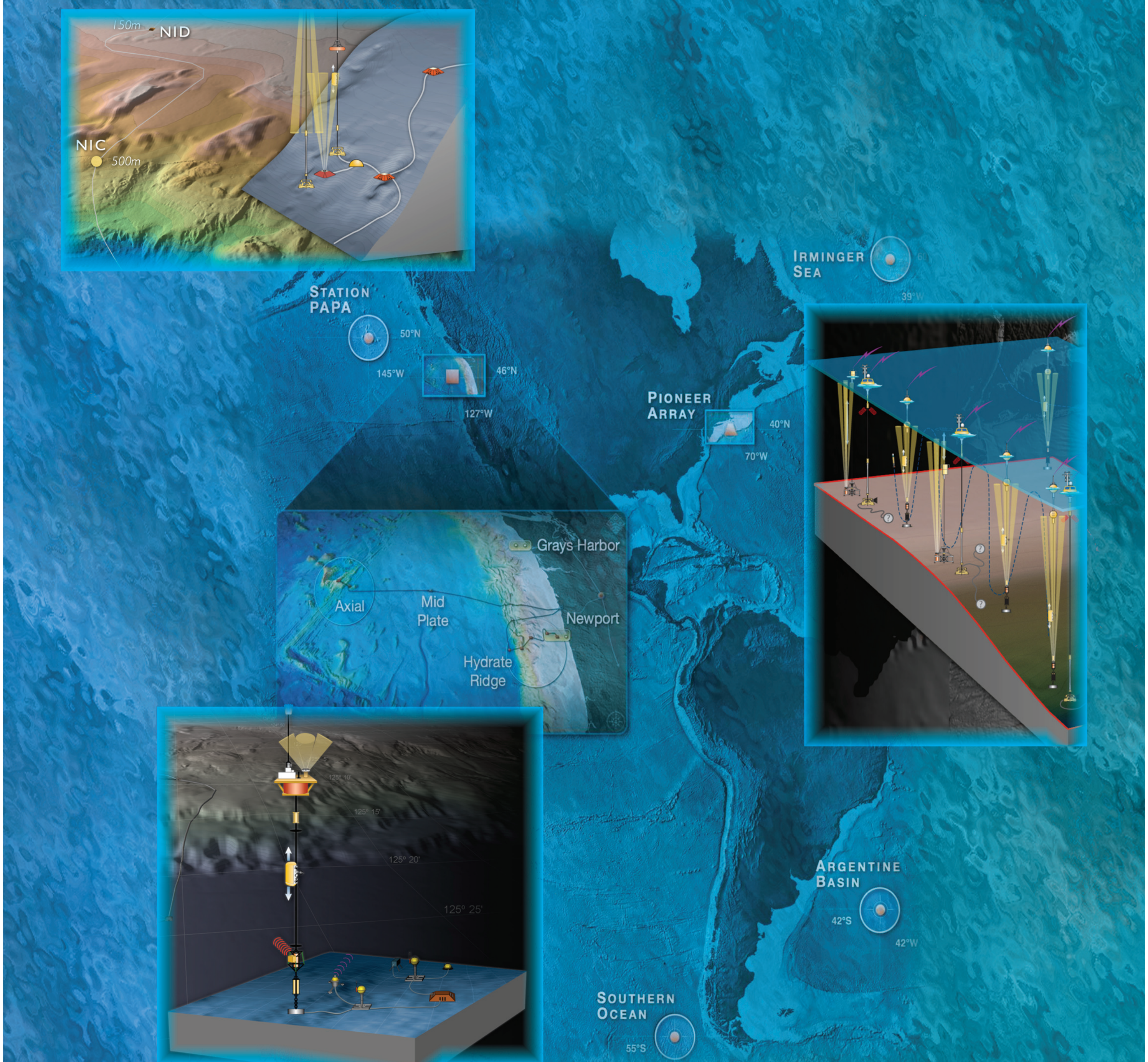
Draft

Site-Specific Environmental Assessment for the National Science Foundation-Funded Ocean Observatories Initiative (OOI)



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Acronyms and Abbreviations

ADCP	acoustic Doppler current profiler
ADV	acoustic Doppler velocimeter
AWOIS	Automated Wreck and Obstruction Information System
AUV	autonomous underwater vehicle
BAP	bio-acoustic profiler
BMH	beach manhole
BMPs	Best Management Practices
CDOM	colored dissolved organic matter
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
CGSN	Coastal/Global-Scale Nodes
CO_2	carbon dioxide
CPS	Coastal Pelagic Species
CSLC	California State Lands Commission
CSN	Coastal-scale Nodes
CTD	conductivity-temperature-depth
CWA	Clean Water Act
CZMA	Coastal Zone Management Act
DA	Double Armored
DAS	days at sea
dB	decibels
dB re 1µPa @ 1 m	decibels reference 1 micropascal at 1 m
DoD	Department of Defense
DPS	Distinct Population Segment
EA	Environmental Assessment
EEZ	Exclusive Economic Zone
EFH	Essential Fish Habitat
EIS	Environmental Impact Statement
EOM	electrical-optical-mechanical
ESA	Endangered Species Act
ESU	Evolutionary Significant Unit
FACT	Fisherman Advisory Committee for Tillamook
FERC	Federal Energy Regulatory Commission
FINE	Fishermen Involved in Natural Energy
fm	fathom
FMC	Fisheries Management Council
FMP	Fisheries Management Plan
FND	Final Network Design
FONSI	Finding of No Significant Impact
ft	foot/feet
GSN	Global-scale Nodes
ha	hectare(s)
HDD	horizontal directional drilling
HMS	Highly Migratory Species
HPIES	horizontal electrometer-pressure-inverted echosounder
ICPC	International Cable Protection Committee
IOOS	Integrated Ocean Observing System
kg	kilogram(s)
kHz	kilohertz
km	kilometer(s)
lbs	pounds
LVN	Low-voltage Node
LW	Lightweight
LWA	Light-wire Armored
m	meter(s)
MARS	Monterey Accelerated Research System
MBES	multibeam echosounder
MBNMS	Monterey Bay National Marine Sanctuary
MFN	Multi-function Node
MHz	megahertz
mm	millimeter(s)
MMPA	Marine Mammal Protection Act
MOTB	Mobile Ocean Test Berth
MREFC	Major Research Equipment and Facilities Construction
ms	millisecond
MSA	Magnuson-Stevens Act
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act
nm/nm^2	nautical mile/square nautical mile
NMFS	National Marine Fisheries Service
NMSA	National Marine Sanctuaries Act
NNMREC	Northwest National Marine Renewable Energy Center
NOA	Notice of Availability
NOAA	National Oceanic and Atmospheric Administration
NOTMAR	Notice to Mariners
NPDES	National Pollutant Discharge Elimination System
NRC	Natural Resources Consultants
NRHP	National Register of Historic Places
NSF	National Science Foundation
O&M	Operations and Maintenance
ODEQ	Oregon Department of Environmental Quality
OEIS	Overseas Environmental Impact Statement
OFCC	Oregon Fishermen's Cable Committee
OOI	Ocean Observatories Initiative
OrCOOS	Oregon Coastal Ocean Observing System
OSU	Oregon State University
PA	Programmatic Agreement
PAR	photosynthetically available radiation
PATON	Private Aid to Navigation
PEA	Programmatic Environmental Assessment
PN	Primary Node
ROI	Region of Influence
ROV	remotely operated vehicle
RSN	Regional-scale Nodes
SBP	sub-bottom profiler
SER	Supplemental Environmental Report
SHPO	State Historic Preservation Officer
SOP	Standard Operating Procedure
SPA	Special Applications
SSEA	Site-Specific Environmental Assessment
SWPPP	Storm Water Pollution Prevention Plan
TRF	trawl resistant frame
U&A	Usual and Accustomed
UNOLS	University-National Oceanographic Laboratory System
µs	microsecond
U.S.	United States
USACE	U.S. Army Corps of Engineers
USC	United States Code
USCG	U.S. Coast Guard
USEPA	U.S. Environmental Protection Agency
USFWS	U.S. Fish and Wildlife Service
UW	University of Washington
VENUS	Victoria Experimental Network Under the Sea
VOO	vessel of opportunity
WD	water depth

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SITE-SPECIFIC ENVIRONMENTAL ASSESSMENT FOR THE OCEAN OBSERVATORIES INITIATIVE

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EXECUTIVE SUMMARY

This Draft Site-specific Environmental Assessment (Draft SSEA) has been prepared by the National Science Foundation (NSF) to assess the potential impacts on the human and natural environment associated with proposed site-specific requirements in the design, installation, and operation of the Ocean Observatories Initiative (OOI) that were previously assessed in a Programmatic Environmental Assessment (PEA) and a Supplemental Environmental Report (SER).

This Draft SSEA has been prepared in compliance with the National Environmental Policy Act (NEPA) of 1969 (42 United States Code 4321 et seq.), the Council on Environmental Quality (CEQ) Regulations for Implementing the Procedural Provisions of NEPA (Title 40 Code of Federal Regulations [CFR] 1500-1508), and NSF procedures for implementing NEPA and CEQ regulations (45 CFR 640). The NEPA process ensures that environmental impacts of proposed major federal actions are considered in the decision-making process.

ES.1 Previous Environmental Compliance Documentation – PEA and SER

Because the OOI action would occur over several different locations across the Atlantic and Pacific oceans and would be phased in over time, it was determined that an initial programmatic approach would be the most efficient in terms of overall analysis and, hence, a PEA was prepared in 2008. A programmatic analysis at a conceptual level of detail provided early identification and analysis of potential impacts, methods to mitigate anticipated impacts, and a strategy to address issue areas at a tiered level if necessary.

Preparing the PEA served several purposes. First, it provided a format for a comprehensive impact analysis of the planned OOI activities as a whole. This was accomplished by assembling and analyzing the broadest range of potential direct, indirect, and cumulative impacts associated with all proposed OOI activities in the Region of Influence (ROI). The PEA also set up a framework for addressing the time- and location-specific aspects of the proposed OOI, as well as more detailed technical information (when it becomes available) through site-specific tiered EAs (e.g., this Draft SSEA) or other environmental documentation (e.g., the SER). Tiering of environmental documents in this manner makes subsequent documents of greater use and meaning to the public as the OOI and associated research develops, without duplicating paperwork and analysis from a previous assessment.

The PEA analysis concluded that installation and operation of the proposed OOI as presented in the 2008 Final PEA would not have a significant impact on the environment and a Finding of No Significant Impact (FONSI) was signed on February 4, 2009. The SER was prepared in April 2009 to assess the potential impacts on the environment associated with proposed modifications in the design, installation, and operation of the OOI since the completion of the PEA. The SER analysis concluded that the proposed changes in the design, installation, and operation of the OOI as presented in the 2008 Final PEA would not result in additional impacts to the environment.

ES.2 Scope of this Draft SSEA

The scope of the environmental impact analysis of this Draft SSEA is tiered from the previously prepared PEA, associated FONSI, and SER. It focuses only on those activities and the associated potential impacts, including cumulative impacts, resulting from the site-specific installation and operation and maintenance (O&M) of OOI assets not previously assessed in the PEA and SER. Installation of OOI assets would be completed by 2015. If the scope and nature of proposed OOI activities have not changed since the preparation of the PEA and SER or there has been a reduction in scope of activities originally proposed and assessed in the PEA and SER, then additional environmental impact analysis under NEPA and other environmental compliance requirements (e.g., Endangered Species Act, Marine Mammal Protection Act, etc.) is not necessary. The impact analysis, including the FONSI, and associated Letters of Concurrence from federal regulatory agencies (e.g., National Marine Fisheries Service, U.S. Fish and Wildlife Service are still valid and applicable for the Proposed Action as described in this Draft SSEA. However, if the proposed site-specific activities associated with the proposed installation and operation of the OOI (i.e., the Proposed Action described in this Draft SSEA) potentially impact additional or larger areas or include activities not previously proposed in the PEA and SER, then the appropriate impact analysis is presented in this Draft SSEA and reinitiation of associated consultations with federal regulatory agencies, as applicable and appropriate, would occur.

ES.3 PROJECT BACKGROUND

To provide the U.S. ocean sciences research community with the basic sensors and infrastructure required to make sustained, long-term, and adaptive measurements in the oceans, the NSF's Ocean Sciences Division developed the OOI from community-wide, national, and international scientific planning efforts. OOI builds upon recent technological advances, experience with existing ocean observatories, and lessons learned from several successful pilot and test-bed projects. The proposed OOI would be an interactive, globally distributed and integrated network of cutting-edge technological capabilities for ocean observatories. This network of sensors would enable the next generation of complex ocean studies at the coastal, regional, and global scale. OOI would complement the broader effort to establish the proposed operationally focused national system known as the Integrated Ocean Observing System (IOOS). As these efforts mature, the OOI integrated observatory would be NSF's contribution to the National IOOS initiative and in turn would be a key and enabling U.S. contribution to the international Global Ocean Observing System (GOOS) and the Global Earth Observation System of Systems (GEOSS).

The OOI infrastructure would include cables, buoys, deployment platforms, moorings, junction boxes, and mobile assets (i.e., autonomous underwater vehicles [AUVs] and gliders). The infrastructure would be powered by solar, wind, fuel cells, and undersea cabled power supplies. The two-way communication systems would allow near real-time availability of oceanographic and meteorological data via the Internet. This large-scale infrastructure would support sensors located at the sea surface, in the water column, and at or beneath the seafloor. The initiative would also support related elements, such as unified project management, data dissemination and archiving, modeling of oceanographic processes, and education and public engagement activities essential to the long-term success of ocean science.

The OOI represents a significant departure from traditional approaches in oceanography and a shift from expeditionary to observatory-based research. It would include the first U.S. owned and managed multi-node, regional-scale cabled observatory array; long-term coastal arrays coupled with AUVs and gliders; and advanced buoys for interdisciplinary measurements, especially for data-limited areas of the Southern Ocean and other high-latitude locations. The OOI Project Office is managed by the Consortium for Ocean Leadership and funded through a cooperative agreement with NSF through the NSF's Major Research Equipment and Facilities Construction (MREFC) account. NSF's MREFC account is an agency-wide account to provide funding to establish major science and engineering infrastructure projects. NSF makes awards to external entities, primarily universities, consortia of universities, or non-profit organizations to undertake construction, management, and operation of large facilities. Such awards frequently take the form of cooperative agreements. In general, NSF does not directly construct or operate the large facilities it supports; however, it does retain responsibility for overseeing infrastructure development, management and successful performance.

The OOI design is based upon 3 main technical elements across global, regional, and coastal scales. At the global and coastal scales, mooring observatories would provide locally generated power to seafloor and platform instruments and sensors and use a satellite and other wireless technologies to link to shore and the Internet. Four Global-scale Nodes (GSN) are proposed for ocean sensing in the Eastern Pacific and Atlantic oceans. The Regional-scale Nodes (RSN) off the coast of Oregon would consist of seafloor and water column observatories with chemical, biological, and geological sensors linked with submarine cables to shore that provide power and Internet connectivity. Coastal-scale Nodes (CSN) would be represented by the Endurance Array off the coast of Washington and Oregon and the Pioneer Array off the coast of Massachusetts. In addition, there would be an integration of mobile assets such as AUVs and gliders with the GSN, RSN, and CSN observatories.

ES.4 Purpose of and Need for the Proposed Action

The OOI would build a network of sensors that would collect ocean and seafloor data at high sampling rates over years to decades. These sensors would be linked to shore using the latest communications technologies, enabling scientists to reconfigure them from their laboratories and use the incoming data in near-real time in their models. Scientists and educators from around the country, from large and small institutions, and from fields other than ocean science, would be able to take advantage of OOI's open data policy – within the boundaries of National Security considerations – and emerging cyberinfrastructure capabilities in distributed processing, visualization, and integrative modeling.

Researchers would make simultaneous, interdisciplinary measurements to investigate a spectrum of phenomena including episodic, short-lived events (tectonic, volcanic, biological, severe storm-related), to more subtle, longer-term changes or emergent phenomena in ocean systems (circulation patterns, climate change, ocean acidity, ecosystem trends). Through a unifying cyberinfrastructure, researchers would control sampling strategies of experiments deployed on one part of the infrastructure in response to remote detection of events by other parts of the infrastructure. Distributed research groups can form virtual collaborations to collectively analyze and respond to ocean events in near real time. The long-term introduction of ample power and bandwidth to remote parts of the ocean by the OOI would provide the ocean science community with unprecedented access to detailed data on multiple spatial scales, studying the coastal-, regional-, and global-scale ocean, and using mobile assets (AUVs and gliders) to complement fixed-point sensors.

The proposed OOI Network would provide the necessary infrastructure to advance research in ocean-atmosphere exchange, climate variability, ocean circulation, turbulent mixing and biophysical interactions, coastal ocean dynamics and ecosystems, plate-scale and ocean geodynamics, fluid-rock interactions, and the sub-seafloor biosphere.

ES.5 Alternatives

Numerous alternative configurations were considered for the CSN, RSN, and GSN components of the proposed OOI. As a result of extensive technical and NSF review of numerous planning and technical supporting documents, no other action alternatives to the Proposed Action emerged that would satisfy the identified purpose and need and scientific objectives and siting criteria. While the No-Action Alternative is not considered a reasonable alternative because it does not meet the purpose and need for the Proposed Action, as required under CEQ regulations (40 CFR 1502.14[d]), the No-Action Alternative is carried forward for analysis.

ES.6 PROPOSED ACTION

Under the Proposed Action, the CSN, RSN, and GSN would consist of the following (Table ES-1):

- CSN – would consist of two elements: a long-term Endurance Array off Grays Harbor, Washington and Newport, Oregon and a relocatable Pioneer Array in the Mid-Atlantic Bight south of Massachusetts.
- RSN – would consist of 3 components: shore station at Pacific City, Oregon; primary infrastructure; and secondary infrastructure.
- GSN – 4 sites: Irminger Sea (Greenland), Station Papa (Gulf of Alaska), Argentine Basin, and Southern Ocean (Chile).

Table ES-1. Summary of the OOI Proposed Action

Component	*SSEA Proposed Action*
CSN – ENDURANCE ARRAY	
Grays Harbor Line Moorings	- 3 paired surface/subsurface at 14, 44, and 273 fathoms (fm) (25, 80, and 500 meters [m]). - active and non-active acoustic sensors on moorings & benthic nodes.
Newport Line Moorings	- 1 paired surface/subsurface mooring at 14 fm (25 m). - 2 paired surface/cabled subsurface moorings at 44 and 273 fm (80 and 500 m). - 1 node with no moorings at 82 fm (150 m) cabled to RSN N1. - active and non-active acoustic sensors on moorings & benthic nodes.
Gliders	- 5 east-west glider tracks from coast to 128° W. - 6 gliders.
CSN – PIONEER ARRAY	
Moorings	- 3 surface moorings. - 2 surface piercing profiler moorings. - 5 wire-following profiler moorings. - Active & non-active acoustic sensors on moorings.
AUVs & Gliders	- 3 AUVs and 6 gliders. - Area of AUV mission box approximately 2,489 nm^2. - Area of glider mission box approximately 5,697 nm^2.
RSN	
Shore Station	- Pacific City, Oregon
Primary Infrastructure	- 7 primary nodes - 903 km of submarine/backbone cable (309 km buried, 594 km surface laid)
Secondary Infrastructure	- 5 low-voltage nodes - 35 km of secondary infrastructure cable - 5 low-power junction boxes - 8 medium-power junction boxes
GSN	- Station Papa, Southern Ocean, Argentine Basin, and Irminger Sea would all have 1 acoustically linked surface buoy, 1 subsurface and 2 flanking subsurface moorings, and 3 gliders.

Under the Proposed Action, there are 5 stages whereby the OOI Network would be implemented and become operational by 2015: installation, gliders deployed, AUVs deployed, data flow, and commissioning. Installation of OOI components would begin in 2011 (RSN backbone cable), limited data flow would begin in 2012 with the deployment of the Endurance Array gliders, and all components would be commissioned, operational, and online by 2015.

Testing of CSN and GSN components prior to deployment is proposed within the ROI of the Endurance and Pioneer arrays. Prior to their installation on the backbone cable off the coast of Oregon, and depending on the device requirements, RSN components could be tested at 1 of 4 sites: 2 sites in Puget Sound in Shilshole Bay near the University of Washington (UW), Seattle; the Monterey Accelerated

Research System (MARS) Ocean Observatory, Monterey Bay, California; and the Victoria Experimental Network Under the Sea (VENUS) facility, British Columbia, Canada. For logistics reasons, each test event would involve the testing a group of OOI devices or components. The Puget Sound sites are the preferred test sites as they are directly accessible from UW research facilities. Each test would last less than 24 hours and a maximum of 5 tests would occur each year, starting in the spring of 2011.

Proposed installation and O&M activities would use standard methods and procedures currently in use by the scientific community and the undersea telecommunications industry. However, methods may change based upon site-specific surveys, ship schedules, and final determination of types of equipment to be installed (e.g., sensor types, models, etc.). If subsequent proposed installation and O&M activities are significantly different than the proposed installation or O&M methods described in this Draft SSEA, then additional environmental documentation would, as appropriate, be prepared to assess any potential impacts to the environment.

ES.6 IMPACT CONCLUSIONS

<u>Pacific Northwest CSN (Endurance Array) and RSN</u>

Terrestrial Biological Resources. The only terrestrial area proposed for use under the Proposed Action would be an existing shore station and beach manhole (BMH) that would be used for the landing of the RSN submarine or backbone cable at Pacific City, Oregon. Proposed horizontal directional drilling (HDD) activities would occur in the vicinity of an existing BMH within a previously disturbed residential area with no sensitive vegetation or habitat. due to the very disturbed nature of the proposed HDD area, its use as a vehicle and pedestrian access point to the beach, there would be no significant impacts to terrestrial biological resources with implementation of the Proposed Action.

Geological Resources. The installation, O&M, and test activities would result in negligible, short-term suspension of bottom sediments and would not change the topography, soils or physical characteristics of the ocean bottom along the RSN cable route, the vicinity of the HDD site, and at the Shilshole Bay test sites.

Water Quality. Implementation of the Proposed Action would result in short-term, minor impacts to marine water quality. It would not alter water currents or wave patterns in the region in a manner that would generate or accelerate erosion of local beaches or modify seabed morphology. The Proposed Action would not affect water quality parameters, such as dissolved oxygen, salinity and nutrients. Cable installation and O&M activities would result in short-term, minor changes in water quality. Small-scale increases in turbidity would occur during cable burial operations and the installation of instruments on the seafloor. Sediments would rapidly disperse and/or settle back to the seabed. There would be no permanent or long term impacts on marine water quality due to suspended sediments.

Marine Biological Resources. Under the Proposed Action, there would be no significant change in the proposed CSN and RSN installation and O&M activities that were previously assessed in the PEA and SER. The installation of 1 less primary/secondary node, 510 km less of backbone cable (including the burying of 166 km less of backbone cable), 15 fewer low-voltage nodes, 7 fewer low-power junction boxes, and 8 fewer medium-power junction boxes, and associated less installation and O&M activities, would result in less potential impact to all marine species than that assessed in the PEA and SER. Implementation of the Proposed Action would impact an estimated 63 hectares of Essential Fish Habitat (EFH), or 36 hectares less than the 99 hectares previously assessed in the SER. The PEA and SER analysis concluded that implementation of the proposed actions identified in those documents would not result in adverse effects to EFH; therefore, there would not be adverse effects to EFH with implementation of the current Proposed Action. The potential use of the Shilshole Bay test sites would occur no more than 5 times over a 1-year period, with each test lasting less than 24 hours and potential bottom disturbance of less than 0.8 m^2 would result in short-term, negligible impacts to marine biological resources, including ESA-listed species.

Cultural Resources. Under the Proposed Action, potential impacts to resources from the proposed (CSN) Endurance Array would only be associated with the placement of 6 mooring anchors (at 14, 44, and 273 fm [25, 80, and 500 m]) on the seafloor for the Grays Harbor Line and associated scientific sensors on the seafloor in the immediate vicinity of the moorings. The proposed RSN cable route would be sited to avoid all known archeological, historic, and cultural resource sites. Site-specific surveys have been conducted to determine if any undiscovered resources are within the immediate vicinity of the proposed RSN cable and Endurance Array moorings. Based on the route-specific surveys, neither archeological resources, nor historic resources (e.g., historic shipwrecks, aircraft wrecks) are within the vicinity of the proposed RSN backbone cable or moorings and Endurance Array moorings. With the routing of the RSN cable and placement of RSN and Endurance Array moorings to avoid known archeological and historic resources, there would be negligible impacts to these resources with implementation of the CSN (Endurance Array) and RSN components of the Proposed Action.

Cultural resources (i.e., traditional Usual and Accustomed [U&A] fishing rights) are present in the vicinity of the Grays Harbor Line of the Endurance Array. Communications were initiated between representatives of NSF and the affected Tribes and Nations potentially impacted by the Grays Harbor Line. Issues discussed with the Quinault Nation centered on the location of the proposed moorings, the timing of the various fishing seasons, information sharing, retrieval of equipment, and development of a Programmatic Agreement. NSF agreed to establish a communication process with the Quinault Nation to establish points of contact to exchange information on OOI installation and O&M of the proposed Grays Harbor Line and Tribal fishing regulations in order to avoid disruption of Tribal U&A fishing patterns. Therefore, implementation of the Proposed Action would result in negligible adverse effects to cultural resources. Because there are no known cultural resources within the vicinity of the RSN cable, there would be no impacts to cultural resources with installation and O&M of the RSN cable.

Socioeconomics (Fisheries). The proposed installation and O&M activities of the CSN (Endurance Array) and RSN would have 2 potential impacts to commercial fisheries operations in the ROI: 1) presence of the cable installation vessel would preclude fishing activities within a limited area (approximately 1.6 km) for a temporary period (a few hours to several days), and 2) commercial fisheries that use equipment that contacts the bottom could potentially snag unburied portions of the cable or scientific sensors, causing damage to or loss of their fishing gear, or damage to the cable or scientific sensors on the seafloor.

Notice would be given to fishing vessels regarding the proposed CSN and RSN installation operations to prevent contact that could potentially damage fishing gear. No exclusions are proposed along the cable route, so interference would not occur between the cable installation vessel and commercial fisheries. Potential interference with commercial fishing activities could occur during cable and mooring installation operations, but these would be temporary and localized. As the cable vessel and installation operations progress, fishing activities would not be precluded along the entire proposed cable route or Endurance Array lines. Only small areas would not be available for fishing while the cable plow and cable-laying vessel are in a specific area.

The potential site-specific placement, or '*micro-siting*', of moorings within the identified study area for each Grays Harbor Line and Newport Line moorings is being coordinated with representatives of marine users and tribal nations. Coordinating with the local marine users regarding the micro-siting of each mooring will assist in avoiding conflicts with regional fishing interests as well as ensuring that the mooring locations meet the scientific objectives of the CSN.

As a result of discussions with the fishing community, the configuration of the RSN cable route and location of several CSN cabled and uncabled components along the Newport Line of the Endurance Array have been revised to avoid or minimize potential impacts to fisheries. To reduce potential impacts to fisheries, an agreement was reached to generally place OOI components in the vicinity of hard grounds or existing fishing hazards such as buoys (i.e., in areas where fishing does not typically occur).

Discussions have also been initiated regarding the establishment of buffer zones or 'watch circles' around the RSN and CSN infrastructures in all areas of burial. Buffer zones identifying no-entry/no-fishing zones around the sites would be established in consultation with the affected fishing communities. The diameters of these buffer zones relate to water depths (larger in deeper water). Currently, a 0.2-nm radius buffer zone is under discussion for the inshore sites and 0.5-nm radius for the shelf and offshore sites. The sites would be clearly charted on National Oceanographic and Atmospheric Administration (NOAA) navigation charts, published in a Notice to Mariners (NOTMAR), and through direct contact with user communities. There will be active radar transponders on surface buoys as well as required U.S. Coast Guard (USCG) markings; other markings are under consideration. Discussions with the fishing community are ongoing and will continue as necessary to address further concerns. With the implementation of these on-going discussions with the fishing community to avoid and minimize potential impacts to area fisheries, there would be short- and long-term minor impacts to commercial fisheries with implementation of the Proposed Action.

Ocean Leadership, UW, and OSU representatives and representatives from the OFCC have been in discussions about a formal agreement that would address concerns of the fishing industry regarding installation of the cable and potential impacts on fishing revenues from potential loss of gear within installation and operation of the proposed CSN and RSN infrastructure off the coasts of Washington and Oregon. Such agreements have been incorporated into the considerations and approvals of previous commercial fiber optic cable projects in Oregon coastal waters. These earlier agreements have provided a model for the preliminary discussions. With the implementation of Standard Operating Procedures and the incorporation of an agreement between the OFCC and Ocean Leadership, there would be short- and long-term minor impacts to commercial fisheries with implementation of the Proposed Action.

Mid-Atlantic Bight CSN (Pioneer Array)

The Proposed Action would only involve the elimination of previously assessed infrastructure, thereby reducing the potential impacts, and would not add any infrastructure or activities that were not previously assessed in the PEA and SER. As the affected environment discussion and impact analysis were regional in nature given the large area of proposed activities, the impact analysis conducted for the Pioneer Array under the PEA and SER is still applicable for the implementation of the Proposed Action. Therefore, additional impact analysis is not necessary within this Draft SSEA for the proposed installation and O&M of the Pioneer Array.

Global-Scale Nodes (GSN)

The Proposed Action would only involve the elimination of 1 GSN site (Mid-Atlantic Ridge) from proposed installation by 2015, thereby reducing the potential impacts, and would not add any infrastructure or activities that were not previously assessed in the PEA and SER. As the affected environment discussion and impact analysis were regional in nature given the large area of proposed activities and lack of site-specific data for each site, the impact analysis conducted for the GSN sites under the PEA and SER is still applicable for the implementation of the Proposed Action. Therefore, additional impact analysis is not necessary within this SSEA for the proposed installation and O&M of the GSN sites.

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CHAPTER 1
PURPOSE AND NEED

This Draft Site-specific Environmental Assessment (Draft SSEA) has been prepared to assess the potential impacts on the human and natural environment associated with proposed site-specific requirements in the design, installation, and operation of the Ocean Observatories Initiative (OOI) that were previously assessed in a Programmatic Environmental Assessment (PEA) (National Science Foundation [NSF] 2008a) and a Supplemental Environmental Report (SER) (NSF 2009a).

This Draft SSEA has been prepared on behalf of the NSF in compliance with the National Environmental Policy Act (NEPA) of 1969 (42 United States Code [USC] 4321 et seq.), the Council on Environmental Quality (CEQ) Regulations for Implementing the Procedural Provisions of NEPA (Title 40 Code of Federal Regulations [CFR] 1500-1508), and NSF procedures for implementing NEPA and CEQ regulations (45 CFR 640). The NEPA process ensures that environmental impacts of proposed major federal actions are considered in the decision-making process. This Draft SSEA has been filed with the U.S. Environmental Protection Agency (USEPA) and announced in a Notice of Availability (NOA) published in the *Federal Register*. This Draft SSEA has been distributed to federal, state, local, and private agencies, organizations, and individuals for review and comment. A Final SSEA will then be prepared that provides responses to the comments received on the Draft SSEA.

1.1 PREVIOUS ENVIRONMENTAL COMPLIANCE DOCUMENTATION – PEA AND SER

Because the OOI action would occur over several different locations across the Atlantic and Pacific oceans and would be phased in over time, it was determined that an initial programmatic approach would be the most efficient in terms of overall analysis and, hence, a PEA was prepared in 2008 (NSF 2008a). A programmatic analysis at a conceptual level of detail provided early identification and analysis of potential impacts, methods to mitigate anticipated impacts, and a strategy to address issue areas at a tiered level if necessary.

Preparing the PEA served several purposes. First, it provided a format for a comprehensive impact analysis of the planned OOI activities as a whole. This was accomplished by assembling and analyzing the broadest range of potential direct, indirect, and cumulative impacts associated with all proposed OOI activities in the Region of Influence (ROI). The PEA also set up a framework for addressing the time- and location-specific aspects of the proposed OOI, as well as more detailed technical information (when it becomes available) through site-specific tiered EAs (e.g., this Draft SSEA) or other environmental documentation (e.g., the SER). Tiering of environmental documents in this manner makes subsequent documents of greater use and meaning to the public as the OOI and associated research develops, without duplicating paperwork and analysis from a previous assessment.

The PEA analysis concluded that installation and operation of the proposed OOI as presented in the 2008 Final PEA would not have a significant impact on the environment and a Finding of No Significant Impact (FONSI) was signed on February 4, 2009 (NSF 2008a, 2009b). The SER was prepared in April 2009 to assess the potential impacts on the environment associated with proposed modifications in the design, installation, and operation of the OOI since the completion of the PEA. The SER analysis concluded that the proposed changes in the design, installation, and operation of the OOI as presented in the 2008 Final PEA would not result in additional impacts to the environment (NSF 2009a). The complete PEA, SER, and FONSI can be found in Appendices A, B, and C, respectively.

1.1.1 Scope of this Draft SSEA

The scope of the environmental impact analysis of this Draft SSEA is tiered from the previously prepared PEA, associated FONSI, and SER. It focuses only on those activities and the associated potential impacts, including cumulative impacts, resulting from the site-specific installation and operation and maintenance (O&M) of OOI assets not previously assessed in the PEA and SER. Installation of OOI assets would be completed by 2015. If the scope and nature of proposed OOI activities have not changed since the preparation of the PEA and SER or there has been a reduction in scope of activities originally proposed and assessed in the PEA and SER, then additional environmental impact analysis under NEPA and other environmental compliance requirements (e.g., Endangered Species Act [ESA], Marine Mammal Protection Act [MMPA], etc.) is not necessary. The impact analysis, including the FONSI, and associated Letters of Concurrence (LOCs) from federal regulatory agencies (e.g., National Marine Fisheries Service [NMFS], U.S. Fish and Wildlife Service [USFWS]) are still valid and applicable for the Proposed Action as described in this Draft SSEA. However, if the proposed site-specific activities associated with the proposed installation and operation of the OOI (i.e., the Proposed Action described in this Draft SSEA) potentially impact additional or larger areas or include activities not previously proposed in the PEA and SER, then the appropriate impact analysis is presented in this Draft SSEA and reinitiation of associated consultations with federal regulatory agencies, as applicable and appropriate, would occur.

1.2 PROJECT BACKGROUND

To provide the U.S. ocean sciences research community with the basic sensors and infrastructure required to make sustained, long-term, and adaptive measurements in the oceans, the NSF's Ocean Sciences Division developed the OOI from community-wide, national, and international scientific planning efforts. OOI builds upon recent technological advances, experience with existing ocean observatories, and lessons learned from several successful pilot and test-bed projects. The proposed OOI would be an interactive, globally distributed and integrated network of cutting-edge technological capabilities for ocean observatories. This network of sensors would enable the next generation of complex ocean studies at the coastal, regional, and global scale. OOI would complement the broader effort to establish the proposed operationally focused national system known as the Integrated Ocean Observing System (IOOS). As these efforts mature, the OOI integrated observatory would be NSF's contribution to the National IOOS initiative and in turn would be a key and enabling U.S. contribution to the international Global Ocean Observing System (GOOS) and the Global Earth Observation System of Systems (GEOSS).

The OOI infrastructure would include cables, buoys, deployment platforms, moorings, junction boxes, and mobile assets (i.e., autonomous underwater vehicles [AUVs] and gliders). The infrastructure would be powered by solar, wind, fuel cells, and undersea cabled power supplies. The two-way communication systems would allow near real-time availability of oceanographic and meteorological data via the Internet. This large-scale infrastructure would support sensors located at the sea surface, in the water column, and at or beneath the seafloor. The initiative would also support related elements, such as unified project management, data dissemination and archiving, modeling of oceanographic processes, and education and public engagement activities essential to the long-term success of ocean science.

The OOI represents a significant departure from traditional approaches in oceanography and a shift from expeditionary to observatory-based research. It would include the first U.S. owned and managed multi-node, regional-scale cabled observatory array; long-term coastal arrays coupled with AUVs and gliders; and advanced buoys for interdisciplinary measurements, especially for data-limited areas of the Southern Ocean and other high-latitude locations. The OOI Project Office is managed by the Consortium for Ocean Leadership (Ocean Leadership) and funded through a cooperative agreement with NSF through the NSF's

Major Research Equipment and Facilities Construction (MREFC) account. NSF's MREFC account is an agency-wide account to provide funding to establish major science and engineering infrastructure projects. NSF makes awards to external entities, primarily universities, consortia of universities, or non-profit organizations to undertake construction, management, and operation of large facilities. Such awards frequently take the form of cooperative agreements. In general, NSF does not directly construct or operate the large facilities it supports; however, it does retain responsibility for overseeing infrastructure development, management and successful performance.

1.3 MISSION OF NSF

Established by Congress with the National Science Foundation Act of 1950 (Public Law 810507, as amended), NSF is the federal government's only agency dedicated to the support of fundamental research and education in all scientific and engineering disciplines. In accordance with the Act, NSF's mission is to "promote the progress of science; to advance the national health, prosperity, and welfare; to secure the national defense; and for other purposes." The primary roles of NSF are to support and fund the Nation's academic-based research in science and engineering, enhance the quality of education, and ensure that the U.S. maintains leadership in scientific discovery and the development of new technologies. The Act authorizes and directs NSF to initiate, support, and fund:

- basic scientific research and research fundamental to the engineering process,
- programs to strengthen scientific and engineering research potential,
- science and engineering education programs at all levels and in all fields of science and engineering,
- an information base on science and engineering appropriate for development of national and international policy,
- the interchange of scientific and engineering information nationally and internationally, and
- the development of computer and other methodologies (NSF 2006, 2008b).

In particular, the research and education activities of NSF promote the discovery, integration, dissemination, and application of new knowledge in service to society. NSF also strives to prepare future generations of scientists, mathematicians, and engineers who are be necessary to ensure America's leadership in the global marketplace. In addition, the emerging global economic, scientific, and technical environment challenges long-standing assumptions about domestic and international policy, requiring NSF to play a more proactive role in sustaining the competitive advantage of the U.S. through superior research capabilities (NSF 2006, 2008).

1.4 COASTAL, REGIONAL, AND GLOBAL SCALES OF THE OOI

The OOI design is based upon 3 main technical elements across global, regional, and coastal scales. At the global and coastal scales, mooring observatories would provide locally generated power to seafloor and platform instruments and sensors and use a satellite and other wireless technologies to link to shore and the Internet. Four Global-scale Nodes (GSN) are proposed for ocean sensing in the Eastern Pacific and Atlantic oceans (Figure 1-1). The Regional-scale Nodes (RSN) off the coast of Oregon would consist of seafloor and water column observatories with chemical, biological, and geological sensors linked with submarine cables to shore that provide power and Internet connectivity. Coastal-scale Nodes (CSN) would be represented by the Endurance Array off the coast of Washington and Oregon and the Pioneer Array off the coast of Massachusetts. In addition, there would be an integration of mobile assets such as AUVs and gliders with the GSN, RSN, and CSN observatories. Further discussion of the GSN, RSN, CSN, and associated infrastructure and assets is provided in Chapter 2.

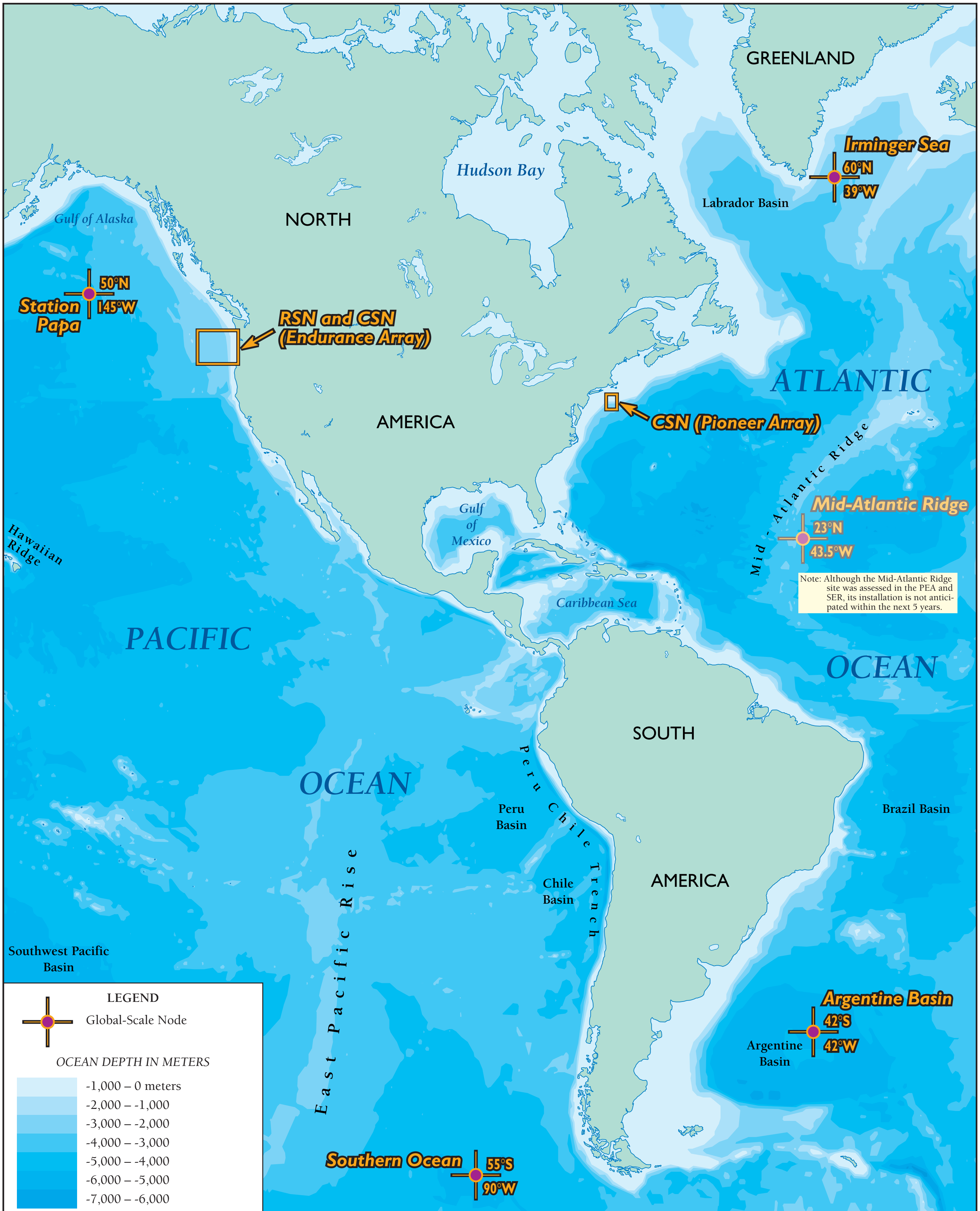

Figure 1-1
Geographic Locations of the Proposed OOI Infrastructure
to be Installed by 2015

1.5 PURPOSE OF AND NEED FOR THE PROPOSED ACTION

1.5.1 Purpose of the Proposed Action

Physical, geological, chemical, and biological processes interact in the ocean, at the seafloor, and at the air-sea interface in complex ways, strongly influencing everything on Earth. This complex ocean system modulates climate, absorbs greenhouse gases, liberates significant amounts of oxygen, significantly influences rainfall and temperature patterns on land, fuels coastal storms, produces major energy and raw-material resources, and supports the largest biosphere on Earth. Ship-based expeditionary research and satellite imagery continue to contribute enormously to our knowledge of the ocean system, but they are restricted by spatial and temporal limitations and many critical ocean phenomena remain unexplored.

