UNITED STATES OF AMERICA
FEDERAL ENERGY REGULATORY COMMISSION

Reedsport OPT Wave Park, LLC — Project No. 12713-002, Oregon

NOTICE OF AVAILABILITY OF ENVIRONMENTAL ASSESSMENT

(December 3, 2010)

In accordance with the National Environmental Policy Act of 1969 and the Federal Energy Regulatory Commission's (Commission or FERC's) regulations, 18 CFR Part 380 (Order No. 486, 52 FR 47897), the Office of Energy Projects has reviewed Reedsport OPT Wave Park, LLC's application for license for the Reedsport OPT Wave Park Project (FERC Project No. 12713-002), which would be located in Oregon State territorial waters about 2.5 nautical miles off the coast near Reedsport, in Douglas County, Oregon.

Staff prepared an environmental assessment (EA), which analyzes the potential environmental effects of licensing the project and concludes that licensing the project, with appropriate environmental protective measures, would not constitute a major federal action that would significantly affect the quality of the human environment.

A copy of the EA is available for review at the Commission in the Public Reference Room or may be viewed on the Commission's web site at www.ferc.gov using the "eLibrary" link. Enter the docket number excluding the last three digits in the docket number field to access the document. For assistance, contact FERC Online Support at FERCOnlineSupport@ferc.gov or toll-free at 1-866-208-3676, or for TTY, 202-502-8659.

You may also register online at www.ferc.gov/docs-filing/esubscription.asp to be notified via email of new filings and issuances related to this or other pending projects. For assistance, contact FERC Online Support.

Any comments should be filed within 30 days from the date of this notice. Comments may be filed electronically via the Internet. See 18 CFR 385.2001(a)(1)(iii) and the instructions on the Commission's web site (http://www.ferc.gov/docs-filing/ferconline.asp) under the "eFiling" link. Commenters can submit brief comments up to 6,000 characters, without prior registration, using the eComment system at http://www.ferc.gov/docs-filing/ecomment.asp. You must include your name and contact information at the end of your comments. For assistance, please contact FERC Online

Support. Although the Commission strongly encourages electronic filings, documents may also be paper-filed. To paper-file, mail an original and seven copies to: Kimberly D. Bose, Secretary, Federal Energy Regulatory Commission, 888 First Street, NE, Washington, DC 20426. Please affix Project No. 12713-002 to all comments.

For further information, contact Jim Hastreiter by telephone at 503-552-2760 or by email at james.hastreiter@ferc.gov.

Kimberly D. Bose,
Secretary.

ENVIRONMENTAL ASSESSMENT

FOR HYDROPOWER LICENSE

Reedsport OPT Wave Park Project—FERC Project No. 12713-002

Oregon

Federal Energy Regulatory Commission
Office of Energy Projects
Division of Hydropower Licensing
888 First Street, NE
Washington, DC 20426

December 2010

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ACRONYMS AND ABBREVIATIONS

AC	alternating current
AMP	Adaptive Management Process
APE	area of potential effects
APEA	applicant-prepared environmental assessment
ATV	all-terrain vehicle
B field	induced magnetic field
BACI	Before-After-Control-Impact
ºC	degrees Celsius
Coast Guard	U.S. Coast Guard
Commission	Federal Energy Regulatory Commission
Corps	U.S. Army Corps of Engineers
CTCLUSI	Confederated Tribes of the Coos, Lower Umpqua, and Siuslaw Indians
dB	decibel
DC	direct current
DPS	distinct population segment
E field	electric field
EA	environmental assessment
EEZ	Exclusive Economic Zone
EFH	essential fish habitat
EMF	electromagnetic fields
ESA	Endangered Species Act
ESU	evolutionarily significant unit
FAD	fish aggregation device
FERC	Federal Energy Regulatory Commission
Forest Service	U.S. Department of Agriculture, Forest Service
FPA	Federal Power Act
FWS	U.S. Department of the Interior, Fish and Wildlife Service
GPS	Global Positioning System
Hz	hertz (the number of cycles per second of a periodic phenomenon)
iE field	induced electric field
LCR	Lower Columbia River
LE	listed as endangered
LT	listed as threatened
kHz	kilohertz
kW	kilowatt
mm	millimeter
MMPA	Marine Mammal Protection Act
MMS	Minerals Management Service
MOU	Memorandum of Understanding
MW	megawatt

MWh	megawatt-hour
National Register	National Register of Historic Places
NERC	North American Electric Reliability Corporation
NHPA	National Historic Preservation Act of 1966
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
OCC	Oregon Coast coho
O&M	Operations and Maintenance
OPT	Reedsport OPT Wave Park, LLC
Oregon DEQ	Oregon Department of Environmental Quality
Oregon DFW	Oregon Department of Fish and Wildlife
Oregon DLCD	Oregon Department of Land Conservation and Development
Oregon FWC	Oregon Fish and Wildlife Commission
Oregon SHPO	Oregon State Historic Preservation Officer
ORS	Oregon Revised Statue
PAT	pop-off archival tags
PCE	primary constituent element
PFMC	Pacific Fishery Management Council
RV	recreation vehicle
ROV	remotely operated underwater vehicle
SC	sensitive-critical
SCORP	Statewide Comprehensive Outdoor Recreation Plan
SCUBA	self contained underwater breathing apparatus
SD	scoping document
SONCC	Southern Oregon and Northern California coho
SOORC	Southern Oregon Ocean Resource Coalition
SP	peripheral or naturally rare
SPCC	Spill Prevention, Control, and Countermeasure
SRKW	southern resident killer whale
SU	undetermined status
SV	sensitive-vulnerable
UHMWPE	ultra high molecular weight polyethylene coating
USP	underwater substation pod

EXECUTIVE SUMMARY

On February 1, 2010, Reedsport OPT Wave Park, LLC (OPT) filed an application for an original license to construct and operate the Reedsport OPT Wave Park Project (Reedsport Project or project). The 1.5-megawatt (MW) project would include 10 wave energy conversion devices moored in Oregon State territorial waters about 2.5 nautical miles off the coast near Reedsport, in Douglas County, Oregon. The onshore portion of the project, also located in Douglas County, would occupy about 5 acres of federal lands administered by the U.S. Department of Agriculture, Forest Service (Forest Service). The project would generate an average of about 4,140 megawatt-hours (MWh) of energy annually. This environmental assessment (EA) evaluates the environmental and economic effects of licensing the proposed project.

Proposed Action

The proposed project would involve the installation of 10 OPT PowerBuoys attached to seabed anchors, tendon lines, subsurface floats, and catenary mooring lines. The PowerBuoy units would be deployed in an array of three rows oriented at an angle to the shore and would occupy about 0.25 square mile of the Pacific Ocean. The 10 PowerBuoy units would be connected to a single underwater substation pod via power/fiber-optic lines. A subsea transmission cable, buried in the seabed to a depth of 3 to 6 feet, would extend from the underwater substation pod to the terminus of an existing wastewater discharge pipeline, about 0.5 mile offshore. The subsea transmission cable would be routed through the wastewater pipeline to a newly constructed underground vault, inland of the sand dunes. At the vault, the transmission cable would transition to an underground transmission line, re-enter the existing wastewater pipeline, and be routed through the pipeline to the point at which it would connect to the Douglas Electric Cooperative transmission line at a proposed shore substation.

The proposed action represents the second phase of a three-phased development approach. Phase I involves the installation of a single PowerBuoy, which will not be connected to the grid, and does not require a Federal Energy Regulatory Commission (Commission) license. Phase II, as proposed in OPT's license application, involves the installation of an additional 9 PowerBuoys, forming a 10-buoy array that would produce power that would be transmitted into the grid. OPT's primary purpose in operating these 10 PowerBuoys, in addition to generating electricity, is to collect sufficient data to support evaluation of additional commercial-scale arrays, including the potential future expansion of the project to 50 MW. In Phase III, OPT may apply to the Commission to amend the 10-PowerBuoy license to allow expansion of the project to up to 50 MW.

OPT proposes to implement the following measures:

- Light PowerBuoys in accordance with U.S. Coast Guard regulations to provide for navigation safety.

- Locate subsurface mooring floats at depth of 30 to 50 feet to avoid potential vessel strike.

- Equip PowerBuoys with materials to prevent pinnipeds (seals and sea lions) from using the buoys as haul-outs (resting sites).

- Route 0.5 mile of the subsea transmission cable and all of the terrestrial transmission line through an existing wastewater discharge pipeline to minimize disturbance of beach and shoreline areas.

- Bury the rest of the subsea transmission cable to a depth of 3 to 6 feet in the seabed to minimize electromagnetic fields (EMF) and the potential for fishing gear loss.

- Implement the proposed Adaptive Management Process, which would guide the implementation of monitoring studies and identification of measures that may be required to address unanticipated effects.

- Implement the proposed Emergency Response and Recovery Plan, which would describe notification procedures and preparedness actions for any unforeseen event that could compromise the mooring system of one or more buoys or create a hazardous situation.

- Implement the proposed Spill Prevention, Control, and Countermeasure Plan, which would describe the response measures and procedures that would be in place if a release of hydraulic fluid were to occur.

- Implement the proposed Operations and Maintenance Plan, which would include periodic inspection of underwater project components of the project every 2 to 3 months for the first 2 years of operation and annually thereafter to identify and remove derelict fishing gear.

- Implement the proposed Crabbing and Fishing Plan to address potential effects on crabbing, fishing, and navigation, which would include collaboratively developing methods to minimize the potential for loss of fishing gear, imposing a transport moratorium and defining transit lanes to minimize impacts of project vessels on the crab fishery, and implementing a marine use/public information plan to inform commercial and recreational users of the location and design of the project.

- Develop and implement an interpretive and education plan, which would include the design and installation of interpretive displays onshore to inform the public about the location and composition of project facilities.

- Implement the Terrestrial and Cultural Resources Plan, which would include measures to protect any cultural materials that are discovered (no measures to protect terrestrial resources are included because OPT does not expect any effects on terrestrial resources).

- Implement wave, current, and sediment transport monitoring to assess any unanticipated effects on wave heights, coastal sediment transport, and depositional processes.

- Implement fish and invertebrate monitoring to assess any unanticipated effects of project structures on the fish and invertebrate community.

- Implement EMF monitoring to assess any unanticipated effects of EMF levels on sensitive aquatic species.

- Implement cetacean monitoring to assess any unanticipated effects on whale migration and the potential for whale entanglement.

- Implement pinniped monitoring to assess any unanticipated effects on the abundance of seals and sea lions.

- Implement OPT's proposed protocols for reporting marine mammal injury.

- Implement offshore avian use monitoring to assess any unanticipated effects on avian collision mortality.

- Conduct a visual assessment review to assess any unanticipated effects of the project on aesthetic values of the project area.

Alternatives Considered

This EA analyzes the effects of project construction and operation and recommends conditions for any license that may be issued for the project. In addition to the applicant's proposal,[1] we consider two additional alternatives: (1) the applicant's proposal with staff modifications (staff alternative); and (2) no action—no project construction (no-action alternative).

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[1] OPT's proposal is consistent with an August 2, 2010, final Settlement Agreement between OPT and 13 other parties, described on page xiii.

Under the staff alternative, the project would be constructed and operated as proposed by the applicant, but would include the following additional measures:

- Review results of monitoring EMF and acoustic emissions from the single PowerBuoy that would be deployed in Phase I to assess the need for project modifications to address any unanticipated adverse effects before additional PowerBuoys are installed. OPT would be required to file the monitoring results and any proposed project modifications for Commission approval.

- During the first year of operation, increase the frequency from every 2 to 3 months to monthly that underwater project components are inspected to detect and remove any derelict fishing gear that becomes entangled on project structures.

- Apply OPT's proposed protocols for reporting marine mammal injury for marine turtles.

- Modify the proposed Spill Prevention, Control, and Countermeasure Plan to identify any hazardous fluids that would be used in the underwater substation pod and describe monitoring methods that would be used to identify any leaks of hazardous fluids.

- Require OPT to consult with the Aquatic Resources and Water Quality Implementation Committee concerning the use of any materials, not originally listed in the license application or Settlement Agreement, that could cause harmful effects to fish, wildlife or the environment if released into the environment.

- Refine, in consultation with stakeholders, several elements of the proposed Crabbing and Fishing Plan and submit them for Commission approval.

- Restrict closures of Sparrow Park Road during construction to weekday work hours outside of the summer recreation season.

- Require consultation with agencies if new information identifies the potential for adverse effects on terrestrial habitats or wildlife. If potential additional measures are identified, modify the proposed Terrestrial and Cultural Resources Plan as needed and file the modified plan for Commission approval.

- Require consultation with the Oregon State Historic Preservation Officer (Oregon SHPO) and the Confederated Tribes of the Coos, Lower Umpqua, and Siuslaw Indians (CTCLUSI) to determine appropriate actions if additional ground-disturbing activities are proposed or if cultural materials or human remains are inadvertently discovered.

The recommended staff modifications include or are based in part on recommendations made by the federal and state resource agencies and other stakeholders that have an interest in the resources that may be affected by construction and operation of the project. We include all of the section 4(e) conditions specified by the Forest Service in the staff alternative.

Public Involvement and Areas of Concern

The intent of the Commission's pre-filing process is to initiate public involvement early in the project planning process and to encourage citizens, governmental entities, tribes, and other interested parties to identify and resolve issues prior to an application being formally filed with the Commission. To this end, OPT conducted consultation under the traditional licensing process, which included 45 meetings or conference calls with a wide range of stakeholders, including numerous resource agencies, tribes, and non-governmental organizations representing fishermen, surfers, and conservation groups.

After the application was filed, we conducted scoping to determine what issues and alternatives should be addressed. A scoping document (SD1) was distributed to interested parties on March 1, 2010. Scoping meetings were held in Reedsport, Oregon, on April 7, 2010, and in Salem, Oregon, on April 8, 2010, and an environmental site review was conducted of the project with OPT staff and governmental agency representatives on April 7, 2010. On June 1, 2010, we requested conditions and recommendations in response to the notice of ready for environmental analysis. On July 6, 2010, we issued SD2, which incorporates written and oral comments received during the scoping process.

On August 2, 2010, OPT filed a final Settlement Agreement between OPT and the U.S. Department of the Interior, Fish and Wildlife Service, National Marine Fisheries Service, Forest Service, Oregon Department of State Lands, Oregon Department of Environmental Quality, Oregon Department of Land Conservation and Development, Oregon Department of Water Resources, Oregon Department of Fish and Wildlife, Oregon Department of Energy, Oregon State Marine Board, Oregon Shores Conservation Coalition, Surfrider Foundation, and Southern Oregon Ocean Resource Coalition. The Commission issued a Notice of Settlement on August 10, 2010. We consider the license application and Settlement Agreement to represent the proposed action for the Reedsport Project.

The primary issues associated with licensing the project are potential effects of the proposed project on marine mammals, birds, salmon, navigation, commercial fishing and crabbing, and recreation.

Project Effects

OPT has designed the project in a manner that would minimize the potential for environmental effects during construction and operation. Key features include the small scale of the project; a phased installation plan; mooring and navigation lighting systems designed to minimize potential adverse effects on whales and seabirds; and routing a portion of the subsea transmission cable and the entire terrestrial transmission line through an existing effluent discharge pipeline to avoid disturbance of beach, dune, and terrestrial habitats. OPT's proposal also includes a number of monitoring efforts designed to detect and address any unanticipated adverse effects.

Geologic and Soil Resources

Construction and operation of the project would likely have only minor effects on geologic and soil resources such as short-term suspension of sediments when anchors are installed and the subsea transmission cable is buried. Any effects on sediment transport processes along the shoreline are unlikely given the small scale of the project and its distance from shore. OPT's proposed wave, current, and sediment transport monitoring would help identify and quantify any unanticipated effects on geologic and soil resources and to identify any potential mitigation measures that may be needed.

Water Resources

Construction and operation of the project would likely have only minor effects on water resources such as short-term increases in turbidity during project construction, minor changes in wave height on the shoreward side of the PowerBuoy array, and a minor potential risk of spills of hydraulic fluids from the PowerBuoys or of fuel from vessels used during construction and maintenance of the project. The proposed wave, current, and sediment transport monitoring and fish and invertebrate monitoring would help identify and quantify the scale of any unanticipated effects on water currents or water quality and identify any potential mitigation measures that may be needed. The Prevention, Control, and Countermeasure Plan would help minimize the potential for spills of hydraulic fluids or fuels, as well as the extent of adverse effects of any spills that do occur. Under the staff alternative, identifying any hazardous liquids in the underwater substation pod and methods to detect leaks would help prevent any potential adverse effects on water quality.

Aquatic Resources

The placement of underwater components of the project would likely cause some changes in the composition and abundance of the fish and invertebrate community, reducing the amount of habitat for species adapted for burrowing in the seabed and creating habitat for structure-oriented species. Designation of the project area as a No Fishing Zone would benefit many aquatic species by providing a refuge from harvest and from habitat damage associated with some types of fishing gear. Enhanced habitat conditions for larger fish of some species would likely increase predation on smaller fish. The proposed fish and invertebrate, EMF, and acoustic monitoring would help evaluate any unanticipated adverse effects on aquatic resources and identify any potential mitigation measures that may be needed. Under the staff alternative, review of monitoring data from the single PowerBuoy would allow the need for any project modifications to address any unanticipated adverse effects from EMF or acoustic emissions to be assessed before additional PowerBuoys are installed.

Marine Mammals, Reptiles, and Birds

The PowerBuoy array would be deployed within the migration route of gray whales. However, construction activities would be scheduled outside of the gray whale migration period, and the noise levels caused by project operation are not expected to adversely affect whales because they are expected to be similar to the background levels. Construction-related noise may have a minor and temporary effect on other species of whales that have the potential to occur in the project area, but the noise levels are not expected to be of sufficient magnitude to cause hearing loss or other injuries. There is some potential for whale entanglement on project structures, especially if any derelict fishing gear becomes entangled on the array; however, this potential would be reduced by the removal of any entangled gear that is found during periodic underwater inspections that would be conducted under OPT's proposed operation and maintenance plan. Because Oregon's nearshore waters are a migration corridor for a variety of waterbirds, there is some potential for birds to be injured or killed if they collide with above-water portions of the PowerBuoys. However, given the proposed project configuration and buoy design, and the features built into the navigation lighting system to minimize bird attraction, the potential for bird collision is low. Unanticipated adverse effects on whales and seabirds, and potential methods to address them, would be evaluated through monitoring. Under the staff alternative, increasing the frequency of underwater inspections for fishing gear entangled with project structures during the first year of project operation would reduce the potential for whale entanglement, and review of monitoring data from the single PowerBuoy would allow OPT to implement any additional monitoring or measures that may be needed through the Adaptive Management Process to address any unanticipated adverse effects from EMF or acoustic emissions to be assessed before additional PowerBuoys are installed.

Terrestrial Resources

The only onshore areas that would be altered by the project have been previously disturbed. As a result, we do not anticipate any adverse effects on terrestrial resources. Under the staff alternative, modification of the Terrestrial and Cultural Resources Plan would provide additional protection for terrestrial resources if new information identifies the potential for adverse effects.

Threatened and Endangered Species and Essential Fish Habitat

There is a minor potential that attraction of predacious fish, seals, sea lions, and birds to the project could result in increased predation on listed species of salmon. There would also be a minor potential for entanglement or injury to listed species of whales that pass through the project area and for collision injury to marbled murrelets. However, the project's small scale and the distance between project features is unlikely to attract salmon or increase the rate of predation on salmon, and as discussed above, the potential for adverse effects on whales and offshore avians during project construction and operation is low. Several monitoring programs would be undertaken to identify unanticipated adverse effects on fish and invertebrates, pinnipeds, cetaceans, and offshore avians. Under the staff alternative, increasing the frequency of inspections for fishing gear entangled with project structures during the first year of project operation would reduce the potential for whale entanglement, and review of monitoring data from the single PowerBuoy would allow unanticipated adverse effects from EMF or acoustic emissions to be assessed before additional PowerBuoys are installed. The project is unlikely to alter beach habitat that supports the western snowy plover, and any unanticipated adverse effects would be evaluated through the proposed wave, current, and sediment transport monitoring program.

Recreation, Ocean Use, and Land Use

Access to the PowerBuoy area for crabbing and commercial and recreational fishing would be precluded if the area is designated as a No Fishing Zone by the Oregon Fish and Wildlife Commission or access is restricted by the Commission for public safety purposes. In addition, crabbers would likely experience some loss of gear and fishing time associated with entanglement of crabbing gear on project structures during storms and gear damage caused by vessels needed to construct and maintain the project. The loss of fishing area would likely be mitigated to some extent by increased crab densities and catch rates in areas adjacent to the project, and the measures proposed by OPT in its Crabbing and Fishing Plan should help minimize any adverse effects on navigation, crabbing, and fishing. These measures include developing a protocol to recover or provide mitigation for fishing gear that becomes entangled in project mooring lines. Any adverse effects on shore recreation and land use would be minor because only limited shore-based construction would occur, the construction period would be brief, and all activities would occur in previously disturbed areas. Under the staff alternative, modification of the Crabbing and Fishing Plan to refine several elements of the plan would help ensure that any adverse effects on recreation and ocean use are minimized, and restricting the timing of closures of Sparrow Park Road would reduce adverse effects on public access to the beach.

Aesthetic Resources

The size of the PowerBuoys when viewed from shore would be approximately 1.6 millimeters at arm's length. At night, the PowerBuoys would be lit for navigational safety. Under clear conditions, these lights would appear as pinpoints on the horizon, creating a minor visual change to relatively unbroken nighttime ocean views off the Oregon Coast. Because most construction activity would take place more than 2 miles offshore, the work vessels that would be present during construction would not be visually obtrusive when viewed from shore. Therefore, aesthetic effects would be minor.

Cultural Resources

Implementation of the Terrestrial and Cultural Resources Plan would ensure that no known cultural resources properties or human remains would be disturbed. Under the staff alternative, additional requirements for consultation with the CTCLUSI and the Oregon SHPO, regarding unanticipated discoveries of cultural materials or human remains during construction activities and over the license term and regarding any new post-construction land clearing or ground disturbing activities undertaken in the future, would provide additional protection to cultural resources.

Socioeconomics

Construction and periodic maintenance activities associated with the project would provide temporary employment for up to 180 skilled workers for 6 months, and operation of the project would provide 8 full-time jobs. The measures summarized above, and discussed in detail below, would mitigate any adverse effects on the crabbing and fishing industry.

Conclusions

Based on our analysis, we recommend licensing the project as proposed by OPT, with some staff modifications.

In section 4.1 of the EA, we compare the total project cost to the cost of obtaining power from a likely alternative source of power in the region, for each of the alternatives identified above. Our analysis shows that during the first year of operation, the project as proposed would produce power at a cost that is $3,331,340 (about $804.67/MWh) more than the cost of alternative power. Under the staff-recommended alternative, the project would produce power at a cost that is $3,336,590 (about $805.94/MWh), more than the cost of alternative power. Although the cost of power that would be produced at the project is high, OPT is hopeful that building the project, in addition to generating electricity, would collect enough data to support development of more economic commercial-scale arrays, with installed capacities up to 50 MW. On the basis of our independent analysis, we conclude that issuing an original license for the project with the staff-recommended measures would not be a major federal action significantly affecting the quality of the human environment.

We chose the staff alternative as the preferred alternative because under it the project would: (1) provide a dependable source of electrical energy for the region (4,140 MW annually); (2) provide 1.5 MW of electric energy generated from a renewable resource that may offset the use of fossil-fueled, steam-electric generating plants, thereby conserving non-renewable resources and reducing atmospheric pollution; (3) include the recommended environmental measures to protect, mitigate, and enhance environmental resources affected by the project; and (4) provide, through proposed monitoring, an improved understanding of the environmental effects of wave energy projects, which would be instrumental in assessing the potential effects of future projects of this type and identifying measures to minimize adverse environmental effects. The overall benefits of the staff alternative would be worth the additional costs of the recommended environmental measures.

ENVIRONMENTAL ASSESSMENT

Federal Energy Regulatory Commission
Office of Energy Projects
Division of Hydropower Licensing
Washington, DC

Reedsport OPT Wave Park Project
FERC Project No. 12713-002—Oregon

1.0 INTRODUCTION

1.1 APPLICATION

On February 1, 2010, Reedsport OPT Wave Park, LLC (OPT) filed for an original license with the Federal Energy Regulatory Commission (Commission or FERC). The 1.5-megawatt (MW) project, which would consist of both marine and onshore components, would be located in Oregon State territorial waters about 2.5 nautical miles off the coast near Reedsport, in Douglas County, Oregon (figure 1). The onshore component of the transmission line would occupy about 5 acres of land within the Oregon Dunes National Recreation Area, Siuslaw National Forest, administered by the U.S. Department of Agriculture, Forest Service (Forest Service). The project would generate an average of about 4,140 megawatt-hours (MWh) of energy annually.

1.2 PURPOSE OF ACTION AND NEED FOR POWER

1.2.1 Purpose of Action

The purpose of the proposed Reedsport OPT Wave Park Project (Reedsport Project or project) is to provide a new source of hydroelectric power. Therefore, under the provisions of the Federal Power Act (FPA), the Commission must decide whether to issue a license to OPT for the Reedsport OPT Wave Park Project (Reedsport Project or project) and what conditions should be placed on any license issued. In deciding whether to issue a license for a hydroelectric project, the Commission must determine that the project will be best adapted to a comprehensive plan for improving or developing a waterway. In addition to the power and developmental purposes for which licenses are issued (such as flood control, irrigation, or water supply), the Commission must give equal consideration to the purposes of: (1) energy conservation; (2) the protection of, mitigation of damage to, and enhancement of fish and wildlife resources; (3) the protection of recreational opportunities; and (4) the preservation of other aspects of environmental quality.

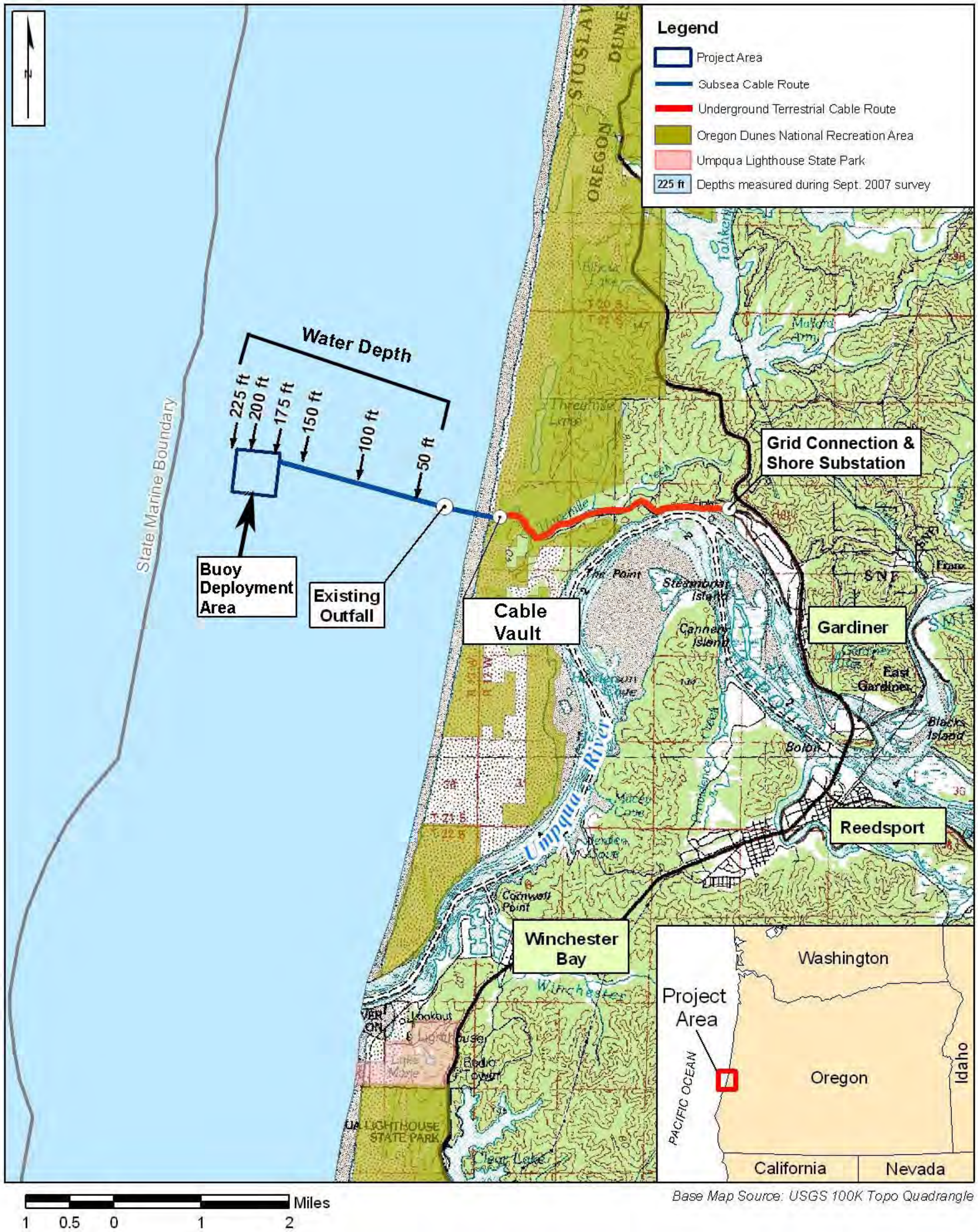

Figure 1. Location of Reedsport OPT Wave Park Project (Source: OPT, 2010, as modified by staff).

The action proposed in OPT's license application represents Phase II of a three-phased development approach. Phase I involves the installation of a single PowerBuoy, which will not be connected to the grid, and does not require a FERC license.[2] Phase II, as proposed in OPT's license application, involves the installation of an additional 9 PowerBuoys, forming a 10-buoy array that would produce power that would be transmitted into the grid. OPT's primary purpose in operating these 10 PowerBuoys, in addition to generating electricity, is to collect sufficient data to support evaluation of additional commercial-scale arrays, including the potential future expansion of the project to 50 MW. In Phase III, OPT may apply to FERC to amend the 10-PowerBuoy license to allow expansion of the project to up to 50 MW. However, it is not known at this time whether OPT will pursue expansion, which will depend on monitoring results, input of stakeholders, and other factors.

Issuing a license for the Reedsport Project would allow OPT to generate electricity for the term of an original license, making electrical power from a renewable resource available to its customers. OPT's proposed monitoring programs would also provide important information on any unanticipated environmental effects of wave energy developments, which would assist with the evaluation of other similar projects.

This environmental assessment (EA) evaluates the environmental and economic effects of constructing and operating the proposed project: (1) as proposed by the applicant and, (2) with our recommended measures. We also consider the effects of the no-action alternative. Important issues that are addressed include potential effects on marine mammals, birds, salmon, navigation, commercial fishing and crabbing, and recreation associated with the construction and operation of the project.

1.2.2 Need for Power

The Reedsport Project would provide hydroelectric generation to meet part of Oregon's power requirements, resource diversity, and capacity needs. The project would have an installed capacity of 1.5 MW and would generate an average of approximately 4,140 MWh per year.

The North American Electric Reliability Corporation (NERC) annually forecasts electrical supply and demand nationally and regionally for a 10-year period. The Reedsport Project would be located in the Northwest subregion of the Western Electricity Coordinating Council region of the NERC. According to the NERC's most recent 2010 forecast, winter peak demands and annual energy requirements for the Northwest subregion are projected to grow at annual rates of 1.1 percent and 1.2 percent,

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[2] OPT proposes an initial installation of a single PowerBuoy, which would not require a FERC license because it is a "test project" that would not be connected to the grid [*Verdant Power LLC*, 111 FERC ¶ 61,024 (2005)].

respectively, from 2010 through 2019 (NERC, 2010). NERC projects that resource capacity margins (generating capacity in excess of demand) will remain above the target reserve margins of 18.6 percent for summer and 20.0 percent for winter throughout the 2010–2019 period.

The project is proposed to help the state of Oregon to attain its goal of meeting 25 percent of the state's electricity needs from renewable resources by 2025 in accordance with the Renewable Portfolio Standard established for Oregon (Oregon Revised Statue [ORS] 469A).

We conclude that power from the Reedsport Project would help meet a need for power in the Northwest subregion in both the short- and long-term. The project would provide power that displaces non-renewable, fossil-fired generation and contributes to a diversified generation mix. The Electric Power Research Institute has concluded that the wave energy potential off the cost of Oregon is significant and that harnessing just 10 percent of the available offshore wave energy resource base (almost 10,000 MW of average annual incident power) at 50 percent efficiency would provide an average power of 500 MW, enough to provide power for about 500,000 Oregon homes (EPRI, 2005). Displacing the operation of fossil-fueled facilities may avoid some power plant emissions and creates an environmental benefit.

1.3 STATUTORY AND REGULATORY REQUIREMENTS

A license for the Reedsport Project is subject to numerous requirements under the FPA and other applicable statutes. We summarize the major regulatory requirements in table 1 and describe them below.

Table 1. Major statutory and regulatory requirements for the Reedsport Project.

Requirement	Agency	Status
Section 18 of the FPA (fishway prescriptions)	NMFS, Interior	Interior and NMFS, by letters filed on August 30 and August 31, 2010, reserved their authority to prescribe fishways.
Section 4(e) of the FPA (land management conditions)	Forest Service	The Forest Service filed conditions on August 27, 2010.
Section 10(j) of the FPA	Oregon DFW, NMFS, FWS	Interior and Oregon DFW filed recommendations on August 30, 2010, while NMFS filed recommendations on August 31, 2010.

Requirement	Agency	Status
ESA Consultation	NMFS, FWS	Table 2 presents our conclusions regarding project effects on listed species and critical habitat. With this EA, we are requesting formal consultation with FWS and NMFS regarding species that may be adversely affected and concurrence with our findings of not likely to adversely affect or no effect for other listed species and critical habitat.
Marine Mammals Protection Act	NMFS	OPT must apply for and receive an Incidental Harassment Authorization from NMFS in order for NMFS to complete section 7 consultation.
Magnuson-Stevens Fishery Conservation and Management Act	NMFS	We conclude that the proposed project is likely to adversely affect EFH. With this draft EA, we are requesting NMFS' concurrence with our conclusion.
Coastal Zone Management Act Consistency	Oregon Department of Land Conservation and Development	A request for consistency determination dated November 4, 2010, was filed with the Commission on November 12, 2010.

Requirement	Agency	Status
National Historic Preservation Act	CTCLUSI, Oregon SHPO	OPT consulted with the Oregon SHPO and the CTCLUSI and completed a survey of the project APE. The survey report did not identify any historic properties within the APE (Davis, 2009; Coyote, 2010). No PA required; but license article will address future ground-disturbing work, unanticipated discoveries, and human remains.

Notes: APE – Area of potential effects

CTCLUSI – Confederated Tribes of the Coos, Lower Umpqua, and Siuslaw Indians

EFH – Essential fish habitat

ESA – Endangered Species Act

Forest Service – U.S. Department of Agriculture, Forest Service

FPA – Federal Power Act

FWS – U.S. Department of the Interior, Fish and Wildlife Service

Interior – U.S. Department of the Interior

NMFS – National Marine Fisheries Service

OPT – Reedsport OPT Wave Park, LLC

Oregon DEQ – Oregon Department of Environmental Quality

Oregon DFW – Oregon Department of Fish and Wildlife

Oregon SHPO – Oregon State Historic Preservation Officer

1.3.1 Federal Power Act

1.3.1.1 Section 18 Fishway Prescriptions

Section 18 of the Federal Power Act states that the Commission is to require construction, operation, and maintenance by a licensee of such fishways as may be prescribed by the Secretaries of Commerce or the Interior. Interior and National Marine Fisheries Service (NMFS), by letters filed on August 30 and August 31, 2010, respectively request that a reservation of authority to prescribe fishways under section 18 be included in any license issued for the project.

1.3.1.2 Section 4(e) Conditions

Section 4(e) of the FPA provides that any license issued by the Commission for a project within a federal reservation will be subject to and contain such conditions as the Secretary of the responsible federal land management agency deems necessary for the adequate protection and use of the reservation. On August 27, 2010, the Forest Service filed four conditions (appendix A) pursuant to section 4(e) of the FPA. These four conditions are described under section 2.2.5, *Modifications to Applicant's Proposal—Mandatory Conditions*.

