing a productive use of the site. For your consideration.	Alternatives Consideration	Email - Scanned	11/7/2016	
686		Linda	Yoder		I live in West Virginia. Ever since I arrived here almost 40 years ago, I have been proud of and awed by the work of the Green Bank Observatory, the jewel of Pocahontas County. let's do what it takes to keep it going. The research done there cannot be done without it.	Against Closure	Email - Scanned	11/7/2016	
687		Robert	Reid		I would like to express my support for the continuation of the NSF's involvement at the Green Bank Observatory. Although I'm not a U.S. citizen I do feel a special connection to the Observatory as I met Mr Grote Reber on a number of occasions when he lived here in Tasmania. As you no doubt know, Grote Reber is considered to be the father of radio astronomy with particular connections to Green Bank. Please add my voice to those who support the Observatory.	Against Closure	Email - Scanned	11/7/2016	
688		Jonathan	Sievers	Professor, School of Chemistry and Physics University of KwaZulu-Natal, Westville Campus ASTROPHYSICS AND COSMOLOGY RESEARCH UNIT	I am writing in support of continuing operations of the Green Bank Telescope. It provides several unique capabilities that will be lost if it shuts down. My particular interest is in galaxy cluster studies with the MUSTANG2 camera via the Sunyaev-Zeldovich effect. The vast majority of SZ clusters have been seen by CMB survey telescopes like Planck, ACT, and SPT. The GBT offers an order of magnitude improvement in resolution, which will open an qualitatively new window on cluster science. High resolution interferometric images with sufficient sensitivity to detect cluster structure have extremely limited fields of view and so miss much of the essential physics taking place, particularly in cluster outskirts. If the GBT is shut down, key questions about the behavior of gas in clusters, questions that are absolutely critical to understanding if the SZ effect can be used to constrain fundamental cosmology, will go unanswered for the foreseeable future. The GBT cluster program is so exciting that I already have a young South African working on it her at UKZN for her postdoctoral fellowship. She is just one of many promising scientists who would suffer from the untimely closing of the GBT. Please do not hesitate to contact me if I can provide any further support for continued GBT operations. My phone is +27 81 798 0489, and email is sieversj@ukzn.ac.za.	Against Closure	Email - Scanned	11/7/2016	sievers_gbt_letter.pdf
689		Peggy	Moore	Science teacher, 104-D Mercer County Public Schools PikeView High School	I was fortunate to spend two weeks in Green Bank, WV this summer with the ESS Passport program. I cannot begin to tell you how awe-inspiring this experience was. To know that West Virginia is home to an internationally reknowned facility makes me proud to teach science in West Virginia. The thought that this facility may not be here to educate and inspire future generations of West Virginia teachers and students is unimaginable. We need this radio observatory as a critical asset in space exploration. Please consider renewing funding for Green Bank for many years to come. The Green Bank Telescope has so much potential that it would be a shame to not utilize it to its full capacity. I would ask that you consider spending some time at this facility before deciding its fate so that you can appreciate everything this site has to offer.	Against Closure	Email - Scanned	11/6/2016	
690		Michael	Vick		It is my firm belief that we should do everything in our power to keep the Green Bank Observatory in operation for as long as we possibly can. There is no ONE single platform like this that has given us everything we were seeking. However, when we have the facilities working together, there is no telling what answers they may reveal. I spent three summer seasons working in the whole of Antarctica and what we are receiving in return is immeasurable. Please keep the Green Bank Observatory open.	Against Closure	Email - Scanned	11/6/2016	
691		Phillip	Groves	N8SFO ARRL WV SM	In regards to public comments for the future of Green Bank Observatory...I strongly urge NSF to continue funding for Green Bank's science-focused operations so the facility may continue to serve our worldwide scientific community as it has done for over half a century. So much knowledge has been gained about our universe over the years thanks to this operation...and there is infinitely more to be learned. I also know of so many young people who have been inspired to pursue science careers thanks to visiting Green Bank. The facility is, of course, a tremendous asset to Pocahontas County and the State of West Virginia. It provides jobs directly and indirectly. But most of all it is an asset to our entire world. The studies done there are a benefit to all citizens of the globe. Indeed a black hole would be created in our world if the facility were changed or closed. Please, keep the Green Bank Observatory as is! Thank you for your kind consideration.	Against Closure	Email - Scanned	11/6/2016	

Green Bank Observatory -Written NSF Public Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
692		James	Damron		<p>In regards to public comments for the future of Green Bank Observatory...I strongly urge NSF to continue funding for Green Bank's science-focused operations so the facility may continue to serve our worldwide scientific community as it has done for over half a century.</p> <p>So much knowledge has been gained about our universe over the years thanks to this operation...and there is infinitely more to be learned.</p> <p>I also know of so many young people who have been inspired to pursue science careers thanks to visiting Green Bank.</p> <p>The facility is, of course, a tremendous asset to Pocahontas County and the State of West Virginia. It provides jobs directly and indirectly.</p> <p>But most of all it is an asset to our entire world. The studies done there are a benefit to all citizens of the globe. Indeed a black hole would be created in our world if the facility were changed or closed.</p> <p>Please, keep the Green Bank Observatory as is! Thank you for your kind consideration.</p>	Against Closure	Email - Scanned	11/6/2016	
693	a	James	Reese	N/A	<p>Here are some potential answers and thought that I hope may be a solution for many caught up in this dilemma.</p> <p>With the alteration of the GBO status to one of a negative status for GBO employees and EMF/EHS people there would be a large ripple effect.</p> <p>Commerce would slow considerable within the area due to loss of people living here. This would happen quite quickly depending on factors that I will speak about below.</p> <p>The eventual close of existing business would be the outcome of loss of people in the area....Now what about all of the employees who work at the GBO and the homes they would have to try and sell as well. There property would most likely never sell. Who would move to this area and purchase a home besides a new EMF/EHS family? Most all of the homes that have sold in the 10 mile and surrounding areas have sold to EMF/EHS families. There are no jobs here for others to want to come here and not other motivation to be here once the GBO was decommissioned.</p>	Against Closure	Email - Scanned	11/6/2016	N/A
693	b	James	Reese	N/A	<p>I have written a previous letter to you a couple of days ago. This morning and idea came to me that I thought might be an answer at least in part, for some aspects of the dilemma surrounding the management and final disposition of the GBO.</p> <p>It seems that what will occur has a couple of listed outcomes (as stated in the newspaper) of which most aspects do not serve a bigger overall purpose. I have always been a believer that we can find answers to problems if we think in terms of kindness as the reasoning process for the answer and solution.</p> <p>My wife and I are five year residents here came here for the Quiet Zone Protection.</p> <p>I would guess from my observations and awareness that there are now between 100 to 200 or more people and families living within the 10 mile area of the GBO and even further out, that are faced with several negative potential outcomes of the closure and reorganization of the the GBO. Many of which I have stated in my previous letter...Those who are here as EMF/EHS would have to walk away from their homes and lose all of their equity in their homes (due to the putting up of Cell Towers and Sender Receiver Smart Meter units,)which for most is their savings not to mention the black marks on their credit that would result, if the Cell Towers and Smart Meters with Sender/Receivers were allowed to be installed in the 10 mile and close surrounding area.</p> <p>There are no other areas set up in the USA for people who have these problems. So they would be essentially be immediately forced into homelessness and have no where to go thus effectively making the refugees. For many the illness from these EMFS effects are life threatening and very severe.</p>	Against Closure	Email - Scanned	11/6/2016	N/A

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Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
694		James	Reese	N/A	<p>Now that I have stated the problems here are some potential answers. Which I am sure would require adequate thought and preparation and more. These are just ideas that can be easily expanded on. The Media and Political benefits to providing a great solution can be great if handled properly.</p> <p>These are in not specific order of importance.</p> <p>1. If the GBO cannot find immediate funding then the next logical step would be to make it into an education center. This then negates the need for Mothballing it and the huge amount of money to return the land back to its original state. The amount of money to make it into and manage an education center would be small in comparison.</p> <p>2. By doing this and leaving the area as it is with the Federally Mandated Quiet Zone in place as it stands, the area would now have people staying in their homes and any homes that needed to come up for sale would be bought by new EMF/EHS people.1. In Europe there are three countries that have created actual safe zones (more are now implementing plans) for EMF/EHS people. This has been a feather in their cap in the world humanity category.</p> <p>1. This could be done here in Green Bank as well. This may also free up some outside funding for the people to help this to occur, by grants and support from other government agencies.</p> <p>1. Also the GBO has I believe 2000 plus acres of land. Much of which is just vacant.</p> <p>1. What if there was an allowance of say 500 acres set aside to be leased out to those who are EMF/EHS in say 6 acre parcels. Each person to pay for their own installation of Septic, and Well. Each person to have their own responsibility to obtain electricity to their home, all underground set up of course.</p> <p>1. They would of course be mandated to meet certain criteria as set up by the GBO/NSF, (to be determined). Such as no wireless devices or broadcast devices in any form. They would be mandated to keep the land in pristine condition at all times and meet all ecological constraints established.</p> <p>1. They would have an initial lease purchase to obtain the land. The lease could be set up for automatic renewal every 10 years lets say. Each resident would sign a form removing the GBO/NSF from and liability or responsibilities.</p> <p>1. Each home would have to be mobile and have no permanent foundations. This would allow for easy removal if needed somewhere down the line if it became necessary to do so (to be determined how this would occur.</p> <p>1. The details of this could be worked out between interested persons and GBO/NSF etc.</p> <p>1. This would allow for the future return and use of the GBO telescope should a re- establishment of funding come available.</p> <p>1. There is much more one could say on these thoughts and subject but this may be a place to begin to explore options from that have not been thought about.</p> <p>1. Lastly the increase of new residents in the area would spawn more potential income to the existing businesses in the area. The new residents may even bring job opportunities to many locals who are already here and need work. The new residents may also create new businesses that may increase the value of the local area by this. There are many reasons to deal with the this problem in a manner that is not ultimately detrimental to many, and in the end actually be a very beneficial outcome to many.</p> <p>Thanks for listening to this.</p>	Alternatives Consideration	Email - Scanned	11/6/2016	N/A
695		Carol	Lambdin		Just read an article in the charleston gazette mail paper about potential closure of Greenbank observatory. I think closing it would be a tragedy.	Against Closure	Email - Scanned	11/6/2016	
696		Michael	Oldaker	Vice President Bobcat Nation, Inc.	<p>I attended college within the National Radio Quiet Zone at WVWC and recognize the Green Bank Observatory as one of our country's unique national treasures.</p> <p>I currently am involved in several unique science based business development projects as I have worked as a contractor within a highly successful innovation center at Johns Hopkins University on their Montgomery County Campus. The key developer of that innovation zone is to direct the development of a new innovation zone as a collaborative effort between West Virginia Wesleyan College and the Upshur County Development Authority. Honing into the services and science at the Green Bank Observatory would represent at the very least an interesting opportunity for discussion of potential development of synergistic relationships.</p> <p>The sense of urgency and its unique science would certainly realign our networking and scheduling focus if mutual interest is discovered.</p> <p>The Green Bank Observatory is also a destination visit for friends and family within our rolodex of activities we like to share. It is always been a very special experience for our children and now looking forward to introducing our new grandson.</p> <p>While I acknowledge that austere times require changes, I implore you to retain the facility for continued use, under scenarios one thru three, and in that order of preference.</p> <p>1) Continued NSF investment for science-focused operations (No-Action Alternative)</p> <p>2) Collaboration with interested parties for science- and education-focused operations with reduced NSF-funded scope</p> <p>3) Collaboration with interested parties for operation as a technology and education park Thank you for your consideration, and best wishes to the folks at the Green Bank Observatory.</p>	Against Closure	Email - Scanned	11/6/2016	
697		Rose	Messer		This facility should be kept open for future generations and to provide important scientific research.	Against Closure	Email - Scanned	11/6/2016	

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Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
698		Mark	Trodden	Department Chair Fay R. and Eugene L. Langberg Professor of Physics co-Director, Center for Particle Cosmology Department of Physics & Astronomy University of Pennsylvania	As chair of the Department of Physics and Astronomy at the University of Pennsylvania I would like to express my strong support for continued NSF-supported operations of the Green Bank Telescope. The GBT is a unique national resource that has enable the work and scientific output of our faculty members and their students. It also provides essential data supporting wide ranging experiments from millimeter observations of the Cosmic Microwave Background (CMB) to X-ray observations of clusters of galaxies both of which are active areas in our department and across the country.	Against Closure	Email - Scanned	11/6/2016	
699		Susan	Reynolds		I am writing to share my support of the Green Bank Observatory. Personally, I love the observatory, and visit it many times every year. I enjoy the indoor exhibits, the movie and bus tour, the gift shop, and the yummy cafe. One time I even met Frank Drake there! looking at the bigger picture, this facility is important in the scientific growth of our planet. We are training our youngsters (STEM curriculum) to move forward into the science fields and we have a duty to keep opportunities in place for them. It just makes sense. Thank you for your consideration.	Against Closure	Email - Scanned	11/5/2016	
700	a	Jennifer	Hempelmann		I would like to take a moment to comment on the benefits of an incredible resource in West Virginia, the Green Bank Observatory. West Virginia is fortunate to be home to a scientific asset that exposes students to an educational experience unlike any other. The Green Bank Observatory offers students in West Virginia and across the United States a chance to experience what a career in astronomy and science can hold for them. Many West Virginia students come from underprivileged areas, and our school systems are often strained in providing unique educational experiences. Therefore, the Green Bank Observatory must remain open and all current education and science operations need to be funded so these students can continue to profit from its services.	Against Closure	Email - Scanned	11/5/2016	Hempelmann_GreenBankObservatoryletter.docx
700	b	Jennifer	Hempelmann		The reasons are plenty for why Green Bank must remain open with the backing of the National Science Foundation. One of the great things that NSF does is to increase opportunities in science careers for women, minorities, and underrepresented students. Green Bank offers field trips for students where they can hear from scientists and those working on cutting edge discoveries. It also gives students an opportunity to stay overnight and to search the skies for pulsars yet to be discovered. These are experiences that many in our state cannot experience in a traditional classroom or even through their home lives. Unfortunately, families in our state cannot afford the opportunities to expose their children to careers in STEM in the ways the Green Bank Observatory can for thousands of students. The Observatory also offers a professional development program for teachers where the facility provides them hands--on experiences so that they can then give our future scientists the tools they need for success. The Green Bank Observatory is providing teachers an experience they can take back to the classroom to give their students an extraordinary perspective on astronomy and science. The Green Bank Observatory is an exceptional asset that is teaching the next generation of scientists and giving our children and teachers experiences they will never forget. In a state that is trying to expand educational opportunities, especially for underrepresented groups of students, the Green Bank allows our teachers that chance. Green Bank is providing education for the next generation of astronomers who will make groundbreaking discoveries. The Green Bank Observatory must remain open and fully operational for our students and our community to continue to thrive in science.	Against Closure	Email - Scanned	11/5/2016	Hempelmann_GreenBankObservatoryletter.docx
701		Jayne	Ford	AFT Greenbrier President	This e-mail is intended to show support for Green Bank Observatory and its' mission by the members of AFT - Greenbrier County. We are a union composed of teachers and service personnel who believe that the observatory provides valuable educational information as well as jobs to the community. We support continued NSF investment for the operations of the observatory to continue without interruption to present operations. We do not support suspension of operations or deconstruction of the facility.	Against Closure	Email - Scanned	11/5/2016	
702		Ed	Norman		I want funding for the observatory continued. It is a valuable resource for all of us.	Against Closure	Email - Scanned	11/4/2016	
703		C.M.	Tanner		What about the disabled that still hasn't got help??? My brother and i are disabled no has ever came around to help us, i pay for everything we get, and the help we get but if we were druggies, we get all kinds of help!! Personally I think WV sucks!!! I plan on taking an ad out in the main newspapers right before election to let everyone know what politications our like!!!! So everyone a cross the internet and WV papers will know!!! Thank You	General	Email - Scanned	11/4/2016	

Green Bank Observatory -Written NSF Public Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
704		Sabrina	Savage	Hinode US Project Scientist NASA/MSFC, ZP13, NSSTC	<p>I am a concerned citizen as well as a colleague of the Green Bank Observatory. I am a solar physicist by trade, so I am fully aware that the GBO is a vital part of our scientific culture as a premier national radio observatory. While the large baseline radio observatories utilizing many dishes may be a significant step towards progress in radio astronomy and tend to receive broader media coverage, GBO has distinct capabilities that necessarily complement the interferometers. And as with all ground-based observatories, having them spread around the world is vital for reducing gaps in coverage.</p> <p>The citizen side of me feels saddened by the potential loss of such a grand and inspiring instrument. I visited colleagues at the GBO just last summer and traveled with my family so that we could all experience this impressive* structure that explores the universe in very unique ways. Standing above the dish is a feeling of profound awe that I will never forget, but I was even more moved by the effect the visit had on my children. Specifically, a colleague of ours from the observatory took us all into one of the smaller dishes to learn how to operate a radio telescope. My 9- year-old daughter, Quinn, operated the dials and obtained data showing that one side of the Milky Way was moving away from us. She was so excited that she was the one to make these measurements and was actually beginning to grasp the scale of even this small experiment. She promptly asked if our colleague could take her back early the next morning before we had to leave so that she could take measurements from the other side of the galaxy. Her request was eagerly obliged, and I was awoken by my daughter standing by my bedside with a huge smile on her face. The first words out of her mouth were, "I measured the blue shift of the galaxy!" Makes my chest swell every time I think of it.</p> <p>This is why we do science. And to do science, we must have these beautifully intricate, technologically challenging, and often expensive tools. Not just for professional scientists, but for everyone who wants to know a little more than they did yesterday. For the Quinns. I realize that it is a difficult and constant struggle to keep GBO up and running, but all fundamentally worthwhile investments are. I urge the committee to maintain this exquisite machine.</p>	Against Closure	Email - Scanned	11/4/2016	N/A
705		Heinz	Andernach	Professor, Departamento de Astronomia Universidad de Guanajuato	<p>Through this letter, I would like to express my strong concerns about the proposed NSF divestment from the Green Bank Telescope (GBT) operations.</p> <p>The GBT has been, and remains, a fundamental instrument for the radio-astronomy community not only in the US but in large parts of the world. The Mexican community has used it extensively for topics related to star-formation, Galactic astronomy, and black holes studies. Indeed, it participated financially in the upgrade of the GBT capabilities to carry out interferometric observations in concert with other telescopes in the US, Mexico, and the rest of the world. Moreover, the GBT was developed with a unique and novel design as the largest steerable single radio dish (together with the Effelsberg antenna in Germany).</p> <p>It is well known that these antennas are essential to complement the radio interferometers (like JVIA, VIBA, ALMA, etc.) for their sensitivity to large diffuse sources to which these interferometers are blind. The GBT was put into operation only about 15 years ago.</p> <p>This age is well below the necessary one to explore all its capabilities I sincerely hope that a solution can be found to guarantee the continuing operation of the telescope at a level that will not affect its important scientific legacy.</p>	Against Closure	Email - Scanned	11/4/2016	
706		Donna	Martin		<p>I strongly encourage you to consider keeping the Green Bank Observatory open in some capacity. It has been such a wonderful asset to our state, and we would certainly hate to lose it. Surely a foundation as creative as yours could find a reasonable, cost effective solution to put the observatory to good use in the future. Thank you for your consideration</p>	Against Closure	Email - Scanned	11/4/2016	
707		David	Hughes	Large Millimeter Telescope (LMT) Director and Principal Investigator	<p>As Director of the large Millimeter Telescope (IMT), a bi-national facility and collaboration between the Consejo Nacional de Ciencia y Tecnologia (CONACYT), Mexico and the the University of Massachusetts, I would like to express my strong concerns about the proposed NSF divestment from the Green Bank Telescope (GBT) operations. The GBT has been, and remains, a fundamental instrument for the radio-astronomy community in the US and North-America in general. The Mexican community has used it extensively for topics related to star-formation, Galactic astronomy, and black holes studies. Mexico has participated financially in the upgrade of the GBT capabilities to carry out interferometric observations together with other telescopes in the US, Mexico, and the rest of the world.</p> <p>Furthermore, as the IMT significantly increases its performance at 1mm with the transition from its current 32- meter diameter format of the primary reflector to the full-sized 50-meter diameter aperture in 2017, the IMT will continue to seek new scientific projects in collaboration with the GBT scientific user community that require data from both of these unique world-class facilities to address common and impactful scientific questions.</p> <p>The GBT and the IMT complement each other, both in their respective capabilities as single dish telescopes, each with their own suite of instrumentation, and also when working together as part of international VIBI networks such as the NRAO HSA and the GMVA.</p> <p>I sincerely hope that a solution can be found to guarantee the continuing operation of the GBT at a level that will not affect its important scientific legacy.</p>	Against Closure	Email - Scanned	11/4/2016	
708		Joshua	Shaffer		<p>I just wanted to encourage you not to negate the future of the Green Bank Observatory. It is not only a point of interest in West Virginia but also a place of employment. Our state has suffered enough from relocations of employers in the past years. Please keep it here, in West Virginia. let our children truly see that even the sky has no limit.</p>	Against Closure	Email - Scanned	11/4/2016	
709		Ed	Connors	Co- Observatory Director of Breezy Point Observatory of the Kanawha Valley Astronomical Society	<p>My name is Ed Connors and I am the Co- Observatory Director of Breezy Point Observatory of the Kanawha Valley Astronomical Society.</p> <p>The facility at Green Bank has been extremely useful to our club and many scientists for many years. It is a landmark and even vacation spot for many people over the years, but it's usefulness as an educational facility far outweighs it's other wonderful uses. It would be an extreme lost to science and our great state to do anything with it, but keep it functioning and even grow it's usefulness! It would seem Education and Science would be one of the worst possible places to cut funding. I know of many people who hold this same view! I won't belabor the point. I just wanted you to know where myself and many other astronomers stand on the issue of the Green Bank Observatory! Standing with you all at Green Bank, sincerely,Ed</p>	Against Closure	Email - Scanned	11/4/2016	