The ocean is a challenging environment for collecting data. It is opaque to radio frequencies, it is corrosive, it exerts tremendous pressure at depth, it harbors marine life that fouls sensor surfaces, it can destroy mechanical structures, and most of its volume is not readily accessible and is far from shore-based power sources and signal cables. At present, most ocean scientists still cannot access their *in situ* data in near-real time because of power and communication constraints, requiring them to study events that, at best, occurred months previous. In some locations, such as high latitudes, scientists still lack the capability to deploy long-term moorings that collect data from the sea surface to the seafloor.

The OOI would meet these challenges by building a network of sensors that would collect ocean and seafloor data at high sampling rates over years to decades. These sensors would be linked to shore using the latest communications technologies, enabling scientists to reconfigure them from their laboratories and use the incoming data in near-real time in their models. Scientists and educators from around the country, from large and small institutions, and from fields other than ocean science, would be able to take advantage of OOI's open data policy – within the boundaries of National Security considerations – and emerging cyberinfrastructure capabilities in distributed processing, visualization, and integrative modeling.

Researchers would make simultaneous, interdisciplinary measurements to investigate a spectrum of phenomena including episodic, short-lived events (tectonic, volcanic, biological, severe storm-related), to more subtle, longer-term changes or emergent phenomena in ocean systems (circulation patterns, climate change, ocean acidity, ecosystem trends). Through a unifying cyberinfrastructure, researchers would control sampling strategies of experiments deployed on one part of the infrastructure in response to remote detection of events by other parts of the infrastructure. Distributed research groups can form virtual collaborations to collectively analyze and respond to ocean events in near real time. The long-term introduction of ample power and bandwidth to remote parts of the ocean by the OOI would provide the ocean science community with unprecedented access to detailed data on multiple spatial scales, studying the coastal-, regional-, and global-scale ocean, and using mobile assets (AUVs and gliders) to complement fixed-point sensors.

The OOI would provide the opportunity to make groundbreaking advances in our understanding of critically important global oceanographic processes by funding the needed transformative observatory infrastructure. Each of the OOI's coastal, regional, and global elements would provide revolutionary ocean-observing capabilities capitalizing on cutting-edge technologies including:

- high-bandwidth, two-way communication with advanced sensors in the remote open ocean;
- continuous measurements of physical, chemical, and biological properties with durations of decades;
- advanced profiling moorings;

- delivery of high power to instruments in the water column or on the seafloor;
- seafloor cabled network of ocean bottom instruments and instruments on water column moorings; and
- autonomous vehicles (gliders and AUVs) capable of adaptive sampling and responding to episodic events in the presence of multi-scale processes.

Insulated copper and electrical-optical cable installed across a tectonic plate would supply continuous power and communications to commandable, multidisciplinary instrument suites. A combination of moorings and mobile samplers (gliders and AUVs) would collect high-resolution, time-series data at the complicated boundary between coastal and deep-ocean regimes on both the west and east coasts of the U.S. Moored observatories stationed in the high northern and southern latitude oceans would record information critical to understanding ocean-atmosphere interactions, and ocean dynamics and biogeochemistry. The OOI cyberinfrastructure would make available the distributed observing assets to all users in near-real time.

The use of large numbers of interconnected, space- and time-indexed, remote, interactive, fixed, and mobile assets by a global user community, collaborating through the Internet and Internet-enabled software, represents the most fundamental shift in oceanic investigative infrastructure since the arrival of satellites. It would induce major changes in the community structure, the nature of collaborations, the style of modeling and data assimilation, the approach of educators to environmental sciences, the manner in which the scientific community relates to the public, and the recruitment of young scientists. The discoveries, insights, and the new technologies of the OOI effort would continuously transfer to more operationally oriented ocean-sensing systems operated by other agencies and countries. Increased ocean coverage, the growth of technical capability, development of new and more precise predictive models, and increasing public understanding of the ocean would all be tangible measures of the OOI’s contribution to transforming ocean science. In this manner, OOI would play a key role in keeping the U.S. science effort at the cutting edge of ocean knowledge.

1.5.2 Need for the Proposed Action

The proposed OOI Network would provide the necessary infrastructure to advance research in the following areas:

Ocean-Atmosphere Exchange. Quantifying the air-sea exchange of energy and mass, especially during high winds, is critical to providing estimates of energy and gas exchange between the surface and deep ocean, and improving the predictive capability of storm forecasting and climate-change models. Conventional technology has been unable to support observations under high wind conditions.

Climate Variability, Ocean Circulation, and Ecosystems. Being a reservoir and distributor of heat and carbon dioxide, the ocean modifies and is affected by climate. Understanding how climate variability affects ocean circulation, weather patterns, processes of the ocean’s biochemical environment (including carbon cycling and ocean acidification), and marine ecosystems is an important driver for multidisciplinary observations.

Turbulent Mixing and Biophysical Interactions. Mixing occurs over a broad range of scales and plays a major role in transferring energy, materials, and organisms throughout the world’s oceans. It has a profound influence on primary productivity, plankton community structure, biogeochemical processes in the surface and deep ocean, and the transport of material to the deep ocean. Quantifying mixing is essential to improving models of ocean circulation and ecosystem dynamics.

Coastal Ocean Dynamics and Ecosystems. Understanding the spatial and temporal complexity of the coastal ocean is a long-standing challenge. Quantifying the interactions between atmospheric and terrestrial forcing, and coupled physical, chemical, and biological processes, is critical to understanding the role of coastal margins in the global carbon cycle and developing strategies for coastal resource management and tracking coastal ecosystem health in a changing climate.

Plate-Scale, Ocean Geodynamics. Movements and interactions at plate boundaries at or beneath the seafloor are responsible for short-term events like earthquakes, tsunamis, and volcanic eruptions. These tectonically active regions are also host to the densest hydrothermal and biological activity in the ocean basins. The degrees to which active plate boundaries influence the ocean from a physical, chemical, and biological perspective are largely unexplored.

Fluid-Rock Interactions and the Sub-seafloor Biosphere. The oceanic crust contains the largest aquifer on Earth. Thermal circulation and reactivity of seawater-derived fluids modifies the mineralogy of oceanic crust and sediments, leads to the formation of hydrothermal vents that support unique micro- and macro-biological communities, and concentrates methane to form massive methane gas and methane hydrate reservoirs. The role that transient events (e.g., earthquakes, volcanic eruptions, and slope failures) play in these fluid-rock interactions and in the dynamics of benthic and sub-seafloor microbial communities remains largely unknown.

1.5.3 Summary

The overall goal of the OOI is to provide a sustained, adaptable infrastructure at selected sites spanning representative processes that are globally significant, expressed locally or regionally, and addressable using new modes of investigation. Among the assets of the OOI is the creativity that would emerge from members of the science community as they embrace and apply these new tools. In addition to the suite of opportunities enabled by the infrastructure, advances would come about partly as a result of influences and developments outside the field of oceanography. The use of a large network of space- and time-indexed, interactive assets connected to a global user community via Internet-enabled tools represents a fundamental shift in oceanic investigative philosophy and capability.

By selecting critical locations at high latitude (i.e., GSN), where extremes in surface forcing result in major transport of volatiles and heat within and between the ocean and the atmosphere, the OOI would open new arenas for crucially important, long-term studies and longer range forecasting tied to these instrument-hostile environments. By selecting contrasting east and west coast continental shelf-slope environments (i.e., CSN), the OOI would begin to address questions spanning the full horizontal and vertical scales of these coastal systems including the impact of climate variability on coastal ecosystems and the role of the coastal ocean in the global carbon and biogeochemical cycles. At a regional scale (i.e., RSN), the OOI would include an entire tectonic plate below the divergence of the current between two major oceanic gyres and a productive eastern boundary current (e.g., Juan de Fuca plate and California Current off the coast of Washington and Oregon). In this regional setting there is a unique opportunity to assess simultaneously major plate tectonic processes and their effects on the overlying ocean, while documenting interannual and decadal forcing of regime shifts that reflect global-scale phenomena.

As the system matures and becomes more extensive and adaptable, users would experience ocean processes as they unfold in real time, using multiple, selectable, *in situ* data streams. Users would follow entire 3-dimensional events or phenomena evolving through space and time. Success of the OOI would induce major changes in our scientific interactions, in the complexity of our investigations, and in our style of data assimilation and model development. The technologies would transform our abilities to capture and understand transient and long-term changes. The program would invigorate the public's ability to share in discoveries, insights, and excitement about understanding the ocean.

1.6 SUMMARY OF KEY FEDERAL ENVIRONMENTAL COMPLIANCE REQUIREMENTS

1.6.1 National Environmental Policy Act (NEPA) (42 USC 4321 *et seq*.)

NEPA requires federal agencies to take into consideration the potential environmental consequences of proposed actions in their decision-making process. The intent of NEPA is to consider impacts on the environment through informed federal decision making. The CEQ was established under NEPA to implement and oversee federal processes and through *Regulations for Implementing Procedural Provisions of the National Environmental Policy Act* (40 CFR §1500-1508). These regulations specify that an EA:

- briefly provide sufficient evidence and analysis for determining whether to prepare an environmental impact statement (EIS) or a FONSI;
- aid in an agency’s compliance with NEPA when no EIS is necessary; and
- facilitate the preparation of an EIS when one is necessary.

1.6.2 Coastal Zone Management Act (CZMA) (16 USC 1451 *et seq*.)

The CZMA requires that “any federal activity within or outside of the coastal zone that affects any land or water use or natural resource of the coastal zone” shall be “consistent to the maximum extent practicable with the enforceable policies” of a state’s coastal zone management plan. Federal agencies, prior to carrying out activities, must comply with the “consistency” regulations of the CZMA promulgated by the Secretary of Commerce. These regulations set forth the procedures that federal agencies must follow to coordinate with coastal states prior to carrying out activities that are reasonably likely to affect coastal uses or resources within a state’s coastal zone.

1.6.3 Clean Water Act (CWA), Sections 401 and 404 (33 USC 1251 *et seq*.)

The CWA is the primary Federal law that protects the nation’s waters, including lakes, rivers, aquifers, and coastal areas. The primary objective of the CWA is to restore and maintain the integrity of the nation’s waters. Jurisdictional waters of the U.S. are regulated resources and are subject to Federal authority under Section 404 of the CWA. This term is broadly defined to include navigable waters (including intermittent streams), impoundments, tributary streams, and wetlands. Areas meeting the waters of the U.S. definition are under the jurisdiction of the U.S. Army Corps of Engineers (USACE). Anyone proposing to conduct a project that requires a Federal permit or involves dredging or fill activities that may result in a discharge to U.S. surface waters and/or waters of the U.S. is required to obtain a CWA Section 401 Water Quality Certification, verifying that the project activities would comply with state water quality standards.

1.6.4 Rivers and Harbors Act, Section 10 (33 USC 401 *et seq.*)

Section 10 of the Rivers and Harbors Act of 1899 regulates structures or work in or affecting navigable waters of the U.S. Structures include any pier, wharf, bulkhead, etc. Work includes dredging, filling, excavation, or other modifications to navigable waters of the U.S. The USACE is authorized to issue permits for work or structures in navigable waters of the U.S.

1.6.5 National Historic Preservation Act (NHPA) (16 USC 470 *et seq*.)

The NHPA established historic preservation as a national policy and defined it as the protection, rehabilitation, restoration, and reconstruction of districts, sites, buildings, structures, and objects that are significant in American history, architecture, archaeology, or engineering. Section 106 of the Act requires Federal agencies to take into account the effects of their undertakings on historic properties that are included in or eligible for listing on the National Register of Historic Places (NRHP). NSF's compliance with Section 106 for the OOI will be done through the NEPA process.

1.6.6 Magnuson-Stevens Act (MSA) (16 USC 1801-1882)

The Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act or MSA) established U.S. jurisdiction from the seaward boundary of the coastal states out to 200 nautical miles (nm) (370 kilometers [km]) for the purpose of managing fisheries resources. The MSA is the principal federal statute that provides for the management of marine fisheries in the U.S. The purposes of the MSA include: (1) conservation and management of the fishery resources of the U.S.; (2) support and encouragement of international fishery agreements; (3) promotion of domestic commercial and recreational fishing; (4) preparation and implementation of Fishery Management Plans; (5) establishment of Regional Fishery Management Councils; (6) development of fisheries which are underutilized or not utilized; and (7) protection of Essential Fish Habitat (EFH). Federal agencies that authorize, fund, or undertake actions that may adversely affect EFH must consult with the Secretary of Commerce, through NMFS, regarding potential effects to EFH, and NMFS must provide conservation recommendations.

1.6.7 Marine Mammal Protection Act (MMPA) (16 USC 1431 *et seq.*)

The MMPA of 1972 protects marine mammals by strictly limiting their "taking" in waters or on lands under U.S. jurisdiction, and on the high seas by vessels or persons under U.S. jurisdiction. The term "take," as defined in Section 3 (16 USC 1362) of the MMPA and its implementing regulations, means "to harass, hunt, capture, or kill, or attempt to harass, hunt, capture, or kill any marine mammal." The term "harassment" was further defined in the 1994 amendments to the MMPA as any act of pursuit, torment, or annoyance, at two distinct levels:

- Level A Harassment – potential to injure a marine mammal or marine stock in the wild.
- Level B Harassment – potential to disturb a marine mammal or marine mammal stock in the wild by causing disruption of natural behavior patterns including, but not limited to, migration, breathing, nursing, breeding, feeding, or sheltering.

The incidental, but not intentional, taking of marine mammals by U.S. citizens is allowed if certain findings are made and regulations are issued.

1.6.8 Endangered Species Act (ESA) (16 USC 1531 *et seq.*)

The ESA of 1973 and subsequent amendments provide for the conservation of threatened and endangered species of animals (including some marine mammals) and plants, and the habitats in which they are found. The ESA prohibits jeopardizing endangered and threatened species or adversely modifying critical habitats essential to their survival. Section 7 of the ESA requires consultation with NMFS and the USFWS to determine whether any endangered or threatened species under their jurisdiction may be affected by a proposed action. Generally, the USFWS manages land and freshwater species while NMFS manages marine species, including anadromous salmon. However, the USFWS has responsibility for some marine animals such as nesting sea turtles, walruses, polar bears, sea otters, and manatees.

1.6.9 National Marine Sanctuaries Act (NMSA) (16 USC 1431 *et seq.*)

The NMSA authorizes the Secretary of Commerce to designate and protect areas of the marine environment with special national significance as national marine sanctuaries. Sanctuaries are administered by the National Oceanic and Atmospheric Administration (NOAA), Office of National

Marine Sanctuaries. Regulations at 15 CFR Part 922 further implement the NMSA and regulate the conduct of certain activities within sanctuaries; activities prohibited by regulation can only be undertaken by obtaining a permit. Section 304(d) of the NMSA further requires Federal agencies to consult with NOAA before taking actions, including authorization of private activities, "likely to destroy, cause the loss of, or injure a sanctuary resource."

1.7 ENVIRONMENTAL REVIEW PROCESS

This section presents an overview of the EA process and timeline, which is summarized in Table 1-1.

Table 1-1. SSEA Process

Item	*Date*
Notice of Intent – Interagency/Intergovernmental Coordination for Environmental Planning (IICEP)	April 2010
Public Scoping	July 2010
Preparation of Draft SSEA	May-August 2010
Notice of Availability of Draft SSEA	August 2010
Public Comment Period – 30 Days	August-September 2010
Public Hearings	September 2010
Preparation of Final SSEA	September 2010
Notice of Availability (NOA) of SSEA	September 2010
Decision Document	September 2010

1.7.1 Notice of Intent (NOI)

Letters and e-mails outlining the OOI proposal and NOI to prepare the SSEA were sent in April 2010 to federal, state, and local agencies; Native American Indian Tribes and Nations; and various interest groups (e.g., fishermen and other marine users) (Appendix D).

1.7.2 Public Scoping Process

Public review, comment, and participation are critical components of the NEPA process. Input gathered from meetings, phone conversations, and written submission of comments is an essential tool for thoroughly addressing issues in the EA. Informal meetings and teleconferences with known interested groups and individuals were held in May 2010. Based on information learned during the informal meetings, NSF decided to hold formal scoping meetings in 3 cities adjacent to the proposed sites on the west coast that could potentially be affected by the Proposed Action: Aberdeen, Washington (July 7, 2010); Westport, Washington (July 8, 2010); and Newport, Oregon (July 9, 2010). Advertisements describing the scoping meetings and the Proposed Action were placed in local newspapers; a copy of the advertisements is presented in Appendix D. The advertisements provided the times, dates, and locations of the scoping meetings. An additional opportunity for providing scoping input was provided to potentially interested Native American tribes. The Quinault Nation responded to this opportunity and, consequently, a government-to-government meeting with NSF was held on July 7, 2010, to discuss the OOI.

The scoping meetings were designed in an "open house" format to facilitate dialogue between meeting attendees and NSF and OOI representatives. Displays were presented to enhance public understanding of the NEPA process, the need for the Proposed Action, how the alternatives were designed and selected, and the public's role in shaping the proposal.

During the scoping meetings, NSF provided the public with several opportunities to make comments on the OOI. Attendees could submit written comments or complete a comment form provided by NSF and mail or e-mail their comments to OOI and NSF representatives. The public could also submit comments by mail and e-mail during the entire scoping period (August 3, 2010 – September 2, 2010). Comments received during the scoping period helped refine NSF's proposal and are reflected in the Proposed Action and Alternatives discussion in Chapter 2.

A total of 32 individuals attended the 3 scoping meetings and 9 individuals (including some individuals representing public and academic groups) submitted comments on the Proposed Action. In addition, 2 Washington State fishing groups submitted written comments after the scoping meetings. In general, the attendees provided positive feedback regarding the scoping process and the proposed OOI. The main concerns about the OOI expressed during the scoping meetings included access to marine areas and resources, economic impacts associated with fisheries, and request for clarification/notification of restrictions and scheduling of proposed OOI activities.

Native American Indian Tribes and Nations, the public, and regulators provided feedback about the proposed locations of Endurance Array and RSN infrastructure during the scoping period. This included identifying potential mooring locations that would avoid known important fishing areas, culturally sensitive areas, and potential conflicts with existing activities or infrastructure (e.g., undersea telecommunications cables).

NSF subsequently used the input from Native American Indian Tribes and Nations, the public, regulators, and marine users obtained during the scoping process to refine the location of RSN infrastructure and CSN infrastructure (i.e., Endurance Arrays – Grays Harbor and Newport lines) resulting in the study areas or siting boxes for the Endurance Array mooring sites under consideration in this Draft SSEA. Chapter 2 provides a description of these locations and the mooring siting process.

1.7.3 Government-to-Government Consultations

NSF began Government-to-Government consultations in April 2010 and are ongoing. The purpose was to present the Proposed Action and this site-specific phase, and to initiate consultations under Section 106 of the NHPA as part of the NEPA process. The Hoh Tribe, Makah Nation, Quileute Nation, and Quinault Nation (listed in alphabetical order) were sent a letter discussing the proposed project. The letters were followed up with email correspondence and telephone calls.

The Hoh Tribe's primary concern is access to data and data sharing. They requested written assurances that the data generated by this project will be made available to Hoh Tribal Fisheries Managers. Additional government to government correspondence is planned with the Hoh Tribe. The Makah Nation responded to a telephone request indicating they would comment on the Draft SSEA and further consultation was not needed. The Quileute Nation responded and indicated that they were reviewing the materials provided and would respond.

The Quinault Nation requested a formal consultation with NSF which took place on July 7, 2010 at the Quinault Nation Administration Building. The Quinault Nation conveyed concerns regarding the potential for restricted access to Usual and Accustomed (U&A) fishing (e.g., shellfish) grounds, potential damage to fishing gear, and access to data generated by the OOI. Plans for a Programmatic Agreement (PA) under Section 106 of the NHPA between NSF and the Quinault Nation were formed.

1.7.4 Draft SSEA

This Draft SSEA for the OOI was made available for public review beginning in August 2010, with the public comment period occurring from August 10, 2010 through September 15, 2010. An NOA for the Draft EA was announced in the *Federal Register*, local newspapers, and in letters and e-mails to federal, state, and local agencies; Native American Indian Tribes and Nations; and other interested parties identified during the scoping process. This notice indicated the duration of the public review and comment period, the address where comments could be sent, and the time and location of the public hearings.

Once the public comment period commenced, NSF also:

- Mailed hard copies and electronic copies on CDs of the Draft SSEA to federal, state, and local agencies, tribal nations, and other interested parties, including those who had requested a copy of the Draft SSEA through the scoping process (see Appendix D for the complete distribution list);
- Conducted 3 public hearings each with an "open house" poster session staffed by NSF and OOI subject matter experts, a formal briefing by NSF, and the opportunity to provide oral and/or written comments;
- Distributed a "fact sheet" brochure at the public hearings that included information on providing comments and a comment sheet to help facilitate public input and feedback;
- Provided a CD to any individual requesting a copy of the Draft SSEA at the public hearings; and
- Conducted briefings to support the Government-to-Government consultation process.

The public hearings will be held at the following dates, times, and locations:

- Wednesday, September 1, 2010, 7-9 pm, Westport Maritime Museum, Westport, WA.
- Thursday, September 2, 2010, 7-9 pm, Guin Library Seminar Room, Hatfield Marine Science Center, Newport, OR.
- Wednesday, September 8, 2010, 7-9 pm, New Bedford Library, New Bedford, MA.

1.7.5 Final SSEA

Following the close of the comment period, written and oral comments on the Draft SSEA will be reviewed and considered, and will be addressed in the Final SSEA.

1.8 ORGANIZATION OF THE DRAFT SSEA

This Draft SSEA is organized as follows:

- *Chapter 1.0, Purpose and Need for the Proposed Action* (this chapter), provides a brief introduction to the OOI, an overview of the purpose of and need for the OOI, and a summary of the environmental compliance requirements.
- *Chapter 2.0, Description of the Proposed Action and Alternatives*, summarizes the proposed installation and operation of OOI components as presented in the PEA and SER, changes in the proposed OOI since completion of the PEA and SER which are now the Proposed Action in this Draft SSEA, alternatives considered but eliminated from further analysis, and the no-action alternative.

- *Chapter 3.0, Affected Environment and Environmental Consequences,* describes the existing conditions and environmental consequences for those resources requiring additional impact analysis not previously assessed in detail in the PEA and SER.
- *Chapter 4.0, Cumulative Effects and Other Considerations Required by NEPA*, identifies any past, present, and foreseeable federal or non-federal actions occurring within the ROI and evaluates impacts on the environment when added to the proposed action. Impacts that narrow the range of beneficial uses of the environment are of particular concern. This refers to the possibility that choosing one development option reduces future flexibility in pursuing other options, or that giving over a parcel of land or other resource to a certain use often eliminates the possibility of other uses being performed at that site.
- *Chapter 5.0, References;* and
- *Chapter 6.0, List of Preparers*.

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CHAPTER 2
DESCRIPTION OF THE PROPOSED ACTION AND ALTERNATIVES

2.1 INTRODUCTION

As early as 1988, the ocean sciences community began discussions about the science, design concepts, and engineering of ocean research observatories. In 1997, NSF funded the Dynamics of Earth and Ocean Systems committee to provide a focus for exploratory planning and to formulate advice on technical specifications and management issues for an ocean observatory network. This committee emphasized two technical approaches and the proposed OOI design developed from these two main technical directions: 1) seafloor observatories linked with submarine cables to land that provide power and Internet connectivity, and 2) buoy observatories that provide locally generated power to seafloor and platform instruments and use a satellite link to land and the Internet. A third technical element, integration of mobile assets such as AUVs and gliders, also emerged during program planning. The community developed these ideas simultaneously, and NSF supported them through numerous related projects and workshops. These activities led to the vision of 3 observatory scales – coastal, regional, and global – within one distributed, integrated network. Two National Research Council reports (2000, 2003) and more than a dozen nationally circulated science and technical reports reflect broad community involvement in this initiative. In 2000, the National Science Board, the highest-level oversight committee for the NSF, approved the OOI as a MREFC account project.

Numerous workshops have been held that provided the forum for the interchange of ideas, proposals, and refinements to the OOI design process. In addition, since 2003, there have been numerous committee and *ad hoc* team reviews of infrastructure plans, Conceptual Network Design (CND), Preliminary Network Design (PND), and white papers covering all aspects of the proposed OOI Network. Based on these workshops, preliminary design plans, etc., criteria were developed that provided guidance as to what sites or configurations for the OOI would effectively meet the scientific, logistical, and financial requirements and goals of the OOI Network. For a more detailed history of the development of the OOI, refer to Section 2.1 of the PEA (NSF 2008a).

The development of the Final Network Design (FND) from the PND incorporates the response to the OOI Preliminary Design Review (PDR). The NSF panel report of the PDR was very favorable and included 43 recommendations for NSF to consider for transmission to the implementation team. These recommendations have been considered, and in most cases implemented as part of the work leading toward the OOI's Final Design Review held and passed in November 2008. Modification of the network design to accommodate NSF recommended infrastructure changes lead to an additional design review and the preparation of the FND approved by the National Science Board in May 2009 (Ocean Leadership 2010a). As stated in the PEA, numerous alternative configurations were considered for the CSN, RSN, and GSN components of the proposed OOI. Based on the extensive technical reviews of CNDs, PND, and technical supporting studies of alternative configurations, the resulting OOI 2010 FND is the Proposed Action in this SSEA.

2.2 PROPOSED ACTION

Under the Proposed Action, the CSN, RSN, and GSN would consist of the following elements:

- CSN – the Endurance Array (Newport and Grays Harbor lines)[(1)] and the Pioneer Array,
- RSN – a configuration with 7 Primary Nodes and one shore station, and
- GSN – 4 sites.

As stated in Section 1.1 above, as the OOI action would occur over relatively large areas across the Atlantic and Pacific oceans and would be phased in over time, the initial environmental impact analysis was programmatic in approach and, hence, a PEA was prepared (NSF 2008a). The SER was subsequently prepared to assess the potential impacts on the environment associated with proposed modifications in the design, installation, and operation of the OOI since the completion of the PEA (NSF 2009a). The PEA provided a format for a comprehensive impact analysis of the planned OOI activities as a whole. This was accomplished by assembling and analyzing the broadest range of potential direct, indirect, and cumulative impacts associated with all proposed OOI activities. The PEA also set up a framework for addressing the time- and location-specific aspects of the proposed OOI, as well as more detailed technical information (when it becomes available) through site-specific tiered EAs (e.g., this Draft SSEA) or other environmental documentation (e.g., the SER).

The following sections present a summary of the changes in the proposed installation and O&M of OOI infrastructure as presented in the National Science Board-approved FND (Ocean Leadership 2010a) that have occurred since the completion of the PEA and SER. Depending on the nature and extent of these changes, this Draft SSEA will assess those changes that may potentially result in site-specific environmental impacts that were not previously addressed in the PEA and SER. For a detailed description of the CSN, RSN, and GSN, refer to the PEA (NSF 2008a).

2.2.1 Coastal-Scale Nodes (CSN)

As assessed in the PEA and SER, the CSN consists of two elements: a long-term Endurance Array off Washington and Oregon and a relocatable Pioneer Array in the Mid-Atlantic Bight south of Massachusetts. A detailed discussion of the purpose and objectives of the Endurance and Pioneer arrays and the associated proposed infrastructure are presented in the PEA (Appendix A).

2.2.1.1 Endurance Array

PEA and SER – Previously Assessed Components

The Endurance Array would be comprised of 2 lines of moorings, one located off the coast of central Oregon (Newport Line), and a second at a contrasting site off central Washington (Grays Harbor Line) (Figure 2-1a) (refer to Section 2.2.1.1 of the PEA and Section 2.1.1 of the SER). Both lines would consist of surface and subsurface moorings and would employ gliders. As assessed in the PEA and SER, the 44-, 82-, and 273-fathom (fm) (80-, 150-, and 500-meter [m]) moorings on the Newport Line would be cabled and connected to the backbone cable of the RSN via NP2.

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(1)The April 2010 FND (Ocean Leadership 2010a) uses the terms Oregon Line and Washington Line for the Newport Line and Grays Harbor Line, respectively. For consistency with the PEA and SER, the naming convention of Newport Line and Grays Harbor Line has been used in this SSEA.

Specifically, each line would contain (Figure 2-1a and Table 2-1):

Grays Harbor Line

- 4 paired surface/subsurface moorings at 14, 44, 82, and 273 fm (25, 80, 150, and 500 m).
- Cabled connection between the Subduction Zone primary node (N4a) and the 44- and 273-fm (80- and 500-m) moorings on the Grays Harbor Line via nodes N4b and N4c.
- Surface buoys at the 44- and 273-fm (80- and 500-m) sites would be powered by methanol fuel cells, wind turbines, or solar panels if the Grays Harbor Line is not cabled to the RSN.
- Active and non-active acoustic sensors on moorings and benthic nodes.

Newport Line

- 1 paired surface/subsurface mooring at 14 fm (25 m).
- 2 paired surface/cabled subsurface moorings at 44 and 273 fm (80 and 500 m).
- 1 subsurface mooring at 82 fm (150 m) cabled to RSN N1 via NP2.
- Surface buoys would be powered by wind turbines and solar panels.
- Active and non-active acoustic sensors on moorings and benthic nodes.

Up to 6 autonomous underwater gliders would also carry multidisciplinary sensor suites along cross-shelf glider lines (Figure 2-1a).

SSEA Proposed Action – Proposed FND Modifications

Grays Harbor Line. The proposed modifications to the Grays Harbor Line (Figure 2-1b and Table 2-1) include:

- Elimination of the 82-fm (150-m) subsurface mooring.
- Elimination of the cabled connection between RSN node N4a and the 44- and 273-fm (80- and 500-m) moorings via nodes N4b and N4c.
- A change in the naming convention of the remaining proposed moorings. The proposed moorings at the nominal depths of 14, 44, and 273 fm (25, 80, and 500 m) are now known as Inshore, Shelf, and Offshore, respectively. The exact depths for each mooring have been determined during site-specific surveys and do not necessarily correspond to the initial proposed nominal depths.

Conceptual views of the proposed Grays Harbor Line and Newport Line depicting the proposed paired moorings, sensors, benthic nodes, buoys, and gliders are provided in Figures 2-2 and 2-3.

Newport Line. The proposed modifications to the Newport Line (Figure 2-1b and Table 2-1) would only include the elimination of the 82 fm (150-m) subsurface mooring. As with the Grays Harbor Line, there is a change in the naming convention of the remaining proposed moorings. The proposed moorings at the nominal depths of 14, 44, and 273 fm (25, 80, and 500 m) are now known as Inshore, Shelf, and Offshore, respectively. The exact depths for each mooring have been determined during site-specific surveys and do not necessarily correspond to the initial proposed nominal depths. In addition, the glider tracks corresponding to the Grays Harbor Line and Newport Line would be extended from 126° W to 128° W and an additional east-west glider track would be added north of Pacific City (Figure 2-1b). All other OOI infrastructure and activities as described and previously assessed in the PEA and SER would remain unchanged.

Table 2-1. Summary of Previously Assessed and Proposed Modifications to CSN (Endurance Array) Infrastructure

Component	*PEA/SER*	*SSEA Proposed Action*
ENDURANCE ARRAY		
Grays Harbor Line Moorings	- 4 paired surface/subsurface at 14, 44, 82, and 273 fm (25, 80, 150, and 500 m) (Figure 2-1a). - 2 cabled subsurface 44 and 273 fm (80 & 500 m) to RSN N4a via N4b and N4c (Figure 2-1a). - active and non-active acoustic sensors on moorings & benthic nodes.	- 3 paired surface/subsurface at 14, 44, and 273 fm (25, 80, and 500 m) (Figures 2-1b and 2-2). - active and non-active acoustic sensors on moorings & benthic nodes.
Newport Line Moorings	- 1 paired surface/subsurface mooring at 14 fm (25 m). - 2 paired surface/cabled subsurface moorings at 44 and 273 fm (80 and 500 m). - 1 subsurface mooring at 82 fm (150 m) cabled to RSN N1. - active and non-active acoustic sensors on moorings & benthic nodes.	- 1 paired surface/subsurface mooring at 14 fm (25 m). - 2 paired surface/cabled subsurface moorings at 44 and 273 fm (80 and 500 m). - 1 node with no moorings at 82 fm (150 m) cabled to RSN N1. - active and non-active acoustic sensors on moorings & benthic nodes (Figures 2-1b and 2-3).
Gliders	- Mission box to 126° W. - 4 east-west glider tracks from coast to 126° W. - 6 gliders	- Mission box to 128° W. - 5 east-west glider tracks from coast to 128° W; new east-west line north of Pacific City (Figure 2-1b). - 6 gliders.

Sources: NSF 2008a, 2009a; Ocean Leadership 2010a.

Site-Specific Selection of Endurance Array Moorings

Siting of the Endurance Array moorings would initially be based on specific science/operational requirements as listed in Table 2-2. Figure 2-4 depicts an overview of the proposed three Grays Harbor Line mooring sites. Figures 2-5a, b, and c provide a detailed view of candidate mooring sites and the ‘siting boxes’ or study areas based on the siting requirements for each proposed mooring (Inshore, Shelf, and Offshore). Figures 2-6 and 2-7 depict the similar approach for the Newport Line. The siting box defines a study area in which a mooring may be sited and would meet the initial science/operational requirements.

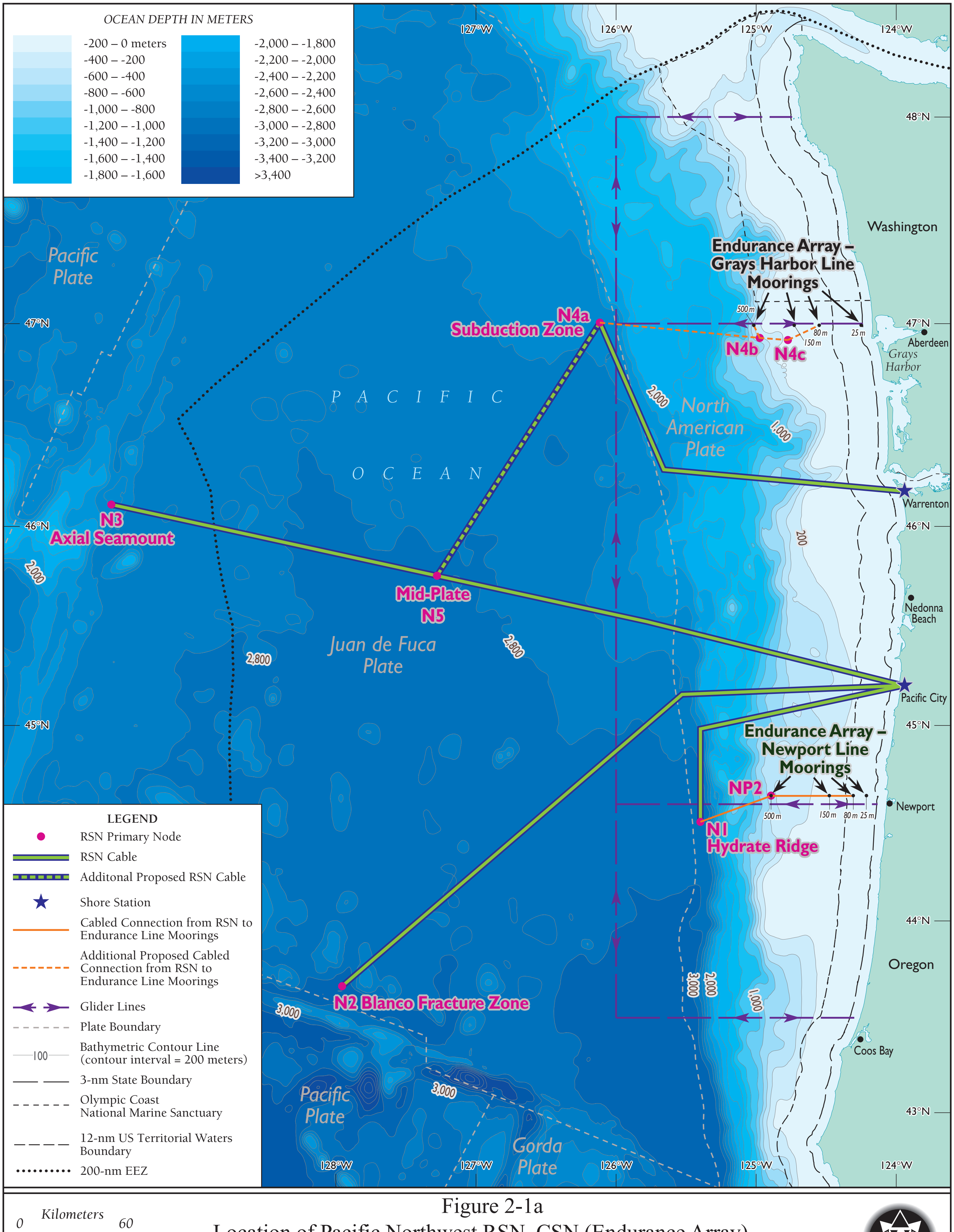


Figure 2-1a
Location of Pacific Northwest RSN, CSN (Endurance Array), and Associated Glider Mission Boxes Previously Assessed in the 2008 PEA and 2009 SER

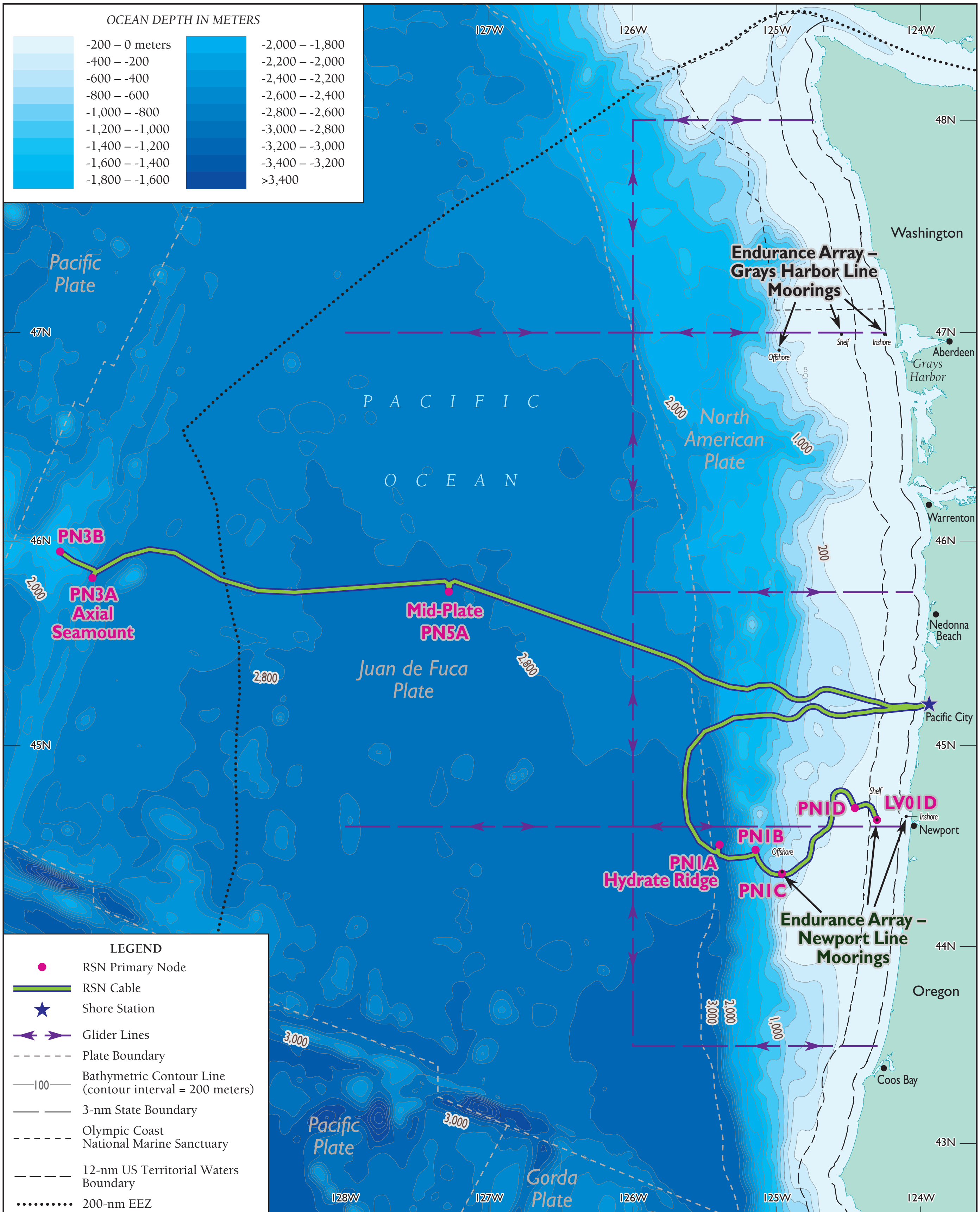


Figure 2-1b
Location of Pacific Northwest RSN, CSN (Endurance Array), and Associated Glider Mission Boxes to be Installed and Operating by 2015

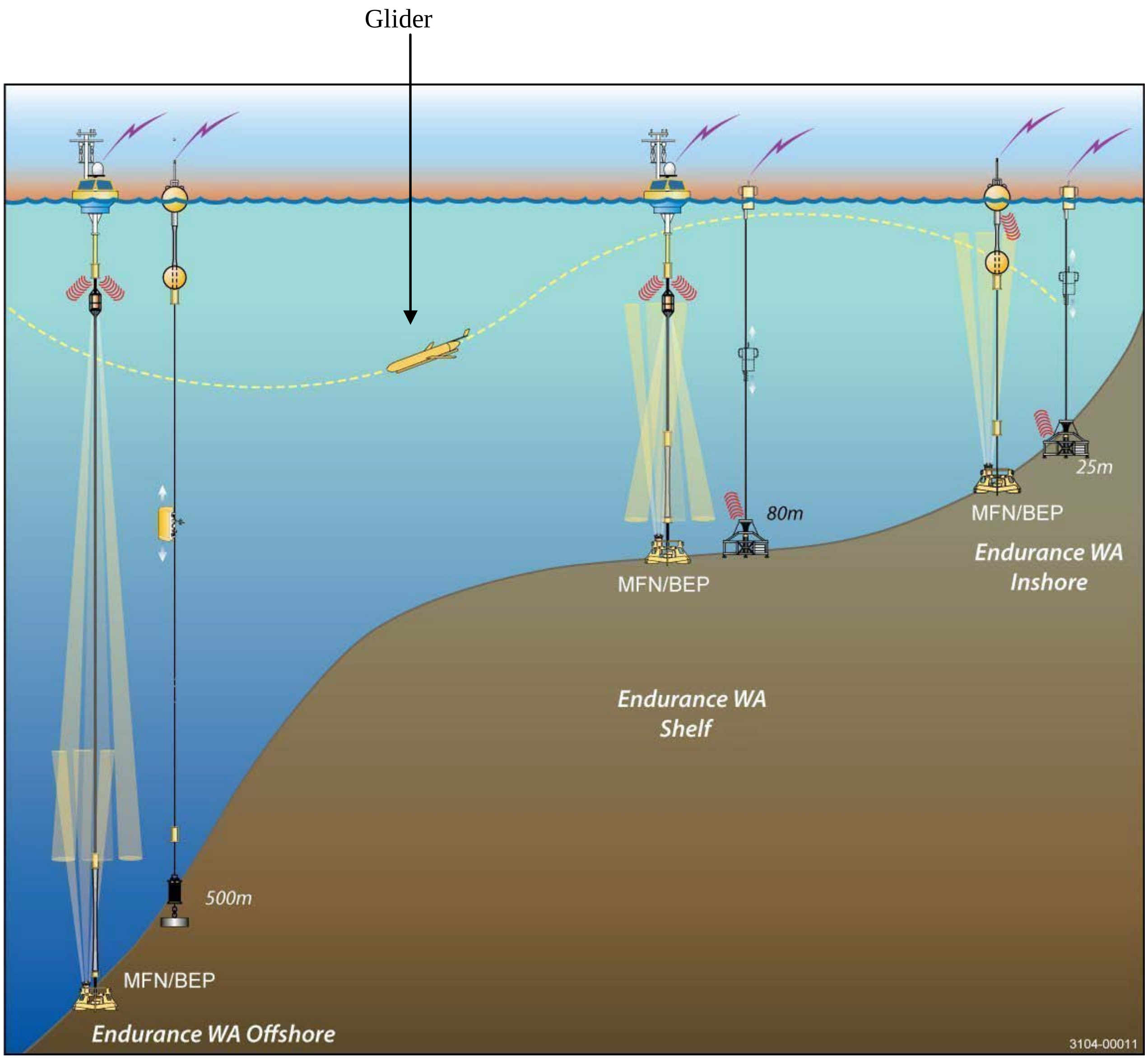


Figure 2-2. Conceptual Representation of the 25-m (Inshore), 80-m (Shelf), and 500-m (Offshore) Moorings of the Proposed Endurance Array (Grays Harbor Line)

Notes: Not to scale. MFN/BEP = Multi-Function Node/Benthic Experiment Package; WA = Washington. For a detailed discussion of the various components of the moorings such as sensors, gliders, etc., refer to the PEA (Appendix A).