The proposed subsea transmission cable and terrestrial transmission line would be placed within an existing underground wastewater discharge pipeline that traverses an easement through the Oregon Dunes National Recreation Area, which is administered by Siuslaw National Forest under the jurisdiction of the Forest Service.

1.3.1.3 Section 10(j) Recommendations

Under section 10(j) of the FPA, each hydroelectric license issued by the Commission must include conditions based on recommendations provided by federal and state fish and wildlife agencies for the protection, mitigation, or enhancement of fish and wildlife resources affected by the project. The Commission is required to include these conditions unless it determines that they are inconsistent with the purposes and requirements of the FPA or other applicable law. Before rejecting or modifying an agency recommendation, the Commission is required to attempt to resolve any such inconsistency with the agency, giving due weight to the recommendations, expertise, and statutory responsibilities of such agency.

Interior (August 30, 2010) and Oregon Department of Fish and Wildlife (Oregon DFW; August 30, 2010) and NMFS (August 31, 2010) timely filed recommendations under section 10(j), as summarized in table 24, in section 5.4.1, *Fish and Wildlife Agency Recommendations*. In section 5.4, we also discuss how we address the agency recommendations and comply with section 10(j).

1.3.2 Endangered Species Act

Section 7 of the Endangered Species Act (ESA) requires federal agencies to ensure that their actions are not likely to jeopardize the continued existence of endangered or threatened species or result in the destruction or adverse modification of the critical habitat of such species. Twenty-four federally listed species could occur in the project vicinity, including seven species of marine mammals, four species of marine reptiles, four species of birds, seven species of salmon, one species of sturgeon, and one species of smelt (eulachon) (table 2). Our analyses of project effects on threatened and endangered species are presented in section 3.3.6, *Threatened and Endangered Species and Essential Fish Habitat*, and our recommendations in section 5.2, *Comprehensive Development and Recommended Alternative*. We will request formal consultation with NMFS and the U.S. Department of the Interior, Fish and Wildlife Service (FWS) for those listed species and designated critical habitats that may be adversely affected by the proposed project and request concurrence for those species and critical habitats that would not be likely to be affected by the proposed project (table 2).

In the following table, we summarize our findings regarding project effects on listed species and designated critical habitat. We present the basis for our conclusions in section 3.3.6.2.

Table 2. List of federally protected threatened and endangered species that may occur in the project area and staff findings regarding listed species and critical habitat (Source: OPT, 2010).

Common Name (*Scientific Name*)	**Federal Status**[a]	**Effect on Listed Species**[b]	**Effect on Critical Habitat**[b, c]
Fish			
Coho salmon (southern Oregon, northern California Coast ESU) (*Oncorhynchus kisutch*)	CH, T	NLAA	ND
Coho salmon (Oregon Coast ESU) (*Oncorhynchus kisutch*)	T	NLAA	NA
Coho salmon (Lower Columbia River ESU) (*Oncorhynchus kisutch*)	T	NLAA	ND
Chinook salmon (Lower Columbia River ESU) (*Oncorhynchus tshawytscha*)	CH, T	NLAA	NA
Chinook salmon (Upper Columbia River spring-run ESU) (*Oncorhynchus tshawytscha*)	CH, E	NLAA	NA
Chinook salmon (Snake River spring/summer-run and Snake River fall-run ESUs) (*Oncorhynchus tshawytscha*)	CH, T	NLAA	NA
Green sturgeon (southern DPS) (*Acipenser medirostris*)	CH, T	NLAA	NLAA

Common Name (*Scientific Name*)	**Federal Status[a]**	**Effect on Listed Species[b]**	**Effect on Critical Habitat[b, c]**
Eulachon (southern DPS) (*Thaleichthys pacificus*)	T	NLAA	ND
Marine Mammals			
Steller sea lion (*Eumetopias jubatus*)	CH, T	LAA	NA
Humpback whale (*Megaptera novaeangliae*)	E	LAA	ND
Southern resident killer whale (*Orcinus orca*)	CH, E	LAA	NA
Blue whale (*Balaenoptera musculus*)	E	NLAA	ND
Fin whale (*Balaenoptera physalus*)	E	NLAA	ND
Sei whale (*Balaenoptera borealis*)	E	NLAA	ND
Sperm whale (*Physeter macrocephalus*)	E	NLAA	ND
Marine Reptiles			
Leatherback sea turtle (*Dermochelys coriacea*)	PCH, E	NLAA	NDAM
Loggerhead sea turtle (*Caretta caretta*)	T	NLAA	ND
Green sea turtle (*Chelonia mydas*)	CH, T	NLAA	NA
(Pacific) Olive ridley sea turtle (*Lepidochelys olivacea*)	T	NLAA	ND
Offshore Birds			
Marbled murrelet (*Brachyramphus marmoratus*)	CH, T	LAA	NA
Short-tailed albatross (*Phoebastria (=Diomedea) albatrus*)	E	NLAA	ND
Terrestrial Wildlife			
Western snowy plover (*Charadrius alexandrinus nivosus*)	CH, T	NLAA	NA

Common Name (*Scientific Name*)	Federal Status[a]	Effect on Listed Species[b]	Effect on Critical Habitat[b, c]
Northern spotted owl (*Strix occidentalis caurina*)	CH, T	NE	NA

[a] Federal status definitions: CH – critical habitat has been designated; PCH – critical habitat has been proposed; E – listed endangered; T – listed threatened.

[b] LAA – may affect, likely to adversely affect; NLAA – may affect, not likely to adversely affect; NE – would not affect; NDAM – no destruction or adverse modification.

[c] ND – critical habitat has not been designated for this species; NA – critical habitat has been designated or is proposed, but does not occur within the project area.

Three federally listed plant species occur in Douglas County, but are not found near the coast. These species include Kincaid's lupine (*Lupinus sulphureus* ssp. *kincaidii*), rough popcornflower (*Plagiobothrys hirtus*), and Gentner's fritillary (*Fritillaria gentneri*). The listed plants are found at locations well inland, and would not occur in the project area.

In comments on the Preliminary Application Document, NMFS stated that North Pacific right whales (*Eubalaena japonica*) would not be expected in the project area (personal communication, Bridgette Lohrman, October 10, 2007, as cited by OPT).

1.3.3 Marine Mammal Protection Act

The 1972 Marine Mammal Protection Act (MMPA) prohibits, with certain exceptions, the "take" (defined under statute to include harassment[3]) of marine mammals in U.S. waters and the high seas. In 1986, Congress amended both the MMPA, under the

[3] Harassment: Under the 1994 Amendments to the MMPA (50 CFR § 216.3), harassment is statutorily defined as any act of pursuit, torment, or annoyance that has the potential to:

- injure a marine mammal or marine mammal stock in the wild (Level A Harassment); or
- disturb a marine mammal or marine mammal stock in the wild by causing a disruption of behavioral patterns, including, but not limited to, migration, breathing, nursing, breeding, feeding, or sheltering but which does not have the potential to injure a marine mammal or mammal stock in the wild (Level B Harassment).

incidental take program, and the ESA, to authorize incidental takings of depleted, endangered, or threatened marine mammals, provided the "taking" (defined under the statute as actions which are or may be lethal, injurious, or harassing) was small in number and had a negligible impact on marine mammals. With this relationship between the MMPA and ESA, NMFS cannot complete section 7 consultation and issue an Incidental Take Permit for listed marine mammals until OPT has applied for and received an Incidental Harassment Authorization.

Based on our analysis of potential project effects on non-listed marine mammals (presented in section 3.3.4.2, *Environmental Effects, Marine Mammals, Reptiles, and Birds*), we conclude that a few individuals of several marine mammal species may be subject to Level A or Level B harassment, or both (table 3). Species that are most common in the project area have the potential for collision with the PowerBuoys or entanglement in derelict fishing gear that could accumulate on the buoy array, which may result in injury (Level A harassment) to individual marine mammals. Those species, plus other marine mammals that are less common in the project area, could potentially experience Level B harassment associated with ship noise and ship movements during construction, potentially interfering with their normal behavior. Two species shown in table 3 (harbor seals and California sea lions) could also be subject to Level B harassment if they are found to use the PowerBuoys as haul-outs and must be removed so that project operators can safely conduct maintenance activities.

Table 3. Non-ESA listed marine mammals within the project area that could be affected by Level A or Level B harassment (Source: staff).

Common Name (*Scientific Name*)	**Sightings Proximal to Project Area**	**Subject to Level A Harassment**	**Subject to Level B Harassment**
Harbor seal (*Phoca vitulina*)	Common in the project area	--	Harassment due to ship noise and movement during construction; possible removal from PowerBuoys
California sea lion (*Zalophus californianus*)	Common in the project area	--	Harassment due to ship noise and movement during construction; possible removal from PowerBuoys
Northern elephant seal (*Mirounga angustirostris*)	Frequently observed in the project area	--	Harassment due to ship noise and movement during construction
Minke whale (*Balaenoptera acutorostrata*)	Few sightings located over continental shelf	--	Harassment due to ship noise and movement during construction

Common Name (*Scientific Name*)	**Sightings Proximal to Project Area**	**Subject to Level A Harassment**	**Subject to Level B Harassment**
Harbor seal (*Phoca vitulina*)	Common in the project area	--	Harassment due to ship noise and movement during construction; possible removal from PowerBuoys
California sea lion (*Zalophus californianus*)	Common in the project area	--	Harassment due to ship noise and movement during construction; possible removal from PowerBuoys
Northern elephant seal (*Mirounga angustirostris*)	Frequently observed in the project area	--	Harassment due to ship noise and movement during construction
Gray whale (*Eschrichtius robustus*)	Predictable seasonal migration occurs along the West Coast in relatively nearshore habitat	Injury due to collision or entanglement in derelict fishing gear	Harassment due to ship noise and movement during construction
Gray whale (Pacific Coast feeding aggregation)	Seasonally found in southern and central Oregon in late spring and fall	Injury due to collision or entanglement in derelict fishing gear	Harassment due to ship noise and movement during construction
Northern right whale dolphin (*Lissodelphis borealis*)	Seasonally migrate through Oregon in late spring and summer	--	Harassment due to ship noise and movement during construction
Pacific white sided dolphin (*Lagenorhynchus obliquidenss*)	Seasonally migrate through Oregon in late spring and summer	--	Harassment due to ship noise and movement during construction

Common Name (*Scientific Name*)	Sightings Proximal to Project Area	Subject to Level A Harassment	Subject to Level B Harassment
Harbor seal (*Phoca vitulina*)	Common in the project area	--	Harassment due to ship noise and movement during construction; possible removal from PowerBuoys
California sea lion (*Zalophus californianus*)	Common in the project area	--	Harassment due to ship noise and movement during construction; possible removal from PowerBuoys
Northern elephant seal (*Mirounga angustirostris*)	Frequently observed in the project area	--	Harassment due to ship noise and movement during construction
Risso's dolphin (*Grampus griseus*)	Seasonally migrate through Oregon in late spring and summer	--	Harassment due to ship noise and movement during construction
Dall's porpoise (*Phocoenoides dalli*)	Commonly seen and make interannual north and south movements	--	Harassment due to ship noise and movement during construction
Harbor porpoise (*Phoecena phoecena*)	Sighted year-around in nearshore transboundary waters	Injury due to collision or entanglement in derelict fishing gear	Harassment due to ship noise and movement during construction

As mentioned above, OPT would be responsible for compliance with the MMPA. OPT has incorporated several features into the project design to minimize potential adverse effects (e.g., sloped and ultra high molecular weight polyethylene [UHMWPE] coated surfaces on PowerBuoys to prevent pinniped haul-out; taut mooring lines to prevent entanglement; monitoring for and removal of derelict fishing gear that may become entangled on project works [incorporated into the project Operations and Maintenance [O&M] Plan]), and would conduct pinniped and cetacean monitoring to evaluate unanticipated project effects and consideration of additional mitigation. OPT proposes to seek an Incidental Harassment Authorization from NMFS for deployment of the nine additional PowerBuoys and operation of the PowerBuoy array in the event that unanticipated effects on marine mammals occur. We present our recommendations in section 5.2, *Comprehensive Development and Recommended Alternative*.

1.3.4 Coastal Zone Management Act

Under section 307(c)(3)(A) of the Coastal Zone Management Act (CZMA), 16 U.S.C. § 1456(3)(A), the Commission cannot issue a license for a project within or affecting a state's coastal zone unless the state CZMA agency concurs with the license applicant's certification of consistency with the state's CZMA program, or the agency's concurrence is conclusively presumed by its failure to act within 180 days of its receipt of the applicant's certification.

On November 4, 2010, OPT submitted a request for Coastal Zone Management Plan consistency determination to the Oregon Department of Land Conservation and Development) Oregon DLCD).[4] The letter was filed with the Commission on November 12, 2010.

In OPT's submittal, it certified that it believes the proposed activities for the Reedsport Project are consistent with the Oregon's coastal policies regarding the goals and use of the Territorial Sea identified in section 1, part G of the Territorial Sea Plan. Further, OPT asked Oregon DLCD to confirm that the project would not affect the coastal zone.

1.3.5 National Historic Preservation Act

In response to OPT's August 2, 2007, request, the Commission designated OPT as its non-federal representative for the purposes of conducting section 106 consultation under the National Historic Preservation Act of 1966 (NHPA) on August 30, 2007. Pursuant to section 106, and as the Commission's designated non-federal representative, OPT consulted with the Oregon State Historic Preservation Officer (Oregon SHPO), Forest Service, and Confederated Tribes of the Coos, Lower Umpqua, and Siuslaw Indians (CTCLUSI) to locate, and assess potential adverse effects on historic properties associated with the project.

As a result of the findings made by OPT, the CTCLUSI, and the Oregon SHPO, a Programmatic Agreement to resolve adverse effects on historic properties will not be necessary. However, we anticipate that any license issued for this project would require OPT to immediately cease work in the vicinity of any cultural materials or human

[4] Oregon DLCD initiates the review of CZMA consistency certification concurrently with Oregon Department of Environmental Quality's initiation of processing the application for section 401 Clean Water Act certification.

remains if they are identified during construction activities. The license would also require consultation with the CTCLUSI and the Oregon SHPO over the license term if any cultural materials or human remains are identified within the area of potential effects (APE) during project activities, or if additional ground-disturbing activities are proposed in the future.

1.3.6 Magnuson-Stevens Fishery Conservation and Management Act

The Magnuson-Stevens Fishery Conservation and Management Act requires federal agencies to consult with NMFS on all actions that may adversely affect essential fish habitat (EFH). In a notice dated August 30, 2007, the Commission formally designated OPT as the Commission's non-federal representative for consultation with NMFS under section 305(b) of the Magnuson-Stevens Fishery Conservation Act and implementing regulations at 50 C.F.R. §600.920.

EFH is determined by identifying spatial habitat and habitat characteristics that are required for each federally managed fish species through a cooperative effort by NMFS, regional fishery management councils, and federal and state agencies. The proposed project area contains EFH for a number of species/lifestages. Effects of the project on EFH are addressed in section 3.3.6.2. Supplemental information pertaining to project effects on EFH is provided in a draft biological assessment (BA) prepared by OPT and filed with the Commission on July 1, 2010.

In summary, we conclude that licensing the project would likely adversely affect EFH of all 59 commercially-harvested fish species that occur in the project area. With this EA, we are requesting NMFS' concurrence with our conclusion.

1.4 PUBLIC REVIEW AND CONSULTATION

The Commission's regulations (18 CFR, section 4.38) require that applicants consult with appropriate resource agencies, tribes, and other entities before filing an application for a license. This consultation is the first step in complying with the Fish and Wildlife Coordination Act, the ESA, the NHPA, and other federal statutes. Pre-filing consultation must be complete and documented according to the Commission's regulations.

1.4.1 Scoping

Before preparing this EA, we conducted scoping to determine what issues and alternatives should be addressed. A scoping document was distributed to interested agencies and others on March 1, 2010. It was noticed in the Federal Register on March 10, 2010. Two scoping meetings, both advertised in the News Review (Roseburg, Oregon), Siuslaw News (Florence, Oregon) and The World (Coos Bay, Oregon), were held on April 7, 2010, in Reedsport, Oregon, and on April 8, 2010, in Salem, Oregon, to request oral comments on the project, and an environmental site review of the project was conducted with OPT staff and governmental agency representatives on April 7, 2010. A court reporter recorded all comments and statements made at the scoping meetings, and these are part of the Commission's public record for the project. In addition to comments provided at the scoping meetings, the following entities provided written comments:

Commenting Entity	Date Filed
U.S. Fish and Wildlife Service	May 4, 2010
Oregon Wild	May 7, 2010
Oregon State Historic Preservation Office	May 7, 2010
U.S. Department of Agriculture, Forest Service	May 10, 2010
Oregon Department of Fish and Wildlife	May 10, 2010
West Coast Seafood Processors	May 11, 2010
Pacific Marine Fisheries Council	May 11, 2010

1.4.2 Interventions

On June 1, 2010, the Commission issued a notice that OPT had filed an application to license the Reedsport Project. This notice set August 30, 2010, as the deadline for filing protests and motions to intervene. In response to the notice, the following entities filed motions to intervene:

Intervenor	Date Filed
U.S. Forest Service	July 19, 2010
Oregon Department of Fish and Wildlife	August 4, 2010
Oregon Department of Land Conservation and Development	August 18, 2010
U.S. Department of the Interior	August 18, 2010
Confederated Tribes of the Coos, Lower Umpqua and Siuslaw Indians	August 30, 2010

On September 15, 2010, NMFS filed a petition for late intervention. The Commission issued a Notice Granting Late Intervention on November 10, 2010.

1.4.3 Comments on the License Application

A notice requesting conditions and recommendations was issued on June 1, 2010. The following entities commented:

Commenting Agency and Other Entity	Date Filed
Pacific Fishery Management Council	July 20, 2010
U.S. Forest Service	August 27, 2010
U.S. Department of the Interior	August 30, 201
Oregon Department of Fish and Wildlife	August 30, 2010
National Marine Fisheries Service	August 31, 2010

The applicant did not file any reply comments.

1.4.4 Settlement Agreement

Beginning in August 2006, OPT engaged in discussions with key regulatory agencies, the Confederated Tribes of the Coos, Lower Umpqua and Siuslaw Indians, commercial fishing interests, and other stakeholders. In October 2006, Oregon Governor Kulongoski designated the Reedsport Project as an Oregon Solutions Project. The purpose of the Oregon Solutions process was to define and ensure broad stakeholder involvement in the regulatory process for reviewing the project and provide information for other wave energy projects along the Oregon Coast. On May 15, 2007, this process resulted in the execution of a Declaration of Cooperation by many parties to the Settlement Agreement. The Declaration of Cooperation presented the signatories' commitments to participate in the settlement discussion, which resulted in the execution of a Settlement Agreement for the Reedsport Project.

OPT filed the final Settlement Agreement on August 2, 2010. The Settlement Agreement sets forth a detailed and collaborative Adaptive Management Process (AMP) through which the parties will evaluate monitoring results and consider the need for changes in design, operations or structures; changes in maintenance or other management practices; new or modified monitoring efforts; temporary suspension of construction or operations; or removal of one or more structures. The parties further agreed to use the AMP to identify and implement additional monitoring that may be required to evaluate a potential future license amendment to expand the project to up to 50 MW.

The Settlement Agreement was signed by representatives of federal and state agencies and NGOs listed below. We consider the Settlement Agreement to represent the proposed action for the Reedsport Project.

Signatories to the Settlement Agreement
Reedsport OPT Wave Park, LLC
U.S. Fish and Wildlife Service
National Marine Fisheries Service
U.S. Forest Service
Oregon Department of State Lands
Oregon Department of Environmental Quality
Oregon Department of Land Conservation and Development
Oregon Department of Water Resources
Oregon Department of Fish and Wildlife
Oregon Parks and Recreation Department
Oregon Department of Energy
Oregon State Marine Board
Oregon Shores Conservation Coalition
Surfrider Foundation
Southern Oregon Ocean Resource Coalition

The Commission issued a notice of the Settlement Agreement on August 10, 2010, and set a deadline for filing comments on the Settlement Agreement of August 30, 2010. As noted in section 1.4.3, the following entities filed conditions and recommendations for the project, which included comments in support of the Settlement Agreement. No comments were filed in opposition to the Settlement Agreement.

Commenting Entities on the Settlement Agreement	**Date Filed**
U.S. Forest Service	August 27, 2010
U.S. Department of the Interior	August 30, 2010
Oregon Department of Fish and Wildlife	August 30, 2010
National Marine Fisheries Service	August 31, 2010

2.0 PROPOSED ACTION AND ALTERNATIVES

2.1 NO-ACTION ALTERNATIVE

The no-action alternative is license denial. Under the no-action alternative, the project would not be built, and the environmental resources in the project area would not be affected.

2.2 APPLICANT'S PROPOSAL

2.2.1 Project Facilities

The Reedsport Project would be located in the Pacific Ocean off the coast near Reedsport, Oregon, in Douglas County. The project would transmit power on shore to the Douglas Electric Cooperative transmission line, which connects to the Bonneville Power Administration's Gardiner substation. There are no existing facilities, but the applicant proposes to route 0.5 mile of the subsea transmission cable and all of the terrestrial section of the transmission line through an existing wastewater discharge pipeline to avoid negatively affecting sensitive intertidal and dune habitat. The location of the proposed project and the existing wastewater discharge pipeline is shown on figure 1.

The project facilities proposed in OPT's license application include ten 150-kilowatt (kW) OPT PowerBuoy wave energy conversion units attached to seabed anchors, tendon lines, subsurface floats, and catenary mooring lines. The PowerBuoy units would be deployed in an array of three rows oriented in a northeast/southwest direction and would occupy about 0.25 square mile of the Pacific Ocean. A plan view of the proposed deployment is shown on figure 2, and a section view and schematic of the buoy anchoring system are shown on figure 3. Each PowerBuoy has a maximum diameter of 36 feet, extends 29.5 feet above water, and has a draft of 115 feet. The PowerBuoys would be located approximately 330 feet apart, and the footprint of the constructed array is expected to be less than 1,000 feet by 1,300 feet, or approximately 30 acres.

Each PowerBuoy would be moored with three anchor lines arranged symmetrically around it. The anchors are expected to be steel-reinforced pre-cured concrete and have dimensions of approximately 32.8 feet in diameter by 24.6 feet in height. They are expected to settle into the sediment and extend above the seabed approximately 18 feet. A total of 16 anchors would be installed.

A power/fiber optic cable would exit the bottom of each PowerBuoy, descending to the seabed in a lazy "S" shape with subsurface floats attached to the cable and a clump weight at the seabed. The football-shaped subsurface floats would be two-piece and clamp onto the power cable at prescribed locations to give the necessary buoyancy to the

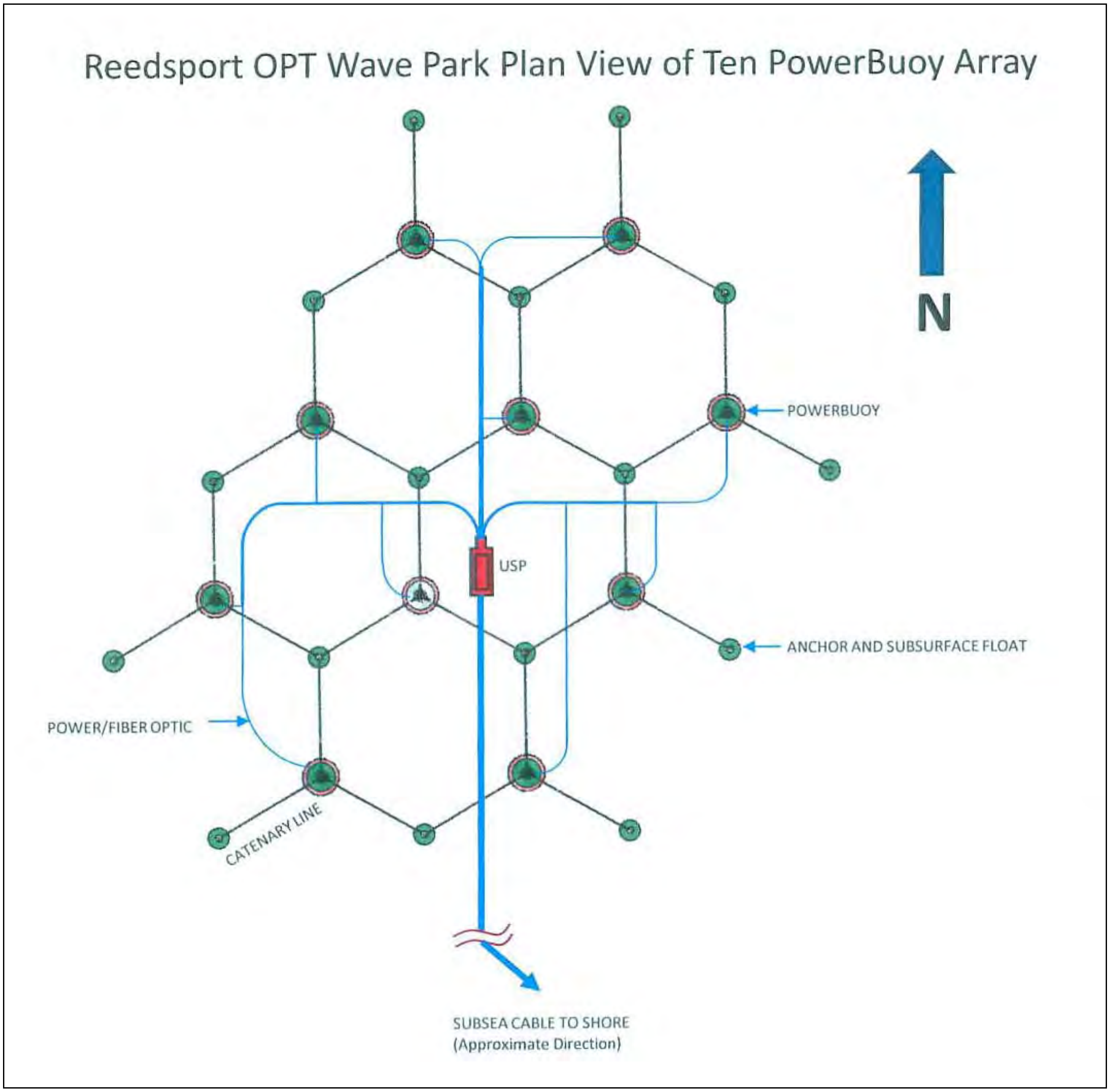

Figure 2. Project facilities—plan view (Source: OPT, 2010).

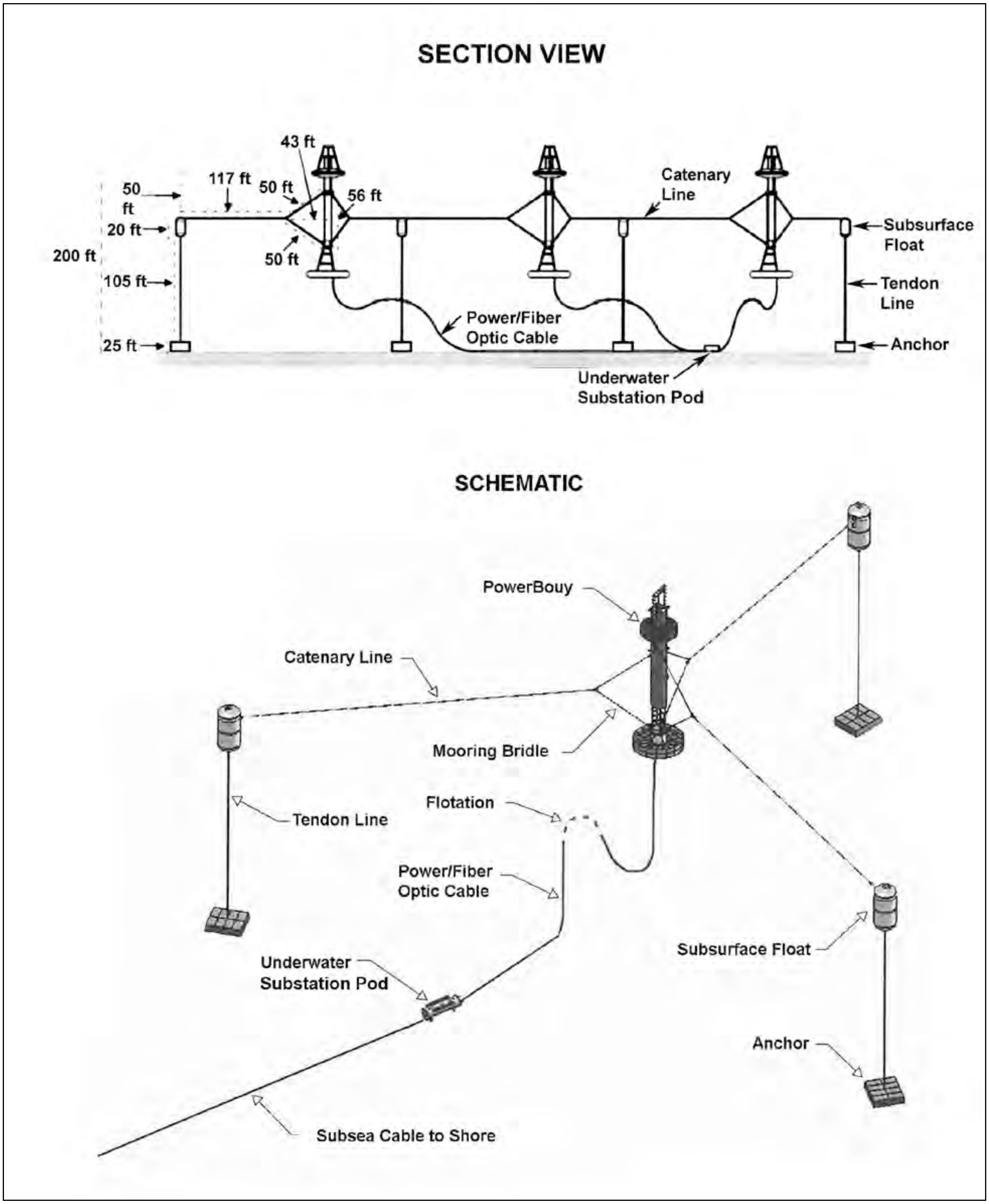

Figure 3. Project facilities—section view and schematic (Source: OPT, 2010).

cable to act as both a strain relief (for the heaving motion of the PowerBuoy) and to keep it off the bottom (prevents cable sweep at the seabed).

The 10 PowerBuoy units would be connected to a single underwater substation pod (USP) via power/fiber-optic lines. The USP would be about 6 feet in diameter and 15 feet in length and would rest on the seabed below the PowerBuoys, held in place with pre-cured concrete ballast blocks. A subsea transmission cable, buried in the seabed to a depth of 3 to 6 feet, would extend from the USP to the existing wastewater discharge pipe. The subsea cable would extend through the wastewater pipeline to an underground vault, which would be constructed at the existing turn-around at the end of Sparrow Park Road, immediately inland of the sand dunes. At the vault, the subsea transmission cable would exit the wastewater pipeline, transition to an underground transmission line, and reenter the wastewater pipeline.

The underground transmission line would continue within the wastewater pipeline eastward for approximately 3 miles, where it would connect to the Douglas Electric Cooperative transmission line at a proposed shore substation. The shore substation would consist of a 100- to 200-square foot building. The pipeline crosses lands owned or managed by a variety of entities including the Forest Service (Oregon Dunes National Recreation Area), Douglas County, International Paper, and private land owners. The shore substation would be located on lands owned by International Paper. The wastewater pipeline originally served a paper mill on this site.

The unit anchors and subsea transmission cable would be located on and buried in the seabed owned by the state of Oregon. The subsea transmission cable would make landfall at the Oregon Dunes Recreation Area, passing under the sand dunes through the wastewater pipeline, within an existing easement. The transmission line would occupy about 5 acres of lands within the Oregon Dunes National Recreation Area,[5] which is part of the Siuslaw National Forest, and is administered by the Forest Service.

2.2.2 Proposed Project Operations

The PowerBuoys would generate power by using the energy potential of the up-and-down motion of the surface waves and using it to cycle hydraulic cylinders. The hydraulic fluid would be pumped through a hydraulic motor. In this way, the reciprocating motion would be converted into rotational motion. In the PowerBuoy, the hydraulic motor would be coupled to a generator that generates alternating current (AC) current smoothed into direct current (DC), and converted back to 60-hertz (Hz) synchronous three-phase power. The AC to DC conversion takes place in each PowerBuoy before exiting and being transmitted to the USP. Ten PowerBuoys would

[5] The linear distance of transmission cable crossing the Oregon Dunes National Recreation Area is approximately 4,332 feet, and the width of the right-of-way is 50 feet.

share one USP. The USP houses switch gear and a transformer, used to increase the voltage to the onshore transmission level before the power is transmitted to shore by means of a subsea transmission cable. The subsea transmission cable would extend to a buried vault located on land. Here, it would transition to an underground transmission line leading to the shore substation, where it would connect via the existing Douglas Electric Cooperative transmission line to the Bonneville Power Administration's Gardiner substation.

OPT proposes to remotely control routine project operations from its operations center. PowerBuoy instrumentation would allow remote monitoring of project systems and functionality in real time. Sensors and control systems would be used to measure and regulate the flow of electricity and to monitor buoy position, hydraulic pressures, and temperatures. In the event of storm conditions, the PowerBuoy would automatically lock up and cease power production. When the wave heights subside to within the normal operating range, the PowerBuoy would unlock and recommence energy conversion and transmission of the electrical power ashore.

OPT's proposed O&M Plan (included in appendix B of the applicant-prepared environmental assessment [APEA]) includes the following activities:

- All aspects of the PowerBuoy array that are visible from the sea surface would be inspected on a monthly basis to check connections, wear conditions, and other visible anomalies.

- Underwater components of the project would be inspected every 2 to 3 months for the first 2 years of operation, and then annually thereafter. This would include inspection for any accumulation of derelict fishing gear on the array.

- The single PowerBuoy to be deployed in Phase I of the project would be retrieved for refurbishment or replacement after 2 years of operation, and all PowerBuoys would be retrieved every 5 years.

- Any unplanned maintenance would be conducted as required, weather and other safety conditions being considered. A site supervisor would be available at the site on short notice

- Reports would be produced after each monthly and annual inspection, and maintenance records would be kept.

2.2.3 Project Safety

OPT proposes to design the mooring system to withstand 100-year storm conditions;[6] tidal variation; and extremes of wind, wave, and current, based upon site-specific meteorological, oceanographic, and geotechnical conditions in accordance with Lloyd's classification standards.[7]

To limit the potential for vessel collisions with project structures and loss of fishing gear, OPT proposes to properly illuminate the PowerBuoys and clearly mark the buoy deployment area on navigation charts. OPT proposes that the buoy deployment area be designated as a No Fishing Zone by the Oregon Fish and Wildlife Commission (Oregon FWC), and as a Restricted Navigation Area, in accordance with U.S. Coast Guard (Coast Guard) regulations. In addition, OPT proposes to implement its Spill Prevention, Control, and Countermeasure (SPCC) Plan to ensure that measures and procedures are in place to respond if a release of hydraulic fluid from a PowerBuoy or of fuel from a ship installing or servicing a buoy were to occur.

OPT proposes to design the transmission system to prevent the potential for fault current entering the ocean in the event of damage to the transmission cable or an internal malfunction in the PowerBuoys or the USP. If electrical leakage were to occur, a computer-controlled fault detection and circuit interruption system would cease exporting electricity from the PowerBuoy, or protective relays in the USP would cause the utility grade breakers to open and stop the flow of electricity. Under these circumstances, the supervisory and fault protection relays are designed to minimize fault current, power down the buoy, and electrically isolate the failed component. Additionally, OPT proposes to armor and bury the subsea transmission cable within the seabed to make it resistant to damage from external sources.

As part of the licensing process, the Commission would review the adequacy of the proposed project facilities. Special articles would be included in any license issued, as appropriate. Commission staff would inspect the licensed project both during and after construction. Inspection during construction would concentrate on adherence to Commission-approved plans and specifications, special license articles relating to construction, and accepted engineering practices and procedures. Operational inspections would focus on the continued safety of the structures, identification of unauthorized modifications, efficiency and safety of operations, compliance with the terms of the license, and proper maintenance.

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[6] Defined as storm conditions that have a 1 percent probability of occurring in any given year.