Green Bank Observatory -Written NSF Public Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
710		Bruce	Partridge	Haverford College	<p>The decision to close the GBT, either permanently or temporarily, is a momentous one for radio astronomy in this country and indeed world-wide, since we maintain an "open sky" policy. I am well aware of the financial pressures facing NSF and the AST program specifically, having served on the 1999 Portfolio Review Committee, the MPS Advisory Committee and a variety of other NSF and NRAO groups. AST bears a particularly heavy burden of supporting many facilities - including those at NRAO - while also trying to fund many worthy requests from individual PIs.</p> <p>The problem, in a sense, is that all of the radio facilities supported by NSF, including the GBT, are unique and best in the world. The one possible exception is Arecibo, given the new Chinese dish (FAST). That is not the case for NSF supported optical facilities. A decision to drop any one of the current NRAO facilities --- GBT, JVIA or the VIBA - would leave a distressing and unfillable hole in the field of radio astronomy. The current portfolio of instruments available to radio astronomers, including these three instruments, AIMA, the IMT, FAST and smaller specialized instruments, is a balanced one. It includes productive and powerful interferometers, with their high resolution capabilities, and single-dish telescopes that cover the wavelength range from meters to sub-mm (FAST/Arecibo, GBT and IMT). MY own research in radio astronomy (as separate from work on the CMB) has largely involved interferometers, especially the JVIA. I readily acknowledge, however, that there many projects (including a handful of mine) that either require or benefit from filled-aperture observations. GBT is central to these, and to the balance I just mentioned.</p> <p>Not surprisingly, therefore, I favor either the No-Action alternative, or some sort of collaborative venture than could ease the funding burden on NSF (I recall just such proposals being made for both Arecibo and the VIBA in the past). Now let me turn to the other listed alternatives for Green Bank. Deconstruction and site restoration would surely be far more expensive in the near run than continued No-Action operation. It seems entirely wrong to spend money that way at this time, when funding is stretched thin and the future of support for science in general hangs in the balance of a contentious presidential election. Mothballing would be better, I suppose -- but the cost/benefit compared to continued operation should be looked at carefully. Finally, despite my deep interest in science education and outreach, I think converting Green Bank into a science education park would be a mistake. The Green Bank site was chosen on purpose to be remote (not what you want for EPO). Worse, imagine the impression on kids and other visitors if all they see is mothballed or dismantled instruments. What better way to reveal that the US is letting its lead in science slowly slip away?</p>	Against Closure	Email - Scanned	11/4/2016	
711		Phyllis	Tuckwiler		<p>I have not been to the observatory for years so am totally ignorant re what they do now or if they have had success in hearing from outer space!!! Has this experiment been totally wasteful? Has there been any results that produced something of value? I recall that due to the observatory there had to be a "hush" over all the area.correct? How much money has been spent on this project? I have yet to visit the site on the internet but will do so now.</p>	General	Email - Scanned	11/4/2016	
712		Laura	Newburgh	Dunlap Postdoctoral Fellow Dunlap Institute, University of Toronto	<p>I am Dr. Laura Newburgh, currently a postdoctoral fellow at the University of Toronto and will be a new faculty member in the physics department at Yale University on January 1, 2017. I am writing in support of continued investment in the GBT for science-focused operations.</p> <p>The GBT is a unique resource for the radio community and has been the premier platform to support a variety of innovative and important instruments. As an experimental cosmologist I am keenly aware of the enormous role the GBT has played in creating new methods of cosmological measurement. In the past 5 years alone, cosmological measurements with the GBT have:</p> <p>(i) demonstrated the technique of 'hydrogen intensity mapping', a new method we will use to study the nature of Dark Energy. This measurement has been enormously fruitful, and initiated a separate, dedicated instruments purely for the purpose of making hydrogen intensity measurements at high redshift. Three large interferometers are currently under construction (SKA, CHIME, and Tianlai) to improve on this groundbreaking work and continue to use neutral hydrogen to understand our high redshift Universe.</p> <p>(ii) GBT has also been the platform for ARGUS, a pilot instrument designed to measure high-redshift CO, also an 'intensity mapping' technique. This instrument will lay the groundwork to use the CO line to understand how the first structures ionized the Universe (the epoch of reionization).</p> <p>(iii) supported MUSTANG-2, an innovative new detector array designed to use the high-resolution of the GBT to image high-redshift clusters to better understand the interplay between astrophysics and cosmology. Currently, using galaxy clusters for cosmology is limited by our ability to estimate their masses, which is in turn determined by our lack of understanding of their merger history and thermal history. This will be characterized and probed with MUSTANG-2, which is also the only instrument using a new, developing detector technology (MKIDs) and readout (microwave multiplexing) which has great promise as a technology for future Cosmic Microwave Background measurements.</p> <p>The GBT continues to initiate new programs, instruments, and measurements and is unique in its visionary approach to improving U.S. radio astronomy. GBT has remained critical to U.S. radio cosmology, trained generations of astronomers, and continued to support innovation in instrumentation, data processing, and analysis. I very much hope you will consider how rare and important GBT is to cosmologists and radio astronomy when making your decision.</p>	Against Closure	Email - Scanned	11/4/2016	
713		Luis	Zapata	Instituto de Radioastronomia y Astrofisica UNAM, Mexico	<p>I would like to express our strong concerns about the proposed NSF divestment from the Green Bank Telescope (GBT) operations. The GBT has been, and remains, a fundamental instrument for the radio-astronomy community in the US and North-America in general. The Mexican community has used it extensively for topics related to star- formation, Galactic astronomy, and black holes studies. Indeed, it participated financially in the upgrade of the GBT capabilities to carry out interferometric observations in concert with other telescopes in the US, Mexico, and the rest of the world.</p> <p>I sincerely hope that a solution can be found to guarantee the continuing operation of the telescope at a level that will not affect its important scientific legacy.</p>	Against Closure	Email - Scanned	11/4/2016	

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Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
714		Arturo	Gomez-Ruiz	CONACYT Researcher Large Millimeter Telescope (IMT)	<p>Through this letter, I would like to express my strong concerns about the proposed NSF divestment from the Green Bank Telescope (GBT) operations. The GBT has been, and remains, a fundamental instrument for the radio- astronomy community in the US and North-America in general. The Mexican community has used it extensively for topics related to star-formation, Galactic astronomy, and black holes studies. Indeed, it participated financially in the upgrade of the GBT capabilities to carry out interferometric observations in concert with other telescopes in the US, Mexico, and the rest of the world. In particular, VBI observations joining the GBT and the IMT provides a very good example of the binational scientific collaboration between two major facilities run by the national scientific agencies in the USA and Mexico. The GBT and IMT are the largest telescopes of their kind, hence their scientific activities have a huge outreach potential as well.</p> <p>We sincerely hope that a solution can be found to guarantee the continuing operation of the telescope at a level that will not affect its important scientific legacy.</p>	Against Closure	Email - Scanned	11/4/2016	
715		Christopher	Wiley	Lecturer in Art & Design Coordinator ART-118, First Year Program Digital Studio Practice liaison, Hubei University of Technology Department of Art and Design Art Building 203 University of Wisconsin Milwaukee	<p>"We all have a thirst for wonder. It's a deeply human quality. Science and religion are both bound up with it. What I'm saying is, you don't have to make stories up, you don't have to exaggerate. There's wonder and awe enough in the real world. Nature's a lot better at inventing wonders than we are." — Carl Sagan, Contact</p> <p>We need to keep looking so we can find more of nature's wonders. Please find a way to keep funding instruments like this and Arecibo.</p>	Against Closure	Email - Scanned	11/4/2016	
716		James and Wendy	Reese	Residents	<p>I and my wife Wendy are residents of Green Bank. We have been here for nearly five years now. In fact we live right across from the GBO Landing Airstrip. 6328 Potomac Highlands Trail.</p> <p>We, like many people moved here for my wife and myself benefit of not having extensive exposure to high EMF's. This is the only place in the USA where you can do this and still live in a town. That is a big deal psychologically. Not having to isolate yourself.</p> <p>We have invested all of our savings in a home and coming here. We are in our late 60's now. This has become our home. We love living here for all of the great reasons. Fresh air, no crime, friendly people and great peace.</p> <p>We are shocked that there is a imminent possibility that the GBO may close. This would be disastrous to us for obvious reason and for others who have made this town and surrounding areas their home.</p> <p>Besides that fact of the EMF protections the GBO brings us in our daily lives here, there are other benefits that the GBO provides the people of this community. Just the fact the GBO employees live here is a big deal for the socio-economic aspects of the area. The GBO adds culture to the area and education for all.</p> <p>If this alone was lost it would be devastating to the financial stability of this area for at least 75 square miles or more. So many businesses and people are here and function here because the GBO is here.</p> <p>What the GBO has done for this area and surrounding areas from its presence is quite amazing. Just the fact that it is what it is draws people here from around the world. This benefits all of Pocahontas County in tourist trade and more.</p> <p>To lose this would create severe hardships on many people. Many would have to just walk away from their homes and mortgages, as they would never be able to sell their homes. There would be many homes for sale and few if any would sell. This area and related areas would collapse and become another West Virginia ghost town. So many people will be affected in so many ways. The ripple effect would be felt for years.</p> <p>It is my hope and I know I speak for many that there is some way of saving the GBO.</p> <p>Well I guess I have communicated my feelings.</p> <p>I am sure that you will have heard nearly this same thing from several by now.</p> <p>I hope there is a way to save the GBO.</p> <p>Look forward to the meeting November 9th. I will be at the early meeting.</p>	Against Closure	Email - Scanned	11/4/2016	

Green Bank Observatory -Written NSF Public Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
717		Gayle	Boyette		<p>The following is a comment on the funding issues with the GBO.</p> <p>I am a resident of Pocahontas County married to a fourth generation Pocahontas native. Together we operate a lodging business, a property maintenance service and co-parent a student of Green Bank Elementary/Middle School. Our interest in the GBO is multifaceted. Not only do we glean income for our own business from tourists visiting the GBO, but our son has benefited through educational opportunities associated with the GBO. On the latter, everything from using their piano for lessons to a NASA sponsored robotics class. The GBO has been a delight to all our county's students who are rewarded with field trips to learn about radio astronomy. The GBO often hosts academic tournaments such as Science Fairs and Math Field Day.</p> <p>When you consider all of the educational benefits and the tourism it seems logical that GBO funding would continue. There's more to the GBO than valuable scientific research. So many discoveries yet to be realized, this is true, but the GBO is like one of those critical organs of the body..... the county would suffer without it.</p> <p>In these economically challenging times, loosing one of our significant resources is even more difficult to accept. And, even though we are a sparsely populated area, we are within easy travel distance to a major population of the United States. The GBO funding should not be cut! The GBO has too much to offer. Rather than spending energy and time on ways to cut it's funding, wouldn't it be better to look at ways to market it and make it profitable?</p> <p>The Green Bank community is a lovely village in the forefront of this amazing telescope. The contrasts of technology and our pristine environment make this a unique landscape. It's viability alone stimulate interest. Keep the GBO going!</p>	Against Closure	Email - Scanned	11/4/2016	
718		Terrence	Beam	Superintendent of Schools, Pocahontas County Schools	<p>I am writing this on behalf of the Green Bank Observatory. I understand that the future of the observatory, may be in question, and that is of great concern to me personally and to the citizens of Pocahontas County.</p> <p>The observatory is a landmark of the entire state of West Virginia and is well-known to many of our state's students. It is the destination of many academic field trips and a symbol of the importance of science instruction and understanding to our students.</p> <p>Also, it is important to note that the Green Bank Observatory employs many people that have spouses that work in our school system. It is very difficult for our school system to attract employees because of the rural nature of the area and lack of employment opportunities. We have many excellent students whose parents work at the observatory. If there are elimination of jobs, that translates into less students, which in turn translates into less dollars for our school system. The Green Bank Observatory staff works in cooperation with our schools to assist in academic areas of instruction and supports our county science fairs, math field day competitions, and other academic com petitions.</p> <p>I understand that in these rough economic times, changes are inevitable. However, I would encourage you to do all that you can possibly do to keep the Green Bank Observatory operational and continue an on-going commitment to the citizens of Pocahontas County.</p>	Against Closure	Email - Scanned	11/4/2016	Green Bank-letter of support.docx
719		Josep	Maria		<p>Through this letter, we would like to express our strong concerns about the proposed NSF divestment from the Green Bank Telescope (GBT) operations. The GBT has been, and remains, a fundamental instrument for the radio-astronomy community in the US and North-America in general. The Mexican community has used it extensively for topics related to star-formation, Galactic astronomy, and black holes studies.</p> <p>Indeed, it participated financially in the upgrade of the GBT capabilities to carry out interferometric observations in concert with other telescopes in the US, Mexico, and the rest of the world.</p> <p>We sincerely hope that a solution can be found to guarantee the continuing operation of the telescope at a level that will not affect its important scientific legacy.</p>	Against Closure	Email - Scanned	11/3/2016	
720		Laurent	Loinard	Professor of Astronomy Universidad Nacional Autonoma de Mexico	<p>Through this letter, I would like to express my strong concerns about the proposed NSF divestment from the Green Bank Telescope (GBT) operations. The GBT has been, and remains, a fundamental instrument for the radio- astronomy community in the US and North-America in general. The Mexican community has used it extensively for topics related to star-formation, Galactic astronomy, and black holes studies. Indeed, it participated financially in the upgrade of the GBT capabilities to carry out interferometric observations in concert with other telescopes in the US, Mexico, and the rest of the world.</p> <p>I sincerely hope that a solution can be found to guarantee the continuing operation of the telescope at a level that will not affect its important scientific legacy.</p>	Against Closure	Email - Scanned	11/3/2016	
721		Luis	Rodriguez		<p>I would like to express my strong concerns about the proposed NSF divestment from the Green Bank Telescope (GBT) operations. The GBT has been, and remains, a fundamental instrument for the radio-astronomy community in the US and North-America in general. The Mexican community has used it extensively for topics related to star-formation, Galactic astronomy, and black holes studies. Indeed, it participated financially in the upgrade of the GBT capabilities to carry out interferometric observations in concert with other telescopes in the US, Mexico, and the rest of the world.</p> <p>I sincerely hope that a solution can be found to guarantee the continuing operation of the telescope at a level that will not affect its important scientific legacy.</p>	Against Closure	Email - Scanned	11/3/2016	
722		G. Paul	Richter		<p>My recommendations are as follows, in the order shown (most preferred is 1st; least, last):</p> <ol style="list-style-type: none"> 1. Continued NSF investment for science-focused operations (No-Action Alternative) 2. Collaboration with interested parties for science- and education-focused operations with reduced NSF-funded scope 3. Collaboration with interested parties for operation as a technology and technology and science education park 4. Mothballing of facilities (suspension of operations in a manner such that operations could resume efficiently at some future date) 5. Deconstruction and site restoration 	Against Closure	Email - Scanned	11/3/2016	

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723		Robert	Sheets		<p>I am a lifelong resident of Green Bank, WV. I remember Green Bank without the Radio Free Quiet Zone, and I can tell you it was really quiet. My mother was employee #3 at NRAO and my father also gained employment a few years later.</p> <p>These jobs had a great impact on our families socioeconomic status and on many other families in Pocahontas and surrounding counties. The consistent payroll and access to health insurance made life in Green Bank much more comfortable. I was a recipient of one of the early AUI scholarships that are awarded each year. These have been a instrumental in furthering the education of many of our students over the past 50+ years. The socioeconomic impact of the Observatory cannot be overstated.</p> <p>The cultural/educational enhancement of the area because of the presence of highly trained scientists and technicians is another area where the Observatory has been a stellar citizen.</p> <p>Going back as far as 1965, the staff at NRAO made themselves available to teach in local schools in the areas of electricity and electronics.</p> <p>They have consistently performed this function and now serve as one of the business partners of Pocahontas County Schools. Many students complete their high school mentoring project on the Observatory site.</p> <p>The impact on tourism in this area would be sharply felt as the Science Center is an important stop for many who gain their first understanding of radio astronomy. I can speak from experience about all of the above and know also that the GBT is in constant demand by scientists from around the world.</p> <p>I also think the fact that all other sites which were considered in 1956 for housing NRAO have grown in population. Not so in Green Bank. Pocahontas County now has far fewer residents than when the Observatory was built and thus is even more valuable because of lower RFI. This area is a valuable and resource for this type of science.</p> <p>Because of this, I strongly urge NSF to adopt the No Action Alternative and continue to support the fine science being carried out at the Green Bank Observatory.</p>	Against Closure	Email - Scanned	11/2/2016	
724		Dave	Williams		<p>Why in the world would you choose to close it the Greenbank Observatory? It is in a quiet zone ... no cell phone service in the area. Where else do you think you could find a comparable environment? For whatever reason I suspect you think you can do it at a lesser cost. Upgrading facilities makes much more financial sense than replacement. Replacement cost will require tax revenue, we are already in the red in spending....</p>	Against Closure	Email - Scanned	11/2/2016	
725	a	Rebecca	Koopmann	Professor and Chair Department of Physics and Astronomy	<p>I write to urge strongly that NSF choose alternative #1 of its "Notice of Intent to Prepare an EIS . . .", namely "Continued NSF investment for science-focused operations (No-Action Alternative)."</p> <p>As a new scientific user of Green Bank Observatory and as director of the NSF-sponsored Undergraduate AIFAIFA Team (UAT) Consortium for research using radio astronomy data, I have witnessed first hand its potential not only for ground-breaking science, but also its potential for impact on undergraduates from across the nation.</p> <p>Here I would like to emphasize the invaluable role of Green Bank in training the next generation of U.S. radio astronomers with one specific example. For the last 10 years I have led the NSF-sponsored Undergraduate AIFAIFA Team, a consortium of 20 undergraduate-focused institutions from across the U.S. (list available at http://egg.astro.cornell.edu/alfalfa/ugradteam/ugradteam.php). Through this program, undergraduates, graduate students, and faculty collaborate with the AIFAIFA (Arecibo legacy Fast AIFA, where AIFA refers to the Arecibo l- band Feed Array detector) consortium (PI, Riccardo Giovanelli, Cornell) on a major legacy astronomical survey and associated followup of neutral hydrogen gas in the nearby Universe. This program has impacted more than 280 students (40% women and members of underrepresented groups) and 26 faculty.</p> <p>Critical to the success of our program is the opportunity for undergraduates and their mentor faculty to visit national radio observatories. Many of our past workshops and observing runs have been hosted by Arecibo Observatory, but as part of our newly awarded grant, we have introduced observing experiences at Green Bank Observatory. Visiting Green Bank adds several advantages to our program: (1) learning how to use the GBT sets the UAT up for additional projects that can take advantage of the higher declination sky not available at Arecibo and/or make use of the lower systematic temperature and radio frequency interference at the GBT. (2) UAT members will be able to see and learn about the phased array feed FLAG prototype that will be similar to the ones used for upcoming HI surveys. Our aim is to engage the UAT at the earliest stages of planning for such future surveys so that they can fully participate in them. (3) A Green Bank workshop will be available to significant numbers of students and faculty each year at reasonable cost.</p>	Against Closure	Email - Scanned	11/2/2016	
725	b	Rebecca	Koopmann	Professor and Chair Department of Physics and Astronomy	<p>We held our first workshop at Green Bank last June and were very excited about our experience there and the potential for our activities. The conference facilities and the management were outstanding. The value of the student experience at Green Bank Observatory cannot be overstated as they discover the physical instrument and as they develop as scientists. Their understanding is not limited to specific AIFAIFA training, but also extends to an appreciation of work going on at the observatory in other research fields. Most importantly for such a diverse group, they realize that there are opportunities to become involved in great scientific efforts and that they are capable of becoming involved. More than 80% of the student attendees in our project to date have completed undergraduate research projects within AIFAIFA and many cite their visit to a national observatory as the major factor in their participation. Faculty and students trained onsite return to their campuses prepared to carry out remote observing. In this way students and faculty contribute to the AIFAIFA survey and followup while extending observing opportunities to students, staff, and faculty on their local campuses, many of whom would never have an opportunity to experience an astronomical observing run. Undergraduate AIFAIFA Team training has had a positive, and often defining, impact on student development, as judged by their career paths to date. The majority of students involved in the project have completed or are still enrolled in an undergraduate STEM program. Of 195 students who have completed their undergraduate degrees and have known status, 59% will be or have been enrolled in graduate school in a science by Fall 2016. 35% of those students are women. The majority of those not in graduate school are pursuing careers in STEM fields, including teaching and engineering/industry.</p>	Against Closure	Email - Scanned	11/2/2016	