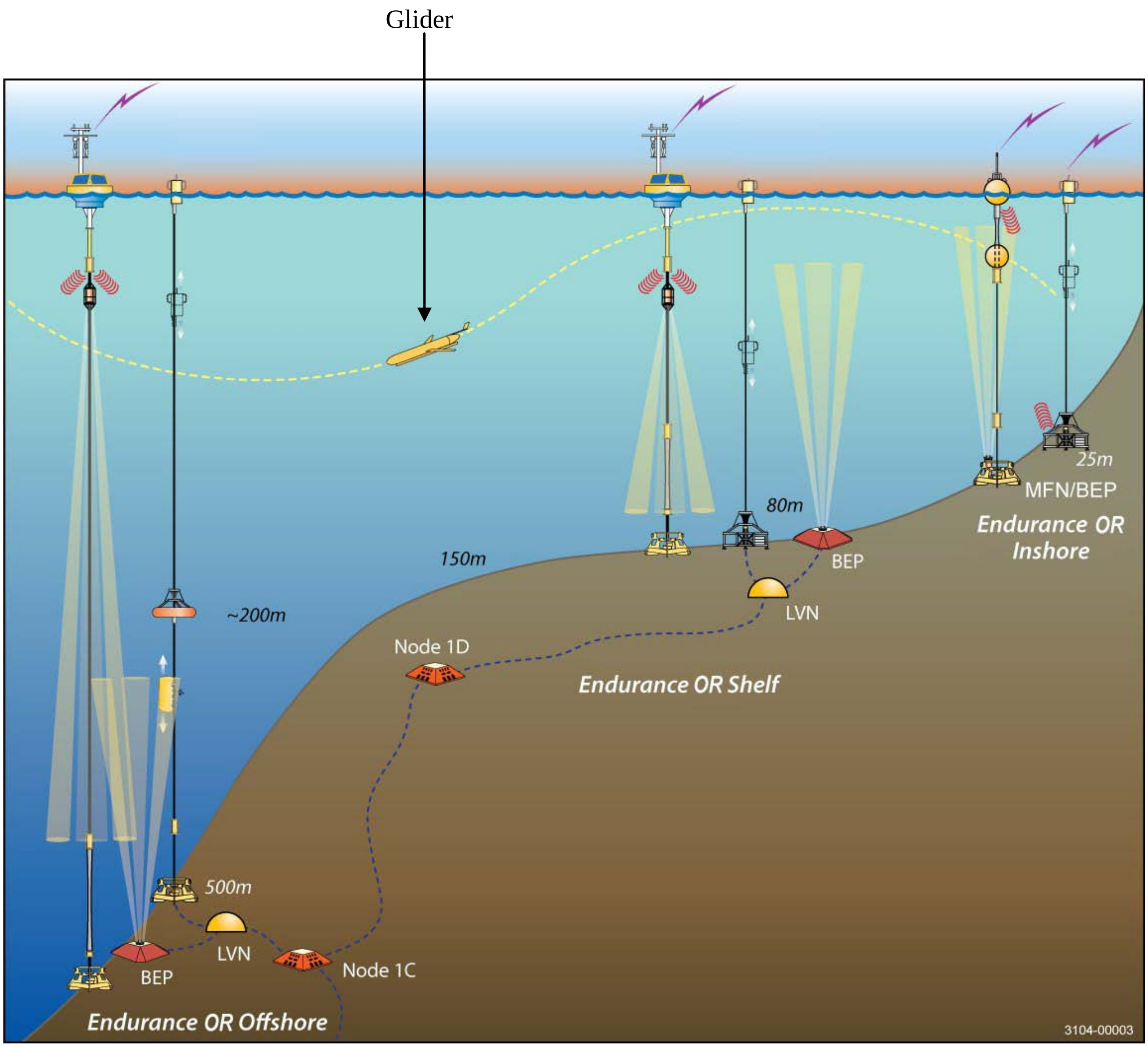


Figure 2-3. Conceptual Representation of the 25-m (Inshore), 80-m (Shelf), and 500-m (Offshore) Moorings of the Proposed Endurance Array (Newport Line)

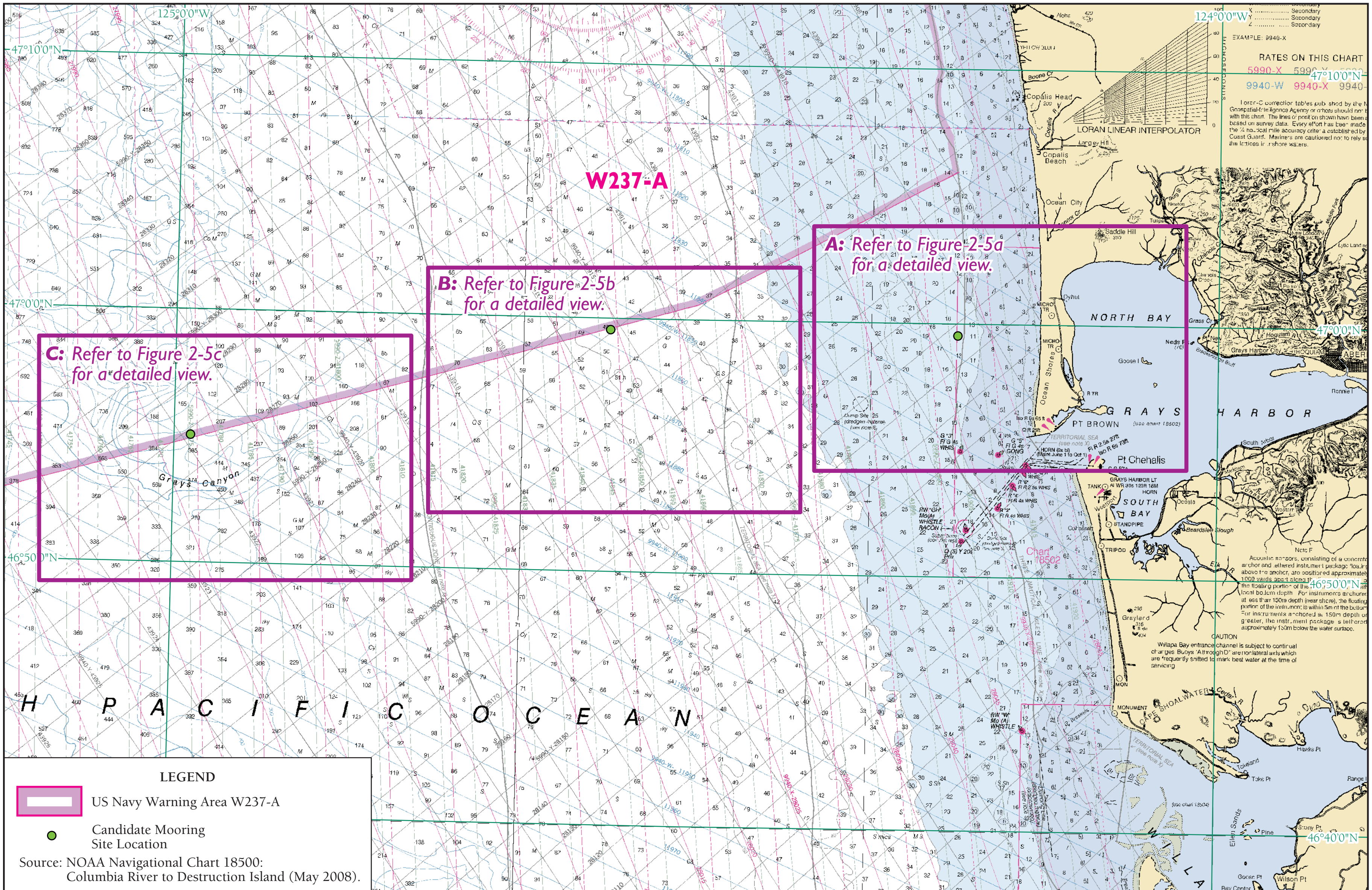
Notes: Not to scale. LVN = Low Voltage Node; MFN/BEP = Multi-Function Node/Benthic Experiment Package; OR = Oregon. For a detailed discussion of the various components of the moorings such as sensors, gliders, etc., refer to the PEA (Appendix A).

After the initial determination of a siting box in which a mooring could be placed to meet the science/operational requirements, the potential site-specific placement, or '*micro-siting*', of a mooring within each study area is being coordinated with representatives of marine users and tribal nations. These include but are not limited to the following: Quinault Nation, Coalition of Coastal Fisheries, Washington Dungeness Crab Fishermen's Association, Grays Harbor Marine Resources Committee, Oregon Dungeness Crab Commission, Oregon Trawl Commission, Oregon Albacore Commission, Oregon Salmon Commission, Midwater Trawlers Co-Op, Fisherman Advisory Committee for Tillamook (FACT), Columbia River Crab Fishermen's Association, Oregon Fisherman's Cable Committee (OFCC), Fishermen Involved in Natural Energy (FINE), Purse Seine Vessel Owners Association, Fishing Vessel Owners Association, and Pacific City Dorymen's Association. Coordinating with the local marine users regarding the site-specific placement of each mooring will assist in avoiding conflicts with regional fishing interests as well as ensuring that the mooring locations meet the scientific objectives of the CSN.

Table 2-2. Science/Operational Siting Requirements for the Endurance Array Moorings

	Mooring	
Inshore	*Shelf*	*Offshore*
GRAYS HARBOR LINE		
• soft bottom (clay, silty or sandy). • at least 0.5 nm (0.9 km) outside of published barge tow lanes. • outside of designated shipping lanes. • in 14-16 fm (25-30 m) water depth. • within 4 nm (7.4 km) from 46.99° N, 124.25° W. • >2 nm (3.7 km) from Grays Harbor entrance (jetties) and navigational markers to the harbor entrance.	• soft bottom (clay, silty or sandy). • at least 0.5 nm (0.9 km) outside of published barge tow lanes. • outside of designated shipping lanes. • in 38-49 fm (70-90 m) water depth. • within 5.4 nm (10 km) of 46.99° N, 124.55° W.	• soft bottom (clay, silty or sandy). • at least 0.5 nm (0.9 km) outside of published barge tow lanes. • outside of designated shipping lanes. • in 219-339 fm (400-620 m) water depth. • within 5.4 nm (10 km) of 46.88° N, 124.97° W. • deployed on bottom with slope <10 degrees.
NEWPORT LINE		
• soft bottom (clay, silty or sandy). • at least 0.5 nm (0.9 km) outside of published barge tow lanes. • outside of designated shipping lanes. • in 14-16 fm (25-30 m) water depth. • at least 0.2 nm (0.4 km) and not more than 3.2 nm (6 km) north of the NH line.* • >2 nm (3.7 km) from Yaquina Bay entrance (jetties) and navigational markers.	• soft bottom (clay, silty or sandy). • at least 0.5 nm (0.9 km) outside of published barge tow lanes. • outside of designated shipping lanes. • in 38-49 fm (70-90 m) water depth. • at least 0.5 nm (0.9 km) and not more than 3.2 nm (6 km) north of the NH line.* • must be accessible by a cable route from PN1C, through PN1D, that can be substantially buried.	• soft bottom (clay, silty or sandy). • at least 0.5 nm (0.9 km) outside of published barge tow lanes. • outside of designated shipping lanes. • in 219-339 fm (400-620 m) water depth. • at least 0.5 nm (0.9 km) and no more than 18 nm (33 km) from the NH line.* • must be serviced by PN1C and accessible by a cable route from PN1B that can be substantially buried. • deployed on bottom with slope <10 degrees.

Notes: *NH = Newport Hydrographic (NH) Line (along 44.65° 'N), is an historical location of repeat hydrographic sampling for over 50 years. It is one of the justifications for siting of the Newport Line. The purpose of siting the proposed Newport Line moorings some distance from NH stations is to reduce the chance of conflict with routine/established ocean sampling programs along this hydrographic sampling line,



Kilometers 0 10

Nautical Miles 0 10

Figure 2-4
Overview of Proposed Endurance Array (Grays Harbor Line) Mooring Sites

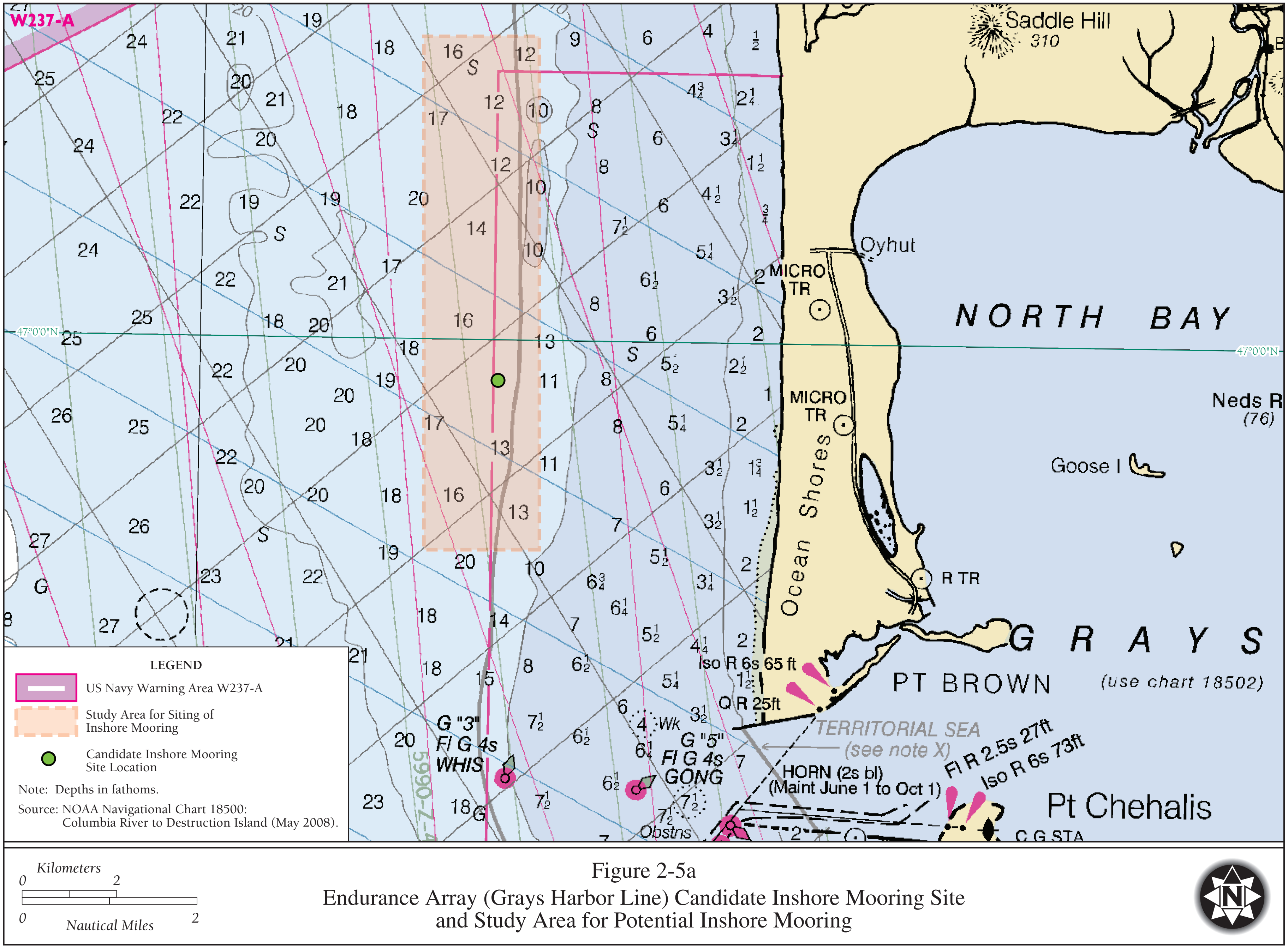


Figure 2-5a
Endurance Array (Grays Harbor Line) Candidate Inshore Mooring Site and Study Area for Potential Inshore Mooring

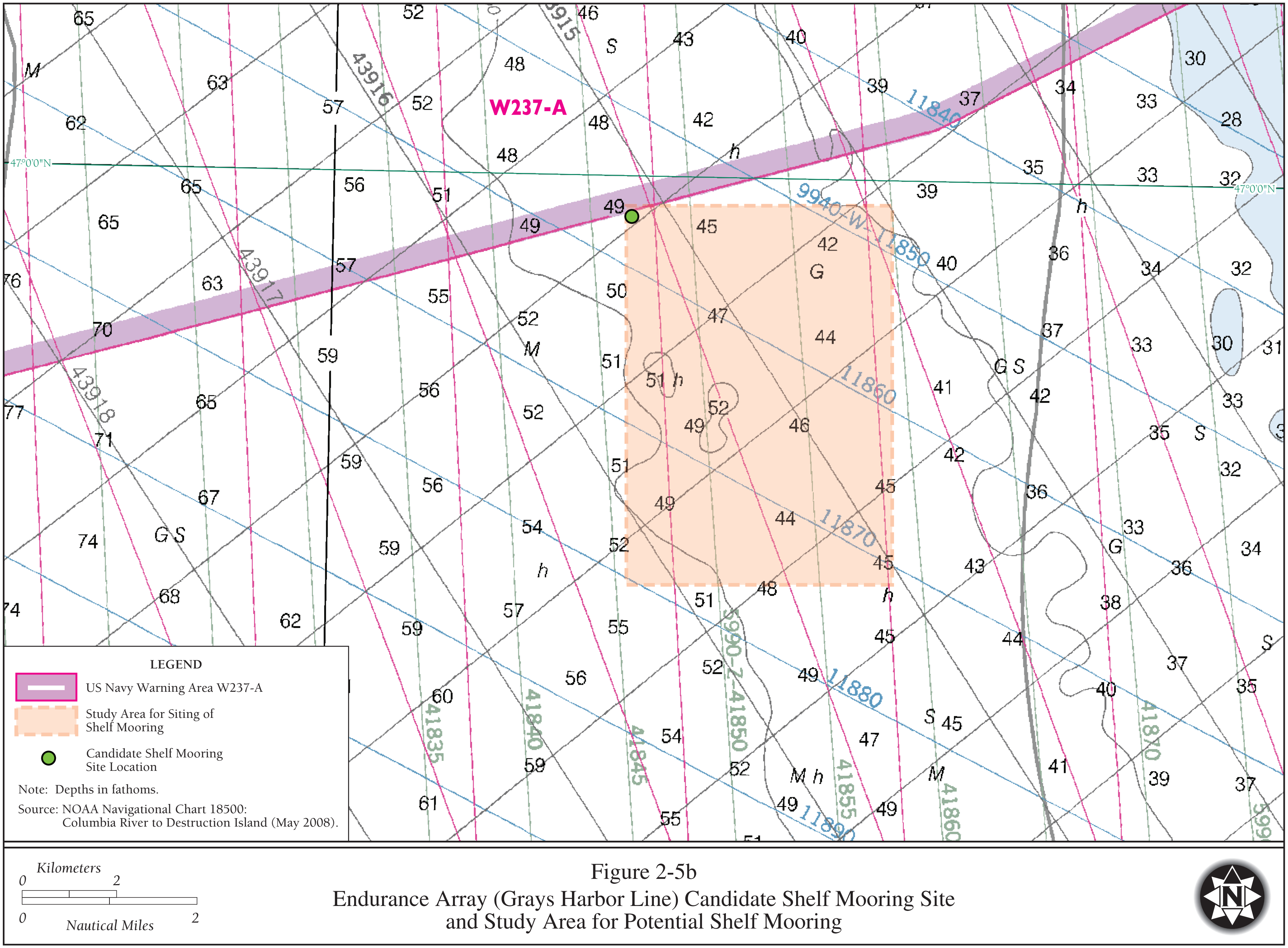
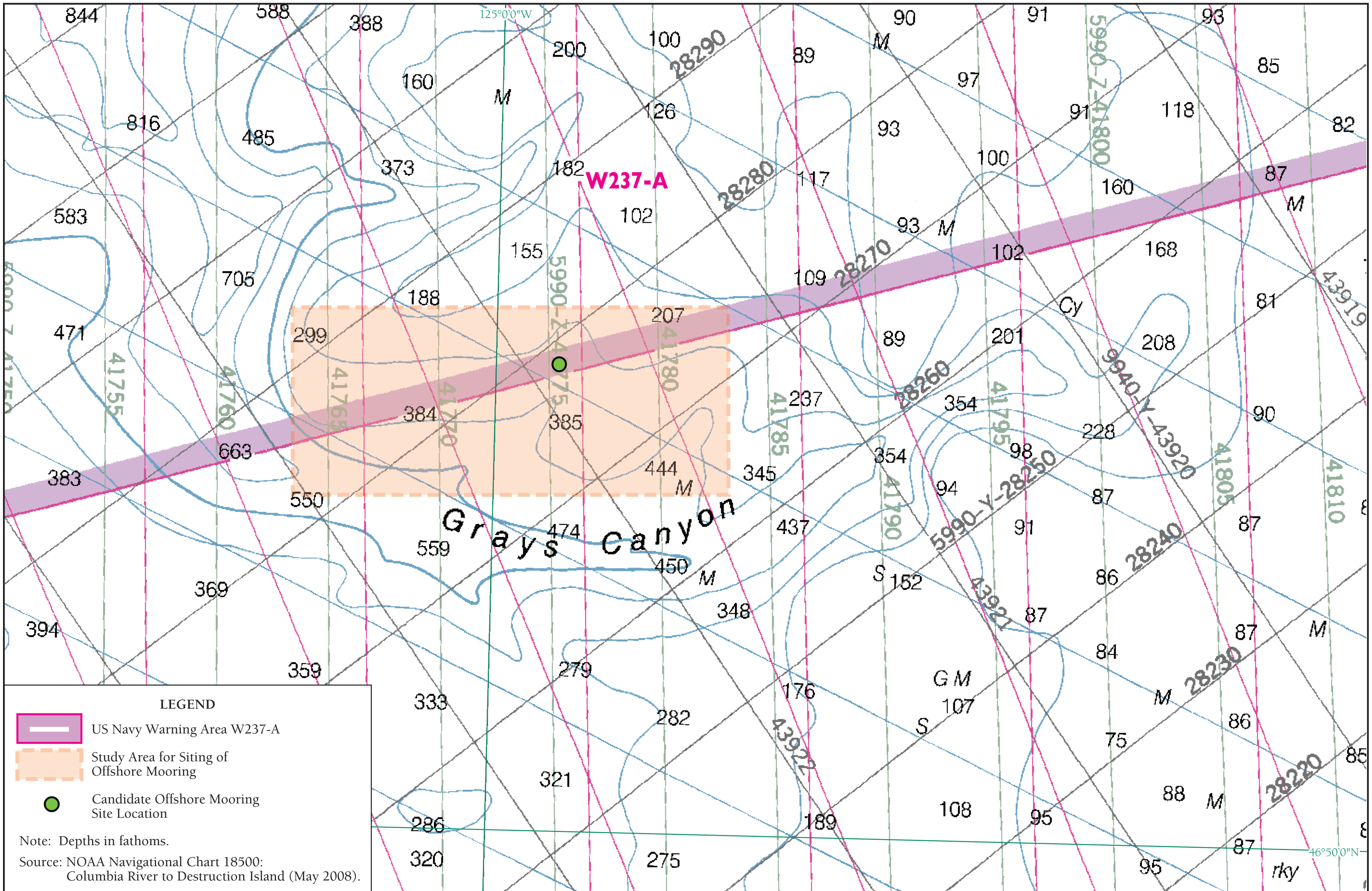


Figure 2-5b
Endurance Array (Grays Harbor Line) Candidate Shelf Mooring Site and Study Area for Potential Shelf Mooring



Kilometers
0 2
0 Nautical Miles 2

Figure 2-5c
Endurance Array (Grays Harbor Line) Candidate Offshore Mooring Site and Study Area for Potential Offshore Mooring

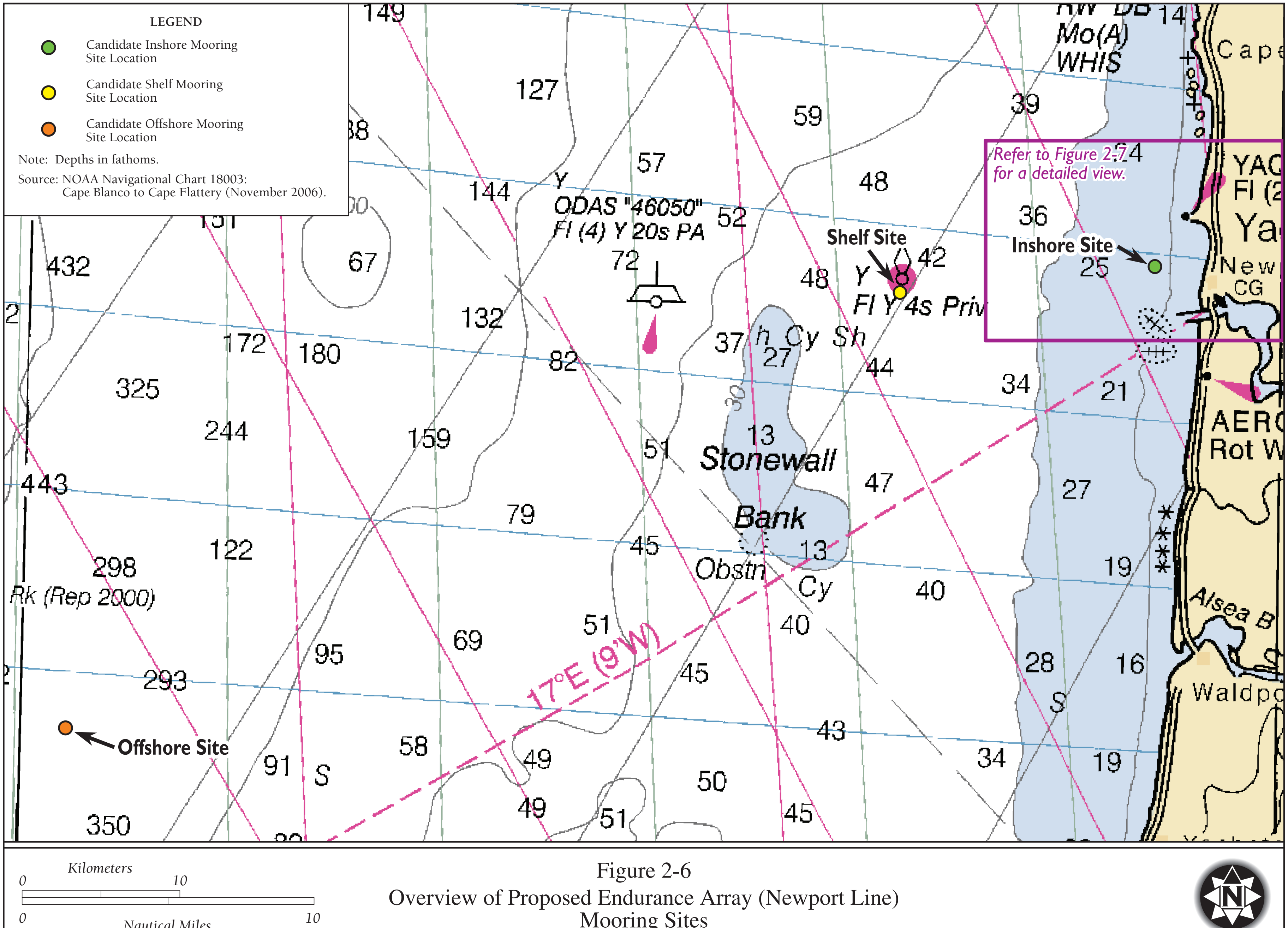


Figure 2-6
Overview of Proposed Endurance Array (Newport Line)
Mooring Sites

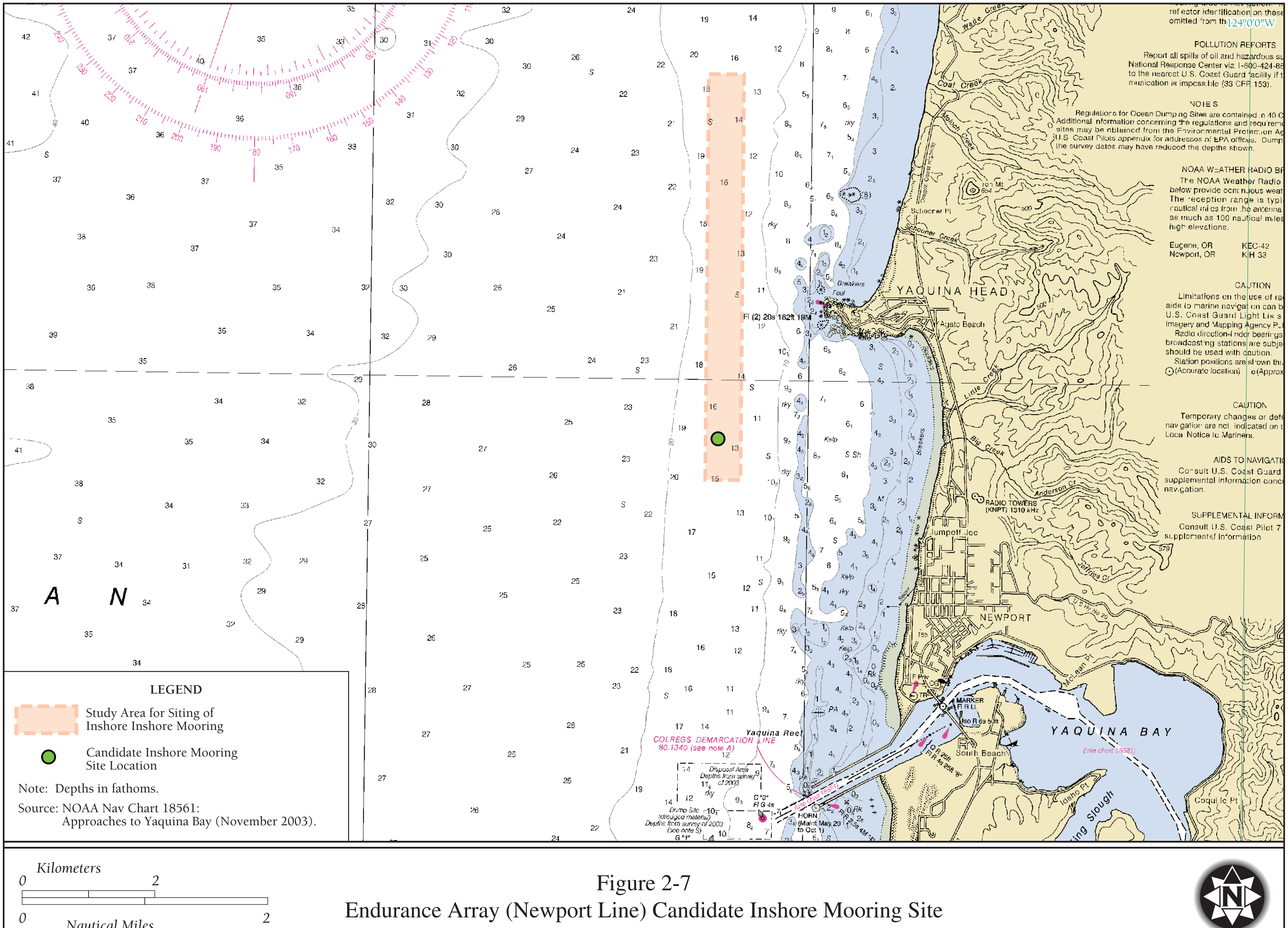


Figure 2-7
Endurance Array (Newport Line) Candidate Inshore Mooring Site

2.2.1.2 Pioneer Array

PEA and SER – Previously Assessed Components

The Pioneer Array would consist of 2 lines of moorings running north-south across the continental shelf (refer to Section 2.2.1.2 of the PEA and Section 2.1.2 of the SER). The western (downstream) line would consist of surface moorings, wire-following profiler moorings with a small surface expression, and surface-piercing profiler moorings with intermittent surface expressions. The eastern (upstream) line would consist of wire-following profiler moorings with small surface expression. Gliders and AUVs would run missions in the vicinity of the moored array (Figure 2-8a). As assessed in the PEA and SER, the Pioneer Array would contain (Table 2-3, Figures 2-8a and 2-9a):

- 4 electrical-optical-mechanical (EOM) surface moorings with local power generation, satellite communications capabilities, and benthic nodes paired with 4 surface-piercing profiler moorings.
- 4 wire-following profiler moorings that would be internally powered.
- 3 AUVs with 2 docking stations at 2 EOM surface moorings for power transfer and communications.
- 10 gliders.
- an AUV mission box of approximately 2,288 square nautical miles (nm^2).
- a glider mission box of approximately 5,398 nm^2.

Table 2-3. Summary of Previously Assessed and Proposed Modifications to Pioneer Array Infrastructure

Item	*PEA/SER*	*SSEA Proposed Action*
Moorings	- 4 EOM surface moorings. - 4 surface piercing profiler moorings. - 4 wire-following profiler moorings. - Active & non-active acoustic sensors on moorings.	- 3 EOM surface moorings. - 2 surface piercing profiler moorings. - 5 wire-following profiler moorings. - Active & non-active acoustic sensors on moorings.
AUVs & Gliders	- 3 AUVs and 10 gliders. - Area of AUV mission box approximately 2,288 nm^2. - Area of glider mission box approximately 5,398 nm^2.	- 3 AUVs and 6 gliders. - Area of AUV mission box approximately 2,489 nm^2. - Area of glider mission box approximately 5,697 nm^2.

Sources: NSF 2008a, 2009a; Ocean Leadership 2010a.

In summary, a total of 12 moorings would be installed on the seafloor under the PEA/SER. In addition, 3 AUVs and 10 gliders would be used to provide monitoring abilities across the entire shelf break.

SSEA Proposed Action – Proposed FND Modifications

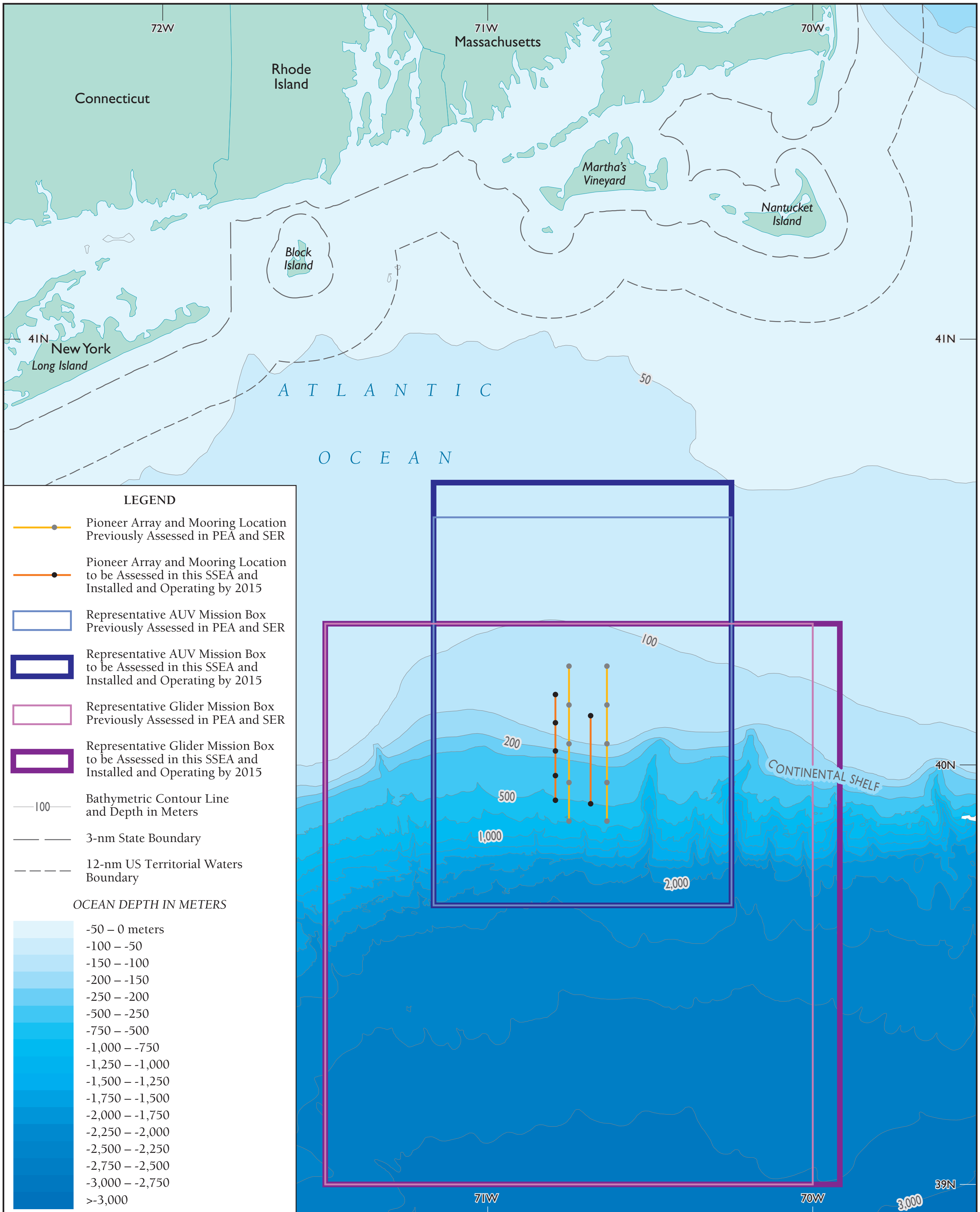
As proposed in the FND and assessed in this SSEA as the Proposed Action (Figures 2-8a, 2-8b, and 2-9b; and Table 2-3), the Pioneer Array would contain:

- 3 EOM surface moorings with local power generation, satellite communications capabilities, and MFNs; 2 of the 3 EOM moorings would be adjacent to surface-piercing profiler moorings, the third would be adjacent to a wire-following profiler mooring.
- 4 stand-alone wire-following profiler moorings that would be internally powered with satellite communication capabilities.
- 3 AUVs with 2 docking stations at 2 EOM surface moorings for power transfer and communications.

- Mooring lines would be shifted less than a kilometer to the west and would not extend as far north and south as proposed in the PEA/SER.
- 6 gliders.
- an AUV mission box extended approximately 5 nm to the north (Figure 2-8a), increasing the total mission area by 201 nm^2 to approximately 2,489 nm^2 (an increase of approximately 9%).
- a glider mission box extended approximately 4 nm to the east (Figure 2-8a), increasing the total mission area by 299 nm^2 to approximately 5,697 nm^2 (an increase of approximately 5%).

The general location of the Pioneer Array elements under the Proposed Action described in this SSEA is unchanged from that previously assessed in the PEA and SER. The distance from shore (Martha's Vineyard) to the northern boundary of the AUV and glider mission boxes and mooring line would be approximately 38, 58, and 68 nm, respectively. Table 2-3 and Figure 2-8a summarize the changes. A total of 10 moorings would be installed on the seafloor, a reduction of 2 moorings. In addition, 3 AUVs and 6 gliders would be used to provide monitoring abilities across the entire shelf break within slightly larger mission boxes as opposed to the 3 AUVs and 10 gliders originally proposed under the PEA and SER.

After the initial determination of candidate sites where a mooring could be placed to meet the science/operational requirements (Figures 2-8a and 2-8b), the potential site-specific placement, or '*micro-siting*', of a mooring is being coordinated with representatives of marine users. These include but are not limited to the following: Massachusetts Fishermen's Partnership, Cape Cod Commercial Hook Fishermen's Association, Commercial Fisheries Center of Rhode Island, Ocean State Fisheries Association, Rhode Island Lobstermen's Association, Rhode Island Shellfishermen's Association, Eastern New England Scallop Association, Atlantic Offshore Lobstermen's Association, and Long Island Commercial Fishing Association. Coordinating with the local marine users regarding the site-specific placement of each mooring will assist in avoiding conflicts with regional fishing interests as well as ensuring that the mooring locations meet the scientific objectives of the CSN.