[7] *Rules and Regulations for the Classification of a Floating Offshore Installation at a Fixed Location*, May 2008.

For the purposes of evaluating potential environmental impact, safety concerns would focus on the potential for vessel collision with project structures, operation of the buoys during a peak meteorological event, the potential severance of the subsea transmission cable, and facility recovery in the event of detachment from its anchor. Each of these items would be a central focus of Commission review prior to construction.

2.2.4 Proposed Environmental Measures

OPT proposes to construct and operate the project with the environmental protection, mitigation, and enhancement measures, as described in the Settlement Agreement and the APEA[8] and listed below. The Settlement Agreement envisions that all measures of the settlement would be included in an original license issued for the project.

Measure	Location
General	
Implement the AMP	Included in sections 3.3, 4.2, 7.5 and exhibit B of the Settlement Agreement
Implement the O&M Plan	Included in appendix B of the APEA, incorporated by reference on page 9 of the Settlement Agreement
Geologic and Soil Resources	
Install the transmission cable through the existing wastewater discharge pipeline to eliminate effects of crossing nearshore, intertidal, and dune habitat	Included in description of the proposed project in various locations in the Settlement Agreement
Install the terrestrial portion of the transmission line within the existing wastewater pipeline to minimize potential visual, cultural, and environmental effects	Included in appendix D of the Settlement Agreement

[8] The APEA (accession no. 20100201-5045) and the Settlement Agreement (accession no. 20100802-5021) are both available on the Commission's web site at http://www.ferc.gov/docs-filing/elibrary.asp.

Measure	Location
Water Resources	
Implement the SPCC Plan	Included in appendix F of the APEA, incorporated by reference on page 9 of the Settlement Agreement
Conduct the Wave, Current, and Sediment Transport Study	Included in appendix A of the Settlement Agreement
Aquatic Resources	
Conduct the Fish and Invertebrates Study	Included in appendix A of the Settlement Agreement
Conduct the Electromagnetic Field (EMF) Study	Included in appendix A of the Settlement Agreement
Marine Mammals, Reptiles, and Birds	
Equip PowerBuoys with devices or materials to prevent pinniped haul-out	Included in descriptions of the proposed project in various locations in the Settlement Agreement
Conduct the Cetacean Study	Included in appendix A of the Settlement Agreement
Conduct the Pinniped Study	Included in appendix A of the Settlement Agreement
Conduct the Offshore Avian Use Study	Included in appendix A of the Settlement Agreement
Light PowerBuoys in accordance with Coast Guard regulations with consideration of protection for offshore birds and recreational and commercial fishing vessels	Included in appendix B of the Settlement Agreement
Recreation, Ocean Use, and Land Use	
Implement the Emergency Response and Recovery Plan	Included in appendix I of the APEA, incorporated by reference on page 9 of the Settlement Agreement
Implement the Crabbing and Fishing Plan, including the marine use/public information plan	Included in appendix C of the Settlement Agreement
Bury the subsea transmission cable to minimize hazards to navigation and fishing	Included in descriptions of the proposed project in various locations in the Settlement Agreement

Measure	Location
Locate subsurface floats (underwater mooring floats) at depths of 30 to 50 feet to avoid potential vessel strike	Included in appendix C of the Settlement Agreement
Develop and implement an interpretive and education plan (including design and installation of interpretive displays on shore)	Included in appendix B of the Settlement Agreement
Aesthetic Resources	
Conduct a visual assessment review from the beach, from the top of a dune near the beach, and from the Umpqua lighthouse following installation of the single PowerBuoy to be deployed in Phase I of the project	Included in appendix B of the Settlement Agreement
Cultural Resources	
Implement the Terrestrial and Cultural Resources Plan	Included in appendix D of the Settlement Agreement

2.2.5 Modifications to Applicant's Proposal—Mandatory Conditions

Section 4(e) Land Management Conditions

The four conditions filed by the Forest Service under section 4(e) are as follows: conditions 1, 3, and 4 are standard conditions that specify Forest Service approval of final project design and project changes, application of indemnification and "hold harmless" provisions, and reservation of the Forest Service's right to modify conditions. Condition 2 specifies preparation of a restoration plan for National Forest System lands approved by the Forest Service (see appendix A).

2.3 STAFF ALTERNATIVE

After evaluating OPT's proposal and recommendations from resource agencies and other interested parties, we compiled a set of environmental measures that we consider appropriate for addressing the resource issues raised in this proceeding, calling this the staff alternative. The staff alternative includes all of the measures included in OPT's proposal and in the Forest Service's section 4(e) conditions, with modifications based on section 10(j) recommendations, and section 10(a) recommendations, and measures developed by Commission staff.

Based on our environmental analysis of OPT's proposal discussed in section 3 and the costs discussed in section 4, we modify some of the environmental measures proposed by OPT. Our recommended modifications to OPT's proposed measures are shown in *italic*.

General

- Implement the AMP (included in exhibit B of the Settlement Agreement). *We modify this measure to require that results from monitoring of EMF and acoustic emissions from the single PowerBuoy be reviewed to assess the need for project modifications to address any unanticipated adverse effects before additional PowerBuoys are installed. We recommend that OPT be required to file the monitoring results and any proposed project modifications for Commission approval.*

- Implement the O&M Plan (included in appendix B of the APEA, incorporated by reference on page 9 of the Settlement Agreement). *We modify this measure to require that underwater inspections for derelict fishing gear entangled on underwater project components be conducted every month, weather and ocean conditions permitting, for the first year after deployment of the 10-buoy array.*

Water Resources

- Implement the SPCC Plan (included in appendix F of the APEA, incorporated by reference on page 9 of the Settlement Agreement). *We modify this measure to require OPT to file an addendum to the SPCC that identifies any fluids that would be used in the USP and identifies monitoring provisions that would be used to detect leakage of any fluids from the USP that could cause adverse environmental effects*.

Marine Mammals, Reptiles, and Birds

- Implement OPT's proposed protocols for reporting marine mammal injury (included in appendix A of the Settlement Agreement). *We modify this measure to include implementing the same protocol for marine turtles*.

Recreation, Ocean Use, and Land Use

- Develop and implement a Crabbing and Fishing Plan (included in appendix A of the Settlement Agreement). *We modify this measure to require that OPT consult with Oregon DFW, Southern Oregon Ocean Resource Coalition (SOORC), and the Crabbing and Fishing Committee to complete the following elements of the plan and file them with the Commission for approval:*

  1. *Methods to minimize the potential for loss of fishing gear and a protocol to recover or provide mitigation for fishing gear that becomes entangled in the PowerBuoy array.*

  2. *Procedures for initiating a transport moratorium*[9] *during the first 8 weeks of the Dungeness crab season.*

  3. *Establishment of a pre-determined transit lane from the port to the PowerBuoy array for project-related vessels during construction and normal maintenance and a plan for providing a 2-week notice of PowerBuoy transport associated with scheduled maintenance.*

  4. *A plan and schedule for the process that would be followed to obtain designation of the project area as a Restricted Navigation Area by the Coast Guard, and as a No Fishing Area by Oregon FWC, to include filing a report on the outcome of the process prior to the start of project construction.*

  5. *A marine use/public information plan to inform commercial and recreational users of the changes in use designation and to provide information about location, hazards, and how to manage a vessel that inadvertently enters the PowerBuoy array area.*

Cultural Resources

- Implement the Terrestrial and Cultural Resource Plan (appendix D of the Settlement Agreement), including a Cultural Resources Survey, Monitoring, and Contingency Mitigation Plan consistent with the Memorandum of Understanding (MOU) signed with CTCLUSI and in consultation with the CTCLUSI and the Oregon SHPO. *We modify this measure to require that: (1) OPT would consult with the Oregon SHPO and the CTLUSI if additional ground-disturbing activities are proposed over the license term; (2) in the*

[9] Defined by OPT as a period in which no PowerBuoys would be moved outside of the project area.

event that human remains or cultural resources are inadvertently discovered during the course of project construction or over the license term, all land-clearing and land-disturbing activities in the vicinity of the discoveries would cease and OPT would consult with the Oregon SHPO and the CTCLUSI to determine appropriate actions; and (3) OPT would consult with Oregon DFW and FWS if new information indicates any potential effects on terrestrial wildlife, plants, or their habitats as affected by project features, and any measures that are needed to address these effects would be submitted for Commission approval.

Additional Measures Recommended by Staff

In addition to OPT's proposed measures listed above, we recommend including the following staff-recommended measure in any license issued for the Reedsport Project:

- *Require OPT to consult with the Aquatic Resources and Water Quality Implementation Committee concerning the use of any materials, not originally listed in the license application or Settlement Agreement, that could cause harmful effects to fish, wildlife or the environment if released into the environment.*

- *Require that any closures of Sparrow Park Road during project construction be scheduled to occur outside of the summer recreation season, any road closures occur only during weekday work hours, and the public be notified in advance of any road closures.*

3.0 ENVIRONMENTAL ANALYSIS

In this section, we present: (1) a general description of the project vicinity; (2) an explanation of the scope of our cumulative effects analysis; and (3) our analysis of the proposed action and other recommended environmental measures. Sections are organized by resource area. Under each resource area, historic and current conditions are first described. The existing condition is the baseline against which the environmental effects of the proposed action and alternatives are compared, including an assessment of the effects of proposed mitigation, protection, and enhancement measures, and any potential cumulative effects of the proposed action and alternatives. Staff conclusions and recommended measures are discussed in section 5.2, *Comprehensive Development and Recommended Alternative*.[10]

3.1 GENERAL DESCRIPTION OF THE PROJECT AREA

The Oregon Coast is a high wave-energy, dynamic environment. The state's beaches and immediate coastal areas typically have mild temperatures; mean summer temperatures are typically in the low 60s (degrees Fahrenheit °F) and mean winter temperatures are typically in the low 40s (°F). Average annual precipitation is 75 to 90 inches. Strong winds strike typically in advance of winter storms and can exceed hurricane force. Winter weather, which is typically wet, is generally influenced by counterclockwise-rotating low-pressure systems that cross the North Pacific, resulting in frontal cyclonic storms characterized by heavy rains and high south to southwesterly winds. Summers are relatively dry and fair, with mild north-northwesterly winds, and frequent strong afternoon breezes and coastal fog.

From the offshore PowerBuoys to the grid interconnection, the project crosses marine, terrestrial, and wetland systems, including soft-bottom subtidal habitats, pelagic habitats, sandy beaches and dunes, estuarine wetlands, palustrine wetlands, riverine (riparian) wetlands, mixed coniferous-deciduous forests, and developed/industrial areas.

The terrestrial portions of the project area are within the south-central portion of the Oregon Coast Range Ecoregion. This ecoregion includes the Oregon Coast Range from the Columbia River to the border with California and east to the edge of the Willamette Valley. As described by the Oregon Gap Analysis Project (Kagan et al., 1999):

> *The Coast Range Ecoregion includes the entire Oregon coastline and the northern and central Oregon Coast Range Mountains, and extends*

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[10] Unless otherwise indicated, our information is taken from the application for license for this project (OPT, 2010) and additional information filed by OPT on May 18, 2010.

north though the state of Washington to southwestern British Columbia on Vancouver Island, and south into California. Elevations in the Oregon Coast Range Ecoregion range from sea level to 4,000 feet, and the marine climate creates the most moderate and wettest habitats in the state. Average annual precipitation of 60 to 180 inches supports spectacular stands of temperate rainforests. Vegetation is characterized by forests of Sitka spruce, western hemlock, Douglas fir, and red alder.

The Oregon Coast has other unique ecological features. Sand deposits from coastal streams and rivers (primarily the Umpqua and Columbia Rivers) have created major coastal dune systems, the largest located at the Oregon Dunes National Recreation Area. In the north coast, steep headlands and cliffs are separated by stretches of flat coastal plain and large estuaries. The south coast includes the warmest areas, with rugged headlands and very mild winters, supporting local endemic species such as the coast redwood and Port Orford cedar.

Almost 40 percent of the region is in public ownership, primarily in National Forest and State Forest lands. Population is dispersed in many small towns, most located within a few miles of the ocean. Forest products, tourism and fisheries are the mainstays of the local economy. The Coast Range Ecoregion includes all of Oregon's coastal resources, including all of the intertidal, marine and estuarine habitats.

3.2 SCOPE OF CUMULATIVE EFFECTS ANALYSIS

According to the Council on Environmental Quality's regulations for implementing National Environmental Policy Act (40 CFR §1508.7), a cumulative effect is the impact on the environment that 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 actions. Cumulative effects can result from individually minor but collectively significant actions taking place over time, including hydropower and other land and water development activities.

Based on information in the license application, agency comments, other filings related to the project, and our independent analysis, we have identified shoreline sediment transport processes, marine life, birds, recreation, and commercial fishing/crabbing as resources having the potential to be cumulatively affected by the proposed Reedsport Project in combination with other activities in the proposed project area.

3.2.1 Geographic Scope

The geographic scope of the analysis for cumulatively affected resources is defined by the physical limits or boundaries of: (1) the proposed action's effects on the resources, and (2) contributing effects from other projects or activities. Based on the nature and location of the Reedsport Project, as well as the interests of the participants in this licensing process, the general geographic scope for the cumulatively affected resources encompasses the Oregon State territorial waters from the shoreline of the Oregon Pacific Coast to the 3-nautical mile boundary. However, because the proposed action would affect resources differently, the geographic scope for each resource may vary. For example, the geographic scope of cumulative effects analysis for the gray whale and loggerhead turtle extends from Alaska to Baja, Mexico, and the geographic scope of the analysis for salmon and green sturgeon includes the full migratory range of the stocks that may be affected by the project.

3.2.2 Temporal Scope

The temporal scope of analysis includes a discussion of the past, present, and future actions and their effects on sediment transport processes, marine life, birds, recreation, and commercial fishing/crabbing. Based on the potential term of a license, the temporal scope looks 30 to 50 years into the future, concentrating on the effect of reasonably foreseeable future actions. The historical discussion is limited, by necessity, to the amount of available information for each resource. We identified the present resource conditions based on the license application, agency comments on the draft license application, and comprehensive plans.

Other than dredging disposal sites, fiber optic cables, and marine reserves (discussed in section 3.3.3), we have not identified any other past, present, or reasonably foreseeable future actions that would interact with the proposed Reedsport Project to cumulatively affect sediment transport, marine life, offshore birds, recreation, and commercial fishing/crabbing.

3.3 PROPOSED ACTION AND ACTION ALTERNATIVES

In this section, we discuss the effect of the project alternatives on environmental resources. For each resource, we first describe the affected environment, which is the existing condition and baseline against which we measure effects. We then discuss and analyze the specific site-specific and cumulative environmental issues. We present our recommendations in section 5.2, *Comprehensive Development and Recommended Alternative.*

3.3.1 Geologic and Soil Resources

3.3.1.1 Affected Environment

Regional Geology

The Oregon Coast is part of a relatively narrow continental margin where three tectonic plates converge: the Juan de Fuca plate, the smaller Gorda plate, and the North American Plate. The Oregon coastal strip is continuously mountainous and consists of Tertiary sedimentary and volcanic rocks.

The Oregon sand dunes are the largest expanse of coastal dunes in North America. The dunes occupy approximately 140 of the 310 miles of Oregon's Coast. The region where dunes are the largest, most diverse, and most abundant is designated as the Oregon Dunes National Recreation Area, a division of the Siuslaw National Forest. This section of dunes spans a distance of approximately 55 miles from Florence to Coos Bay. Formed since the last Ice Age, these Holocene sand dunes in this region reach heights of 500 feet above sea level and extend as far as 2.5 miles inland. The source sand is continuously replenished by ocean currents. Dunes along the Oregon Coast are constantly reshaped and moved with seasonally changing coastal winds, blowing sand inland.

Marine Geology

OPT conducted a geological survey of the 800-meter-by-800-meter PowerBuoy array site and of a 200-meter-wide corridor centered on the subsea cable route from the seaward end of the wastewater pipeline outfall to the array site. The seabed in the project area is generally flat and featureless, with depths ranging from 165 to 225 feet at the array area. Surface sediments in the project area and cable corridor consist uniformly of fine sand, based on 15 grab samples collected by OPT at water depths ranging from 87 to 162 feet. The sand was dark brown to black in color; grain sizes ranged from 0.17 to 0.19 millimeters (mm). There are no rocky outcroppings or ledges. The layer of sand in the substrate has a thickness of at least 65 feet (the penetration depth limit of the sub-bottom profiler used in the survey). The towed video camera survey did not reveal any flora or fauna on the seabed in the proposed PowerBuoy array area or subsea transmission corridor, although the visibility was low. A system of multiple submerged bars in the surf zone, as well as a subtidal bar 500 m offshore from the beach parallel to the shore were observed in the summer of 2009 (OSU and Oregon DOGAMI, 2009). These bars appear to be highly variable. The wastewater pipeline, which consists of a concrete-encased steel pipe that extends approximately 0.5 mile from shore, was the only feature detected in the substrate. The pipeline is covered by approximately 2 to 3 feet of sand.

Terrestrial Geology

The coastal area at the landfall consists of Quaternary dunes, which are part of the Oregon Dunes National Recreation Area. These dunes are largely protected from wind and erosion by vegetation, although coastal forest "blowouts" have occurred near the project area. This land type is a transition from a coastal ecosystem to a terrestrial ecosystem. Approximately 0.2 mile inland, the geology transitions to the Tyee Formation from the Cenozoic/Tertiary period, which extends to the Douglas Electric Cooperative grid connection. The Tyee Formation is characterized by thick, rhythmic sequences of sandstone and siltstone. Surface soils consist of sandy and silty loam.

The northern shoreline of the sharp bend in the Umpqua River near the underground transmission line has a steep slope (approximately 28 degrees or greater). The slopes near the grid interconnection and just inland of the dunes have been characterized as "high" landslide potential for a distance of approximately 0.75 mile along the alignment.

3.3.1.2 Environmental Effects

Potential effects of the project on geology and soils are related to the deployment and decommissioning of the anchors and subsea transmission cable, shoreline changes due to dampening of waves and altered sediment transport, and construction of the underground terrestrial transmission line.

Installation of Anchors and Subsea Transmission Cable

As described in section 2.2.1, *Project Facilities*, the proposed project would involve the installation of 10 OPT PowerBuoys attached to seabed anchors, tendon lines, subsurface floats, and catenary mooring lines. The 10 PowerBuoy units would be connected to the USP via power/fiber-optic lines. A subsea transmission cable, buried in the seabed to a depth of 3 to 6 feet, would extend from the USP to terminus of an existing wastewater discharge pipe, about 0.5 mile offshore. Installation of the anchors, USP, and subsea transmission cable has the potential to cause localized increases in turbidity during construction.

The subsea transmission cable would be trenched from the USP to the outlet of the wastewater discharge pipe, a distance of about 2.3 statute miles[11] (the wastewater pipe opening is located about 0.5 statute miles from shore). The cable would be installed at a minimum depth of approximately 3 to 6 feet below the sea floor according to conventional trenching or jet plowing methods, to be selected by the cable deploying

[11] A statute mile is 5,280 feet (1,609 meters), as opposed to a nautical mile of 6,076 feet (1,852 meters).

contractor. Conventional trenching would involve an ocean vessel pulling an underwater plow that continuously cuts a trench and places the cable into the trench.

Our Analysis

Trenching associated with the deployment of the cable would temporarily displace sand along the cable route. Part of the sediment would be placed back in the trench to cover the cable. Another portion would be dispersed by currents and resettle onto the seabed. The redeposited layer of sediment is expected to be thin beyond the immediate vicinity of the trench. Also, there would be localized sediment resuspension from anchors and cable sweep during the installation of the PowerBuoys and transmission cable. Effects on the seabed are considered to be short term. Potential effects on local marine life living on or in the seabed are discussed in section 3.3.3, *Aquatic Resources*.

Waves, Current, and Sediment Transport

Because PowerBuoys extract and absorb power from passing waves, the project could affect shoreline erosion and accretion at the beach. Depending on the size and other characteristics of the array, an array of PowerBuoys could cause changes in wave height and direction in its lee. These variations could persist shoreward to the outer edge of the surf zone and could affect nearshore currents, potentially resulting in changes to the stability and configuration of the beach (i.e., erosion or accretion), nearshore aquatic habitat, and surfing conditions.

To address stakeholder concerns about these potential effects, OPT proposes to conduct a wave, current, and sediment transport monitoring program. OPT consulted with Dr. Ozkan-Haller and other staff from the Oregon State University during development of the monitoring plan (OSU and Oregon DOGAMI, 2009).

Our Analysis

The PowerBuoys that would be installed at the Reedsport Project have a float diameter of 36 feet and would be placed approximately 330 feet apart. Based on a Fresnel analysis (a numerical model) of the PowerBuoy array at these dimensions, OPT estimated attenuation of wave amplitude to be about 12 percent behind the PowerBuoys and a worst-case (maximum) instantaneous attenuation of wave amplitude at the beach of 2.1 percent. This estimate assumes monochromatic waves, which would be worst-case, and a directional wave spreading factor of 0.95. Initial preliminary modeling for an array of five wave energy converters suggests a 15 percent decrease in wave height is possible immediately in the lee of the array (OSU and Oregon DOGAMI, 2009). Closer to shore the decrease diminishes to only about 3 percent due to diffusion. These findings are consistent with the independent analysis by the Surfrider Foundation (Surfrider) that was provided at a February 5, 2007, Oregon Solutions Recreation/Public safety meeting. Surfrider predicted an attenuation of less than 15 percent given the current level of wave energy conversion technology and the density and placement of the proposed PowerBuoys. In a letter to OPT dated February 5, 2007, Surfrider stated that it expects the proposed project to cause very little wave reduction at Winchester Bay, a premier surf spot located 1.5 miles south of Reedsport.

The shoreline along the high-energy coast of Oregon is episodically shaped by large waves and high water levels associated with major storms. As described by Allen et al. (2002), shoreline changes are highly variable both spatially and temporally, and beaches are undergoing periods of rapid episodic erosion, followed by intervening years to decades of rebuilding of beaches and dunes. Given the dynamic nature of the Pacific Ocean off Oregon, combined with the small size and distance of the 10-PowerBuoy array from shore, we expect that any dampening of wave energy or ocean currents and associated changes in erosion or accretion of the shoreline resulting from the PowerBuoy array would not be discernable.

OPT's proposed wave, current, and sediment transport monitoring program would address the remaining uncertainty surrounding the magnitude of the effects of the PowerBuoys on wave energy, ocean currents, and associated erosion or accretion of the shoreline, effects on nearshore aquatic habitat, and surfing conditions. Specifically, the monitoring program focuses on (1) identifying the near-field effects of the PowerBuoys, and (2) monitoring the bathymetry, shoreline contour, and water column properties to capture anomalous nearshore effects. The monitoring program would include the following components:

- *In-situ observations*: Metrics would include wave height, wave direction, and vertical structure of currents, temperature, and salinity both seaward and shoreward of the PowerBuoys.

- *X-band radar observations*: Observations would produce estimates of wave speed and wave direction over an area with a radius of 2 to 3 kilometers.

- *Video observations*: Video observations would produce time-exposure images of the submerged topography. Variance images would give an indication of the presence of any rip currents before and after buoy installation.

- *Beach monitoring:* Metrics would be based on shoreline position as a function of time. Development of potential rip embayments could be monitored.

- *Numerical modeling:* Metrics would include wave height and direction in the lee of the buoy deployment area, percent-change in wave height at the outer edge of the surf zone, and any associated changes in surf zone circulation.

The monitoring program would include relevant observations on spatial changes over time of the coastal environment. Due to the small scale of the proposed installation and the substantial distance offshore that the PowerBuoys would be deployed, we consider it unlikely that substantial nearshore effects would occur. However, in the event that substantial effects from changes in waves and currents are observed, further evaluation of effects on shoreline processes could be developed through the proposed AMP.

Onshore Transmission Line

OPT proposes to use a pull line to run the subsea transmission cable through the existing wastewater pipeline from the outfall to the proposed underground vault just inland of the dunes at the turn-around located at the end of Sparrow Park Road. The onshore portion of the transmission line would be contained within the wastewater pipeline and would run the length of the pipeline, emerging 3 miles inland to connect with the existing Douglas Electric Cooperative transmission line. A small shore substation would be constructed close to the interconnection point with the Douglas Electric Cooperative transmission line. The existing roads would be used for access along the pipeline, so no temporary access roads would be constructed for installation of the project.

Our Analysis

Installation of the subsea cable and transmission line through the wastewater pipeline would not require any vehicle access over unroaded areas and, as a result, should not result in any erosion or compaction of soil or wastewater disturbance to the beach and dune areas. Similarly, erosion is not expected during the construction of the proposed buried vault or the shore substation, provided that standard best management practices are employed.

3.3.1.3 Cumulative Effects

The Reedsport Project is expected to have very little effect on sediment transport due to its small scale and its substantial distance from shore. In addition, sediment transport would not be cumulatively affected by the proposed Reedsport Project because we have not identified any reasonably foreseeable actions, including other wave energy projects, that could affect sediment transport.

3.3.2 Water Resources

3.3.2.1 Affected Environment

Water Quality

The project is located within the territorial limits of the state of Oregon and falls under the water quality standards outlined in the Oregon Administrative Rules (OAR)

340 41. Relevant rules applicable to the project consist of the following: (1) support aquatic species without detrimental changes in the resident biological communities; (2) prevent a reduction in ambient dissolved oxygen concentrations; (3) maintain pH between 7.0 and 8.5; (4) prevent water temperature increases that adversely affect fish or other aquatic species; and (5) prevent the introduction of toxic substances above natural background levels in amounts, concentrations, or combinations that may be harmful to aquatic life, public health, or other designated beneficial uses. The designated beneficial uses for marine waters adjacent to the Mid-Coast and Umpqua River basins (which contain the project area) are industrial water supply, fish and aquatic life, wildlife and hunting, fishing, boating, water contact recreation, aesthetic quality, commercial navigation, and transportation.

The OAR also include 16 statewide narrative criteria for water quality, which include the following conditions relevant for this project: (1) creation of tastes or odors or toxic or other conditions deleterious to aquatic life or affecting the potability of drinking water or the potability of fish or shellfish; (2) formation of appreciable bottom or sludge deposits or the formation of any organic or inorganic deposits deleterious to aquatic life or injurious to public health, recreation, or industry; (3) objectionable discoloration, scum, oily sheens, or floating solids, or coating of aquatic life with oil films; and (4) aesthetic conditions offensive to human senses of sight, taste, smell, or touch.

Water quality data are available from two stations in the vicinity of the project, located approximately 0.8 mile southwest and 10.5 miles northwest of the PowerBuoy array, respectively. Sampling at these stations was conducted in 2003 by Oregon Department of Environmental Quality (Oregon DEQ) at a variety of depths in the water column. Samples were analyzed for nutrients, pigments, pH, nitrate/nitrite, total copper, total organic carbon, and total suspended solids. The pH values were around 8. Copper was not detected. The concentrations of all other components were low, as can be expected in this open ocean setting.

Wave Characteristics

Ocean waves arriving at the project area are generated by distant storms and by local winds. Distant storms produce waves that arrive at the coast uniform in height, period, and direction. Local winds produce seas containing a mixture of wave height, periods, and directions. Generally, local seas have higher waves and shorter periods than incoming swells from distant storms. The Electric Power Research Institute (EPRI) reported that the nearest wave data monitoring to the project site is the Coquille River Station (CDIP 0037) data buoy, located at a depth of 210 feet about 70 miles southwest of the project site (EPRI, 2004a, as cited by OPT). From results of the 12 years of available data (1984 to 1996), the average annual wave power at the data buoy was 21 kW per meter, ranging from about 6 kW per meter to 41 kW per meter (figure 4). The largest single-wave event for this period was estimated to be 49.2 feet (15 meters), and the median height (trough to crest) of the one-third highest waves for a 12-hour period averaged over the 12-year data set was 25.6 feet. The smallest waves occur in summer; the largest waves occur in winter.

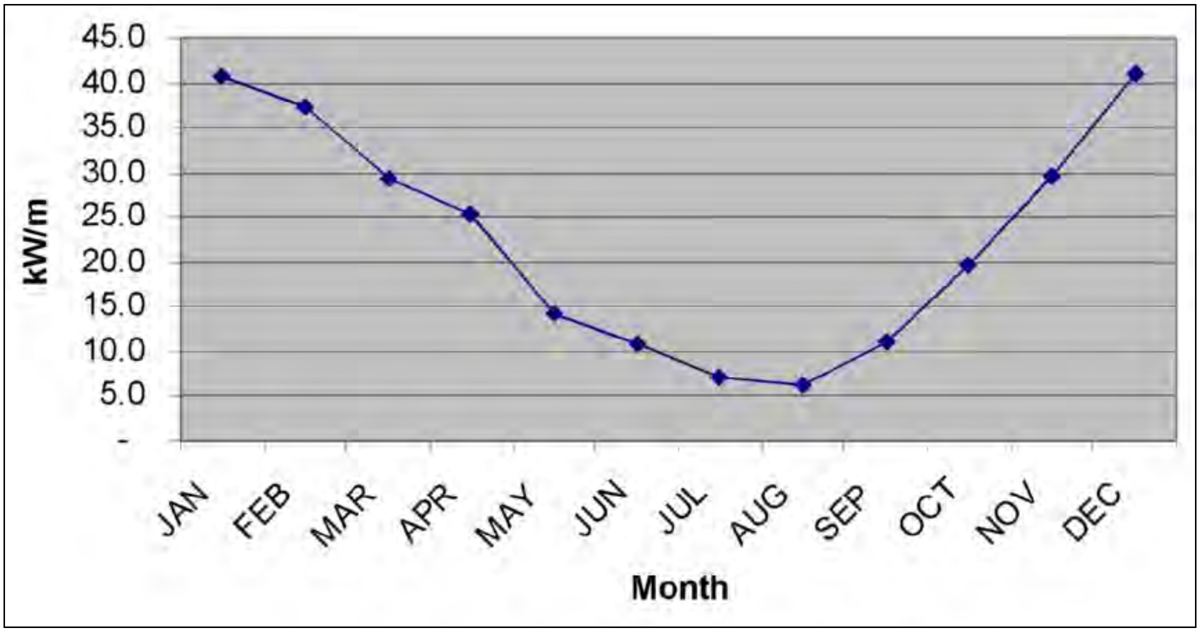

Figure 4. Monthly average wave power generated at the Coquille River Station (CDIP 0037) data buoy (Source: EPRI, 2004a, as cited by OPT).

Overall, the wave climate in Oregon is dominated by swells approaching from a southwesterly direction and more moderate waves approaching from a westerly or northwesterly direction (OSU and Oregon DOGAMI, 2009). Larger waves, approaching the OPT location at a high angle from the south, are affected by Cape Blanco. This cape causes a shadow effect reducing the wave height at the OPT site.

Wind and Currents

Winds along the Oregon Coast help to drive ocean currents and strong waves. During the winter, strong low pressure systems generate winds predominantly from the south and southwest. During the summer, high pressure systems generate predominant winds from the north. In both seasons, there are short-term fluctuations related to local systems. Wind direction and strength drive upwelling of deeper water and thereby biological production in the surface waters. Typically southward, upwelling winds occur in the spring and summer and northward, downwelling winds occur in the late fall and winter. As a result of upwelling, the nearshore waters are cooler than the offshore waters. During winter, the pattern is reversed and warm water moves nearshore, warming the inshore water 5°F more than the offshore water.

3.3.2.2 Environmental Effects

Installation and operation of the project is not expected to influence dissolved oxygen concentrations, pH, or temperature of the surrounding water. Potential environmental effects on water quality from the construction and operation of the facility include the following: (1) effects of anchor and cable installation, including sediment re-suspension on turbidity (this was discussed in section 3.3.1.2, *Geologic and Soil Resources*); (2) effects of spills of hydraulic oil from the structures; (3) effects of spills of fuel or lubricants from vessels used during installation and maintenance; (4) effects of antifouling paint or coatings; and (5) effects of aquatic growths on mooring lines, including potential anoxic episodes when growths are dislodged and decompose. Potential effects on wave height, currents, and sediment transport are discussed in section 3.3.1.2.

Effects of Spills of Hydraulic Oil from the Structures

Each PowerBuoy would contain 198 to 264 gallons of hydraulic fluid. The fluid would be contained within a hydraulic system that would be fully contained within the steel PowerBuoy structure. The spar would act as a secondary containment system capable of holding more than 110 percent of the fluid in the hydraulic system. No hydraulic components would be located external to the PowerBuoy; the design does not have any hydraulic seals exposed directly to the ocean. Additionally, each seal would be backed up with an end cap that would capture any fluid leakage. Hydraulic fluid pressure and volume would be monitored by the PowerBuoy computer and available via radio and fiber optic link. In the event that any fluid leaks at this end cap, or any other place in the hydraulic circuit, it would be contained inside the PowerBuoy spar. Sensors inside the bottom of the spar would measure the quantity of leaked fluid and would trigger an alarm, alerting OPT and initiating the SPCC protocol. SPCC Plans are required by Coast Guard regulations for facilities having the potential to spill oil into a navigable waterway or a stream/river leading to a navigable waterway.

A vessel strike on a PowerBuoy was identified as a concern with regard to a scenario under which hydraulic fluids could be released from a PowerBuoy. A vessel strike of a PowerBuoy would first impact the PowerBuoy's float, which is passive and does not contain any hydraulic fluid. If the strike were a large impact, and for some reason, it did reach the spar (which is over 13 feet from the float edge) and damaged it, there would only be a small chance that the hydraulic system would be affected as it is protected by the steel structure of the spar.

In a catastrophic failure, the hydraulic fluid would be released into the ocean. Dispersal of the fluid could have immediate effects on offshore birds and minor effects on marine mammals. The working fluid proposed for the PowerBuoy's power generating system is Shell Tellus Oils T, which is formulated to maintain viscosity over a range of temperatures and chemical stability in the presence of moisture. According to the Material Safety Data Sheet prepared by Shell, the fluid floats on water and is poorly soluble. Major constituents are expected to be inherently biodegradable, but the product contains components that may persist in the environment. After a catastrophic failure, the drifting or grounded buoy would most likely be recovered and brought to shore.

Interior, NMFS, and Oregon DFW recommend that OPT consult with the Aquatics Resources and Water Quality Implementation Committee concerning any materials that were not listed in the license application or Settlement Agreement are used that could cause harmful effects to fish or wildlife if they are released into the environment.

Our Analysis

The PowerBuoy would be designed to minimize the potential for leaks of hydraulic fluid. In addition, the volume of fluid used in each PowerBuoy is relatively small. Therefore, the potential effect of the hydraulic fluid used in the PowerBuoy on marine mammals and birds is expected to be small. In addition, when implemented, the SPCC for this project should be adequate to respond in the event of a release of hydraulic fluid. Consulting with the Aquatics Resources and Water Quality Implementation Committee concerning the use of any potentially harmful materials would further reduce the potential for adverse effects.

OPT did not identify any potentially harmful fluids that would be used in the USP, or any methods for detecting any leaks from the USP that could occur as a result of corrosion and cracks in the structure. Although its location on the seabed limits the potential for physical strikes by ships or other objects, identifying any harmful fluids and methods to detect leaks, if present, would reduce the potential for the release of harmful fluids into the environment.

Spills during Installation

During the installation of the project, a number of vessels, including tugs, barges, cranes, and workboats, would be employed. Each of these vessels contains fuel, hydraulic fluid, and potentially other hazardous materials. Stakeholders have raised a concern about the potential for spills of such materials while these vessels are being employed. OPT plans to hire licensed and insured marine construction contractors that would be required to have spill response plans.

Our Analysis

The installation of the arrays and cabling would not require handling project-related fluids at sea, such as the hydraulic fluid for the PowerBuoys. Therefore, the potential for spills would only be associated with the typical operation of the respective vessels. The use of licensed, insured operators with their own spill response plan, in combination with the SPCC Plan for this project, should minimize the potential for of spills during installation.

Effects of Antifouling Paint or Coatings

Species that colonize underwater surfaces, such as spores, barnacles and algae, present a challenge to marine underwater structures and ships. The natural adhesive "biological glue" these organisms use to adhere to surfaces can lead to corrosion. Extensive colonization can also increase the roughness of the surface. Biofouling can result in extensive efforts being required to remove and repair colonized structures.