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726		Vance	High		Thus, the partnering of Green Bank Observatory with the AIFAIFA consortium will continue a model of undergraduate education in which a large number (>280) of undergraduates contribute directly to HI studies of the local universe. The undergraduates experience the workings of a major national observatory and the way that a science collaboration functions through their interactions with their faculty mentors, their peers, Green Bank Observatory staff, and the leaders of the AIFAIFA project. Transformative research experiences develop student skills not only within AIFAIFA, but also with other astronomical tools such as SDSS, NED, and programming. They present and publish their results in the astronomical community. Faculty at a wide range of U.S. schools contribute their expertise and improve their scholarly collaborations. The effectiveness of the program is especially relevant in the era of large astronomical surveys. The model we have developed will apply to future surveys by the next generation of instruments, including proposed Phased Array Feeds. Continued support of Green Bank will thus ensure the success of countless researchers and also provide meaningful experiences to very bright minds early in their careers, a contribution vital to the long term success of science in this country.	Against Closure	Email - Scanned	11/2/2016	
727		John Michael	Strubhart		Please consider continuing operations at the Green Bank Observatory. I'm from Texas, where there is much government endorsed stupidity and we need something in the USA to balance that nonsense. Besides, the work that Green Bank Observatory does is important, interesting and inspiring. We need a stronger science future for all Earth's citizens, so please let them keep doing their part.	Against Closure	Email - Scanned	11/2/2016	
728		Justin			The area is a park except for a few large structures. There is no heavy traffic and they are not producing toxic wastes. The Green Bank Observatory area is very beneficial to the local flora and fauna.	Against Closure	Email - Scanned	11/2/2016	
729		Patrick	Rawlings		When I was a youngster I visited the Green Bank site with my uncle who worked for the company doing the original construction. I have the memory of standing on top of the concrete base of the 140 ft scope before the scope was installed. When I became an adult with a family I made regular trips to Green Bank to share with my children. We were sorry for the loss of the 300 ft scope but celebrated the installation of the 450 ft scope. It would be a shame for current and future generations to not have the opportunity to visit this facility as it has become a big part of WV's history, as well as the many visitors that share the same memories traveling to WV to visit this site.	Against Closure	Email - Scanned	11/2/2016	
730		Randy	Fry		Please consider further funding a project "where discoveries begin " . It is one of West Virginia's most precious assets.	Against Closure	Email - Scanned	11/2/2016	
731		Vaia	Meador	WV citizen	Hello! I'm a West Virginia citizen, taxpayer, and voter. I'm also an educator. I've had the pleasure of bringing students to Greenbank for the wonderful programs that they offer for about 8 years now. Each year my students talk about how much they enjoyed the field trip. The tour to the GBT, the discovery museum and other programs including Starlab and other activities equally impressed my students...all the students remember the demonstration with liquid nitrogen and the video about the facility...over the years we've run into students from other schools and random tourists enjoying the program. Hopefully these programs will continue to be offered so that students and citizens alike can learn about this resource that we have here in West Virginia!	Against Closure	Email - Scanned	11/2/2016	
732	a	Kelsey	Offutt		My name is Kelsey Offutt. I am a sophomore at West Virginia University majoring elementary education. My hometown is Huntington, West Virginia, where both of my parents have lived and worked for over 25 years. Although Huntington is home to me, my roots go much farther back, into the hills of Pocahontas County. My father's family has lived in the Green Bank area for over one hundred years. In 1955, my great grandmother, Mary Beard, sold her 140-acre farm to the National Science Foundation, and this land became the very heart of the National Radio Astronomy Observatory (NRAO). After selling the farm, my great grandmother moved a few miles away from to a small house in Arbovale. Nearby, my grandparents raised my father and my uncles and their home is still in our family's possession today. Because of his close ties with his hometown and family, my father would often take my brother and me on a four-hour drive to Pocahontas County for the weekend. We would spend the day walking around the Observatory and visiting the nearby Arbovale Cemetery, where many of my ancestors are buried. Those weekend trips are a valuable part of my childhood memories. I can remember how proud I felt to look up at the monstrous telescopes and realize their important role in scientific research and my family's role in their development...The Green Bank residents who sold their land in 1955, including my family, would be proud of all that the Observatory has accomplished and continues to accomplish since its establishment over sixty years ago. Some of the biggest proponents for building the Observatory were the teachers of the local schools, including some that taught my father. They knew that it would bring new opportunities and dreams to the students of the area, as well as students around the State. To tear down the Observatory is to tear down over sixty years of education, discoveries, and progress. West Virginia children that hear about the Observatory feel empowered, because they see that they are able to go to college, study science and continue to live in their home state while contributing to this field of science in huge ways. If the Observatory were to disappear, so would that vision. Not only is it an incredibly important site for astronomers and physicists, the Observatory serves as a beacon of hope for students hoping to advance while living in underprivileged communities. I hope that the National Science Foundation truly considers the massive impact that they could have on the futures of West Virginia's youth.	Against Closure	Email - Scanned	11/1/2016	Greenbank letter.docx

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732	b	Kelsey	Offutt		<p>Today, I am still incredibly proud of what the Observatory represents for West Virginia. When I arrived at WVU, I joined the Science Public Outreach Team, which allows me to visit schools all over West Virginia and talk to children about the remarkable scientific endeavors that are in progress in their own State. SPOT has allowed me to spend more time at the Observatory over the past couple of years, and get to know it as a scientific community, rather than just a landmark to look at. I have met so many brilliant people that live and work in Green Bank and use the telescopes to make scientific breakthroughs that will affect people all over the world. They go above and beyond in terms of outreach. The public tours offered by the Observatory are extremely informative and entertaining. Numerous school groups visit every year bringing students from far and wide to experience this wonderful site. Some only stay for the day, while others attend programs in the summer lasting for weeks at a time and proving to be an invaluable experience for these students. For example, the Pulsar Search Collaboratory, created by a WVU professor, allows West Virginia high school students to spend several weeks looking through real data from the telescopes in the search for pulsars.</p> <p>Since I am studying to be an educator, the children of West Virginia's futures are extremely important to me, as I think they should be to everyone in this State. A lot of children in our State do not believe that they have the potential to become scientists, doctors, or lawyers. They feel destined to blue-collar jobs in their hometowns, just like the many generations before them. Although there is nothing wrong with choosing that particular path in life, these children do not understand that they have other options. They rarely have family members that have attended college, and they generally feel destined for the same life they have seen repeated over and over in their families, neighbors and friends. When we, as college students, show up at their schools and tell them about these incredible educational and scientific opportunities that exist within a few hours of them, it truly opens up a new world to them. Without the Observatory, I fear that these thousands upon thousands of children will never know a world where they could go to college and contribute to our ever-expanding scientific knowledge. The Observatory's history, location and current work is truly exciting to West Virginia children and adults alike, and has become a part of our state's identity.</p>	Against Closure	Email - Scanned	11/1/2016	Greenbank letter.docx
733	a	Mack	Samples		<p>I am certain that you have received numerous letters of support for maintaining the Greenbank Observatory in its present form because of the enormous impact it has on the education of young people from, not just West Virginia, but all over the nation (and world). The National Youth Science Camp is just one example. I know that West Virginia colleges use the facility on an ongoing basis. Plus, college students from all over that nation come for extended stays. I don't know where else students could get such exposure. But I leave such letters of support to those who know more about use of the facility than I do.</p>	Against Closure	Email - Scanned	11/1/2016	
733	b	Mack	Samples		<p>It is my purpose here to encourage you to think about the economic impact the closing of the GBO would have on the local economy. In a state that is teetering on economic collapse, closing of that facility would be another nail in the coffin. The GBO has been for many years, and continues to be, a major tourist attraction. It brings many people into West Virginia that otherwise would never cross its borders. Also, closure would cause an exit of a multitude of families. That would be devastating for a state that is already losing throngs of people because of mine closures.</p> <p>I suppose what would happen if closure did occur is that the federal government would then come in and squander millions of dollars on a useless, meaningless retraining program. I have witnessed that drill on a number of occasions here in the Mountain State. Folks who go through those programs end up making half of what they were making before they lost their jobs, then most of them leave the state anyway.</p> <p>What kind of sense does it make to close a facility that is obviously providing a useful service while at the same time providing good-paying jobs and generating tourist dollars for the area where it is located? I guess it makes the same kind of sense as closing coal mines to protect the environment while the rest of the world is free to mine, sell, and burn all the coal they want to. After all, we all live on the same planet. Sometimes it is advisable to look beyond your own selfish nose and consider what is best for the good of all.</p>	Against Closure	Email - Scanned	11/1/2016	
734		Gabriel	Stevens		<p>My name is Gabriel Stephens and I am currently a Neuroscience Ph.D. student at Baylor College of Medicine in Houston, Texas. In Summer 2011, I attended the National Youth Science Camp as an Indiana delegate. This experience was greatly enriching to me as a young scientist and shaped me in ways both professional and intangible.</p> <p>One of the highlights of my stay at NYSC was visiting Green Bank, as well as exploring the surrounding area owned by the observatory. Learning about cosmology at the observatory, though I was a biologist, was a lesson in scope (no pun intended). I study synapses in the brain, infinitesimally small structures thought to be critical to cognition and all the things that make us human. To consider the vast scale of the universe, to hold in my eye entire worlds that we may never fully understand nor fully observe, yet see the scientists of Green Bank devoting their lives to understand those expanses while not knowing whether they ever would, is an experience enriching to young researchers in any discipline. To be a scientist is to discover and seek to understand worlds inside us, below us, and above us in hopes that one day we may know who we are, where we are, and where we are going.</p> <p>It would be a great loss if these formative experiences had by America's young scientists were lost by a dismantling of the Green Bank facilities. As a working scientist, I know well that funding difficulties are a boot on the neck of many valuable studies and research programs, and understand that Green Bank has some hard fiscal realities to face. However, I urge you, even if the primary research capacity of Green Bank is lost, that priority be given to continuing the use of some of the facilities as an educational endeavor and that federal/non-profit requests be made to open these educational opportunities at Green Bank to a wider audience.</p> <p>I am grateful for the time I spent in the West Virginia hills and I wish others to have the same opportunity as well.</p>	Against Closure	Email - Scanned	11/1/2016	

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735		Mary	Crone Odekon	Professor and Chair, Department of Physics Skidmore College	<p>This letter is in response to the Federal Register Notice of an EIS evaluating potential environmental effects of proposed changes to the operations at Green Bank Observatory (GBO).</p> <p>As a member of the NSF-funded "Undergraduate ALFALFA Team" (PI: Koopmann), a collaboration that includes dozens of educational institutions, I participated in a three-day workshop at GBO in June 2016. The workshop was enormously informative and inspiring for me and my students. Besides providing well-run conference facilities, it was a great opportunity for us see radio astronomy equipment across the spectrum of historical and educational facilities to state of the art telescopes and detectors. Our collaboration is hoping to continue holding regular workshops there in the future.</p> <p>The impact of the workshop and the collaborative work it facilitates extends far beyond the participants themselves. The results of our work were presented to groups on campus through campus-wide research symposia, department presentations, and educational modules designed for introductory astronomy courses. The Undergraduate ALFALFA Team model has been described in two recent articles, in Mercury magazine and the CUR Quarterly:</p> <ul style="list-style-type: none"> • Parker Troisht, Rebecca Koopmann, Aileen O'Donoghue, Mary Crone Odekon, and Martha Haynes, "The Undergraduate ALFALFA Team: A Collaborative Model for Undergraduate Research in Major Legacy Projects," 2016 CUR Quarterly on Undergraduate Research Collaborations: Partnering for High(er) Impact • Mary Crone Odekon, 2015, "Harvesting ALFALFA," Mercury, Vol. 44, No. 3 <p>The support of GBO has already been important for our collaboration, and I expect it will become even more so in the future. I hope this statement about the value of the GBO helps inform any decisions for the future of the observatory.</p>	Against Closure	Email - Scanned	11/1/2016	Green Bank 2016.pdf
736		Karen	Pennebaker		<p>I don't think "mothballing" the facility is a good idea. A partnership (public and private) to use the facility would make a lot more sense. Even if some of the technology is outdated, it is the only facility quite like this in the world. Not only is it an educational facility, it attracts tourists. Having a site with "radio silence" might, in the future, be extremely valuable in this world of "instant access" to everything.</p> <p>I would hope that the NSF would consider a partnership with one or more private agencies to keep the facility open and to continue its use for education.</p>	Against Closure	Email - Scanned	11/1/2016	
737		Robert	Colgan		<p>Please add my voice to those who are advocating for the continuance of the GRT either through continued NSF funding or a combination of NSF and commercial funding-----but PLEASE DO NOT CLOSE the facility. Science is too important.</p>	Against Closure	Email - Scanned	11/1/2016	
738		Ted	Nelson, Jr.		<p>I am shocked and beyond disappointment that you would even think about mothballing or deconstructing the Green Bank Observatory, as I read in the Charleston (West Virginia) Gazette-Mail.</p> <p>My wife, Cindy, and I visited Green Bank three years ago. It was a privilege just to be standing in the site of so many scientific discoveries and to see a facility that is so heavily used. The Green Bank Observatory also has been involved in exoplanet research, the most important astronomical research now being conducted. I am convinced that this research will lead to discoveries of life and intelligent life in the universe. A recent example is the studies of KIC 8462852 (Tabby's Star) to try and determine what causes it to dim at times by 20 percent.</p> <p>With so many important discoveries to be made, I am horrified that you would consider closing the observatory. Please, please reconsider. Add this your list of public comments and keep the marvelous Green Bank Observatory open. Dedicate it to exoplanet discoveries. From this can come the most important scientific discovery in the history of our Earth: that we are not alone and the universe is full of life and intelligent beings.</p>	Against Closure	Email - Scanned	11/1/2016	
739		Guy	Sims		<p>I believe that this letter shows our collective value for the Green Bank Observatory as an educational resource for the state.. Well said.</p>	Against Closure	Email - Scanned	11/1/2016	
740		Anne	Cavalier		<p>Excellent and thank you!</p>	General	Email - Scanned	11/1/2016	

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Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
741	a	Ellie	White		<p>I am 16 years old and in the 11th grade. I am extremely interested in astronomy, physics, and engineering, and hope to be a radio astronomer someday. My fascination with astrophysics began when I was 13, after reading Carl Sagan's Cosmos. Later that year my interest was sparked further by a visit to the National Radio Astronomy Observatory in Green Bank, West Virginia for a Family Science Day. When I was 14, I learned that the National Science Foundation intended to cut funding to the Green Bank facility, and was (and still am) very worried about losing such an amazing place. So I decided to do something about it - I opened a small business to sell hand-sewn dolls made to look like famous and not-so-famous scientists (e.g. Einstein, Marie Curie, Henrietta Leavitt, and Grote Reber), to Green Bank's Galaxy Gift Shop, at a special price so that they can make a little extra profit off of them. I know it isn't much, but I wanted to do something to help, after all they've done for me and so many other young people who are interested in science...The close contact with Green Bank has really kept my passion for science strong over these past few years. They got me started in astronomy with their Radio Astronomer for a Day program, in which I was allowed to stay onsite and operate their 40 foot telescope, then analyze the resulting data. Another program they introduced me to was Skynet Junior Scholars, which is a great way to learn about astronomy while doing real science and taking your own remote observations with participating telescopes, such as the Green Bank 20 meter radio telescope. The Observatory has continued to be an amazing resource - this summer/fall I am excited to be working with Green Bank on a radio frequency interference mitigation project under astronomer Dr. Richard Prestage alongside Keith Omogrosso, a Research Experience for Undergraduates student from Oregon Tech. It has been an absolutely amazing experience - I worked in their historic Jansky lab, met scientists and engineers from all over the world, and, most exciting of all, I was given a bottom-to-top tour of the Robert C. Byrd Green Bank Telescope (GBT)!...Of all the NRAO facilities, Green Bank has, by far, the strongest STEM programs in place; there are several science camps for school-aged kids, including the PING (Physicists Inspiring the Next Generation) camp for minority and female students, to try to make sure that in the future no one is left out of, or underrepresented in, the physics and science world. Their 40 foot radio telescope is used exclusively for educational purposes; school-aged children are taught how to use the scope, take their own observations, and are then shown how to analyze the data they collect. Green Bank provides opportunities for undergraduate and graduate students as well, with their Research Experience for Undergraduates program, Co-Op/Internship programs, Grote Reber Doctoral Fellowships, the Student Observing Support program, and WVU Senior Design and Research Projects. There are opportunities for teachers as well, as part of the Research Experience for Teachers program. If funding is decreased or cut to this facility, the educational programs will lack the resources they need to continue the high-level programs that are currently such a big part of inspiring young people from all over, and especially in the hard-hit area of rural West Virginia, to explore new horizons and find their passion.</p>	Against Closure	Email - Scanned	11/1/2016	
741	b	Ellie	White		<p>I am writing with concern about the Notice of Intent to Prepare an Environmental Impact Statement for the Green Bank Observatory published in the Federal Register on October 19, 2016. I wanted to express that I think it is extremely important that the full funding and operation of the Green Bank Observatory continues in the future...The Green Bank Observatory is a world-class facility in so many ways. The telescopes onsite are really engineering wonders - the technology that is required to keep them up to date and operational is extremely advanced, and still moving forward. The 100 meter GBT, which is currently the largest fully steerable single-dish radio telescope on Earth, is a tremendous tribute to the skill and expertise of the engineers, astronomers, machinists, and Green Bank personnel who designed, built, and continue to maintain it. Its 100 meter offset parabolic dish is almost as large as two football fields and is made up of 2,004 adjustable panels, with a total surface accuracy to within a standard deviation of 300 microns (0.01 inches - thinner than a business card). It is a vastly sensitive instrument; the amount of energy it is capable of detecting is equivalent to that of a single snowflake falling to the ground. The extremely wide range of frequencies that the telescope is capable of observing (0.3-116 GHz) allows it to be extremely versatile in the research projects it can participate in. Reduction or elimination of funding to this facility, or decommissioning the telescopes would tremendously hinder the technological progress that can be made in radio astronomy and related fields, due to the unique nature of the engineering skills required to operate, maintain, and upgrade one of the few large fully-steerable radio telescopes in the world.</p> <p>The science that is being done there is cutting-edge - from mysterious pulsars and fast radio bursts to the exciting new Breakthrough Listen project to search for extraterrestrial civilizations - Green Bank's scientists and visiting researchers are really moving us another step toward understanding the Universe and our place within it. Particularly intriguing and relevant research topics include studies on gravitational waves (in collaboration with the North American Nanohertz Observatory for Gravitational Waves (NANOGrav)), star formation, galaxy evolution, dark energy, and the search for the chemical precursors to life in space, not to mention locating a lost NASA solar satellite and mapping a nearby asteroid. Full NSF funding is really the very best option available for continued astronomical research at the GBO; if funding is reduced or cut, the GBO will be forced to seek out other avenues for funding, which could entail the loss of the vital "open skies" policy which allows data to be freely disseminated among scientists so progress in research can continue to move forward. Converting the GBO into a non-operational facility would mean the loss of not only the uniquely sensitive and versatile GBT, but also a loss in a significant amount of precious observing time which astronomers are already short on. Scientific discoveries and research projects aren't the only exciting things going on at Green Bank, though; there are many progressive and unique educational opportunities and initiatives on site too.</p>	Against Closure	Email - Scanned	11/1/2016	