Kilometers 0 35
0 *Nautical Miles* 19

Figure 2-8a
Location of the Mid-Atlantic Bight CSN (Pioneer Array) and Associated AUV and Glider Mission Boxes Previously Assessed in the 2008 PEA and 2009 SER and to be Assessed in this SSEA

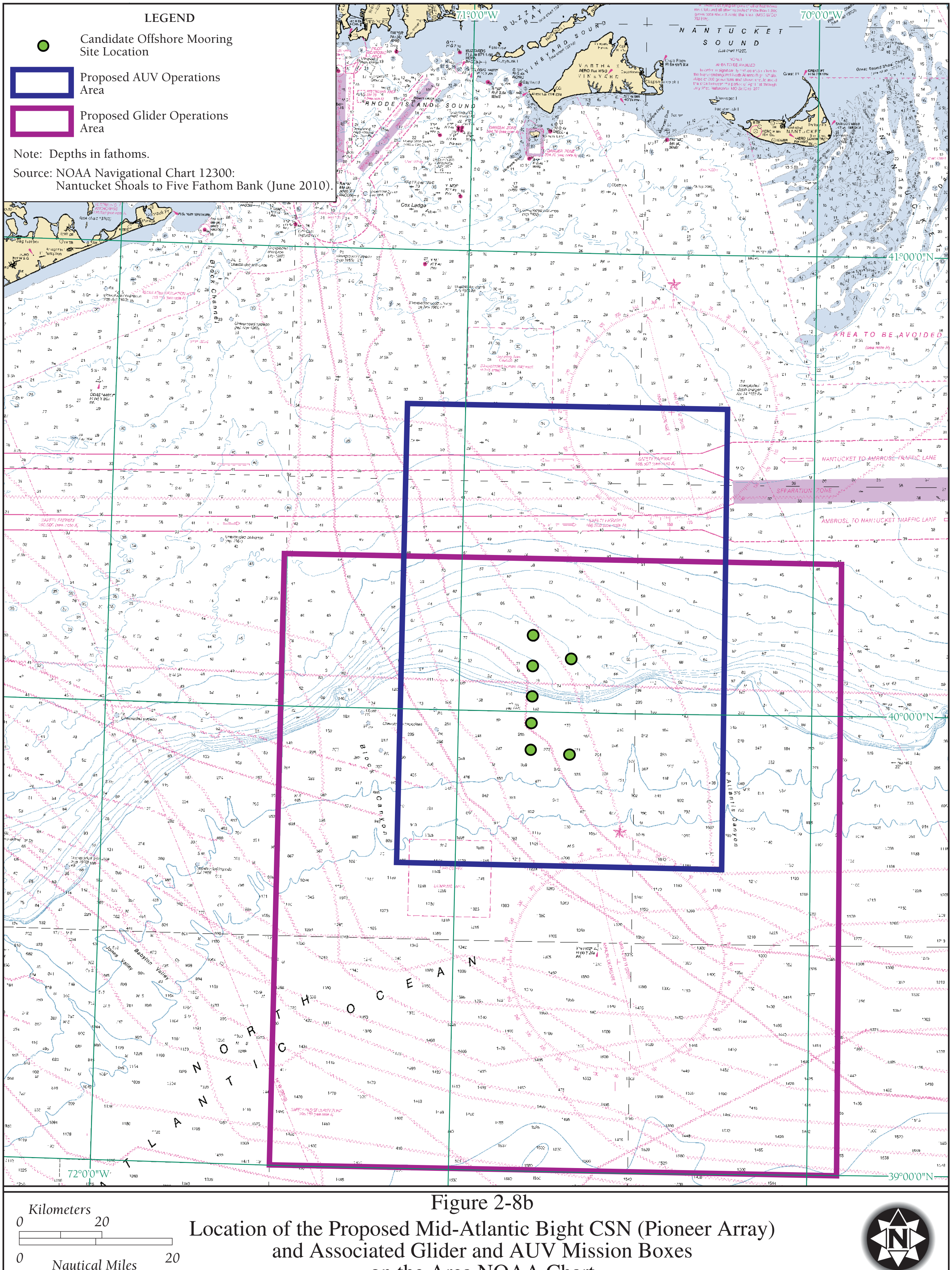


Figure 2-8b
Location of the Proposed Mid-Atlantic Bight CSN (Pioneer Array) and Associated Glider and AUV Mission Boxes on the Area NOAA Chart

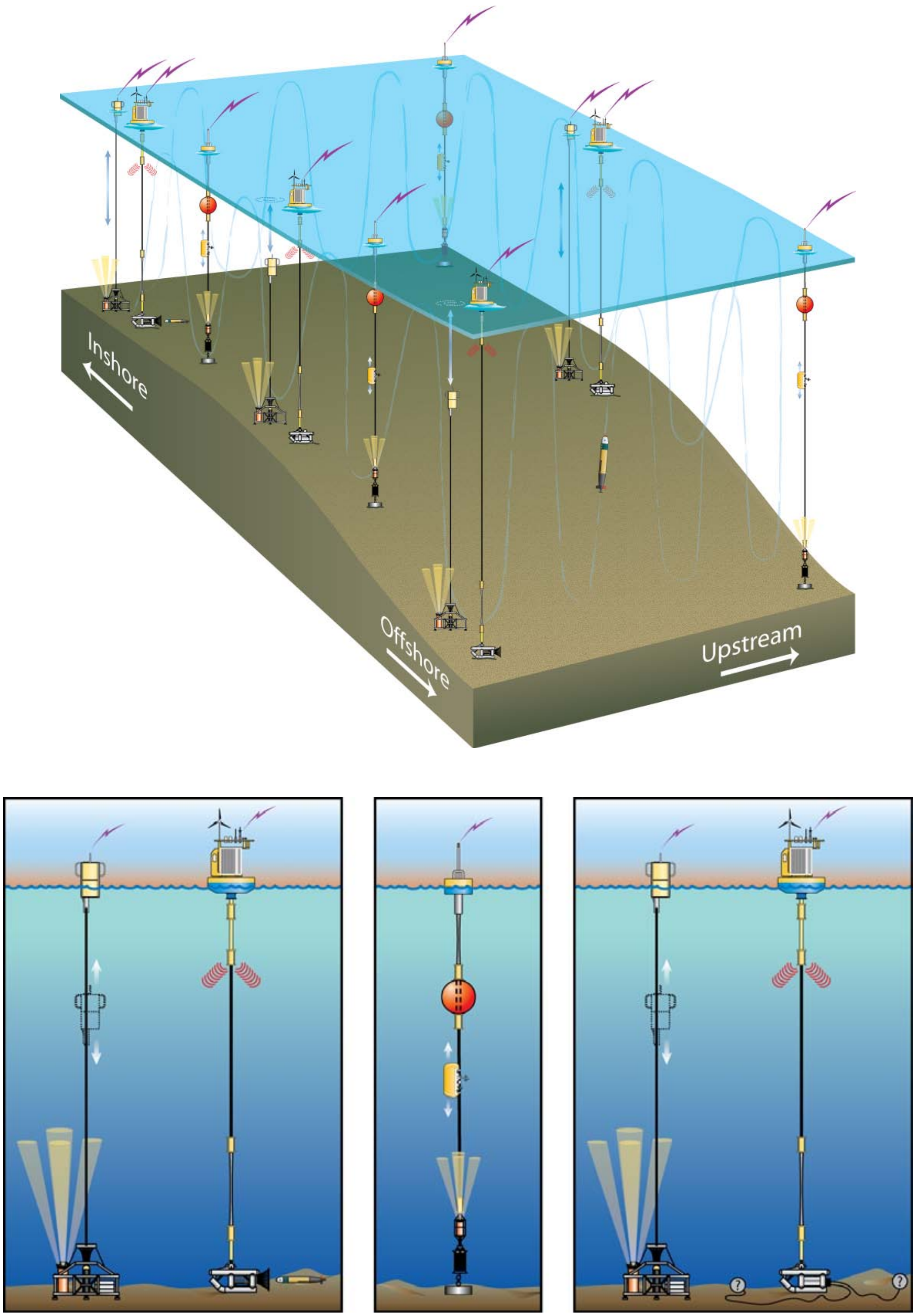
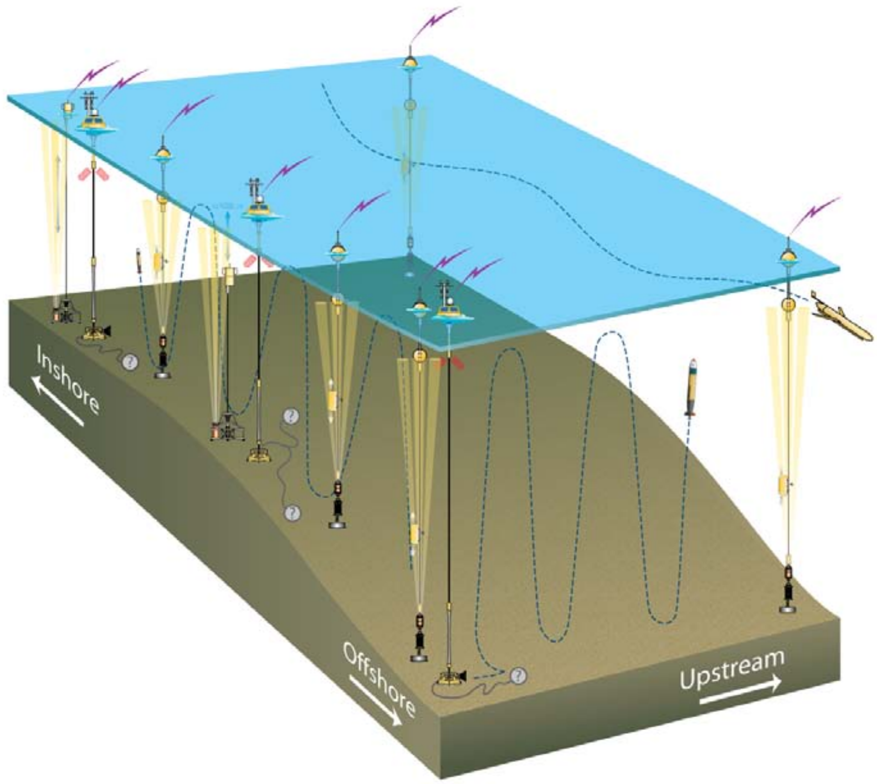


Figure 2-9a. Schematic Diagrams of the Pioneer Array (top) and Moorings (bottom) as Previously Assessed in the PEA and SER

Inshore and offshore sites would pair EOM/AUV-dock moorings with surface-piercing winched profilers (left). Central sites would pair EOM/MFN moorings with winched profilers and seafloor sensors (right). The array would also include stand-alone moorings with a wire-crawler profiler and an acoustic Doppler current profiler (ADCP) coupled inductively to a telemetry buoy (center). (Not to scale)



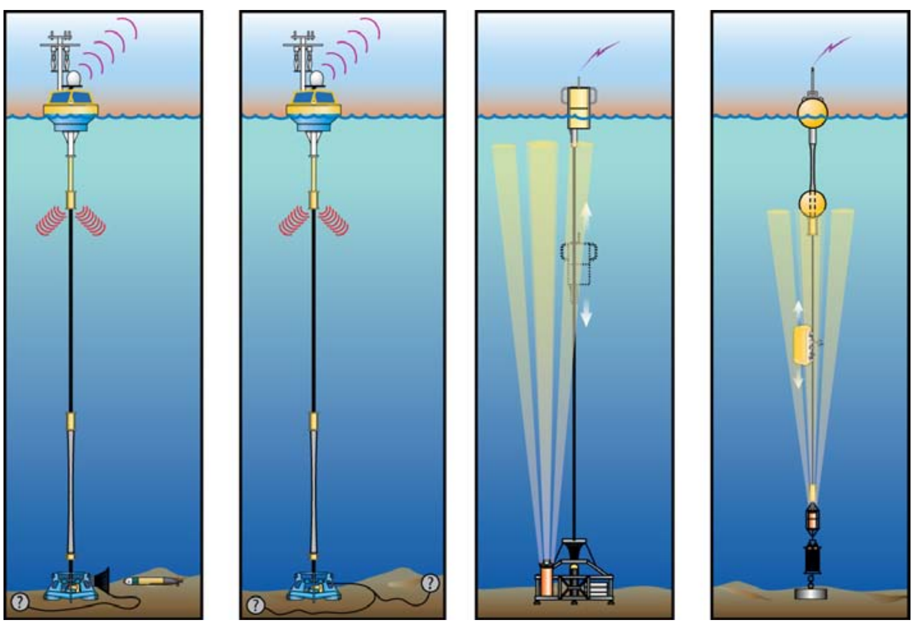


Figure 2-9b. Schematic Diagrams of the Proposed Pioneer Array (top) and Moorings (bottom) as Assessed in this SSEA

EOM moorings with MFNs supporting AUV docks (left) will be at the inshore and offshore sites. An EOM mooring with MFN supporting science user instrumentation (left center) will be at the central site. Surface-piercing winched profilers with ADCPs at their base (right center) will be at the inshore and central sites. Moored wire-following profilers with ADCPs (right) will be at the intermediate sites along the inshore/offshore line, and at the upstream corners.

2.2.2 Regional-Scale Nodes (RSN)

2.2.2.1 PEA and SER – Previously Assessed Components

As assessed in the PEA (refer to Appendix A, Section 2.2.2) and SER (refer to Appendix B, Section 2.2), the RSN was comprised of 4 components: shore stations, primary infrastructure, secondary infrastructure, and tertiary infrastructure.

<u>Shore Station</u>

The PEA and SER assessed 2 existing submarine telecommunications shore stations as potential RSN cable landing sites: Warrenton and Pacific City, Oregon (Figure 2-1a). The Warrenton shore station is not carried forward as part of the Proposed Action in this SSEA and is not discussed further.

Previously owned and operated by the now bankrupt North Pacific Cable, the University of Washington (UW) currently has a lease for the facility from Tillamook Lightwave Inter-governmental Agency (IGA), the current owner. The station has sufficient space to support all possible RSN configurations. At least 2 ducts are available from the station to the existing beach manhole (BMH). Since no bore pipes are available to land new cables across the beach, horizontal directional drilling (HDD) would be required from the BMH to a water depth of 8-11 fm (15-20 m). The shore station at Pacific City would provide a cabled shore connection to the proposed RSN infrastructure including connections to Primary Nodes N1, N2, N3, and N5 (Figure 2-1a).

<u>Primary Infrastructure (Backbone Cable and Primary Nodes)</u>

Under the PEA and SER, the Primary Infrastructure included:

- 5 Primary Node sites (N1, N2, N3, N4, and N5) (Figure 2-1a) and
- 757 nm (1,403 km) of backbone cable of up to 4 types of standard submarine telecommunications electrical-optical cable, of which 255 nm (472 km) would be buried and 503 nm (931 km) would be laid on the seafloor (refer to Appendix B, Table 2 of the SER).

Primary Nodes. The Primary Nodes function as gateways between the backbone cable and the Secondary Infrastructure, converting the high voltage from the shore stations to a lower, useable voltage for distribution to the Secondary Infrastructure. Each node would be enclosed in a trawl-resistant frame (TRF), which protects each node from fishing activities (Figure 2-10). The TRF is 14.8 ft (4.5 m) long, 11.8 ft (3.6 m) wide, 4.3 ft (1.3 m) high, and weighs 10,582 pounds (lbs) (4,800 kilograms [kg]) in air.

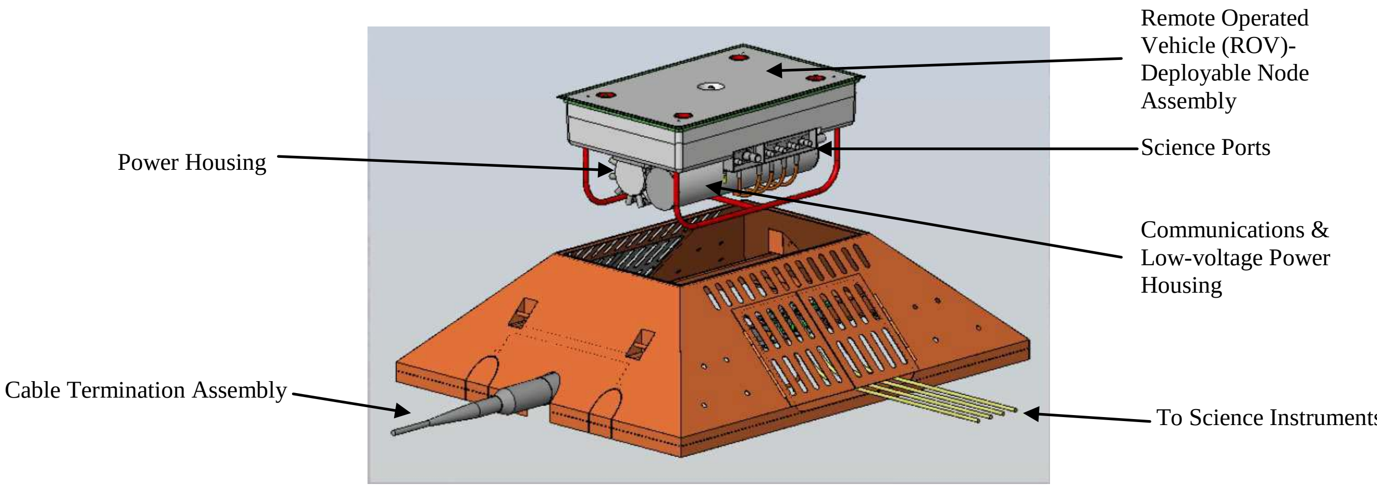


Figure 2-10. Trawl-resistant Frame (TRF) for Primary Nodes

All Primary Nodes would host an initial suite of basic sensors, most likely an ocean bottom seismometer coupled to a hydrophone, a differential pressure gauge, a pressure sensor, and a current meter, and all would potentially host water column moorings.

Backbone/Submarine Cable. Depending on seabed conditions and burial requirements, the backbone infrastructure of the RSN as assessed in the PEA and SER comprised 757 nm (1,403 km) of up to 6 types of standard submarine telecommunications electrical-optical cable from the Tyco SL17 family of fiber-optic cable: Lightweight (LW), Special Applications (SPA), Light-Wire Armored (LWA), Single Armored (SA), Double Armored (DA), and Rock Armored (RA) (Table 2-4). The basic underlying component of all cable types is the LW cable comprised of:

- the unit fiber structure supporting the electrical-optical fibers protected by 2 layers of high-strength, steel-stranded wires;
- a copper sheath; and
- a medium-density polyethylene jacket.

Table 2-4. Summary of RSN Primary Infrastructure Cable Types and Previously Assessed Amount for Installation under the PEA and SER

Cable Type	*Outside Diameter (mm)*	*Applications*	*Features*	*Length to Install (km) (% of Total)*
Lightweight (LW)	17.0	Benign, sandy bottom; deploy to 4,375 fm (8,000 m).	Core cable; light protection.	451 (32%)
Special Applications (SPA)	22.4	Rough seabed; risk of moderate abrasion and/or attack by marine life; used as spare for LW; deploy to 3,554 fm (6,500 m).	Metallic tape and second polyethylene outer jacket applied over core; additional abrasion and hydrogen sulfide protection.	384 (27%)
Light-Wire Armored (LWA)	28.9	Rocky terrain; some risk of fishing damage; used for burial in areas of decreased risk of external damage; deploy to 1,094 fm (2,000 m).	Light-wire armored layer applied to core cable.	340 (24%)
Single Armored (SA)	31.3	Rocky terrain; moderate risk of fishing damage; deploy to 820 fm (1,500 m).	Armor wire layer applied to core cable for additional protection.	0
Double Armored (DA)	35.9	Very rocky terrain; high risk of fishing damage; pipeline crossings; deploy to 438 fm (800 m).	Second armored wire layer applied to LWA for additional protection.	228 (16%)
Rock Armored (RA)	48.6	Very rocky terrain; very high risk of fishing damage; high risk of abrasion; risk of crushing; deploy to 109 fm (200 m).	Short-lay armor wire layer applied over SA cable.	0
			Total	**1,403**

The remaining cable types utilize the LW cable as the base cable and simply add additional protection for various applications. The final outside protective cover for the SPA cable is a high-density polyethylene jacket. The LWA and DA are covered with a tar-soaked nylon yarn.

The cable types and proposed lengths were based on a preliminary analysis of the proposed cable route at the time of the preparation of the SEA and SER, seafloor substrate characteristics, and potential environmental activities (e.g., commercial fishing). As part of the current OOI planning process and the preparation of this SSEA, a Desktop Study and detailed site-specific surveys were conducted to examine, in detail, the proposed route and provide recommendations for cable types, locations for placement, and if burial or surface placement is necessary (UW 2010a, b).

Secondary and Tertiary Infrastructure

The electrical and EOM cables connecting the Primary Infrastructure to the Secondary Infrastructure would be approximately 25 millimeters (mm) in diameter and would be placed on the seafloor. Low-voltage nodes (LVNs) interconnect sensors, their associated low-power and medium-power junction boxes, moorings, and Primary Nodes. Note that in the PEA and SER, secondary infrastructure included Secondary Nodes. Since that time all Secondary Nodes are now called Primary Nodes. The LVN includes a pressure housing attached to a frame (TRF if required) that would sit on the seafloor. A typical LVN has a 1 m x 1 m base and be 2 m high.

The RSN portion of OOI would also support hybrid profiler moorings at 3 Primary Nodes: PN1A (Hydrate Ridge), PN3A (Axial Seamount), and PN1C (the cabled connection to the Offshore Newport Line of the Endurance Array, see Figure 2-3).

Moored platforms provide oceanographers the means to deploy sensors at fixed depths between the sea floor and the sea surface and to deploy packages that profile vertically at one location by moving up and down along the mooring line or by winching themselves up and down from their point of attachment to the mooring. The combination of a wire-following and shallow profiler on one subsurface mooring is called a hybrid profiler mooring. A mooring of this type provides the capability to sample the water column from near the seafloor to the sea surface. The hybrid profiler mooring will generally consist of 3 components: 1) mooring line; 2) deep profiler and instrument package; and 3) subsurface buoyant platform that includes an instrument package, winch, and shallow profiler. Figure 2-11 depicts a conceptual view of a hybrid profiler mooring.

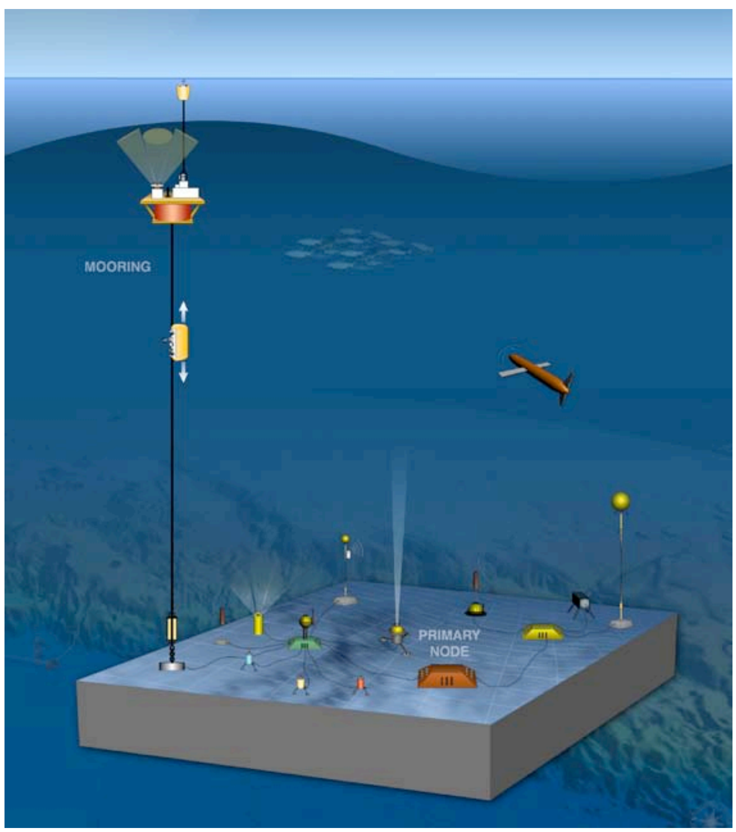


Figure 2-11. Conceptual Representation of a Hybrid Profiler Mooring

Mooring Line. The mooring line of the hybrid profiler moorings would be an EOM cable with copper conductors and optical fibers. The EOM cables would allow power and data to flow through the mooring line. Innovations to EOM moorings for the OOI include the use of molded chain and stretch-hose elements with spiral-wrapped conductors and optical fibers on GSN and CSN sites. The hybrid mooring, because of the subsurface platform and dual profilers does not have the stretch-hose elements and in itself is an innovation. These elements allow a high degree of adaptability to different water depths and oceanographic conditions.

Deep Profiler and Instrument Package. The deep profiler would consist of a wire-following profiler, which would operate along the continuous, unobstructed section of the EOM mooring line, to collect scientific data in the water column. This deep profiler would format and store the collected scientific data during the profile, and then transmit the data back to an LVN when the profiler is seated in its docking station at the base of the platform that also recharges the profiler. The system shall have the ability to profile up to 3,500 m of water column with a payload of up to 8 independent scientific sensors mounted on the instrument package. The instrument package contains sensors to scientifically monitor the water column from seafloor to the subsurface buoyant platform with a focus on turbulent mixing. The deep profiler would receive input power and a communication link from the LVN. The operation of the deep profiler would be remotely controlled from the RSN infrastructure via commands sent to the profiler from the LVN while seated in its Docking Station.

Subsurface Buoyant Platform. The subsurface buoyant platform would be located approximately 109 fm (200 m) below the sea surface. At this water depth, the platform would be below the depth of strong waves and the euphotic zone, isolating the mooring from much of the high-frequency variability in forces that a surface mooring experiences and minimizing biofouling. The buoyant platform would be fitted with an instrument package to monitor the upper mixed water column and serve as a base of operations for a shallow profiler that would provide sampling of the water column from the platform to near the water surface.

Shallow Profiler. The shallow profiler resides on subsurface buoyant platform at 109 fm (200 m) below the sea surface and profiles the upper water column from the 109-fm (200-m) platform to a point close to the air-water interface. Since most light only penetrates to about 109 fm (200 m), the upper water column contains much of the commercially interesting life. Also, because of surface wave action and currents, exchange of gasses and heat is a significant driver for ocean acidification and weather. The profiler would contain up to 16 instruments that would sample this segment with light, chemical, and biological sensors. An instrument controller would accumulate data and send it through an EOM cable to the platform where it would be sent directly to the primary nodes and shore station. On-board engineering sensors would determine how close to the surface the profiler can approach safely.

The electrical and EOM cables connecting the components within the Tertiary Infrastructure (e.g., junction boxes to sensors) and the Secondary Infrastructure to the Tertiary Infrastructure would be approximately 25 mm in diameter and would be placed on the seafloor. Note that since the preparation of the PEA and SER, there are now only 2 types of infrastructure considered under this SSEA: primary and secondary; tertiary infrastructure has been combined with secondary infrastructure.

2.2.2.2 SSEA Proposed Action – Proposed FND Modifications

The following are the proposed modifications to the RSN component of the OOI (Figure 2-1b and Table 2-5):

- Removal of the Warrenton shore station. A single shore station in Pacific City would be used under the Proposed Action.

- Removal of Primary Nodes N2 (Blanco Fracture Zone) and N4a (Subduction Zone) and associated connecting backbone cable from the Pacific City and Warrenton shore stations, respectively. This would reduce the backbone cable length from approximately 757 nm (1,403 km) as assessed in the PEA/SER to approximately 488 nm (903 km) under this SSEA (Proposed Action).
- Changing nomenclature/naming convention of several Primary and Secondary nodes as follows (Figure 2-1b):
  - Primary Node N1 now Primary Node 1A (PN1A).
  - Secondary Node NP1 now Primary Node 1B (PN1B).
  - Secondary Node NP2 now Primary Node 1C (PN1C).
  - Secondary Node NP3 now Primary Node 1D (PN1D).
  - Primary Node N3 now Primary Node 3A (PN3A).
  - Secondary Node 3A now Primary Node 3B (PN3B).

  (*Note:* The Secondary Nodes described in the PEA/SER differed from Primary Nodes only in the number of expansion ports and the presence of an optical amplifier in the Primary Node (see Section 2.2.2.3 of the PEA). Therefore, changes in the naming convention do not affect the physical characteristics of the nodes.
- Reduction in the secondary infrastructure (i.e., the number of LVNs, low-power junction boxes, medium-power junction boxes, and associated secondary extension cables, water column moorings, and seafloor and mooring sensor packages positioned geographically around each Primary Node).
- Under the SSEA Proposed Action there is no longer a tertiary infrastructure component. What was previously called tertiary infrastructure under the PEA/SER is now combined with the secondary infrastructure in this SSEA.

A summary of the RSN infrastructure design changes assessed in the PEA/SER and in this SSEA as the Proposed Action are listed in Table 2-5. A detailed discussion of the RSN infrastructure and its installation is provided in Section 2.2.7.2.

Table 2-5. Summary of Infrastructure Previously Assessed in the PEA and SER and Proposed Modifications to RSN under the SSEA Proposed Action

Equipment	*PEA/SER*	*SSEA Proposed Action*	*Total Change*
PRIMARY INFRASTRUCTURE*			
Primary Nodes (ea)†	5	7	-1†
Total Cable to Install (km)	1,403	903	-500
By Cable Type			
DA (km)	228	0	-228
LWA (km)	340	318	-22
SPA (km)	384	164	-220
LW (km)	451	421	-30
Mode of Cable Installation			
Buried (km)	472	306	-163
within HDD conduit (km)	na	3	na
Surface (km)	931	594	-337
SECONDARY INFRASTRUCTURE*			
Secondary Nodes (ea)†	3	na	na
LVN (ea)	20	5	-15
Cable (km)	286	35	-251

Table 2-5. Summary of Infrastructure Previously Assessed in the PEA and SER and Proposed Modifications to RSN under the SSEA Proposed Action

Equipment	*PEA/SER*	*SSEA Proposed Action*	*Total Change*
TERTIARY INFRASTRUCTURE*			
Low-power junction box (ea)	12	5	-7
Medium-power junction box (ea)	16	8	-8
Cable (km)	120	na*	na*

Sources: NSF 2008a, 2009a; Ocean Leadership 2010a; UW 2010b.

Notes: na = not applicable.

*There has been a change of nomenclature between the PEA/SER and this SSEA and there are now only 2 types of infrastructure – primary and secondary. The secondary infrastructure cable length assessed in the PEA/SER is now contained within the secondary infrastructure in this SSEA.

†Due to change of nomenclature. All Secondary Nodes at time of the PEA/SER are referred to as Primary Nodes in this SSEA. Therefore, a total of 8 Primary Nodes were assessed in the PEA/SER and 7 Primary Nodes are proposed under the SSEA; no Primary Nodes were added.

Site-Specific Selection of RSN Infrastructure

Siting of the RSN backbone cable and associated moorings was initially based on specific science/operational requirements as described in the PEA. After the initial determination of a potential RSN cable route that would meet the science/operational requirements, the potential site-specific siting of the RSN cable is being refined based upon:

- a Desktop Study completed in March 2010 (UW 2010a),
- completion of geophysical and geotechnical survey along the proposed RSN cable route (i.e., backbone cable route and primary node locations), and
- on-going coordination with the Oregon fishing community with the assistance of appropriate representatives.

Desktop Study. One of the goals of the Desktop Study was to identify potential hazards and obstructions along a predetermined route and recommend route design modifications. The Desktop Study provided information on conditions along the RSN cable route including detailed discussions of bathymetry, climate, geology, oceanography (e.g., currents, tides, waves), existing infrastructure (e.g., telecommunications cables), natural resources (e.g., endangered species, protected habitats), socioeconomics (e.g., fisheries), and cultural resources (e.g., shipwrecks). This included the identification of main fishing grounds and discussions with local fishermen in the ports of Garibaldi, Newport, and Astoria. Based on the most current databases accessed during the preparation of the Desktop Study, the initial planned RSN cable route was reengineered and updated to account for the potential for the cable to impact various resources and for those resources to impact the cable. The following were considered when making route design modification: bottom temperatures, ocean currents, obstructions, potential impacts to fisheries, and state and federal permitting requirements (UW 2010a).

Geophysical and Geotechnical Offshore Survey. To further refine and delineate the RSN cable routing, an extensive geophysical and geotechnical survey was conducted in April-May 2010 along the entire RSN cable route as recommended in the March 2010 Desktop Study. OFCC representatives participated in the RSN cable route survey and were directly involved with cable route design and real-time route modifications. By coordinating efforts with the fishing fleet (trawlers and others), OFCC representatives verified that a “buried” cable route could be found that would limit potential impacts to fisheries. Although representing essentially trawlers, the OFCC also informally agreed to coordinate discussions with other marine users in the area of the proposed OOI project. The results from the April-May 2010 geophysical and geotechnical survey are currently being analyzed and a final report is due in late summer 2010. These results will be incorporated into the Final EA.

Discussions with Fishing Community. As stated above, prior to the start of the geophysical and geotechnical survey operations, the RSN route recommended during the Desktop Study was presented to several member of the Oregon fishing community (FINE, FACT, Pacific City Dorymen's Association, and OFCC) to obtain further input on fishing ground locations and potential impacts of the RSN primary and secondary infrastructure on fisheries. Coordinating with the local marine users regarding the site-specific placement of OOI infrastructure will assist in avoiding conflicts with regional fishing interests as well as ensuring that the locations of the OOI infrastructure meet the scientific objectives of the RSN and CSN.

Upon signature of a Memorandum of Understanding and Subaward between Ocean Leadership and the OFCC in March 2010, meetings were held in Newport in March 2010 between Ocean Leadership, UW, and Oregon State University (OSU) and the fishing community including trawlers (represented by the OFCC), longliners, and crabbers. During the meetings, fishermen provided information on seabed conditions along the proposed RSN cable routes, identifying areas where burial may be challenging, and suggesting cable re-routing and re-location of several primary nodes to avoid or reduce potential impacts to major fishing grounds. As a result of these discussions, the configuration of the RSN cable route and location of several CSN cabled and uncabled components along the Newport Line of the Endurance Array (PN1C, PN1D, and LV01D) were changed. To reduce potential impacts to fisheries, an agreement was reached to generally place OOI components in the vicinity of hard grounds or existing fishing hazards such as buoys (i.e., in areas where fishing does not typically occur).

In addition, based on suggestions provided by fishermen during the March meeting, Ocean Leadership contracted a fishing boat to complete a reconnaissance survey of the (new) primary node sites PN1C and PN1D. The survey was conducted March 26-27, 2010 on board the F/V *Miss Sue* with an OFCC representative on board. Following this survey, a number of options for these sites were provided by fishermen. They were checked against science requirements and the subsequent April-May geophysical and geotechnical survey of the RSN cable route was planned accordingly.

Discussions were also initiated regarding the establishment of buffer zones or 'watch circles' around the RSN and CSN infrastructures in all areas of burial. Buffer zones identifying no-entry/no-fishing zones around the sites would be established in consultation with the affected fishing communities. The diameters of these buffer zones relate to water depths (larger in deeper water). Currently, a 0.2-nm radius buffer zone is under discussion for the inshore sites and 0.5-nm radius for the shelf and offshore sites. The sites would be clearly charted on NOAA navigation charts, published in a Notice to Mariners (NOTMAR), and through direct contact with user communities. There will be active radar transponders on surface buoys as well as required U.S. Coast Guard (USCG) markings; other markings are under consideration. Discussions with the fishing community are ongoing and will continue as necessary to address further concerns.

2.2.3 Global-Scale Nodes (GSN)

The OOI's design process originally identified 4 strategic high-latitude sites and 1 mid-latitude site as comprising the initial GSN that was assessed under the PEA (refer to Appendix A, Section 2.2.3) and SER (refer to Appendix B, Section 2.3) (Figure 1-1):

1. Station Papa in the southern Gulf of Alaska – 50° N, 145° W; depth = 2,324 fm (4,250 m)
2. Southern Ocean off Chile – 55° S, 90° W; depth = 2,625 fm (4,800 m)

3. Irminger Sea southeast of Greenland – 60° N, 39° W; depth = 1,531 fm (2,800 m)
4. Mid-Atlantic Ridge – 23° N, 43.5° W; depth = 2,439 fm (4,460 m)
5. Argentine Basin – 42° S, 42° W; depth = 2,843 fm (5,200 m)

Station Papa, Southern Ocean, Argentine Basin, and Irminger Sea would all have an acoustically linked surface buoy, 1 subsurface and 2 flanking subsurface moorings, and 3 gliders. The Mid-Atlantic site would have an Extended Draft Platform with a benthic node, 1 subsurface and 2 flanking subsurface moorings, and 5 gliders.

Although all 5 GSN sites are still considered as viable and important components of the overall OOI project, the Mid-Atlantic Ridge site is not proposed for installation and operation by 2015. The 4 other GSN sites are proposed for installation and operation by 2015. Under the Proposed Action, there are no changes to the proposed installation or operation of the remaining 4 GSN sites that were previously assessed in the PEA and SER.

2.2.4 Gliders and AUVs

Gliders and AUVs would carry multidisciplinary sensor suites and sample at the mesoscale field within the GSN and CSN. They would sample autonomously for up to 1 year along programmable sampling patterns.

2.2.4.1 Gliders

A glider is a type of buoyancy-driven, unmanned and untethered underwater vehicle that navigates autonomously without any physical connection to a research vessel at the surface. The Seaglider is representative of the class of gliders that is proposed for use in the OOI (Figure 2-12). The Seaglider is 6 ft (1.8 m) in length, a wingspan of 3.3 ft (1 m), weighs 115 pounds (52 kg), and has an operating speed of about 0.5 knot (Figure 2-11). Except for the bladder and measurement sensors, the glider has no external moving parts or motors and all parts are encased inside an aluminum hull. It moves on a pre-programmed course vertically and horizontally in the water by pumping mineral oil to or from an internal bladder. This action changes the volume of the glider, making it denser or lighter than the surrounding water. When they dive or rise, the glider's wings achieve lift allowing the glider to fly forward through the water. The OOI gliders will be smaller and lighter than the OOI AUVs, and multiple gliders can be deployed and recovered from a small boat. Gliders are used throughout the CSN and GSN arrays infrastructure.

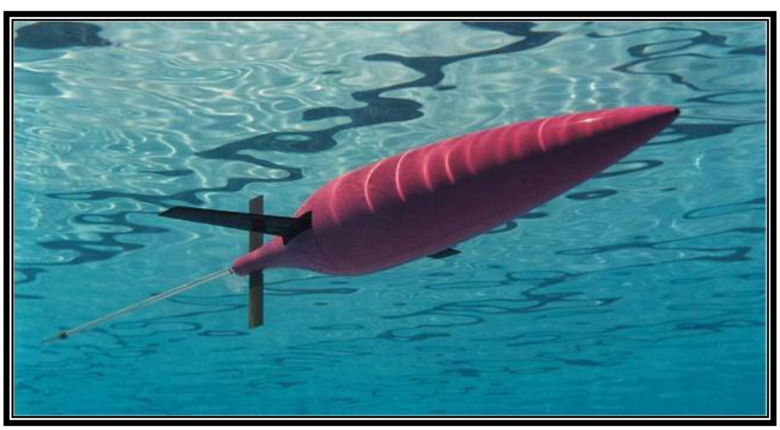


Figure 2-12. Representative Seaglider

On a mission, a Seaglider resembles a whale moving through the water as it repeatedly submerges and resurfaces. It takes 3.5 hours for the glider to reach a depth of 547 fm (1 km) before it ascends to the surface, gathering data as it rises. During that time it would travel a horizontal distance of approximately 3 nm (5 km) (Figure 2-13). At the beginning and the end of each dive, the glider obtains and records its position by surfacing to expose its Global Positioning System (GPS) antenna. Researchers obtain data from the glider and send new instructions to it via satellite communications. In addition, the glider may also communicate acoustically to vertical moorings associated with the GSN. Currently Seagliders operate at depths less than 547 fm (1 km) and can range up to 2,484 nm (4,600 km). Proposed for use in the GSN and CSN, gliders can carry an entire suite of oceanographic sensors that can measure temperature, salinity, pressure, turbidity, currents, dissolved oxygen, chlorophyll and colored dissolved organic matter (CDOM) fluorescence, and photosynthetically available radiation (PAR) (or sunlight).

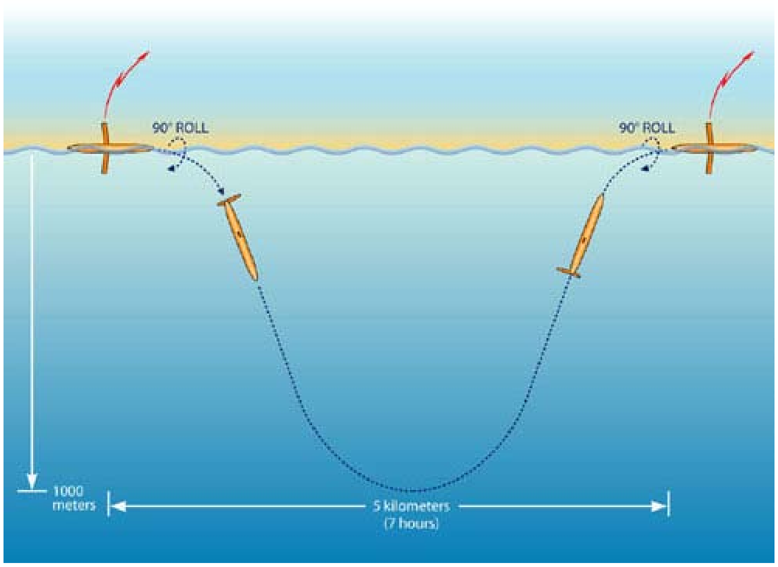


Figure 2-13. Example of a Glider Mission

2.2.4.2 Autonomous Underwater Vehicles (AUVs)

Unlike the long missions, deep-diving abilities, and slow speeds of gliders, a powered AUV travels faster, but for a shorter duration. The Remus 600 AUV is representative of the class of AUVs that is proposed for use in the OOI. The Remus 600 AUV can operate for up to 50 hours on rechargeable lithium ion batteries, can operate at depths to 328 fm (600 m), and can reach speeds of up to 4.5 knots. It is 10.7 ft (3.25 m) long, has a diameter of 1 ft (0.3 m), and weighs 529 lbs (240 kg). AUVs would conduct missions in support of the Pioneer Array. The base of some of the vertical profiler moorings would be equipped with AUV docking stations, which would allow an AUV to dock and recharge its batteries, thereby extending its at-sea mission. It may be equipped with a number of sensors including conductivity-temperature-depth (pressure) (CTD), acoustic Doppler current profiler (ADCP), dissolved oxygen, chlorophyll and CDOM fluorescence, sunlight (PAR), and acoustic imaging.

2.2.5 Sensors

To measure changes and variability in the chemical, biological, and geological processes in the ocean, the proposed OOI would be equipped with a complex suite of sensors. These sensors would be deployed from a number of platforms including water column moorings and on the seafloor. Table 2-6 provides a list of potential sensors that may be utilized within the OOI. It is important to note that the actual sensors to be deployed as part of the OOI program would be determined based on scientific objectives, costs, and the on-going discussions between engineers and investigators. It is expected that additional sensors would be added as the OOI program proceeds and the scientific objectives change based on researcher needs and priorities. Although these sensors would be largely commercial off-the-shelf sensors, some would require modification for extended deployment and a small number would require further development to meet the scientific objectives and requirements of the proposed OOI. This would maximize the utility of the proposed OOI to the broader ocean research community. As additional sensors are proposed, they would be examined for potential environmental impacts, either during their installation or operation, and additional environmental documentation would be prepared if necessary.