OPT plans to coat the PowerBuoy floats and spars and subsurface floats with Ameron's "ABC3 Antifouling" paint to reduce biofouling. "ABC3 Antifouling" is a self-polishing organotin-free (lower toxicity) antifoulant coating specifically designed for use in the marine environment. The Company may also use SigmaGlide paint on the SSFs. SigmaGlide is made by SigmaKalon Marine and Protective Coatings BV. SigmaGlide is biocide-free, and its high solids content (low volatile organic content) and long service life contribute to low solvent emissions. However, algal and invertebrate species are still expected to recruit to and colonize hard surfaces associated with the PowerBuoys and mooring gear.

OPT would conduct water quality monitoring during construction and project operation. OPT would monitor the seabed for accumulation of biofouling debris every 3 to 4 months during the first 2 years, and annually thereafter. In the event that a build-up of biofouling debris is seen to occur, OPT would consult with the Aquatics Resources and Water Quality Implementation Committee to determine an appropriate course of action.

Our Analysis

Antifouling marine paints time-release (leach) toxins into the proximal area of the structure over time. Antifouling paint is toxic to a variety of aquatic organisms, and stakeholders have raised a concern that antifouling leachate may negatively affect the environment. However, the presence of strong currents in the project area is expected to prevent such elevated concentrations of toxins. Based on OPT's calculation of the release rate of toxins and the surface area of all array structures coated with antifouling paint, the concentration within the project boundary would be well below the water quality criteria for copper by the State of Oregon, and the impact on water quality from antifouling paint is expected to not be detectable.

Paint sloughing or chipping off of the structures due to aging or abrasion could result in a localized accumulation of toxins in the sediments on the seafloor, potentially affecting marine benthic organisms. Such accumulation can be limited by adequate maintenance of the structures. OPT's planned monitoring of the sediments for any debris build-up underneath the PowerBuoys would help to detect any accumulation of toxins that approach levels that could have an adverse effect, which would allow any needed corrective actions to be evaluated through the AMP.

Aquatic Growth on Mooring Lines

The project would include approximately 12 miles of synthetic mooring lines. Mooring lines would attract some growth of aquatic organisms. The movement of these lines would eventually dislodge some of this growth, which would then settle on the seafloor. Concerns were raised that this growth might potentially result in localized anoxic conditions on the seafloor.

Our Analysis

The buildup of organic growth on mooring lines would be limited as a result of the constant motion of these lines. In addition, fragments that fall off and settle to the seafloor are expected to be too small for localized anoxic conditions to occur, given the dynamic nature of the ocean floor with constant flushing.

3.3.2.3 Cumulative Effects

Although the concentration of copper would be slightly higher in the water column, it is expected to still be well below water quality criteria. Cumulative effects on marine life from the leachate of antifouling paint are not expected because we have not identified any past, present, and reasonably foreseeable actions that would interact with such effects of the proposed project.

3.3.3 Aquatic Resources

3.3.3.1 Affected Environment

In the following section, we provide a brief overview of the coastal habitat and aquatic organisms that could potentially be affected by the construction and operation of the proposed Reedsport Project.

Oregon Coastal Habitat

The Oregon coastline and marine waters can be generally divided into five megahabitat types (Oregon DFW, 2006): rocky shore, sandy beach, rocky subtidal, soft bottom subtidal, and pelagic. The results of OPT's Marine Geophysical Survey completed in September 2007 indicate that three of the five habitat categories are present in the project vicinity: sandy beach, soft bottom subtidal, and pelagic habitats. Sandy beach habitat is prevalent along the nearshore Oregon coastline and represents the majority of the nearshore habitat. Moving slightly offshore are long stretches of soft bottom subtidal habitat that are the result of Oregon's high-energy waves. Beyond the soft bottom subtidal habitat is the pelagic habitat, stretching out into deep marine waters and well beyond the extent of the project vicinity.

Sandy Beach

Sandy beach habitat represents approximately two-thirds of the Oregon coastline (Oregon DFW, 2006). This habitat is generally low gradient, relatively homogenous and represents a challenging environment for long-term inhabitants. Most species residing along the sandy beach are intermittently present, using the area only for foraging. Permanently residing organisms are generally embedded within the sand as protection from the constant wave action.

Sandy beach habitat can be further categorized into three additional classes: high-, mid- and low-intertidal zones. The high-intertidal zone is briefly wetted during high tide and is primarily inhabited by aquatic insects and crustaceans. The mid-intertidal zone is frequently wetted and provides habitat for sand crabs. The low-intertidal zone remains wet most of the day and is dominated by clams and Dungeness crab.

Soft Bottom Subtidal Habitat

Oregon's soft bottom subtidal habitat occurs between the shoreline to a depth of approximately 165 feet and it is "significantly affected by wave energies that reach the bottom, vertical mixing, and seasonal along-shore and cross-slope sediment movement" (Oregon DFW, 2006). Consequently, most soft bottom subtidal areas along the Oregon Coast are sandy; however, mud can be a more pronounced bottom type in areas receiving less energy from water movement (e.g., isolated and sheltered embayments) and in deeper waters toward the outer edge of the Territorial Sea.

According to Sea Engineering (2007, as cited by OPT), the seabed in the project area is generally flat and featureless, with depths ranging from 165 to 225 feet in the PowerBuoy array area. The bottom is uniformly sandy with no rocky outcroppings or ledges.

As reported in Oregon DFW (2006):

> *Soft bottom subtidal habitat comprises a number of distinct organism assemblages, influenced by differences in substrate type (e.g., sand and mud), organic content, and bottom depth. Most of these communities are dominated by infaunal (burrowing) invertebrates such as polychaete worms, but other organisms such as crustaceans, echinoderms and mollusks may be locally abundant. Common epifauna (on the sediment surface) can include species of shrimp, crabs, snails, bivalves, sea cucumbers and sand dollars. Dungeness crab are important*

components of sandy bottom communities and are found both on the surface as well as buried in the sand. Common fish in this area include several species of flatfish (e.g., sand dab, English sole and sand sole), important forage species such as sand lance, and the burrowing sandfish.

Pelagic Habitat

Pelagic habitat includes thousands of miles of open ocean; however, in the context of the proposed Reedsport Project, we are primarily interested in what is classified as the "neritic zone" of pelagic habitat. The neritic zone is the area of the ocean that extends from the mean low-water mark over the continental shelf to the continental slope at a depth of around 600 feet. Within the neritic zone, upwelling and relaxation events and river plume salt barriers provide abundant nutrients and create unique habitats for a variety of migratory and resident species.

Biologically, the pelagic environment offers two primary forms of food resources: plankton and nekton. Plankton are small plants and invertebrate animals that are incapable of swimming against marine currents. These organisms are readily consumed by migrating fish and whales. Nekton are marine organisms capable of swimming against marine currents and can include marine mammals, fish, and squid.

Plankton

Plankton include organisms such as diatoms, dinoflagillates, krill, and copepods, as well as the microscopic larva of crustaceans, sea urchins, and fish. They provide the primary food source for a majority of the ocean community ranging from large migratory whales to small pelagic anchovy. Concentrations of phytoplankton[12] can be seasonally found during upwelling events, when cool nutrient-rich water circulates to the surface from the seafloor. Phytoplankton bloom from enriched nitrogen and phosphorous found within the water. Zooplankton[13] also concentrate and feed on the phytoplankton in the same upper 60 feet of the water column, forming a resource dense area for foraging species.

Plankton occur throughout Oregon's coastal waters, but concentrated populations generally occur over the continental shelf. Lamb and Peterson (2005, as cited by OPT) found the highest concentration of zooplankton inshore of the 300-foot isobath. Within

[12] Phytoplankton is the photosynthetic or plant constituent of plankton; mainly comprised of unicellular algae.

[13] Zooplankton is the animal constituent of plankton; mainly small crustaceans and fish larvae.

that isobath, species are separated by preferences in water temperature and salinity. The actual offshore location and density of plankton is directly affected by seasonal variations in wind and current. While upwelling events generally occur in late summer, events like El Niño can upset the usual pattern of upwelling events and alter the timing and occurrence of plankton abundance, species composition, and blooms.

During four cruises in June and August 2000 and 2002, NMFS collected neustonic[14] mesozooplankton samples from Crescent City, California, to Newport, Oregon (Pool and Brodeur, 2006). Tows were conducted along transects crossing the continental shelf along a line at the Umpqua River, as well as at five other locations: Newport Hydroline, Heceta Head, Five Mile River, Rogue River, and Crescent City. Dungeness crab megalopae, Oregon cancer and red rock crab megalopae, Pacific krill, *Hyperoche medusarum*, *Themisto pacifica*, and *Sagitta* spp. were the dominant taxa collected during sampling.

Marine Vegetation/Algae

There are approximately 437 species of macrobenthic marine algae that are thought to occur in Oregon. Much of the Oregon Coast, including the project area, is exposed, sand-scoured habitat with less flora species richness than the more diverse habitat present in the neighboring states of Washington and California.

Macrobenthic marine algae typically require hard substrate, and it is uncommon to find macrobenthic marine algae in water deeper than 100 feet in Oregon. The substrate in the area of the proposed cable route and the PowerBuoy array is primarily composed of sand. The depth at the proposed location for the PowerBuoy array in the northwest corner of the project area ranges from approximately 204 to 225 feet. Therefore, macrobenthic algae are not expected to occur in the project area. However, marine algae may grow on the cable and the mooring lines once the project is in place (at least on portions of the mooring line that receive enough light to support algal growth).

Invertebrates

Information describing the benthic invertebrate community in the proposed project vicinity was derived from sampling conducted at an offshore dredge disposal site near the mouth of the Umpqua River by NMFS and the U.S. Army Corps of Engineers (Corps) in September 1984 and January 1985 (Emmett et al., 1987, as cited by OPT), and by Marine Taxonomic for the Corps Portland District in July and September 2007 (Marine Taxonomic, 2008, as cited by OPT).

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[14] Neuston is the collective term for the organisms that float on the top of water (epineuston) or live right under the surface (hyponeuston).

NMFS and the Corps collected a total of 48 benthic grabs, consisting of 24 grabs each in 1984 and 1985, and Marine Taxonomic collected five biological samples at each of the 16 predetermined sampling stations in 2007. Results of the surveys revealed that polychaetes were the dominant benthos captured during all three survey years. Mollusks were the second most abundant invertebrate captured during the 1984 and 2007 surveys, and amphipods were the second most abundant invertebrate observed during the 1985 survey.

The bottom composition at the Umpqua dredge disposal site, during the 1984, 1985, and 2007 surveys, consisted of clean fine sand that was low in silt-clay and organics (Emmett et al., 1987, as cited by OPT; Marine Taxonomic, 2008, as cited by OPT). This nearshore sandy habitat was also identified at the Reedsport Project site during the September 2007 Marine Geophysical Survey. As a result, the benthic invertebrate species identified at the Umpqua site are expected to be similar to those in the project area.

Dungeness Crab

Dungeness crab is an invertebrate species that supports an important recreational and commercial fishery along the Oregon Coast. During the 2004–2005 commercial Dungeness crab season, a total of 30,326,019 pounds of Dungeness crab were landed into Oregon ports consisting of Astoria/Seaside, Garibaldi/Pacific City, Depoe Bay, Newport/Waldport, Florence/Winchester Bay, Charleston, Port Orford, and Brookings/Gold Beach.

Although commercial Dungeness crab fishing pots are typically set at depths between 30 and 600 feet of water, the Dungeness crab is tolerant of salinity changes and can be found from the shallowest parts of lower estuaries to depths of 1,200 feet of water (Oregon DFW, 2010c). The Dungeness crab prefer a sandy or muddy bottom in salt water and feed along the sea floor for organisms that live partly or completely buried in the sand. The crab's carnivorous diet consists of shrimp, mussels, small crabs, clams, and worms. Crab persistence and annual abundance is driven by meteorological and biological ocean conditions. Dungeness crab, which use sand habitat areas, are known to be present in the project vicinity.

Dungeness crab mating occurs in nearshore coastal locations in the West Coastal region of the Pacific Northwest. Eggs hatch in coastal waters from December to April in Oregon. Upon hatching, Dungeness crab are referred to as Zoea; the Zoeal period lasts from winter to spring (typically 80 to 95 days). During this time, the Zoea are suspended in water (plankton) and are generally transported seaward with currents, as they have very limited swimming capabilities.

Beginning in the late stages of spring and continuing into summer, the Zoea enter the megalopae stage and continue to live pelagically (suspended in water). At this time, large concentrations of megalopae can be seen throughout the nearshore areas of Oregon. In Oregon waters, megalopae are most abundant in April and May and are carried within 0.6 mile of shore by tidal currents and by vertical migration. The megalopae stage is short lived (approximately 30 days), and most megalopae molt into juveniles between April and May off the coast of Oregon. Immediately after molting, the Dungeness crab buries itself in the sand to allow their new shell to harden.

The Dungeness crab reaches maturity after about 2 years. As Dungeness crabs grow/mature, they tend to move into progressively deeper water, live within ocean waters at depths primarily between 60 and 1,200 feet and show a random pattern of movement.

Fish

Information describing the fish community in the proposed project vicinity was also derived from sampling conducted near the mouth of the Umpqua River by the NMFS and Corps in September 1984 and January 1985 (Emmett et al., 1987, as cited by OPT), and by Marine Taxonomic for the Corps, Portland District, in July and September 2007 (Marine Taxonomic, 2008, as cited by OPT). During the NMFS and Corps' study, fish and crab samples were collected at depths ranging from 60 to 115 feet using a semi-balloon shrimp trawl with an overall mesh size of 1.5 inches (stretched) to ensure retention of small fish and invertebrates. A total of 12 trawls, six each during 1984 and 1985, was conducted near the mouth of the Umpqua River. During the 2007 Marine Taxonomic surveys, fish samples were collected using 26-foot semi-balloon otter trawls with a quarter-inch mesh liner at depths ranging from 70 to 100 feet along seven pre-selected trawl tracks close to the mouth of the Umpqua River. The results of these surveys are presented in table 4. Commercial species of substantial value that were captured in abundance included Dungeness crab, English sole, petrale sole, butter sole, sand dab, sand sole, northern anchovy, and ling cod (Emmett et al., 1987, as cited by OPT; Marine Taxonomic, 2008, as cited by OPT).

Table 4. Fish species captured at the Umpqua River dredge disposal sites (Source: OPT, 2010).

Common Name	Scientific Name	Number Collected in 1984–1985[a]	Number Collected in 2007[b]
Night smelt	*Spirinchus starksi*	6,140	--
Pacific tomcod	*Microgadus proximus*	526	--
Pricklebreast poacher	*Stellerina xyosterna*	453	--
Sand sole	*Psettichthys melanostictus*	386	34
Speckled sanddab	*Citharichthys stigmaeus*	319	--

Common Name	Scientific Name	Number Collected in 1984–1985[a]	Number Collected in 2007[b]
Pacific sandlance	*Ammodytes hexapterus*	250	--
English sole	*Parophrys vetulus*	134	434
American shad	*Alosa sapidissima*	82	--
Pacific staghorn sculpin	*Leptocottus armatus*	59	33
Warty poacher	*Chesnonia verrucosa*	47	--
Shiner perch	*Cymatogaster aggregate*	41	--
Spotfin surfperch	*Hyperprosopon anale*	35	--
Butter sole	*Isopsetta isolepis*	30	65
Tubenose poacher	*Pallasina barbata*	26	4
Pacific sanddab	*Citharichthys sordidus*	24	--
Bay pipefish	*Syngnathus leptorhynchus*	9	--
Big skate	*Raja binoculata*	8	5
Whitebait smelt	*Allosmerus elongates*	7	--
C-O sole	*Pleuronichthys coenosus*	4	--
Wolf-eel	*Anarrhichthys ocellatus*	3	--
Larval groundfish	--	2	--
Northern anchovy	*Engraulis mordax*	2	32
Larval flatfish	--	2	0
Lingcod	*Ophiodon elongatus*	1	4
Spiny dogfish	*Squalus acanthias*	1	--
Cabezon	*Scorpaenichthys marmoratus*	1	--
Longfin smelt	*Spirinchus thaleichthys*	1	--
Unidentified juvenile smelt	*Osmeridae* spp.	1	--
King-of-the-salmon	*Trachipterus altivelis*	1	--
Smelts	*Osmeridae*	--	420
Sanddab	*Citharichthys sp.*	--	169
Pricklebreast poacher	*Stellerina xyosterna*	--	101

Common Name	Scientific Name	Number Collected in 1984–1985[a]	Number Collected in 2007[b]
Cod	*Gadidae*	--	83
Right hand flat fish	*Pleurenectidae*	--	45
Petrale sole	*Eopsetta jordani*	--	22
Staghorn sculpin	*Leptocottus armatus*	--	10
Showy snailfish	*Liparis pulchellus*	--	9
Sculpins	*Cottidae*	--	1
Total		8,595	1,471

[a] Data from Emmett et al., 1987, surveys conducted in September 1984 and January 1985.

[b] Data from Marine Taxonomic, 2008, surveys conducted in July and September 2007.

Demersal Fish

Demersal fish live on or near the bottom of the ocean and typically a have a body plan adapted to a life in direct contact with the substrate; substantially flattened, with eyes oriented upward and fins arranged for locomotion along or just off the bottom. Flatfish, such as Dover sole or starry flounder, exemplify this body shape. However, other species, such as lingcod or rockfish, may be less flattened, or like hagfish, may be adapted to burrowing into the substrate.

Rockfish comprise a diverse and ecologically important group of demersal fish that inhabit the nearshore marine community in the temperate eastern Pacific Ocean. However, they are not expected to be abundant within the project area because of a lack of hard substrate. No rockfish were captured during the NMFS and Corps fish surveys near the Umpqua River in 1984 and 1985 (Emmett et al., 1987, as cited by OPT), although 19 species of demersal fish were collected, totaling 2,103 individuals or 23 percent of the total number of fish collected (table 4). Overall, four out of the five most abundant fish species collected were demersal fish. The dominant demersal fish caught were Pacific tomcod (6.1 percent), pricklebreast poacher (5.3 percent), sand sole (4.5 percent), and speckled sanddab (3.7 percent) (Emmett et al., 1987) (table 4). The demersal fish species captured by Marine Taxonomic in 2007 were similar to those reported in Emmett (1987, as cited by OPT) (table 4). The most common demersal species collected during these surveys included pricklebreast poacher, sanddab species, and sand, English, and butter sole.

Pelagic Fish

Coastal pelagic species live in the water column as opposed to living near the sea floor. They are generally found anywhere from the surface to 3,000 feet deep. Pelagic fish are an important component of the biological food chain and serve as prey to numerous species. Many pelagic fish are found near the top of the water column and feed on small invertebrate species. While the majority of the pelagic species are found in warmer California waters, there are several small fisheries for schooling pelagic species in Oregon, and combined they collectively hold substantial commercial importance (PFMC, 2006). In the NMFS and Corps fish survey at the Umpqua River site (Emmett et al., 1987, as cited by OPT), eight species of pelagic schooling species were collected, totaling 6,484 individuals or 76.4 percent of the total number of fish collected (table 4). Overall, three out of the top eight fish species collected were pelagic fish. The dominant species caught were night smelt (71.4 percent), Pacific sandlance (2.9 percent), and American shad (0.95 percent). Smelts and northern anchovy were the only pelagic schooling species captured by Marine Taxonomic in 2007 (table 4).

The sardine fishery is the most profitable pelagic fishery in Oregon, providing $6.1 million of revenue in 2005. Currently on the Pacific Coast, the sardine fishery is managed under the Pacific Fishery Management Council's (PFMC's) Coastal Pelagic Species Fishery Management Plan. Under the plan, the biomass of sardines is estimated each year and a coast-wide harvest guidance is established. Management of the sardine fishery in Oregon continues under state management as long as the state's measures are consistent with the PFMC's plan. Most of Oregon sardine harvesting (approximately 99 percent) occurs around Astoria within approximately 25 nautical miles of shore, but a small bait fishery is located in Winchester Bay (McCrae and Smith, 2004). Peak concentrations of pelagic fish occur from July through September. The majority of sardines harvested in Oregon are processed for bait in Asian longline operations.

Anadromous Fish

Pacific salmonids, green sturgeon, white sturgeon, Pacific lamprey, and eulachon are anadromous, meaning that they spawn in freshwater rivers and streams, rear in freshwater for a variable amount of time, and then migrate to the ocean to mature. Pacific salmonids migrate to the ocean primarily in the spring and early summer, coinciding with the greatest availability of prey, and grow rapidly by feeding on small fishes, crustaceans, and squid. They occur in the epipelagic zone in offshore and coastal nearshore waters and are more abundant in the subarctic and northern Pacific waters, decreasing in abundance toward subtropic waters. They are known to migrate long distances in oceanic waters, although some species and individuals remain in coastal waters near their natal rivers.

The Umpqua River, located approximately 5.5 miles south of the proposed project area, is the most likely source of anadromous fish that could pass through the proposed project area. The Umpqua River supports native anadromous salmonids, green sturgeon, white sturgeon, Pacific lamprey, and eulachon. Native salmonids include spring and fall Chinook salmon, Oregon Coast coho (OCC) salmon (federally listed as threatened), steelhead, and cutthroat trout. There are infrequent reports of chum, sockeye, and pink salmon, most of which are considered strays. In addition, salmon from other river basins along the West Coast may pass through the proposed project area (see section 3.3.6, *Threatened and Endangered Species and Essential Fish Habitat*).

Most Pacific salmon feed and grow in the ocean for 6 months to several years before returning to fresh water to spawn. Coho salmon remain in the ocean for generally no more than 2 years, while the amount of time Chinook salmon spend at sea is highly variable, ranging from 1 to 6 years (more commonly 2 to 4 years). Upon entering coastal waters, juvenile salmonids generally exhibit a northward orientation and swim pattern toward the migration corridor of the Alaska Current. Temperature, oceanography, and food availability are all known to influence their distribution, although migration patterns and distributions have not been related consistently to ocean features.

Chinook salmon that migrate to sea during their first year of life (ocean-type) are known to generally reside in coastal waters while those that migrate to sea after a year in fresh water (stream-type) are more oceanic in distribution (Pearcy, 1992). Coho salmon undertake shorter migrations, but commonly move both north and south along the ocean shoreline. Brodeur et al. (2004) found that juvenile Chinook salmon distribution was largely limited to the cooler nearshore waters (within approximately 300 feet of the shore) while coho salmon juveniles tended to occupy habitat located further offshore (depth unspecified).

Recent research has suggested that there are several potential mechanisms that Pacific salmon use for navigation, including orienting to the earth’s magnetic field, using a celestial compass (sun and moon), and using the odor of their natal stream to migrate back to their original spawning grounds (Groot and Maragolis, 1998; Quinn et al., 1981). Crystals of magnetite have been found in four species of Pacific salmon, although not in sockeye salmon (Mann et al., 1988, as cited by OPT; Walker et al., 1988, as cited by OPT). These magnetite crystals may serve as a compass that orients to the earth’s magnetic field (Scottish Executive, 2007). However, Quinn and Brannon (1982, as cited on OPT) conclude that while Pacific salmon can apparently detect magnetic fields, their behavior is likely governed by multiple stimuli.

Pacific lamprey, green sturgeon, and white sturgeon also occur in the Umpqua River. The Pacific lamprey is a parasitic species that undergoes dramatic morphological changes and develops from a blind, freshwater, filter-feeding larval stage, to a parasitic marine adult. Some Native American tribes have placed cultural value in lamprey and harvest adults for food and other unique applications. The ocean distribution of Pacific lamprey generally parallels their hosts, which are usually salmon or other large fish.

Green and white sturgeons are large-bodied, cryptic bottom-dwelling species. Very little is known regarding their marine ecology (e.g., movements, behavior, habitat preferences, or requirements), although available information indicates that they make extensive long-shore migrations in coastal waters. According to archival tag data, green sturgeon generally occupy waters shallower than 330 feet. The species can also be found in deep water along the Oregon coastline and within larger rivers, like the Umpqua River.

Sturgeon have highly sensitive electroreceptive sense organs for predation, mate detection, and orientation and navigation. Electric and magnetic fields could cause disorientation and behavioral changes, including changes in foraging behavior.

In Oregon, sturgeon are captured in recreational and charter fisheries. Green sturgeon are not commonly consumed (due to oily meat) and are primarily by-catch of anglers fishing for the more palatable white sturgeon. Green sturgeon are listed as threatened under the ESA and are discussed further in section 3.3.6, *Threatened and Endangered Species and Essential Fish Habitat*.

Eulachon are a species of smelt that occur from northern California to the southern Bering Sea. They are relatively small (less than 10 inches long), anadromous, and semelparous (die after spawning once). Besides eulachon, it is known as Columbia River smelt, candlefish, and hooligan. Eulachon were, and still are, highly important, ceremonially, nutritionally, medicinally, and economically, to Native American tribes in northern California and the Pacific Northwest (NMFS, 2010a).

Eulachon spawn in the lower reaches of rivers, followed by a movement to the sea as small pelagic larvae. Although they spawn in fresh water rivers and streams, eulachon are mainly a marine fish, spending more than 95 percent of their lives in marine waters. After living in the ocean for 3 to 5 years, they migrate back to the estuaries and rivers to spawn. Within the proposed Reedsport Project vicinity, eulachon are known to be “common” in the Umpqua River (NMFS, 2010a), and from the 1960s through the 1980s, the Umpqua River supported a relatively small eulachon commercial and recreational fishery. Eulachon are listed as threatened under the ESA and are discussed further in section 3.3.6, *Threatened and Endangered Species and Essential Fish Habitat*.

Sharks, Skates, and Rays (Elasmobranchs)

Elasmobranchs are diverse and ecologically important members of the marine community that occupy the project area and nearby habitats. The Oregon Coast provides habitat for 15 shark species, a fraction of the world’s population of 450 total species (Wharton, 2007). Species that occur off Oregon include the Pacific sleeper shark, basking shark, white shark, soupfin shark, and spiny dogfish. The basking shark feeds primarily on plankton. The majority of shark species that occur in Oregon are 2- to 3-foot demersal fish that prey on other benthic fish species. Great white sharks are only found seasonally (summer) as they migrate along the coast searching for food. Large shark species, including the great white shark, are found in deeper offshore areas. Many of the smaller sharks are found in sandy and nearshore environments when they are searching along small reefs for potential prey.

Skates and rays spend much of their time either skimming along sandy sea floors or buried in the sand. There are 4 families and 14 species of skates and rays off the Oregon Coast. Food sources include crustaceans and demersal fish, such as sculpin. Longnose skates are the most common species captured in offshore trawls. The big skate and sandpaper skate are other common species found in Oregon waters generally deeper than 50 feet. Rays, like the bat ray and stingray, and California skate are less common in the Oregon Coast. Sharks, skates, and rays are of limited recreational and commercial value and are not directly sought after; if they are captured, it is generally as by-catch. However, there is a developed big skate fishery in Charleston, Oregon, and sharks and skates are occasionally targeted recreationally.

During the NMFS and Corps collaborative fish survey at the Umpqua site (Emmett et al., 1987, as cited by OPT), a total of nine elasmobranchs were captured, representing two species (0.10 percent of the total). The two species collected were big skate (eight individuals) and a single spiny dogfish. During the 2007 Marine Taxonomic surveys, the big skate was the only elasmobranch species collected (Marine Taxonomic, 2008, as cited by OPT).

Rays and larger shark species including the basking, white, and sleeper sharks are expected to be present in low numbers in the project area while some smaller shark species and skates are expected to be present in moderate numbers based on existing habitat.

State of Oregon Special-Status Aquatic Resources

Table 5 lists state special-status aquatic species potentially occurring in the project vicinity, as compiled from the Oregon DFW state sensitive species list (Oregon DFW, 2010a). Species listed under the ESA (federally listed species) are discussed in section 3.3.6, *Threatened and Endangered Species and Essential Fish Habitat*.

Table 5. State special-status aquatic species potentially occurring in project area (Source: Oregon DFW, 2010a).

Common Name	Scientific Name	State Status
Pacific lamprey	*Lampetra tridentate*	SV
Coho salmon (Southern Oregon/Northern California Coasts ESU)	*Oncorhynchus kisutch*	SC
Coho salmon (Oregon Coast ESU)	*Oncorhynchus kisutch*	SC
Coho salmon (Lower Columbia River ESU)	*Oncorhynchus kisutch*	E
Steelhead (Upper Willamette River ESU)	*Oncorhynchus mykiss*	SC
Steelhead (Oregon Coast ESU)	*Oncorhynchus mykiss*	SV
Chinook salmon (Southern Oregon/Northern California Coasts ESU)	*Oncorhynchus tshawytscha*	SC
Chinook salmon (Lower Columbia River ESU)	*Oncorhynchus tshawytscha*	SC
Coastal cutthroat trout (Oregon Coast ESU)	*Oncorhynchus clarki clarki*	SV
Coastal cutthroat trout (Southern Oregon/Northern California Coasts ESU)	*Oncorhynchus clarki clarki*	SV

Notes: E – Listed as endangered

ESU – Evolutionarily significant unit

SC – Sensitive-critical

SV – Sensitive-vulnerable

3.3.3.2 Environmental Effects

Effects of Alteration of Habitat on the Marine Community Composition and Predator/Prey Interactions

Construction and operation of the Reedsport Project would alter the seabed, pelagic, and surface habitat in the project vicinity through placement of project components and the creation of “new” habitat features (i.e., hard structure on the surface, in the water column, and on the seabed). Resulting potential environmental effects on the marine community could include:

- direct effects on the benthic community from placement of project mooring components and subsea transmission cable on the seabed; and
- changes to marine community composition and predator/prey interactions throughout the water column from the creation of new habitat features.

As described in section 2.2, *Applicant's Proposal*, the proposed project would include approximately 16 concrete block anchors approximately 32.8 feet in diameter by 24.6 feet high. The anchors are presently designed to protrude above the ocean floor. The PowerBuoys would be attached to the concrete anchors with synthetic mooring lines that may become encrusted with a limited amount of biofouling. This biofouling may, in turn, affect the quantity and type of fish species that would be located in and around the proposed project (similar to what would occur after the construction of an artificial reef).

The introduction of the project's underwater infrastructure may affect existing predator/prey interactions in the project vicinity through changes in the benthic and marine community composition and habitat. Aquatic Species Subgroup members are particularly concerned that both Pacific salmon and their predators may be attracted to the PowerBuoy array area and that accelerated predation on salmon may occur in the project area.

OPT proposes to conduct fish and invertebrates monitoring in consultation with the Aquatic Species Subgroup (as described in appendix A of the Settlement Agreement). The purpose of this monitoring would be to:

- characterize and describe the presence and abundance of key fish and invertebrate species in the project area, prior to deployment of the 10 PowerBuoy array; and

- evaluate the potential effects of the project on these resources following project deployment.

To better define the suite of species of concern and possible indicator species and groups associated with the project and project area, the scientific literature was reviewed and input was gathered from the Aquatic Species Subgroup and state and federal agency scientists, peer-reviewed journals and other recent research, and local dredge spoil site monitoring reports.

Criteria for selection included:

- marine and anadromous fishes and invertebrate species that could occur in the project area before and/or after project construction;

- their potential value as indicators of local ecological processes;

- their regulation under governmental statutes (e.g., EFH, ESA); and

- their commercial or recreational importance.

The major species/life stage groupings selected for evaluation included:

- juvenile salmon;
- rockfishes;
- Dungeness crab;
- green sturgeon;
- flatfish and epibenthic invertebrates;
- pelagic fish and invertebrates;
- biofouling community; and
- benthic infauna (organisms that burrow or reside within the substrate).

Specific information describing OPT's proposed sampling methods, frequencies, data analyses and metrics, and other sampling and analytical constraints, are provided in OPT's proposed fish and invertebrates monitoring program (included in appendix A of the Settlement Agreement). In addition, H.T. Harvey and Associates (no date) recently completed a baseline data and power analysis for the Oregon Wave Trust that was designed to collect baseline data, the "before" component for the Before-After-Control-Impact (BACI) study of the effects of proposed Reedsport project on the local benthic ecology.

In its comments on the license application and Settlement Agreement, PFMC recommended that the control sites used in these various evaluations be established beyond the boundary of the proposed Phase III build-out to support long-term monitoring of Phase II. It also noted that if this is not feasible, control sites should be selected that they would be unaffected by all future phases of this project.

Our Analysis

Based on our review of aquatic habitat conditions in the proposed project area, and on the configuration of the proposed project, project construction and installation would likely cause only minor effects on the benthic marine community. Any effects related to construction on the seabed would be expected to be minor and short term, and after construction, it is anticipated that sediments (primarily sand) around the subsea cable(s) and anchors would quickly redistribute. Although immobile or slow moving benthic organisms could be covered, disturbed, injured, or killed during installation of the moorings and subsea transmission cable, it is likely that these organisms would quickly resettle in areas that are disturbed during project construction (DOE, 2009). It is also anticipated that groundfish and other fish that use the area would quickly return to preconstruction levels. Pelagic fish (such as salmon) are highly mobile and therefore would not be affected during installation of the PowerBuoys, associated moorings, and the subsea transmission cable. In addition, most bottom-dwelling fish and other mobile organisms, such as crabs, would likely move to nearby areas, minimizing any potential adverse effects during construction activities.

Over time, the proposed project's anchoring and mooring systems would likely provide habitat for a variety of aquatic biota including algae, barnacles, mussels, bryozoans, corals, tunicates, and tube dwelling invertebrates (DOE, 2009; Boehlert et al., 2008). In addition, fish typically seek areas of shelter, structure, or cover for protection from predators. Artificial structures associated with the proposed project would likely represent attractive sources of cover and refuge, especially hard substrate having a vertical orientation, because most of the area in the project vicinity has comparably little structure associated with the seabed. In particular, these changes to local habitat may attract structure-oriented fish, such as rockfish, and may ultimately enhance local fisheries (outside the exclusion zone[15]). However, the project configuration does differ from many artificial reefs in that the PowerBuoy mooring structures are widely spaced in the array, the mooring lines are only 5 inches in diameter, and the anchors are located at depths of at least 204 feet; artificial reef structures are often in shallower water. Therefore, the degree to which the project structures would serve as artificial reefs is uncertain.

Once installed, the PowerBuoys and their mooring systems may also act as fish aggregation devices (FADs). While these areas of shelter, structure, or cover are typically sought by pelagic fish for protection from predators, the gathering of fish near the PowerBuoys may, in turn, attract predators (such as larger fish, sea birds, and marine mammals) (Ogden, 2005, as cited by OPT). As a result, changes in predator-prey interactions are possible in the project vicinity, and thus the food web and trophic structure of the nearshore ecosystems at wave energy conversion installations would be altered from existing conditions (Boehlert et al., 2008). In particular, members of the Aquatic Species Subgroup are concerned that juvenile salmonids may be attracted to the PowerBuoys for food or cover,[16] which may increase the potential for predation by pinnipeds or other fish that also are attracted to the project area for the same reasons.

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[15] The exclusion zone is the area that would be closed to fishing and navigation associated with the propose project (approximately 30 acres of sport fishing, commercial fishing, and crabbing area).

[16] The plan for siting of the Reedsport Project places the PowerBuoys in habitat used by juvenile fall Chinook salmon, which spend their first year at sea in the nearshore zone, from the surf zone out to a few miles from shore.

Installation of the project anchors and USP, and the increase in habitat structure that these components represent, may lead to development of artificial reefs and FADs within the proposed 30-acre project footprint potentially changing the marine community composition and predator/prey interactions. This effect is expected to be limited based on the small proportion of the footprint (1.7 percent) that would be occupied by these structures. However, there remains some level of uncertainty regarding exactly how or if the wave energy structures would impact Pacific salmon and other important fish species. Thus, it is important to determine if there are any negative effects on Chinook salmon and on aquatic biota, including the juveniles of other anadromous salmonids species. As described above, OPT proposes to address uncertainly regarding the potential effects of the proposed project structures on the fish and invertebrate community through the implementation of the fish and invertebrates monitoring described in appendix A of the Settlement Agreement.

Overall, we agree with OPT's proposed fish and invertebrates monitoring approach and find that its sampling methods, sampling frequency, and proposed data analyses (i.e., trawling, gillnetting, hook and line, gut content analysis, trapping, water quality monitoring, and self-contained underwater breathing apparatus [SCUBA]/remotely operated underwater vehicle [ROV] surveys) are technically sound and would help to identify any unanticipated project effects on the existing aquatic community. For example, multimesh gillnets would be used to capture small, medium and large fishes at the project site and at two control sites. The gillnets would be sized to capture both juvenile and adult salmonids, as well as other comparably sized fishes (including various predators), providing information on the presence of different species (and life stages) at the project and control sites. Gut contents analysis of predators captured using the gillnets or through other methods (i.e., hook and line) would allow OPT to assess potential species or species-group predation rates on juvenile salmonids.