Green Bank Observatory -Written NSF Public Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
741	c	Ellie	White		<p>The GBO is a vital part of the West Virginian economy as well - it is the life force of the rural and remote Pocahontas County, where it provides jobs to people from around the world as well as from West Virginia, all of whom in turn contribute to the local shops and services. Funding cuts or elimination would decrease or even totally eliminate the positive influence of the GBO, creating a gaping hole in the local economy, not likely to be filled anytime soon due to the remoteness of the surrounding area.</p> <p>Green Bank means a lot to me, both on a personal and a practical level, and I would really like to see it continue to thrive. If funding were to be reduced or cut, or if it were to be converted to a nonfunctioning facility, it would be a devastating loss to science, technology, West Virginia, and the rest of the world. It is a very important resource in my state of West Virginia, as we are really starved as far as research and technology goes. The educational resources provided at the GBO are really the best we have in this state; if it were not for this facility, I and so many other students in West Virginia would never have had the opportunity to learn in such a high-level and inspiring atmosphere that does so much to foster interest in pursuing STEM careers. We have focused for far too long on the declining coal industry, which will soon be gone - but science, like that done at Green Bank, will continue to grow and provide future opportunities. I am writing because I want to do all I can to make sure we never lose this national treasure. The Green Bank Observatory means so much to so many people, and compared to many high- budget scientific endeavors, this state-of-the-art facility is run on a relatively low operating budget.</p> <p>If the NSF decides to secure total funding for the GBO in the years to come, it would mean that the observatory would be able to continue to push the frontiers of what is known about the cosmos, keep building super-advanced technology, and it would stand as the wonderful STEM resource it is for young, excited potential scientists like me and many others. I can't overstate just how much this beautiful place means to me - it has helped me develop from the time I first discovered the wonder of astronomy to now, when I am starting on my journey into the field. I want to make sure that I'm not the last generation of young people to benefit from Green Bank's influence - I really hope it stands for many more generations of young explorers yet to come. I really believe that science is the key to a better, healthier, and more peaceful and prosperous future.</p>	Against Closure	Email - Scanned	11/1/2016	
742		Angela	Hoffman		<p>I am writing in support of continuing operations and funding of Green Bank Observatory in Green Bank, WV. As a long time resident of the area and a frequent supporter of the science and education that occurs at this facility, I believe that the impact to the community, regional area, state, and overall science community would be seriously detrimental. The detrimental impacts would indeed be financially devastating to the region, as the observatory employs numerous residents. Additionally, the observatory bring in tourism funds through visitors and educational groups.</p> <p>I sincerely advocate for the continued funding and expansion of the science and education services occurring at Green Bank Observatory. I appreciate you taking the time to consider my input and reading this email.</p>	Against Closure	Email - Scanned	11/1/2016	
743		Christopher	Evans		<p>I just read about the telescope and I just want to say that I definitely want it to stay!!!! As someone who loves Science and is majoring in General Science Education it would make my heart sore if they remove it. I have seen it only once but it would make for a good field trip for my science classes when I begin teaching.</p>	Against Closure	Email - Scanned	11/1/2016	
744		John	Kyer		<p>The present operation of Green Bank has been a life threatening situation for all Fire and EMS services operating in Greenbrier County. The ability to operate our emergency radios at full capacity or very limited capacity in some areas, affects response calls and endangers lives. Many tax payers are not aware that limitations set by Green Bank interferes with emergency responders'ability to communicate with 911 calls.</p>	Resource Considerations	Email - Scanned	10/31/2016	
745		Leslie	Stone		<p>Please continue this facility as described in options 1,2 or 3</p>	Against Closure	Email - Scanned	10/31/2016	
746		Joyce	Izat		<p>As a resident of West Virginia my family has visited the Green Bank facility many times over the years, each time it has been more enlightening. We always take our out of state and overseas friends there, all have enjoyed the experience, not to mention their surprise that our state even has such a facility. I wish it was a mandatory field trip for every school in the state, our own children enjoyed and learned from each visit we made as a family.</p> <p>I hope the facility continues to operate for many years to come, to even consider closing a usable facility that continues to give good data seem a waste and a loss to the scientific community that use it for their research.</p>	Against Closure	Email - Scanned	10/31/2016	
747		Jason	Murphy		<p>The Green Bank Observatory is a critical peice of our science infrastructure and exploration mission. It should be restored to full funding and continue to operate. Shutting it down would be a huge mistake.</p>	Against Closure	Email - Scanned	10/31/2016	
748		Melinda	Russell		<p>Please accept this email as a public comment. The quiet zone that exists around this facility is rare and special and should not be allowed to deteriorate. Once cellphones, etc. are free to proliferate in this geographic area, they will permanently degrade this pristine site. The Observatory is on the brink of attracting more respectful visitors and private industry users. If the Observatory were to be deconstructed or mothballed,the impact on the local economy would be catastrophic. Generations of bright, STEM-focused children have grown up in and around Green Bank, the children of scientists who are employed at the facility. Our country needs more of these future STEM professionals. And Green Bank is an idyllic environment in which to nurture them.</p>	Against Closure	Email - Scanned	10/31/2016	
749	a	Lonnie	Henderson		<p>West Virginia was selected for the location of this Green Bank Radio Telescope due to its unique topological structure and was responsible for the 13000 square mile National Radio Quiet Zone.. It is insulated from our increasing radio polluted world. It is also used by our government for the same reasons. I am sure that our governments secret radio observations will not cease to operate. So why allow our scientific observations be allowed to stop?</p>	Against Closure	Email - Scanned	10/31/2016	

Green Bank Observatory -Written NSF Public Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
749	b	Lonnie	Henderson		<p>As a citizen of West Virginia and the United States, also a concerned individual I am amazed of the article that I recently read in the Charleston Gazette Mail about the current situation of the Green Bank Observatory Radio Telescope.</p> <p>The devaluing of this scientific observatory to one of lesser value by the National Science Foundation is stunning . How can or national scientific community allow this to happen? Most of or great national achievements have been directly related to our scientific discoveries in many disciplines of scientific endeavor. Many not entirely decipherable until our scientific minds have had a chance to analyze it and determine how to use it. Much of the knowledge obtained from this device is of our unobservable universe, much of which is still unknown and new to us. It is used for astronomy about 6500 hours every year, with 2000–3000 hours per year going to high-frequency science. Part of the scientific strength of the GBT is its flexibility and ease of use, allowing for rapid response to new scientific ideas. It is scheduled dynamically to match project needs to the available weather. The GBT is also readily reconfigured with new and experimental hardware. The high-sensitivity mapping capability of the GBT makes it a necessary complement to the Atacama Large Millimeter Array, the Expanded Very Large Array, the Very Long Baseline Array, and other high-angular resolution interferometers. Facilities of the Green Bank Observatory are also used for other scientific research, for many programs in education and public outreach, and for training students and teachers. This observatory has divined exceptional scientific knowledge in the past and can continue to do so in the future. We need the data and new findings from the radio telescope to improve our knowledge of our universe, our own galaxy and any other structures or objects that pique our interest. Why this was done to a premier device which has expanded our knowledge of black holes, pulsars, star formations, gravitational wave and non visible structures throughout or universe which have featured great improvements to our knowledge.</p> <p>How this has been allowed to happen is very disturbing to me. To close down or lessen the operation of one the largest radio observatories in the world is just unfathomable...To limit its operation would be a blow to our Nation. Who decided to why this is to happen should be reviewed also. A Foundation portfolio review committee in 2012 recommendation of dropping financial funding should be looked into deeply. Why it was decided to perform an Environmental Impact Statement in the guise or stop operation is like the method used to shut down companies using poisonous compounds to manufacture objects we use everyday. If this was going to be done why was it not performed after the failure in 15 November 1988?</p> <p>I strenuously oppose any reduction of funding or lessening of support to the Green Bank Radio Telescope observatory by the National Science Foundation.</p>	Against Closure	Email - Scanned	10/31/2016	
750		Richard	Mitnick		You cannot possibly not see the value of keeping Green Bank as a functioning radio telescope. No one could be that blind.	Against Closure	Email - Scanned	10/31/2016	
751		Derek	Bas		<p>I'm writing you to express my concern for the future of the Green Bank Telescope. The telescope needs to stay fully funded. I am a recent Ph.D. graduate from West Virginia University's physics program, and I was close to many colleagues (especially Dr. McLaughlin and her students) who did some really fantastic work with the telescope. I recently attended a conference talk where Dr. McLaughlin discussed her group's future plans for the project and as a physicist I can tell you that her goals are incredibly important. Her work with pulsar timing arrays to detect low frequency gravitational waves will absolutely redefine the field of astrophysics, and it is in our nation's best interest to keep it funded and stay at the leading edge. Consider the amount of press gravitational waves has already received from the LIGO project: The GBT project is a complementary project that is just as groundbreaking (if not more), and its cost pales in comparison.</p> <p>LIGO is one of the largest and most successful science projects in history- and the GBT has the potential to use pulsars to replicate it, but on an almost unimaginable scale! Even setting aside the future gravitational wave findings, such a project can surely be used to draw in generation after generation of new STEM students, excited to play the next big role in our search for an understanding of the universe. Just as a past generation needed the moon landing, our future generations need this to keep our nation's kids excited about science and technology so that they can continue to lead the world in innovation.</p>	Against Closure	Email - Scanned	10/31/2016	
752		Kris	Dixon		Please don't take this site from WV. The state is already losing so much. It would be another big hit to them. Thank you	Against Closure	Email - Scanned	10/31/2016	
753		Josh	Deem		Don't get rid of greenbank	Against Closure	Email - Scanned	10/31/2016	
754		Nate	Van Wey		<p>As the NSF considers the future of the Green Bank Observatory, I would like to add my support of the observatory and the work it does both in astronomy and especially in science education.</p> <p>I have been a teacher for 44 years, teaching physics and astronomy at both the high school and college level. I have attended numerous teacher workshops and student workshops at the observatory, and can testify that the impact that the observatory and the personnel have had on my teaching has been no less than phenomenal. In a time when the United States is concerned about education and especially STEM education we should not be considering doing away with the facility such as the Green Bank Observatory which is a strong supporter of STEM education both in West Virginia and in the United States. The impact on the hundreds and hundreds of teachers and thousands and thousands of students by the dedicated personnel at the observatory is something that will stay with the teachers and the students for years to come. The people at Green Bank and the work that they do in their dedication to the education of our youth has brought about major changes in the teaching style, the curriculum content, and enthusiasm for science education and science itself.</p> <p>The observatory provides a very unique setting for focusing research in astronomy for scientist worldwide, but also for teachers and students who wish to focus specifically on scientific research, understanding astronomy, and learning how to become better teachers and better learners. The loss of such a facility would severely impact science education in this region.</p> <p>From the perspective of this science educator, I strongly urge the NSF to consider continued support of the Green Bank Observatory in the future.</p>	Against Closure	Email - Scanned	10/31/2016	

Green Bank Observatory -Written NSF Public Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
755	a	Scott	Garber		<p>Where do I begin? My name is Scott Garber and I am the forestry teacher at Pocahontas County HS. Not only do I teach here but I live within a few miles of the GBO and grew up around it as well.</p> <p>From an educator stand point my program would be greatly affected by the loss of the GBO. In recent years we have partnered with the GBO to affect the hands-on learning environment of many students. Four years of my students have gotten true, on-site work experience due to this project, a project which probably is the largest class/partner project in county and school history. Through this project my students get to actually work through all aspects of forestry. Aspects that include forest planning, timber volume estimation, forest harvesting, product evaluation, mapping, and reforestation just to name the major components. They also get to see how business relationships work between partners, our program, the company forester and the GBO. This kind of education is priceless, losing this opportunity would effect the opportunities of countless potential future foresters or land managers to come. Our program has been very successful and part of that success is because students know what kind of projects we get to work on and that it is real life experience in the field!</p>	Against Closure	Email - Scanned	10/31/2016	
755	b	Scott	Garber		<p>As a community member the devastation would be similar. The GBO is such a meaningful place for all ages of our community. The many events that are held there that benefit folks. The positive culture that comes from the diverse employees and students that come there to work and study cannot even begin to be measured or put into terms. As a parent I love the fact that my children get to see how limitless their science education can be and where it can go. Socially what other cultures they can be around just by living and going to school by the GBO. This diversity and the advanced science and math type people is extremely rare for such a rural community anywhere in the world and we would never want to lose those opportunities for our young people. And those folks immerse themselves into our communities. Which can open so many eyes and worlds for all people, both local and transplants! This has inspired 1000's of kids over the last 40+ years to explore more in the science, math and computer fields. The starwatch events, biking events, science exploration days, soccer leagues and the tours are a big part of our young childrens lives as well as everyone else for that matter. Where else can a rural kid take a simple bike ride and possibly be inspired to actually listen and look for life in space and study stars, moons and planets, and actually see that this really is a possibility and that how far you can take it is truly limitless! All that from a simple bike ride when you are a little kid. Then they just might be neighbors with someone who does this and studies these things or works on the telescopes which takes it even farther.</p> <p>So to say it would impact our community negatively would be such an understatement. All ages would suffer but most of all our young people, our little children, our children to come and their education. Which means the future of our county, our communities and the education system would lose way more than we can even comprehend!</p>	Against Closure	Email - Scanned	10/31/2016	
755	c	Scott	Garber		I could go on even more about how the job loss and monetary losses and how it would affect our communities but those are the things most people can see and figure out. I hope that this email helps the cause to keep the GBO here and open! Thank you for taking the time to read my email! Have a great week!	Against Closure	Email - Scanned	10/31/2016	
756		Naveed	Zaman	Professor of Mathematics Interim Dean, College of Natural Sciences and Mathematics	<p>As the dean of College of Natural Sciences and Mathematics, I strongly support the continued NSF investment for science-focused operations for Green bank Observatory.</p> <p>Our student groups have taken trips to the GB observatory for educational purposes. Those trips have always motivated the students and have created an enthusiasm of science in them. Our students visit GB regularly to become ambassadors for the WV SPOT program. I strongly believe that the multidimensional impact of GB Observatory on the Scientific Community and the State of WV is extraordinary. Consequently, I strongly recommend full support of the Green Bank Observatory facility.</p>	Against Closure	Email - Scanned	10/31/2016	
757		Sandie	Chaney		Please do not. Close greenback. This is a very important site for not only the community...but the world. So much has been is so much is yet to be discovered through greenbank. Please keep this place going for future generations.	Against Closure	Email - Scanned	10/31/2016	
758		Christopher	Thomas		<p>It has recently come to my attention that an EIS has been prepared for the Green Bank Observatory in West Virginia. I have reviewed the document and alternatives presented and as a concerned West Virginian and one that has found great inspiration in this unique facility I'd like to offer some comments.</p> <p>To start, I'd like to say that I am an engineer that works in West Virginia and my family and I have visited the facility on many occasions and believe that this facility is one of the most unique and inspirational science facilities that we have ever visited. As a person of science, I see this facility as one of the few places that bring scientist and other researchers together from all over the world while at the same time educating and inspiring the young minds that pass through its doors every year.</p> <p>As for the proposed alternatives listed in the EIS, on the alternative that the NSF fund the whole facility, I'd hope that the NSF would still see the great value and work the facility does to introduce people to science and the research that takes place there. As for the second alternative with collaboration with interested parties for a science and education focused operations, I see as viable but would still like to see scientific work being done at the facility. There are not many facilities on this scale that you can go to and see actual data and the people behind it working and collaborating. For the third option as a facility that operates as a technology and education park, I think really undermines the facility's potential and this kind of shift would lead to the further deterioration of West Virginia's role in science. The fourth and fifth options to mothball or deconstruct it, I feel are counterproductive to all the work that has gone into this great facility. As a site that can bring together a scientific community both at the facility and remotely is truly amazing and helps West Virginia in many ways.</p> <p>As for my family it provided inspiration to know that such a facility exists in our state and that we can see science in real time. This facility has done a lot for my family and I hope that it will be able to in the future.</p>	Against Closure	Email - Scanned	10/31/2016	GBO Public Comment for EIS.pdf

Green Bank Observatory -Written NSF Public Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
759		C. Thomas	Beer	Chemical Engineer, and Science Advocate	<p>I read an article in the Dominion Post regarding the possible closure of the Green Bank Observatory. The \$10M dollars per year operating costs are small compared to the discoveries made by this installation, including the most recent "stealth black hole" discovery. This one thing has the potential to have a huge impact on the ability to find and either utilize or avoid these newly found stealthy black holes across the sphere of the cosmos.</p> <p>This is the world's largest steerable radio telescope, has very high sensitivity, and compliments other installations in basic research and discovery. I compare these installations with the Lewis and Clark Expeditions... we don't know what we are going to find, but we need to look. I believe that expanded outreach and enhanced educational opportunities can be a great addition to the Green Bank Mission, in addition to the groundbreaking research functions of the facility. There is so much to learn about the structure of the cosmos and its application to our lives on earth (or beyond), how could we even consider closing our interstellar ears to the possibilities of gaining this knowledge?</p>	Against Closure	Email - Scanned	10/31/2016	
760	a	Tony	Mroczkowski	Submillimeter/Millimeter Instrument Scientist / Astronomer European Southern Observatory (ESO)	<p>The Green Bank Observatory and specifically the 100-meter Green Bank Telescope (GBT), which is the largest steerable single-dish telescope in the world, are unique resources to the scientific and academic community. At high frequencies (20-115 GHz), the GBT is an extremely valuable complement to the AIMA interferometer, and is operated at only a fraction of the cost. As a single dish, the GBT provides faster mapping speeds and a larger field of view than AIMA, and serves as a valuable source finder for detailed high-resolution interferometric follow-up.</p> <p>I therefore write in support of the "No-Action Alternative", which would continue science operations with the Green Bank Observatory as they are now performed, including adhering to the Open Skies policy.</p> <p>Please see the high-frequency GBT science case recently presented in Bally et al. 2016, available here: https://arxiv.org/abs/1610.09014 (submitted 27 Oct 2016). As noted in this white paper, the most impressive upgrades to the GBT have only recently been commissioned or are still undergoing commissioning, keeping the GBT poised for great discoveries unique to its capabilities. Specific to my work on galaxy clusters and the cosmic microwave background (CMB), MUSTANG-2 and the GBT will soon map the pressure substructure in galaxy clusters and probe high-redshift dusty star-forming galaxies; the former goal complements lower angular resolution (>arcminute-scale) CMB instruments, while the latter goal complements the mains of the James Webb Space Telescope to find and image the first galaxies to form.</p>	Against Closure	Email - Scanned	10/31/2016	
760	b	Tony	Mroczkowski	Submillimeter/Millimeter Instrument Scientist / Astronomer European Southern Observatory (ESO)	<p>In addition to the groundbreaking science the GBT will continue to deliver, it is a rare resource in education and training of the next generation of astronomical instrument scientists. This is achieved primarily through outreach to the local West Virginia community and through the PI-instrumentation program. While other millimeter/submillimeter facilities have become privatized or shut down in recent years, I find myself working in a field with fewer scientists obtaining hands-on experience with cutting edge instruments, particularly in the U.S. For me personally, the shrinking amount of public facilities has led to my moving from the U.S. to work in Europe, while many of my colleagues have been discouraged and have left the field.</p> <p>Please consider the future of U.S. mm-wave and radio instrumentation as you debate the future of this unparalleled resource. Please also consider the important precedent the NSF has maintained, for the U.S. and the world, of outreach programs, cutting edge science, and the Open Skies policy that anyone with a great science case can obtain observations on the GBT.</p>	Against Closure	Email - Scanned	10/31/2016	
761		Cheng-Yu	Kuo	Astronomer	<p>My name is Cheng-Yu Kuo, an astronomer in Taiwan and a long term user of the Green Bank Telescope (GBT). I am writing this email to convey my personal opinions on the future operation of the GBT.</p> <p>As a radio astronomer, I still remember that when I first heard the divestment recommendation made by the Eisenstein-Miller Portfolio committee, I thought that this was a really unwise recommendation, given the great scientific values of the GBT. After talking to a key member in the Portfolio committee, the person who made the suggestion to shut down the GBT, I realized that the divestment recommendation was not totally objective and therefore cannot be representative for the entire astronomy community in the US.</p> <p>The original suggestion made within the Portfolio committee was to shut down an optical telescope, rather than the GBT. It was out of the strong "personal" preference and opinion of an optical/planet astronomer in the committee who wanted to protect optical astronomy that the final divestment recommendation went to the GBT. Clearly, the divestment recommendation was not made out of scientific values of the GBT, but also involves personal preference or biases. Therefore, I strongly appeal the NSF to re-assess the recommendation based more on the scientific values of the GBT and see whether it is really the right thing to do to shut down this wonderful telescope.</p> <p>From the point of view of AGN studies, either closing down the GBT or dramatically reduce the science time of the telescope will cause severe damage to astronomy. Our team has been using the GBT to study water megamasers around supermassive black holes at the centers of active galaxies. Our effort has produce the most precise measurements of black hole masses in astronomy, and these precise measurements has become an important part in the black hole-galaxy coevolution study.</p> <p>Based on our data collected in the past 10 years, we are now very close to find a new/efficient technique to discover water maser emissions from gas orbiting around supermassive black holes. As a result, it is very likely that we will be able to find maser emissions from active galaxies in a substantially faster pace, and the number of percentage-level black hole mass measurements will increase significantly in the following years. This new development would definitely bring the black hole-galaxy coevolution research to a new forefront. However, without the survival of the GBT, all these new progress in astronomy will be hampered severely.</p> <p>Above all, I wish that the NSF can reconsider the decision to change the GBT operation in a significant way and re- evaluate the situation based more on the scientific impacts of the GBT, which may be underestimated by the Eisenstein Committee. Thank you !</p>	Against Closure	Email - Scanned	10/31/2016	