Table 2-6. Representative Non-Acoustic Sensors Proposed for Use in the OOI

Sensor	*Measurement*	*Platform(s)*
CTD	Water conductivity, temperature, and depth (pressure)	Mooring, glider, AUV, benthic
PAR	Light radiation	Mooring, glider, AUV
Nitrate sensor	Nitrates	Mooring
Broadband seismometers	Seismicity	Benthic
Short-period seismometers	Seismicity	Benthic
Pressure	Tidal and storm influence on seismicity and hydrothermal flow	Mooring, benthic
Temperature-resistivity-H_2	Temperature-chlorinity and dissolved hydrogen	Mooring, benthic
Fluid-particulate DNA	Fluid-particulate DNA	Benthic
High-definition camera	Imaging of biology and fluid flow at vents	Benthic, mooring
Gravity meter	Gravity field	Mooring, benthic
Surface meteorology	Air temperature, barometric pressure, relative humidity, wind velocity, short- & long-wave radiation, precipitation	Surface mooring
Microbial incubators	Environmental conditions within vent walls, co-registered microbe-temperature-fluid sampling	Benthic
pH	Acidity	Mooring, benthic
Chl-a and CDOM fluorescence	Chlorophyll a and dissolved organic matter	Mooring, glider, AUV, benthic
Optical backscatter	Turbidity and sediment concentration	Mooring, glider, AUV, benthic
Oxygen	Dissolved oxygen	Glider, AUV, benthic, mooring
Carbon dioxide (CO_2)	Partial pressure of CO_2 (air); dissolved CO_2 (seawater)	Mooring

The active acoustic sources proposed for use in the proposed OOI include (Table 2-7):

- Acoustic Doppler Velocimeter (ADV). ADVs are active sensors with an operating frequency of 5-6 megahertz (MHz), a source level of approximately 220 dB reference 1 micropascal at 1 m (re 1µPa @ 1 m), and a pulse length of 600 microseconds (µs). They would be placed on moorings or on the seafloor to investigate turbulence, boundary layers, directional waves, and sediment transport.
- ADCP. An ADCP can calculate the speed of the water current, direction of the current, and the depth in the water column of the current. This instrument can be placed on the seafloor, attached to a buoy or mooring cable, or mounted on an AUV or glider. The ADCP measures water currents with sound, using a principle of sound waves called the Doppler effect and works by transmitting high frequency (approximately 150-1,200 kilohertz [kHz]) very short pings (0.6-1.5 milliseconds [ms]) of sound into the water. The source level would be approximately 220 dB re 1µPa @ 1 m.
- Bio-acoustic Profilers (BAPs). BAPs monitor the presence and location of zooplankton within the water column by transmitting short (approximately 300 µs) narrow-beam (10°) signals at 38-460 kHz, which measure acoustic backscatter returns. The source level is 213 dB re 1µPa @ 1 m. Other targets detected include fish and suspended sediments. Much like a downward looking fish-finder, this tool measures the vertical distribution of plankton and fish.

- Altimeters. Altimeters would be used to assist AUVs and gliders with determining their altitude above the sea floor. They generally use generally high frequency (170 kHz) sources that emit a narrow (<5^o), downward directed beam with a source level of 206 dB re 1µPa @ 1 m.
- Multibeam Echosounder (MBES). During research activities, the ocean floor would be mapped with an MBES. The MBES emits brief pulses of high-frequency (100 kHz) sound in a narrow (1-2^o) fan-shaped beam at a source level of 225 dB re 1µPa @ 1 m.
- Acoustic Modems. Acoustic modems would be used for communication between mooring profilers, benthic sensors, gliders, and surface and subsurface buoys. They would operate as a omni-directional 20-30 kHz signal with a pulse duration of 1-2,000 ms.
- Tracking Pingers. These pingers would enable the tracking of AUVs and gliders once they are deployed. These pingers operate at a frequency of 10-30 kHz and emit a very brief (7 ms) pulse at source levels of 180-186 dB re 1µPa @ 1 m.
- Horizontal Electrometer-Pressure-Inverted Echosounder (HPIES). The HPIES is proposed as a core sensor on the RSN located on the seafloor near the full water column moorings. This instrument package combines a bottom pressure sensor, 12-kHz inverted (i.e., upward looking) echosounder, and a horizontal electrometer. Together these sensors allow measurement of bottom pressure, seafloor to sea surface acoustic travel time, and motionally induced electric fields. These properties provide insights into the vertical structure of current fields and water properties including temperature, salinity, and specific volume anomaly, separation of sea surface height variation and temperature, and near-bottom water currents. The echosounder would operate at a source level 172, 177, 182 dB re 1µPa @ 1 m at depths of 547, 1,094, and 1,641 fm (1, 2 and 3 km), respectively. There would be 24 narrow beamed (<5^o), 6-ms pings per hour.
- Sub-bottom Profiler (SBP). The SBP is normally operated to provide information about the near-surface features and bottom topography that is simultaneously being mapped by the MBES. It operates at mid-frequencies (2-7 kHz) with a source level of 203 dB re 1µPa @ 1 m.

Table 2-7. Representative Active Acoustic Sensors Proposed for Use in the OOI

Acoustic Source	*Frequency*	*Source Level (re 1µPa @ 1 m)*	*Pulse Length*	*Purpose/Platform(s)*
ADV	1-6 MHz	220 dB	600 µs	Current velocity/Mooring, benthic
ADCP	75-1,200 kHz	220 dB	0.6-1-5 ms	Current velocity across the water column/Mooring profilers, gliders, AUVs, benthic sensors
BAPs	38-460 kHz	213 dB	150-350 µs	Presence and location of biological parameters (e.g., zooplankton)/Mooring profilers
Altimeters	170 kHz	206 dB	4 sec	Height above seafloor/AUVs, gliders
MBES	100 kHz	225 dB	*	Bottom mapping/AUVs
Acoustic modems	20-30 kHz	180 dB	1-2,000 ms	Communication/Moorings, AUVs, gliders, mooring profilers
Tracking pingers	10-30 kHz	180-186 dB	7 ms	Location/AUVs, gliders, moorings
HPIES	12 kHz	172, 177, 182 dB (depending on depth)	6 ms	Water column velocity, pressure, temperature/Mooring, benthic sensors
SBP	2-7 kHz	203 dB	*	Bottom mapping/AUVs

Notes: *Unlike conventional continuous waveform sonar systems that transmit a short-duration, constant-frequency pulse, the proposed MBES and SBP would transmit a chirp pulse (i.e., a long, linearly swept pulse that changes in frequency linearly over time).

2.2.6 Schedule for OOI Testing, Installation, and Operation (2010-2014)

Under the Proposed Action, there are 5 stages whereby the OOI Network would be implemented and become operational by 2015. These are depicted in Table 2-8 and summarized below.

1. *Installation*. When the infrastructure element is scheduled to be installed in its designated location in the marine environment.
2. *Gliders Deployed*. Scheduled deployment of the designated Global, Endurance, or Pioneer Array glider fleet.
3. *AUVs Deployed*. Scheduled deployment of the AUVs in the Pioneer Array location.
4. *Data Flow*. Once installed (i.e., deployed), when measurement data is scheduled to be made available to the public via the Internet, on an experimental basis. Data flow may be interrupted at any time or discontinued before commissioning for engineering adjustments, repair, or replacements. The data flow depicted in Table 2-8 in the 2nd quarters of 2011 and 2012 is for cyberinfrastructure software testing and validation and no actual data would flow as the first OOI components would not be deployed and operational until the middle of 2012 (Endurance Array glider deployment).
5. *Commissioning*. The process of validation and verification that the integrated infrastructure system performs according to the design and operational requirements. It is the scheduled transfer from the installation and testing phase to the operations phase.

Installation of OOI components would begin in 2011 (RSN backbone cable), limited data flow would begin in 2012 with the deployment of the Endurance Array gliders, and all components would be commissioned, operational, and online by 2015.

Table 2-8. Proposed Schedule for Installation and Initial Operation of OOI Infrastructure (2011-2014)

OOI Component	*Asset*	*2011*				*2012*				*2013*				*2014*			
		Q1	*Q2*	*Q3*	*Q4*	*Q1*	*Q2*	*Q3*	*Q4*	*Q1*	*Q2*	*Q3*	*Q4*	*Q1*	*Q2*	*Q3*	*Q4*
GSN	Argentine									In	G D C						
	Irminger										G In	D C					
	S Ocean													G In D	C		
	Station Papa										G In	D C					
CSN	Endurance						G D				In D (OR)				In D (WA)	C	
	Pioneer							G D				A In	D C				
RSN	Primary Infrastructure			In	Backbone Cable			In	D Primary Nodes								
	Secondary Infrastructure										In	Sensors	D		In	Moorings D	

Notes: A = AUVs deployed; C = Commissioning; D = Data flow; G = Gliders deployed; In = Installation.

2.2.7 Pre-Installation Testing of OOI Components and Systems

2.2.7.1 CSN and GSN

The Coastal/Global Scale Nodes (CGSN) team would conduct tests of OOI components in support of platform development, with some tests occurring as engineering units are available. Since many of the moorings and associated components of the Endurance Array are the same as Pioneer Array components, separate testing activities would not be necessary. Some testing would be performed by the CGSN team and other tests would be performed by selected suppliers, particularly in support of vehicle (glider and AUV) enhancement design verification. The secondary cabled array components of Endurance would be developed and tested by the RSN with the collaboration of CGSN. The major planned tests are:

- *2011 At-Sea Test*. Three mooring configurations would be tested on the Atlantic shelf-break south of Massachusetts, at depths of approximately 55-1,094 fm (100-2,000 m) for up to 3 months. The proposed mooring configurations would be Global Hybrid Profiler Mooring, Coastal Profiler Mooring, and Coastal EOM Surface Mooring.
- *2011 Coastal Surface Piercing Profiler Tests*. Two 30-day demonstration tests of the profiler will be conducted off the coast of Oregon. Due to restricted weather windows off Oregon, it is unlikely that this testing would begin until the spring 2011. Test locations would be the proposed Shelf mooring of the Newport Line of the Endurance Array. This area has already been assessed in the PEA and SER for the installation and operation of similar equipment. A series of tests are proposed, with as many as three during the summer of 2011. The configuration of the test equipment would be very similar to the equipment previously assessed in the PEA and SER, and currently being assessed in this SSEA. The base unit would serve as the anchor and is similar in design to a MFN base. All these test deployments would be conducted in accordance with local requirements consistent with other temporary marine infrastructure including USCG Private Aid to Navigation (PATON) permits, NOTMAR, and State of Oregon permits (if conducted inside the 3-nm boundary of State Waters).
- *2010-2011 Nearshore Mooring Tests*. The Nearshore Mooring system was tested over the winter in 2009-2010 and recovered in April 2010. OSU filed for and received a PATON, State of Oregon permit, and published a NOTMAR for this test. Engineering design changes will be incorporated, based on the test result and the mooring would be redeployed in the same location – the notional Inshore mooring of the Newport Line of the Endurance Array (Figure 2-7a). Deployment is proposed for late fall (December) so that it can be tested through winter storm conditions (2010-2011); recovery is anticipated in May 2011. The deployed configuration will still be similar to the previous moorings designed for this site and assessed in the PEA. All test deployments would be conducted in accordance with local requirements consistent with other temporary marine infrastructure including PATON permits, NOTMARs, and State of Oregon permits (if conducted inside the 3-nm boundary of State Waters).

2.2.7.2 RSN

Prior to their installation on the backbone cable off the coast of Oregon, and depending on the device requirements (see below), RSN components could be tested at one of 4 sites: 2 sites in Puget Sound in Shilshole Bay near UW, Seattle; the Monterey Accelerated Research System (MARS) Ocean Observatory, Monterey Bay, California; and the Victoria Experimental Network Under the Sea (VENUS) facility, British Columbia, Canada. For logistics reasons, each test event would involve the testing a group of OOI devices or components. The Puget Sound sites are the preferred test sites as they are directly accessible from UW research facilities. Each test would last less than 24 hours and a maximum of 5 tests would occur each year, starting in the spring of 2011. UW anticipates 2 types of testing:

1) *Shallow-water (approximately 11 fm [20 m] in depth)* – testing of components of the RSN secondary infrastructure (e.g., LVNs and junction boxes).
2) *Deep-water (approximately 33-66 fm [60-120 m] in depth)* – testing of components of the RSN vertical moorings (Tables 2-5 and 2-6).

Puget Sound

Located in Seattle, Washington, UW is a public research university located close to Puget Sound, a complex estuarine system of interconnected marine waterways and basins offering a convenient test bed for RSN components. Test activities in Puget Sound would occur at a shallow-water site at depths around 11 fm (20 m), and at a deep-water site at depths of 33-66 fm (60-120 m). For RSN components that require deeper waters, they would be tested at either the MARS or VENUS facilities.

Test Site A – Shallow Water Site. The shallow-water test deployment site (Site A) would be located in Shilshole Bay, in the eastern portion of central Puget Sound (Figure 2-14). This would be the preferred test location for all components of the RSN secondary infrastructure such as LVNs and junction boxes (Table 2-5 and refer to Sections 2.2.2.3 and 2.2.2.4 of the PEA for details on LVNs and junction boxes). Testing would be conducted over the side of a vessel with the equipment deployed to the bottom. Testing at this site would occur around 11 fm (20 m) water depth. Testing of some components would involve use of about 100 watts of power.

Test Site B – Deep Water Site. The deep-water test deployment site (Site B) would be located approximately 3.5 nm (6.5 km) north of Site A, also in the eastern portion of central Puget Sound (Figure 2-14). Site B would be the preferred test location for of all components of RSN vertical moorings. Tests would be performed over the side of a vessel at depths ranging from approximately 33-66 fm (60 to 120 m). Due to the excess buoyancy of the mooring platform, the equipment would need to be anchored to the seabed with 4 stacked railroad wheels, which would be recovered at the end of the test operations. Railroad wheels are approximately 3.3 ft (1 m) in diameter and weigh 1,102 lbs (500 kg) each. Testing of some components of the vertical mooring would involve use of up to 2 kilowatts of power. The only active acoustics that would potentially be used during test operations would involve the use of ADCPs which were previously described and assessed in the PEA. The ADCPs would operate at a frequency of 150-600 kHz, a source level of 220 dB re 1µPa@1m, and a pulse length is 0.6-1-5 ms (Table 2-7).

Testing at all Puget Sound sites would be conducted from the UW Applied Physics Laboratory's research vessel (R/V) *Henderson* or R/V *Robertson*. The proximity of the sites to Applied Physics Laboratory facilities would also ensure quick access and efficient testing turn around.

MARS

MARS is a cabled-based observatory system located in Monterey Bay approximately 13 nm (25 km) west-northwest of Monterey, California. One of the primary purposes of MARS is to provide an easily and quickly accessible, deep-water facility where researchers can test ocean observing equipment and instruments that may subsequently be deployed as part of oceanographic research around the world. An EIS/Environmental Impact Report (EIR), under NEPA and the California Environmental Quality Act, respectively, was completed in 2005 for the MARS installation (California State Land Commission [CSLC] and Monterey Bay National Marine Sanctuary [MBNMS] 2005). It is expected that proposed testing of RSN components of OOI would be covered under the MARS EIS/EIR and no additional environmental compliance would be required.

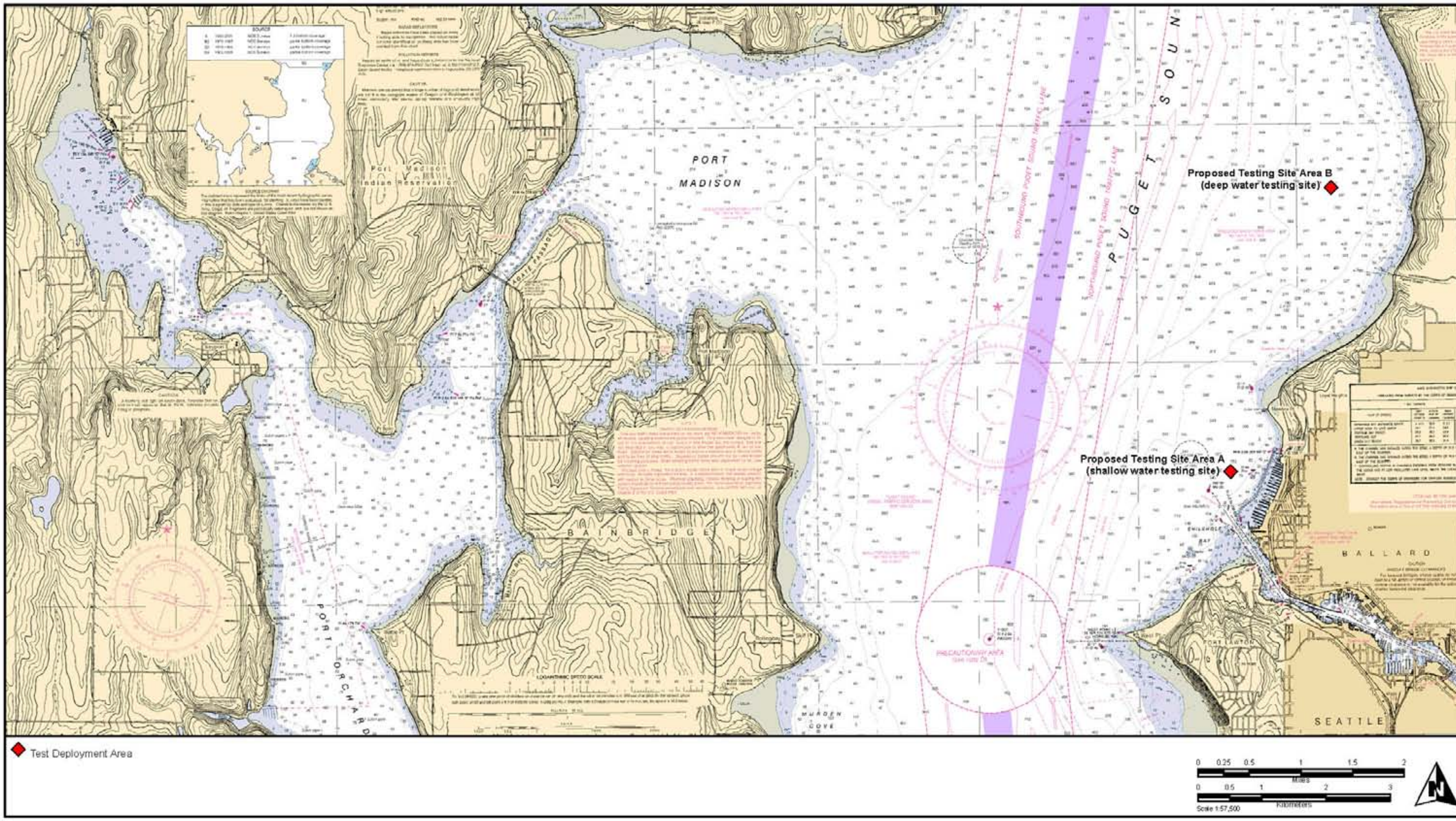


Figure 2-14. Proposed Puget Sound Testing Locations for RSN Components

VENUS

VENUS is a research facility run by the University of Victoria, British Columbia, Canada. This coastal seafloor observatory connects researchers and observers on shore via fiber optic cable, offering a new way of studying the ocean. The facility consists of three seafloor nodes on 2 separate cable arrays, 2 shore stations, a network operations centre and a data archive. Saanich Inlet would be the most likely test deployment area, due to its close proximity to land and easy access. An EA was completed for the VENUS cable systems in 2008 under Section 5 of the Canadian Environmental Assessment Act (Canadian Environmental Assessment Agency 2009). This review concluded that, with appropriate mitigation measures, the systems would not have significant adverse impacts on the environment. It is expected that proposed testing of OOI RSN components would be covered under the VENUS EA and no additional environmental compliance would be required.

2.2.8 Installation and Operation & Maintenance (O&M)

The following sections describe the methods that would be used to install the infrastructure of the proposed OOI and conduct routine O&M activities (Ocean Leadership 2010b). Proposed installation and O&M activities would use standard methods and procedures currently in use by the scientific community and the undersea telecommunications industry. However, methods may change based upon site-specific surveys, ship schedules, and final determination of types of equipment to be installed (e.g., sensor types, models, etc.). If subsequent proposed installation and O&M activities are significantly different than the proposed installation or O&M methods described in this Draft SSEA, then additional environmental documentation would, as appropriate, be prepared to assess any potential impacts to the environment.

2.2.8.1 RSN

Shore Station

The proposed Pacific City shore station is a special-purpose built facility for telecommunications submarine cables located on a 5-acre (2-hectare [ha]) lot, at 33395 Cape Kiwanda Drive in Pacific City, Oregon, in a populated beach residential/vacation community approximately 100 miles (161 km) west of Portland. The facility is commercial-grade cinder block construction with a metal roof and meets earthquake Seismic Zone 2B conditions and tsunami event requirements (Figure 2-15).

Figure 2-15. Proposed Pacific City Shore Station

The shore station is located on the eastside of Cape Kiwanda Drive, approximately 1 mile (1.6 km) north of the existing BMH, which corresponds to the existing North Pacific Cable beach vault. The BMH lies at the western terminus of Pacific Avenue, landward of the sand dunes (Figures 2-16 thru 2-18). Access to the beach is provided to both vehicles and pedestrians through the dunes. The sandy beach slopes gently between the existing BMH and the ocean. The proposed connection from the BMH to the shore station would utilize existing underground conduit along Cape Kiwanda Drive (Figure 2-19).

Figure 2-16. View to the East along Pacific Avenue Showing the Existing BMH at the Western End of the Parking Area

Figure 2-17. View to the West from Just East of the Existing BMH

Figure 2-18. View looking east from the existing BMH

Figure 2-19
Proposed RSN Terrestrial Cable Route from the Pacific City Shore Station to Existing BMH and HDD Cable Routes from the Existing BMH

Installation of RSN Submersible Plant

The installation of the submersible plant (i.e., submarine or backbone cable and Primary Nodes) would take place in 3 phases:

1. Beach Works – HDD
   - Spring 2011
   - Conducted at existing BMH at end of Pacific Avenue, Pacific City, Oregon
   - 2 bores drilled for RSN Segments 1 and 5.
2. Backbone Cable Installation
   - Summer 2011
   - Conducted from cable ship
   - 2 shore landings
   - 8 segments (backbone cable)
3. Node and Spur cable Installation
   - Summer 2012
   - Conducted from a vessel of opportunity (VOO)
   - 7 Primary nodes
   - 1 spur – short segment of cable for future expansion

Horizontal Directional Drilling (HDD)

HDD is a common technique used to install cables, pipelines, fiber-optic ducts and other types of buried infrastructure under environmentally sensitive areas or technically difficult sites. A major advantage of HDD is the considerable reduction of impacts that are generally associated with surface (trench) installations. Typical operations range from 0.2 to 1.2 m in diameter and 0.5-1 nm (1-2 km) in length.

For the RSN cables, HDD would be used for the terrestrial-to-marine transition to minimize possible disturbances to the beach area near Pacific City, Oregon. It would also provide maximum protection to the cables in the surf zone, therefore reducing maintenance activities close to shore throughout the lifetime of the cable system.

Segments 1 and 5 would originate from the existing cable station in Pacific City (Figure 2-19), which would host the Power Feed Equipment and Network Termination Equipment for the submarine cables. From the station, the 2 cables would extend approximately 1 mile (1.6 km) on land via existing conduits to the BMH at the western terminus of Pacific Avenue.

HDD staging and operations in the vicinity of the BMH would be limited to an area of less than 1 acre (0.4 ha). These operations would involve setting up a drilling rig next to the existing BMH (Figures 2-15 thru 2-17), and drilling 2 bores under the beach and seabed from the BMH to 2 points offshore: one for Segment 1 (to PN1A) and one for Segment 5 (to PN5A) (Figure 2-19). Each bore would be approximately 0.2 m in diameter. The HDD exit points along both Segments 1 and 5 would be located at a distance of about 0.9 mile (1.5 km) from the BMH at a water depth of approximately 11 fm (20 m).

The HDD diameter, length, depth and exit points are determined by several site factors, including the biological characteristics of the beach and the seafloor, the technical requirements for the protection of each cable, and the technical specifications of the drilling rig. Drilling the 2 RSN cable bores may take up to 60 days (based on a 7-day work week, operating 12 hours/day).

Drilling mud would be used to cool and lubricate the drill bit, stem and other down-hole tools. The mud would be composed of naturally formed bentonite clay and polymers. It would also assist sealing the sides of the bore, therefore reducing the potential for breakage in the drilling hole (frac-out) and the release of drilling mud into the ocean. Containment structures would be used around the drilling platform to control any mud leakage to the surroundings. A contingency plan for potential frac-out would also be developed and approved by the appropriate permitting agency prior to drilling. Furthermore, to avoid noise disturbance to nearby residences, noise suppressors would be used during HDD operations. It is estimated that, with the use of noise suppressors, sound levels during drilling operations would be approximately 60-70 A-weighted dB (dBA) at a distance of 98 ft (30 m) from the source, sufficient to comply with local bylaws.

From the existing BMH, close to shore, both RSN cables would be pulled landward through 8 additional manholes linked by existing conduits to the Pacific City shore station. UW would lease 2 conduits from Tillamook Lightwave, a local telecommunications provider, for an initial duration of 30 years. The shore station is located approximately 1 mile (1.6 km) north of the BMH. No additions to the building would be necessary for RSN, as there is sufficient space to support the proposed cable configuration. The marine and terrestrial cable installation would occur at separate and later dates than the HDD operations.

RSN Primary Infrastructure Backbone Cable

As part of the current OOI planning process and the preparation of this SSEA, a Desktop Study and detailed site-specific survey were conducted to examine in detail the proposed route and provide information on:

- seabed depths,
- geological conditions,
- hazards,
- existing cables and pipelines,
- fisheries, and
- weather considerations.

In addition, recommendations were also provided regarding cable types and locations for cable placement, including burial or surface placement (UW 2010a, b).

The RSN design includes of a “backbone” cable route of about 488 nm (903 km) in length consisting of 8 main segments of cables that support a network of 7 Primary Nodes (Table 2-9, Figures 2-20 and 2-21).

Table 2-9. Backbone Cable Route Summary

Segment	*Approximately Length (km)**	*From*	*To*	*Water Depth (m)* Minimum	*Water Depth (m)* Maximum
1	214	BMH†	PN1A	0	2,920
2	30	PN1A	PN1B	2,920	1,232
3	23	PN1B	PN1C	1,232	616
4	77	PN1C	PN1D	616	113
4NP	18	PN1D	LV01D	113	79
5	289	BMH†	PN5A	0	2,820
Stub @ PN5A	10	PN5A	end	2,813	2,820
6	215	PN5A	PN3A	2,820	2,620
7	27	PN3A	PN3B	2,620	1,510
Total	903				

Notes: *All cable lengths are approximate and are subject to further site-specific route surveys and review of environmental conditions along the proposed cable route.
†Cable would extend from the shore station to PN1A or PN5A (approximately 1.5 km) via the BMH and HDD conduit.

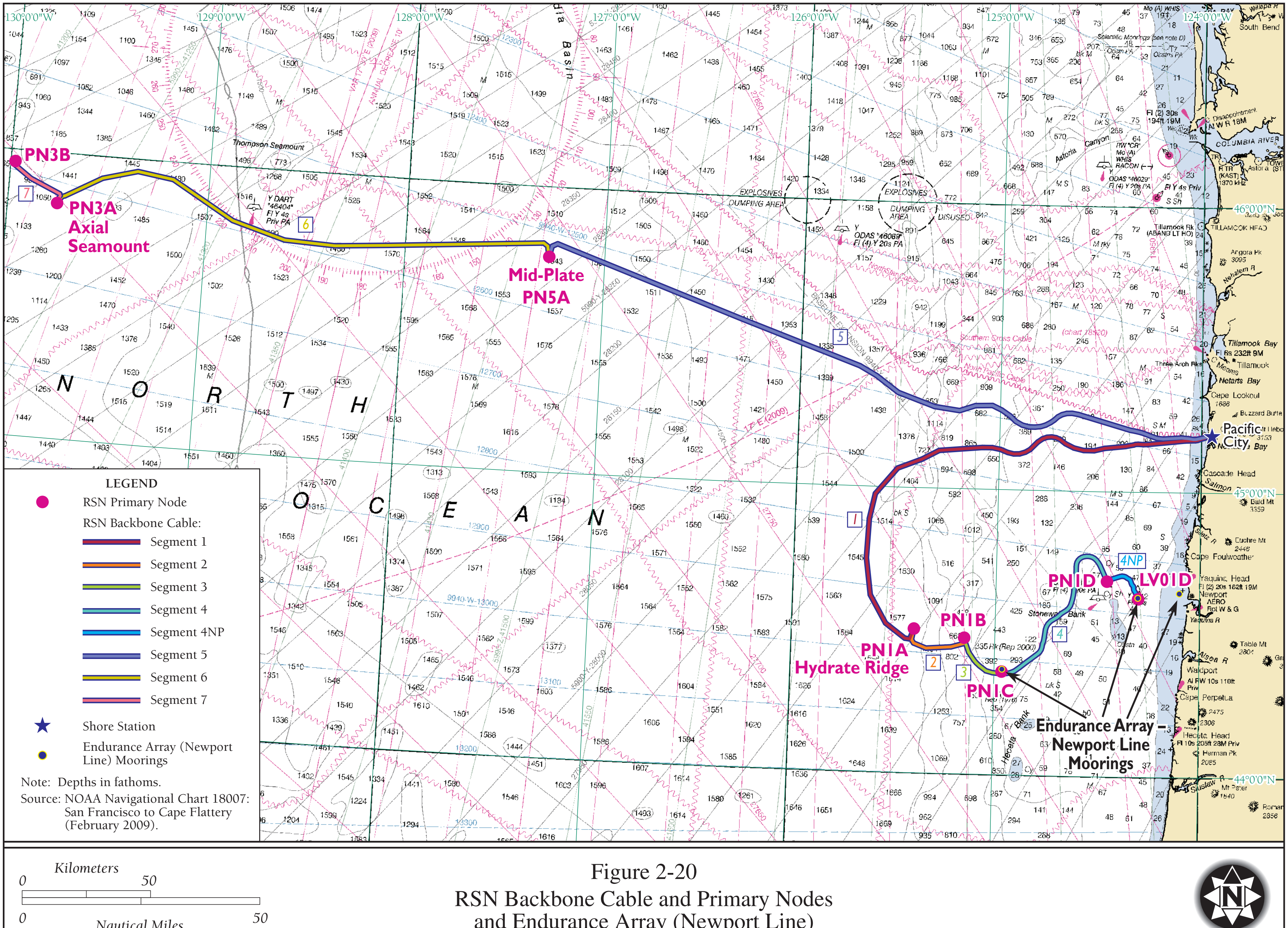


Figure 2-20
RSN Backbone Cable and Primary Nodes
and Endurance Array (Newport Line)

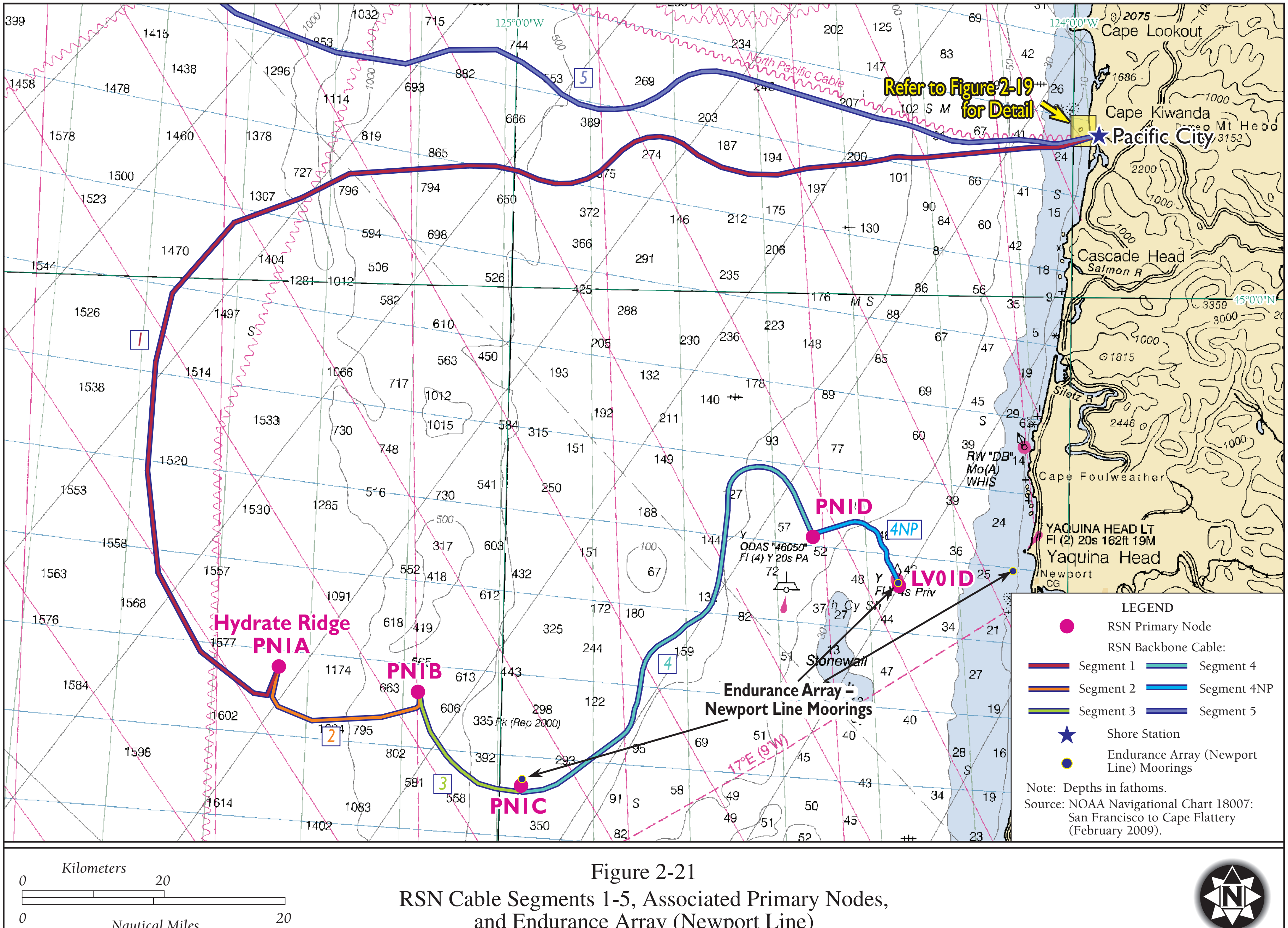


Figure 2-21
RSN Cable Segments 1-5, Associated Primary Nodes, and Endurance Array (Newport Line)

Based on the preliminary review of data acquired during the site-specific cable route survey conducted in spring 2010, approximately 167 nm (309 km) of the RSN backbone route would be buried below the seabed to a target depth of 1.3 m. The remaining 320 nm (593 km) of the cable route would be laid on the surface of the seafloor. Only three of the cable types are currently planned for the RSN system: LWA, LW, and SPA. Preliminary cable types, lengths, and whether they are buried or surface laid for each segment are given in Table 2-9.

Cable Laying and Burial Operations. On the continental margin off Oregon, all portions of the RSN backbone cable route from the HDD exit point to a position located 0.54 nm (1 km) seaward of the 700-fm (1,280-m) EFH boundary would be buried to a target depth of 4.3 ft (1.3 m) using a submarine cable plow. Those sections of the RSN backbone in deeper water would be laid on the seafloor. Based on the recommendations presented in the RSN Desktop Study (UW 2010a) and following the recent completion of a 0.54 nm (1-km) swath geophysical and geological survey (April/May 2010), it is anticipated that a successful burial route will be identified in all areas where cable burial is planned to avoid impact on environmental resources, such as cultural sites or fisheries. In deep water, essentially seaward of the 700-fm (1,280-m) EFH boundary, geophysical data were collected during the marine route survey in a corridor extended to 3 times the water depth or up to 5.4 nm (10 km) in width. A successful surface laid route is also anticipated within this corridor to allow for avoidance of any obstructions on the seabed. A 450-500 ft cable-laying ship is proposed for cable deployment. The cable laying and plowing operation, conducted from the cable laying ship, constitutes the primary construction activity.

Prior to the cable laying operation, a grapnel run would be carried out along the route to ensure that it is free from debris that could interfere with the cable burial operation. A grapnel run involves dragging a small, anchor-like hook on the seafloor along the proposed cable route, to insure that no obstructions or debris are present along the path. Although the sensitivity of the instruments used during the cable route survey ordinarily detects the presence of obstacles, there is a possibility during the period between the cable route survey and actual deployment, that intervening events have deposited debris on the seafloor. All detected debris is removed from the cable path to avoid interference with the burial plow. The grapnel would not be pulled through rocky areas, since the cable plow would not be used along these portions of the route.

Cable burial would be accomplished using a submarine cable plow (Figure 2-22), an existing tool used by the undersea telecommunications industry. The ship would tow the plow, which would dig a narrow trench into the seafloor and insert the cable into the trench. The trench would be approximately 6-8 inches (15-20 centimeters) wide, and would refill immediately when the seabed material slumps back due to the surrounding hydrostatic pressure, which pushes into the temporary suction vacuum created by the trenching-blade. No dredging or other removal of material is required. Cameras on the sea plow are used to give the operator warning of any visible obstacles. The plow rides lightly on skids and wheels that limit the temporarily disturbed area to 2 narrow swaths (1 m each) in soft mud, the most easily disturbed bottom type. The plow would be lifted well off the seafloor when it is traveling over areas of hard bottom to avoid impacts to hard-bottom communities. Temporary increases in turbidity are expected to last only a few minutes, depending on currents and sediment type, and would occur within only a few feet of the plow.

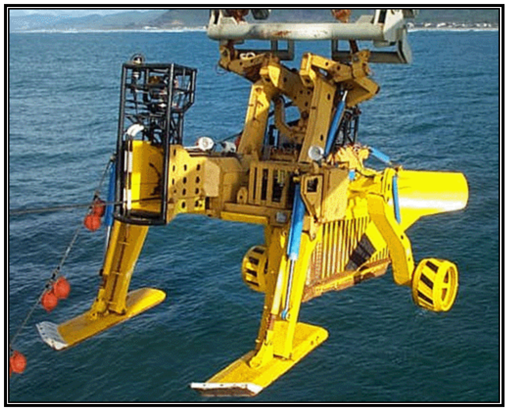


Figure 2-22. Example of a Submarine Cable Plow

Cable installation speed varies from 0.5-1 knots (1-2 km per hour [km/hr]) for a buried cable (by plow) to 5.4-7.6 knots (10-14 km/hr) for a surface laid cable. Based on this level of effort, it would take approximately 35 days to lay the entire proposed RSN backbone cable. However, additional contingency days may be necessary to allow for inclement weather or other unforeseen delays, therefore extending the number of days for cable installation.

The cable laying operation in the vicinity of the landing sites would take 2-5 working days (depending on weather conditions). This includes time for the ship to establish position dynamically, for divers to jet the conduit exit points clear, float the cable to the exit points, winch the cable through each conduit to the BMH and bury the cable from the exit points to the ship's location.

Controlled Slack to Avoid Cable Suspensions. Cable suspensions can occur in hard-bottom areas with an uneven surface. The RSN cable route has been designed to avoid hard-bottom areas. Two important parameters would contribute to the degree and amount of cable suspensions in hard-bottom regions along a cable route: (1) the flexibility of the cable, and (2) the control of cable slack during deployment. The small-diameter cable proposed for the RSN is the same as that employed for transoceanic systems and therefore has the same flexibility. Cable flexibility is the key characteristic that determines whether the cable will readily conform to the seafloor contours, provided that sufficient cable slack is introduced to enable conformation. Cable slack is the excess length of cable needed to conform to variable bottom conditions along the seafloor. The exact degree of slack required will be estimated during the review of detailed seabed survey data and real-time data collection in the course of installation, as well as from experience of the cable-laying contractor gained on similar route sections of transoceanic cable laying projects.

Extremely rocky areas and regions with rapidly changing slopes (i.e., greater than or equal to 15 degrees) would be avoided by refining the proposed cable path after analysis of the cable route survey data. While surface laying the cable, the vessel speed and necessary slack are computed in real time to allow the cable to conform to the seabed.

Cable Burial Considerations. In the areas where the cable will be buried, the equipment that digs the trench also lays the cable in the trench in one continuous operation. The primary consideration in cable burial is to avoid the potential "conflict of use" of the seabed with local fishermen. The required burial depth is a function of the seafloor bottom conditions and the seafloor penetration depth of fishing trawler equipment. The burial depth required to protect the cable from fishing trawlers and ship anchor hits is based on previous, standard transoceanic cable burying operations in the area and the results of the Desktop Study. This information would be used to determine a burial depth that can reasonably be expected to avoid such conflicts and is also practically and economically feasible. Bottom soil materials such as coarse sand, fine sand, sand mixed with shell, mud and clay, will allow various degrees of cable burial; however, the cable cannot be buried into a solid rock bottom.

If burial is not complete, the ordinary fishing gear that is most likely to become entangled in the cable and become damaged or cause damage to the cable, would be otter-boards of trawling vessels, and other fishing gear having long hooks. Trawlers represent the greatest threat to and from the cable, because of the relatively wide areas of the seafloor over which trawling equipment is engaged to catch fish. Long hooks and various types of anchors used to set gillnets or lobster pots are not as significant a threat, due to the low probability they will be cast in precisely the small region occupied by the cable. In addition, because of their shape and comparatively lesser weight, these types of fishing gear are less likely to penetrate the seabed to the same depths as trawling gear. Various types of ship's anchors are also a potential hazard to the cable. For this reason, much time has been spent to determine a planned cable route that avoids known anchorages, and to a lesser extent, shipping lanes. Ordinarily, anchorages are limited to the shallow water depths in the range of 50 to 60 m.

Post-Lay Inspection and Burial. Video cameras mounted on the plow would be used to monitor the burial process. Areas where burial difficulties are encountered as well as rocky areas would be recorded and/or the positions noted. A post lay inspection would be performed using a remotely operated vehicle (ROV) at the locations noted above. The ROV would be equipped with water jets that would be used to complete the burial operation to the extent possible.

Crossing Other Cables or Pipelines. The proposed RSN cable route crosses existing submarine cables 29 times, including 22 crossings of active systems. The proposed route, however, does not cross any pipelines (UW 2010a). Special attention and effort has been paid to cable crossings. Databases that identify existing cables, pipelines, and sewage outfalls were used during the planning phase of the RSN to determine a route that avoids crossings to the maximum extent practicable. In addition, a route-specific survey was conducted in order to "fine-tune" the cable route in the intersecting areas. The survey and subsequent data analysis would allow the selection of the safest cable route through areas of potential crossings. Consistent with standard industry practice, the owners of cables that must be crossed would be contacted and industry-standard crossing techniques would also be performed.

Periodic Re-inspection of the Installed Cable. The installed cable would be re-inspected at least every 5 years to ensure that buried portions of the cable remain buried.

Installation of Primary Nodes, TRFs, and Spur Cable

There are currently 3 general methods or configurations being considered for the installation of the RSN cable at the proposed primary node locations:

1. Overlapping Segment End
2. Straight Continuous Piece
3. Looped Continuous Piece

At this time, the Overlapping Segment End method is the preferred installation method; a final decision on the actual method to be employed would be made in fall 2010.

Overlapping Segment End. The node installation would take place after the backbone cable is installed. Installation of the Primary Nodes would be phased such that the Backbone Interface Assembly would be installed first using a cable-laying ship, with follow-on installation of the electronics module (Science Interface Assembly) using an ROV. At node locations, each cable segment end would be deployed with a separation of 1 water depth (WD), and overlapped longitudinally by 3.5 WDs (Figure 2-23). The ends of the cables would be capped to prevent water ingress and all cable ends would be deployed with ground tackle for subsequent grappling and recovery by a VOO. A segment of bottom tackle, approximately 1.5 WDs, would be attached with an anchor at the end of the cable (Figure 2-24). This would allow the cable to be grapneled without causing damage to the fiber optic cable. The anchor system would consist of a 2- x 2-ft (0.6- x 0.6-m) cement cube (or similar) (or 4 ft^2 [0.4 m^2 on bottom surface]) weighing approximately 500 lbs (227 kg); 15 anchors would be used. The cable installation vessel would "stream" the ends by lowering them to the bottom with an acoustic release. The cable and ground tackle will be buried over a length of about 3.5 WDs in areas shallower than 820 fm (1,500 m). The target depth of burial (below seabed) would be reduced to about 1.6 ft (0.5 m) to allow retrieval the following year when the nodes are installed.