In addition, baited trap sampling would help OPT to determine if Dungeness crab distribution and abundance is altered within the array; bottom trawling would provide information on potential project effects on flatfish and epibenthic invertebrates; SCUBA surveys would collect quantitative information on fishes and invertebrates associated with the proposed project array; hydrophone receivers placed at the project would contribute to ongoing efforts to track coastal migrations of green sturgeon; and SCUBA/ROV-based biofouling monitoring would allow OPT to evaluate overall biofouling growth, including invasive and non-native species.

Establishing control sites in areas unaffected by all future phases of the proposed project, as recommended by PFMC, would allow stakeholders (including PFMC) to evaluate project effects on aquatic organisms independently from any changes that may occur as a result of activities that are not directly related to project installation and operation. Although the proposed fish and invertebrate monitoring program would place control sites at locations that are either 5 kilometers or 20 kilometers outside of the project influence, as discussed with the Aquatic Species Subgroup during a meeting on March 21, 2008, the exact location of the control sites would be determined in the field and the selected control sites, including location and site characteristics (e.g., depth, substrate), would be described in a report to the Aquatic Resources and Water Quality Implementation Committee for its confirmation.

Baseline data and power analyses described in H.T. Harvey and Associates (no date), represents a first step in OPT's Dungeness crab and benthic fish BACI study and provides valuable information regarding differences in Dungeness crab catch per unit effort that may reflect differential habitat uses by male and female crabs. This evaluation also found differences in species richness and diversity and differences in sizes of Dungeness crabs at the PowerBuoy site and two control sites, and made a series of recommendations regarding the amount of sampling needed to detect differences between the project site and the two control sites.

OPT would present the results of each component of its fish and invertebrates monitoring program, including the baseline data and power analysis described above, to the Aquatic Resources and Water Quality Implementation Committee during annual meetings and in annual reports, and these findings would provide a basis for determining appropriate additional steps to either further evaluate or mitigate for project operations through adaptive management.

Effects of Electromagnetic Fields on Aquatic Resources

EMFs are common and exist in a wide variety of natural and human-made forms. Natural forms include the earth's magnetic field, magnets, and different processes within organisms (i.e., biochemical, physiological, and neurological). Human-made sources include telecommunications cables (fiber optic and coaxial), electric power transmission lines; AC and DC electric distribution panels; transformer substations; TV stations, radio and cellular relay stations, home appliances, and numerous other devices. At the proposed Reedsport Project, sources of EMF could include the PowerBuoys, the underwater USP, and the subsea transmission cable.

EMFs consist of both electric (E) field and an induced magnetic (B) field. B fields have a second induced component, a weak electric field, referred to as an induced electric (iE) field, which are created by the flow of seawater or movement of organisms through a B field. The strength of both E and B fields depends on the magnitude and type of current flowing through the cable and the construction of the cable (including any cable shielding that can reduce or eliminate E fields).

Some marine animals have specialized organs to sense EMFs, which allow for prey detection and ocean navigation. As described previously, members of the elasmobranch family (sharks, skates, and rays) can sense the weak E fields that emanate from their prey's muscles and nerves during muscular activities, such as respiration and movement. Sharks can similarly create an iE field around their bodies as they swim through the earth's magnetic field. This iE field may allow them to detect their magnetic compass headings (Scottish Executive, 2007).

Marine animals that can detect B fields are presumed to do so through either iE field detection or through magnetite[17] based detection. Although data are limited, studies have shown that organisms as diverse as Atlantic salmon, cod, plaice, eels, lampreys, sea trout, yellowfin tuna, lobster, crab, shrimp, prawns, snails, bivalves, and squid are able to detect B fields (Gill et al., 2005).

During the prefiling process, the Aquatic Species Subgroup and other stakeholders expressed an interest in evaluating the potential effects of the EMF generated by the proposed subsea transmission cables and PowerBuoys on marine life, with an emphasis on elasmobranchs, adult and juvenile salmon, green sturgeon, Dungeness crab, and plankton. Concerns have been raised that EMF generated by the project may disrupt migration or cause disorientation of salmon in the project area. Surfers and fishermen have also expressed concern that the EMF may attract sharks.

In addition, resource agency staff are concerned that the proposed Reedsport Project differs from traditional sources of EMF in the ocean. Specifically, agency staff noted that instead of a single cable lying on or under the seabed, the proposed project represents 10 PowerBuoys and associated cables running through the entire water column, as well as the multiple cables running along the seabed, converging on the USP. Wave energy generation units, such as PowerBuoys, are also a new technology, and there is no experience with wave energy projects along the Pacific Coast.

To address these concerns, OPT proposes to conduct EMF monitoring (as described in appendix A of the Settlement Agreement).

The objectives of the EMF monitoring would be to:

- determine the physical characteristics of EMF likely to be generated by the single PowerBuoy and the 10-PowerBuoy array;
- anticipate which marine organisms might be adversely affected; and
- estimate the magnitude of potential effects.

In its comments on the license application and Settlement Agreement, PFMC indicated its concern with OPT's characterization of existing literature on EMF and EMF

[17] Magnetite is a ferromagnetic mineral in a fish's brain that may function as a biological compass that is "set" at the time of entry into the ocean.

sensing species, and indicated there were several instances in the license application and Settlement Agreement where the results or conclusions of studies were inaccurately characterized or not used effectively to forecast possible effects of EMF. PFMC felt that this led the reader to conclude that EMF represents no significant concern (which they indicated is not the case). To address this issue, PFMC recommended a verification of the existing literature (including that presented in appendix A of the Settlement Agreement) by an independent peer review process.

In its comments on the license application and Settlement Agreement, PFMC also recommended that the parties to the Settlement Agreement begin compiling candidate species lists and working toward establishing EMF levels that would trigger additional monitoring efforts or development of mitigation measures before project construction begins.

Our Analysis

Three components of the proposed Reedsport Project represent potential sources of EMF: the PowerBuoys, the USP, and the subsea transmission cable. From the array, the subsea cable would follow an easterly course about 2.3 miles to the underwater outlet of an existing wastewater discharge pipe. This portion of the subsea cable, seaward of the wastewater pipe outfall, would be buried in the seabed approximately 3 to 6 feet deep.

The PowerBuoys would produce power at frequencies between 1/12 and 1/8 cycles per second (Hz). The frequency would then be rectified to 60 Hz before exiting the PowerBuoy and transmitted to shore via the USP and subsea cable. As proposed, the enclosed steel structure of the PowerBuoy and underwater USP would serve as Faraday cages. (Faraday cages shield objects from electromagnetic radiation and also act to eliminate or reduce emitted electromagnetic emissions from devices inside the enclosure/cage.)

Because of this Faraday shielding, the PowerBuoys and USP are not expected to emit substantial E field radiation. In addition, metallic sheathing and grounding on the transmission cables leading from the PowerBuoys to the USP and from the USP to shore would be used to substantially reduce or eliminate E fields from being emitted into the surrounding aquatic environment. Consequently, it is expected that E fields generated by the proposed project would not have an adverse effect on aquatic resources in the project vicinity (i.e., elasmobranchs, salmon, green sturgeon, Dungeness crab, or plankton).

In its evaluation of the array of subsea cables associated with the proposed Cape Wind Energy Project in Massachusetts, Mineral Management Service (MMS) reached a similar conclusion and determined that E fields from the proposed project's 60-Hz cables (contained within shielding) would not adversely affect the aquatic community (MMS, 2009). Similarly, Sound & Sea (2002) conducted an assessment of the potential behavioral effects of EMF on marine life in response to EMF generated by an OPT 40-

kW PowerBuoy at the OPT Kaneohe Bay Project in Hawaii. Sound & Sea (2002) concluded that EMF effects on marine organisms may range from no effect to avoidance in the vicinity of the subsea cable.

While information describing the effects of B fields (and resulting iE fields) on aquatic organisms is limited, the ability of many organisms to detect magnetic fields suggests that potential interactions between the B field and aquatic organisms could occur in the project vicinity (Gill et al., 2005). However, detection does not necessarily translate to an adverse effect. For example, the Corps (2004), using an EPRI model, estimated the peak intensities of B fields anticipated from the proposed Cape Wind Energy Project, having cables that would carry substantially more power than the Reedsport Project, would quickly attenuate to about 10 percent of the peak intensity within 10 to 20 feet directly above the seafloor, and 20 to 30 percent of the peak intensity within 10 feet horizontally from the centerline of the cables (Corps, 2004). Ultimately, the Corps (2004) concluded that there were no anticipated adverse effects on fish species or the marine environment resulting from the 60-Hz B fields that would result from operation of the proposed Cape Wind Energy Project, as the magnitude of the B fields in the vicinity of the transmission cable would be limited to an extremely small space and decrease rapidly within a few feet of the cable.

In its environmental assessment for the wave energy project at Kaneohe Bay, the Department of the Navy (2003)[18] noted that while the magnetic field resulting from the proposed wave energy conversion cable may affect the magnetoreception[19] sensors of fish, including sharks, rays, and skates, in the vicinity of the cable and cause these animals to be temporarily confused, it concluded that the effect on sharks would be minor. Bottom dwelling organisms would be the most likely to show avoidance behavior, while pelagic species (fish that spend most of their life swimming in the open area of the ocean) could readily swim over the magnetic field. The Department of the Navy (2003) also concluded that since the cable occupies only a small area of the seafloor, the effect of avoidance behavior that could be potentially exhibited by marine organisms, in response to the presence of the transmission cable, would be minimal.

Based on our analysis, we agree with OPT that the effects of EMF on elasmobranchs, Pacific salmon, and other potentially sensitive species would likely be minor and short term because the B and iE fields resulting from the proposed transmission cable would be expected to decrease rapidly with distance from the cable, and would be easily avoidable by elasmobranchs and other species of concern. We also agree that given the limit of B field and iE field emission, that while an indigenous shark

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[18] Using data presented in Sea & Sound (2002).

[19] The sensing of electric fields by organisms is termed electroreception. The sensing of magnetic fields is magnetoreception.

may reorient its swimming direction within a few hundred feet of the cable, it would be unlikely that the project would attract sharks from greater distances. Based on conclusions from Quinn and Brannon (1982, as cited by OPT); Yano et al. (1997, as cited by OPT), and Scottish Executive (2007), we conclude that it is unlikely that salmonids would be adversely affected by the proposed project's B field.

Although recent research has found no evidence to indicate that EMF adversely affects marine life, Gill et al. (2005) concluded that there are substantial gaps in knowledge regarding the sources and effects of EMF in the marine environment. They also cautioned that networks of cables in proximity to each other are likely to have overlapping, and potentially additive, EMF fields. In addition, wave energy generation units, such as PowerBuoys, are a new technology, and there is no experience with wave energy projects along the Pacific Coast (Boehlert et al., 2008). To address these concerns, OPT and the resource agencies believe that the potential effects of this unique EMF-generating array on marine life should be evaluated *in situ*.

Specifically, OPT would implement its EMF monitoring program using a phased approach. Prior to deploying any PowerBuoys, baseline measurements of naturally occurring field strengths would be obtained at the project site and a control site. The same instruments used to establish the baseline data would then be employed to assess the field strength around the Phase I PowerBuoy in both an energized and de-energized state. Because the single unit would not be sending power to the grid, there would be no transmission cables or USP. In Phase II of the project, an additional 9 PowerBuoys would be deployed and all 10 PowerBuoys would be connected to the grid via a single USP, underwater cable and underground transmission line. Once the full array became operational, both installed and hand-held units would be employed to measure the EMF for the following project components: (1) the 10 PowerBuoys; (2) the cables leading from the PowerBuoys to the USP; and (3) the USP. To measure the EMF strength associated with the cable connecting the USP to the shore, OPT would use either a permanently installed sensor system or an ROV-mounted cable tracking system.

Overall, OPT concludes, and we agree, that its proposed EMF monitoring would allow for the collection of information needed to evaluate the B fields generated by the project and to identify whether any E fields are generated at higher than anticipated levels. The EMF monitoring program would also include a description of the schedule for collection and reporting of baseline EMF data from the single buoy and provisions that require OPT to review the findings of this initial monitoring with the Aquatic Resources and Water Quality Implementation Committee to determine whether any additional actions are needed. Comparison of the recorded EMF levels to known thresholds for sensitive species would allow for a determination of potential effects, if any, of EMF emitted by the project. Where threshold levels are not available in the literature for species of concern or other surrogates, the Aquatic Resources and Water Quality Implementation Committee would be convened to determine appropriate steps through adaptive management to understand the effects of the EMF on these important species. We note that the proposed monitoring methodology, within an adaptive management framework, would provide for a methodical and flexible approach to evaluate and potentially mitigate issues regarding EMF and project area marine resources. Again, we note that the phased approach defined in the settlement was developed in consultation with Aquatic Resources and Water Quality Implementation Committee including representative from NMFS, Interior, and Oregon DFW.

While initial research on documented EMF thresholds of sensitive species is already summarized in appendix A of the Settlement Agreement, Commission staff agrees with PFMC and sees no reason why a comprehensive list of threshold species and their appropriate EMF triggers could not be developed prior to installing and operating the project. However, we do not agree with PFMC regarding its recommendation to have OPT initiate an independent peer review of the existing literature on EMF and EMF sensing species that was presented in the license application and Settlement Agreement (or of any further literature collected during the EMF monitoring). We conclude that it would be more appropriate for the Aquatic Resources Implementation Committee to conduct this review (if deemed necessary) and to discuss and resolve any inconsistencies or misrepresentations that might be found during the monitoring report review process defined in the AMP.

Effects of Underwater Noise/Vibration on Aquatic Resources

Ambient noise, intermittent and continuous, in the marine environment originates from a variety of both natural and human-made sources including commercial and recreational vessel traffic, wave action, marine life, seismic events, and atmospheric noise. Ambient continuous noises in the ocean include those generated by oceanic traffic (10 to 1,000 Hz) and breaking waves and associated spray and bubbles (100 to 25,000 Hz). Noise pressure spectral densities can range from about 35 to 80 decibels (dB) for usual marine traffic and 20 to 80 dB for breaking waves and associated spray and bubbles (Richardson et al., 1995, as cited by OPT).

Animals such as fish and marine mammals have biological receptors that are sensitive to sound pressure levels (expressed in decibels), particle velocity (expressed in m/s), and the frequency of sound (expressed in Hz); and rely on sound for many aspects of their lives including reproduction, feeding, predator and hazard avoidance, communication and navigation. Consequently, underwater noise generated during installation and operation of an ocean energy conversion device has the potential to affect these organisms (DOE, 2009).

The installation and maintenance of the PowerBuoys would cause a certain level of noise from service vessels and equipment. Noise associated with the installation activities may temporarily alter fish and marine mammal migration and feeding patterns.

The PowerBuoy would also produce some level of noise during its operation. While the level of noise that would be generated by the proposed project during operation is expected to be similar to that of ship traffic (Ocean Power Technologies, 2010), it has the potential to affect the behavior and feeding ecology of both resident and migratory cetaceans and fish.

During the APEA process, the Aquatic Species Subgroup expressed an interest in evaluating the potential effects of noise and vibration produced by the project on marine life, primarily marine mammals. The subgroup identified the need to quantify frequencies and sound pressure levels of the project facilities.

To address this concern, OPT proposes to conduct the cetacean monitoring program (described in appendix A of the Settlement Agreement). As a component of this monitoring program, OPT would conduct *in situ* measurements of the acoustic emissions as a function of seastate (at different representative conditions) at the proposed project site. Although this monitoring program would focus on potential project effects on marine mammals (see section 3.3.4), it would also provide valuable information regarding the potential effects of noise on a variety of fish species. This monitoring would be conducted on the single Phase I PowerBuoy, expected to be installed prior to the rest of the PowerBuoy array.

Our Analysis

Virtually all fish have some form of auditory sensory mechanisms that allow them to sense their sound-filled, hydrodynamic environment. Fishes use their inner ear for sound detection and balance, and their lateral line system to sense movement of water. Salmon, sardines, herring, rockfish, and a number of other groundfish species are all thought to be particularly noise-sensitive (Boehlert et al., 2008).

In their literature review of what is known about the effects of sound on fishes of the Pacific Coast region, Hastings and Popper (2005) found that many species of fish that are similar to those found on the Pacific Coast are not adversely affected by sound levels less than about 160 dB (re 1 μPa). However, at greater levels fish exhibit avoidance, stress, temporary and permanent hearing loss, auditory and non-auditory tissue damage, egg damage, reduced growth rates, or mortality. The majority of Pacific fish species studied to date have no special adaptations to enhance their hearing function and are capable of detecting sounds between 75 and 150 dB and frequencies between 30 and 20,000 Hz. Atlantic salmon, which have similar auditory systems as Pacific salmonids, generally detect sounds between 95 and 130 dB (re 1 μPa), at frequencies between 30 and 300 Hz (Hastings and Popper, 2005).

OPT expects the peak underwater sound intensity, generated by tugs, barges, and diesel-powered vessels (representative of vessels that would be used for project installation and maintenance) fully underway, to be no greater than 130 to 160 dB over a frequency range of 20 Hz to 10 kilohertz (kHz). However, most of the time during project installation and maintenance, the sound intensity is expected to be much lower.

Because the studies reviewed by Hastings and Popper (2005) generally showed that a large number of fish similar to those found on the Pacific Coast are not adversely affected by sound levels less than about 160 dB, and given that the greatest sound intensities that would be produced by the proposed project during construction/installation and maintenance would likely be less than 130 to 160 dB, we do not expect fish in the project area to be adversely affected by underwater noise associated with the project installation and maintenance.

During periods of project operation, we expect the source levels generated by the PowerBuoys to be closer to ambient ocean noise levels and to be much less than 130 to 160 dB, as expected for representative project installation and maintenance vessels fully underway. Consequently, project operations should not cause noise being produced at levels that would negatively affect fish, or other marine life in the area.

As part of its proposed cetacean monitoring program, OPT would conduct *in situ* measurements of the acoustic emissions as a function of seastate at the Reedsport Project site (see section 3.3.4). The noise emitted by the single PowerBuoy that would be deployed in Phase I of the project would be evaluated under a range of sea states to allow for collection of device and project-specific information regarding actual noise emitted by a PowerBuoy. OPT would review the collected noise data with stakeholders, and if more noise is generated than expected, the monitoring data would provide a sound basis for determining appropriate additional steps to either further evaluate or mitigate for project operations when the other 9 PowerBuoys are installed in Phase II, through adaptive management. Implementing this monitoring program, as proposed by OPT, would help to ensure that noise and vibration associated with the proposed project would not have a long-term, adverse effect on fish community located in the project vicinity.

Effects of Changes in Wave Energy, Current, and Sediment Transport

As described in section 3.3.1, *Geologic and Soils Resources*, sandy beach habitat is prevalent along the nearshore of the Oregon coastline and represents the majority of the nearshore habitat in the proposed project vicinity (Oregon DFW, 2006). Wave energy drives the physical processes that affect sandy beach habitats. When waves shoal and break, they generate tremendous forces on the bottom, resulting in turbulence, wave runup, nearshore currents, and longshore and cross-shore sediment transport.

Operation of the proposed PowerBuoy array would extract and scatter wave energy from the project area, which in turn would reduce the height of waves experienced on the beaches. This loss of wave energy could reduce surf energy, alter sediment transport and sediment deposition of the nearby shoreline, and change habitats for a variety of shoreline and shallow bottom dwelling organisms (i.e., aquatic insects, clams, and crustaceans (DOE, 2009; Boehlert et al., 2008).

Although OPT does not expect the proposed 10-PowerBuoy array to substantially attenuate wave energy at the beach, the Aquatic Species Subgroup is concerned that the proposed project could potentially affect shoreline habitat. To address this concern, OPT proposes to conduct wave, current, and sediment transport monitoring (described in appendix A of the Settlement Agreement) to evaluate changes to the wave field and water column characteristics due to the placement of the PowerBuoy array. The proposed monitoring program focuses on:

- identifying the near-field effects of the PowerBuoys; and
- monitoring the bathymetry, shoreline contour, and water column properties to capture any anomalous nearshore effects.

Our Analysis

OPT's proposed PowerBuoy array would generate power by capturing the up-and-down motion of the surface waves and using it to cycle hydraulic cylinders. The hydraulic fluid would then be pumped through a hydraulic motor, which would be made to spin. In this way, the reciprocating motion would be converted into rotational motion. In the PowerBuoy, the hydraulic motor is coupled to a generator that generates AC current that is smoothed into DC current, and then is converted back to 60-Hz, synchronous, three-phase power. This conversion of wave energy to electric energy is expected to slightly alter wave heights in the near field and potentially in the far field.

Although direct effects on wave heights at operating wave energy conversion projects have not yet been made, DOE (2009) summarized wave height information gathered during modeling analyses conducted for a variety of existing and potential wave energy conversion projects in the United Kingdom, Hawaii, and other locations. The evaluation showed that effects on wave heights are largely a function of the number and size of wave energy conversion buoys, their height, and the angle of approaching waves. For example, a wave energy research facility located off the coast of Cornwall, UK, was predicted to reduce wave heights at shorelines 3.1 to 12.4 miles away by 3 to 6 percent. In addition, operation of six wave energy conversion buoys in Hawaii was not predicted to impact oceanographic conditions. This conclusion was based on modeling analyses of wave height reductions of 0.5 percent for a wave period of 9 seconds and less than 0.3 percent for a wave period of 15 seconds. Recognizing that impacts are technology and location specific, other estimates predicted wave height reductions ranging from 3 to 15 percent, with maximum effects associated with those installations located closest to the shoreline (DOE, 2009).

Based on a Fresnel analysis (a numerical model) of OPT's proposed PowerBuoy array, OPT estimated an attenuation of about 12 percent behind the PowerBuoys and an attenuation of wave amplitude at the beach of 2.1 percent (worst case). In addition to this evaluation, Surfrider provided an independent analysis at a February 5, 2007, Oregon Solutions Recreation/Public safety meeting that confirmed an attenuation of less than 15 percent, given the current level of wave energy conversion technology and the density and placement of the proposed PowerBuoys.

While a substantial reduction in wave heights in the project vicinity could alter bottom erosion and sediment transport and deposition along the shoreline in the proposed project vicinity, the potential reductions in wave heights associated with the proposed project are expected to be minimal, and would likely have only minor effects on littoral and shoreline habitat. The PowerBuoys would be located approximately 2.5 nautical miles off the coast, would be relatively small (36 feet in diameter), and would be located approximately 330 feet apart. Consequently, effects on shoreline habitat are not expected to be substantial. In addition, the aquatic species that occupy shoreline habitat near the proposed project area have adapted to dramatic changes in wave heights, both on a daily and seasonal basis, and could easily adapt to a very slight change in habitat conditions.

Although OPT concludes the above findings suggest that a project the size of the proposed Reedsport OPT Wave Park would only have only a minor effect on ocean currents, wave attenuation, and related erosion or accretion patterns, we agree that its proposed wave, current, and sediment transport monitoring program would provide an effective means to obtain site-specific data and evaluate, through associated modeling of acquired data, potential effects of the project on waves and currents. Boehlert et al. (2008) also concluded there is a need for field investigations of the environmental changes that result from the construction of wave energy facilities. This is critical for those constructed on the Pacific Northwest Coast, due to its extreme waves and currents and the fairly unique processes and responses of its beaches.

Specifically, OPT's proposed monitoring includes *in situ* observations of the wave field, the vertical structure of horizontal currents and water column properties, and synoptic observations of the wave field near the PowerBuoys (with an X-band radar system). Changes to the topography and bathymetry would also be monitored using regular beach surveys, as well as a video-based monitoring system. A numerical model of the effects of the Power Buoys on the wave field would then use these measurements to predict project effects, if any, on waves, currents, and sediment transport in the project vicinity.

In the event that substantial effects on waves, currents, and sediment transport are observed, OPT would conduct additional evaluations as needed to evaluate appropriate measures within an adaptive management framework.

Effects of Navigation and Fishing Closures on Fish and Wildlife

To limit the potential for vessel collisions with project structures and the loss of fishing gear, OPT proposes to properly illuminate the PowerBuoys and clearly mark the buoy deployment area on navigation charts. OPT also proposes that the buoy deployment area be designated as a No Fishing Zone[20] and a Restricted Navigation Area.[21]

Closure of this area could affect aquatic resources through the (1) elimination of fishing pressure within the exclusion zone; and (2) removal of potential sources of scour (and other fishing gear effects) on benthic habitat.

Our Analysis

As described in section 3.3.7.1, the fishing and navigation closure associated with the proposed project would cause the loss of approximately 30 acres of sport fishing, commercial fishing, and crabbing area in the proposed project area (combined with any additional buffer zone that the Coast Guard or fishermen may impose to avoid gear entanglement). While commercial crabbing would be the primary fishery affected by the closure, other recreational and commercial fishing activities would also be excluded. According to Oregon DFW, commercial beach trawling and hook and line fishing for yellowtail and widow rockfish occurs in the project vicinity. The project area once also supported a weathervane scallop fishery; however, this fishery is not currently active (personal communication, Oregon DFW, September 4, 2008, as cited by OPT).

Although detailed data are not available describing the use of the proposed project area by fishing gear type, stakeholder involvement to date suggests that this area is of primary concern to commercial crab fishermen; therefore, the main consequence of the proposed project would be the elimination of the crab fishery in the exclusion zone. Closing this area to crab fishing would have only a minor economic effect on the commercial crab fishery (see section 3.3.9); however, it may also have a localized beneficial effect on the abundance, size, and distribution Dungeness crab in the project vicinity (i.e., the exclusion zone would create a refuge for adult Dungeness crab).

The restriction of other fishing gear types and methods in the exclusion zone could also have an effect on the area’s benthic habitat and aquatic biota. Towed bottom fishing gear, for example, can re-suspend upper layers of the seabed, re-mineralize nutrients and contaminants, and resort sediment particles. This type of fishing gear can also cause damage, displacement, or death to a proportion of animals and plants living in the seabed. In addition, the gear can alter the habitat structure directly through the flattening of wave

[20] No Fishing Zones are designated by the Oregon Fish and Wildlife Commission.

[21] The Coast Guard designates Restricted Navigation areas.

forms, removal of rock, and removal of structural organisms (Kaiser et al., 2003). The creation of an exclusion zone around the proposed project would eliminate these potential effects on both benthic habitat and non-target benthic organisms living in the seabed. Blyth et al. (2004, as cited in DOE, 2009) found that cessation of towed-gear fishing resulted in significantly greater total species richness and biomass of benthic communities compared to sites that were still fished using towed fishing gear.

As described in *Effects of Alteration of Habitat on the Marine Community Composition and Predator/Prey Interactions*, OPT would monitor the marine community (including the distribution and abundance of adult Dungeness crab) in the PowerBuoy array before and after project deployment as part of its fish and invertebrates monitoring. Specifically, through the fish and invertebrates monitoring, data would be collected to evaluate potential project effects on the distribution and abundance of key species. Any dramatic changes in fish abundance in the exclusion zone would likely be captured in this evaluation.

Fish or Wildlife Emergency Circumstances

Installing and operating the proposed project has the potential to injure or kill fish and wildlife in the project vicinity in a manner that may not be anticipated or previously authorized by the resource agencies. To address this concern, section 3.6 of the Settlement Agreement requires OPT to immediately take appropriate action to prevent further loss in a manner that does not pose a risk to human life, limb, or property. Specifically, within 6 hours of becoming aware of an emergency circumstance, OPT would call the emergency contacts listed in exhibit C of the Settlement Agreement and would cooperate with the relevant agency or agencies to allow them to perform life-saving measures or collect dead animals. As soon as practicable but no later than 10 days after any such occurrence, OPT would notify the appropriate Implementation Committee members to allow members to initiate the AMP and provide a copy of this notification to the Commission and the Settlement Agreement Parties.

Our Analysis

Notifying the appropriate resource agency or agencies of a marine emergency circumstance would ensure that they would provide timely recommendations on a case-by-case basis to minimize or avoid ongoing effects on fish and wildlife resources. This recommendation is designed to protect and mitigate damages to fish and wildlife; however, specific measures to protect and mitigate adverse effects cannot be predetermined because these events are by nature unanticipated or emergencies that may occur randomly, without forewarning, and resolution cannot be predetermined.

3.3.3.3 Cumulative Effects

The geographic scope of cumulative effects analysis for marine life resources encompasses those activities within the Oregon State territorial waters from the shoreline of the Oregon Pacific Coast to the 3-nautical mile boundary. The exception is for anadromous salmonids, where activities located throughout their migratory range may cumulatively affect some species.

Benthic organisms may be cumulatively affected by dredging activities and the placement of anchors associated with the project. In addition, a number of dredge disposal sites are located along the Oregon Coast; the Umpqua Ocean Dredged Material Disposal Site, located about 1 mile offshore of the Umpqua River mouth, or approximately 5.5 miles south of the Reedsport Project site, is the closest dredge disposal site to the project. Between 1976 and 2008, an annual average of 156,447 cubic yards of dredged material was deposited at this site (Corps, 2007). The dumping of dredge disposal material results in the suffocation and death of immobile or slow moving benthic organism and a change in the seabed (creation of subsurface disposal mounds). The effects of dumping these quantities of sediment into the ocean over a period of 84 years represents a very large effect on the environment, particularly for benthic species and their habitat, consisting of annual smothering of benthic organisms, increases in turbidity during the dumping, and creations of underwater mounds.

The proposed Reedsport Project would also have an effect on benthic species and their environment. As indicated above, each anchor would cover an area approximately 32.8 feet (10 meters) in diameter, and the total area of the seafloor ultimately covered by 16 anchors would be 13,760 square feet (0.321 acre), or 1.7 percent of the footprint of the array.

Compared to the Umpqua dredging disposal activities, the amount of benthic organisms that would be covered by the anchors (0.31 acre, one time only) represents a very minor additive effect to that of the dredging operations (the dump site has an area of approximately 103 acres on which an average of 163,407 cubic yards has been dumped on an annual basis). Results of OPT's proposed fish and invertebrates monitoring and AMP would facilitate the evaluation and characterization of these potential effects for the Reedsport Project and provide a better understanding of the projection of potential future cumulative effects.

Installation of the project anchors and USP, and the increase in habitat structure that these components represent, may lead to development of artificial reefs and FADs within the 30-acre project footprint, thus potentially changing the marine community composition and predator/prey interactions. This effect is expected to be limited based on the small proportion of the footprint (1.7 percent) that would be occupied by these structures. Outside the project area, the addition of this open ocean structure does not represent a substantial increase in FADs within the geographic scope of this analysis; however, this effect could become significant if additional wave energy conversion projects are developed. Results of OPT's proposed fish and invertebrates monitoring and AMP would facilitate the evaluation and characterization of these potential effects for the Reedsport Project and provide a more thorough understanding of the projection of potential future cumulative effects.

Large-scale wave energy projects create a matrix of cables spanning the water column and converging on the seabed. There is concern that wave energy projects may affect sensitive species by altering their behavior and inhibiting their ability to sense and respond to naturally occurring EMF stimuli. Additionally, the project's underwater transmission cables may represent an additive effect to fiber optic cables with regard to EMF. However, the power cables that would be installed at the project would be shielded and buried, which would reduce or eliminate emission of electric fields. Fiber optic cables are also typically shielded and are often buried, limiting the EMF contributed from these sources. Given that EMF drops off at an exponential rate with distance from a source, we agree with OPT that the effects and cumulative effects of EMF from the proposed project cables are not a concern.

Outside the project area, the EMF contributed by this project would not represent a substantial increase in the amount of anthropogenic EMF produced within the geographic scope of this cumulative effects analysis. Results of OPT's proposed EMF monitoring and AMP would facilitate the evaluation and characterization of these potential effects for the Reedsport Project and provide a better understanding of the projection of potential future cumulative effects.

Effects of noise/vibration generated by large networks of wave energy conversion devices would result in potential effects over a larger area of the Coast than with a single smaller wave project. Results of OPT's cetacean monitoring program, which proposes to characterize the acoustic background of the project area, would facilitate an understanding of the acoustic impact of the project and provide a better understanding of the potential for cumulative effects.

The effects on shoreline habitat of the proposed Reedsport Project are not expected to be substantial because the predicted attenuation of wave energy would be minor. In addition, the aquatic species that occupy shoreline habitat near the proposed project have adapted to dramatic changes in wave heights, both on a daily and seasonal basis, and could easily adapt to a very slight change in habitat conditions. Results of OPT's proposed wave, current, and sediment transport monitoring program would facilitate the evaluation and characterization of these potential effects for the Reedsport Project and provide a better understanding of the projection of potential future cumulative effects.

3.3.4 Marine Mammals, Reptiles, and Birds

3.3.4.1 Affected Environment

Marine Mammals

A variety of pinnipeds (seals and sea lions) and cetaceans (whales, dolphins, and porpoises) occur along the Oregon Coast. As described in section 1.3.3, the MMPA provides protection for all pinnipeds and cetaceans, but several species are also protected under the ESA. Federally listed species that could occur in the project area include the Steller sea lion, humpback whale, sperm whale, Sei whale, blue whale, fin whale, and southern resident killer whale (SRKW). We discuss these federally listed marine mammals in section 3.3.6, *Threatened and Endangered Species and Essential Fish Habitat*.

Pinnipeds

The most common pinniped species that occur in Oregon coastal waters are the harbor seal and California sea lion. Northern elephant seals can also be present but are infrequently observed, and northern fur seals are rare.

Pinnipeds feed on migratory species (e.g., hake, clupeids, salmonids), as well as non-migratory species (e.g., rockfish, lingcod). Pinniped occurrence and use of haul-outs in Oregon is related to seasonal trends of molting and breeding in some species. Seals and sea lions can easily cover long distances while foraging, and, therefore, the project is within range of a number of haul-out sites. Table 6 shows the abundance of pinniped species at haul-out sites in the project vicinity.

Harbor seals are commonly found year-round along the shore of coastal waters, bays, estuaries, or sandy beaches and mudflats and are permanent residents along the Oregon Coast. Hundreds of harbor seals haul out in the mouth of the Umpqua and along the beach in the vicinity of the project area. Harbor seals are not migratory, although local movements are driven by season, pupping, and prey location. The population of harbor seals in Oregon grew following protection under the MMPA of 1972 until stabilizing in the early 1990s. The estimated population of harbor seals (all age classes) during the 2002 reproductive period was 10,087 individuals. In Oregon, seals are born from March to May.

California sea lions are also numerous and more likely to be located further offshore, in waters where the proposed project would be located. California sea lions range from Vancouver Island, British Columbia, to Baja Mexico. California sea lions do not breed in Oregon or Washington; in habitat north of California, the haul-out grounds are only occupied by males. Therefore, only male sea lions are present off the Oregon Coast from fall to spring, with minimal numbers in the summer. The primary haul-out

Table 6. Pinniped species and abundance at haul-out sites in the project vicinity, including Lane, Douglas, and Coos counties (Source: OPT, 2010).

Haul-Out (approximate distance from project area)	**Species**	**Abundance**
Sea lion caves (~25 miles north of project area)	Steller sea lions	Variable; up to 1,000 non-pups
	California sea lions	Variable; non-pup males
Siuslaw River (~20 miles north of project area)	Harbor seals	100–200 non-pups; 10–15 pups
Siltcoos Outlet (~12 miles north of project area)	Harbor seals	100 non-pups; 5 pups
Takenitch Outlet (~6 miles north of project area)	Harbor seals	0–10 non-pups
Umpqua River (~1.5 miles south of project area)	Harbor seals	600–700 non-pups; 100 pups
Tenmile Outlet (~8 miles south of project area)	Harbor seals	0–50 non-pups; 1–2 pups
Coos Bay (~25 miles south of project area)	Harbor seals	250–350 non-pups; 50 pups
Cape Arago (~30 miles south of project area)	Steller sea lions	Variable; up to 600 non-pups
	California sea lions	Variable; up to 2,000 non-pup males
	Harbor seals	400–500 non-pups; 100–200 pups
	Elephant seals	20–30; a few pups

areas along the Oregon Coast are Rogue Reef, Orford Reef, and Shell Island of Simpson Reef (approximately 90 miles, 68 miles, and 30 miles south of the project area, respectively); and Three Arch Rocks, Cascade Head, South Jetty, and Sea Lion Caves (approximately 270 miles, 95 miles north, 62 miles, and 25 miles north of the project area, respectively).