Green Bank Observatory -Written NSF Public Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
762	a	Gary	Gillespie		<p>For many reasons the operational funding of the Green Bank Radio Astronomy Center deserves to continue without changing the original mission of this vital scientific project.</p> <p>Over the years research carried out there has contributed to the knowledge of scientists and astrophysicists. As our nation continues to send sky labs and astronauts into outer space, the Green Bank Observatory will enhance the growing information needed for successful missions and space research. The GBRA Center continues to search for those environments in the universe that are life- supporting for earth's humans. In time the research may learn if intelligent beings inhabit any of the systems making up the universe. Auditory information is an important piece in the puzzle of mankind's understanding of the universe.</p>	Against Closure	Email - Scanned	10/30/2016	
762	b	Gary	Gillespie		<p>GBRA Center is a first rate educational source for visitors from elementary schools to post-graduates. The field trips that help school children learn more about their world and the universe is, in itself, reason enough to continue its funding. Children's field-trip experiences there inspires them to study science and math with vigor. This part of the GBRA mission is a significant building block in the education of children. School children get study guides and work pages on various aspects of science that carry over into their classrooms long after their field-trip ends.</p> <p>On a personal level, the GBRA has a coincidental humanitarian impact on many visitors. As one listens to the guides explain the scopes and what they reveal about space, the realization of the vastness of the universe with its constantly moving parts gives a new perspective on how infinitesimal our solar system is by comparison and how insignificant man is in its myriad parts. Visitors are humbled in the face of its limitlessness where there may be no beginning or end. This is good for mankind to know because it makes us better to know earth's population shares the same destiny.</p>	Against Closure	Email - Scanned	10/30/2016	
762	c	Gary	Gillespie		The GBRA stimulates local and state economy.	Against Closure	Email - Scanned	10/30/2016	
763		Jeffrey	Zemerick		<p>I would like to provide my feedback regarding the NSF and the Green Bank Observatory.</p> <p>My recommended option is "Collaborate with interested parties for scientific and educational functions with reduced NSF funding."</p> <p>As a citizen with a STEM degree working in what little STEM industry West Virginia currently offers, I would be extremely disappointed to lose the Green Bank facility or for it to lose its primary goals of science and education. It is a world-class facility nestled in a state where you can count the "world-class" locations on one hand (and maybe with a finger or two to spare).</p> <p>The observatory and the surrounding places has long been a popular destination for activities in our family. Seeing the telescopes and learning about them is something I look forward to sharing with my kids. I was very excited to recently see data from the observatory being processed in my home computer's Seti@Home tasks.</p> <p>While any possibility that allows the observatory to remain open is better than any that mothballs it or closes it, I strongly hope the observatory it is able to maintain its purposes of science and education for generations to come.</p>	Against Closure	Email - Scanned	10/30/2016	
764	a	Earl	Scime	Oleg D. Jefimenko Professor and Chair of Physics and Astronomy	I note that in NSF's announcement of the EIS review for the GBO (https://www.nsf.gov/news/news_summ.jsp?cntn_id=190089&WT.mc_id=USNSF_51&WT.mc_ev=click), the Breakthrough Foundation is prominently cited, yet over the past 4 years, West Virginia University has provided significantly more funding to support GBT operations than the Breakthrough Foundation. WVU has been the major partner for the GBO over the past few years. I raise this issue on behalf of the department of physics and astronomy at WVU to highlight the extensive connections our department has with the GBO. Loss of the GBO would affect dozens of undergraduate and graduate students at WVU, over a dozen faculty and research scientists, and hundreds of regional high school students and teachers.	Against Closure	Email - Scanned	10/29/2016	
764	b	Earl	Scime	Oleg D. Jefimenko Professor and Chair of Physics and Astronomy	The GBO facility is a critical element in the growth of astronomical research in West Virginia and therefore there would be a significant educational impact where the GBO to close. It is my opinion that the public scoping process should include a detailed discussion of the potential impact on educational programs in the region.	Resource Considerations	Email - Scanned	10/29/2016	
765		Diana	Buttaro	University of Virginia School of Engineering and Applied Science (CpE)	<p>I am an undergraduate college student at UVA, active member of the Astronomy Club, and huge fan of the Green Bank Observatory. Every year our club has an annual trip to collect data on the 40-ft educational telescope there using old-school equipment. It feels like we are scientists from the 1960s and I love it.</p> <p>I have been informed that public comment is open on the future of the observatory, and I want to provide my input that I find it extremely important to keep Green Bank fully operational and receive funding from NSF. Aside from the educational trips, the Green Bank telescope itself is an important tool for discovery. It is the largest fully movable telescope in the world and this alone makes it an invaluable resource for astronomers to collect data. The telescope needs funding so there is sufficient time for open science. While private projects of those with more money are enticing, it is more important for the nature of discovery to allow astronomers working on various projects to be able to apply for time on the telescope. Many of my friends are already conducting research in astronomy and astrophysics. By keeping Green Bank publicly funded and operational, so many bright minds will have the opportunity to use the telescope, and these people will be able to utilize the telescope to its full potential.</p> <p>The Astronomy Club at UVA is looking forward to returning to Green Bank in the years to come. Thank you for your time.</p>	Against Closure	Email - Scanned	10/28/2016	

Green Bank Observatory -Written NSF Public Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
766	a	Rita	Kelly	Green Bank Elem. / Middle School Preschool / Preschool Special Needs Teacher	<p>I understand that you are considering withdrawing funding of the Green Bank Observatory. I would hope that you understand the scope of that change in funding on our community. Please let me share just a small portion of what the GBO (NRAO) has meant to us.</p> <p>I have been a teacher in Pocahontas County where Green Bank is located for 30 years, and at the Green Bank Elementary/Middle School since 1995. In that time I have been acquainted with several of the families who have moved here to work at the Observatory, and many who were local people who are and have been employed at the NRAO. I have also had many students throughout the years whose parents are employed by the NRAO. The positive impact that these families have had on our community has been amazing! I can not imagine our small community without having the influence of the NRAO employees.</p> <p>Socially: Many years ago I had a daughter in soccer & soft-ball. Her coaches & referees were mostly NRAO employees. Even today GBO employees coach, volunteer and support many of the sports in our high school and county recreational leagues. It would be a great loss to our community to lose all of that support.</p> <p>There are many more ways that the GBO and it's employees have positively effected our community and the loss of this resource would be absolutely devastating to our community. I hope you will consider continuing to fund this amazing resource.</p>	Against Closure	Email - Scanned	10/28/2016	
766	b	Rita	Kelly	Green Bank Elem. / Middle School Preschool / Preschool Special Needs Teacher	<p>Economical: Our small community would be absolutely devastated if the GBO was no longer one of the largest employers in our county. If I am right, it's the 3rd largest employer in Pocahontas County which is geographically the 2nd largest county in our state. Many of our small businesses would no doubt be forced out of business due to the loss of revenue and our housing market would be devastated. Employees of the GBO would not be able to sell their homes at the market value because no one in the community would be able to afford those houses.</p>	Against Closure	Email - Scanned	10/28/2016	
766	c	Rita	Kelly	Green Bank Elem. / Middle School Preschool / Preschool Special Needs Teacher	<p>Educational: The NRAO has always been open to help our school in many ways. Anything from educational activities at their science center to offering evening activities that stimulate our students. I am so thankful for the many, many educational resources that they have provided. Also, without the students in our schools whose parents are employed by the GBO, our number of students would drop dramatically, which would mean that our school funding would drop dramatically.</p>	Against Closure	Email - Scanned	10/28/2016	
767		Frederick	Walker	Adjunct Faculty, Marshall University	<p>The future of our country depends on stimulating our youth in math & science. The Greenbank Observatory not only discovers new and important things about our universe, it also discovers new & exciting things. Young potential scientists from all over the Country are able to see directly how their education in STEM subjects is put to use in understanding the physics of space.</p> <p>I implore you to continue funding this work as essential and not discretionary.</p>	Against Closure	Email - Scanned	10/28/2016	
768		Devin	Crichton	Ph.D. Candidate Department of Physics and Astronomy Johns Hopkins University	<p>As graduate student and prospective user of the NSF supported MUSTANG-2 instrument, I am writing this letter to advocate for maintained NSF investment in the Green Bank Telescope.</p> <p>In particular for my work, the efficiency with which the recently commissioned MUSTANG-2 in-strument can make high resolution Sunyaev-Zel'dovich (SZ) effect followup observations of galaxy clusters represents a significant advancement. By enabling efficient, high resolution characterization of the pressure distribution of the intracluster medium (ICM), MUSTANG-2 observations will help advance our understanding of the astrophysical processes at play in these high mass haloes. This is not only important for understanding the baryonic processes which affect structure formation, but also for understanding the systematic uncertainties that are holding back cosmological analyses of large SZ selected cluster surveys. As such, MUSTANG-2 observations stand to be exceedingly relevant in enhancing the scientific outputs derived from the galaxy cluster samples of existing and forthcoming surveys, including those from NSF funded projects such as ACTPol and Advanced ACT.</p> <p>Furthermore, having visited the GBT as a student and with other students, I have both personally experienced and witnessed its ability to inspire young astronomers and the general public. The GBT is a truly remarkable observatory in terms of both its scientific output and its potential as an educational tool. As such, NSF divestment of the GBT could potentially represent a significant and tragic loss to the astronomical community.</p>	Against Closure	Email - Scanned	10/28/2016	gbt_support.pdf
769		Devin	Crichton	Ph.D. Candidate Department of Physics and Astronomy Johns Hopkins University	<p>I agree broadly with the statements made in https://arxiv.org/abs/1610.02329 that significant developments of both the GBT, its instrument complement and its context in the field need to be carefully reevaluated before divestment is considered.</p>	Against Closure	Email - Scanned	10/28/2016	
770		Bob	Mikulas	President National Lawn & Garden Show	<p>I attended college within the National Radio Quiet Zone and recognize the Green Bank Observatory as one of our country's unique national treasures. While I acknowledge that austere times require changes, I implore you to retain the facility for continued use, under scenarios one thru three, and in that order of preference.</p> <ol style="list-style-type: none"> 1) Continued NSF investment for science-focused operations (No-Action Alternative) 2) Collaboration with interested parties for science- and education-focused operations with reduced NSF-funded scope 3) Collaboration with interested parties for operation as a technology and education park 	Against Closure	Email - Scanned	10/28/2016	
771		Jerome	Gilbert		<p>I want to register my support for continuing the operation of the Green Bank Observatory and for continued NSF support. This facility is an asset for West Virginia and is of tremendous value in basic science discovery. I had the opportunity to visit Green Bank many years ago and was very impressed.</p>	Against Closure	Email - Scanned	10/28/2016	

Green Bank Observatory -Written NSF Public Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
772		Charles	Sheets	Green Bank Lifelong Citizen	<p>National Science Foundation publication dated 10/19/2016, under the provisions of section 106 per 36 CFR 800.2(d) is proposing two scoping meetings for an EIS to determine the future of the Green Bank Observatory. These meetings are scheduled for 11/9/2016 at 3:00 PM and 6:00 PM, the same day, located in the Green Bank Science Center, Green Bank, WV.</p> <p>I am a life long citizen of Green Bank, WV, and have seen and read much scientific progress over the years. I was in Green Bank High School when land was purchased and observed ground breaking ceremonies as a student. We were in the automotive business in the community for 90 years closing our leadership in 2012, mostly due to the economy.</p> <p>I am requesting that the Notice of Intent to prepare and EIS be postponed for the following reasons: (1)You have scheduled this just one day after the General Election, (2) Pocahontas County will have just gone through a contentious School Bond Levy Vote to up grade our county schools, (3) because of these two important events I believe our citizens are not focused on this important hearing for our community.</p> <p>We are a small rural community, without cell phones, and only one weekly newspaper. I am confident that most of our citizens have not been informed and postponement of the hearing is necessary.</p>	General	Email - Scanned	10/27/2016	
773		Donald	Martin, II		<p>As a returned native West Virginian, living for more than 30 years within the NRQZ at French Creek, I take great pride to include Green Bank Observatory as one of our country's unique national treasures, pushing the frontiers of our understanding of our universe.</p> <p>Over the years we have visited the GBO a number of times, with friends, family, and school classes, and I always find it inspiring. It stimulates the senses and imagination in so many ways. And conducts good science.</p> <p>While I recognize that austere times require changes, I implore you to retain the facility for continued use, under scenarios one thru three, and in that order of preference.</p> <p>1) Continued NSF investment for science-focused operations (No-Action Alternative) 2) Collaboration with interested parties for science- and education-focused operations with reduced NSF-funded scope 3) Collaboration with interested parties for operation as a technology and education park</p> <p>As noted in the email string below, the GBO and the NRQZ has been the subject of some recent email exchanges with friends across the country (my brother-in-law was stationed at Sugar Grove with the Navy a number of years ago & that too is intriguing).</p> <p>I'm retired from the WV Department of Environmental Protection and have kicked around the idea of getting tee shirts printed (as outlined below) and distributed in the tourism spots here within Our Home Among the Hills.</p> <p>Any objections?</p> <p>Thank you for your consideration, and best wishes to the folks at the Green Bank Observatory. FYI, attached are a couple of photos I took last year.</p>	Against Closure	Email - Scanned	10/28/2016	image002.png, IMG_1882 v-2.jpg, IMG_1878 v-2.jpg
774		William	Lively		<p>As a West Virginia resident and tax payer I want to express my disapproval of the Green Bank Observatory (GBO), being dis-commissioned. I feel that the GBO contributes immensely to our understanding of the cosmos and there's still a lot to be discovered!</p> <p>The United States Government is wasting monies in many other places and being that a small portion of those monies are mine I am of the mind that they be spent on projects such as the GBO.</p>	Against Closure	Email - Scanned	10/28/2016	
775		Laura Jo	Elliott		<p>Last year, I had the opportunity to visit an old friend who was, at the time, employed at the Green Bank Observatory. Although the visit to Green Bank was social, I took the opportunity to very briefly tour the observatory. I wasn't expecting to have a strong reaction but I ended up being so impressed with several aspects of the facility. Firstly, everyone I met that was connected with the observatory radiated intelligence and passion. It was obvious that the observatory attracts the top in the field, by measure of ability and ambition. That should stand alone as a credit to the importance of the Green Bank Observatory. Moreover, people not only cared about what they were doing and studying but also about making it accessible to the public. Evidence of public outreach programs was around every corner. I heard about camps and school groups and programs in schools that teach students about science and space. I believe there is almost nothing more important to the future of humanity than educating and encouraging students interested in science. Green Bank Observatory excels at that. Although I was using vacation time to make a social visit to an old friend when I visited, I couldn't help but wander around and feel excited at the knowledge and energy of the place.</p> <p>As the future of the observatory is being determined, please consider the huge impact the facility has on the public. I believe the importance of encouraging the next generation's interest in the sciences can't be overstated.</p> <p>Thank you for your time and consideration.</p>	Against Closure	Email - Scanned	10/27/2016	

Green Bank Observatory -Written NSF Public Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
776		Collette	Ridgeway	Administrative Support Assistant Academic Affairs	<p>I wanted to add my comments to the list as you consider the future of the Green Bank Observatory at your meeting on Nov 9th.</p> <p>A visit to the Green Bank Observatory in the late 1980's played a huge part in the role of science in my life. Although I am not currently in a career in the sciences, a lifetime of curiosity was encouraged when those great telescopes appeared on the West Virginia horizon. My family made an unscheduled stop, and we were able to get a tour. I was even lucky enough to see the 300 ft telescope before it's collapse.</p> <p>The idea that a place like that existed, and work like that was going on, captured my imagination. For the remainder of my high school years, Green Bank and radio astronomy were the subjects of most any project on which I could use those topics. My college years then allowed me to explore engineering, earth sciences, and environmental policy. After never being able to settle on just one discipline, I now find myself enjoying work in an academic setting supporting all sorts of faculty members doing all sorts of interesting things... and a lifetime of learning continues.</p> <p>Thank you to everyone who has done the good work of funding and operating this facility. I hope Green Bank can continue to inspire curiosity and innovation into the future.</p>	Against Closure	Email - Scanned	10/27/2016	
777		Kavilan	Moodley	Associate Professor, University of KwaZulu-Natal, South Africa	<p>I am writing in support of maintaining full NST operations on the Green Bank Telescope (GBT).</p> <p>I have a very talented former graduate student who is working on MUSTANG-2 on the GBT on her first postdoctoral fellowship, and her future career in astronomy is largely based on the scientific interpretation of the data that will come from MUSTANG-2 on the GBT.</p> <p>Together with my former graduate student, a current graduate student and a host of colleagues in South Africa and across the world, we are involved in a survey of Sunyaev-Zel'dovich selected galaxy clusters on other radio facilities across the world, specifically the GMRT in India, with a planned survey on MeerKAT in South Africa, for which complementary MUSTANG-2 observations on the GBT will be critical to delivering a comprehensive understanding of astrophysical (thermal and non-thermal) processes in galaxy clusters. This in turn will contribute greatly to understanding the scaling relation between Compton Y parameter and cluster mass, specifically how it depends on the dynamical state of the cluster. This relation is the key challenge in using clusters to constrain the equation of state of dark energy, a key goal of current and future cosmology surveys. Moreover, MUSTANG-2 observations on the GBT will contribute significantly to understanding detailed astrophysical processes in the intracluster medium, which provides a unique astrophysical environment.</p> <p>I urge you to consider seriously continued support from the NSF in maintaining GBT operations to enable the above science, and a range of other high-impact science, to be accomplished on this unique facility.</p>	Against Closure	Email - Scanned	10/26/2016	
778		Brian	Koopman	Physics Department	<p>I am writing to voice my opinion on supporting observations at the Green Bank Observatory. I have friends and colleagues in both the NANOGrav and MUSTANG2 collaborations who's work depends on the operation of the Green Bank Telescope. The work of NANOGrav compliments the recent discovery made by LIGO and the work of MUSTANG2 will provide exciting high resolution measurements of galaxy clusters, complimenting x-ray observations. The GBT is a valuable and unique facility from which to perform these measurements and I hope the NSF will continue to support these efforts.</p>	Against Closure	Email - Scanned	10/26/2016	
779		Michael	Niemack	Assistant Professor Physics Department	<p>I am writing to encourage continued NSF support of the GBT. It is a unique astronomical resource and is currently playing an important role in multiple exciting fields of astronomical and cosmological research.</p>	Against Closure	Email - Scanned	10/26/2016	
780		Jud	Worth		<p>I strongly urge you to keep the Green Bank Observatory as one of our Nation's Treasures. Please consider "Continued NSF Investment for Science-Focused Operation" (No-Action Alternative.) The Green Bank Observatory has many new investments including the new telescope and visitor's center. The wealth of technology and investment on this campus is epic. Your continued support is paramount for this premier facility to continue it's operations. The educational dynamic of this campus is international and is reliant on it's continued on-line operation.</p>	Against Closure	Email - Scanned	10/26/2016	
781		Shawn	Henderson	Cornell University Physics Department	<p>I am writing to express my support for continued National Science Foundation (NSF) involvement in the Green Bank Telescope (GBT). The GBT is a unique astronomical and educational resource. I am a postdoc at Cornell University working on the Atacama Cosmology Telescope (ACT), a National Science Foundation project, and I have collaborated closely with colleagues at the University of Pennsylvania who are working to deploy the GBT MUSTANG2 instrument. Over the next three years, MUSTANG2 will map galaxy clusters through their thermal Sunyaev-Zel'dovich signatures, enabling unprecedented constraints on cluster physics and models describing the formation of galaxies and cosmic structure. In particular, MUSTANG2 will significantly enhance the science impact of ACT's planned lower angular resolution survey of galaxy clusters over more than half of the sky, a large fraction of which are observable from the GET. The GET is also a critical platform for testing new technologies and techniques for future NSF projects like CME-Stage4, which will rely on improvements in microwave instrumentation first developed for projects like MUSTANG2 on the GET in order to map the sky in the mm- and sub-mm using ground-based telescopes to the fundamental limits. Ongoing work at the GBT is well aligned with the NSF's core science mission, and is critical to the success of other current and future NSF-funded efforts. I urge you to consider continuing support for this valuable community resource.</p>	Against Closure	Email - Scanned	10/26/2016	N/A