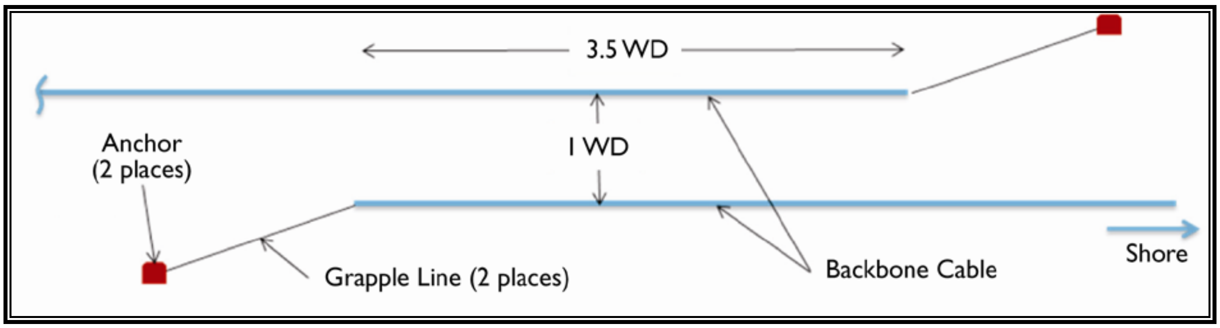


Figure 2-23. Proposed Cable Laying at Node Locations – Overlapping Segment End Method

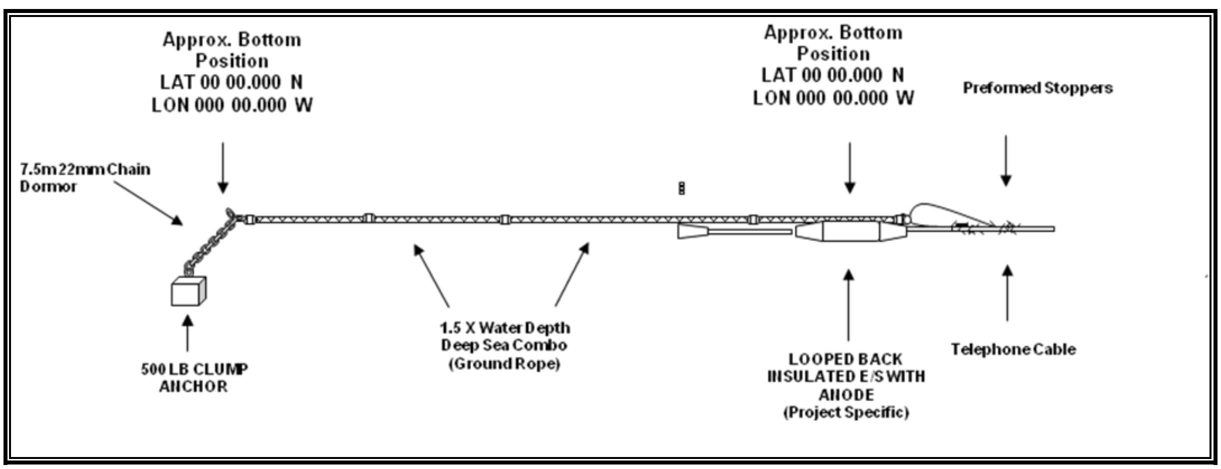


Figure 2-24. Example of Ground Tackle Proposed for Use at Node Locations

The nodes would be installed off of a VOO that has been outfitted with the required equipment to perform at-sea installations. The method used for node deployment would be similar to procedures used by standard cable ships for installing a branching unit or repairing a damaged cable. The ends of the cable would be grapneled and brought aboard the VOO where they would be spliced into the primary nodes. Once spliced into place and tested, the node and attached cables would be lowered to the seafloor. If the node is located in burial areas, the cables leading to the node would be buried per the requirements of the permit and system specifications. Once the nodes are installed, an ROV will be used to confirm that the installation is proper and to bury the portions of the cables running to the nodes (in burial areas). Figure 2-25 describes the general node installation scenario.

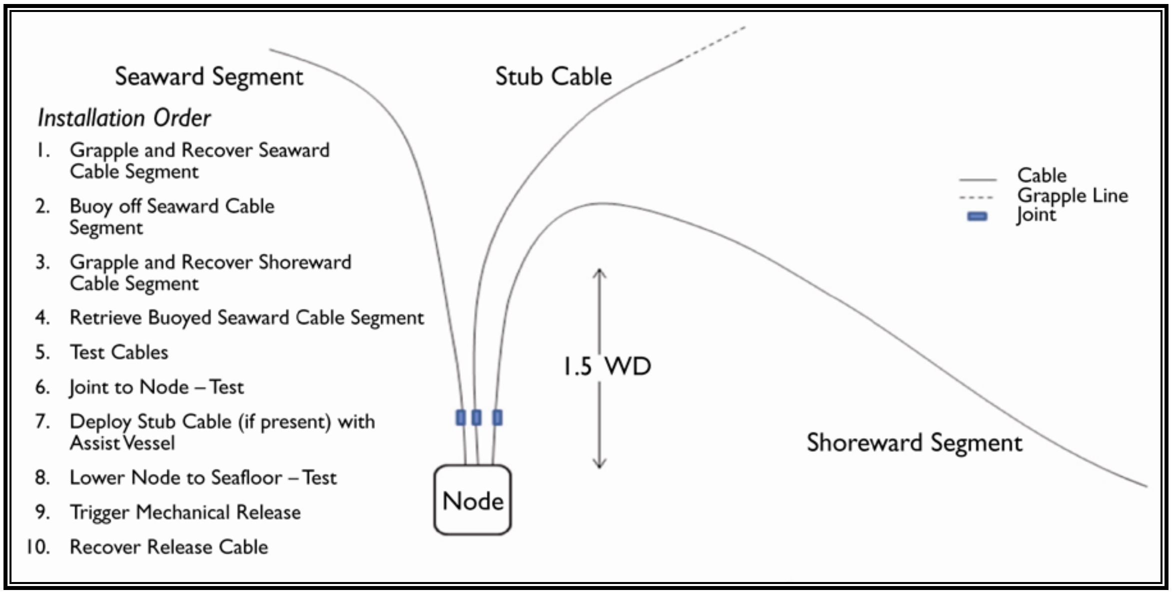


Figure 2-25. Proposed Node Installation – Overlapping Segment End Method

Straight Continuous Piece. In this method, the entire backbone cable would be laid in a straight, continuous segment with no breaks at the node locations (Figure 2-26). An additional segment of cable would be jointed onto the backbone cable at the time of the node installation. In areas above 820 fm (1,500 m) water depth, to allow recovery of the cable at the time of the node installation, the cable would only be buried to 0.5 m below seabed over a length of approximately 4 WDs in the approach to each node. After completion of the node installation, all cable sections would be buried to 1 m using an ROV.

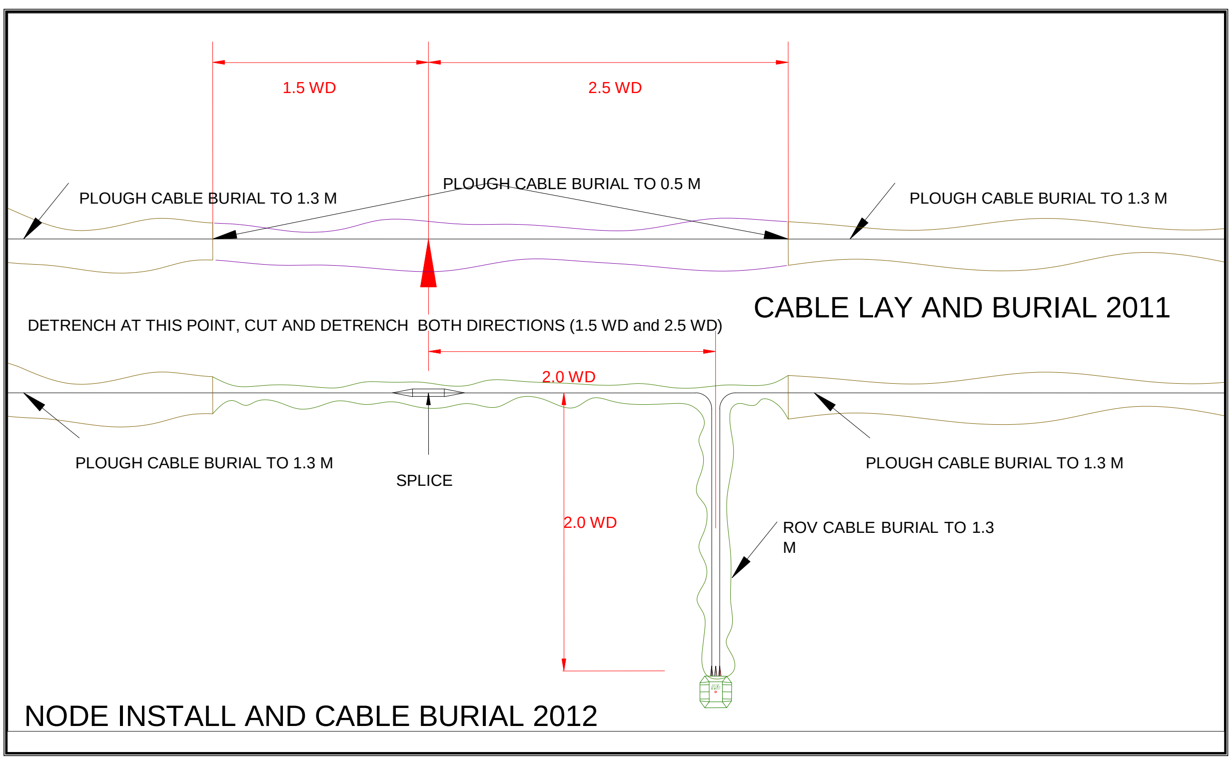


Figure 2-26. Proposed Cable Laying at Node Locations – Straight Continuous Piece Method

Looped Continuous Piece. A third method being considered would be to lay the entire backbone in a continuous piece with cable "loops" at the node locations (Figure 2-27). In areas deeper than 820 fm (1,500 m), a recovery ring would be placed at the apex of the loop to facilitate recovery with an ROV. A lowering line would be attached to the recovery ring and the cable would be brought to the surface using appropriate deck gear. If an ROV was not available, the system would be retrieved using grapnel gear and associated deck equipment. In areas shallower than 820 fm (1,500 m), the cable "loops" would need to be buried using an ROV. This would be done to a reduced depth (approximately 0.5 m) for eventual recovery the following year.

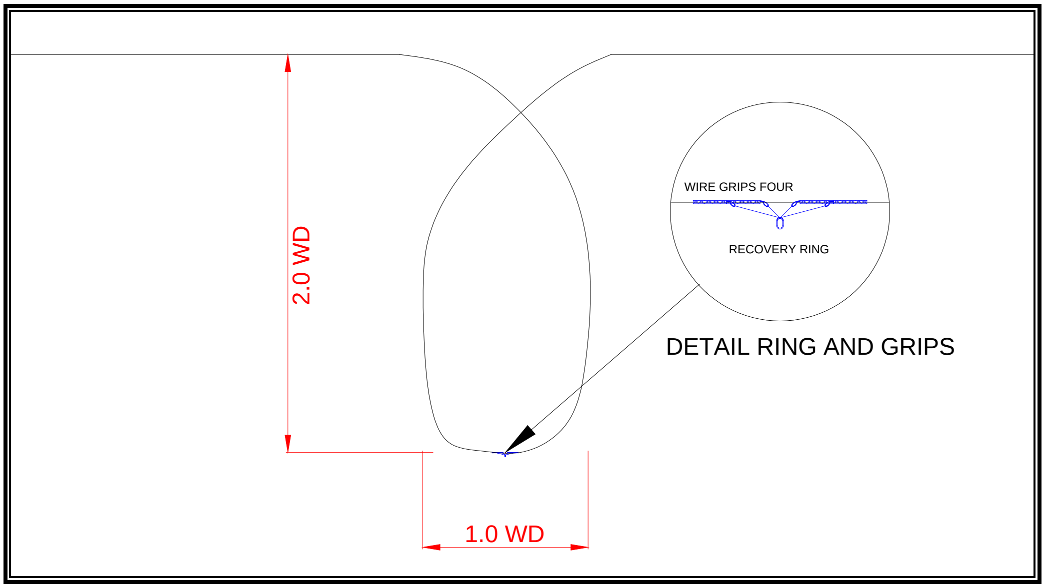


Figure 2-27. Proposed Cable Laying at Node Locations – Looped Continuous Piece Method

Installation of Secondary Infrastructure

Extension cables provide power and communication links between the Primary Infrastructure, Secondary Infrastructure, and sensors across the RSN. This cabling may be installed in various seafloor conditions from harsh areas (sharp rocks, inside the caldera of an active undersea volcano, across an active fault line) to benign areas, and will be powering different types of loads; therefore different types of cables are necessary depending on local environmental conditions. All RSN secondary extension cables would be surface laid, except along the portion of the cable route between PN1B and LV01B on Hydrate Ridge, and between PN1D and LV01D at the end of the Endurance Array offshore Newport, Oregon. Along these 2 portions of the RSN route, the cable would be buried to a target depth of 1.3 m in a manner similar to the backbone cable.

Two methods could be used for the installation of the secondary extension cables. The preferred method would be the use of a cable-laying module mounted beneath an ROV. The ROV would first connect the cable to the appropriate infrastructure using a wet mateable connector, and then begin laying cable to the next piece of infrastructure where the connection would once again be made with a wet mateable connector. ROV cable-laying modules are limited in the diameter and weight of cable that they can carry.

The secondary method would be for an ROV to carry the cable end with a wet mateable connector from the surface vessel to the seafloor and connected to the infrastructure. The ROV would then be recovered and using precision cable laying software, the cable would be laid by the surface vessel to the next piece of infrastructure. Upon arrival at the final connection point, a slack loop of cable with a wet mateable connector would be lowered to the seafloor with a lowering line and ROV/acoustic release. Once the connector is on the seafloor the lowering line would be released. The ROV would be launched and would proceed to connect the wet mateable connector to the infrastructure.

Installation of infrastructure such as LVNs, junction boxes, and sensors would be dependent on the weight of the component. In cases where the weight is within the specification of the ROV, the vehicle would carry and place the equipment on the seafloor. Infrastructure that exceeds the weight limits of the ROV would be lowered into place from a surface vessel using lowering lines and ROV/acoustic releases. The RSN secondary infrastructure would include installation of 18 elements (LVNs and junction boxes) as listed in Table 2-10.

Table 2-10. RSN Secondary Infrastructure (LVNs and Junction Boxes) Associated with the Primary Nodes

Primary Node	*Site*	*Description*
PN1A	Hydrate Ridge	LVN (LV01A)
		Low-power junction box (LJ01A)
		Medium-power junction box (MJ01A)
PN1B	Hydrate Ridge	LVN (LV01B)
		Low-power junction box (LJ01B)
		Medium-power junction box (MJ01B)
PN1C	Endurance (Newport Line)	LVN (LV01C)
		Low-power junction box (LJ01C)
PN1D	Endurance (Newport Line)	LVN (LV01D)
		Low Power junction box (LJ01D)
PN3A	Axial Seamount	LVN (LV03A)
		Low-power junction box (LJ03A)
		Medium-power junction box (MJ03A)
PN3B	Axial Seamount	Medium-power junction box (MJ03B)
		Medium-power junction box (MJ03C)
		Medium-power junction box (MJ03D)
		Medium-power junction box (MJ03E)
		Medium-power junction box (MJ03F)
PN5A	Mid-plate	Not applicable

<u>RSN – Operation and Maintenance (O&M)</u>

The Primary Infrastructure is defined as the backbone cable and components starting at the BMH and extending seaward to the Primary Nodes. With the exception of the nodes themselves, all components are expected to be commercial off-the-shelf products of the undersea cable industry. Based on the specialized equipment required to properly install and repair these cables, it is anticipated that wet repairs would be conducted by a traditional cable ship. This cable ship would be dynamically positioned using a highly accurate navigation system and equipped with specialized cable laying machinery, as well as an ROV capable of assisting in cable recovery and reburial in water depths from 8-820 fm (15-1,500 m).

Two maintenance cruises would be required each year to maintain the RSN Secondary Infrastructure. Optical, chemical, and biological sensors are most likely to need annual refurbishment due to potential biofouling. While some of the benthic instruments associated with the RSN moorings would need to be replaced annually, instrumentation such as seismometers and acoustic sensors are expected to be in place for at least 5 years. The moorings themselves would remain in place for at least 5 years as well.

Based on the sea-keeping abilities of the University-National Oceanographic Laboratory System (UNOLS) Global class, and the expected weather conditions, the RSN maintenance cruises will be scheduled in the beginning of the weather window (late spring/early summer) and the second cruise at the end of the weather window (late summer/early fall). If a UNOLS vessel is unavailable or if an emergency repair must be made to primary or secondary infrastructure, a cable ship in Portland, Oregon is available on 24-hour call out.

2.2.8.2 CSN Moorings

Endurance Array

Surface moorings and uncabled profiler moorings would be installed and maintained using a UNOLS vessel which would use deployment and retrieval techniques common in oceanographic research. Gliders may be initially deployed using a UNOLS vessel or VOO (e.g., local commercial fishing vessel), but would probably be retrieved for periodic maintenance using a VOO. The cabled connection of the Shelf and Offshore moorings of the Newport Line of the Endurance Array to the RSN at PN1D and PN1C, respectively, would be laid in concert with the RSN cable after site surveys are completed. These cabled connections of the Endurance Array would be buried either in the same manner as the RSN cable or by an ROV from a UNOLS vessel. Deployments of cabled infrastructure (LVNs, junction boxes, benthic sensor packages, hybrid profilers, and winched profilers) would be coordinated with the installation of the RSN, using the same ship and ROV (if necessary). Sensors on surface moorings would be installed before deployment using dry-mated connectors. Note that the installations of cabled and non-cabled components are independent of one another. That is, installations of non-cabled components (surface moorings, uncabled profiler moorings, and the nearshore sites) do not depend on cabled infrastructure and vice versa. Similarly, glider deployment does not depend on the deployment of fixed assets.

Endurance Array moorings and scientific equipment would be deployed for a specific in-service period then recovered and replaced with equivalent equipment. The recovered equipment would be returned to shore facilities for refurbishment to support future “recover and replacement” operations. Because maintenance will be a cyclical process, corrective actions, such as those required to repair equipment malfunctions, would be implemented as equipment is recovered and refurbished. It is expected that the 10 un-cabled Endurance Array moorings (Grays Harbor Line and Inshore Newport Line), including the MFNs and mooring anchors, would be completely turned around every 6 months. The cabled infrastructure, deployed at the Shelf and Offshore sites on the Newport Line, would be turned around annually. Both surface moorings and stand-alone subsurface profilers for the entire Endurance Array would be serviced using a UNOLS intermediate class ship.

Endurance Array components that are connected to the RSN cable would be serviced in coordination with RSN servicing of Primary Node infrastructure. Servicing would be done using a ship with ROV support capabilities. For replacement of cabled infrastructure, attrition rates are expected to be similar as for other moored components.

The Endurance Array surface-piercing profilers are designed to be sent to the surface where slack wire can be run out. The profilers would then be recovered on deck and serviced. This servicing would occur twice per year when non-cabled Endurance Array components are turned around.

Gliders are relatively light-weight, unmanned, and untethered underwater vehicles that navigate autonomously without any physical connection to a vessel at the surface. Gliders carry a suite of scientific instruments and can remain deployed for 3-6 months before they need to be recovered. An array of 6 gliders will survey the shelf and slope waters offshore of Washington and Oregon. Glider installation and servicing would occur through small boat operations.

Pioneer Array

All Pioneer moorings, gliders, and AUVs would be installed and maintained from a UNOLS vessel using deployment and retrieval techniques common in oceanographic research. There would be three principal installation phases: (1) gliders, (2) wire-following profiling moorings, and (3) surface-piercing profilers, EOM surface moorings/MFNs, and AUVs.

As with the Endurance array moorings, the Pioneer Array moorings and scientific equipment would be deployed for a specific in-service period then recovered and replaced with equivalent equipment, including the MFN/AUV dock and mooring anchors. The recovered equipment would be returned to shore facilities at Woods Hole Oceanographic Institution (WHOI) for refurbishment to support future "recover and replacement" operations. Once the full Pioneer Array is installed, O&M would potentially include 5 mooring cruises per year. Maintenance cruises would be for mooring service and glider and AUV recovery and redeployment. Due to the desire to operate in hospitable weather, the mooring cruises are expected to occur in May and October.

2.2.8.3 GSN Moorings

All GSN moorings would be installed and maintained from a UNOLS vessel using deployment and retrieval techniques common in oceanographic research. The timing of the mooring servicing would be made known to international ship operators through POGO (Partnership for the Observation of the Global Ocean) and other ship resource sharing groups.

Planning for and installation of the Irminger Sea Array would be coordinated with the government of Denmark through the U.S. State Department. Additional planning would be done with European partners and in coordination with their plans for observations off southeast Greenland through the international ocean time series scientific steering group (OceanSITES).

The deployment and operation of Station Papa in the Gulf of Alaska would be based on cooperation with NOAA and with Canadian interests in ongoing sampling at and around the site.

Planning for and installation of the Argentine Basin Array would be coordinated with international research programs such as Climate Variability and Predictability (CLIVAR), OceanSITES, the University of Buenos Aires, and the Hydrographic Service of the Argentine Navy.

Depending on the infrastructure component, O&M would generally be conducted on an annual basis during the period of good weather for the GSN sites. The surface and subsurface mooring would be designed for turnaround on a 1-year cycle. Turnaround would consist of deployment of refurbished, replacement mooring systems, then release-and-recover of the existing moorings from their anchors. Mechanical wire rope, nylon, polypropylene, and chain mooring elements as well as all mooring hardware such as shackles and links would be replaced with new material at each turnaround.

2.2.8.4 Shore-Side O&M Facilities

There would be 3 shore facilities to support the CSN and GSN O&M plan. The facilities reside at Woods Hole, Massachusetts; La Jolla, California; and Corvallis, Oregon and are responsible for system operations, fields operations, and data operations. The Woods Hole shore station, operated by WHOI, would manage the Pioneer Array and Southern Ocean and Irminger Sea GSN assets including gliders and AUVs. The La Jolla shore station, operated by Scripps Institution of Oceanography, would manage the

Station Papa and Argentine Basin GSN sites including gliders. The Corvallis shore station, operated by OSU, would manage the Endurance Array including the Newport and Grays Harbor lines and gliders.

RSN shore facilities would be located at the UW's Applied Physics Laboratory. Additionally, the UW School of Oceanography's pressure tank will be used to test new and recently calibrated sensors before they are deployed.

2.2.8.5 Estimated Days at Sea (DAS) for CSN, RSN, and GSN Installation and Annual O&M Activities

Under the Proposed Action, the installation of the CSN, RSN, and GSN components of the proposed OOI Network would generally occur from 2011 through 2014, with all OOI components operational by 2015. However, some components (e.g., portions of RSN, Newport Line, Pioneer Array, and some GSN sites) would be operational before 2015 and associated O&M activities for those components would begin before 2015. Overall, it is expected to take approximately 100-250 DAS, depending on the year, and involve 4 classes of vessels to install the various OOI components (Table 2-11). All OOI infrastructure would be maintained from UNOLS vessels or VOOs using deployment and retrieval techniques common in oceanographic research. Average annual O&M operations after the OOI Network is fully commissioned and operational (i.e., beginning in 2015) would take an estimated 286 DAS. Note that the weather window for installation and O&M activities in the Northern Hemisphere is May through October and in the Southern Hemisphere is November through April.

Table 2-11. Estimated Annual DAS for Installation and O&M of Proposed CSN, RSN, and GSN (2010-2017)

Infrastructure	*Vessel Class*(1)	*Year*(2) 2010	2011	2012	2013	2014	2015	2016	2017
RSN	Cable Laying/Repair	0	35	30	0	0	TBD	TBD	TBD
	Global(3)	43*	14	14	88	99	58	58	58
Testing	Coastal	0	5	5	5	5	TBD	TBD	TBD
CSN									
Pioneer Array	Global	0	0	0	24	24	24	24	24
	Coastal	0	0	4	12	12	12	12	12
Testing	Intermediate	0	14	0	0	0	0	0	0
Endurance (Newport Line)	Global(3)	0	0	0	5	5	5	5	5
	Intermediate	12*	12	15	8	8	12	12	12
	Coastal	0	0	0	27	0	27	27	27
Endurance (Grays Harbor Line)	Global	0	0	0	0	8	8	8	8
	Intermediate	0	0	0	0	8	10	10	10
	Coastal	0	0	0	0	27	27	27	27
Testing	Intermediate	0	12	0	0	0	0	0	0
GSN									
Testing	Global	0	5	0	0	0	0	0	0
	Intermediate	0	5	0	0	0	0	0	0
Station Papa	Global	0	0	0	22	22	22	22	22
Southern Ocean	Global	0	0	0	0	24	24	24	24
Irminger Sea	Global	0	0	0	33	33	33	33	33
Argentine Basin	Global	0	0	24	24	24	24	24	24

Table 2-11. Estimated Annual DAS for Installation and O&M of Proposed CSN, RSN, and GSN (2010-2017)

Infrastructure	*Vessel Class*[1]	*Year*[2] 2010	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*
Subtotals by vessel class	Cable Laying/Repair	0	35	30	0	0	TBD	TBD	TBD
	Global	48	14	38	196	239	198	198	198
	Intermediate	17	38	15	8	16	22	22	22
	Coastal	0	5	9	44	44	66	66	66
	Total DAS	**55**	**102**	**92**	**248**	**299**	**286**	**286**	**286**

Note: [1]Approximate vessel lengths: Cable-laying = 450-500 ft.; Global = 235-280 ft.; Intermediate = 170-200 ft; Coastal = 66-100 ft.

[2]DAS includes transit time to and from the CSN, RSN, or GSN site and proposed activities at each site. Proposed DAS are a potential maximum and actual DAS may be less depending on actual O&M requirements after OOI is operational. TBD = to be determined based on potential annual RSN testing and cable repair requirements. RSN O&M begins in 2013 after installation of backbone cable and Primary Nodes.

[3]An ROV may be used during installation and O&M activities utilizing the Global vessel.

*The 2010 DAS for RSN and CSN are to complete site-specific bathymetric and other supporting surveys to support the cable routing and mooring placement of the RSN and CSN infrastructure.

2.2.9 Summary of Infrastructure under the Proposed Action

The infrastructure and siting characteristics for the proposed CSN, RSN, and GSN associated with the Proposed Action are summarized in Table 2-12.

Table 2-12. Summary of the Infrastructure of the Proposed OOI Network

COASTAL SCALE NODES (CSN)	
Endurance Array	
Grays Harbor Line Moorings	- 3 paired surface/subsurface (Inshore, Shelf, and Offshore) - active and non-active acoustic sensors on moorings & MFNs
Newport Line Moorings	- 1 paired surface/subsurface (Inshore) - 2 paired surface/cabled subsurface (Shelf and Offshore) - active and non-active acoustic sensors on moorings & benthic nodes
Gliders	6 gliders
Pioneer Array	
Moorings	- 3 EOM surface moorings - 2 surface piercing profiler moorings - 5 wire-following profiler moorings - Active and non-active acoustic sensors on moorings.
AUVs and Gliders	3 AUVs and 6 gliders.
REGIONAL SCALE NODES (RSN)	
Primary Infrastructure Cable	903 km
Buried Unburied – laid on seafloor	309 km (3 km within HDD conduit) 594 km
Shore Station	Pacific City, Oregon
Primary Nodes	7
Moorings	2 subsurface hybrid profilers
GLOBAL SCALE NODES (GSN)	
Station Papa	
Buoys	1 acoustically linked surface mooring (supplied by NOAA)
Moorings	1 subsurface hybrid profiler & 2 flanking subsurface
Gliders	3 gliders
Argentine Basin	
Buoys	1 acoustically linked surface mooring
Moorings	1 subsurface hybrid profiler & 2 flanking subsurface
Gliders	3 gliders

Table 2-12. Summary of the Infrastructure of the Proposed OOI Network

Southern Ocean	
Buoys	1 acoustically linked surface mooring
Moorings	1 subsurface hybrid profiler & 2 flanking subsurface
Gliders	3 gliders
Irminger Sea	
Buoys	1 acoustically linked surface mooring
Moorings	1 subsurface hybrid profiler & 2 flanking subsurface
Gliders	3 gliders

2.2.10 Special Operating Procedures (SOPs) for Installation and O&M of the Proposed OOI

Table 2-13 lists the SOPs that would be implemented as part of the Proposed Action to avoid and minimize any potential impact to biological resources and commercial fishing activities.

Table 2-13. SOPs to be Implemented under the Proposed Action

SOP	*Applicability*
1. Cable and equipment locations for all components of the proposed OOI would be published on NOAA Charts and through a NOTMAR, and accurate locational information would be made available to fishers to assist their avoidance of the instruments. Surface buoys would be marked per USCG requirements. A contact phone number would be established where fishers can report possible entanglements.	CSN RSN GSN
2. Onshore construction activities would avoid sensitive coastal dune, bluff, and wetland habitats, or scenic locations, and be sited on relatively level ground and to the maximum extent practicable on previously disturbed or developed land.	RSN
3. For onshore construction activities, appropriate best management practices (BMPs), based on the Oregon Department of Environmental Quality's Erosion and Sediment Control Manual (Oregon Department of Environmental Quality [ODEQ] 2005), would be incorporated into a stormwater pollution prevention plan (SWPPP) and submitted to the ODEQ in partial fulfillment of the CWA Section 301 National Pollutant Discharge Elimination System (NPDES) permit.	RSN
4. The shallow water exit points for HDD have been sited in sandy bottom areas. Pre-installation cable route surveys have been conducted to identify bottom conditions, plan cable burial accordingly, and to minimize the crossing of rocky and/or geologically unstable areas.	RSN
5. The OFCC has been notified regarding the proposed submarine cable, moorings, and associated sensors. An agreement would be negotiated with the OFCC to minimize risks to, interference with, and/or interruption of commercial trawler activities and of submarine cable operations.	CSN (Endurance Array – Newport Line), RSN
6. The cables would be buried approximately 1.3 m deep where substrate conditions allow, using a combination of plow and/or ROV. In so far as practicable, cables would be buried to a position about 1 km seaward of the 700-fm EFH boundary. In addition to complying with any permit conditions, it is expected that the cable routes would be inspected at 5-year intervals after the installation to determine whether there are exposed sections of cable that could be snagged by fishing gear, and such areas would be reburied to the extent possible.	RSN
7. During initial installation, where it is anticipated that burial cannot be achieved, the cable would be armored and fishers notified of the location of the exposed cable.	RSN
8. The RSN cable route and locations of moorings have been submitted to the U.S. Navy for review.	RSN
9. Owners of all existing and proposed cables would be contacted to coordinate crossings, if necessary. To the extent possible, all crossings would meet the recommendations of the International Cable Protection Committee (ICPC).	RSN

Table 2-13. SOPs to be Implemented under the Proposed Action

SOP	Applicability
10. As much as possible, cables will be laid perpendicular, rather than parallel to, steep offshore slopes. Perpendicular placement is more stable and reduces the risks of damage from underwater landslides or differential slippage of cable sections down side slopes.	RSN
11. Site-specific surveys have been completed and discussions with marine users (i.e., fishers) are ongoing to address the proposed mooring locations for the Pioneer and Endurance arrays and the Primary Nodes, LVNs, and junction boxes of the RSN to ensure adequate, acceptable positions for the siting of OOI infrastructure.	CSN (Endurance and Pioneer Arrays) RSN
12. For HDD operations, an HDD Monitoring and Spill Contingency Plan would be prepared and submitted to the USACE and ODEQ as appropriate. The plan would include, but not necessarily be limited to the following: • description of surficial and bedrock geological conditions and the proposed bore profile at each HDD location; • use a forward-reaming drilling method, as planned, for the HDD; this method would result in much smaller volumes of drilling mud and drill cutting discharges than an alternative back-reaming method;. • Flush the drilling mud and cuttings from the borehole, when technically feasible, prior to the final drill out during a forward-reaming process • assessment of the likelihood of a "frac-out" involving the release of drilling fluids from the bore hole into the overlying ocean waters; • procedures to monitor drilling fluid returns, regulate drilling pressure, and add lost circulation materials as necessary to plug fractures along the bore path and minimize the possibility of a frac-out; • to minimize the release of drilling mud when the drill punches through on the seabed, operators would switch from drilling mud to water only to lubricate the bore during the last stage of the operation before the drill reaches its exit point; • procedures for monitoring the bore path between the bore entry and the planned exit point to detect a release of drilling mud; • construct a drilling mud and cuttings containment area at the HDD drill base to receive and temporarily contain the discharged materials where they could be recovered and disposed of; • a Contingency Plan for the containment and cleanup of a discharge of drilling mud onto the shore or seabed; and • reporting procedures to document the implementation of the plan and its effectiveness.	RSN

2.3 NO-ACTION ALTERNATIVE

Numerous alternative configurations were considered for the CSN, RSN, and GSN components of the proposed OOI (refer to Chapter 2 of the PEA [NSF 2008]). As a result of extensive technical and NSF review of numerous planning and technical supporting documents, no other action alternatives to the Proposed Action emerged that would satisfy the identified purpose and need and scientific objectives and siting criteria.

Under the No-Action Alternative, NSF-funded research integrated across multiple geographic scales using a suite of infrastructure assets would not occur. The oceanographic data from the proposed OOI have important implications for scientific research and, in some cases, human safety and well-being. The No-Action Alternative, through the loss of oceanographic research funding, would result in a loss of important scientific data and knowledge relevant to a number of research fields. While the No-Action Alternative is not considered a reasonable alternative because it does not meet the purpose and need for the Proposed Action, as required under CEQ regulations (40 CFR 1502.14[d]), the No-Action Alternative is carried forward for analysis.

2.4 SCOPE OF ENVIRONMENTAL REVIEW

The major environmental compliance requirement for the analysis of potential impacts from the installation and operation of the OOI is NEPA and the preparation of an EA. Within an EA, potential impacts to the natural and human environment must be considered for a number of resource areas such as biological resources, cultural resources, socioeconomics, transportation, water quality, air quality, geological resources, etc. The geographic extent for the Proposed Action is based upon three geographic scales for proposed activities: CSN, RSN, and GSN. Based upon a preliminary analysis of the potential impacts of the proposed activities associated with the installation and subsequent O&M of the proposed OOI, some resource areas typically analyzed in an EA will not be addressed in this Draft SSEA because impacts to these resource areas are considered unlikely. A detailed discussion of the reasons for not carrying these resource areas forward for analysis is presented in Chapter 3.

CHAPTER 3
AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

3.1 APPROACH TO ANALYSIS

In compliance with NEPA and CEQ regulations, the description of the affected environment focuses only on those resources potentially subject to impacts. This chapter describes the existing environmental conditions in the ROIs for the RSN, CSN (Endurance Array), CSN (Pioneer Array), and GSN for resources potentially affected by implementation of the Proposed Action as described in Chapter 2. Since the proposed installation and O&M of the GSN and CSN (Pioneer Array) that are described in this Draft SSEA as the Proposed Action fall within the scope of analysis of the proposed installation and O&M of the GSN and CSN (Pioneer Array) as described and assessed in the PEA and SER, the impact analysis presented in the PEA and SER is applicable and more detailed, site-specific impact analysis is not necessary in this SSEA.

3.2 PACIFIC NORTHWEST CSN (ENDURANCE ARRAY) AND RSN

As the ROI for the RSN and CSN (Endurance Array) under the Proposed Action in this SSEA has not changed since the preparation of the PEA and SER, the number and length of proposed infrastructure has been reduced from that assessed in the PEA and SER, and the overall installation and O&M methods have not changed as that described in the PEA and SER, the affected environment and environmental consequences discussions within the PEA and SER for the RSN and CSN (Endurance Array) are still applicable for the current Proposed Action described in this Draft SSEA. Although the PEA was prepared with a programmatic approach, due to the nature of the marine environment, the location of proposed OOI infrastructure across a large ROI, and the lack of significant changes in the general location of proposed OOI infrastructure and installation and O&M activities within the ROI, the affected environment and environmental consequences sections of the PEA and SER did address the more defined locations currently being assessed as the Proposed Action in this Draft SSEA. Therefore, the discussion of the affected environment and associated environmental impact analyses in this SSEA focuses only on those areas where additional information has become available since the preparation of the PEA and SER which may result in different or additional impacts not previously assessed in the PEA and SER (e.g., occurrence of ESA-listed species, site-specific location of the proposed HDD activities). Those resources where changes in the Proposed Action may have potential new or additional impacts include terrestrial biological resources, marine biological resources, water quality, cultural resources, and socioeconomics (fisheries) within the ROI for the CSN (Endurance Array) and RSN. In particular, since the proposed moorings associated with the Grays Harbor Line and Newport Line and portions of the proposed RSN cable would be located within important fishing areas, micro-siting of the Endurance Array moorings and RSN backbone cable will require coordination with fishermen and tribal nations in order to avoid or minimize potential conflicts with local fishing interests and tribal U&A fishing rights.

3.2.1 Terrestrial Biological Resources

The only terrestrial area proposed for use under the Proposed Action would be an existing shore station and BMH that would be used for the landing of the RSN submarine or backbone cable at Pacific City, Oregon. Proposed HDD activities would occur in the vicinity of an existing BMH within a previously disturbed residential area with no sensitive vegetation or habitat (refer to Figures 2-15 thru 2-18). Although the ESA-listed threatened western snowy plover (*Charadrius alexandrinus nivosus*) is known to nest at Nestucca Spit approximately 1.6 km to the south of the HDD project area (USFWS 2007), due to the very disturbed nature of the proposed HDD area, its use as a vehicle and pedestrian access point to the beach, and lack of suitable plover nesting or foraging habitat within the proposed HDD laydown area (see Figure 2-19), proposed HDD activities would have no effect on the western snowy plover. Designated snowy plover critical habitat does not occur within or in the immediate vicinity of the HDD project area (USFWS 2005). No other sensitive terrestrial biological resources are expected to occur at or in the vicinity of the proposed HDD and BMH site. Therefore, there would be no significant impacts to terrestrial biological resources with implementation of the Proposed Action.

3.2.2 Geological Resources

For the purposes of this Draft SSEA, the discussion of the geology of the CSN (Endurance Array) and RSN project area will be based on the Desktop Study prepared for the RSN (UW 2010a), site-specific surveys for the RSN (including grab and core sampling at waters depths ranging from 10 to 1,500 m), and data from the National Geophysical Data Center (2010).

3.2.2.1 Affected Environment

<u>RSN Cable Route</u>

The proposed RSN cable route would span part of the North American and Juan de Fuca tectonic plates. It would be located largely within the Cascadia Basin, the Cascadia Subduction Zone, the Astoria Fan and the Oregon Margin. The Cascadia Basin is a generally flat physiographic feature, bordered to the east by the Cascadia Subduction Zone and Astoria Fan, to the west by the Juan de Fuca Ridge, and to the south by the Blanco Fracture Zone. It is bisected by the Cascadia Sea Channel, which extends southwest across the basin and is more than 2,000 km long (Griggs and Kulm 1970). To the east of the Cascadia Sea Channel, the Astoria Fan comprises a thick accumulation of fine-grained sediments and is split by the Astoria Channel and the Tillamook Channel.

The following discussion is based on findings gathered during site specific marine surveys of the proposed cable route and from the National Geophysical Data Center (2010).

Segment 1. Starting from shore, Segment 1 would pass approximately 1 km south of Haystack Rock, an extinct volcanic plug that rises prominently above the seabed. A belt of small, isolated rock outcrops or consolidated sediment extends west-southwest from Haystack Rock between the 10 and 50 m isobaths; the proposed cable route would pass through this belt between the 40 and 50 m isobaths. Sand dominates the shelf sediments from the shore to the 120 m isobath, and west of this isobath, the sediment is comprised of mud and sandy mud. Segment 1 would cross approximately 13 mapped faults.

Segment 2. Segment 2 would pass through a muddy drape over layers of rock that has the appearance of a fold overlying the Cascadia Accretionary Prism. The accretionary prism comprises sediments scraped off the Juan de Fuca Plate as it subducts beneath the North American Plate. The prism is a complex of thrust-faults and folds forming north-striking ridges. Segment 2 would rise from the seafloor up a steep, potentially rocky slope at the base of the continental margin to the 1,500 m isobath. From the 1,500 m isobath, the slope gradually decreases and sediments are primarily comprised of mud.

Segment 3. Segment 3 would curve southeast along the base of South Hydrate Ridge, and enter a mini-basin located southeast of the ridge. This mini-basin is filled with a very thick deposit of sandy mud. Node PN1C is located in an area of rock, bounded by mud and sandy mud.

Segment 4. From node PN1C, Segment 4 would cross a muddy benign seabed between two rocky features, Daisy Bank and Stonewall Bank. The route would skirt around the northern extension of Stonewall Bank before ending close to its wall, at the location of node PN1D.

Segment 4 Newport. From node PN1D, the Newport Segment (4NP) would cross a muddy outer shelf seabed, and skirt around north-south trending (rocky) ridges of Stonewall bank prior to ending at LV01D, at the location of an existing buoy.

Segment 5. Near shore, Segment 5 would run approximately 600-700 m south of Haystack Rock. Sand dominates the shelf sediments from shore to about 120 m water depth; west of this isobath, the sediment is composed of mud to sandy mud, with occasional rock outcrops. A belt of small, isolated rock outcrops extends west-southwest from Haystack Rock between the 10 and 50 m isobaths (as described for Segment 1). At the base of the continental slope, the route would pass over the Astoria Fan. Mud dominates the sediment for the remainder of this segment of the proposed route. Segment 5 would cross approximately 10 known faults, all of which are assumed to be active.

Segment 6. Between node PN5A and the Juan de Fuca Ridge, Segment 6 would run over mud deposits of the Cascadia Basin. The floor of the Cascadia Sea Channel is likely comprised of coarser grained sediments. As this segment nears the Juan de Fuca Ridge, the sediment layer is thinner, with increasing volcanic content.

Segment 7. From node PN3A, the route would ascend the eastern flank of Axial Seamount. This flank has built up from lava flows from the Axial Caldera. The caldera is active with periodic eruptions. Node PN3B would be located at the southeastern edge of the caldera.

HDD Site

To protect the RSN cable at the shore landing and in the shore approach, HDD is planned between the shore and a water depth of approximately 11 fm (20 m); over a distance of about 0.8 nm (1.5 km). The local geology at the Pacific City BMH is dominated by unconsolidated sand. The sand is fine to medium grained, sub-rounded to rounded, composed primarily of quartz grains with a considerable portion of chert, plagioclase, and basalt grains. The sand is constantly mobilized by both water and wind. Wind blowing from offshore moves sand landward, sometimes resulting in the creation of low lying dunes (UW 2010a).

Waves and littoral currents act on the beach and nearshore sands to mobilize and transport large quantities of sediment near the landing site. This interaction between current and wave energy seasonally results in net deposition of sand into breaker bars and net erosion that results in fore-bar and back-bar depressions. The resulting breaker bar topography is dynamic, and changes with seasonal variations in weather. The seafloor seaward of the breaker bars, within 0.8 km of shore, is comprised of sand (UW 2010a).