Northern elephant seals occur in the North Pacific and range from Baja Mexico to the Gulf of Alaska, where they live offshore outside of molting periods. Adult northern elephant seals are rarely reported in Oregon, but small numbers of juveniles routinely come ashore during the April to August molting season. The northernmost breeding ground on the Pacific Coast is Shell Island (approximately 30 miles south of the project site). Cape Arago, just north of Shell Island, is the nearest haul-out location of northern elephant seals (table 6).

The northern fur seal is a migratory species that is currently listed as depleted under the MMPA but is not listed under the ESA. Northern fur seals migrate in the early winter through the eastern Aleutian Islands into the northern Pacific Ocean. Upon entering the northern Pacific Ocean, they move into coastline habitat off British Columbia, Washington, Oregon, and California. The northward migration begins in March, returning the animals back to the breeding colonies, and the general cycle is repeated. Numbers of northern fur seals found to occur in the project area are expected to be very low.

Cetaceans

As shown in table 7, as many as 17 cetaceans that are not federally listed can be found along the Oregon Coast. Based upon both literature review and sea-based surveys in the project vicinity, harbor porpoises and gray whales are the two cetacean species most commonly found in the project area.

Harbor porpoises are small marine mammals that generally remain near estuaries and rivers. They feed on small fish, such as herring, and can venture into freshwater rivers for extended periods. Populations are in a stable condition with projections estimating approximately 37,745 total individuals in Oregon and Washington. Research has shown that porpoise do not generally migrate and have a limited local range that does not intermix with other proximal stocks. They can be found more than 100 miles offshore, but generally remain in nearshore waters. Distribution is based on food resources.

Gray whale populations are composed of an eastern and western stock. The western stock is found along the Korean coastline and remains federally classified as endangered. The eastern stock inhabits the Pacific Coast and was de-listed from federal protection in 1994. The current population is estimated to be more than 20,000 whales, which is thought to be near pre-exploitation levels. However, the gray whale is state-listed as an endangered species in the state of Oregon.

Gray whales migrate up and down the Pacific Coast between their Alaskan feeding waters (summer) and Mexican breeding grounds (winter). This migration covers 10,000 to 14,000 miles for a round trip, and it represents the longest migration of any mammal. During migration, whales pass along the Oregon and Washington coasts. However, approximately 200 to 250 whales from the Eastern North Pacific stock do not migrate north to the Bering Sea, but instead spend summer and fall feeding along the Pacific Coast south of Alaska. These gray whales are referred to as the Pacific Coast Feeding Aggregation, and there is no evidence of genetic or demographic distinction from the eastern population.

Table 7. Summary of non-ESA listed cetaceans that could occur within the project area (Source: OPT, 2010, modified by staff).

Common Name	Distribution and Habitat	Population Status
Minke whale	Migratory movement along Oregon's continental shelf.	No direct population estimates are available. Population is not considered threatened and is not a strategic stock.
Gray whale	Eastern population migrates seasonally along the West Coast. Northbound migration generally in nearshore habitat, while southern migration is farther offshore.	Species was delisted in 1994 and is making a marked recovery. Population is currently more than 20,000 individuals and showing positive growth.
Gray whale (Pacific Coast feeding aggregation)	Spend summer and fall feeding along the Pacific Coast south of Alaska instead of migrating north to the Bering Sea.	Includes approximately 200 to 250 whales from the Eastern North Pacific stock. There is no evidence of genetic or demographic distinction from the eastern population.
Bottlenose dolphin	Located primarily in warm waters of southern California. Rarely venture into Oregon and found in distant offshore areas.	No direct population estimates are available, but the population is considered to be in good health.
Common dolphin (short beaked)	Primarily found off the California Coast. Few sightings in southern Oregon. Can be found from nearshore up to 300 nautical miles offshore.	The common dolphin represents the most abundant cetacean off the California Coast, and its population status is in excellent condition.
Northern right whale dolphin	Found in shelf and slope waters in California, Oregon, and Washington. Undergoes seasonal migrations along the coastline.	While moderate risk of unnatural mortality exists, insufficient data are available to indicate low abundance or negative population trends.

Common Name	Distribution and Habitat	Population Status
Pacific white sided dolphin	Found in shelf and slope waters in California, Oregon, and Washington. Concentrated in California. Undergoes seasonal migrations along the coastline.	Population trend appears stable and unchanged. Population is not considered threatened and is not a strategic stock.
Risso dolphin	Found in shelf and slope waters in California, Oregon, and Washington. Undergoes seasonal migrations along the coastline.	Population trend appears stable and unchanged. Population is not considered threatened and is not a strategic stock.
Dall's porpoise	Located in near and offshore waters within shelf and slope habitat. Movement along coastline determined by seasonality and interannual time scales.	Assessment of population trends are not available, but no direct threat to the population was identified and is considered a non-critical stock.
Harbor porpoise	Located in nearshore habitat during most of year, but can shift to deeper offshore waters during winter months. Population concentrations driven by primarily by prey availability.	Population is not considered "strategic" due to low annual unnatural mortality. Numbers are not listed as depleted. Overall population trends are not known.
Baird's beaked whale	Found primarily near Japan with only a few offshore deepwater sightings occurring in Oregon. Most sightings occur from late spring and early fall. Offshore movements occur from November to late April.	Due to rarity, population trend assessment is not available. Population is not considered threatened and is not a strategic stock.

Common Name	Distribution and Habitat	Population Status
Mesoplodont beaked whale	Found in deepwater habitats near the continental shelf.	Due to rarity, population trend assessment is not available. Population is not considered threatened and is not a strategic stock.
Stejneger's beaked whale	Endemic to cold-temperature waters of the North Pacific, Sea of Japan, and deep waters of the southwest Bearing Sea.	Reliable estimates of abundance for this stock are currently unavailable.
Cuvier's beaked whale	Found in deepwater habitats near the continental shelf.	Due to rarity, population trend assessment is not available. Population not considered threatened and is not a strategic stock.
Killer whale (transient)	Along the West Coast of North America, killer whales occur along the entire Alaskan Coast, in British Columbia and Washington inland waterways, and along the outer coasts of Washington, Oregon, and California.	The minimum population estimate for the Eastern North Pacific Transient stock of killer whales is 346.
Pygmy sperm whale	Species remains submerged in distant offshore pelagic waters for long periods of time. Small size makes species cryptic and poorly understood.	Due to rarity, population trend assessment is not available. Population is not considered threatened and is not a strategic stock.
Pilot whale (short finned)	Primarily found off the southern California Coast. Possible migrants sighted in Oregon were in offshore waters.	Population appears healthy, although no trend analyses are available.

Gray whales feed primarily on benthic invertebrates, though they have been documented to feed on kelp-dwelling crustaceans. Generally, gray whales remain within a few miles of the shoreline. They can intermittently be found near the mouths of estuaries as they are searching for food.

To evaluate the migration patterns of gray whales along the Oregon Coast, OPT conducted Phase I, Baseline Characterization, of the cetacean monitoring (Ortega-Ortiz and Mate, 2008). Phase I involved visually monitoring whales every day (weather permitting) between December 10, 2007, and May 30, 2008, from an observation point at Yaquina Head, located approximately 70 miles north of the proposed project area. In 78 days of observations, scientists recorded a total of 2,416 gray whale locations, including 460 during scan sampling and 1,956 during focal follows (i.e., tracking of an individual whale's movement past Yaquina Head). Only two observations of cetaceans other than gray whales were reported: two minke whales were observed moving south at the end of May.

Marine Reptiles

While sea turtles are considered a warm temperate marine reptile, four species—leatherback, loggerhead, green, and olive ridley—have been documented in strandings along the Oregon and Washington coasts. All four of these species are federally listed as endangered, and for this reason, we discuss their occurrence in the project area in section 3.3.6, *Threatened and Endangered Species and Essential Fish Habitat.*

Offshore Birds[22]

The coastal area of Douglas County offers an expansive coastline and open-marine nearshore foraging area for resident and migrant seabirds throughout the year. The outer coast in the project vicinity is predominantly sandy beaches and dunes. Relatively few seabirds nest along this stretch of the shoreline; the vast majority use headland cliffs, sea stacks, and islands along rockier stretches of the coast, both to the north (e.g., Three Arches National Wildlife Refuge) and to the south, from Cape Arago to the California border (Naughton et al., 2007).

Although there is little nesting along the coastline in the project vicinity (double-crested cormorants and marbled murrelets are the only seabirds documented to nest in Douglas County), seabirds that nest in adjacent counties may forage in the project area. These include Leach's storm-petrels, Brandt's and pelagic cormorants, common murres,

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[22] In this EA, we use the terms *offshore birds* or *seabirds* in a general sense to include waterbirds (whether waterfowl, shorebirds, or pelagic species) that would be likely to use the coastline or marine waters within 3 miles of the coastline.

pigeon guillemots, western gulls, tufted puffins, and rhinoceros auklets. Outside the breeding season, large numbers of loons, sooty shearwaters, scoters, and other seabirds also migrate through or overwinter in the area. We present species documented throughout the year in Coos County, which borders Douglas County on the north, in table 8.

Table 8. Expected abundance and timing of select species found along the coast of Coos County, Oregon (Source: OPT, 2010, as modified by staff).

Species	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Albatross	R	R	R	C	C	A	A	A	A	C	R	R
Ancient murrelet	C	C	R	R	E	E	E	E	R	R	C	C
Black-legged kittiwake	R	R	C	C	R	E	R	R	C	C	R	R
Bonaparte’s gull	R	R	R	A	C	R	R	C	C	A	C	R
Brandt’s cormorant	R	C	C	C	C	C	C	C	C	C	C	R
Brant	C	C	A	A	R	E	E	E	R	C	C	C
Brown pelican	R	R	R	R	R	A	A	A	C	C	C	R
California gull	R	R	C	C	R	R	C	C	C	C	R	R
Cassin’s auklet	R	R	R	R	R	R	R	R	C	C	C	R
Common loon	C	C	C	C	C	C	R	C	C	C	C	C
Common murre	R	R	C	A	A	A	A	A	A	C	R	R
Common tern	E	E	R	C	C	R	R	C	C	R	R	E
Fork-tailed storm-petrel	R	R	R	C	C	C	C	C	C	R	R	R
Glaucous-winged gull	A	A	A	A	R	R	C	C	A	A	A	A

Species	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Herring gull	R	R	R	R	R	E	R	R	R	R	R	R
Marbled murrelet	R	R	R	R	R	R	C	C	C	C	R	R
Mew gull	A	A	A	C	R	E	R	R	C	A	A	A
Northern fulmar	C	C	C	R	R	E	E	E	R	C	C	C
Pacific loon	C	C	C	C	A	A	C	C	A	A	C	C
Pomarine jaeger	E	E	E	R	R	E	R	R	R	R	R	R
Red phalarope	R	R	R	C	C	E	E	E	R	R	C	C
Red-legged kittiwake	R	R	E	E	E	E	E	E	E	E	R	R
Red-necked phalarope	E	E	E	C	C	E	R	C	C	R	R	E
Red-throated loon	C	C	C	C	C	R	R	R	C	C	C	C
Ring-billed gull	A	A	A	A	C	E	R	R	C	C	C	C
Scoters	A	A	A	A	A	R	R	R	R	C	C	C
Short-tailed shearwater	C	R	R	R	E	E	E	E	R	C	A	C
Snowy plover	R	R	R	R	R	R	R	R	R	R	R	R
Sooty shearwater	R	R	R	C	C	C	A	A	A	A	C	R
Thayer’s gull	R	R	R	R	R	E	E	E	R	R	R	R
Tufted puffin	E	E	R	C	C	C	C	C	C	E	E	R

Notes: A – Abundant, C – Common, E – Absent or extremely rare, R – Rare

Special-Status Seabirds

Special-status seabirds in the project area include those that are federally listed as threatened or endangered or proposed for listing and those that Oregon DFW has designated as threatened, endangered, or sensitive. The marbled murrelet and western snowy plover are listed as threatened under the ESA; we discuss these species in section 3.3.6, *Threatened and Endangered Species and Essential Fish Habitat.*

Five non-federally listed special status seabirds would be likely to occur in the project vicinity. The California brown pelican is state-listed as endangered in Oregon. The fork-tailed storm-petrel, Cassin's and rhinoceros auklets, and tufted puffin are considered sensitive-vulnerable (SV), meaning that they are facing one or more threats to their population or habitat, but are not currently imperiled (Oregon DFW, 2008).

3.3.4.2 Environmental Effects

Marine Mammals

Based on consultation with local stakeholders and state and federal agencies, OPT identified several issues related to marine mammals. These include the potential for pinniped attraction to the buoys; effects of underwater noise/vibration on cetacean behavior; and cetacean collision/entanglement in the buoy tethering system and/or derelict fishing gear that may be snagged on the tethering system.

Pinniped Attraction

Pinniped use of the PowerBuoys as haul-out sites may be detrimental to project operation because it could interfere with power production and pose a risk to maintenance workers that would occasionally require access to the PowerBuoys. In addition, the project's underwater infrastructure may affect existing predator/prey interactions through changes in the benthic and marine community composition and habitat. Of particular concern is the potential that salmon may be attracted to the PowerBuoy array's structure, in much the same way an artificial reef will serve as habitat for some species, and that pinnipeds may in turn be drawn to the area to feed on them.

To address these concerns, OPT proposes to design the buoys to minimize the opportunity for pinnipeds to use them as haul-outs and to conduct pinniped monitoring in two phases. The first phase would evaluate pinniped haul-out activity on the single PowerBuoy. The second phase would evaluate pinniped abundance in the project area around the 10-buoy array.

Pinniped Haul-out Activity—OPT plans to coat the float of the single PowerBuoy to be deployed in Phase I of the project with UHMWPE material to prevent pinnipeds from using the buoy as a haul-out. UHMWPE is generally described as having a very low friction coefficient (thereby making it slippery), high impact strength, low moisture absorption rate, and is non-corrosive. The material is also self-lubricating, so no regular maintenance would be required.

OPT proposes to monitor pinniped haul-out activity during brief (1 minute) weekly supervisor inspections from shore via binoculars, and during monthly preventive maintenance/site inspection visits by boat. Observations would also be recorded during the proposed cetacean, fish and invertebrates, and offshore avian use monitoring programs. Monitoring would continue for a 1-year period following installation.

If pinnipeds are observed on the PowerBuoy, OPT would notify the Aquatic Species Subgroup within 2 weeks to describe the event, and initiate a discussion on how best to respond. OPT would provide a summary of observations in periodic updates to the subgroup. If no pinniped haul-out behavior is observed, OPT would provide a summary report to the subgroup within 6 weeks of completing the direct observations.

Our Analysis

The propensity of seals and sea lions (and sea lions in particular) to haul out on human-made structures is well-documented. OPT reports that Coast Guard buoy tender crews in the Reedsport area estimate that they observe seals and sea lions about 25 percent of the time, both on the buoys and in the water, when they are servicing aids to navigation between May and October. Preventing pinniped use of the PowerBuoys would help to maintain the units in good operating condition and minimize safety risks to OPT personnel.

Weekly, monthly, and opportunistic observations (OPT indicates they would monitor use a minimum of 75 times in the year following deployment of the single PowerBuoy) would be useful in evaluating whether pinnipeds are using the UHMWPE-coated PowerBuoy as a haul-out site. If pinnipeds are observed on the single PowerBuoy to be deployed in Phase I of the project, the Aquatic Species Subgroup has identified the installation of fencing as a potential response. Fencing has been used successfully to prevent seals and sea lions from hauling out on other types of buoys and docks, and could be effective on the PowerBuoys.

Pinniped use of the Project Area—As with the haul-out surveys, direct observations would be used to examine pinniped presence and abundance in the project area following deployment of the single and then the multiple-buoy array. To identify and count pinnipeds by species and age class, OPT would conduct the surveys from vessels positioned in proximity to the generating unit. Observations would be recorded by trained observers during monthly preventive maintenance/site inspection visits, unplanned maintenance visits, and during the cetacean, fish and invertebrate, and offshore avian use monitoring. OPT would make the observations for 1 year following deployment of the first buoy, and in years 1, 2, 5, 10, and 15 following deployment of the

10-buoy array. The observations would be conducted to ensure seasonal distribution, with at least three surveys in spring, summer, and fall. The frequency of winter observations would depend on weather conditions.

As with the haul-out surveys, OPT would provide a summary of study progress to the Aquatic Species Subgroup in periodic updates. OPT would provide a summary of results of the single buoy observations within 6 weeks of study completion. OPT would provide annual reports of surveys of the array.

Finally, OPT proposes to seek an Incidental Harassment Authorization under the MMPA from NMFS for construction and operation of the project in the event that unanticipated effects to marine mammals occur.

Our Analysis

Seal and sea lion predation can have a significant effect on salmonid populations in areas where salmonids are concentrated by blocks to migration (waterfalls, dams), in net pens for aquaculture, or where they are the target of commercial fisheries (Scordino, 2010; Würsig and Gailey, 2002), but the effect would likely be much smaller in open water conditions. For this reason, we conclude that the number of observations OPT would collect (a minimum of 75 observation periods) would likely be adequate to evaluate how pinnipeds respond if the buoys function as FADs.

No systematic baseline data are available to describe the numbers of seals and sea lions that forage in the project area under current conditions, so we agree that OPT's proposal for regular monitoring until year 15 would be valuable in determining whether pinniped use of the area increases over time after deployment. In the event that monitoring documents a marked increase of pinnipeds in the area, the Aquatic Species Subgroup would have the information needed to evaluate the results in conjunction with results of other monitoring. The subgroup can determine whether there appears to be a nexus between increased pinniped presence and potential for increased salmon predation. If so, the AMP would provide an effective means of assessing the need for further evaluation and consideration of new measures.

Effects of Underwater Noise and Vibration on Cetaceans

Human-caused underwater noise and vibration have the potential to adversely affect cetaceans by interfering with communication, prey and predator detection, and navigation and by causing temporary or permanent hearing loss. Noise has the potential to alter migration patterns, if cetaceans respond to noise by avoiding it, or to increase the potential for collision or entanglement, if cetaceans respond to it by investigating.

Service vessels and equipment used to install and maintain the PowerBuoys would create underwater noise and vibration. The PowerBuoys would also produce some level of noise during operation. The cetacean monitoring program would focus on noise associated with project operation and its potential effect on gray whales because such effects could be long-lasting. As described in section 3.3.4.1, *Marine Mammals, Reptiles, and Birds*, the first task in Phase I of the cetacean monitoring (Baseline Characterization, completed in October 2008) involved monitoring gray whale migration along the coast of Oregon, based on observations at Yaquina Head. The second task involved in Phase I is for OPT to provide the Aquatic Species Subgroup with a report summarizing the key findings of the October 2008 workshop, a recommendation for a strategy to avoid whale collisions and entanglement, and a draft approach for monitoring the behavior of whales near the project. The results of the 2008 workshop were considered during development of OPT's proposed cetacean monitoring program.

In Phase II of the cetacean monitoring, OPT would conduct *in situ* measurements of acoustic emissions under a range of sea states to allow for collection of device and project-specific information regarding actual noise emitted by the single PowerBuoy to be deployed in Phase I of the project. OPT proposes to deploy two autonomous recorders for 1 month prior to deployment of the test buoy and for a total of at least 2 months, likely between December and March, the period when highest sea states can be expected (winter storms), following deployment. OPT would submit a study report to the Aquatics Resources and Water Quality Implementation Committee within 2 months of monitoring completion, and notify the Implementation Committee if acoustic measurements indicate that sound produced by the PowerBuoy has not attenuated to below broadband 120 dB (the level of continuous noise NMFS currently considers to be the threshold for Level B harassment) at the boundaries of the physical footprint of the PowerBuoy structure including moorings. If such is the case, the AMP would be used to determine any additional steps that should be taken.

Phase III of the cetacean monitoring would involve evaluating gray whale movements through the project area during the gray whale migration season, from December 2011 through June 2012, after the expected installation of the 10-buoy array. OPT would construct an observation station on top of an approximately 80-foot-high sand dune located approximately ¼ mile inland from a location adjacent to the proposed deployment site. Observers would use the same methods to record and track gray whale movements as were used during the Phase I surveys at Yaquina Head.

OPT would use boat-based monitoring to supplement the shore-based observations. Boat-based surveys would be conducted by trained observers in conjunction with fish and invertebrates monitoring sampling efforts, the offshore avian use monitoring, and operation and maintenance site visits that would be conducted on a monthly basis throughout the life of the project.

In its comments on the final license application and Settlement Agreement, PMFC suggests there is a need to characterize acoustic emissions, determine species-specific sound thresholds, and evaluate responses for species of concern in the project area. Additionally, it recommends the employment of techniques to dampen sound effects where possible. It notes that monitoring the acoustic emissions and species responses, and developing any potential mitigation measures where species responses are deemed significant, should be included in the AMP.

Our Analysis

As many as 17 non-ESA-listed cetaceans could occur in the project area (table 8), but under current conditions, only the harbor porpoise and gray whale are common, and are the species most likely to be affected by project-related noise. Other non-listed cetaceans are typically found farther offshore or do not regularly occur off the coast of Oregon, but could occasionally swim through the project area. We discuss potential effects on federally listed cetaceans in section 3.3.6, *Threatened and Endangered Species and Essential Fish Habitat*.

There is considerable variation among cetaceans in terms of absolute hearing threshold and sensitivity. The composite range of cetacean hearing is from ultrasonic (frequencies greater than 20 kHz) to infrasonic (frequencies less than 20 Hz). Mysticetes (baleen whales, such as gray whales and humpback whales) are low-frequency specialists with peak spectra of their vocalizations occurring from 12 Hz to 3 kHz. Odontocetes (toothed whales, such as harbor porpoises and killer whales) are high-frequency specialists, with peak spectra of their vocalizations occurring from 10 kHz to 200 kHz.

In general, underwater sound travels five times faster and 60 times farther than comparable sounds generated in air, and noise generated by ships and other human activities can often be detected by marine mammals many miles from the source. Site-specific factors (e.g., substrate, underlying geology, bathymetry, water temperature) can alter the rate of attenuation of a sound over distance.

Ambient, or background, noise can also affect the distance at which a sound can be heard, and may interfere with the ability of marine mammals to detect sound signals that would otherwise be audible (Richardson et al., 1995). Ambient noise in the Reedsport Project area has not yet been measured. In general, Boehlert et al. (2008) refers to average ambient levels of about 90 dB in the open ocean; the estimate used for the Cape Wind Project Biological Assessment (ESS Group and Batelle, 2006) was 74 to 100 dB; and MMS (2007) suggests ambient levels may be about 130 dB.

During project construction, the predominant source of noise would originate from the propellers of vessels used to deploy the PowerBuoys. Installation of the anchoring and mooring system would not involve percussive pile driving or drilling, the most significant noise source during most marine construction projects. For this reason, we conclude that construction activity would not cause impulse noise exceeding a sound pressure level of 180 dB, the threshold NMFS currently would consider to cause Level A harassment, and would not be likely to cause temporary or permanent hearing loss.

Peak sound intensity generated by tugs, barges, and diesel-powered vessels (representative of vessels that would be used for project installation and maintenance) fully underway would likely range from 130 to 160 dB over a frequency range of 20 Hz to 10 kHz (Richardson et al., 1995). Cavitation during vessel starts and stops during construction activities could generate similar noise levels. Work vessels should only be fully underway when traveling to and from the project site, so the sound intensity would be lower than 130 to 160 dB most of the time during construction, although smaller boats with outboard motors (e.g., a 16-foot Zodiac) traveling back and forth to the site would produce source sound levels of 152 dB at higher frequencies (e.g., 63 kHz) (Richardson et al., 1995).

Construction noise would also originate from trenching equipment used to lay the subsea transmission cable from the PowerBuoy array to the wastewater pipe outfall. The license application does not describe the techniques or equipment that would be used for trenching or jet-plowing, indicating that the details would be determined after a trenching contractor is selected. OPT expects the sound of cable trenching to be similar to a work vessel at idle speed, but based on measurement of a source level of 178 dB for cable trenching for an offshore windfarm in the North Sea (Nedwell et al., 2003), the sound may be somewhat higher than the 130- to 160-dB range.

Once the PowerBuoys are installed, vessel noise would also be generated during natural resource monitoring and monthly and unplanned project maintenance activities. The level of monitoring-related noise would be similar to the noise produced by commercial and recreational vessel traffic under current conditions. Maintenance noise may be louder than the noise produced by vessels underway, but would occur intermittently.

Based on the types of vessels and activities described above, we expect that source levels of noise during construction would exceed 120 dB, the level that NMFS currently considers as a threshold for continuous and intermittent sources of noise that can cause harassment by altering marine mammal behavior. Some attenuation would occur around the work area; Richardson et al. (1995) indicates that for vessels producing relatively low-frequency sounds, the received sound level at 50 meters would about 34 dB less than at 1 meter from the source. However, modeling conducted for the Neptune liquid natural gas pipeline off Cape Cod (Laurinolli et al., 2005) predicted that trenching would generate continuous sounds exceeding 120 dB at distances ranging from about 2.4 miles to about 7 miles. We conclude that cetaceans would be exposed to noise levels exceeding 120 dB within a relatively small area as a result of most construction activities, but within a much wider area during trenching.

Cetacean responses to the noise associated with construction could vary widely from species to species. Responses may also vary from individual to individual, depending on the animal's experience with noise in the past and its activity at the time of disturbance (Richardson et al., 1995; Moore and Clarke, 2002).

Harbor porpoises, which are not thought to be migratory, may use the project area year-round for feeding. During a survey off the coasts of California, Oregon, and Washington, Barlow (1988, as cited by OPT) observed harbor porpoises rapidly moving away from the path of a survey vessel within 1 kilometer of the boat. Harbor porpoises off the coast of California are reported to move away from all types of boats, including sailboats and kayaks (Sanctuary Integrated Monitoring Network, undated [a]). Given this behavior, we conclude that effects of construction-related noise would be minor and temporary, i.e., that harbor porpoises would avoid the project area during construction.

Gray whales would move through the project vicinity during their migration, and 200 to 250 animals may remain along the Oregon Coast all summer. Based primarily on studies of gray whales during their migration along the California Coast (Malme et al., 1984; Malme et al., 1983), Moore and Clarke (2002) calculated a 0.9 probability of avoidance of continuous low-frequency noise at levels of about 127–129 dB. Richardson et al. (1995) cites studies indicating that migrating gray whales changed course at a distance of 200–300 meters in order to move around a vessel in their paths (Wyrick, 1954, as cited by Richardson, 1995), but that some migrating gray whales do not seem to react until ships are within 15 to 30 meters (Schulberg et al., 1989, as cited by Richardson, 1995). Although these results indicate substantial variability in the kinds of responses that would be expected, we anticipate that effects of construction-related noise would be minor and temporary, i.e., that gray whales that might be present during the summer would temporarily avoid the Reedsport Project area during construction. Scheduling installation of the PowerBuoys during the summer, as OPT proposes, would prevent disturbance to migrating gray whales during project construction, because it would occur outside the gray whale migration period.

During project operation, underwater noise would originate from waves impacting the float portion of the PowerBuoy. We expect that some noise would also be associated with cycling of the hydraulic cylinders, spinning of the hydraulic motors, and transfer of vibration from the buoys' superstructure into the water, and that noise could also occur as a result of vibration of the mooring cables (Austin et al., 2009). Maintenance divers working underwater around the PowerBuoys deployed in Kaneohe Bay and in New Jersey have not noticed any audible sounds from the PowerBuoys or mooring system, but OPT notes that diver hearing underwater would not likely detect low frequencies.

During operation, the PowerBuoy uses relatively low-intensity wave-to-electrical energy conversion technologies that are expected to produce low-intensity, broadband noise of a repetitive continuous nature, similar in character to noise from ship operations

(Austin et al., 2009). Given this design, the source levels generated by the PowerBuoys should be close to ambient ocean noise levels. In addition, noise associated with the power plant machinery would increase in proportion to the ambient background noise associated with surface wave conditions, which would minimize the noticeable effect. We conclude that the potential for PowerBuoy operation to adversely affect cetaceans as a result of underwater noise or vibration would be very low. Acoustic monitoring of the PowerBuoys, together with shore-based and boat-based whale monitoring, would allow any unanticipated effects to be identified, by measuring noise levels in relation to ambient conditions and by evaluating cetacean response.

Phase II of the cetacean monitoring program calls for OPT to measure acoustic conditions at the site where the single PowerBuoy would be deployed in Phase I of the project for 1 month prior to deployment and 2 months after deployment, which would capture noise levels during a variety of sea states. Placing two recorders on the same depth contour at approximately 200 and 500 meters from the test PowerBuoy, as proposed, would provide information about attenuation with distance. The recorded values would be compared against acoustic thresholds documented in scientific literature. OPT concludes that this approach to monitoring would be sufficiently robust, but indicates that marine mammal acoustic experts who participated in the October 2008 workshop recommended a full year of monitoring, an approach also recommended by Austin et al. (2009) in an assessment of underwater noise generated by wave energy conversion devices. To address this uncertainty, OPT proposes to review the initial results of acoustic emissions monitoring with the Aquatic Resources and Water Quality Implementation Committee to determine whether additional monitoring is needed, i.e., whether noise levels attenuate to 120 dB or less within the footprint of the first deployed PowerBuoy. We agree this review would be beneficial because a full year of monitoring may be needed to adequately characterize ambient conditions. The level of background noise in the Reedsport Project area would depend not only on sea state, but on the other types of activities that would be taking place in the project area (e.g., commercial vessel traffic, recreational boating) as well. Ambient noise at a given frequency can vary as much as 10 to 20 dB from day to day (Richardson et al., 1995). Because ambient noise could mask sounds produced by the PowerBuoy, it could significantly affect the ability of cetaceans to detect it, and thus avoid it.

Review by the Aquatic Resources and Water Quality Implementation Committee would also be useful in determining whether it would be beneficial to measure the acoustic emissions of the 10-buoy array. Interactions between the buoys could result in a very different acoustic environment once all 10 buoys are in place. Boehlert et al. (2008) note that synchronous movement of array components could create a much louder noise than if the units moved separately. In their assessment of underwater noise generated by wave energy devices, Austin et al. (2009) also note that a single point absorber device, such as a PowerBuoy, is not likely to cause a significant noise impact at longer ranges, but a full assessment should consider the additive effect for groups of devices.

Employing techniques to dampen sound during installation and operation (as recommended by PMFC) would not be necessary, because, as described above, construction would temporarily produce relatively low levels of noise, and would not produce impulse noise exceeding a sound pressure level of 180 dB. The need to employ techniques to dampen sound during operation (as also recommended by PMFC) could be determined through the monitoring program outlined in Phase II. Overall, monitoring the acoustic emissions and species responses and developing any potential mitigation measures (where species responses are deemed significant) through the AMP would allow the members of the Water Quality and Aquatic Resources Implementation Committee to recommend appropriate modifications to the project, as needed, to minimize any potential adverse effects on cetaceans and other species of concern.

Phase III of the cetacean monitoring is intended to provide information about how whales move through the project area. OPT proposes shore-based monitoring during the first migration season following deployment of the full PowerBuoy array, and boat-based monitoring to supplement these observations throughout the life of the project. We agree that shore-based monitoring would allow OPT to document whether and how whales deflect their migration paths to avoid the array, but limiting the shore-based surveys to one migration season may not be adequate to capture the variability of responses that cetaceans may have to the array. Over 25 years of observations in Cape Cod waters, minke whales' reactions to boats changed from frequent positive interactions to a general lack of interest, while humpback whales reactions changed from often being negative to often being positive, and finback whales reactions changed from being mostly negative to being mostly uninterested (Richardson et al., 1995). For gray whales, Moore and Clarke (2002) calculated a 0.5 probability of avoidance to continuous noise at levels ranging from 117 to 123 dB, which is in the range OPT anticipates the PowerBuoys would produce. In a play-back experiment off Vancouver Island simulating the underwater sound of a 2-MW wind-turbine (128 dB at 160 Hz), harbor porpoises responded to the sound by using their sonar more often during replayed sound sessions, and some porpoises approached within 4.5 meters, possibly to inspect the source of the sound (Koschinski et al., 2003). The need for additional monitoring would be determined through the AMP. The monitoring plan was designed with the intent that OPT would regularly communicate with the Aquatic Resources and Water Quality Implementation Committee to provide new information as it becomes available so that the Committee could use the initial monitoring results to determine if additional monitoring is warranted.

In addition to capturing behavioral variability, another factor that suggests additional shore-based monitoring may be needed is the limited utility of boat-based surveys in providing a systematic means of determining how gray whales avoid or move through the Reedsport Project. Boat-based surveys have the potential to alter cetacean behavior, and would not be scheduled to cover all months of the gray whale migration. Like the pinniped survey schedule, cetacean surveys would be linked to other project-related activities. Linking the cetacean surveys with the avian use surveys would provide intensive coverage for the year following deployment of the test buoy, but avian use surveys would not continue thereafter. Linking cetacean surveys with fish and invertebrates monitoring would provide opportunities for observations in March, May, June, July, August, September, and November during that same time, and during the same months in years 1, 2, and 3, but would not cover January, February, April, October, or December, so some of the gray whale migration period (January, February, April, and December) would be missed. Monthly observations would continue for maintenance inspection throughout the life of the project.

We agree that boat-based surveys would provide good information about the presence of any species of cetaceans, including gray whales, in the project area during most months of the year. Comparison of the results of the boat-based and shore-based monitoring from the first year of post-deployment monitoring would help to determine whether additional shore-based monitoring (i.e., in years 2 and 3, post-deployment) is needed to determine whether acoustic deterrence measures (e.g., pingers) should be implemented to protect gray whales and other cetaceans. Other relevant information that could be considered include a new study proposed to be conducted at Yaquina Head from December 2010 through March 2011, designed to evaluate cetacean response to an acoustic device which, it is hoped, would make whales alter course by about 500 meters (OSU, 2010). This information should allow OPT and the Aquatic Resources and Water Quality Implementation Committee to determine whether additional shore-based monitoring is warranted, which could be implemented, if needed, through the AMP.

If gray whales detect the array (or acoustic deterrence devices that could be installed on the array) and swim around it, their potential for collision or entanglement would clearly be reduced. A small deflection around the array would result in the greatest benefit (preventing collision) with the least energetic cost (extending the migration distance). Other effects of avoiding the array, if any, would depend on the importance of the path that gray whales are generally following along the isobath in terms of migration cues, foraging opportunities, or predator avoidance.

The Aquatic Species Subgroup indicates that avoidance of one array would not be likely to adversely affect harbor porpoises or other Odontocetes because of the relatively small footprint of the Reedsport Project, but that the cumulative effects of numerous arrays would be of concern. We discuss this issue in section 3.3.4.3, *Cumulative Effects, Marine Mammals, Reptiles, and Birds.*

Potential for Cetacean Collision/Entanglement

Gray whales are vulnerable to collision and entanglement, because they often swim with their mouths open, and forage by drawing benthic material into the mouth and then straining it through baleen plates. Because of these behaviors, there is a potential that if gray whales are unable to detect the PowerBuoy mooring lines, the lines could become entangled in their mouths. Harbor porpoises are vulnerable to entanglement because of their use of nearshore habitat, where they are most likely to encounter derelict gear. If derelict fishing gear snags on project moorings, these lines could increase the potential for entanglement of both gray whales and harbor porpoises.

OPT has developed an O&M Plan that would afford regular opportunities for inspection of the PowerBuoys for cetacean entanglement. Preventive maintenance/site inspection would occur monthly from the sea surface. The O&M Plan indicates that subsurface inspections would be completed every 2 or 3 months, weather permitting, in years 1 and 2 following deployment and then annually, while the cetacean monitoring included in the Settlement Agreement indicates underwater inspections (by SCUBA or ROV) would be performed every 3 to 4 months, weather permitting, in years 1, 2 and 5, and then annually. Also, as described above, OPT would conduct boat-based cetacean surveys as part of Phase III of the cetacean monitoring, and collect opportunistic observations in conjunction with other natural resource monitoring efforts.