Green Bank Observatory -Written NSF Public Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
782		Federico	Nati	Department of Physics and Astronomy	<p>This letter is in support of continued NSF operations of the GBT.</p> <p>I am an italian postdoc researcher currently working at the University of Pennsylvania in the field of Cosmology and Astrophysics. I've been working for around 15 years on several experiments designed for high resolution observations of clusters of galaxies, in particular to study the SZ effect (Planck/HFI, ACTPol, and balloon projects dedicated to SZ effect). These missions have demonstrated a strong impact on cosmology and astrophysics, with an enormous amount of data and publications, and still leave open many relevant questions that make GBT a unique tool to find their answer. We need the resolution provided by GBT and an instrument like MUSTANG-2 to address questions like: how do hot diffuse baryons dynamically evolve in dark matter potentials? How and when was the excess energy we observe in the intergalactic medium generated? What is the thermodynamic state of the ICM, and what determines it? Besides, understanding the complex internal SZ structure of clusters could help to untangle the Y-M relationship which limits our ability to constrain cosmological parameters from cluster surveys.</p> <p>The MUSTANG-2 instrument received a three year award to begin science observations on the GBT and should be installed up on the telescope in a few weeks. It's a state of the art instrument which, among other things, attracts the interest of a world-wide community, and people like me moved from Europe also to have the opportunity to work on it. I really hope that these opportunities will still be there in the future.</p>	Against Closure	Email - Scanned	10/26/2016	
783		Renee	Hiozek	Assistant Professor of Astrophysics	<p>I am a faculty member at the University of Toronto working as part of the Atacama Cosmology Telescope Collaboration (ACT). My work in the field of microwave cosmology is to understand the physical processes in galaxy clusters and in the cosmos through effects like the Sunyaev-Zeld'ovich effect.. As such, multi-wavelength observations from telescopes like the GBT are essential if we are to accurately probe the physics of SZ clusters.</p> <p>This impacts on our ability to disentangle astrophysical processes from cosmological ones, which is key to understanding the structure and evolution of the universe and the nature of dark energy: one of the major goals of the Decadal Survey.</p> <p>The continued funding of the GBT will ensure that we move forward on our science goals, and leverage the precision measurements that GBT provides. The telescope has been upgraded in recent years, and there are funded projects ready to be placed on the GBT that will bring significant astronomical rewards.</p> <p>I urge you to continue funding this world-class telescope which provides a eye to the radio universe so key for my science and that of my colleagues.</p>	Against Closure	Email - Scanned	10/26/2016	
784		Arthur	Kosowsky	University of Pittsburgh	<p>I know there has been talk of closing down Green Bank, and I hear that one of the options on the table is simply demolishing this facility. I think this would be a short-sighted misstep for US science.... programs at Green Bank are highly relevant to my interests in cosmology and gravitational wave physics. I am a long-time member of the Atacama Cosmology Telescope collaboration, which makes arcminute resolution maps of the microwave sky from a site in the Atacama Desert in Chile. Our collaboration has achieved a number of notable scientific firsts, including the first detection of six acoustic peaks in the microwave temperature power spectrum, the first detection of gravitational lensing of the microwave background, the first detection of galaxy cluster motions through the kinematic Sunyaev-Zeldovich effect, and the discovery of the most extreme galaxy cluster in our visible universe. One of the very interesting data products from our experiment, and from similar sky maps made by the South Pole Telescope and the Planck Satellite, is a catalog of all the largest galaxy clusters, detected via their thermal Sunyaev-Zeldovich distortion of the microwave background spectrum in the sky direction of the cluster. It has long been appreciated that the growth of galaxy clusters in the universe is a sensitive probe of structure growth, which can in turn provide insight into the nature of dark energy. Selecting clusters via the SZ effect is by far the cleanest way to do this. But galaxy clusters are not quiescent static objects: they continually accrete smaller objects, and the state of their gas is in constant dynamical upheaval, with larger departures from equilibrium at large radii and early times. We have a limited array of possibilities for measuring these nonequilibrium effects, and thus calibrating our cosmological probes. Thermal SZ bservations on angular scales smaller than one arcminute is one way to do it, and the GBT equipped with a bolometer array like MUSTANG-2 is one of the only instruments in the world which has that capability. It would be my hope that, as part of our multifaceted approach to understanding dark energy, that we would be seriously looking at prospects for building a succession of increasingly sensitive mm-wave detector arrays for the GBT to probe galaxy clusters. X-ray satellites, which are often cited as an alternative way to get at the same astrophysics, are vastly more expensive, and X-ray data is far more difficult to interpret than SZ data. ... This group is one of the world leaders in discovering millisecond pulsars, and using them as precision clocks for the detection of gravitational waves with wavelengths on the order of the distance to nearby stars. I don't need to remind anyone of the jolt sent through the entire physics and astronomy community by the LIGO detection last spring: we are truly at the doorstep of the gravitational wave astronomy era. It is my hope that we will see accelerated plans for a space-based interferometer at ten million-kilometer wavelengths, to complement ground-based efforts at thousand-kilometer wavelengths. The only known probe of gravitational waves at even longer parsec wavelengths is a pulsar timing array. Such an array puts limits on stochastic backgrounds at wavelengths longer than those dominated by white dwarf binaries. With enough pulsars and observation time, it may be possible to put important limits on (or detect!) a stochastic background of gravitational waves from inflation in the very early universe. GBT is a workhorse for discovering pulsars and for doing precision timing measurements; its loss would greatly hamper this unique route to gravitational wave detection. Not to mention the rich field of neutron star astrophysics, which also is likely to experience a renaissance once LIGO starts detecting neutron star binaries. As someone who has no direct involvement with radio astronomy, I still have professional interests in two completely different observing programs at GBT. I think this speaks to the versatility and importance of this instrument, and the limited alternatives available world-wide for doing this science. It is hard to accept that serious consideration is being given to shutting down a facility with unique science capabilities, high potential impact, and relatively low cost. Other contemporary observational efforts probing dark energy and gravitational waves are huge and vastly more expensive enterprises. I urge the NSF to continue supporting science at GBT.</p>	Against Closure	Email - Scanned	10/26/2016	

Green Bank Observatory -Written NSF Public Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
785		Tobias	Marriage	Assistant Professor Johns Hopkins University	This is a letter of support for continued NSF investment for science-focused operations at the Green Bank Observatory. The GBT and associated facilities are crucial tools for the astronomical community and thus a valuable asset for advancing science. They both enable ground breaking science now and provide crucial training to young scientists to ensure scientific progress into the future. I can offer two examples from my own experience. (1) My student Ting Su traveled to Green Bank in the spring of 2015 to train and use the Z-Spec instrument to measure the redshifts of high redshift lensed star forming galaxies. These observations are part of her thesis to understand galaxy evolution at the peak of star formation 11 billion years ago. (2) My student Devin Crichton is collaborating with the MUSTANG(2) team to use the GBT to measure the gas profiles in galaxy clusters from a cleanly selected cosmological sample reaching back to the half the age of the universe, when the first massive clusters were formed. By studying the pressure in this sample, we learn how these most massive objects formed. For both of these projects, the samples come from the Atacama Cosmology Telescope, an NSF sponsored project. These projects illustrate how the different NSF initiatives rely on one another for full realization of scientific potential. It is important to note that these student-led projects would not have been realized with ALMA simply because the demand for time is too great to support the rich ecosystem of science we have in the US. Without facilities like the GBT this ecosystem will suffer, and the public good of scientific knowledge will not be served at the level commensurate with our society's expansiveness and potential.	Against Closure	Email - Scanned	10/26/2016	
786		Laura	Solliday		<p>A letter in support of the GBO.</p> <p>I have always said that we live in the best place. We live in a community that has people that never finished school to people with PhD's and yet our pre-k through 8th grade school only has about 270 students. How is it possible such a tiny little place has such a beautiful variety of people? People, that speak many languages and have all levels of education, The Green Bank Observatory is how. I grew up with NRAO. My grandfather and father were both engineers there. I have been blessed to be part of all the NRAO facilities from Tucson to Green Bank. I know that it is no longer through NRAO, but the impact is no different. Every time I see that big ole GBT I feel privileged to live in a tiny place that is constantly searching all the bigness there is.</p> <p>The resources, partnership, and culture that the GBO offers in this place is priceless. Without the GBO this community will die. I know that is an age-old problem, communities die and we shrug our shoulders and say "oh well". Shoe factories close and move somewhere else, perhaps even out of country. Coalmines shut, things close down to save money to move elsewhere. Oh well, towns die, communities die, oh well. We seem to live in a time where we shrug and say "oh well" ..</p> <p>Yet shutting a place that studies, examines, searches and educates, well that feels wrong beyond measure. I don't say that just because I know what will happen here in our tiny little community. I say that because I have always felt so blessed to be part of a tiny little community that is doing big big things. We don't have an abundance of things in this world that are just doing things because it is furthering our knowledge and expanding our worldview it seems to me that preserving a place of curiosity and examination and true exploration is a noble thing to do. However, maybe being noble and true is something we can shrug off easily now too.</p> <p>The people that make up the observatory and the community that surrounds it, it is a special beautiful thing. I know that many others and I will not find it so easy to shrug off if they disappear. There will not be a chorus of "oh well's" it will be a chorus of a far more desperate and sadly whispered "Oh No's"...</p>	Against Closure	Email - Scanned	10/26/2016	
787		Edward	Wollack	Research Astrophysicist NASA/Goddard Space Flight Center	<p>Please find resubmission of comments below.</p> <p>Observation: The email address text provided reads "envcomp-AST-greenbank@nsf.gov". In my mail client if one directly copies or clicks the link in email the address is "envcomp-AST@nsf.gov". This "feature" could potentially reduce the number of successful comment submissions.</p>	General	Email - Scanned	10/26/2016	
788		Edward	Wollack	Research Astrophysicist NASA/Goddard Space Flight Center	The 100 meter Green Bank Telescope (GBT) represents a unique world class scientific asset. For example, the potential discovery space the MUSTANG2 camera has opened for the study the formation of galaxies and cosmic structures in the primordial Universe has high scientific merit and is of great interest to the community. In particular, this imaging system's mapping speed, sensitivity, and optical configuraiton allow efficient and precise surveys which could not be previously envisioned. Similarly recent NFS instrumentation efforts under the AST-ATI program, namely the 16-pixel Argus array and the VEGAS spectrometer, have opened the promise of high angular resolution wide-field mapping at 3mm. Considered from a multi-wavelength astrophysics perspective the GBT offers the sensitivity, control, and high resolution of an off-axis filled-aperture which is suitably matched for resolving cold cores within local star-forming regions as-well-as efficiently mapping X-ray and optically selected galaxy clusters for cosmology. These instrumentation attributes are unique and well posed to provide new and valued astrophysical insights.	Against Closure	Email - Scanned	10/26/2016	

Green Bank Observatory -Written NSF Public Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
789		Mark	Devlin	Reese W. Flower Professor of Astronomy and Astrophysics	<p>I am writing to express my strong support for continued NSF support of science operations with the Green Bank Telescope.</p> <p>The GBT is a unique astronomical and educational resource. It is also essential for our high resolution observations of galaxy clusters in addition to a host of other science goals. We recently received a three year award to begin science observations with the MUSTANG 2 instrument on the GBT. It is slated to go up on the telescope in a few weeks. In addition to being fascinating objects on their own, understanding the complex internal structure of clusters could help to untangle the relationship between the mass of the cluster and the Sunyaev-Zel'dovich effect which limits our ability to obtain cosmology from cluster surveys.</p> <p>The amount of time for general observing proposals has already been reduced. A further reduction in NSF support of the GBT operations would have a major negative impact on our science. This is especially true for MUSTANG2 because our 3mm observations require the best observing conditions, so the number of nights we can use is limited. last year, scheduling our observations around the non-NSF supported observing was difficult. If things go more in the same direction, our observations could become impossibly to schedule.</p> <p>Of course, the above assumes that there will be some ongoing support for the GBT. I would consider decommissioning the Green Bank Observatory based on short term funding issues to be a tragedy that we would regret for many decades.</p> <p>Finally, I want to point out that the Green Bank Observatory has inspired thousands of young scientists. My very small example of this comes from bringing a van load of Penn undergrads to the Green Bank site this past summer. It was a fantastic experience that has inspired several of them to take up a career in astrophysics. Extending this to the large numbers of students who cycle through the observatory each year points to a very valuable tool for inspiring the next generation of STEM students.</p> <p>In summary, while the Green Bank site has been around for a while, it continues to produce ground breaking science that cannot be done any other way. I hope you can find a way to maintain this valuable resource.</p>	Against Closure	Email - Scanned	10/26/2016	
790		Matt	Hilton	Senior Lecturer, University of KwaZulu- Natal	<p>I'm writing to you to urge the NSF to continue to support science operations with the Green Bank Telescope, in particular with MUSTANG-2, which is a unique instrument with the potential to have a huge impact on galaxy cluster science.</p> <p>I am an astrophysicist who has spent most of my career studying the properties of galaxy clusters, using optical/IR, X-ray, and Sunyaev-Zel'dovich (SZ) observations. In particular, I have been involved in the search for SZ clusters with the Atacama Cosmology Telescope (ACT). Cosmological cluster surveys have had a high impact, and beyond the cosmological implications, there is much still to learn about the impact of cluster galaxies and AGN on the intracluster medium (ICM).</p> <p>Current SZ surveys, conducted by ACT, South Pole Telescope (SPT), and Planck, have been limited by their coarse resolution (1'-5'). To interpret the SZ signal, we must at the moment rely on the assumption of an average pressure profile for the cluster population, and assume that it does not change with redshift. Given the orders of magnitude change in AGN activity and star formation up to redshift 1, and the increased frequency of cluster mergers at high redshift, this seems unlikely. The unique combination of GBT and MUSTANG-2, which provides arc-second level resolution, promises to be game changing - for the first time, it will allow us to measure, in detail, how cluster pressure profiles change with redshift. This will tell us a lot about the processes that shape the ICM, such as feedback by AGN, merger shocks, and cold fronts, which can be interpreted in the context of hydrodynamical simulations.</p> <p>Without GBT and MUSTANG-2, it is hard to see how and when this science will be done. Current x-ray observatories lack the sensitivity to study the ICM at cluster outskirts (which the GBT is able to see) and are expensive, taking 100 ksec to study clusters at redshifts. Moreover, we will not see a significant advance on the Chandra until well into the next decade (the European-led ATHENA+ mission). GBT and MUSTANG-2 can do this science now - and will certainly have a huge impact on cosmological studies of clusters with both current (ACTPol, AdvancedACT, SPT-3G) and future (Simons Observatory, CMB-S4) mm-wavelength survey facilities.</p>	Against Closure	Email - Scanned	10/26/2016	
791		William "Skip"	Crilly, Jr.	Education & Public Outreach Volunteer Science Ambassador Green Bank Observatory	<p>My name is Skip Crilly. I am a recently retired executive of the wireless industry, and now an unpaid volunteer electrical engineer, working at the Green Bank Observatory. I primarily help with educational and telescope performance objectives, during the last two years.</p> <p>The Green Bank Observatory is a scientific and engineering center of excellence.</p> <p>It is extremely important that humans who seek scientific explanations, and have an interest in the future, fund the work of the outstanding Green Bank Observatory.</p>	Against Closure	Email - Scanned	10/25/2016	
792		Carolyn	Kender	Archaeologist, WV SHPO	<p>Automatic Reply: Thank you for contacting me. I am currently out of the office and will reply to your message when I get back on October 31, 2016. If you have questions regarding the status of a review for a Section 106 project and need immediate assistance, please contact Belinda Gray at (304) 558-0240 ext. 722 or via email at belinda.d.gray@wv.gov.</p>	General	Email - Scanned	10/25/2016	

Green Bank Observatory -Written NSF Public Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
793	a	Simon	Dicker	Department of Physics and Astronomy University of Pennsylvania	<p>A reduction in funding to this unique facility would result in the loss of an important telescope, one that is highly complementary to other instruments in the NSF's portfolio. (GBT) has contributed and continues to contribute to our understanding of many astronomical phenomena and has an active, diverse, and growing user base. A few examples that illustrate the breadth of the science enabled by the GBT include the study of solar system objects, the investigation of star formation, gravitational wave research, and the study of giant clusters of galaxies. Many of these fields are listed as priorities in the 2010 decal review and in the more recent 2016 review - "New Horizons, New Worlds". For many types of observations, such as the large scale mapping of low surface brightness features, the GBT is the only telescope able to collect the data needed on any reasonable timescale. Many more examples of projects made possible by the GBT are given in publications and white papers - for example arXiv:1610.02329v1. Letter: As a scientist who has built 90GHz instrumentation for the (GBT) and as someone who has worked with the people at the (GBO) for over 15 years I would like to bring to your attention the importance of this unique facility. To quote from the NSF's 2012 review, the GBT is the world's most sensitive single-dish telescope at wavelengths shorter than 10cm. Since this review was written significant investments have extended the GBT's range of operating frequencies to the 67-116 GHz spectral window. The good resolution and high surface brightness sensitivity of the GBT at these frequencies give it large scale mapping capabilities significantly better than any other telescope in this frequency range. This and other new abilities were not taken into account in the 2012 review yet even so, as the above quote shows, the review noted the GBT's high intellectual merit. A testament to the capabilities of the GBT can be seen in the oversubscription rate for time at both high and low frequencies. Proposals to use the GBT come from astronomers working on diverse topics from cosmology to planetary science. Many of these research projects, such as the study of gravitational waves and the formation of large scale structure, are listed as priorities in the 2010 decadal review and again in the 2016 review New worlds, New Horizons. I would like to take the opportunity to illustrate some of the cutting edge science made possible by the GBT. At the University of Pennsylvania we have started on a program to map at high resolution, a significant number of galaxy clusters. Using a pathfinder bolometer array on the GBT we were able to detect shocks inside several clusters. These shocks were too faint to be seen in X-ray observations and survey telescopes built to find clusters of galaxies using the Sunyaev Zel'dovich effect (SZE) do not have the resolution to detect them. Unresolved features are a major systematic that limits the ability of SZE surveys to constrain the large scale structure in the Universe. The GBT's combination of resolution and mapping speed will enable us to map all known clusters in the northern sky thus removing systematic limitations in cluster surveys with the added benefit of deepening our understanding of these interesting objects. The GBT with its new high frequency capabilities is the only instrument able to map these clusters at a high enough resolution and on a reasonable timescale (less than a few hours per cluster). The above example is just one of the many ways in which the GBT plays a vital role in astronomical research. More examples of how the GBT provides unique capabilities that complement other astronomical instruments include:</p> <ul style="list-style-type: none"> • The GBT is used by the NANOGrav Collaboration in its search for gravitational waves at nHz frequencies. • Large area surveys from the GBT can be used to identify rare sources for follow up with ALMA and JWST. • Spectroscopic measurements of molecules between 67-116 GHz can be used to study star formation. The GBT's 6"-10" resolution at these frequencies is well matched to mid and far- infrared telescopes such as Spitzer, SOFIA, and Herschel. In addition it provides critical short-spacing data for aperture synthesis. • The GBT is used as the receiving element for bi-static radar programs that study our solar system. The loss, or even a reduction in the capabilities, of the GBT would have a detrimental effect across the astronomical community. 	Against Closure	Email - Scanned	10/25/2016	EIS_comment.pdf
793	b	Simon	Dicker	Department of Physics and Astronomy University of Pennsylvania	<p>Email: When considering future plans for the Green Bank Observatory I urge you to consider the growing importance of this facility to the astronomical community. However I also ask that you consider its importance to the training of the next generation of scientists, public outreach, STEM education, and to the local community that surrounds it.</p> <p>Letter: In closing, I would like to point out that as well as being a critical facility to scientists across the U.S and indeed the world, the Green bank Observatory is a great center for the training of the next generation of scientists, of public outreach, STEM education, and is an integral part of its local community. Reductions in funding put at risk the collaboration behind this great facility, a collaboration which will not easily be recreated, and whose loss would be a detriment to us all.</p>	Against Closure	Email - Scanned	10/25/2016	
794	a	James	Armbrust	Property owner in Pocahontas County, WV	As requested on the Notice posted to the Federal Register: https://www.federalregister.gov/documents/2016/10/19/2016-25213/notice-of-intent-to-prepare-an-environmental-impact-statement-and-initiate-section-106-consultation I am writing you to support operations if changes can occur to the quiet zone to allow the community and surrounding communities to gain access to cellular services and high speed internet.	Against Closure	Email - Scanned	10/25/2016	
794	b	James	Armbrust	Property owner in Pocahontas County, WV	<p>As you are aware, the facility is located in Pocahontas County, WV and is considered by the research and statistics to be a financially depressed area that is facing continued challenges both fiscally and socially by the limitations placed by the quiet zone. At this juncture, the people in the immediate county and surrounding counties must have access to cellular service and high speed internet to become competitive with the rest of the country and global commerce as well. Currently, the lack of proper cellular and high speed internet services is making this county fall further behind in its ability to progress in the future which will have downstream impacts on the Greenbank Observatory by loss of employee potential and of course the complete loss of very limited services from the community as it becomes harder and harder to compete and earn a living or come out of school prepared to work with technology in a global market.</p> <p>I believe that the Observatory is vital for scientific data and information sharing to further scientific endeavors, but at the same time technology is available to counteract the use of cellular and high speed internet services and this needs needs to be determined to move into the future to remain competitive with others that will no doubt have brought to market telescopes and other services that could make the Observatory obsolete quickly and decisively. Of course, it goes without saying that if that occurs it would have severe implications on the surrounding communities and there currently in no mitigation plan in place.</p> <p>The use of people, process and technology needs to occur in the area to revitalize and bring revenue and opportunities forth to the area.</p>	Alternatives Consideration	Email - Scanned	10/25/2016	