A well drilled approximately 1.4 km north of the BMH indicates the presence of at least 36.6 m of unconsolidated sediments beneath the beach surface (Oregon Water Resources Department 2006). Due to the similarity between the beach conditions at the well site and the RSN landing site, a comparable thickness of sand is anticipated to be present at the BMH.

Shilshole Bay Test Sites

The seabed of the Shilshole Bay test sites is sand/mud with no rocky outcrops in the vicinity.

3.2.2.2 Environmental Consequences

Impact Assessment Methodology

The levels of potential impacts to geological resources with implementation of the Proposed Action are defined in Table 3-1.

Table 3-1. Levels of Potential Impacts to Geological Resources with Implementation of the Proposed Action

Impact Level	*Definition*
Negligible	No change to the topography, natural physical resource, or soils, or changes would be so small that it would not be of any measurable or perceptible consequence.
Minor	A detectable change to the topography, natural physical resource, or soils, but the change would be small, localized, and of little consequence.
Moderate	A measurable and consequential change to the topography, natural physical resource, or soils. Mitigation may be needed to offset adverse impacts and would be relatively simple to implement and likely be successful.
Major	A substantial change to the topography, natural physical resource, or soils. Extensive mitigation measures to offset adverse impacts would be needed and their success could not be guaranteed.
Short-term	Occurs only during the period of OOI installation, test, or O&M activities.
Long-term	Continues after the period of OOI installation, test, or O&M activities.

<u>Proposed Action</u>

The installation, O&M, and test activities would result in negligible, short-term suspension of bottom sediments and would not change the topography, soils or physical characteristics of the ocean bottom along the RSN cable route, the vicinity of the HDD site, and at the Shilshole Bay test sites.

<u>No-Action Alternative</u>

Under the No-Action Alternative, the NSF-funded OOI, including the CSN (Endurance Array) and RSN components, would not be implemented. Therefore, baseline conditions would remain unchanged and there would be no impacts to geological resources with implementation of the No-Action Alternative.

3.2.3 Water Quality

3.2.3.1 Affected Environment

<u>RSN and CSN (Endurance Array)</u>

For a description of the marine environment of the RSN and CSN (Endurance Array) refer to the Section 3.4.1 of the PEA.

<u>Shilshole Bay Test Sites</u>

The two test sites in Shilshole Bay are located on the east side of the central portion of Puget Sound, just north of Seattle. The waters of the Sound are somewhat isolated from exchange with incoming Pacific Ocean waters. Although the Washington Department of Ecology has rated Puget Sound water quality as generally good in most areas (Newton et al. 2002), pollutants such as fertilizers or toxics released into the Sound may become locally entrapped over relatively long periods of time. Marine sediments in the eastern portion of central Puget Sound are contaminated by industrial activities. Eutrophication occurs in the Sound due to a combination of weather patterns and nutrient inputs, typically from runoff or wastewater sources, such as treatment plant discharges or failing septic systems. Commercial and recreational vessel traffic in the area also has the potential to stir up bottom sediments and cause short-term increases in turbidity to the marine environment (Washington Department of Ecology 2008).

3.2.3.2 Environmental Consequences

<u>Impact Assessment Methodology</u>

The levels of potential impacts to water quality with implementation of the Proposed Action are defined in Table 3-2.

Table 3-2. Levels of Potential Impacts to Water Quality with Implementation of the Proposed Action

Impact Level	*Definition*
Negligible	No impacts to water resources (chemical, physical, or biological).
Minor	Impacts to water resources (chemical, physical, or biological), but the impacts would be well below water quality standards or criteria and within historical or desired water quality conditions.
Moderate	A measurable and consequential impact to water resources (chemical, physical, or biological), but the impact would be at or below water quality standards or criteria. Historical baseline or desired water quality conditions would be temporally altered. Mitigation measures would be necessary to offset adverse impacts and would likely be successful.
Major	A substantial impact to water resources (chemical, physical, or biological); the impact would be frequently altered from the historical baseline or desired water quality conditions. Chemical, physical, or biological water quality standards or criteria would temporarily be slightly and singularly exceeded. Extensive mitigation measures to offset adverse impacts would be needed and their success could not be guaranteed.
Short-term	Occurs only during the period of OOI installation, test, or O&M activities.
Long-term	Continues after the period of OOI installation, test, or O&M activities.

Proposed Action

RSN Cable Route and CSN (Endurance). Implementation of the Proposed Action would result in short-term, minor impacts to marine water quality. It would not alter water currents or wave patterns in the region in a manner that would generate or accelerate erosion of local beaches or modify seabed morphology. Project activities are expected to occur on level sites without surface water features or direct drainage to the ocean. A project-specific SWPPP incorporating BMPs for erosion and sedimentation control would be prepared and implemented to prevent the discharge of sediment or pollutants or runoff from the sites. The Proposed Action would not affect water quality parameters, such as dissolved oxygen, salinity and nutrients.

Cable installation and maintenance activities would result in short-term, minor changes in water quality. Small-scale increases in turbidity would occur during cable burial operations and the installation of instruments on the seafloor. Trenching would temporarily increase turbidity and disturb sediments to approximately 1.3 m below the seabed, which is the target depth of burial. Approximately 309 km of the backbone cable would be buried. Sediments would rapidly disperse and/or settle back to the seabed. Coarse sediments (sand or larger) would resettle within seconds in the immediate area, whereas fines (silt to clay) would tend to drift and remain in suspension for minutes to hours, depending on particle sizes and bottom currents (Minerals Management Service 1999). Depending on the currents, which are generally between 13 to 20 cm/sec, turbidity would be dispersed and sediments would settle back to the seafloor or be diluted to background levels within minutes to hours of the passing trenching equipment (cable plow). There would be no permanent or long term impacts on marine water quality due to suspended sediments.

In deeper waters (>820 fm [1,500 m]), the surface-laying procedure for the installation of the cable and primary nodes would result in some minor resuspension of bottom sediments. The impact of the cable settling on the seafloor is expected to displace a relatively small volume of water, which would create a local turbulence sufficient to resuspend nearby sediments. Due to the small size of the cable, it is expected that the turbulence would create a plume of suspended sediments with a maximum radius of no more than 50 cm.

Installation and removal of the nodes and cable would not result in oil or grease or other physico-chemical changes that would impact water quality or sediment characteristics. However, indirect effects from accidental spills of oil or hydraulic fluids required for the operation of the cable installation vessel may occur. To minimize the potential impacts of these spills, the cable laying vessel would be required to comply with a Spill Prevention Control and Countermeasure Plan and that appropriate BMPs address spill control measures.

Once installed, the buried cable would not result in any subsequent alterations in suspended sediments or turbidity levels. The offshore cables consist of metallic and synthetic, essentially inert materials (glass fibers, plastic [polyethylene], copper, steel, waterproof nylon yarn). Based on observations of underwater cables off Kauai (Office of Naval Research 2001) and elsewhere (Monterey Bay Aquarium Research Institute 2003; Navy 2004), the cables would soon be covered with marine growth or buried by sand, and would not break down over time. The available information, although limited, suggests that cable constituents (such as copper and zinc) are not normally leached into surrounding waters unless the cable is damaged, and that in any case, the amounts are small and unlikely to affect the organisms that grow on the cables (ICPC 2007). Ultimately, as cable components disintegrate, decompose, or corrode, the constituent elements would be dispersed into surrounding media, with short-term minor impacts to water quality.

The only hazardous substances that would be used in the proposed project are lubricants and fuel contained in marine vessels and equipment. Vessels would adhere to federal, state, and IO requirements (i.e., UNOLS 2003; University of California-San Diego 2007, 2010; University of Washington 2007, 2010c; OSU 2010; WHOI 2010) for the management of hazardous materials and hazardous waste. Vessels engaged in installation would adhere to all USCG (CWA §311) requirements regarding the containment, cleanup, and reporting of spills, which would assure that the effects are minimized. Therefore, there would be no significant impacts to marine water quality with implementation of the Proposed Action.

The HDD process would not directly or cumulatively introduce toxic or hazardous substances or chemicals, organic substances, or solid wastes into bodies of water or on land to cause the level of these substances to exceed regulatory standards. The drilling mud would be a water-based slurry consisting predominantly of bentonite, a naturally occurring, non-toxic clay material commonly used to install drinking water wells. Drilling mud would be used during the HDD operations to facilitate the drilling of the hole. It would be pumped under pressure into the hole to run the drill motor. The mud would also help cut through geologic formations, transport the cut soil and rock particles (drill cuttings) out of the 2 drilling holes back to the HDD platform, lubricate the borehole and the drill bit, and seal off fractures and pores in the formation. A non-toxic polymer could be added to the bentonite mud to enhance the suspension of drill cuttings and allow their removal from the borehole.

The drilling mud would be circulated down the drill hole and back to the surface at the mud tank where drill cuttings would settle down. The mud would then be circulated again down the borehole. Because the mud would be circulated under pressure, it could induce or open up an existing fracture in the soil or rock. Fracturing would be more likely to occur in highly permeable unconsolidated formations and fractured bedrock. Such a fracture could potentially reach the surface (a situation referred to as a “frac out”). In the event that a frac out would occur, it is possible that drilling mud be temporarily discharged into the ocean while drilling operations are shutdown. Although bentonite is considered inert and non-toxic, at high concentration in water it could cause impacts on organisms by physical abrasion or clogging. The drilling contractor would follow procedures established in a project-specific Drill Monitoring and Cleanup Plan to minimize the possibility of a release of drilling mud into the ocean, and to remove any accumulation of drilling mud on the seafloor (refer to Section 2.2.10).

Discharge of drilling fluids and drill cuttings could occur at the HDD exit holes, as the drill bit reaches the seabed. To avoid discharging drill cuttings and fluids, when the pilot hole approaches the exit hole locations, the drill string would be pulled back to the onshore drilling pad and a forward-reaming technique would be used to increase the diameter of the bore. The reaming would advance forward until the HDD reaches the surface at the exit hole. At this time, a limited portion of the drilling fluids and drill cuttings present in the borehole would be discharged into the coastal waters. Flushing out the drilling mud and cuttings from the borehole with water prior to the final drill out, and using the water as a drilling fluid in place of the bentonite mud in these final stages is the preferred option. This would reduce the volume of drilling mud and cuttings potentially discharged.

It may not be technically feasible, however, to flush out the borehole and use water as the drilling fluid for drill out. In general, the volumes of drill cuttings and drilling mud discharged would depend upon the drilling method used to ream out the pilot hole, the length and diameter of the bore, and the elevation of the HDD exit relative to the HDD platform. The characteristics of the materials that could be discharged are difficult to predict and depend upon the volume of materials discharged, the hydraulic gradient (i.e. pressure) that is driving the discharge, the diameter of the borehole and the presence of currents in the receiving environment. Any drill cuttings discharged would settle onto the seafloor quickly and would accumulate near the HDD exit. Much of the bentonite would be expected to flocculate in suspension near the exit hole, although some bentonite would also be dispersed by currents.

Regular O&M operations would have impacts on marine water quality similar to those of installation at the affected locations.

Shilshole Bay Test Sites. Testing of the RSN infrastructure would occur no more than 5 times over a 1-year period, with each test lasting less than 24 hours. Depending on the test, some equipment may be placed on the seabed, including for instance the Secondary Nodes and or four 1,100 pound weights allowing the vertical mooring to remain stable. Deployment and retrieval of each device would create temporary resuspension of sediments and turbidity. However, turbidity or sediment suspension would not persist as the effects would be reversed by natural dispersive processes in the area within minutes of the equipment deployment or its removal. The temporary increase in suspended sediment concentrations and turbidity levels are expected to cause negligible effects to the surrounding water quality.

<u>No-Action Alternative</u>

Under the No-Action Alternative, the NSF-funded OOI, including the CSN (Endurance Array) and RSN components, would not be implemented. Therefore, baseline conditions would remain unchanged and there would be no impacts to water quality with implementation of the No-Action Alternative.

3.2.4 Marine Biological Resources

3.2.4.1 Affected Environment

The affected environment discussion as presented in the PEA and SER is still applicable for the proposed analysis of the RSN and CSN (Endurance Array) in this Draft SSEA. The information used for the PEA affected environment and the associated impact analysis is on a regional scale and the proposed action assessed in this Draft SSEA does not include any areas or resources not previously addressed at the level of detail available for the ROI. The only changes are due to the federal listing of 3 species and designation and proposed designation of critical habitat since the completion of the PEA, FONSI, and SER. A discussion of those ESA-listed species is presented below. In addition, under the Proposed Action testing of RSN infrastructure would occur at 2 potential test sites within Shilshole Bay in southern Puget Sound. As proposed testing of RSN infrastructure within Puget Sound was not addressed in the PEA and SER, a discussion of the affected environment and potential environmental consequences of implementing the proposed testing activities within Shilshole Bay are provided.

RSN and Endurance Array – ESA-Listed Species and Critical Habitat

The PEA provided a discussion of 7 marine mammals, 1 sea turtle, and 4 Evolutionary Significant Units (ESUs) and 1 Distinct Population Segment (DPS) of anadromous fish species that are federally listed as threatened or endangered under the ESA, with 1 anadromous fish DPS having designated critical habitat, and potentially occur in the vicinity of the proposed Endurance Array and RSN cable off the coast of Washington and Oregon (refer to Table 3-2 in the PEA).

Since the completion of the PEA and SER, 2 fish species have become listed as threatened and potentially occur within the CSN (Endurance Array) and RSN ROI: green sturgeon Southern DPS (*Acipenser medirostris*) and Pacific eulachon Southern DPS (*Thaleichthys pacificus*) (NMFS 2006, 2010a). Critical habitat was also designated for the green sturgeon (NMFS 2009). NMFS has also proposed revising the critical habitat for the leatherback sea turtle (*Dermochelys coriacea*) to include areas along the Pacific Coast of the U.S. (NMFS 2010b) (Table 3-3).

During their marine phases, other federally listed ESUs or DPSs of anadromous fishes that spawn outside of the action areas (e.g., in the Columbia River system and Oregon coastal streams), range hundreds to thousands of kilometers across the ocean and could thereby occur in the ROI. Those anadromous fish species that do not have spawning-rearing habitat, migration corridors, or other designated or proposed critical habitat within the action area (e.g., Oregon Coast coho ESU and Pacific eulachon Southern DPS) would only occur within the ROI during their non-breeding marine life stages. As a result, there would be no potential effects on their up- or downstream migration corridors or breeding areas. Although data on the occurrence of these specific species within the ROI area are not available, they are considered potentially present. However, the possibility that vessels, activities, or materials associated with the proposed test activities could harm (through physical contact) individuals or their habitat, or significantly interfere with their behavior in the open ocean is considered discountable. Since the Proposed Action poses no likelihood of harm to individuals or other interference with the oceanic life stages of these species, they are not considered further in this SSEA.

Table 3-3. ESA-listed Marine Species Potentially Occurring within the Vicinity of the Proposed CSN (Endurance Array) and RSN and Addressed in this SSEA*

Species	*ESA Status*
FISH	
Oregon Coast coho ESU (Oncorhynchus kisutch)	*T*
Pacific eulachon Southern DPS (*Thalichthys pacificus*)	**T**
Green sturgeon Southern DPS (*Acipenser medirostris*)	**T, CH**
SEA TURTLES	
Leatherback (*Dermochelys coriacea*)	E, **PCH**
Green (Chelonia mydas)	*E*
Loggerhead (Caretta caretta)	*T*
Olive ridley (Lepidochelys olivacea)	*E*
MARINE MAMMALS	
Steller sea lion – Eastern DPS (Eumetopias jubatus)	*T*

Notes: *CH = critical habitat, E = endangered, PCH = proposed critical habitat, T = threatened.
- Species in **bold** are those species that became listed or CH was designated or proposed as such after the completion of the PEA and SER and are therefore addressed in this SSEA.
- Species in *italics* were not addressed in the PEA and SER and are therefore addressed in this SSEA.

Sources: Department of the Navy (Navy) 2006; NMFS 2010c.

Green Sturgeon. The green sturgeon is an anadromous fish which ranges in the ocean from the Bering Sea, Alaska to Ensenada, Mexico. Juvenile fish spend their first 3 years in freshwater streams, and then migrate to the ocean. Upon reaching maturity at 10-15 years, individuals return to their natal streams to spawn every 2-5 years. The species consists of 2 DPSs, southern and northern, which cannot be distinguished except by genetic analysis. The southern DPS was listed as threatened in 2006 and spawns only in the Sacramento River system. The northern DPS, which is not ESA listed, spawns in coastal watersheds from the Eel River (California) northward. Outside of their natal streams, distributions of the 2 DPSs overlap, including coastal bays and estuaries of Washington (Willapa Bay and Grays Harbor) and Oregon (Coos Bay, Winchester Bay, Yaquina Bay, and Nehalem Bay) as well as the outer coastal waters of Washington and Oregon State (NMFS 2006, 2008b, 2009).

Adult and subadult green sturgeons, presumed to include the southern DPS, range widely along the outer Washington coast, in shallow waters to a depth of 110 m; hence they may occur within the shoreward portions of the RSN and Endurance Array ROI. They are known to congregate in the Columbia River estuary, Willapa Bay, and Grays Harbor. They feed on the bottom, on smaller fishes and benthic invertebrates, including shrimp, crabs, and clams (NMFS 2005, 2008b).

Critical habitat was designated in October 2009 for the Green Sturgeon Southern DPS to include the marine coastal waters from northern California to the Strait of Juan de Fuca to a depth of 110 m (NMFS 2009), including areas within the RSN and Endurance Array ROI. The designated critical habitat includes the coastal area identified as an important component of the migratory/connectivity corridor for Southern DPS subadults and adults (from San Francisco Bay, California to Vancouver Island, British Columbia), supporting migration to and from oversummering habitats in Oregon and Washington, and overwintering habitats in British Columbia. This area may support subadult/adult aggregations and feeding (NMFS 2008a, b). NMFS developed a list of Primary Constituent Elements (PCEs) that are essential to the species' conservation. PCEs of Green Sturgeon Southern DPS critical habitat in coastal marine areas include the following:

(1) Migratory corridors that allow unimpeded passage within marine and between estuarine and marine habitats, enabling adult and subadult fish to access foraging areas, oversummering and overwintering habitats, and to migrate back to the Sacramento River for spawning.
(2) Water quality, with adequate dissolved oxygen and low levels of contaminants.
(3) Food resources that include abundant benthic invertebrates and fishes believed necessary to support the long-distance migrations undertaken by green sturgeon (NMFS 2008a, b, 2009).

Leatherback Turtle. Leatherback sea turtles are the largest of all sea turtles, reaching 8 ft (2.4 m) long and weighing 1,600 lbs (725 kg). Leatherbacks range widely through the tropics and subtropics, migrate seasonally into Arctic and Antarctic waters, and typically nest between 40º N to 35º S latitudes; no nesting occurs on beaches under U.S. jurisdiction. They feed mainly on jellyfish near the surface or within the water column. Sea surface temperatures where leatherback turtles have been observed are usually in the 15-16 °C range, suggesting that leatherbacks can range as far north as Oregon and Washington waters when sea surface temperatures are highest in the summer and fall. During vessel and aerial surveys in 1990, leatherback turtles were observed in both Oregon and Washington waters, but most sightings were along the coast of Washington. Turtles were observed between June and September with most sightings in July in continental slope waters, while fewer occur over the continental shelf (Navy 2006). Leatherback turtles may potentially occur during the summer in small numbers in the deeper, offshore waters of the proposed Endurance Array and RSN.

In January 2010, NMFS proposed revising the current critical habitat for the leatherback turtle by designating additional areas within the Pacific Ocean. Specific areas proposed for designation include 2 adjacent marine areas stretching along the California coast from Point Arena to Point Vincente; and one marine area stretching from Cape Flattery, Washington to the Umpqua River, Oregon east of a line approximating the 2,000-m depth contour (NMFS 2010b). Proposed revised leatherback critical habitat occurs within the RSN and Endurance Array ROI. NMFS identified 2 PCEs essential for the conservation of leatherbacks in marine waters off the U.S. West Coast:

(1) Occurrence of prey species, primarily jellyfish (scyphomedusae) of the order Semaeostomeae (*Chrysaora, Aurelia, Phacellophora,* and *Cyanea*) of sufficient condition, distribution, diversity, and abundance to support individual as well as population growth, reproduction, and development.
(2) Migratory pathway conditions to allow for safe and timely passage and access to/from/within high use foraging areas (NMFS 2010b).

Green, Loggerhead, and Olive Ridley Turtles. The entire RSN and Endurance Array ROI is an area of rare occurrence for greens, loggerheads, and olive ridleys. Water temperatures off Oregon and Washington are near the minimum tolerable limits for these 3 species of sea turtles throughout much of the year. This is evidenced by the scarcity of available occurrence data for both the upwelling and relaxed seasons. Even during El Niño events, the waters of the Pacific Northwest Region are still at temperatures below the thermal preferences of these species. Range expansion into waters off Oregon and Washington is unlikely. Green, loggerhead, and olive ridley turtles are much more common in the tropical/subtropical waters off southern California, Mexico, and Central America, which are located hundreds of kilometers to the south of the ROI (NMFS and USFWS 1998a, b, c; Navy 2006). Therefore, these 3 species are not expected to occur within the ROI except only very rarely and are not discussed further.

Steller Sea Lion. The range of the Steller sea lion extends throughout most of the North Pacific from southern California through the Aleutian and Pribilof Islands to the Kuril Islands and Okhotsk Sea. In the Pacific Northwest, rookeries are located in British Columbia and Oregon; there are no rookeries in Washington State. Steller sea lions regularly occur off the coast of Oregon and Washington year-round. Peak abundance occurs on land during the spring breeding season and at sea during the fall. In the Pacific Northwest region, Steller sea lions mostly occur in shallow waters (<200 m) but have been sighted in water depths as great as 2,250 m off the coast of California (Jeffries et al. 2000; Navy 2006).

In Washington State, Steller sea lions primarily haul out along the coast from the Columbia River to Cape Flattery. The number of Steller sea lions in Washington varies with season but peaks at about 1,000 animals during the fall and winter months. Four Steller sea lion haulouts with sea lions numbering in the tens to hundreds are located at rocks associated with the Split Rock area, approximately 35 nm north of the proposed Grays Harbor Line (Jeffries et al. 2000; Navy 2006).

Primary rookery sites in Oregon are located along the southern coast at Orford and Rogue reefs, over 20 nm south of the RSN and Newport Line of the Endurance Array. Main haulout sites are at Sea Lion Caves, Three Arch Rocks, Ecola Point, and the Columbia River jetty. During the summer, Steller sea lions are common in cold, upwelled waters off southern Oregon; they tend to remain near their rookeries (within 15 nm), Heceta and Stonewall Banks, and the mouth of the Umpqua River, all well south of the RSN and Endurance Array ROI (Navy 2006).

RSN (Testing of Infrastructure Components) – Shilshole Bay Test Sites

ESA-Listed Species and Critical Habitat. Six ESA-listed species potentially occur within the proposed RSN test sites in Shilshole Bay: 1 ESU and 3 DPSs of anadromous fish species, with 1 DPS and 1 ESU having designated critical habitat, and 2 marine mammals (Table 3-4).

Table 3-4. ESA-listed Marine Species Potentially Occurring within the Vicinity of the Proposed RSN Infrastructure Test Sites*

Species	*ESA Status*
FISH	
Puget Sound Chinook salmon ESU (*Oncorhynchus tshawytscha*)	T, CH
Puget Sound Steelhead DPS (*Oncorhynchus mykiss*)	T
Green sturgeon Southern DPS (*Acipenser medirostris*)	T, CH
Pacific eulachon Southern DPS (*Thalichthys pacificus*)	T
MARINE MAMMALS	
Southern Resident killer whale (*Orcinus orca*)	E, CH
Steller sea lion – Eastern DPS (*Eumetopias jubatus*)	T

Notes: *CH = critical habitat, E = endangered, T = threatened.
Sources: Navy 2006; NMFS 2010c.

Although these species are considered potentially present within the Shilshole Bay test sites, the possibility that vessels, activities, or materials associated with the proposed test activities that would occur no more than 5 times over a 1-year period, with each test lasting less than 24 hours could harm (through physical contact) individuals or their habitat, or significantly interfere with their behavior in the in the marine environment is considered discountable. Since the Proposed Action poses no likelihood of harm to individuals or other interference with these species, they are not considered further in this SSEA.

EFH. Within Puget Sound, which includes the Shilshole Bay test site, EFH has been designated for 45 groundfish species, 4 Coastal Pelagic Species (anchovy, Pacific sardine, market squid, and Pacific chub mackerel), and 3 salmon species (coho, Chinook, and pink) (Pacific Fisheries Management Council 1998; 2006).

3.2.4.2 Environmental Consequences

This section identifies potential direct and indirect impacts to marine biological resources that may result from implementing the Proposed Action or No-Action Alternative. The significance criteria used in this analysis of the level and extent of impacts on ESA-listed species that would result from installation, O&M, and test activities are described below.

Impact Assessment Methodology

The levels of potential impacts to marine biological resources with implementation of the Proposed Action are defined in Table 3-5.

Table 3-5. Levels of Potential Impacts to Marine Biological Resources with Implementation of the Proposed Action

Impact Level	*Definition*
Negligible	No impact to marine biological resources or the impact would be below or at the lower levels of detection.
Minor	A detectable change to biological resources, however the impact would be small, localized, and of little consequence.
Moderate	A readily apparent change to biological resources over a relatively wide area.
Major	A substantial change to the character of the biological resource over a large area.
Short-term	Occurs only during the period of OOI installation, test, or O&M activities.
Long-term	Continues after the period of OOI installation, test, or O&M activities.

Proposed Action

Under the Proposed Action, there would be no significant change in the proposed CSN and RSN installation and O&M activities that were previously assessed in the PEA and SER. The installation of 1 less primary/secondary node, 510 km less of backbone cable (including the burying of 166 km less of backbone cable), 15 fewer LVNs, 7 fewer low-power junction boxes, and 8 fewer medium-power junction boxes, and associated less installation and O&M activities, would result in less potential impact to all marine species than that assessed in the PEA and SER.

Installation and O&M Activities. The vessels and activity associated with installation of RSN cable, surface and subsurface moorings, and associated scientific sensors on the sea floor may cause Steller sea lions to temporarily avoid the immediate vicinity of the proposed CSN (Endurance Array) and RSN. The vessel used for cable and mooring deployment would move very slowly during the activity and would not pose a collision threat to Steller sea lions. In addition, Steller sea lions generally occur in shallow waters (<200m) and at haul out sites to the north of the proposed OOI activities associated with the Grays Harbor Line, and at rookeries in Oregon over 20 nm south of proposed OOI activities associated with the Newport Line. There are no documented incidents of marine mammal entanglement in a submarine cable during the past 50 years (Norman and Lopez 2002). The cables would be taut against the seafloor, without loose slack. Entanglement of Steller sea lions is not likely because the submarine cable would be buried in water depths less than 1,100 m. For water depths greater than 1,100 m, where the cable is not buried, the rigidity of the cable would cause the cable to lie extended on the sea floor and not coil thereby eliminating the potential for entanglement. Entanglement of marine species within mooring cables in the water column is considered highly unlikely because of the rigidity of the mooring cables and the ability of marine species to detect and avoid the mooring lines. Therefore, the implementation of the Proposed Action would result in short-term, negligible direct impacts to Steller sea lions, would not result in takes under the MMPA, and is not likely to adversely affect Steller sea lions.

Implementation of the Proposed Action would not affect green sturgeon critical habitat and proposed leatherback critical habitat. Proposed OOI installation and O&M activities would not impact critical habitat PCEs for both species: migratory corridors and food resources for both green sturgeon and leatherback, and water quality for green sturgeon.

The use of up to six gliders within a survey area of ~16,000 nmi^2 around the Endurance Array is not expected to affect marine species, as the proposed gliders would move within the water column similar to a dolphin or whale. Gliders are sealed, contain no motors, fuels, or hazardous materials; and move at very slow speeds (~0.5 knot), thereby eliminating the potential for collisions with marine fauna.

No additional active acoustic sources are proposed and the analysis of potential effects of acoustic sources on marine fauna as provided in the PEA is still applicable to the current Proposed Action.

Under the provisions of the MSA, federal agencies must consult with NMFS prior to undertaking any actions that may adversely affect EFH. Federal agencies retain the discretion to determine what actions fall within the definition of "adverse affect." Temporary or minimal impacts, as defined by NMFS regulations and below, are not considered to "adversely affect" EFH (50 CFR Part 600). "Temporary impacts" are those that are limited in duration and that allow the particular environment to recover without measurable impact. "Minimal impacts" are those that may result in relatively small changes in the affected environment and insignificant changes in ecological functions.

In considering the potential impacts of a proposed action on EFH, all designated EFH must be considered. Impacts on EFH would entail temporary mechanical disturbance of the substrate, and long-term coverage of relatively small areas of substrate by RSN cable, TRFs, mooring anchors, LVNs, junction boxes, and cabled scientific sensors. Implementation of the Proposed Action would impact an estimated 63 ha of EFH, or 36 ha less than the 99 ha previously assessed in the SER. The PEA and SER analysis concluded that implementation of the proposed actions identified in those documents would not result in adverse effects to EFH, therefore, there would not be adverse effects to EFH with implementation of the current Proposed Action.

Testing of RSN Infrastructure. The potential use of the Shilshole Bay test sites would occur no more than 5 times over a 1-year period, with each test lasting less than 24 hours and potential bottom disturbance of less than 0.8 m^2 would result in short-term, negligible impacts to marine biological resources, including ESA-listed species.

No-Action Alternative

Under the No-Action Alternative, the NSF-funded OOI, including the CSN (Endurance Array) and RSN components, would not be implemented. Therefore, baseline conditions would remain unchanged and there would be no impacts to marine biological resources with implementation of the No-Action Alternative.

3.2.5 Cultural Resources

The occurrence of *cultural, historic, and archeological resources* were evaluated within the ROI. *Cultural resources* contain significant information about a culture and are tangible entities or cultural practices. Tangible cultural resources are defined as districts, sites, buildings, structures, and objects for the National Register of Historic Places and categorized as archeological resources, cultural landscapes, structures, museum objects, and ethnographic resources. The term 'ethnographic resources' is defined as a site, structure, object, landscape, or natural resource feature assigned traditional legendary, religious, subsistence, or other significance in the cultural system of a group traditionally associated with it. *Historic resources* includes districts, sites, structures, or landscapes that are significant in American history, architecture, engineering, archeology or culture. *Archeological resources* are defined as any material remains or physical evidence of past human life or activities which are of archeological interest, including the record of the effects of human activities on the environment. They have the "potential to describe and explain human behavior" (National Park Service 1998).

Each of these resources within the ROI was evaluated. Since there would be no terrestrial construction and all proposed activities would occur within the offshore (i.e., underwater or on the water's surface) or nearshore environment, the following discussion focuses on those resources that occur in the offshore or nearshore environment. These resources include submerged sites, shipwrecks, and traditional cultural resources related to fishing and other marine or nearshore resources. Specifically, the Western Washington tribes had been assured the right to fish at "usual and accustomed grounds and stations" by Federal treaties signed in the mid 1850s, in particular the Quinault Treaty of 1856. A February 1974 federal court ruling, the "Boldt Decision", granted Western Washington Native American Indian Tribes and Nations access to their U&A grounds and reaffirmed the fishing rights stated in the treaties with the U.S. Government in the 1850s and that treaty tribes have the right to an equal share of the annual catch.

Government-to-Government Consultations

NSF has been conducting Government-to-Government consultations since April 2010. The purpose of the consultations has been to present the Proposed Action and this site-specific phase. They also have served to initiate consultations under Section 106 of the NHPA and to inform the Native American Indian Tribes and Nations that compliance with Section 106 of the NHPA would be through the NEPA process. The Hoh Tribe, Makah Nation, Quileute Nation and Quinault Nation (listed in alphabetical order) were sent a letter discussing the proposed project. The letters were followed up with email correspondence and telephone calls. NSF also offered an opportunity to hold an in-person Government-to-Government consultation with each Tribe and Nation.

The Hoh Tribe's primary concern is access to data and data sharing and they requested written assurances that the data generated by this project will be made available to Tribal Fisheries Managers. Additional Government-to-Government correspondence is planned with the Hoh Tribe. The Makah Nation responded to a telephone request indicating they would comment on the Draft SSEA and further consultation was not needed. The Quileute Nation responded and indicated that they were reviewing the materials provided and would respond.

The Quinault Nation requested a formal consultation with NSF which took place on July 7, 2010 at the Quinault Nation Administration Building. The Quinault Nation conveyed concerns regarding the potential for restricted access to U&A fishing (e.g., shellfish) grounds, potential damage to fishing gear, and access to data generated by the OOI. Plans for pursuing a PA under Section 106 of the NHPA between NSF and the Quinault Nation were formed.

3.2.5.1 Affected Environment

CSN (Endurance Array – Grays Harbor Line) and RSN

Traditional Cultural Resources. The Quinault Nation has U&A fishing rights within the area of the proposed Grays Harbor Line. The proposed glider lines associated with the Endurance Array would occur within the areas of Quileute Nation and the Quinault Nation U&A fishing rights (Figure 3-1).

3.2.5.2 Environmental Consequences

Impact Assessment Methodology

This section identifies potential direct and indirect impacts to cultural, historic, and archaeological resources that may result from implementing the Proposed Action or No-Action Alternative. The levels of potential impacts to cultural, historic, and archaeological resources with implementation of the Proposed Action are defined in Table 3-6.

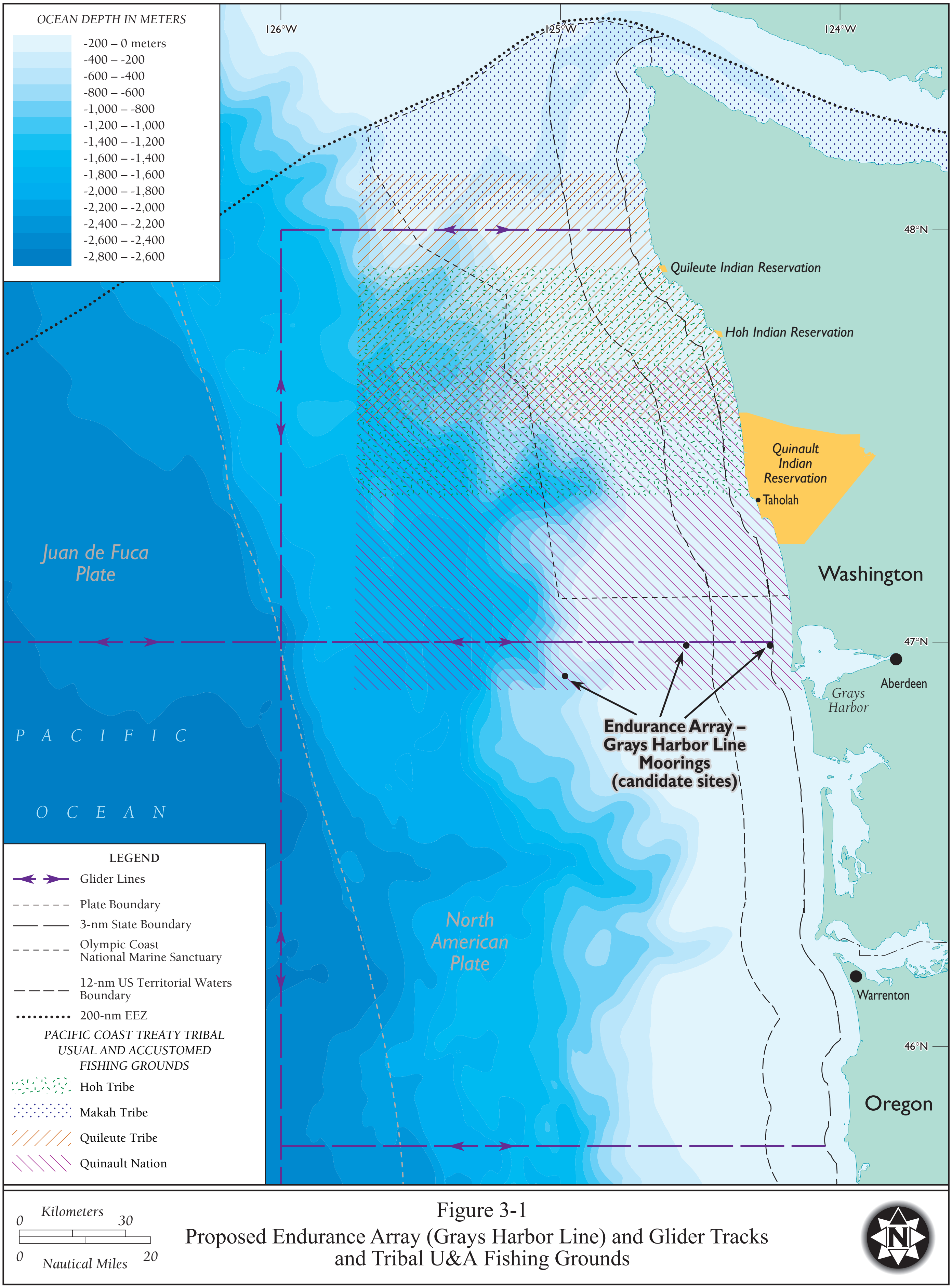


Figure 3-1
Proposed Endurance Array (Grays Harbor Line) and Glider Tracks and Tribal U&A Fishing Grounds

Table 3-6. Levels of Potential Impacts to Cultural, Historic, and Archaeological Resources with Implementation of the Proposed Action

Impact Level	*Definition*
Negligible	Effect is at the lowest levels of detection with neither adverse nor beneficial consequences and would neither alter resource conditions, such as traditional access or site preservation, nor the relationship between the resource and the affiliated group's body of practices and beliefs. This is analogous to a determination of *no effect* under Section 106 of the NHPA.
Minor	Adverse impact — impact(s) result(s) in little, if any, loss of integrity and would be slight but noticeable, but would neither appreciably alter resource conditions, such as traditional access or site preservation, nor the relationship between the resource and the affiliated group's body of practices and beliefs. This is analogous to a determination of *no adverse effect* under Section 106 of the NHPA.
Moderate	Adverse impact — disturbance of a site(s) results in loss of integrity and impact(s) would be apparent and would alter resource conditions. There would be an interference with traditional access, site preservation, or the relationship between the resource and the affiliated group's practices and beliefs, even though the group's practices and beliefs would survive. Also included are major impacts that have been mitigated to reduce their intensity under NEPA CEQ 1508. 20 from major to moderate. The determination of effects for Section 106 would be *adverse effects*.
Major	Adverse impact — disturbance of a site(s) results in loss of integrity and impact(s) would alter resource conditions. There would be a block to, or great affect on, traditional access, site preservation, or the relationship between the resource and the affiliated group's body of practices and beliefs, to the extent that the survival of a group's practices and/or beliefs would be jeopardized. This is analogous to a determination of *adverse effect* under Section 106 of the NHPA, and measures to minimize or mitigate adverse effects cannot be agreed upon that would reduce the intensity of impacts under NEPA CEQ 1508.20 from major to moderate.
Short-term	Occurs only during the period of OOI installation, test, or O&M activities.
Long-term	Continues after the period of OOI installation, test, or O&M activities.

<u>Proposed Action</u>

Under the Proposed Action, potential impacts to resources from the proposed (CSN) Endurance Array would only be associated with the placement of 6 mooring anchors (at 14, 44, and 273 fm [25, 80, and 500 m]) on the seafloor for the Grays Harbor Line and associated scientific sensors on the seafloor in the immediate vicinity of the moorings. The proposed RSN cable route would be sited to avoid all known archeological, historic, and cultural resource sites. Site-specific surveys have been conducted to determine if any undiscovered resources are within the immediate vicinity of the proposed RSN cable and Endurance Array moorings. Based on the route-specific surveys, neither archeological resources, nor historic resources (e.g., historic shipwrecks, aircraft wrecks) are within the vicinity of the proposed RSN backbone cable or moorings and Endurance Array moorings. With the routing of the RSN cable and placement of RSN and Endurance Array moorings to avoid known archeological and historic resources, there would be negligible impacts to these resources with implementation of the CSN (Endurance Array) and RSN components of the Proposed Action.

Cultural resources (i.e., traditional U&A fishing rights) are present in the vicinity of the Grays Harbor Line of the Endurance Array. Communications were initiated between representatives of NSF and the affected Tribes and Nations potentially impacted by the Grays Harbor Line. NSF representatives met with the Quinault Nation on July 7, 2010 to engage in a Government-to-Government consultation to address potential impacts to cultural resources. Issues discussed with the Quinault Nation centered on the location of the proposed moorings, the timing of the various fishing seasons, information sharing, retrieval of equipment, and development of a PA. NSF agreed to establish a communication process with the Quinault Nation to establish points of contact to exchange information on OOI installation and operation of the proposed Grays Harbor Line and Tribal fishing regulations in order to avoid disruption of Tribal U&A fishing patterns. Therefore, implementation of the Proposed Action would result in negligible adverse effects to cultural resources. Because there are no known cultural resources within the vicinity of the RSN cable, there would be no impacts to cultural resources with installation and O&M of the RSN cable.

No-Action Alternative

Under the No-Action Alternative, the NSF-funded OOI, including the CSN (Endurance Array) and RSN components, would not be implemented. Therefore, baseline conditions would remain unchanged and there would be no impacts to archeological, historic, and cultural resources with implementation of the No-Action Alternative.

3.2.6 Socioeconomics (Fisheries)

3.2.6.1 Affected Environment

The main socioeconomic resource along the Oregon and Washington coasts is commercial fishing fish and shellfish. Fishing typically occurs from the shoreline to approximately 1,012 fm (1,850 m) depth and most effort takes place between January and September, with less from October through December. There are 4 main gear types used along the Oregon and Washington coasts: bottom trawl, near-bottom trawl, longlines, and pot gear. Scallop dredges are also used, but rarely as there are very few scallop areas remaining off of Oregon and Washington (Natural Resources Consultants [NRC] 2007). Fisheries targeted by gear type are provided in Table 3-7 and a brief description of each method (except sport hook-and-line) is summarized below.

Table 3-7. Gear Type and Fisheries within the Proposed CSN and RSN ROI

Gear Type	*Fisheries*
COMMERCIAL	
Bottom trawl	flatfish, rockfish, groundfish, shrimp, prawns
Near-bottom trawl and pelagic trawl	whiting, rockfish
Longlines	halibut, sablefish, rockfish
Pot	Dungeness crab, sablefish, slime eels
SPORT (RECREATIONAL/CHARTER)	
Hook-and-line	salmon, halibut, groundfish

Bottom Trawl

Bottom trawling is the method most often used off Washington and Oregon coasts. Bottom trawling gear that targets flatfish on muddy/sandy bottom sediment consists of wire bridles that connect a heavy chaffing web net to the trawl doors. The bridles are positioned so that they can penetrate 2-3 cm into the soft bottom for the purpose of kicking up fish that are lying on the sea floor. The bottom of the net nearest the codend stays in contact with the soft bottom as trawling activity occurs and may dig into the soft bottom several centimeters. The leading edge of the doors is bowed up to allow for bouncing up and over obstructions. Most flatfish fishing occurs January through September (NRC 2007).

Gear used to target shrimp is similar to that used to target flatfish except that gear consists of 2 net bottom trawls used simultaneously along areas of soft bottom sediments at an average depth of 82 fm (150 m). The net itself is not designed to contact the bottom; however, wire footropes may dig into the bottom as deep as 5 cm. Most trawling effort for shrimp occurs during the summer months at 55-110 fm (100-200 m) depths near Tillamook Bay (NRC 2007). Figure 3-2 depicts the bottom trawl fishing effort in the vicinity of the proposed CSN (Endurance Array) and RSN.