OPT proposes to work with the crabbing industry after license issuance to identify ways to minimize the potential for loss of fishing gear that could accumulate on the mooring lines and increase the potential for cetacean entanglement. Summaries of OPT's monitoring of derelict fishing gear would be reported to the Aquatic Resources and Water Quality Implementation Committee on an annual basis at a minimum. In the event that derelict fishing gear is found on the project array, OPT would remove it by any practicable means as soon as possible (consistent with personnel safety) after it is detected. Specific procedures and approaches would be subject to future discussions with the Aquatic Resources and Water Quality Implementation Committee.

If results of monitoring indicate that cetaceans are colliding with or becoming entangled with the mooring system, OPT would work with marine mammal experts and the Aquatics Resources and Water Quality Implementation Committee to identify response measures (e.g., acoustic deterrence systems) and then to monitor their effectiveness. As an immediate response to cetacean injury or entanglement, OPT proposes to implement the NMFS marine mammal injury response protocols included in appendix A of the Settlement Agreement. OPT also developed a protocol for reporting evidence of entanglement, collision, or injury to the Aquatic Resources and Water Quality Implementation Committee.

Mr. Crombie, the Director of Natural Resources for the CTCLUSI, has stated that the CTCLUSI has an interest in the potential effects of the project on marine life including marine mammal populations, but has also indicated that with regard to natural resources, they would defer to the state and federal resource agencies (personal communication, H. Crombie, CTCLUSI, April 12, 2007, as cited by OPT).

In scoping comments, West Coast Seafood Processors Association recommends that underwater inspections be conducted more frequently than once per year, especially during the initial phases of the project and after storms.

Our Analysis

Because the Reedsport Project would be located approximately 2.5 miles from shore, harbor porpoises could encounter the PowerBuoy array throughout the year. Although gray whales that remain along the Oregon Coast during the summer could encounter it as well, the primary concern with cetacean collision and entanglement relates to migrating gray whales. Based on the results of Phase I of the cetacean monitoring (Baseline Monitoring) at Yaquina Head, tracked whales appeared to follow a constant depth (isobath) rather than the shoreline. For example, some whales that were tracked more than 3 kilometers from the observation point maintained a straight path even as they approached Yaquina Head and linearity of their path continued as they moved away from Yaquina Head. However, variability in the isobaths followed by different whales occurred within each of the three migration phases. The results indicate that if whales follow similar paths along the coast near Reedsport, they would be most likely to encounter the array in April and May, during their northward migration, when their path takes them closer to shore (table 9).

Table 9. Gray whale observations from Yaquina Head documented during Phase I (Baseline Characterization) of the cetacean monitoring (Source: Ortega-Ortiz and Mate, 2008).

Migration Phase	**Average Distance**	**S.D.**	**Number Observed (n)**
Southbound	4.09 miles (6.59 kilometers)	0.200	139
Northbound (February 26–April 7, 2008)	3.15 miles (5.08 kilometers)	0.155	230
Northbound (April 7–May 29, 2008)	2.54 miles (4.08 kilometers)	1.529	26

If gray whales do not avoid the Reedsport Project as they migrate along the coast, there is a possibility they would swim safely between the PowerBuoys, which would be spaced 330 feet apart. Figure 5 depicts, to scale, a gray whale of average length (45 feet) within the PowerBuoy array. Although mooring lines would be taut (tension is estimated at several tons), they would allow for some give, and the hard, rounded surface of the PowerBuoys would be expected to deflect an animal rather than halt its progress, if a collision were to occur. We found no literature describing cetacean injuries or mortalities in collisions with moored vessels, buoys, or aquaculture facilities. In 2006, researchers monitoring aquaculture facilities off the coast of New Hampshire (which employ a similar mooring system, occupy a similar 30-acre footprint, and are located a similar distance offshore) reported that no incidents related to marine mammals or turtles had occurred since the beginning of aquaculture activities in 1997 (UNH, 2006).

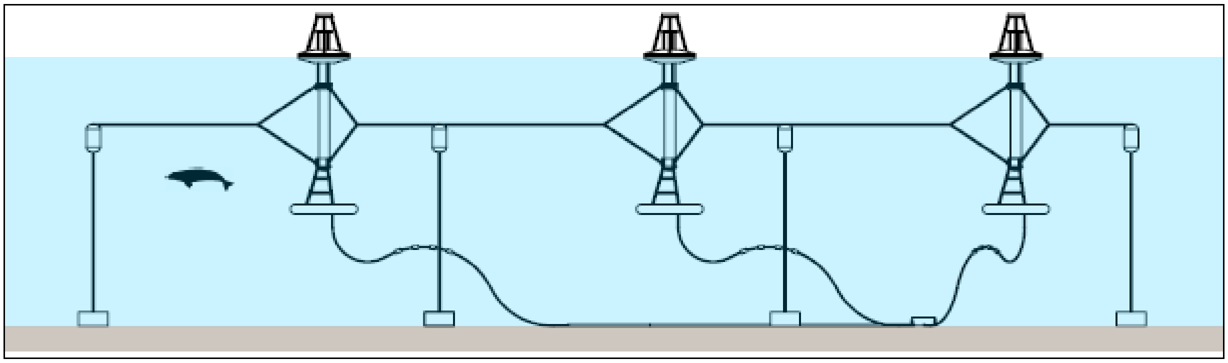

Figure 5. Scale illustration of a 45-foot-long adult gray whale within the PowerBuoy array (Source: OPT, 2010).

The spacing of the PowerBuoys and the characteristics of the mooring lines would also minimize the potential for entanglement of most cetaceans. The mooring lines would be 5-6 inches in diameter, and the power/fiber optic cables would be 2-3 inches in diameter. By comparison, the drift gillnets, polypropylene/nylon lines, and crab pot lines that are responsible for most cetacean entanglement typically have diameters of 1 inch or less. The double-armored power/fiber optic cables would be relatively inflexible, and the mass of the PowerBuoys and the anchors is expected to create enough tension in the mooring lines to preclude the formation of loops or twists around a passing animal. We conclude that the potential for entanglement would be very low for animals swimming through or near the array, but it is possible that gray whales swimming with their mouths open or feeding on the sea floor could become entangled in the tethering system.

Entanglement in derelict fishing gear, if it snags on the array, would be of greater concern. Between 1999 and 2009, 502 large whales were confirmed to have been entangled in fishing or pot gear (IWC, 2010). Although gray whales accounted for a small fraction (less than 5 percent) of these cases, the number of whales that are entangled is probably higher than the number of cases that are observed and reported. The most recent gray whale entanglement mortality reported in Oregon (a juvenile entangled in crab pot gear) occurred in April 2010, about 200 miles north of Reedsport.

Reedsport supports an active crab fishery. OPT indicates that in big storms, wind and waves could cause crab pots to move and drift into the array and become entangled in the mooring lines. The Crabbing and Fishing Subgroup estimates that with three to four storm events per year, as many as 300 crab pots could be lost annually. This estimate is consistent with a report by Oregon Sea Grant indicating that up to 10 percent of the commercial crab pots that leave Oregon ports break free in rough seas, are cut by propellers of passing vessels, tangle in seaweed, or snag on other, older derelict gear (Oregon Sea Grant, 2009).

As discussed above (*Effects of Underwater Noise and Vibration on Cetaceans*), comparison of cetacean hearing sensitivities with sounds produced by the PowerBuoys and sounds produced by other underwater sources indicates that cetaceans would detect and could avoid the array, so entanglement in fishing gear that could be caught up on the mooring system would be very unlikely. The results of Phase II of the cetacean monitoring (measurements of acoustic emissions and ambient noise associated with the single PowerBuoy to be deployed in Phase I of the project) would help to define the potential for cetaceans to detect the array, and the results of Phase III (monitoring of whale movement in relation to the 10 buoy-array) would help to determine whether cetaceans actively avoid the array. However, results of Phase III would not be available for at least 1 year following installation of the full array. In the absence of data to determine whether cetaceans are avoiding the array, underwater inspections for lost fishing gear would be especially important during this period. Lost fishing gear may not be visible from the surface, due to ocean depths in the project area, and conducting underwater surveys once a month (rather than every 2 or 3 months, as indicated in the O&M Plan) during the first year of project operation would increase the opportunity for early detection, and thus, prompt removal, of lost fishing gear. The frequency of underwater surveys could be reduced, if the results of Phase III monitoring indicate that cetaceans are avoiding the array, and if no fishing gear is observed.

If collision or entanglement occurs, the proposed protocol for reporting evidence of whale encounters with the Reedsport Project would provide an avenue for addressing it immediately. Over the long term, results of Phase III monitoring (shore-based and boat-based) and entanglement monitoring (surface and underwater) should provide the information necessary to determine whether additional measures are needed to protect cetaceans. If results of the monitoring efforts show that whales are not safely deflecting their migration paths to avoid the Reedsport Project, the results of monitoring that will be conducted at Yaquina Head in 2010–2011 (OSU, 2010) should provide some indication as to the effectiveness of an acoustic deterrence system, and how it could be adapted to the Reedsport Project. We conclude that this combination of measures, which emphasizes adaptive management, would provide an effective means of addressing the potential for of cetacean collision or entanglement.

Offshore Birds

The Aquatic Species Subgroup identified potential effects on seabirds and other waterbirds that may result from operation of the Reedsport Project as an area of concern. Migratory and resident waterbirds are habituated to flying through unobstructed habitats, when away from nesting and roost areas. Because the OPT PowerBuoys rise 29.5 feet above the water surface, stakeholders have raised concerns the project may result in bird injury or mortality via collision, particularly during inclement weather. Required navigational lighting of the PowerBuoys is also a concern because lights have the potential to attract some bird species.

OPT proposes to address the potential for seabird attraction through project design, and would also conduct offshore avian use monitoring. Details of project design features and implementation of the monitoring would be developed during further consultation with the Aquatic Resources and Water Quality Implementation Committee, as described in appendix A of the Settlement Agreement.

Seabird Attraction

To minimize the potential for of seabird attraction, OPT would shield the navigation lights on the PowerBuoys, as recommended by FWS, to direct light only toward approaching watercraft, not directly upward. Also as recommended by FWS, the flash intensity would be designed to meet the minimum Coast Guard requirement for navigational safety.

OPT proposes to light the eight perimeter PowerBuoys in the array with Carmanah Model 702-Global Positioning System (GPS) units. The Carmanah Model 702-GPS is a fully-integrated, solar LED 3-nautical-mile (3.4-mile) marine light with GPS synchronization. The integrated GPS receiver would allow the lights to synchronize flash pattern timing. OPT would also light the inside two PowerBuoys with a flashing light of less intensity, as recommended by the Coast Guard.

OPT would develop the lighting flash pattern in consultation with stakeholders and the light manufacturer so that it would aid in depth perception, visibility in a variety of sea states, and the ability to distinguish individual PowerBuoys. To minimize the potential for of seabird attraction, OPT would ensure that the flash timing would be equal to or greater than 4 seconds for each individual light, as recommended by FWS.

Seabird Collision

The offshore avian use monitoring program includes the following components: (1) monitoring of avian presence to collect information on use of the PowerBuoy array by the bird community as a whole; (2) risk-assessment modeling to estimate the annual fatality of seabirds at the array; and (3) monitoring of behavioral-avoidance/collision rates to collect information on avian avoidance behavior and fatality at the array. Results of risk-assessment models or post-deployment fatality monitoring would be reviewed by the Aquatics Resources and Water Quality Implementation Committee, which may determine that additional monitoring is unnecessary; that additional monitoring is warranted; or that measures should be taken to reduce the potential for collision/fatality at PowerBuoys. Thus, if a problem is identified with avian collision, OPT proposes to work on appropriate mitigation methods with the Aquatics Resources and Water Quality Implementation Committee at that time.

Our Analysis

Oregon's nearshore waters constitute a migration corridor for a variety of waterbirds (loons, grebes, and gulls), seabirds (shearwaters, cormorants, terns, and alcids), waterfowl (scoters and brants), and shorebirds (phalaropes and sandpipers). Many of these birds fly just above the surface of the sea and more than 100,000 birds per hour can be seen during peak movements. Specific reports in and around the project area include a 1999 reconnaissance flight that recorded an estimated 20,000 scoters 2 to 3 miles offshore of the Umpqua River. On September 17, 2007, FWS documented approximately 1,600 scoters just north of the Umpqua River and many thousands just south of the Umpqua River during a brown pelican aerial survey. While red phalarope typically do not occur in near-shore areas, large numbers are known to be weakened and driven ashore during storm events, and may be susceptible to collision with the proposed project.

Many nocturnal seabird species and nocturnal avian migrants are highly attracted to artificial light. Primary sources of artificial light in the marine environment include vessels, lighthouses, light-induced fisheries, oil and gas platforms, and coastal resorts; and marine birds often collide with these structures. The attractive effect of lights during cloudy nights is enhanced by fog, haze, or light rain because the moisture droplets in the air refract the light and greatly increase the illuminated area. While collisions are known to occur whether structures are lit or unlit, a higher incidence of collisions is reported from terrestrial towers equipped with steady-burning lights than those equipped with flashing lights or no lights of any kind (Gehring et al., 2009).

We would anticipate that the potential for bird collision with the 29.5-foot-tall PowerBuoys would be much lower than it is for collision with offshore wind turbines, which are often over 200 feet tall. Investigations of bird behavior in response to a 72-unit offshore wind farm in Denmark suggest that migrating waterbirds would be likely to take alternative flight routes to avoid the PowerBuoys (Desholm and Kahlert, 2005). Mapping of flight trajectories of migrating water birds (mainly common eider and geese) using surveillance radar indicated that less than 1 percent of the water birds flew close enough to the turbines to be at risk of collision. The probability of birds flying into the wind farm did not seem to be markedly affected by time of day, by wind direction, or by the migratory orientation of the birds.

Guy wires have been demonstrated to kill most of the birds colliding with terrestrial communication towers. The PowerBuoys would not be equipped with guy wires or stays, which would also reduce the potential for collision.

Although the PowerBuoy array must be lit, the navigational lighting from the PowerBuoys would be much less intense than the lighting on commercial fishing vessels, and lights would be shielded. In addition, flash timing would be designed to minimize the potential for of attraction.

We conclude that with this combination of design factors (330-foot spacing between the buoys, low vertical profile of the buoys, absence of guy wires or stays, shielded lighting, appropriate flash timing) the potential for adverse effects would be very low. However, we also conclude that the monitoring proposed by OPT would be important, because of the project's location. The array would be located in an area that experiences a high incidence of rain, mist, fog, and low cloud cover, when visibility would be poor; Reedsport averages 167 days per year with precipitation (Sperling's BestPlaces, 2010). The array would also be located in a migratory corridor along the Oregon Coast, where large numbers of waterbirds are sometimes present. All of these species are protected by the Migratory Bird Treaty Act, and several (brown pelican, fork-tailed storm-petrel, Cassin's and rhinoceros auklets, and tufted puffin) are designated as sensitive species in Oregon. OPT's proposed offshore avian use monitoring would provide important baseline data on bird species, abundance, and behavior in the project area, which could be used to further evaluate seabird interactions with the array.

The avian presence portion of the monitoring would focus on ship-based survey data, supplemented by radar monitoring that provides information on nocturnal bird activity. Conducting the 2- to 3-day surveys twice each month, approximately 2 weeks apart, should be adequate to establish at-sea distribution, seasonal occurrence, and behavior of species throughout the annual cycle during 1 year following deployment of the test buoy. The overall sampling area would include transects through the proposed project area, as well as areas up to 8 kilometers to the south and north, which should provide an adequate context for evaluating potential project effects.

Radar sampling for 1 year following completion of the boat-based surveys (4 hours of diurnal sampling and 4 nocturnal hours, with efforts spread throughout the year to account for seasonal differences in daily activity patterns) would be applied to the boat-based survey results to estimate the number of birds present in the project area at night. The key data to be collected for this portion of the monitoring would include seasonal information on movement rates through the project area (birds/kilometer/hour), bird species-composition, distance offshore, flock sizes (number of birds/flock), flight altitudes (in meters above sea level), and flight directions. These data would provide input values for the risk-assessment modeling.

For the risk modeling, OPT would adapt existing models for estimating seabird fatalities at wind farms and other tower structures for application to the OPT Wave Park. OPT would evaluate the probability of horizontal and vertical interactions with the array, and the probability of fatality if a bird flies into the airspace occupied by a PowerBuoy.

OPT would periodically review the modeling results with the Aquatics Resources and Water Quality Implementation Committee. If the collision risk is deemed sufficiently low, future monitoring would not be conducted; otherwise, OPT would initiate a behavioral-avoidance/fatality evaluation in order to assess more precise estimates of risk and impact. The observed avoidance rates would then be applied to the models to derive precise fatality estimates for all species. The Aquatics Resources and Water Quality Implementation Committee may also determine whether additional fatality monitoring should be undertaken. Alternatively, high fatality estimates may trigger additional measures to mitigate or reduce fatality rates.

We anticipate that the step-wise approach described above would assist OPT in eliminating unnecessary modeling components and focusing on those that are critical, once low and high fatality rates are defined. We assume that the significance of any fatalities would be evaluated in consultation with Aquatic Resources and Water Quality Implementation Committee.

3.3.4.3 Cumulative Effects

The geographic scope for the cumulative effects analysis of marine mammals and offshore birds encompasses activities that occur along the West Coast of North America from the Bering Sea to Baja, Mexico. We selected this scope to address the migratory range of the gray whale, as well as to encompass the range of the harbor porpoise. These two cetaceans are most likely to occur in the project area and would be most vulnerable to cumulative effects. Many of the offshore birds that use habitat in the Reedsport Project area may be found within a similar range (e.g., Cassin's auklet), while others would use inland habitat, as well as shorelines and coastal waters of Oregon (e.g., common loon). Below, we summarize the incremental effects of the Reedsport Project on marine mammals and offshore birds and how these effects could contribute to the effects caused by other kinds of human activities. Cumulative effects may arise from migratory hazards and localized changes in behavior, underwater noise and vibration, changes to marine community composition, and human disturbance.

Migratory Hazards and Localized Behavior

The Reedsport Project would be located in the path of migratory gray whales and within habitat that is used year-round by harbor porpoises and various species of offshore birds. The project could contribute to cumulative effects from other existing and future offshore energy projects, including wave, tidal, and wind projects; oil and gas platforms; and marine aquaculture facilities, because it may function as an impediment to wildlife movement, alter migration, and pose a potential for collision.

If gray whales swim around the PowerBuoy array to avoid it, the result may be higher energy costs of migration, interference with migration cues, reduced foraging opportunities, or increased exposure to predators. The magnitude of the effect would depend on how far whales would deviate from their path to avoid the project, but given the 0.25-mile length of the buoy deployment area in relationship to the 5,000- to 7,000-mile distance between the Bering Sea and Baja, Mexico, the cumulative impact is expected to be very small. Results of Phase III of the cetacean monitoring would help to define how whales move around or through the PowerBuoy array.

The Reedsport Project may block local movements of harbor porpoises. The project area does not appear to provide a unique foraging resource, but exclusion from this 30-acre site would add to the cumulative effects of exclusion from other areas that are or may be occupied by other offshore energy projects, oil or gas platforms, or marine aquaculture facilities. Again, relative to the area of available habitat for harbor porpoises, which use waters of various depths and distances from shore, the cumulative effect is expected to be small.

The Reedsport Project may pose a collision risk to gray whales, if they do not detect and swim around it. However, acoustic deterrence devices could be installed if results of the cetacean monitoring indicate a need for them, so we anticipate there would be no contribution to cumulative effects for gray whales as a result of collision. The Aquatic Species Subgroup concluded that harbor porpoises would not be at risk of collision because they could use echolocation to detect and avoid the PowerBuoy array.

Offshore birds that fly close to the water surface during migration or local movements could be at risk of collision with the PowerBuoys, especially during poor weather conditions. However, project design features (e.g., shielded lighting, timing of navigation lights, and absence of guy wires) should minimize the possibility of contribution to the cumulative effects of other offshore energy projects. The offshore avian use monitoring would provide information that could be used to estimate the likelihood of avian interactions, injuries, and mortalities at the Reedsport Project, so that cumulative effects could be further quantified.

There is a possibility that the Reedsport Project would contribute to the cumulative effects of commercial fishing and crabbing on cetaceans because of the unanticipated effect that gray whales (which often swim with their mouths open) could become entangled in the PowerBuoy mooring lines, if such lines are caught up and trapped in the baleen plates, or that cetaceans could become entangled in derelict fishing gear that could snag on the mooring lines. Results of the cetacean monitoring would help to determine how whales move past or through the PowerBuoy array, and as mentioned above, if acoustic emissions of the project are not adequate to allow for avoidance, acoustic deterrence devices could be installed. Regular inspection of the array would be used to evaluate whether derelict fishing gear does accumulate and would afford opportunities to increase or decrease monitoring and efforts to remove snagged gear to address this concern.

Underwater Noise/Vibration

The Reedsport Project would contribute to the cumulative effects of underwater noise and vibration associated with other ocean, tidal, and offshore wind energy projects, oil and gas drilling, dredging operations, and vessel traffic, especially in light of probable increases in human populations along the coast of western North America within the next 50 years. Noise associated with the installation activities may temporarily alter migration and feeding patterns. Such temporary effects have been observed during the exploration and establishment of oil and gas operations (Richardson et al., 1995, cited in Moore and Clarke, 2002). Conversely, activities associated with the Reedsport Project are generally quieter and require fewer support operations; Moore and Clarke (2002) note that gray whales have been migrating past oil exploration and production activities in California for decades, suggesting that they habituate to or tolerate these activities (Richardson et al., 1995, cited in Moore and Clarke, 2002).

OPT expects operational noise to be similar to ambient noise. Phase II of the cetacean monitoring would provide information about long-term acoustic emissions of the single PowerBuoy to be deployed in Phase I of the project, and if continuous noise exceeds levels that NMFS considers to be the threshold for Level B harassment (120 dB), this concern could be addressed through the AMP.

Changes to Marine Community Composition and Predator/Prey Interactions

Our analysis of pinniped attraction indicates it is unlikely that the Reedsport Project would contribute to cumulative effects on seals or sea lions. Either UHWMPE coating or fencing should be adequate to prevent them from using the PowerBuoys as haul-out sites. If the PowerBuoys function as FADs and lead to higher populations of fish around the array, seals and sea lions could benefit from increased prey availability, but such increases would have to be substantial to result in any population-level effects on pinnipeds.

3.3.5 Terrestrial Resources

3.3.5.1 Affected Environment

Vegetation

The existence of a variety of habitats found in the terrestrial portion of the project, ranging from sandy beaches to upland transitional forests, is due in part to the interface or ecotone of two highly diverse ecosystems, the ocean and the coastal mountain forest. Major upland vegetation communities in the project vicinity include Sitka spruce-western hemlock maritime forest, grass-shrub-sapling/regenerating young forest, coastal dunes, and mixed conifer/deciduous forest. These upland communities support a variety of different flora.

Several types of wetlands occur in the project vicinity. Based on National Wetland Inventory mapping, a total of about 1,094 acres of marine, estuarine, palustrine, and riverine wetlands are located within 0.25 mile of the terrestrial portion of the Reedsport Project. No wetlands are located near the proposed underground vault. The shore substation would be located in uplands adjacent to two human-made wetland types that formerly served as International Paper's wastewater settling ponds. Between the underground vault and the shore substation, the wastewater pipeline that would contain the transmission line is buried within the Sparrow Park Road prism. The road passes adjacent to a small palustrine emergent wetland approximately 1.5 miles east of the underground vault, and adjacent to estuarine wetlands along the northern edge of Winchester Bay.

State Special-Status Plant Species

Known and potentially occurring state special-status plants in the project vicinity listed below (table 10) are based on OPTs' query of the Oregon Natural Heritage Information Center database in 2004. Federally listed plant species are discussed in section 3.3.6, *Threatened and Endangered Species and Essential Fish Habitat*.

Table 10. State special-status plants known from the Coastal Range ecoregion of Douglas County (Source: OPT, 2010).

Common Name ***(Scientific Name)***	**Habitat and Known Occurrences in Project Vicinity**	**State Status**
Pink sandverbena *(Abronia umbellata* ssp. *breviflora)*	Beaches and foredune on open sand. No known occurrences.	LE
Bensonia *(Bensoniella oregano)*	Moist forests along edges and roadsides, often north slopes with big-leaf maple. No known occurrences.	C
Tall bugbane *(Cimicifuga elata* var. *elata)*	Wet meadows, bogs, and deflation plains in dune habitats. Known from bog approximately 3.4 miles north of transmission line.	C
Howell's montia *(Montia howellii)*	Moist forests along edges and roadsides, often north slopes with big-leaf maple. No known occurrences.	C

Notes: Special-status definitions:

C – Oregon Candidate

LE – Oregon Listed Endangered

Noxious Weeds

Numerous weed species are likely to occur in the project vicinity. Representative species include butterfly bush, meadow knapweed, purple loosestrife, Japanese knotweed, and tansy ragwort.

Wildlife

Based on the types of habitat available and the species that are typically associated with them, almost 200 vertebrate wildlife species are predicted to potentially occur in the project vicinity. No directed wildlife surveys or assessments in the project vicinity are known.

Amphibians likely to occur in the project area include ensatina, northwestern salamander, and red-legged frog. The introduced bull frog may also be present. Reptiles may include northwestern pond turtle, California mountain kingsnake, common garter snake, northern alligator lizard, and western fence lizard.

Representative birds in the project area include wading birds, such as great blue heron, and shorebirds, such as sanderling. Raptors (e.g., red-tailed hawk, osprey) and songbirds (Swainson's thrush, Wilson's warbler, western tanager) are also present.

Representative mammals in the project area include black-tailed deer, black bear, coyote, raccoon, and mink. Several small mammal species would also likely be present, including mice, voles, moles, and shrews.

State Special-Status Terrestrial Wildlife Species

OPT's license application included a list of terrestrial special status wildlife species that occur in Douglas County, which lies within the Coastal Range ecoregion. Douglas County supports a wide range of habitats, from sea level on the west to elevations of almost 7,000 feet on the east. However, the number of species that would likely be found near terrestrial elements of the Reedsport Project is much smaller. Terrestrial special-status wildlife that could use habitat near the proposed underground vault at the end of the Sparrow Park Road, along the road prism, and near the shore substation at the wastewater outfall pumps are listed in table 11. We discuss federally listed species in section 3.3.6, *Threatened and Endangered Species and Essential Fish Habitat*.

Table 11. State special-status terrestrial wildlife species likely to occur in the project area (Source: OPT, 2010, modified by staff).

Common Name *(Scientific Name)*	**State Status**	**Habitat Requirements**
Clouded salamander *(Aneides ferreus)*	SU	Found in moist areas of the forest under downed logs and other debris.
Western toad (*Bufo boreas)*	SV	Found in a variety of habitats as long as there is some source of water for breeding.
Northern red-legged frog *(Rana aurora aurora)*	SV/SU	Lives in meadows, woodlands, and forests, but is usually found near ponds, marshes and streams.
Common nighthawk *(Chordeiles minor)*	SC	Forage in nearly every habitat in Oregon and nest in open areas.
Olive-sided flycatcher *(Contopus cooperi)*	SV	From sea level to subalpine prefers open coniferous forests.
Streaked horned lark *(Eremophila alpestris strigata)*	SC	Lives near coastal dunes and beaches.
American peregrine falcon *(Falco peregrinus anatum)*	LE	Usually nest in cliffs near seacoasts, marshes, lakes, and cities.
Bald eagle *(Haliaeetus leucocephalus)*	LT	Associated with coasts, rivers, lakes, and marshes. Needs mature trees or cliffs for nesting.
Yellow-breasted chat *(Icteria virens)*	SC	Breeds in brushy areas and in riparian woodlands along streams.
White-footed vole *(Arborimus albipes)*	SU	Live in riparian areas of coniferous forests, also likes small clearings with forbs.
Silver-haired bat *(Lasionycteris noctivagans)*	SU	Usually associated with mature coniferous forests near water.
Long-eared myotis *(Myotis evotis)*	SU	Lives primarily in forested habitats and forested edges. Can live in shrublands if roosting sites are available
Long-legged myotis *(Myotis volans)*	SU	Lives in coniferous forests. Roosts in cliff face crevices, buildings, caves, and mines.

Notes: LE – Listed as endangered; SP – Peripheral or naturally rare
LT – Listed as threatened; SU – Undetermined status
SC – Sensitive-critical; SV – Sensitive-vulnerable

3.3.5.2 Environmental Effects

Upland and Wetland Plant Communities

Construction and maintenance activities have the potential to remove or alter native plant communities, impair wetland functions, and expose soils. Transitioning of the subsea transmission cable to an underground transmission line within the proposed underground vault; construction of a shore substation to connect to the Douglas Electric Cooperative's transmission lines at Gardiner; and accessing the wastewater pipeline at several points to pull line are the only elements of the proposed project that would have the potential to affect upland or wetland plant communities.

Our Analysis

OPT's proposal to lay the subsea transmission cable and transmission line within an existing wastewater pipeline would minimize potential effects on upland and wetland plant communities. The area disturbed for construction at the proposed underground vault is not vegetated and would be returned to its current condition (gravel) following construction.

The shore substation would be constructed near the existing outfall pumps for the wastewater pipeline and Douglas Electric Cooperative's transmission lines. Our review of aerial photographs (GoogleEarth) indicates that this site is sparsely vegetated with herbaceous cover. As no foundation work would be required, vegetation removal would be limited to the footprint of the building (about the size of a garage).

Assuming OPT would use only existing access points along the wastewater pipeline to pull the transmission line from the underground vault to the shore substation, it is possible that no new ground disturbance would be required. If new access points are needed, we assume the area of disturbance at each access point would be small (e.g., 100 square feet or less), and disturbance of vegetation or wildlife would be localized and temporary.

The Sparrow Park Road borders approximately 100 feet of a palustrine emergent wetland located approximately 1.5 miles east of the proposed underground vault, and borders approximately 1 mile of estuarine wetlands along the edge of Winchester Bay. The existing pipeline access points are located within the road prism, and we do not anticipate that pulling the transmission line would affect either palustrine or estuarine wetlands. However, erosion and sediment control measures may be needed at some of the access points to ensure that disturbance of soils and vegetation does not adversely affect wetlands adjacent to the road.

State Special-Status Plant Species

Ground-disturbing activities would have the potential to damage rare plant populations, if any exist within the construction area. Indirect effects can also occur, if construction alters the habitat that supports special-status plants.

Our Analysis

None of the four special-status plant species that could occur in the project area would be present in the graveled surface that would be removed for construction of the proposed underground vault, in the sparse herbaceous cover that currently occupies the shore substation site, or in the ditch along Sparrow Park Road, which is maintained by regular brushing. For this reason, we conclude that project construction and operation would not affect special-status plants.

Noxious Weeds

Construction activities that cause ground disturbance can create soil conditions that promote the spread of noxious weeds, if any are present in the construction area. Construction equipment also has the potential to serve as a vector to introduce new weed species.

Our Analysis

Based on our observations during the site visit, no weeds are present within the graveled surface of the road at the location of the proposed underground vault. As the surface would be returned to its current condition following construction or any maintenance activities, we do not anticipate that these activities would increase the potential for introducing or spreading noxious weeds.

OPT has not conducted any vegetation surveys at the shore substation site or at pipeline access points along the Sparrow Park Road, and it is possible that ground disturbance in these areas could contribute to the spreading of noxious weeds. Implementation of monitoring and control measures would ensure that project construction and operation do not contribute to the introduction or spread of invasive species that could adversely affect native plant communities adjacent to the site.

Wildlife

Construction and maintenance activities have the potential to remove or alter wildlife habitat and cause noise disturbance to wildlife. As the transmission line would be laid underground, avian electrocution or collision would not be of concern.

Our Analysis

Heavy equipment that would be used for excavation and construction would cause noise disturbance to wildlife near the proposed underground vault and the shore substation, but effects would be localized and temporary. Noise associated with pulling the transmission line from access points along Sparrow Park Road would also cause localized, temporary noise disturbance.

State Special-Status Terrestrial Wildlife Species

Construction and maintenance activities have the potential to remove or alter habitat that supports special status wildlife species. It also has the potential to cause noise disturbance.

Our Analysis

No habitat for special status terrestrial wildlife species would be removed or altered. Construction and maintenance activities could slightly increase the potential for of traffic mortality for special status amphibians, but the risk would be similar to existing conditions in the turn-around, along Sparrow Park Road, and at the parking area near the proposed underground vault. Noise could cause temporary and localized disturbance of special status bird species. Diurnal mammals would likely avoid the work areas, temporarily, and construction or maintenance activities would not affect bats that might forage at night along the road corridor.

3.3.5.3 Cumulative Effects

Sandy beaches that support snowy plover nesting could be cumulatively affected if project operations alter the supply of sand. However, as discussed in section 3.3.1.3, *Cumulative Effects, Geologic and Soil Resources*, sediment transport would not be cumulatively affected by the proposed Reedsport Project because the project would have only minor effects on sediment transport, and we have not identified any reasonably foreseeable actions, including other wave energy projects, that could affect sediment transport. Because the western snowy plover is federally listed as a threatened species, we address this potential cumulative effect in section 3.3.6.3, below.

3.3.6 Threatened and Endangered Species and Essential Fish Habitat

3.3.6.1 Affected Environment

Fish Species

Federally listed threatened or endangered fish species that may occur in the project area are listed in table 12.

Table 12. List of federally protected threatened and endangered aquatic species that may occur in the project area (Source: OPT, 2010, as modified by staff).

ESU/DPS	**Scientific Name**	**Status**
Coho salmon (southern Oregon, northern California Coast, and Oregon Coast ESUs)	*Oncorhynchus kisutch*	CH/T
Coho salmon (Lower Columbia River ESU)	*Oncorhynchus kisutch*	T
Chinook salmon (Lower Columbia River ESU)	*Oncorhynchus tshawytscha*	CH/T
Chinook salmon (Upper Columbia River spring-run ESU)	*Oncorhynchus tshawytscha*	CH/E
Chinook salmon (Snake River spring/summer-run and Snake River fall-run ESUs)	*Oncorhynchus tshawytscha*	CH/T
Green sturgeon (Southern DPS)	*Acipenser medirostris*	CH/T
Eulachon (Southern DPS)	*Thaleichthys pacificus*	T

Notes: CH – Critical habitat designated
DPS – Distinct population segment
E – Listed endangered
ESU – Evolutionarily significant unit
T – Listed threatened

Southern Oregon and Northern California Coho Salmon Evolutionarily Significant Units

Coho salmon is a widespread species of Pacific salmon, occurring in most major river basins around the Pacific Rim from Monterey Bay, California, north to Point Hope, Alaska, through the Aleutians, and from the Anadyr River south to Korea and northern Hokkaido, Japan. The federally threatened Southern Oregon and Northern California coho (SONCC) salmon evolutionarily significant unit (ESU) consists of all naturally spawned populations of coho salmon from Cape Blanco, Oregon (65 miles to the south of the project area), south to Punta Gorda, California, as well as from three hatcheries (70 FR 37160). Critical habitat for the SONCC ESU is designated to include all river reaches accessible to listed coho salmon between the Elk River in Oregon (approximately 65 miles to the south of the project) and the Matolle River in California, inclusive (64 FR 24049). Critical habitat consists of the water, substrate, and adjacent riparian zone of estuarine and riverine reaches (including off-channel habitats). Accessible reaches are those within the historical range of the ESU that can still be occupied by any life stage of coho salmon. Critical habitat does not extend out into open ocean area and does not include the project area.

Unlike other coho salmon runs, which migrate to waters north of Oregon, the SONCC ESU is primarily captured in California waters (NMFS, 1995). However, juvenile SONCC coho salmon have been captured off the Oregon Coast; 40 percent of all juvenile coho salmon captured in trawl surveys off the southern Oregon Coast were genetically identified from coastal rivers below Cape Blanco, including the Rogue and Klamath rivers (Brodeur et al., 2004).

Like other Pacific salmon, coho are anadromous. Spawning adults typically migrate up their natal rivers in the late summer and fall, and spawn in mid-winter. Spawning adults build gravel nests, or redds, to incubate the eggs and larvae. The egg and larval stage can last 1.5 to 4 months and juveniles may rear in their natal rivers for up to 15 months. They then migrate out to sea as smolts the following spring. Smolt size (typically measuring 90 to 115 mm) and outmigration timing can vary within their distribution range and interannually (Weitkamp et al., 1995, as cited by OPT).