Green Bank Observatory -Written NSF Public Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
795		Deana	White		<p>Good evening! I left a voice mail earlier and then decided maybe it would be better to contact you via email. I had a few questions regarding the public comment period for the Green Bank Observatory Federal Register Notice of Intent to Prepare an EIS published October 19, 2016. I have listed them below for the ease of answering. Thank you so much for your time and consideration on this matter.</p> <p>- Does the written public comment need to be received by or postmarked by November 19, 2016?</p> <p>- Is there an accepted or formal length of maximum time issued for each individual's verbal public comment at the public hearing meetings scheduled for November 9, 2016?</p> <p>-Is an actual signature required on written public comments submitted via email? Again thank you and have a good and safe evening!</p>	General	Email - Scanned	10/24/2016	
796	a	Kevin	Harrington		<p>Regarding the status of the Green Bank Telescope, and now Green Bank Observatory, I have many concerns with the future alternatives proposed. Before I voice my opinions I would like to start by acknowledging how the United States of America is in a painful time of dealing with current politics and the behavior of those with financial power (many of whom are also corrupt with their power and authority). It is the case, as evidence suggests it is. BUT, the primary saving grace, if you will, is the era changing science taking place across all disciplines, from the microcosm to the macrocosm, right here in the same country that has so many flaws. We need to cherish what is before our eyes that serves as a means to bring people together and change the current awareness of how the universe really appears. Science can do this through the cycle of research and education for everyone. Therefore the most important tools/instruments in any science, which have already been proven effective, must be sustained and developed. There are more than enough reasons to promote the Green Bank Telescope as the premiere telescope of its kind. The engineering feats of physical construction, as well as the success of being the pioneers in surface activated panels on a radio telescope to observe/track objects while simultaneously changing their surface shape according to thermal and gravitational deformations. As you may know, there is a white paper being developed by Senior Astronomer, F. J. Lockman and it is in its final stages of preparation (first draft can be viewed already on the archive).</p> <p>The separation from the NRAO seems to me a logical decision if we are to not take away funds, and so give proper funds appropriate to the fact that the GBT is still the leading telescope of its kind. It is so big that it must build a facility on its own accord, now the Green Bank Observatory, as the NRAO has invested in ALMA and the next generation VIA. It's simply too much for the NRAO to keep these three major telescopes functioning, as they all have outgrown the box, so to say. They are all contributing equally important science, which I repeat is a saving grace in today's time. To restore the natural state of the area rather than utilize this amazing telescope would be wasteful. Any additional funding that could potentially be granted to the GBO could even have an environmental stipulation on it, such that the success of the GBT as a premier educational and research instrument would lead to the responsibility of the GBO to contribute in some way to the sustainability of the environment-- which it is already doing by providing educational resources to the public, for example. Also, being the competitive instrument of its kind, many private funds seek usage of the GBT--for instance in the Search for Extraterrestrial Intelligence--and this should be considered supplemental and always welcomed, rather than a competing source of funding from the point of view of the NSF who would be choosing why to justify giving money to the GBT. The NSF needs to cherish the GBT with all its heart because it is one of the driving factors in the interdisciplinary scientific world we live in, and which we in the US are contributing to internationally. In this light, the NSF needs to seriously consider how the state of the GBT, with its surface activators functioning efficiently only since 2010 and multiple new receivers/technology, is worthy of scientific respect, and is worthy of direct funding. On top of this, it should be allowed to receive private funding if the interest of the private funding party is to utilize this instrument to develop our understanding of the universe. Now is not the time to consider taking away any scientific momentum the GBT has. If anything, there has been a distorted shift in funding the military compared to the funding of honest scientific pursuits, and the tradition could possibly date back to when former President Nixon decided to cut NASA funding. The money is there in principle to build multiple GBT's, which would be quite the feat, so it should be possible to give the GBO the financial footing it needs to get its work done and more.</p>	Against Closure	Email - Scanned	10/25/2016	

Green Bank Observatory -Written NSF Public Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
796	b	Kevin	Harrington		<p>From here on I write from the point of view of someone who is a doctoral student ..., who also benefited from the tradition of Green Bank (previously via the NRAO) in hosting summer students for research internships. I have had the unique opportunity of doing two summer internships in radio astronomy, at Arecibo Observatory in Puerto Rico, and last summer in Green Bank. I am now soon publishing the results that were obtained during my undergraduate thesis work as the PI of a GBT proposal to observe the most luminous galaxies and their star forming gas reservoirs, and I am the PI and co-I of two recently submitted proposals using multiple receivers on the GBT, of which the proposals will be evaluated within a month. This would lead to immediate observations at the beginning of my PhD career. The research atmosphere is always something to acclimate to in any situation of a career in science, and for young astronomers to experience the friendly atmosphere at Green Bank it is a vital model for what a positive research environment can/should be. Being in the midst of the radio free zone provides a life lesson in being able to work without something you normally think you need ... This level of maturity in looking at this situation from the point of view of someone who wants to succeed in work aids in future research endeavors where it is important to use one's resources wisely. I understand that many previous summer students from Green Bank have gone on to contribute to society in many ways, and on many scales in science--including a Nobel Prize in Physics. The opportunity to study radio astronomy quantitatively where radio astronomy has many of its origins serves as a huge source of inspiration which can lead other scientists, and young astronomers, to carry out their work most productively and creatively. While doing an internship at Green Bank is significant in an educational experience in and of itself, many of the research projects are of course publication worthy. Thus a student can feel confident in going on to shine in a community (i.e. astronomical or general scientific) as one who has directly contributed to the work published in a journal article. If this is done at the stage before graduating undergraduate, this can lead to advantages for that student to be accepted into competitive graduate schools where this knowledge and research experience will be refined. The opportunity of having a summer research experience with world class faculty and staff also ensures that the student will have a better direction in their careers, and will be a safe alternative to changing fields without having had any experience of the initial field. The benefits of the internship at Green Bank also included personal experiences of education styles, where during the summer there are many scientific talks presented, as well as ""layperson"" talks to the amateur astronomers who come to stargazing parties offered on site at Green Bank. And by doing a research internship at Green Bank, one can in principle experience the propagation of education by observing or contributing to the scientific activities offered to elementary/middle/high-school aged students of varying socioeconomic backgrounds. While at Green Bank I learned first hand that the spectrum of astronomical fields probed with this single instrument (with many receivers of course) is amazing! From the moon to high-redshift galaxies to pulsars (important for gravitational wave astronomy!!). My undergraduate work for my Honors thesis included the study of high-redshift galaxies, and while a summer intern I submitted a proposal as the Principal Investigator, to use the GBT to study my galaxy sample and include these observations in my thesis work to complement the work that was already going to be published from the use of another telescope. To summarize this, with the GBT and its current functioning strategies as a premiere telescope in the professional scientific community, an undergraduate student can use this instrument to do cutting edge research if he/she can write a compelling proposal. This is a true benefit to the GBT as it applies to students' undergraduate Honors / Masters / PhD thesis. I was able to learn how to remote observe by going to GB and taking part in the remote observing school, and here I also grew a deeper level of appreciation for the experts working year-round at the GBT to make this a functioning research facility to support the motivated students up through the hierarchy of a professional career in astronomy in a non- judgmental fashion The GBT would thrive if the funding would cover the costs to sustain the operations of the telescope proposals submitted for proper research, and if the educational aspect is highlighted and developed towards undergraduate and graduate students so that these populations are given access to this world-class telescope amidst the resources of the scientific staff and the experts supporting these students(i.e. the professional community, professors, etc.). This does not take away from the science that can be done educationally at levels below undergraduate as the GB site has of course other functioning radio telescopes, such as the 140 ft telescope. This is currently being implemented and I was impressed by the integrity of the facility when I was a summer student last year.</p>	Against Closure	Email - Scanned	10/25/2016	

Green Bank Observatory -Written NSF Public Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
797	a	E. Gordon	Gee	President, West Virginia University	Thank you for the opportunity to register [WVU's] unwavering support for the continued operations of the (GBO) and concerns about the devastating impact that its closure would have upon the University's renowned radio astronomy program and the Green Bank community at large. Because of the GBO, [WVU] has been able to build from the ground up world- class astrophysics research and teaching program. Just over ten years ago, [WVU] was home to one astronomer. Today, [WVU] is home to seven astronomers, 20 graduate students, and 8 post docs, with over 6000 undergraduates having completed the introductory course in Astronomy since 2001. Last year, [WVU] faculty and students conducted a total of 2,700 research hours on the (GBT). In the past decade, university and faculty have produced 56 GBT-related publications, with 19 of those published in the last year alone. And, as described in more detail below, West Virginia University faculty and students across campus have been successful in securing a multitude of competitive research awards from the (NSF) and other agencies that entail the use or enhancement of the GBO. There is no question that the GBO has served as a magnet in attracting high caliber faculty and students around the globe to West Virginia University. Without the Green Bank Observatory, the incredible contributions that West Virginia University has made in radio astronomy, training the next generation of scientists, as well as STEM education, would come to an abrupt halt. As West Virginia's flagship, land-grant institution, West Virginia University's responsibility is to be an all-in partner when it comes to the GBO's future viability. When the Astronomy Portfolio Review Committee made its 2012 recommendation that NSF divest in the [GBO], West Virginia University immediately stepped up to the plate. The University entered into a Memorandum of Understanding (MOU) with the National Radio Astronomy Observatory (NRAO) to procure dedicated research time on the Green Bank Telescope - an agreement that continues to be in place to date. [WVU's] efforts to use and safeguard the GBO go well beyond the MOU. Over the past six years, the University has been successful in identifying opportunities to more fully utilize and strengthen the capabilities of the GBO as outlined below: • In 2010, [WVU] , working with universities and organizations around the world, received a \$6.5 million NSF Partnerships for International Research and Education program to detect gravitational waves, a key prediction of Einstein's theory of general relativity. • In 2013, [WVU], in collaboration with Brigham Young University, was awarded a \$500,000 NSF grant to build a new detector for the Green Bank Telescope that will allow the universities to map regions of the sky three to five time faster. • In 2014, [WVU] and the NRAO inaugurated a new \$8 million super high-speed broadband data network to bolster collaboration and scientific research between our organizations -- the new system is more than 200 times faster than the previous link. • In 2015, the North American Nanohertz Observatory for Gravitational Waves (NANOGrav), of which West Virginia University is a lead member, was awarded a \$14.5 million NSF Physics Frontier Center grant to use radio timing of pulsars monitored by the GBT to detect and study gravitational waves. • Also in 2015, the State of West Virginia was awarded a \$20 million NSF Experimental Program to Stimulate Competitive Research, of which about \$9.65 million is devoted to building both physical and personnel infrastructure to allow [WVU] and other researchers in the state to enhance their ability to detect and characterize gravitational waves. • In January 2016, the West Virginia University was awarded \$364,000 by the NSF to create a three-dimensional map that will provide insight into star formation in the galaxy. • In September 2016, Associated Universities secured \$300,000 in NSF funding to undertake the FIRST TWO project, an initiative in collaboration with West Virginia University and a number of West Virginia education stakeholders to increase the STEM degree completion rate of first generation college students in [WV] with emphasis on the first two years of college. • And, for the past nine years, through NSF funding, [WVU] and the GBO have introduced thousands of high school students to the wonders of science through the (PSC) outreach program. Since its inception, WVU and GBO personnel have trained over 2000 high school students in 20 states to search for pulsars using the radio astronomy data from the GBO. The PSC allows students from all backgrounds to make personal connections with the frontiers of space and make scientific discoveries that they never thought possible such as identifying new pulsars.	Against Closure	Email - Scanned	11/22/2016	Pres. Gee GBO FINAL.pdf
797	b	E. Gordon	Gee	President, West Virginia University	West Virginia University also shares the concerns of many in the Green Bank community about the extreme economic hardships the region would face if GBO were to be closed or mothballed. The estimated annual economic impact of the Green Bank Observatory to our state is approximately \$30 million. Rightly so, the community is grappling with how it could attract an entity that would offer a comparable level of economic impact and community engagement given that most enterprises would find operating in a National Radio Quiet Zone (NRQZ) extremely challenging in today's age of connectivity. As a case in point, just fifty miles away and also located in the NRQZ, the National Security Agency recently closed the lower base of the Navy Information Operations Command at Sugar Grove, an operation that once supported approximately 330 personnel. Unfortunately, a new tenant for the Sugar Grove lower base has still yet to be identified, leaving Pendleton County's economic recovery in question. The people of this region have given up their ability to connect with the world for the operations of the GBT and Sugar Grove for more than a half century. The economy of West Virginia is in a fragile state. It would be huge disservice for the federal government to abandon yet another quality high technology operation in a remote part of West Virginia that has few options in attracting new enterprises.	Against Closure	Email - Scanned	11/22/2016	Pres. Gee GBO FINAL.pdf
797	c	E. Gordon	Gee	President, West Virginia University	While West Virginia University is contributing to the operations of GBO and pursuing research that relies on GBO, it is my hope that the NSF is continuing to aggressively seek out additional partnerships that may be necessary to fully maintain GBO during this EIS process. To supplement NSF's efforts, the University is engaged in seeking out new partnerships and research collaborations. As NSF Astronomy Division staff are aware, West Virginia University personnel accompanied Department of Defense (DOD) and NSF officials to the GBO to explore its potential as a test and evaluation site for a new DOD initiative. On the industry side, West Virginia University has had preliminary discussions with a major space corporation about its potential radio telescope needs for its future space expeditions and has facilitated an introduction with the GBO Director for more detailed conversations. Let me assure you that the University will continue to investigate any and all leads that might result in new opportunities at the GBO, and, again, hopes that NSF will not let up in its pursuits.	Alternatives Consideration	Email - Scanned	11/22/2016	Pres. Gee GBO FINAL.pdf

Green Bank Observatory -Written NSF Public Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
798	a	Eugene	Cilento	Dean, and Professor of Chemical and Biomedical Engineering	<p>As dean of the Statler College of Engineering and Mineral Resources, I am writing in support of maintaining the Green Bank Telescope (GBT) located in West Virginia. This unique radio telescope is of critical importance to the scientific community as well as the State of West Virginia. The science being done at Green Bank is at the cutting-edge of our scientific knowledge, and is playing an important role in both astrophysics research and education.</p> <p>It is the largest fully steerable structure on Earth. As such, this radio telescope is used to detect faint signals from celestial sources. The GBT is one of the newest telescopes built by the National Science Foundation. Cutting edge astronomy is being done there currently, including making ground breaking discoveries in fields as broad as quantum mechanics, the study of gravity and gravitational waves, and the search for life beyond Earth. This facility is located in an area of West Virginia that is conducive to this type of research; one where the residents sacrifice many modern conveniences (e.g., cell phones) to support the research.</p> <p>There is other broad based support for maintaining the GBT. For example, Yuri Milner, a Russian billionaire made a very significant announcement with Stephen Hawking. He pledged \$100 million to the University of California at Berkeley to search for alien life. This is an incredible private investment in science, and all the telescopes at Green Bank comprise one of only two facilities worldwide that can be used to search for such long range communications. These facilities are in great demand prompting the case for monetary resources such as this Milner gift to help researchers gain access more than a day or so each year.</p> <p>It is shortsighted and unrealistic to consider such options as deconstruction or otherwise idling this unique facility. In fact, instead of discussing these options, we should elevate the Greenbank Observatory as a major national lab that is a national treasure and among the best facilities in the world for this type of fundamental scientific research so important for the advancement and development of new technology.</p>	Against Closure	Email - Scanned	11/9/2016	Letter of suport for Green Bank - Statler College.pdf
798	b	Eugene	Cilento	Dean, and Professor of Chemical and Biomedical Engineering	<p>The GBT and facilities are excellent at detecting fast radio bursts which enable researchers to study pulsars. In fact, recently high school students from the Pulsar Search Collaboratory discovered six new pulsars. The students had a once in a lifetime experience and were even given the opportunity to explain their pulsar research to President Obama at the White House. Imagine the sense of pride and accomplishment these high school students felt to discuss the amazing discovery they made! And, their experience was recently featured in an award winning documentary called "Little Green Men" (http://gmfilm.com).</p> <p>A faculty member who directed a summer Science Academy for high school students for fifteen years commented at a ceremony that if he had access to such an amazing scientific resource he could have kept nearly all the students as STEM majors and the ones who did not would have been fans of science for life. Keep in mind that over 3,500 students get a chance to use the GBT facilities, so this is good for STEM education in the U. S.</p>	Against Closure	Email - Scanned	11/9/2016	Letter of suport for Green Bank - Statler College.pdf
798	c	Eugene	Cilento	Dean, and Professor of Chemical and Biomedical Engineering	<p>The Green Bank Observatory welcomes over 50,000 visitors to experience this facility annually. The use of this facility for science also has huge economic impact for the State of West Virginia and region. This is critical for a State in serious need of economic development.</p> <p>In summary, the Green Bank Observatory provides opportunity that changes lives and demonstrates the best America has to offer. This facility is contributing to innovation, economic prosperity, and is a serious tool available to scientist worldwide. It promotes community and excites young men and women to pursue science careers. As a College we urge the NSF to at least continue the current level of support for the research and education being done at the Green Bank Observatory. This is truly a unique facility that has much to offer the country in remaining a competitive world leader in science and technology.</p>	Against Closure	Email - Scanned	11/9/2016	Letter of suport for Green Bank - Statler College.pdf
799		Gay	Stewart	Director, WVU Center for Excellence in STEM Education Professor of Physics and Eberly Professor of STEM Education, West Virginia University	<p>In 2014, I made what was frankly a dramatic change in my career to come to West Virginia and be part of turning a state around in terms of STEM education. I felt this was a state that needed such change, and could provide a national model for doing so. The educational and economic indicators in the state may lead one to doubt such a thing was possible, but The Pulsar Search Collaboratory (PSC) through WVU and the Green Bank Observatory was one of the features that led me to believe this could be done. Just last year, this program has been extended through an AISL program to reach more students.</p> <p>Roughly 2,100 students have been a part of the PSC. In a state with the lowest college degree rate for those under 25 years of age, PSC students intend to major in STEM fields: 99% are either in college or plan to go to college, and 68% intend to receive an advanced STEM degree (doctorate (45%), master's (17%), medical school (6%)) and 62% report good to great increases in STEM career awareness. Approximately 50% of these participants are female or underrepresented minority students.</p> <p>Green Bank Observatory has since my arrival been central to other initiatives in STEM Education. They are the lead organization in our successful NSF INCLUDES grant, Improving STEM Persistence in the First Two Years of College. West Virginia lies completely within Appalachia, an area of great rural poverty. West Virginia's college-going rate is low, STEM course taking in high school is even lower. The efforts of these programs, which rely on the robust research being carried out at Green Bank Observatory for their vitality, is moving the needle for these young people. The impact is far reaching: Imagine breaking the cycle of poverty for the families and communities of these young people! So many Appalachian students have no exposure to STEM careers outside of the mineral extraction industries, which are in a downward spiral. We are working hard to grow a generation of highly qualified mathematics and science teachers for Appalachian public schools, but the need is great, and will not be satisfied in just a short time. Green Bank Observatory serves as a nucleus for efforts to build the STEM pipeline in Appalachia. This is key to our future educational goals, and thus to prepare the future STEM workforce.</p> <p>If I can provide you with any further information, please feel free to contact me at (304) 293-5032 (direct line), (479) 445-2402 (cell) or gbstewart@mail.wvu.edu.</p>	Against Closure	Email - Scanned	11/7/2016	Gay Stewart GBT Final.pdf