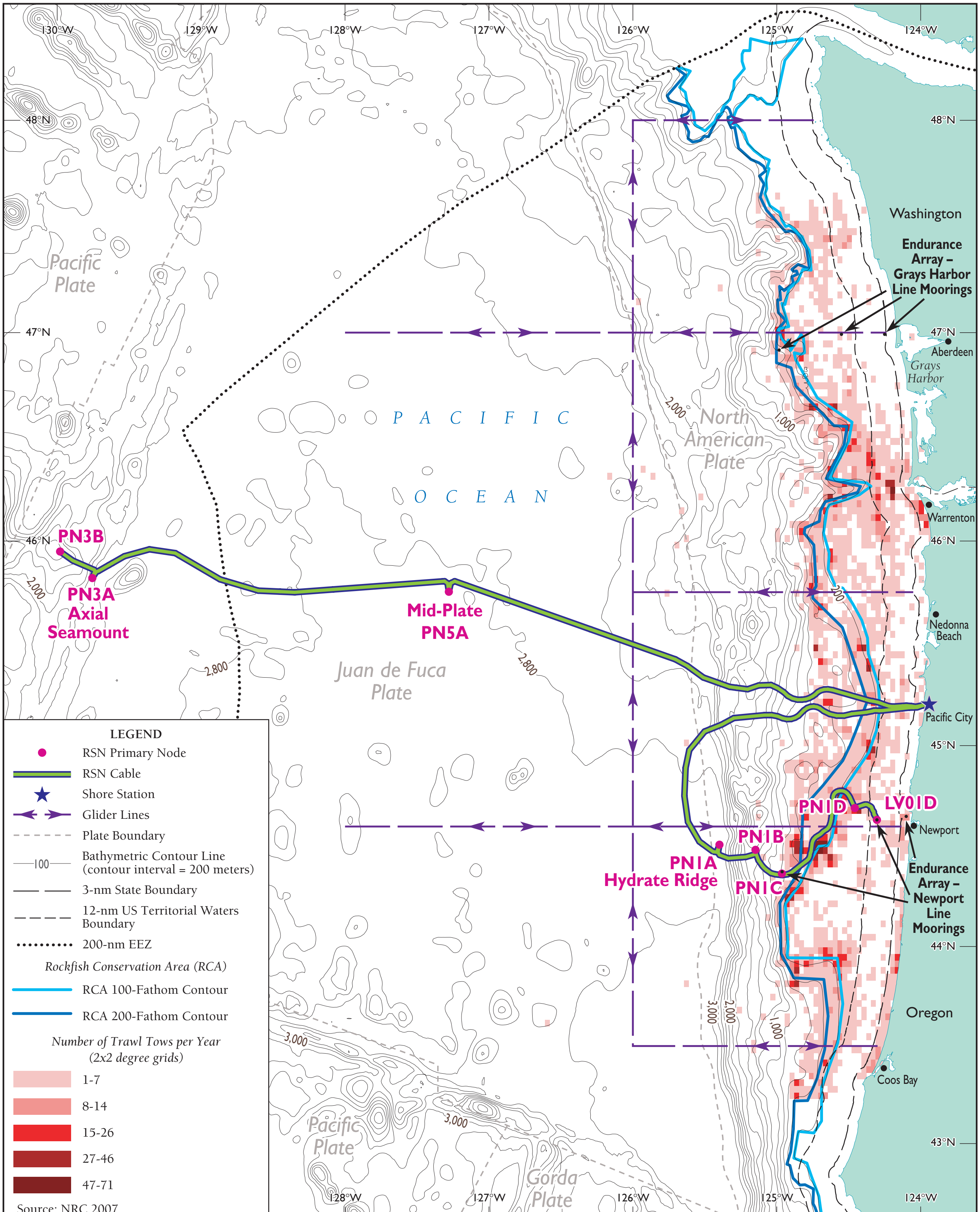


Figure 3-2
Trawl Fishing Effort and Rockfish Conservation Areas in the Vicinity of the Proposed Pacific Northwest RSN, CSN (Endurance Array), and Glider Mission Boxes

Near-bottom Trawl and Pelagic Trawl

Gear used to target rockfish consists of similar gear as described above for bottom trawling. However, trawling areas contain a rocky bottom with drop offs and canyons rather than sand and muddy sediments. Therefore, the gear is set to remain just off of the bottom. Due to reduced rockfish stocks, bottom-trawling effort has been restricted between 55 and 109 fm (100 and 200 m) off of Oregon and Washington with restrictions expecting to continue until stocks increase. Mid-water or pelagic trawling has no contact with the bottom and often takes place from 8 to 547 fm (15 to 1,000 m) depths with most fishing effort occurring 20 to 30 nm offshore. The target fish for pelagic trawling is primarily Pacific hake (NRC 2007).

Longlines

Longline gear used to target halibut consists of a 10- to 16-mm diameter 3-strand twisted poly rope with each end attached to a 44-77 lbs (20-35 kg) anchor. Baited circle hooks are attached along the line where it is positioned along the bottom sediment. Braided poly or nylon rope is attached to the groundline and extend up to the surface, attaching to a buoy and light/radar reflector poles. Longline gear targeting sablefish is similar to halibut except that only one end of the longline is anchored to the bottom while the other extends up to the surface and attaches to a buoy, flags, lights, and radar detectors.

Pot

Pot gear targeting crab is composed of a 1.5 m circular or rectangular steel frame and weighs 77-154 lbs (35-70 kg) each. Pots are baited and set over soft bottoms at relatively shallow depths 16-131 ft (5-40 m) and are attached to a longline up to the surface held in place by a buoy. Pots can penetrate the bottom but rarely and no more than 5 cm deep. Pots are typically checked every 12-48 hours. Most fishing effort occurs between the Columbia River and Tillamook (NRC 2007).

Pots are also used for sablefish. Gear consists of 50 to 200 pots attached to 0.8-1 inch (20-25 mm) in diameter groundline. The groundline is set and marked at the surface as described for the halibut longline fishery above (NRC 2007).

3.2.6.2 Environmental Consequences

Impact Assessment Methodology

This section identifies potential direct and indirect impacts to socioeconomic resources that may result from implementing the Proposed Action or No-Action Alternative. The levels of potential impacts to socioeconomic resources with implementation of the Proposed Action are defined in Table 3-8.

Table 3-8. Levels of Potential Impacts to Socioeconomics (Fisheries) with Implementation of the Proposed Action

Impact Level	*Definition*
Negligible	No change to socioeconomic resources or the change (beneficial or adverse) would be so small that it would not be of any measurable or perceptible consequence.
Minor	A change to socioeconomic resources but the change (beneficial or adverse) would be small and localized and of little consequence.
Moderate	A measurable and consequential change to socioeconomic resources. Mitigation measures would be necessary to offset adverse impacts and likely be successful.
Major	A substantial change to socioeconomic resources; the change (beneficial or adverse) would be measurable and result in a severely adverse impact. Extensive mitigation measures to offset adverse impacts may be needed and their success could not be guaranteed.
Short-term	Occurs only during the period of OOI installation, test, or O&M activities.
Long-term	Continues after the period of OOI installation, test, or O&M activities.

Proposed Action

Bottom trawl fisheries targeting flatfish, rockfish, roundfish, shrimp, and prawns represent the greatest threat of damage to submarine fiber optic cables in the project area. Near-bottom and pelagic trawl fisheries targeting whiting and rockfish offer less of a threat since they only rarely contact the seabed but may impact scientific instrument packages that extend upward into the water column. Bottom contact longline gear targeting halibut, sablefish, and rockfish offers yet a lower level of threat to cables and scientific instrument packages from entanglement in terminal anchors and mainline. Pot gear targeting Dungeness crab, sablefish, and slime eels offer a similar low level of threat to project cables and equipment on the seabed.

The 2 proposed cable routes extending out from the Pacific City shore station bisect flatfish/round fish bottom trawl areas as well as near-bottom rockfish and pelagic trawl pacific hake areas (Figure 3-2). However, restrictions imposed that eliminate trawl effort between 55 and 109 fm (100 and 200 m) offshore of the Oregon Coast provides an area at which impacts to trawling from cables are insignificant. Crab fisheries occur in the nearshore depths of the cable route from Pacific City; however, crab pot gear is not anticipated to have issues with snagging on cables. Bottom trawl effort is generally low along the proposed cable route and the Grays Harbor and Newport lines of the Endurance Array (Figure 3-2).

The proposed installation and O&M activities of the CSN (Endurance Array) and RSN would have 2 potential impacts to commercial fisheries operations in the ROI: 1) presence of the cable installation vessel would preclude fishing activities within a limited area (approximately 1.6 km) for a temporary period (a few hours to several days), and 2) commercial fisheries that use equipment that contacts the bottom could potentially snag unburied portions of the cable or scientific sensors, causing damage to or loss of their fishing gear, or damage to the cable or scientific sensors on the seafloor.

Notice would be given to fishing vessels regarding the proposed CSN and RSN installation operations to prevent contact that could potentially damage fishing gear. No exclusions are proposed along the cable route, so interference would not occur between the cable installation vessel and commercial fisheries. Potential interference with commercial fishing activities could occur during cable and mooring installation operations, but these would be temporary and localized. As the cable vessel and installation operations progress, fishing activities would not be precluded along the entire proposed cable route or Endurance Array lines. Only small areas would not be available for fishing while the cable plow and cable-laying vessel are in a specific area.

The potential site-specific placement, or '*micro-siting*', of moorings within the identified study area for each Grays Harbor Line and Newport Line moorings is being coordinated with representatives of marine users and tribal nations. These include but are not limited to the following: Quinault Nation, Coalition of Coastal Fisheries, Washington Dungeness Crab Fishermen's Association, Grays Harbor Marine Resources Committee, Oregon Dungeness Crab Commission, Oregon Trawl Commission, Oregon Albacore Commission, Oregon Salmon Commission, Midwater Trawlers Co-Op, Fisherman Advisory Committee for Tillamook (FACT), Columbia River Crab Fishermen's Association, Oregon Fisherman's Cable Committee (OFCC), Fishermen Involved in Natural Energy (FINE), Purse Seine Vessel Owners Association, Fishing Vessel Owners Association, and Pacific City Dorymen's Association. Coordinating with the local marine users regarding the micro-siting of each mooring will assist in avoiding conflicts with regional fishing interests as well as ensuring that the mooring locations meet the scientific objectives of the CSN.

As stated in Section 2.2.2.2, prior to the start of the geophysical and geotechnical survey operations, the RSN route recommended during the Desktop Study was presented to several member of the Oregon fishing community (FINE, FACT, Pacific City Dorymen's Association, and OFCC) to obtain further input on fishing ground locations and potential impacts of the RSN primary and secondary infrastructure on fisheries. In addition, meetings were held in Newport in March 2010 between Ocean Leadership, UW, and OSU and the fishing community, including trawlers (represented by the OFCC), longliners, and crabbers. During the meetings, fishermen provided information on seabed conditions along the proposed RSN cable routes, identifying areas where burial may be challenging, and suggesting cable re-routing and re-location of several primary nodes to avoid or reduce potential impacts to major fishing grounds. As a result of these discussions, the configuration of the RSN cable route and location of several CSN cabled and uncabled components along the Newport Line of the Endurance Array were changed. To reduce potential impacts to fisheries, an agreement was reached to generally place OOI components in the vicinity of hard grounds or existing fishing hazards such as buoys (i.e., in areas where fishing does not typically occur).

Based on suggestions provided by fishermen during the March meeting, Ocean Leadership contracted a fishing boat to complete a reconnaissance survey of the (new) primary node sites PN1C and PN1D with an OFCC representative on board. Following this survey, a number of options for these sites were provided by fishermen. They were checked against science requirements and the subsequent April-May geophysical and geotechnical survey of the RSN cable route was planned accordingly.

Discussions have also been initiated regarding the establishment of buffer zones or 'watch circles' around the RSN and CSN infrastructures in all areas of burial. Buffer zones identifying no-entry/no-fishing zones around the sites would be established in consultation with the affected fishing communities. The diameters of these buffer zones relate to water depths (larger in deeper water). Currently, a 0.2-nm radius buffer zone is under discussion for the inshore sites and 0.5-nm radius for the shelf and offshore sites. The sites would be clearly charted on NOAA navigation charts, published in a NOTMAR, and through direct contact with user communities. There will be active radar transponders on surface buoys as well as required U.S. Coast Guard (USCG) markings; other markings are under consideration. Discussions with the fishing community are ongoing and will continue as necessary to address further concerns. With the implementation of these on-going discussions with the fishing community to avoid and minimize potential impacts to area fisheries, there would be short- and long-term minor impacts to commercial fisheries with implementation of the Proposed Action.

Ocean Leadership, UW, and OSU representatives and representatives from the OFCC have been in discussions about a formal agreement that would address concerns of the fishing industry regarding installation of the cable and potential impacts on fishing revenues from potential loss of gear within installation and operation of the proposed CSN and RSN infrastructure off the coasts of Washington and Oregon. Such agreements have been incorporated into the considerations and approvals of previous commercial fiber optic cable projects in Oregon coastal waters. These earlier agreements have provided a model for the preliminary discussions. With the implementation of SOPs (Section 2.2.10) and the incorporation of an agreement between the OFCC and Ocean Leadership, there would be short- and long-term minor impacts to commercial fisheries with implementation of the Proposed Action.

3.2.6.3 No-Action Alternative

Under the No-Action Alternative, the NSF-funded OOI, including the CSN (Endurance Array) and RSN components, would not be implemented. Therefore, baseline conditions would remain unchanged and there would be no impacts to fisheries with implementation of the No-Action Alternative.

3.3 MID-ATLANTIC BIGHT CSN (PIONEER ARRAY)

The Proposed Action (i.e., proposed FND modifications to the Pioneer Array) would only involve the elimination of previously assessed infrastructure, thereby reducing the potential impacts, and would not add any infrastructure or activities that were not previously assessed in the PEA and SER (NSF 2008a, 2009a). As the affected environment discussion and impact analysis were regional in nature given the large area of proposed activities, the impact analysis conducted for the Pioneer Array under the PEA and SER is still applicable for the proposed implementation of the FND modifications under the Proposed Action. Therefore, additional impact analysis is not necessary within this Draft SSEA for the proposed installation and O&M of the Pioneer Array as described in the FND (Ocean Leadership 2010a). Refer to Chapter 4 of the PEA for detailed impact analysis (NSF 2008a, 2009a).

3.4 GLOBAL-SCALE NODES (GSN)

The Proposed Action (i.e., proposed FND modifications to the Pioneer Array) would only involve the elimination of one GSN site (Mid-Atlantic Ridge) from proposed installation by 2015, thereby reducing the potential impacts, and would not add any infrastructure or activities that were not previously assessed in the PEA and SER (NSF 2008a, 2009a). As the affected environment discussion and impact analysis were regional in nature given the large area of proposed activities and lack of site-specific data for each site, the impact analysis conducted for the GSN sites under the PEA and SER is still applicable for the proposed implementation of the FND modifications under the Proposed Action. Therefore, additional impact analysis is not necessary within this SSEA for the proposed installation and operation of the GSN sites as described in the FND (Ocean Leadership 2010a). Refer to Chapter 5 of the PEA and Section 3.2 of the SER for detailed impact analysis (NSF 2008a, 2009a).

CHAPTER 4
CUMULATIVE IMPACTS AND OTHER CONSIDERATIONS REQUIRED BY NEPA

4.1 CUMULATIVE IMPACTS

CEQ regulations (40 CFR §§1500 – 1508) implementing the provisions of NEPA, as amended (42 USC §§4321 *et seq*.) provide the definition of cumulative impacts. Cumulative impacts are defined as:

> "the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions." (40 CFR §1508.7)

Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time. A cumulative impact results from the additive effect of all projects in the same geographical area. Generally, an impact can be considered cumulative if: a) effects of several actions occur in the same locale, b) effects on a particular resource are the same in nature, and c) effects are long-term in nature. The common factor key to cumulative assessment is identifying any potential temporally and/or spatially overlapping or successive effects that may significantly affect individual or populations of marine resources occurring in the analysis areas.

4.1.1 Past, Present, and Reasonably Foreseeable Projects within the ROI

Other past, present, and reasonably foreseeable future actions that warrant consideration for potential cumulative impacts when added to the impacts of the Proposed Action include the installation and use of submarine cables, moorings, scientific instruments, or anchored structures such as wind or wave energy generators, in the same affected areas; and commercial fishing and fisheries management, especially as it pertains to bottom trawling. These types of activities could interact or combine with components of the Proposed Action to affect marine resources and/or their use. On land, other development activities at the shore station locations could in principle affect coastal resources and their use in the same manner as the Proposed Action. Actions relevant to the analysis of cumulative effects of each element of the Proposed Action are presented below.

4.1.1.1 CSN (Endurance Array) and RSN

<u>Submarine Cables</u>

Several submarine cable systems have been previously installed off the coasts of Oregon and Washington; some are in-service, some have been retired and left in place. Active systems include but are not necessarily limited to: three landings of Videsh Sanchar Nigam Limited cables (TGN Pacific Segments G1 and G6, which are trans-Pacific, and G5, which goes to California); TPC-5; PC-1; Southern Cross; Northstar; and China-US systems. Further information on these and some of the out-of-service cables is available at www.iscpc.org. In addition, Verizon's Trans-Pacific Express cable from China to Nedonna Beach, Oregon, was completed at the end of 2008 (Wikipedia 2010). These projects involve a single cable landing in Oregon and cable routes that traverse the offshore waters where the Proposed Action would occur. With the implementation of current agreements between cable owners and marine users (e.g., OFCC), past, present, and reasonably foreseeable submarine cable projects would have negligible, long-term impacts to cultural resources and socioeconomics (fisheries).

<u>Wave Energy Projects</u>

Wave energy projects are designed to capture wave and tidal energy using surface buoys, which are anchored to the ocean bottom and connected by cables to shore. The Federal Energy Regulatory

Commission (FERC) has regulatory oversight responsibility for wave energy projects. A review of FERC's recently issued and pending permits indicates that no projects are currently proposed off of the Oregon coast in the vicinity of the proposed OOI (FERC 2010). Off of Washington, the proposed Grays Harbor Ocean Energy Project is directly inshore of the Grays Harbor Line (Washington Wave Company 2007; Grays Harbor Ocean Energy Company 2010). These projects are generally within 3 nm of shore and so have limited overlap with the proposed CSN and RSN components, but may result in minor, short-term impacts to marine biological resources and fishing activities in a similar manner as the Proposed Action.

Mobile Ocean Test Berth (MOTB) Project

The Northwest National Marine Renewable Energy Center (NNMREC), led by OSU, was established through the U.S. Department of Energy (DoE) Water Power Program and local funding to support wave and tidal energy development for the U.S. One of the key projects of NNMREC is development of an MOTB Project, a pioneering effort to deliver a mobile capability for testing the output of wave energy conversion (WEC) devices (NNMREC 2010).

DoE's Proposed Action would provide funding to NNMREC to support the design, construction, and operation of a mobile, full-scale, open ocean wave energy testing facility consisting of up to 2 MOTBs. Each MOTB would be connected to a WEC device during testing. One underwater sub-station pod (USP) may also be included in the facility and would be connected to both MOTBs and WEC devices. The combined 2 MOTBs, 2 WEC devices, and 1 USP are referred to as the Proposed Project. The Proposed Project would be capable of testing the output of a variety of WEC devices without being connected to the electrical grid as a cost-effective means to evaluate the technical aspects, performance characteristics, and environmental impacts of developing marine renewable energy (NNMREC 2010).

The MOTBs, WEC devices, and USP would be located approximately 1.7 nm off the Oregon coast near the city of Newport, Oregon. The project area would measure 2.6 nm from north to south, and 1.7 nm from east to west. The project site would be limited to a 0.75-nm^2 area located within the 4.4-nm^2 project area. The final 0.75-nm^2 project site would be refined though ongoing environmental studies and consultation with stakeholders and other interested parties (NNMREC 2010).

The project area was identified through consultation and cooperation with interested groups and individuals, including the NNMREC research team, OSU's Hatfield Marine Science Center, FINE, Lincoln County Board of Commissioners, and Oregon Sea Grant (NNMREC 2010). Currently an EA is being prepared and will be released for public review in late August 2010. It is likely that the proposed MOTB would result in negligible, short-term impacts to marine biological resources. Due to the potential for the establishment of an area of restricted from fishing activities within the vicinity of the proposed NNMREC, it is likely that implementation of the NNMREC would result in moderate, long-term impacts to socioeconomics (fisheries).

Other Regional Ocean Observing Systems

Other ocean observing systems include the coastal buoys installed and maintained by NOAA, and ocean observing systems with goals and architecture similar to those of the Proposed Action, with similar potential environmental effects. A number of collaborative scientific efforts are in progress, including the Oregon Coastal Ocean Observing System (OrCOOS), which currently has 1 surface buoy 10 nm (18 km) west of Newport, Oregon in the vicinity of the Proposed Action (OrCOOS 2010). OrCOOS is a recent partner in the Nation's ongoing efforts to develop the IOOS. OrCOOS, which is funded primarily through NOAA's National Ocean Service, is partnered with the Northwest Association of Networked Ocean

Observing Systems (NANOOS). The installation and O&M for the 1 surface buoy associated with OrCOOS is expected to only have negligible, short-term (installation) and long-term (O&M) impacts to marine biological resources and socioeconomics (fisheries).

Commercial Fishing and Fisheries Management

The Pacific Northwest coastal region supports a large and diversified commercial fishing industry. Fishing impacts bottom, water column, and surface habitats, affecting both target and non-target species, especially in areas subject to bottom trawling. Key developments affecting fisheries resources have been the finalization of Fisheries Management Plans (FMPs) and EFH, including Habitat Areas of Particular Concern (HAPCs), for Groundfish, Highly Migratory Species, Coastal Pelagics, and Salmon. Pursuant to the sustainable use of fishery resources, the FMPs identify and protect areas that are especially vulnerable to certain types of fishing, especially bottom trawling. The implementation of FMPs is generally beneficial to the resource species, but regulates commercial fishing activity.

Department of Defense (DoD) Activities

Naval Sea Systems Command (NAVSEA) Naval Undersea Warfare Center (NUWC) Keyport Range Complex Extension EIS/Overseas EIS (OEIS). The U.S. Navy prepared the EIS/OEIS to analyze the potential impacts of actions associated with the proposed NAVSEA NUWC Keyport Range Complex extension in Washington State. The NAVSEA NUWC Keyport Range Complex is composed of the Keyport Range Site, Dabob Bay Range Complex (DBRC) Site, and Quinault Underwater Tracking Range (QUTR) Site. The Keyport Range Site is located within Kitsap County and includes portions of Port Orchard Reach and the southern tip of Liberty Bay in Puget Sound. The DBRC Site is located in Hood Canal and Dabob Bay within Puget Sound, and is within Jefferson and Kitsap counties. The QUTR Site is located off the coast of Jefferson County. The Navy is the lead agency for the EIS/OEIS, and NMFS is a cooperating agency (Navy 2010a).

The Navy's proposed action would provide additional operating space at each of the three range sites to better support current and evolving test requirements and range activities for the Navy's manned and unmanned undersea vehicle program conducted by NUWC Keyport. The preferred QUTR site alternative would include extending the existing QUTR range to the boundaries of W-237A, providing surf-zone access at Kalaloch for unmanned underwater vehicle testing, and conducting various Navy test and evaluation operations (Navy 2010a). The proposed Shelf and Offshore moorings of the Grays Harbor Line of the Endurance Array would potentially occur within W-237A.

The proposed action within the proposed extended QUTR Site within W-237A would not result in any substantial short- or long-term impacts on physical or socioeconomic resources. Minimal cumulative impacts would occur and natural or cultural resources would not be irreversibly or irretrievably committed as a result of implementation of the proposed action. The Navy is working with NMFS through the MMPA permitting process to ensure compliance with MMPA regarding Level B exposures to marine mammals. In accordance with the ESA, the Navy is in consultation with the USFWS and NMFS regarding impacts to federally listed species and designated critical habitat. In addition, the Navy is in consultation with NMFS regarding impacts to EFH. In compliance with the CZMA, the Navy has prepared and submitted a Coastal Consistency Determination to the Washington Department of Ecology (WDOE) for proposed activities occurring on the shoreline or in-water as required by federal implementing regulations. The WDOE concurred with the determination that the proposed action will not result in significant impacts to the state's coastal resources. A Record of Decision (ROD) for the EIS/OEIS is expected in late summer 2010 (Navy 2010a).

Northwest Training Range Complex (NWTRC) EIS/OEIS. The Navy prepared the EIS/OEIS to analyze the potential environmental impacts associated with the proposed increase in training activities and range enhancements within the NWTRC. The proposed action would support and conduct current, emerging, and future training and research, development, test, and evaluation (RDT&E) activities (unmanned aerial systems only) in the NWTRC. The preferred alternative would support: (1) an increase in training activities, (2) additional training and RDT&E activities required by force structure changes to be implemented for new weapons systems, instrumentation, and technology as well as new classes of ships, submarines, and new types of aircraft; and (3) range enhancements such as new electronic combat threat simulators/targets, development of a small scale underwater training minefield, development and use of the portable undersea tracking range, and development of air and surface target services. The Draft EIS/OEIS was issued in December 2008; the Final EIS/OEIS is currently scheduled for submission in summer 2010 followed by a ROD in the summer/fall 2010 (Navy 2010b).

4.1.1.2 CSN (Pioneer Array)

Since the preparation of the PEA and SER, no additional projects have been identified within the proposed Pioneer Array ROI that would potentially result in cumulative impacts when assessed with the proposed OOI. Refer to Section 6.2.2 of the PEA for further details (Appendix A).

4.1.1.3 GSN

Since the preparation of the PEA and SER, no additional projects have been identified within the ROIs of the proposed GSN that would potentially result in cumulative impacts when assessed with the proposed OOI. Refer to Section 6.2.3 of the PEA for further details (Appendix A).

4.1.2 Cumulative Impact Analysis of Project Elements

It is expected that additions (e.g., sensors, moorings, cables) to some or all elements of the proposed OOI (i.e., CSN, RSN, and GSN) may be proposed in the future. These additions to the OOI that are not covered under this SSEA would be analyzed under future NEPA documents, including the potential for any cumulative effects.

4.1.2.1 Resource Considerations

Certain resources do not need to be considered for cumulative impacts because either, a) the effects of the proposed action would be so small and localized that the potential additive effects with other actions would be negligible; or b) the effects of the proposed action would be limited sufficiently by statutory or regulatory requirements and procedures that again, potential additive effects would be negligible. These include the following:

Air Quality. Emissions from the Proposed Action would be minimal in comparison with other local and regional sources and would be transitory during installation and use of the proposed systems. Local air basin jurisdictions establish emissions thresholds for significance and mitigation that help ensure that individual project emissions do not individually or cumulatively have a significant impact on air quality. Emissions from the Proposed Action would be below levels of significance and do not involve permanent stationary sources. In the offshore waters, emissions from proposed activities would involve relatively small quantities of pollutants produced by project vessels; such emissions would be transient and rapidly dispersed. Therefore, there would be negligible, short-term cumulative impacts to regional air quality as the result of implementation of the proposed OOI and other past, present, and reasonably foreseeable actions within the ROI.

Geological Resources and Water Quality. Effects of the Proposed Action are sufficiently small in magnitude and limited in extent that potential additive effects are negligible. Potential water quality impacts are also limited by CWA requirements for permitting, which would be followed for all in-water installation activities. Therefore, there would be negligible, short-term cumulative impacts to geological resources and water quality as the result of implementation of the proposed OOI and other past, present, and reasonably foreseeable actions within the ROI.

Transportation. Marine transportation effects would be minimized by coordination with local coastal authorities and the avoidance of heavily used vessel transit corridors, the latter by design of the system. NOTMARs would be used to minimize the potential conflicts with other vessels, during installation, and the depiction of the structures on NOAA navigation charts would minimize conflicts thereafter. Surface buoys or other structures would be marked in accordance with USCG regulations and readily avoidable. Therefore, there would be negligible, short- and long-term cumulative impacts to regional marine transportation as the result of implementation of the proposed OOI and other past, present, and reasonably foreseeable actions within the ROI.

*Hazardous Materials***.** The only potential sources of hazardous materials would be unanticipated accidents or spills that resulted in a discharge of fuel, lubricants, or sensor components (e.g., batteries) from a project vessel or associated OOI equipment and sensors. Based on existing requirements and procedures for management of such materials on board vessels and the design of scientific equipment and sensors, such events are extremely unlikely to occur. If such a spill were to occur, it would be a localized occurrence, and adherence to standard containment, cleanup, and reporting requirements would assure that the effects are minimized. In addition, residual material would be dispersed by natural processes, but the potential for additive effects with other discharges of hazardous materials in the same location(s) is considered negligible. Therefore, there would be negligible, short-term cumulative impacts regarding the hazardous materials as the result of implementation of the proposed OOI and other past, present, and reasonably foreseeable actions within the ROI.

Marine Biology. Marine biological resources, including the species and communities of marine benthic, water column, and surface water habitats affected by the Proposed Action, are subject to potential cumulative impacts through the incremental effects of multiple actions on habitats, species' populations, or ecological processes. Cumulative effects on habitats can result from incremental degradations and losses that ultimately diminish the capacity of the habitat to support species, communities, and ecological processes. Owing to the dispersal of populations, incremental effects on species at one location can interact with effects occurring elsewhere to affect the overall distribution and abundance of the species. However, as described in Chapters 2 and 3, installation and use of the CSN (Grays Harbor and Newport lines of the Endurance Array) would entail relatively small, localized areas of disturbance to the seabed during installation. The extent of disturbance to the seabed associated with the RSN is of wider extent, but still affects a very small area of the seabed in any particular location. Disturbance would be predominantly in soft-sedimentary habitats, which are subject to natural disturbances (bioturbation by fishes and invertebrates) and strong sediment deposition and transport in the dynamic cross-shelf environment. These natural phenomena ensure that alterations of the soft-bottom habitat are temporary. Once in place, the permanent structures of the RSN would either remain buried or provide hard surfaces for attachment and sheltering of fishes and invertebrates, a beneficial effect. Therefore, there would be negligible, short-term cumulative impacts to marine biological resources as the result of implementation of the proposed OOI and other past, present, and reasonably foreseeable actions within the ROI.

Terrestrial Resources at Shore Station. Since the proposed shore station is on a previously developed and disturbed site, the impacts on land are essentially contained within an existing "footprint" and there is little to no potential for cumulative effects with development or other activities onshore. Finally, the permitting for the new infrastructure onshore would address consistency with zoning requirements, local land uses, and resources of the adjacent coastal areas. Therefore, there would be negligible, short-term cumulative impacts to terrestrial biological resources as the result of implementation of the proposed OOI and other past, present, and reasonably foreseeable actions within the ROI.

The remaining resources that require further consideration for cumulative impacts include the cultural resources and socioeconomics (fisheries).

4.1.2.2 CSN (Endurance Array) and RSN

Cultural Resources. Under the Proposed Action, potential impacts to resources from the proposed Endurance Array would only be associated with the placement of 6 mooring anchors (at 25, 80, and 500 m) on the seafloor for the Grays Harbor Line and associated scientific sensors on the seafloor in the immediate vicinity of the moorings. The proposed RSN cable route would be sited to avoid all known archeological, historic, and cultural resource sites. Site-specific surveys have been conducted to determine if any undiscovered resources are within the immediate vicinity of the proposed RSN cable and Endurance Array moorings. Based on the route-specific surveys, neither archeological resources, nor historic resources (e.g., historic shipwrecks, aircraft wrecks) are within the vicinity of the proposed RSN backbone cable or moorings and Endurance Array moorings. With the routing of the RSN cable and placement of RSN and Endurance Array moorings to avoid known archaeological and historic resources, there would be negligible, short-term cumulative impacts to these resources with implementation of the CSN (Endurance Array) and RSN components of the Proposed Action.

Cultural resources (i.e., traditional U&A fishing rights) are present in the vicinity of the Grays Harbor Line of the Endurance Array. NSF agreed to establish a communication process through the preparation of a PA with the Quinault Nation to establish points of contact to exchange information on OOI installation and operation of the proposed Grays Harbor Line and Tribal fishing regulations in order to avoid disruption of Tribal U&A fishing patterns. Similar agreements are in place or proposed for those past, present and reasonably foreseeable projects in the ROI that may potentially impact Tribal U&A fishing rights (e.g., proposed Navy actions). Therefore, there would be negligible, long-term adverse cumulative impacts to U&A fishing rights as the result of implementation of the proposed OOI and other past, present, and reasonably foreseeable actions within the ROI.

Socioeconomics (Fisheries). Potential cumulative effects on Socioeconomics (Fisheries) reflect primarily the potential for structures installed on the seabed and within the water column to interfere with commercial and tribal fishing. These potential impacts would be reduced, but not eliminated, through coordination with local fishing groups and the implementation of agreements regarding damage to fishing gear (e.g., the OFCC and trawler gear) and preclusion from fishing areas, as part of the Proposed Action.

The CSN and RSN structures could potentially interfere with commercial fishing and U&A fishing areas to varying degrees, depending on gear type, and in conjunction with potential restrictions imposed under the proposed NNMREC and restrictions imposed under the FMPs. Coordination with the Native American Tribes and Nations and local fishing community would reduce these potential impacts, and it is possible that the presence of structures may contribute to resource sustainability by providing localized refuges from fishing. Overall, however, because of the expanding, incremental loss of access to fishing grounds due to the placement of structures on the seabed and in the water column, the potential exists for the proposed OOI to have moderate, long-term cumulative impacts on commercial fishing. Such impacts would be mitigated by the finalization of fishing agreements with the affected parties (e.g., OFCC).

Due to the location and nature of proposed DoD activities as described in the NWTRC EIS/OEIS and NAVSEA NUWC Keyport Range Complex Extension EIS/OEIS, it is unlikely that there would be any cumulative impacts to socioeconomics when these actions are combined with the proposed installation and O&M of the OOI. NSF and Ocean Leadership have coordinated with the Navy regarding the proposed installation of the OOI Network and the associated infrastructure, and the Navy has no concerns.

4.2 Relationship between Short-Term Uses and Long-Term Productivity

NEPA requires consideration of the relationship between short-term use of the environment and the impacts that such use could have on the maintenance and enhancement of long-term productivity of the impacted environment. Impacts that narrow the range of beneficial uses of the environment are of particular concern. This refers to the possibility that choosing one development option reduces future flexibility in pursuing other options, or that giving over a parcel of land or other resource to a certain use often eliminates the possibility of other uses being performed at that site. The proposed OOI would allow academic scientists to investigate the geology, geophysics, ecology, oceanography, etc. of the world's oceans. This research would require both short-term and long-term commitments of human labor and financial resources. Nonrenewable resources that would be consumed during the installation and operation of the proposed OOI include primarily fuel and oil associated with the installation of the CSN, RSN, and GSN components and the routine maintenance of this infrastructure. The proposed protective measures or standard operating procedures to be implemented during the installation of the proposed OOI, which include avoiding sensitive habitats and/or seasons, avoiding submerged cultural resources, etc., would all serve to minimize the effects of the proposed marine research. The majority of effects from the installation of the OOI and associated marine research would be temporary in nature. As a result, implementation of the proposed OOI would not result in any environmental impacts that would significantly affect the maintenance and enhancement of long-term productivity of the marine environment.

4.3 Irreversible or Irretrievable Commitment of Natural or Depletable Resources

Resources that are irreversibly or irretrievably committed to a project are those that are used on a long-term or permanent basis. This includes the use of non-renewable resources such as metal and fuel, and other natural or cultural resources. These resources are irretrievable in that they would be used for this project when they could have been used for other purposes. Human labor is also considered an irretrievable resource. Another impact that falls under this category is the unavoidable destruction of natural resources that could limit the range of potential uses of that particular environment.

Implementation of the Proposed Action would not result in a significant commitment of resources. Under the Proposed Action, installation and operation of the proposed OOI would require the consumption of limited amounts of materials typically associated with similar scientific activities in the marine environment (e.g., ship fuel, materials used for construction of infrastructure components, human labor, etc.).

4.4 Compliance with Applicable Laws and Regulations

Based on evaluation of the Proposed Action with respect to consistency with land use guidelines for the project areas, the Proposed Action does not conflict with the objectives of federal, regional, state, and local land use plans, policies, and controls. Table 4-1 provides a summary of compliance of the Proposed

Action with federal, state, and local plans, policies, and controls. Appendix D contains relevant communications associated with regulatory compliance.

Table 4-1. Status of Compliance with Relevant Plans, Policies, and Controls

Plans, Policies, and Controls	*Responsible Agency*	*Status of Compliance (in progress)*
NEPA (42 USC §4321 *et seq*.); CEQ NEPA implementing regulations (40 CFR 1500-1508; NSF Procedures for Implementing NEPA (45 CFR 640)	NSF	This EA has been prepared in accordance with CEQ regulations NEPA and NSF's NEPA procedures. Preparation of this EA and provision for its public review are being conducted in compliance with NEPA.
CZMA (16 USC 1451 et seq.); Washington Shoreline Management Act (RCW 90.58; WAC 173-27-060); Oregon Coastal Management Program (ORS 195, 196, 197, 660)	NSF WDOE ODLCD Local Counties	NSF believes that the Proposed Action would be consistent to the maximum extent practicable with the enforceable policies of Washington's and Oregon's coastal management programs and will complete a Coastal Consistency Determination in accordance with the CZMA, after consideration of comments on the Draft EA.
CWA (Sections 401 and 404, 33 USC 1251 *et seq*.)	USEPA/USACE WDOE ODEQ	• Section 401 certification not required for RSN provided that a NWP 5 is issued by USACE Portland District. • Section 404 permit not required for RSN provided NWP 5 is issued by USACE Portland District. Section 404 not likely required for CSN; however, Section 10 and NWP package to be reviewed by USACE and they will make final determination as to whether exempt from Section 404.
Rivers and Harbors Act (Section 10, 33 USC 401 *et seq.)*	USEPA/USACE	NWPs 5, 6, and/or 12 would be required for RSN and CSN (Endurance Array) in conjunction with Section 10. An Individual Permit is required from the USACE for CSN (Pioneer Array). Ocean Leadership, on behalf of NSF, will apply for the necessary permits through the USACE.
Clean Air Act (CAA) (42 USC §7401 *et seq*.)	USEPA	All affected counties are in attainment. The Proposed Action would not compromise air quality attainment status in Washington or Oregon or conflict with attainment and maintenance goals established in their State Implementation Plans. Therefore, a CAA conformity determination is not required.
ESA (16 USC §1531 *et seq*.)	USFWS, NMFS	NSF consulted with the Services during the preparation of the PEA and SER. The USFWS and NMFS issued Letters of Concurrence (LOCs) for effect determinations of the PEA and SER (Appendix A).
MSA (16 USC §§1801-1802)	NMFS	NSF has determined that the Proposed Action would not have adverse affects on EFH and that consultation with NMFS is not required.
MMPA (16 USC §1431 *et seq.* and 50 CFR Part 216)	NMFS	NSF consulted with NMFS during the preparation of the PEA and SER and received an LOC for effect determinations in the PEA and SER (Appendix A).
EO 13186, *Responsibilities of Federal Agencies to Protect Migratory Birds*	NSF	The Proposed Action is not likely to have a measurable negative effect on migratory bird populations and would be in compliance with EO 13186.
Migratory Bird Treaty Act (MBTA) (16 USC §§703-712)	USFWS	The Proposed Action is not likely to have a measurable negative effect on migratory bird populations and would be in compliance with the MBTA.

Table 4-1. Status of Compliance with Relevant Plans, Policies, and Controls

Plans, Policies, and Controls	*Responsible Agency*	*Status of Compliance (in progress)*
NHPA (§106, 16 USC §470 *et seq.*)	Hoh Tribe, Makah Nation, Quileute Nation, Quinault Nation; WDAHP SHPO; OPRD SHPO	The Proposed Action would have no effects on National Register-listed or eligible properties, including TCPs, and would be in compliance with Section 106 of the NHPA.
National Marine Sanctuaries Act (NMSA) (16 USC §1431 *et seq.*) and Olympic Coast National Marine Sanctuary (OCNMS) Regulations (15 CFR §922.150 *et seq.*)	NOAA	NSF has briefed OCNMS as proposed glider activities would take place within their boundaries. Proposed OOI activities are consistent with NMSA and OCNMS regulations and would not destroy, cause the loss of, or injure a Sanctuary resource. Therefore, consultation under §304(d) of the NMSA is not required. The Proposed Action would be in compliance with the NMSA; amendment to the OCNMS regulations is not necessary.
EO 12114, *Environmental Effects Abroad of Major Federal Actions*	NSF	This EA has been prepared in accordance with NSF procedures implementing EO 12114 for components of the Proposed Action beyond 200 nm from shore.
EO 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations*	NSF	No disproportionately high and adverse impacts to minority and low-income populations would be expected for the resources analyzed in this EA.
EO 13045, *Protection of Children from Environmental Health Risks and Safety Risks*	NSF	Children would not be disproportionately exposed to environmental health and safety risks by the Proposed Action.
EO 13547, *Stewardship of the Ocean, Our Coasts, and the Great Lakes*	NSF	Implementation of the OOI would support the following policies of the EO: • increase scientific understanding of ocean and coastal ecosystems as part of the global interconnected systems of air, land, ice, and water, including their relationships to humans and their activities; • improve our understanding and awareness of changing environmental conditions, trends, and their causes, and of human activities taking place in ocean and coastal waters; and • foster a public understanding of the value of the ocean and our coasts to build a foundation for improved stewardship.
PATON, Local Notice to Mariners (LNM), and Regulated Navigation Area (RNA)	USCG	Ocean Leadership, on behalf of NSF, will apply for the required permits for applicable OOI moorings and glider/AUV operations.
U.S. Navy Operating Area; DoD Warning Areas	U.S. Navy	The Navy has approved the proposed RSN route and CSN mooring locations and there are no conflicts with Navy operations. The Navy has no additional concerns.
Foam Encapsulation Certification (OAR 250-14-0010 through -0090)	Oregon State Marine Board	Ocean Leadership, on behalf of NSF, will apply for the required permit for the Nearshore Endurance Array mooring within Oregon State waters.
Installation and operation of GSN site in Danish Territorial Waters	NSF/ U.S. State Department	Following completion of the SSEA, NSF will work with the U.S. State Department regarding the installation and operation of the Irminger Sea GSN site within the territorial waters of Denmark.

Notes: EO = Executive Order; NWP = Nationwide Permit; OAR = Oregon Administrative Rules; ODLCD = Oregon Department of Land Conservation and Development; ORS = Oregon Revised Statute; RCW = Revised Code of Washington; WAC = Washington Administrative Code; WDOE = Washington Department of Ecology.

4.4.1 Government-to-Government Consultation

Over the course of the preparation of this Draft SSEA, NSF representatives have been in contact with Tribal representatives regarding the Proposed Action. See Section 1.7.3 for a discussion of Government-to-Government consultation conducted for this EA. As part of the environmental review process, this EA was presented to Native American Indian Tribes and Nations to provide information, gather comments, and to continue the dialogue and ongoing communication regarding the Proposed Action.

CHAPTER 5
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CHAPTER 6
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All figures were prepared by TEC except for the following:

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E&E – Figure 2-19 with modifications by TEC.

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