Green Bank Observatory -Written NSF Public Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
800		Laura	Gibson	Senior Associate Vice President for Research and Graduation Education Associate Dean for Research; School of Medicine Alexander B. Osborn Distinguished Professor	As the Senior Associate Vice President for Health Sciences Research and Graduate Education at West Virginia University 's Health Sciences Center (HSC), and most importantly, as a native West Vir ginian, I am writing to express my strong support for the Green Bank Observatory (GBO). My role at WVU HSC and growing up in West Virginia has given me a unique perspective of the importance of the novel physical and personnel infrastructure that exists at GBO. It serves as a beacon of scientific exposure, investigation, and discovery for young citizens in the state and region. West Virginia is known for being " wild and wonderful" with a robust history that emphasizes our pride and tenacity. Though our culture and nature prove rich and abounding, having diverse educational opportunities can be challenging. Despite our commitment to education, regional resources that provide formative educational experiences to someone in a more urban area are simply not the same in West Virginia. It is in this way that many West Virginians depend upon the existence of GBO. From a young age, West Virginia students across the state have the opportunity to begin learning about the unique scientific treasure that is GBO. A student' s first chance to see the Green Bank Telescope and experience the GBO Science Center leaves quite an impression of awe and wonder. In these first encounters, either in the classroom or at Green Bank, students begin to develop a sense of quite how big the world is, how big space is, and how much there is still left to be discovered. Not every student who le arns about or visits Green Bank has a direct affinity for astronomy, space, or pulsars, but make no mistake the GBO does provide a formative connection to the spirit of inquiry and learning that is the foundation of much of the STEM disciplines. A student may take a field trip to GBO a few times for science class during the academic year, but they may return independently any number of times for events like science camps focusing on astronomy, engineering, or coding; guest speakers; or even community events. GBO couples its status as home to world-class scientific instruments with its ability to be a community, state, and regional resource to ultimately serve as a catalyst for science and STEM education. There are numerous stories of students that continued their education in the STEM disciplines after their experiences at GBO. These very same students have become engineers, physicists, astrophysicists, professors, computer scientists, to name a few. Their careers may have been notably different had they not had the chance to experience STEM in action at Green Bank. In an area where opportunities are critical and in a state where investments can provide hope and a better future, the National Science Foundation's continued operation of the Green Bank Observatory significantly impacts the future prospects of many children in our state. The National Science Foundation has noted its commitment to promoting science while advancing prosperity, healthcare, and national defense all in pursuit of transfonning the future. I say that in few other places can continuing investment allow NSF to so directly address their mission - promoting science and advancing prosperity and healthcare - as it can at Green Bank Observatory. Providing students, both young and old, the chance to know and study STEM fields promotes science. Exposing students to STEM creates additional educational and career possibilities, which advances prosperity. And, as we know, educated, employed, and prosperous adults attain personal and familial health that can spread throughout communities. In summary, the Green Bank Observatory is not only a point of pride for West Virginia, it is also an integral part of science, technology, engineering, and math education and exposure in the state. In a state that faces uncertain economic futures and challenges of rural America, the Green Bank Observatory is, and I hope will continue to be, a vital tool in spurring educational, social, and economic opportunities for all students in West Virginia, the region, and the Nation. In this way, I reiterate my strong support for the continued existence and operation of Green Bank Observatory in West Virginia.	Against Closure	Email - Scanned	11/21/2016	
801	a	Debbie	Ervine		When I heard about the proposed changes to the Green Bank Observatory, my first thoughts, of course, are on the impact to our community. If we lost the observatory, our community would be devastated!!! We have a very unique & wonderful community here in the Green Bank area. The observatory is the center of our community. If the center is gone, the rest will fall apart. The employees at the observatory contribute to our fire & rescue departments, churches, local radio station, schools, and other organizations in our community. Without the help from the GBO and the GBO employees, most of these organizations would no longer exist in our community. What would our community do???? I think about the doctor's offices, dentist office & hospital. These could very easily have to close without the GBO in our community.	Against Closure	Email - Scanned	11/21/2016	Debbie Ervine.pdf
801	b	Debbie	Ervine		Economically & financially, the observatory contributes a tremendous amount of money into our community, county & state. I have lived in the Green Bank area for all of my life. I am the branch manager of the bank that is across the street from the observatory. My husband owns Trent's Store in Arbovale. Both of these businesses, along with other businesses in Pocahontas County, depend heavily on the observatory. I can't even begin to think what would happen if the observatory were to close.	Against Closure	Email - Scanned	11/21/2016	Debbie Ervine.pdf
801	c	Debbie	Ervine		The GBO contributes greatly to the education of the students in our county, state & nation. When I went to the meeting that was held on November 9 at GBO, I was so amazed at what the students & professors from WVU had to say about how the GBO had impacted their lives. The GBO has made a difference in our community, county, state, nation & world!!!!!! It would be a tremendous loss to lose this facility!!! I strongly believe that option number 1, which is the No---Action Alternative, is the absolute best option for everyone concerned. If you have any questions about anything I have said in this letter, please feel free to contact me.	Against Closure	Email - Scanned	11/21/2016	Debbie Ervine.pdf

Green Bank Observatory -Written NSF Public Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
802	a	R. Gregory	Dunaway	Dean,Eberly College of Arts and Sciences	<p>I am the Dean of the Eberly College of Arts and Sciences, the largest college at West Virginia University (WVU) in Morgantown, West Virginia. WVU was founded in 1867, and is the flagship land-grant, doctoral degree-granting research university in West Virginia. Today, WVU consists of 15 colleges and schools offering 185 bachelors, masters, doctoral, and professional degree programs to approximately 30,000 students, and as the only West Virginia institution classified by the Carnegie Foundation as doctoral granting, Research High, the university occupies a unique position within the state.</p> <p>I am writing this letter in response to the National Science Foundation (NSF) invitation for public comment on the preliminary proposed alternatives and resource areas identified for analysis for proposed changes to the Green Bank Observatory Operations, in Green Bank, West Virginia. I would implore you to continue investment of the Green Bank Observatory for science-focused operations and collaboration with interested parties for science and education focused operations.</p> <p>As our nation becomes increasingly dependent on technology, there is a critical need for skilled workers with backgrounds in science, technology, engineering, and mathematics fields. The Green Bank Observatory is of critical importance to the scientific and education community in West Virginia, the United States, and the world. Since 2006, WVU has been awarded \$14.5 million, including \$4.7 million to support a Physics Frontier Center, for Green Bank Observatory related research. WVU faculty, postdocs, and students were competitively awarded over 2,300 hours of Green Bank Telescope time, which resulted in 19 publications in 2016 alone.</p> <p>Further, the education programs of the Green Bank Observatory are impacting countless children across a state that is in desperate need of scientific role models. Specifically, over 2,100 high- school students have participated in the NSF funded collaboration between the National Radio Observatory and WVU, titled the Pulsar Search Collaborative, of those students, 99% are either attending college or plan to attend college, and 68% intend to pursue post-secondary education. Approximately 50% of those students are underrepresented minorities.</p>	Against Closure	Email - Scanned	11/18/2016	Dean Dunaway GBO Letter FINAL.pdf
802	b	R. Gregory	Dunaway	Dean,Eberly College of Arts and Sciences	<p>The observatory has been instrumental in recent astronomy discoveries, such as work on the direct detection of gravitational waves, and because of its location in the National Radio Quiet Zone, it is the only instrument capable of continuing research at redshifts to constrain the expansion rate of the Universe and the nature of Dark Energy. These are just a few examples of the work that would be difficult or impossible to make with any other telescope.</p> <p>In short, the Green Bank Observatory partnerships advance discovery and understanding while promoting teaching, training, and learning to underrepresented groups, while also enhancing the infrastructure for research, education, and economic development. It is for these reasons that I strongly encourage continued NSF investment for science-focused operations at the Green Bank Observatory.</p>	Against Closure	Email - Scanned	11/18/2016	Dean Dunaway GBO Letter FINAL.pdf
803		Gypsy	Denzine	Dean , College of Education and Human Services	<p>It is with great enthusiasm I submit my letter of support for continued funding for the National Radio Astronomy Observatory (NRAO) in Green Bank, West Virginia. I have personally visited the Green Bank Telescope and the Green Bank Science Center, so I can speak to the high quality educational outreach programs at the site. For example, the telescope tours motivate children to learn about radio waves and observe fundamental chemistry and physics. Moreover, local science teachers in Pocahontas County are able to use the Green Bank Telescope as a teaching tool for units in star formation, cosmic chemistry, and the origins of life. The RFI-restricted Zone provides a terrific learning opportunity for students in Pocahontas and nearby counties. One of the many strengths of the Green Bank Science Center is that telescope tours are offered year round.</p> <p>While many of the educational outreach programs are free, the programs that charge a fee do so at a very low cost. For example, Star Lab Fridays only cost participants \$3 per person. This is important because the most recent United States Census Bureau shows the median household incomes in 2014 in Pocahontas County was \$34,761 and the poverty rate was 17.6%. Thus, having affordable after-school and summer enrichment programs is imperative for families living in Pocahontas County. The fact that the telescope tour is free for children under the age of 10 is perhaps the best educational outreach program in the state of West Virginia. I note, the NRAO has been a very good educational partner. For example, NRAO recently provided space for the Regional Math Field Day that was comprised of children, families, and teachers from 6 West Virginia Counties.</p> <p>We are very excited about the potential for future collaborations with the NRAO due to the opening of the WVU Tech campus in Beckley, WV. In fall 2016, the WVU Tech campus was moved from Montgomery, WV to Beckley, WV. The Green Bank Telescope is located 119 miles from Beckley, WV. The proximity of the Green Bank Telescope to our regional WVU campus will allow us to consider more outreach activities for students, families, and teachers. West Virginia University is also heavily engaged in The Summit Bechtel Reserve (http://www.summitbsa.org/), which is located 132 miles from the Green Bank Telescope. We anticipate many collaborative projects between WVU Tech, The Summit Bechtel Reserve, and the National Radio Astronomy Observatory. For example, when The Summit hosts the 2017 National Scout Jamboree, we know that thousands of visitors will come to WV in July 2017. The planning team for the Jamboree have developed tourism guides for scouts and families that includes visiting the Green Bank Telescope.</p> <p>In conclusion, the NRAO and Green Bank Science Center are an educational and tourist gem in a beautiful, but economically stressed, part of West Virginia. The Green Bank Telescope is to WV what the Statue of Liberty is to New York. The Telescope is recognizable, children find it "awesome", and it puts West Virginia on the map for STEM education and innovation.</p>	Against Closure	Email - Scanned	UNK	Dean Denzine GBO Letter FINAL.pdf
804		Traves	Lewis		**No written comment. Submittal was a single image of an art project.	Against Closure	Email attachment	UNK	GBT_Traves Lewis.pdf
805		Emily	Rimm		**No written comment. Submittal was a single image of an art project.	Against Closure	Email attachment	UNK	GBO_Emily Rimm.pdf
806		Jesse	Johnson		**No written comment. Submittal was a single image of an art project.	Against Closure	Email attachment	UNK	GBO_Jesse Johnson.pdf
807		Gabe	Arnold		**No written comment. Submittal was a single image of an art project.	Against Closure	Email attachment	UNK	GBO_Gabe Arnold.pdf
808		Caitlin	Mallow		**No written comment. Submittal was a single image of an art project.	Against Closure	Email attachment	UNK	GBO_Caitlin Mallow.pdf

Green Bank Observatory -Written NSF Public Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
809		Michael Connor	Kane Taylor		**No written comment. Submittal was a single image of an art project.	Against Closure	Email attachment	UNK	GBO_Michael Kane and Connor Taylor.pdf
810		Dave	Huber	Director of Program Operations	<p>NROCKS Outdoor Adventures, along with our parent company Endless Horizons, are very interested in the continual operation of the Greenbank Observatory(GBO). For over 30 years, Endless Horizons has focused on creating lifelong learning and growth opportunities for our Nation's youth through our operation of Summer Camps, Outdoor Learning Centers and Job Corp Centers in both Virginia and West Virginia.</p> <p>Throughout our endeavors, we continue to invest in our local region and its people. NROCKS Outdoor Adventures, located in Circleville WV, is an extension of this work. Since 2009 we have continued to invest and expand within Pendleton County. We would not be as successful without our regional partners such as the GBO. It is the combination of attractions and activities in our region that have set us apart as a destination experience. Without such a key player as the GBO, we will all certainly feel the consequences. Beyond the scientific significance of this site and the economic impact to the region, a closure of this facility would result in a negative impact on WV's educational system.</p> <p>As we have reviewed the various alternative uses, we believe the only two options that are viable are continued funding at the current level, or Option 2 – collaboration with interested parties and only a slightly reduced rate of funding from the National Science Foundation.</p> <p>We support the continued operation of the GBO and look forward to a successful resolution to maintain the current level of operations.</p>	Against Closure	Email- scanned and Letter - mailed	11/14/2016	Dave Huber.pdf
811		Multiple	Multiple (See list of names in body of comment)	4-H Kanawha County WVU extension	<p>Over 50,000 visitors and 3500 students visit Green Bank a year. We the Plane Janes GWC at 4-H Kanawha County WVU extension visited Green Bank. The level of education program and the staff dedication was superb. We were able to do scientific research.</p> <p>Best regards, Isabel Bombandiere, GWC Facilitation, Jeannette A. Bombandiere, Radnel Coffield, Farah Kisto, Kayla Lucas, Arwa Sidding, Aya Hasino, Hannah Mullins, Sherry Suint, Grace Mullins, Ari Swint, and Askya Patterson</p>	Against Closure	Letter - mailed	UNK	
812	a	MG James	Hoyer	Major General, WVARNG The Adjutant General	<p>I would ask that the National Science Foundation continue their financial support for the Green Bank Observatory. The Observatory has made discoveries in scientific knowledge which have led in extraordinary advancements in understanding our universe. The present telescope began regular science operation in 2001 and is now used for astronomy about 6500 hours every year and 2000-3000 hours per year going to high-frequency science. Its flexibility and ease of use allows for rapid response to new scientific ideas.</p> <p>I ask that you continue funding the Green Bank Observatory so it continues to remain on the cutting edge of astronomy, can still make discoveries in quantum mechanics, the study of gravity and in the search for life beyond Earth.</p>	Against Closure	Letter - mailed	11/15/2016	
812	b	MG James	Hoyer	Major General, WVARNG The Adjutant General	The Green Bank Observatory affects the careers of over 900 astronomers and brings in an estimated \$30M annually in economic benefits to Pocahontas County in West Virginia.	Against Closure	Letter - mailed	11/15/2016	
813		Jill	Molin		Continuation of Green Bank Observatory in West Virginia is vital not only for its services but for survival of the whole area. It carries the community and surrounding space completely, from jobs to schools and all industry. Please don't let an entire area be wiped out!!!	Against Closure	Letter - mailed	11/6/2016	
814	a	Kay	Goodwin	Cabinet Secretary	I am writing to urge continued funding of the Green Bank Observatory by the National Science Foundation. Since its inception in 2001, this exceptional facility put West Virginia at the forefront of international, collaborative, cutting-edge research. The Green Bank telescope is one of the National Science Foundation's newest large telescopes and remains the vanguard of astronomy, making groundbreaking discoveries in fields as broad as quantum mechanics, the study of gravity, and the search for life beyond our planet. The research conducted at Green Bank could transform our understanding of our vast universe.	Against Closure	Letter - mailed	11/12/2016	
814	b	Kay	Goodwin	Cabinet Secretary	In addition to its significance in the global community of science and research, The Green Bank Observatory serves as a powerful tool to improve STEM education in West Virginia. Students visiting the facility have the opportunity to participate in the Pulsar Search Collaboratory using data collected by radio telescopes at the facility allowing them to gain important scientific and mathematical skills as a result. Just last year, more than fifty-four groups spent at least one night at Green Bank using the forty foot telescope and taking part in the facility's unique STEM education programs. In addition, fourteen different week-long residential educational workshops were held at Green Bank last year along with four groups comprising West Virginia science teachers, high school students, college students, and the general public. Citizens travel from all across West Virginia, the nation and the world to learn at the Green Bank Observatory. Collaborative projects with the observatory allow West Virginia's students to gain hands-on experiences while also making real contributions to the scientific community through their classwork and projects completed during site visits. Clearly, the Green Bank Observatory has a profound impact on West Virginia students and STEM education.	Against Closure	Letter - mailed	11/12/2016	
814	c	Kay	Goodwin	Cabinet Secretary	The Green Bank Observatory is a source of pride for all West Virginians. The facility attracts more than 50,000 curious visitors each year which generates a good measure of economic development opportunities, as well as igniting positive impressions of our state.	Against Closure	Letter - mailed	11/12/2016	

Green Bank Observatory -Written NSF Public Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
815		Sue	Howard	Community Member	<p>There is a relatively large community of people who have been injured by wireless radiation and who have sought refuge in the Green Bank area. These people suffer from a very real and debilitating medical condition known as Electrohypersensitivity (EHS). This is also known as Radiowave sickness or Microwave Syndrome. I never ever thought this could happen to me, but it did. And now, I am here in Green Bank, trying to find a way to live in peace. Sadly, experts now say that due to the proliferation of wireless-everything in today's world, many more people will develop this devastating condition. And that as many as 3 to 5 percent of the world's population already has.</p> <p>After years of suffering, I am very grateful to have found a safe haven in the National Radio Quiet Zone, where I am able to live, sleep, work, and play without constant sickness and pain.</p> <p>I ask you, in a world now filled with overlapping, omnipresent radiofrequency and pulsed microwave technologies, where exactly do you think these people should go if the Green Bank Observatory were to close? For us, this is not about losing a job or having to move. This is about our very survival. If the GBO were to close, would the National Science Foundation help relocate us to another quiet zone? Is there another quiet zone?</p> <p>I would like to suggest that instead of decreased funding, why not increase funding and not miss out on this golden opportunity to study the effects of wireless radiation on human, animal, and plant biology? You could use the Green Bank residents as a control group, as wireless-free control groups are rapidly vanishing from our planet.</p> <p>The Green Bank Observatory, within the National Radio Quiet Zone, is a rare and precious place. It is a historic landmark and endangered species, if you will. Once it's gone, there is not getting it back. Industry would seep through like a tidal wave and people's lives would be devastated.</p> <p>I leave you to ponder this one final thought; what will you do when one of your loved ones, perhaps a child or grandchild, develop EHS? Will you sit them down and tell them the story of Green Bank? How once upon a time there was a magical little town...but it no longer exists...And I have something to do with that?</p> <p>Or maybe you won't have to. Maybe, with your help, this magical place will still be here as a safe haven for them as well.</p> <p>Thank you for your time and consideration on this most 'sensitive' matter.</p>	Against Closure	Letter - mailed	11/16/2016	
816		Dustin	Madison	NRAO Jansky Postdoctoral Fellow North American Nanohertz Observatory for Gravitational Waves	<p>I write you today to advocate for continuing scientific operations at the Green Bank Observatory (GBO) largely as is. The Robert C. Byrd Green Bank Telescope (GBT) is a singular and powerful scientific tool that is in the prime of its life. GBO provides opportunities to train young radio astronomers in observational techniques and facilitates the testing of innovative new radio astronomy hardware that is, frankly, more difficult or infeasible to do at interferometric facilities such as the Karl G. Jansky Very Large Array. The location, with its strict restrictions on radio transmitters, is becoming rarefied and sacred ground for radio astronomers. GBO provides crucial STEM education and outreach for Pocahontas County and the greater Appalachian Mountain community. Mothballing or dismantling the telescope would be tragic for the American astronomy community and Pocahontas County. Dramatically reducing the amount of open-skies time at GBO would also be detrimental to the astronomy community, not only because it would reduce scientists' access to what is arguably the best single-dish radio telescope in the world, but also because it would advance the unfortunate movement towards the privatization of science. It will be a sad day when the best scientific instruments in the world are completely co-opted by industrial/defense contractors or the whims of billionaires.</p> <p>In addition to the broad detriments of shuttering GBO that I just discussed, it would also directly hurt my career and would essentially doom my research collaboration. I received my PhD a year and a half ago having conducted research on how monitoring an array of millisecond pulsars over decadal time scales can lead to the direct detection of extremely low-frequency gravitational waves generated by the most massive black holes in the Universe. My collaboration, The North American Nanohertz Observatory for Gravitational Waves (NANOGrav) consists of over 100 scientists distributed over more than 30 institutions in the United States and Canada. We rely exclusively on data collected at GBO and Arecibo, which is currently up against comparable existential threat. Both telescopes are extremely important for our science. Arecibo is the most sensitive radio telescope in the world and provides us with much of our very best data, but since the GBT is itself incredibly sensitive and fully-steerable, it can see many more pulsars than Arecibo. GBO is, in my opinion, more critical for the success of our scientific mission and we need it for years to come. I will conclude with a story that has nothing to do with NANOGrav or the broader American radio astronomy community. This is entirely personal. I consider myself an astrophysicist, but I am much more a physicist than an astronomer. All of my degrees are in physics and much of my dissertation work was theoretical. As I began my postdoctoral fellowship at The National Radio Astronomy Observatory, I committed myself to advancing my abilities as an observational astronomer. This past summer I attended many conferences and heard many talks. I synthesized some of the information I learned into an original idea to look for a particular class of radio transients at the sites of short gamma-ray bursts. I developed a science case and submitted a proposal for 50 hours of GBT time in the first half of the coming year. I was recently awarded that time for which I am extremely happy and proud. However, a week after submitting that proposal, one of the closest short gamma-ray bursts ever observed occurred at a quite high northern latitude, a place in the sky for which the GBT is undoubtedly the best and most sensitive radio telescope in the world. I submitted a target-of-opportunity proposal to GBO. It was reviewed and accepted the next day. Shortly thereafter, I got 10 hours of GBT time yielding 2.5 terabytes of data. I am currently analyzing that data and cannot yet tell you if I have found what I sought to find. I can tell you that hours-long spans of the data are gorgeous, suffering from negligible amounts of well-understood radio-frequency interference. I can tell you that the staff at GBO were enormously responsive and helpful to this early-career scientist. I can tell you that this experience has made much more of an astronomer out of this physicist. It has been very professionally and personally fulfilling. I feel deeply that this has been a model for how science should be done. Please do all that you can to preserve GBO.</p>	Against Closure	Letter - mailed	11/18/2016	

Green Bank Observatory -Written NSF Public Comments

Comment Number	Segment Number	First Name	Last Name	Affiliation	Comment	Category	Comment Source	Date Comment Received	Attachments
817		Carol	Polan		<p>I have three young granddaughters who have not had the chance to explore the galaxy from Greenbank.</p> <p>All of my children had this chance, one is a doctor, one a surgical nurse and one a historian.</p> <p>To visualize science as my children did at an early age at Greenbank Observatory was magic. Science can happen in rural WV and must continue.</p> <p>The economic impact is just a shadow compared to the absence of technology in the unique manner the observatory gives not just W VA but the world S.T.E.M. is the new buzz in education, how dare The National Science Foundation remove our jewel.</p>	Against Closure	Letter - mailed	11/12/2016	

Appendix 5-E
List of Research Papers

List of Research Papers

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