While rearing in freshwater, juvenile coho salmon feed on aquatic insects, zooplankton and small fish. As young juveniles, salmon pass through the nearshore areas, where they grow rapidly and move into the open ocean as pelagic feeders. Juvenile coho salmon in the nearshore environment initially feed on marine invertebrates, but as they grow, their diet shifts to mainly fish and some marine invertebrates. Prey species in the marine environment include herring, sardine, anchovy, sandlance, squid, smelt, groundfish and crab. Coho salmon generally remain in ocean waters over two growing seasons prior to returning to natal rivers to spawn (Weitkamp et al., 1995, as cited by OPT; Good et al., 2005).

The historical abundance of SONCC is estimated to range from 150,000 up to 500,000 adults (Good et al., 2005). SONCC have declined significantly over the past decades with estimates of approximately 10,000 naturally produced adults. NMFS (2007a) described the overall ESU population status trend as unchanged since the first status review and remains low. The list of threats and impacts for SONCC is long but primarily relate to habitat degradation or elimination within freshwater and estuarine distribution range (NMFS, 2007a). A Technical Recovery Team was formed in 2002 and since has been working to develop the technical information needed to prepare the species recovery plan.

Oregon Coast Coho Salmon ESU

The OCC salmon ESU is federally listed as threatened and includes all naturally spawning populations in Oregon coastal streams north of Cape Blanco to south of the Columbia River (Good et al., 2005). This geographical area includes 11 major river systems and three coastal lakes. Critical habitat has been designated to include riverine and estuarine areas within 80 occupied watersheds in 13 associated subbasins, including the Umpqua River. However, critical habitat does not extend out into the offshore waters of the project area, including the subsea cable, and the proposed underground transmission line would not cross any critical habitat streams. OCC salmon have been the focus of a considerable conservation effort by the State of Oregon, local and private entities, and federal management partners.

The ocean migration patterns for coho salmon are not well documented, but are expected to overlap the project area. Ocean migration studies conducted using coded-wire tags indicated that juvenile coho salmon released from hatchery facilities located south of Cape Blanco were recovered as returning adults primarily in California with some recoveries in Oregon (Weitkamp et al., 1995, as cited by OPT).

Salmon biologists from Oregon DFW were consulted for information on salmon migration and distribution in the project area. They confirmed that little is known regarding coho salmon migration and distribution in the open ocean. Coho salmon of the SONCC and OCC ESUs may transit through the vicinity of the proposed PowerBuoy array during their ocean phase. They are typically found in upwelling zones that move around based on variable temperatures and other ocean conditions (Brodeur et al., 2004).

For more local stocks, Oregon DFW staff thought adult coho salmon could occur in the project area from June to August or later. Wild coho salmon return to the Umpqua River in mid-October, while hatchery coho salmon return to the river in December. For juveniles, seaward migration from the Umpqua River peak in the estuary from April to May, but little is known regarding distribution once they leave the estuary.

In 1997, extensive survey data were available for coho salmon in the Oregon Coast region. Overall, spawning escapements declined substantially during the twentieth century and were at less than 5 percent of their abundance of the early 1900s (Good et al., 2005). Naturally produced OCC declined to historically low levels since the 1950s with 80,000 estimated in 1996 (Good et al., 2005). The primary historical threats or impacts to OCC salmon were attributed to habitat loss/degradation, water diversions, harvest, hatchery production, and poor ocean conditions (71 FR 3045). However, more recent data suggest an increase in marine survival rates as average spawner abundance increased to 140,600 (Good et al., 2005). NMFS has concluded that habitat protection and improvement activities along with other regulatory programs have reduced the severity of most of these threats. On this basis, it concluded that the OCC did not warrant listing as an endangered or threatened species and withdrew its proposed listing, as well as proposed critical habitat (71 FR 3033). However, after further review, in 2008 NMFS listed OCC salmon as threatened and designated critical habitat (73 FR 7816).

Lower Columbia River Coho Salmon ESU

Originally part of a larger Lower Columbia River/Southwest Washington ESU, Lower Columbia River (LCR) coho salmon were identified as a separate ESU and listed as threatened on June 28, 2005. The ESU includes all naturally spawned populations of coho salmon in the Columbia River and its tributaries from the mouth up to and including the Big White Salmon and Hood Rivers, includes the Willamette River to Willamette Falls, Oregon, plus 25 artificial propagation programs. Critical habitat has not yet been designated for the LCR coho.

Salmon declines in the LCR have been attributed to habitat degradation and loss due to extensive hydropower development projects, urbanization, logging, and agriculture, and these activities continued to threaten recovery of the ESU. Coho salmon population levels declined drastically in the 1980s and with near zero spawner counts in the 1990s (Suring et al., 2006, as cited by OPT). Based on the most recent NMFS status review (Good et al., 2005), LCR coho salmon have very little natural reproduction and the population is sustained primarily through hatchery reproduction. Possible exceptions to this include the Clackamas and Sandy subbasins. LCR coho salmon are caught in ocean and Columbia River fisheries and recent exploitation rates were limited to 15 to 20 percent.

Lower Columbia River Chinook Salmon ESU

The LCR Chinook salmon ESU includes all naturally spawned populations of Chinook salmon from the Columbia River and its tributaries from the mouth up to and including the Hood and White Salmon rivers, plus 17 artificial propagation programs. The LCR Chinook salmon was first listed as threatened under the ESA in 1999 and reaffirmed in 2005 (70 FR 37160). Critical habitat was designated in 2005 (70 FR 352630). Designated critical habitat includes much of the Lower Columbia River drainages; Middle Columbia/Hood, Lower Columbia/Sandy, Lewis, Lower Columbia/Clatskanie, Upper Cowlitz, Cowlitz, Lower Columbia, Clackamas, and Lower Willamette subbasins, as well as the LCR migration corridor. Critical habitat does not extend out into open ocean area and does not include the project area.

There are generally two spawning runs based on timing. The LCR Chinook salmon stock is dominated by fall-run spawning adults (Myers et al., 1998). Spawning adults of about 3 to 4 years of age return to the river in late August and October with the peak spawning interval in November. Spring-run Chinook salmon in the LCR are typically 4 to 5 years of age and enter freshwater in March and April well in advance of spawning in August and September. LCR Chinook salmon are primarily represented by “ocean-type” Chinook salmon. These salmon tend to use estuaries and coastal areas more extensively for juvenile rearing, while “stream-type” use offshore ocean habitat more extensively. In general, the younger (smaller) that juveniles are at the time of emigrating to the estuary, the longer they reside there (Myers et al., 1998). The out-migration migratory behavior in ocean-type Chinook salmon juveniles is also positively correlated with water flow.

Myers et al. (1998) described the extensive salmon tagging studies as dominated by hatchery populations and therefore the migratory routes of many wild fish stocks had to be inferred from these. Furthermore, tag recoveries are obtained through commercial and sport fishery samples; therefore, the relative intensity of each fishery may bias the interpretation of the oceanic distribution of each stock. Additionally, oceanic distributions across years can be influenced by changes in fishing regulations and ocean conditions (such as during an El Niño). Based on these tagging studies, the LCR salmon stocks tend to occur off the British Columbia and Washington coasts, with a small proportion of tags recovered from Alaska. Brodeur et al. (2004) conducted a study of juvenile salmonids in the California Current system from central Oregon to northern California and found small numbers of Chinook salmon believed to have originated from the Columbia River Basin. These researchers concluded that juvenile salmon were following productive ocean upwelling currents. Based on archival tag data for Chinook salmon monitored between near Oregon and California, the best indicator of adult Chinook salmon habitat in the coastal ocean was the temperature range between 48 and 54°F (Hinke et al., 2005).

Salmon declines in the LCR have been attributed to habitat degradation and loss due to extensive hydropower development projects, urbanization (and the associated channelization and diking of streams, filling and draining of wetlands, and degraded riparian habitat), logging (and associated road construction), agriculture, pollution, as well as intensive hatchery productions (Myers et al., 1998). These activities continue to threaten recovery of the ESU. Chinook salmon are also managed as a harvest species as well as collected incidentally in coastal and offshore fisheries. The average total exploitation rates range from 29 to 44 percent, depending on run type.

Upper Columbia River Spring-Run Chinook Salmon ESU

The Upper Columbia River spring-run Chinook salmon ESU includes all naturally spawned populations of Chinook salmon in all river reaches accessible to Chinook salmon in the Columbia River tributaries upstream of Rock Island dam and downstream of Chief Joseph dam in Washington State, excluding the Okanogan River (64 FR 14208). Designated critical habitat includes the Wenatchee River Basin, Okanogan River Basin, Chewack River Basin, and the Columbia River Basin in northern Washington State. Critical habitat does not extend out into open ocean area and does not include the project area.

Upper Columbia River spring-run Chinook salmon have similar life-history characteristics to spring Chinook salmon runs originating in the Snake River system. Adults begin returning from the ocean in the early spring, with the run into the Columbia River peaking in mid-May. Spring Chinook salmon enter the Upper Columbia tributaries from April through July. After migration, they hold in freshwater tributaries until spawning occurs in the late summer, peaking in mid to late August. Juvenile spring

Chinook salmon spend a year in freshwater before migrating to salt water in the spring of their second year of life. Most Upper Columbia River spring Chinook salmon return as adults after 2 or 3 years in the ocean. Some precocious males, or jacks, return after one winter at sea. A few other males mature sexually in freshwater without migrating to the sea. However, 4- or 5-year-old fish that have spent 2 to 3 years at sea, respectively, dominate the run.

Snake River Spring/Summer-Run Chinook Salmon ESU

The Snake River spring/summer-run Chinook salmon ESU includes all naturally spawned populations of spring/summer-run Chinook salmon in the mainstem Snake River and the Tucannon River, Grande Ronde River, Imnaha River, and Salmon River subbasins (57 FR 23458). Designated critical habitat includes areas of the Snake River fall-run Chinook salmon critical habitat and areas to the southwest in Idaho. Drainages include the Snake River, Tucannon River, Grande Ronde River, Wallowa River, and Salmon River. Critical habitat does not extend out into open ocean area and does not include the project area.

NMFS classified spring- and summer-run Chinook salmon returning to the major tributaries of the Snake River as an ESU. This ESU includes production areas characterized by spring- and summer-timed returns, and combinations from the two adult timing patterns. Runs classified as spring-run Chinook salmon are counted beginning in early March and ending the first week of June; runs classified as summer-run Chinook salmon return to the Columbia River from June through August. Returning fish hold in deep mainstem and tributary pools until late summer, when they emigrate up into tributary areas and spawn. In general, spring-run type Chinook salmon tend to spawn in higher elevation reaches of major Snake River tributaries in mid- through late August, and summer-run Snake River Chinook salmon spawn approximately one month later than spring-run fish. Summer-run Chinook salmon tend to spawn lower in the Snake River drainages, although their spawning areas often overlap with spring-run spawners (Good et al., 2005).

Direct estimates of annual runs of historical spring/summer-run Chinook salmon to the Snake River are not available. Returns to Snake River tributaries have declined since the late 1960s. Increases in hatchery production over subsequent years have masked a continued decline in naturally produced fish (Good et al., 2005).

Snake River Fall-Run Chinook Salmon ESU

The Snake River fall-run Chinook salmon ESU includes all naturally spawned populations of fall-run Chinook salmon in the mainstem Snake River below Hells Canyon dam, and in the Tucannon River, Grande Ronde River, Imnaha River, Salmon River, and Clearwater River subbasins (57 FR 14653; 57 FR 23458). Designated critical habitat includes much of the Snake River drainages in southern Washington, northeast

Oregon, and central Idaho. Critical habitat includes the Tucannon River Basin, Grande Ronde River Basin, Imnaha River Basin, and the Clearwater River, Selway River, and Lochsa drainages. Critical habitat does not extend out into open ocean area and does not include the project area.

Snake River fall-run Chinook salmon have been steadily declining in abundance since the early 1970s. Declines have been attributed to a loss of primary spawning and rearing areas due to hydropower projects, decreases in naturally produced spawners, and harvest impacts by ocean and in-river fisheries. According the latest status update (Good et al., 2005), the 1997–2001 mean return of natural-origin Chinook salmon exceeded 3,700. The increase was largely driven by the 2001 return, which was estimated to have exceeded 17,000 naturally produced spring-run Chinook salmon; however, a large proportion of the run in 2001 was estimated to be of hatchery origin.

Green Sturgeon (Southern DPS)

The green sturgeon is an anadromous fish species with a wide distribution along the Pacific Coast from Ensenada, Mexico, to southeast Alaska, though the population is more concentrated between northern California and Willapa Bay, Washington (PSMFC, 1996, as cited by OPT). Based on a preliminary genetic analysis and suspected fidelity to natal rivers, the North American green sturgeon was split into two distinct population segments (DPSs). The northern population (Northern DPS) consists of green sturgeon populations originating from coastal watersheds northward of, and including, the Eel River in northern California. The southern population (Southern DPS) consists of green sturgeon populations originating from coastal and Central Valley watersheds south of the Eel River in California.

Critical habitat for the green sturgeon Southern DPS was proposed by NMFS in September 2008 (73 FR 52084) and finalized on October 9, 2009 (74 FR 52300). Critical habitat designation includes the coastal U.S. marine waters within 110 meter depth from Monterey Bay, California (including Monterey Bay), north to Cape Flattery, Washington, including the Strait of Juan de Fuca, Washington, to its U.S. boundary; the Sacramento River, lower Feather River, and lower Yuba River in California; the Sacramento-San Joaquin Delta and Suisun, San Pablo, and San Francisco bays in California; the lower Columbia River estuary; and certain coastal bays and estuaries in California (Humboldt Bay), Oregon (Coos Bay, Winchester Bay, and Yaquina Bay), and Washington (Willapa Bay and Grays Harbor). In Oregon the following areas are excluded from designation: Tillamook Bay, and the estuaries to the head of the tide in the Rogue, Siuslaw, and Alsea rivers (74 FR 52300). Figure 6 shows the designated critical habitat, which encompasses the project area.

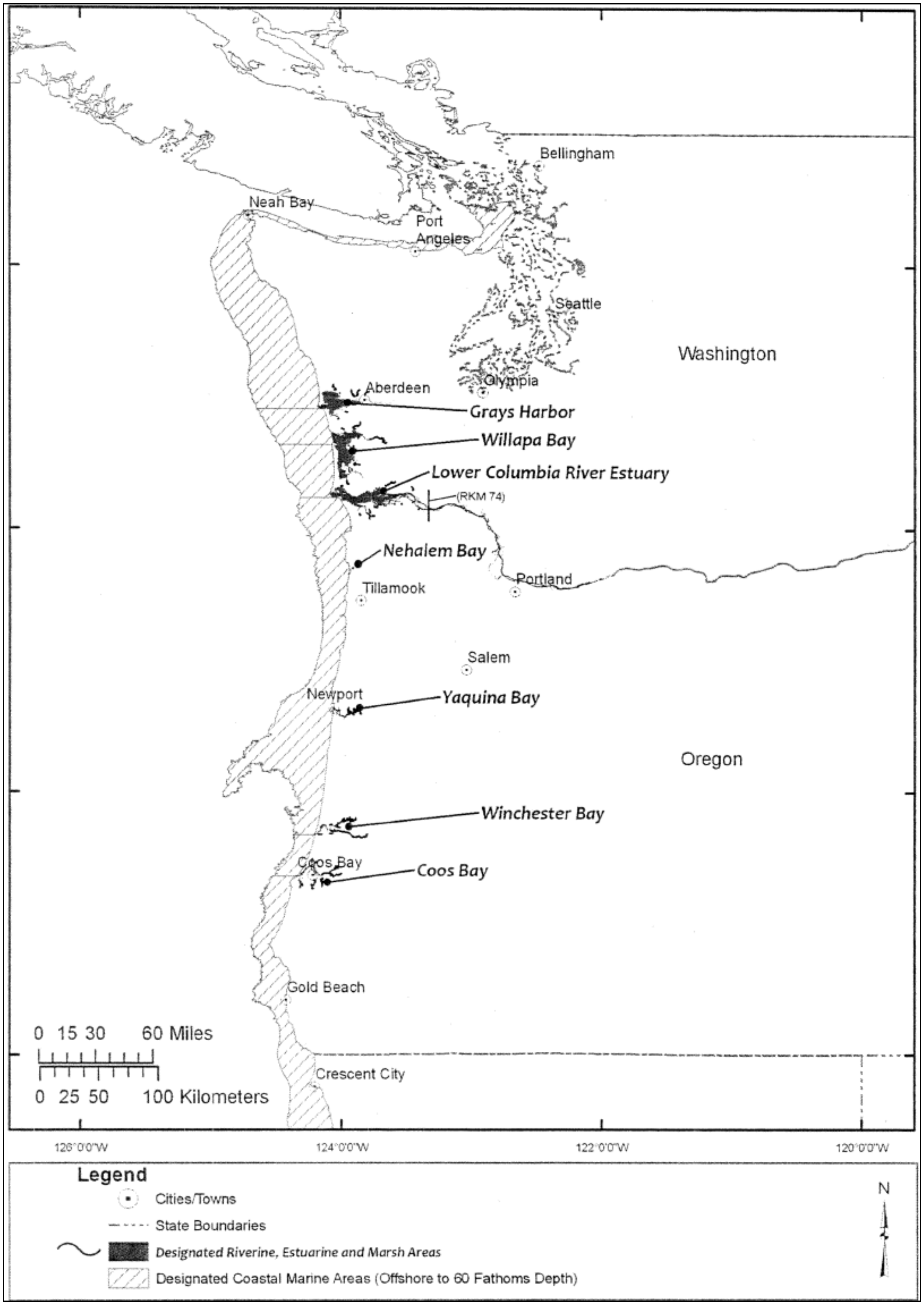

Figure 6. Green sturgeon Southern DPS critical habitat (Source: 74 FR 52300, October 9, 2009).

Green sturgeon are thought to have a maximum age of 60 to 70 years (NMFS, 2007b). This species reaches maturity at 15 to 19 years of age. Spawning frequency is not well known, but the best information suggests that adult green sturgeon spawn every 2 to 4 years (Lindley and Moser, 2008). The Sacramento River is the only area where spawning by Southern DPS green sturgeon has been confirmed and where all life stages of the Southern DPS are supported (NMFS, 2008a). Spawning in the main stem of the Sacramento River has been documented over 240 miles upstream, both downstream and upstream of Red Bluff diversion dam (Brown, 2007, as cited by OPT).

NMFS identified seven unoccupied areas in the Central Valley, California, which may provide additional spawning habitat for the Southern DPS of green sturgeon and may be essential for conservation of the species. The areas include: (1) reaches upstream of Oroville dam on the Feather River; (2) reaches upstream of Daguerre dam on the Yuba River; (3) areas on the Pit River upstream of Keswick and Shasta dams; (4) areas on the McCloud River upstream of Keswick and Shasta dams; (5) areas on the upper Sacramento River upstream of Keswick and Shasta dams; (6) reaches on the American River; and (7) reaches on the San Joaquin River (NMFS, 2008a).

NMFS was able to determine that these seven unoccupied areas may be essential, but not that they are essential, to the conservation of the Southern DPS at this time. Thus, these seven unoccupied areas were not considered further for designation as critical habitat. NMFS determined that exclusion of the lower Feather River would significantly impede the conservation of the Southern DPS. NMFS identified the lower Feather River as an important area for the conservation of the Southern DPS because it has been occupied consistently by the species and most likely contains spawning habitat for the Southern DPS, potentially providing a spawning river for the Southern DPS in addition to the Sacramento River (NMFS, 2008a).

As with other sturgeon species, the green sturgeon is a large species with mature fish ranging from 54 to 88 inches and can weigh up to 350 pounds (NMFS, 2007c). Based on studies being conducted in the Rogue River, spawning adult green sturgeon enter the river during spring months and migrate upstream above tidal influence to spawn, remain in the river for up to 6 months, and then migrate back out to sea in November and December when water temperature drops below 10 degrees Celsius (ºC) and water flows increase (Erickson et al., 2002, as cited by OPT; Erickson and Webb, 2007, as cited by OPT). Juvenile green sturgeon may remain in natal rivers for 1 to 4 years and then migrate out into the ocean where they spend most of their lives in coastal areas (NMFS, 2007c). Southern DPS green sturgeon are known to make extensive migrations, generally northward, and are often concentrated in the Columbia River estuary, Willapa Bay, and Gray’s Harbor during late summer (70 FR 17386; Israel and May, 2007). Erickson and Hightower (2007, as cited by OPT) collected data from seven out-migrating green sturgeon tagged with pop-off archival tags (PAT) in the Rogue River (approximately 90 miles to the south of the project area) indicating that green sturgeon are more active at night, generally inhabited depths of 131 to 230 feet (40 to 70 meters), and occasionally made rapid ascents to the surface. These fish traveled from 221 to 968 kilometers prior to the tag release. All PAT release locations were inside the 110-meter contour.

Data on the population status of the Southern DPS green sturgeon is also scarce. However, recently, Oregon DFW has deployed arrays of acoustic telemetry receivers near Seal Rock (approximately 50 miles north of the project area) and Siletz Reef (approximately 80 miles north of the project area), to observe tagged green sturgeon. Seventy-five different green sturgeon were detected by the array, some of which were Southern DPS (exact number is indeterminate) (Lindley et al., 2008) out of total approximately 350 green sturgeon that were tagged on the West Coast.

Some adults and juvenile green sturgeon persist in the Sacramento River, thus NMFS concluded the population was not in eminent risk of extinction. However, threats to the population continue (71 FR 17757). The primary threat is attributed to the decrease in spawning habitat available in the upper Sacramento River.

Eulachon

Eulachon (commonly called smelt, candlefish, or hooligan) are a small, anadromous fish endemic to the eastern Pacific Ocean, ranging from northern California to southwest Alaska and into the southeastern Bering Sea. They are distinguished by their large canine teeth and 18 to 23 rays in the anal fin. Like Pacific salmon, they have an adipose fin. Adult coloration is brown to blue on the back and top of the head, lighter to silvery white on the sides, and white on the ventral surface; speckling is fine, sparse, and restricted to the back. They feed on plankton but only while at sea.

Eulachon typically spend 3 to 5 years in saltwater before returning to freshwater to spawn from late winter through mid-spring. Eggs are fertilized in the water column. After fertilization, the eggs sink and adhere to the river bottom, typically in areas of gravel and coarse sand. Most eulachon adults die after spawning once. Eulachon eggs hatch in 20 to 40 days. The larvae are then carried downstream and are dispersed by estuarine and ocean currents shortly after hatching. Juvenile eulachon move from shallow nearshore areas to mid-depth areas.

Eulachon occur in nearshore ocean waters and to a depth of approximately 500 feet (NMFS, 2010a), except for the brief spawning runs into their natal (birth) streams. Spawning grounds are typically in the lower reaches of larger snowmelt-fed rivers with water temperatures ranging from 39 to 50°F. Spawning occurs over sand or coarse gravel substrates.

In the continental United States, most eulachon originate in the Columbia River Basin. Other areas in the United States where eulachon have been documented include the Sacramento River, Russian River, Humboldt Bay and several nearby smaller coastal rivers (e.g., Mad River), and the Klamath River in California; the Rogue River and Umpqua River in Oregon; and infrequently in coastal rivers and tributaries to Puget Sound, Washington.

Eulachon abundance exhibits considerable year-to-year variability. However, nearly all spawning runs from California to southeastern Alaska have declined in the past 20 years, especially since the mid-1990s. Habitat loss and degradation threaten eulachon, particularly in the Columbia River Basin. Hydroelectric dams block access to historical eulachon spawning grounds and affect the quality of spawning substrates through flow management, altered delivery of coarse sediments, and siltation.

On March 18, 2010, NMFS issued a final determination to list the southern DPS[23] of eulachon as threatened under the ESA (75 FR 13012). The listing became effective on May 17, 2010, and includes eulachon within and near the proposed Reedsport Project area. At the time of the listing, NMFS noted that critical habitat is not determinable at this time for the following reasons: (1) sufficient information is not currently available to assess effects of designation; (2) sufficient information is not currently available on the geographical area occupied by the species; and (3) sufficient information is not currently available regarding the physical and biological features essential to conservation.

Essential Fish Habitat

The Magnuson-Stevens Act, as amended by the Sustainable Fisheries Act of 1996 (Public Law 104-267), established procedures designed to identify, conserve, and enhance EFH for those species regulated under a federal fisheries management plan. Pursuant to the Magnuson-Stevens Act:

- Federal agencies must consult with NMFS on all actions, or proposed actions, authorized, funded, or undertaken by the agency, that may adversely affect EFH.

- NMFS must provide conservation recommendations for any federal or state action that would adversely affect EFH.

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[23] Extending from the U.S.-Canada border south to include populations in Washington, Oregon, and California.

- Federal agencies must provide a detailed response in writing to NMFS within 30 days after receiving EFH conservation recommendations. The response must include a description of measures proposed by the agency for avoiding, mitigating, or offsetting the impact of the activity on EFH. In the case of a response that is inconsistent with NMFS' EFH conservation recommendations, the Federal agency must explain its reasons for not following the recommendations.

EFH means those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity. For the purpose of interpreting this definition of EFH, waters include aquatic areas and their associated physical, chemical, and biological properties that are used by fish and may include aquatic areas historically used by fish where appropriate; substrate includes sediment, hard bottom, structures underlying the waters, and associated biological communities; necessary means the habitat required to support a sustainable fishery and the managed species' contribution to a healthy ecosystem; and "spawning, breeding, feeding, or growth to maturity" covers a species' full life cycle (50 CFR §600.10). Adverse effect means any impact that reduces the quality and/or quantity of EFH, and may include direct (e.g., contamination or physical disruption), indirect (e.g., loss of prey or reduction in species fecundity), site-specific, or habitat-wide impacts, including individual, cumulative, or synergistic consequences of actions (50 CFR §600.810).

EFH consultation with NMFS is required regarding any federal agency action that may adversely affect EFH, including actions that occur outside EFH, such as certain upstream and upslope activities. The objectives of EFH consultation are to determine whether the proposed action would adversely affect designated EFH and to recommend conservation measures to avoid, minimize, or otherwise offset any potential adverse effects to EFH.

For Pacific Coast species, EFH is described under four Fishery Management Plans covering groundfish, coastal pelagic species, highly migratory species, and Pacific salmon. In a letter dated August 3, 2007, and an e-mail dated August 10, 2007, NMFS identified species that have designated EFH in the project area and these are shown in table 13. These species fall into four categories: groundfish, salmon, highly migratory, and coastal pelagic species.

Table 13. Fish species with designated EFH in the project area (Source: OPT, 2010).

Category	**Common Name** *(Scientific Name)*
Groundfish Species	
	Arrowtooth flounder *(Atheresthes stomias)*
	Bank rockfish *(Sebastes rufus)*
	Big skate (*Raja binoculata)*
	Black rockfish *(Sebastes melanops)*
	Blue rockfish *(Sebastes mystinus)*
	Bocaccio *(Sebastes paucispinis)*
	Butter sole *(Isopsetta isolepis)*
	Cabezon *(Scorpaenichthys marmoratus)*
	Canary rockfish *(Sebastes pinniger)*
	Chilipepper *(Sebastes goodie)*
	Copper rockfish *(Sebastes caurinus)*
	Cowcod *(Sebastes levis)*
	Curlfin sole *(Pleuronichthys decurrens)*
	Darkblotched rockfish *(Sebastes crameri)*
	English sole *(Parophrys vetulus)*
	Flag rockfish *(Sebastes rubrivinctus)*

Category	Common Name *(Scientific Name)*
	Flathead sole *(Hippoglossoides elassodon)*
	Grass rockfish *(Sebastes rastrelliger)*
	Greenstriped rockfish *(Sebastes elongatus)*
	Kelp greenling *(Hexagrammos decagrammus)*
	Lingcod *(Ophiodon elongatus*
	Pacific cod *(Gadus macrocephalus)*
	Pacific hake *(Merluccius productus)*
	Pacific ocean perch (*Sebastes alutus)*
	Pacific sanddab *(Citharichthys sordidus)*
	Petrale sole *(Eopsetta jordani)*
	Quillback rockfish *(Sebastes maliger)*
	Redstripe rockfish *(Sebastes proriger)*
	Rex sole *(Glyptocephalus zachirus)*
	Rock sole *(Lepidopsetta bilineata)*
	Rosethorn rockfish *(Sebastes helvomaculatus)*
	Rosy rockfish *(Sebastes rosaceus)*
	Sablefish *(Anoplopoma fimbria)*

Category	Common Name *(Scientific Name)*
	Sand sole *(Psettichthys melanostictus)*
	Sand sole *(Psettichthys melanostictus)*
	Sharpchin rockfish *(Sebastes zacentrus)*
	Shortbelly rockfish *(Sebastes jordani)*
	Shortraker rockfish *(Sebastes borealis)*
	Shortspine thornyhead *(Sebastolobus alascanus)*
	Soupfin shark *(Galeorhinus galeus)*
	Spiny dogfish *(Squalus acanthias)*
	Splitnose rockfish *(Sebastes diploproa)*
	Spotted ratfish *(Hydrolagus colliei)*
	Starry flounder *(Platichthys stellatus)*
	Stripetail rockfish *(Sebastes saxicola)*
	Tiger rockfish *(Sebastes nigrocinctus)*
	Vermilion rockfish *(Sebastes miniatus)*
	Widow rockfish *(Sebastes entomelas)*
	(Sebastes entomelas)
	Yelloweye rockfish *(Sebastes ruberrimus)*

Category	Common Name *(Scientific Name)*
	Yellowtail rockfish (*Sebastes flavidus)*
Pacific Salmon	
	Coho salmon *(Oncorhynchus kisutch)*
	Chinook salmon *(Oncorhynchus tshawytscha)*
Highly Migratory Species	
	Common thresher *(Alopias vulpinus)*
	Bigeye thresher shark *(Alopias superciliosos)*
Coastal Pelagic Species	
	Pacific sardine *(Sardinops sagax)*
	Pacific (chub) mackerel *(Scomber japonicas)*
	Northern anchovy *(Engraulis mordax)*
	Jack mackerel (*Trachurus symmetricus)*
	California market squid *(Loligo opalescens)*

The following is an overview summarizing EFH for the four fish groupings.

Pacific Groundfish

Pacific groundfish represent a large number of species that are residents along the West Coast. More specifically, the Oregon Coast provides habitat from nearshore to deep-water areas for groundfish. Habitat usage ranges and varies by species and lifestage. In 1998, PFMC reviewed 82 groundfish species and made over 400 EFH identifications (PFMC, 2005). This led to a new EFH boundary that included, "…all waters from the mean higher high water line, and the upriver extent of saltwater intrusion in river mouths, along the coasts of Washington, Oregon, and California seaward to the boundary of the U.S. Exclusive Economic Zone" (PFMC, 2005). As indicated in table 13, NMFS has identified 50 species of groundfish having EFH in the project area.

Since this boundary was very broad and encompassing, PFMC applied additional effort to narrowly define highly important habitat by species and lifestage. Habitat Areas of Particular Concern include both discrete areas of interest (areas that are of special interest due to their unique geological and ecological characteristics) and specific habitat types. Specific habitat types include estuaries, canopy kelp, seagrass, and rocky reefs. All available information within the proposed action area indicates there are no Habitat Areas of Particular Concern in the area. Further, there are no designated areas of interest.

Pacific Salmon

Specific habitat range or EFH for Chinook salmon and coho salmon vary by water temperature and currents (PFMC, 2000). The marine environment is vast and has not been sampled extensively in many ocean areas. Thus, the salmon EFH in the marine environment can only be defined generally. Both Chinook salmon and coho salmon may occur in the project vicinity. The geographic extent of essential marine habitat for both species extends from north of Point Conception, California northward to marine areas off Alaska and out to the Exclusive Economic Zone (EEZ) boundary (figures 7 and 8).

During the ocean life history phase of development, salmon utilize both littoral and pelagic habitat (PFMC, 2000). Some juvenile Chinook salmon use nearshore littoral habitat, then move to deeper water as they mature; however research has shown no significant preference towards littoral habitat by juveniles (PFMC, 2000). Coho and sub-adult Chinook salmon are primarily found in pelagic waters feeding on zooplankton, schooling fish and squid (PFMC, 2000).

Generally, salmonids will concentrate near shelf habitat where food resources and appropriate water temperature can be found (PFMC, 2000). The salmon distribution map figures show that the Oregon Coast represents only a small portion of the total habitat, which is primarily located off the coast of Canada and Alaska. The end result is that the project area is not identified as critical habitat, but is generally assigned as EFH. Based on these salmonid life histories and range, salmon can be present in the project vicinity; however, reliance upon the project area for feeding or long-term residence is not likely.

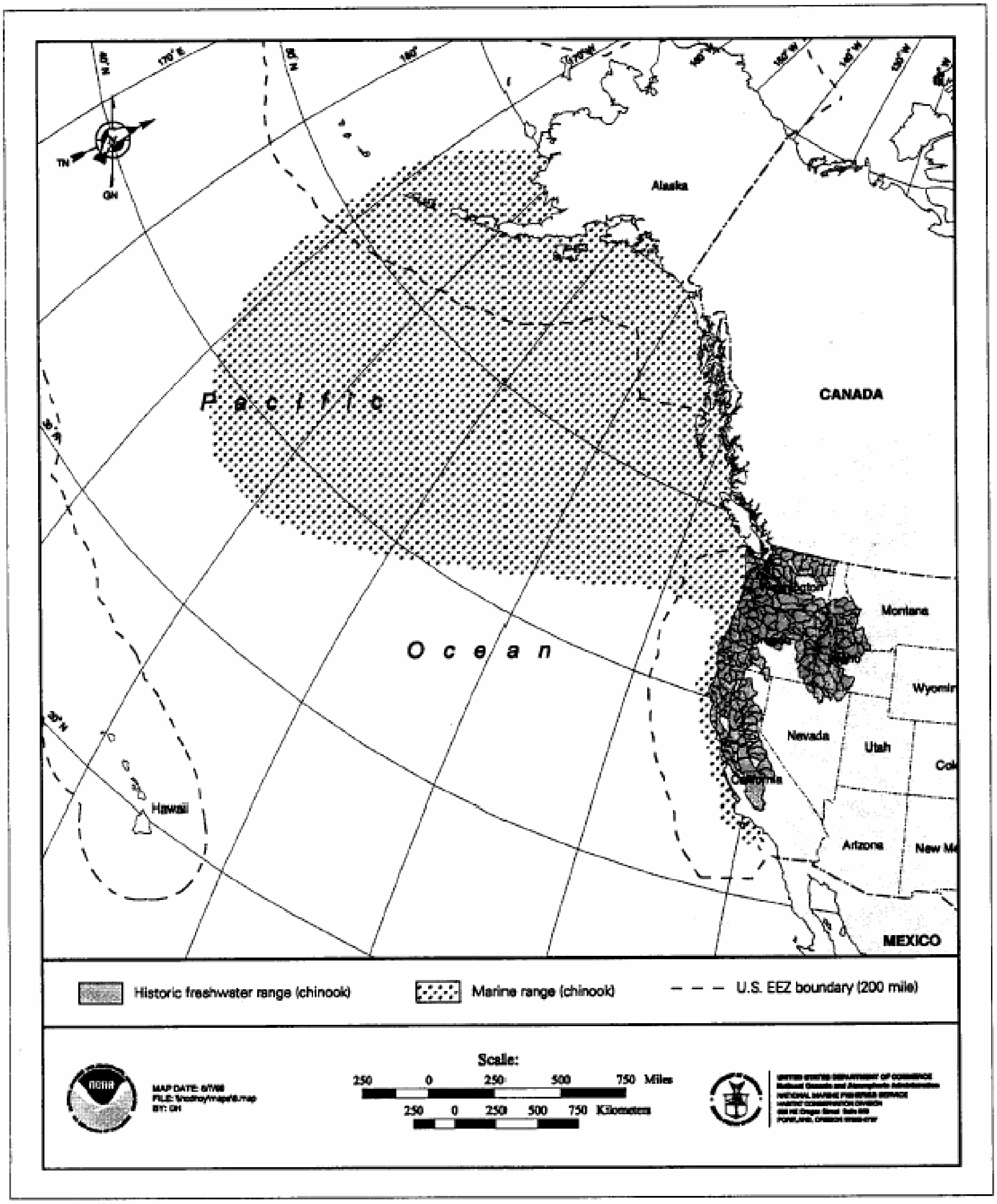

Figure 7. Map depicting the marine range of Chinook salmon in relation to the Exclusive Economic Zone boundary (Source: PFMC, 2000).

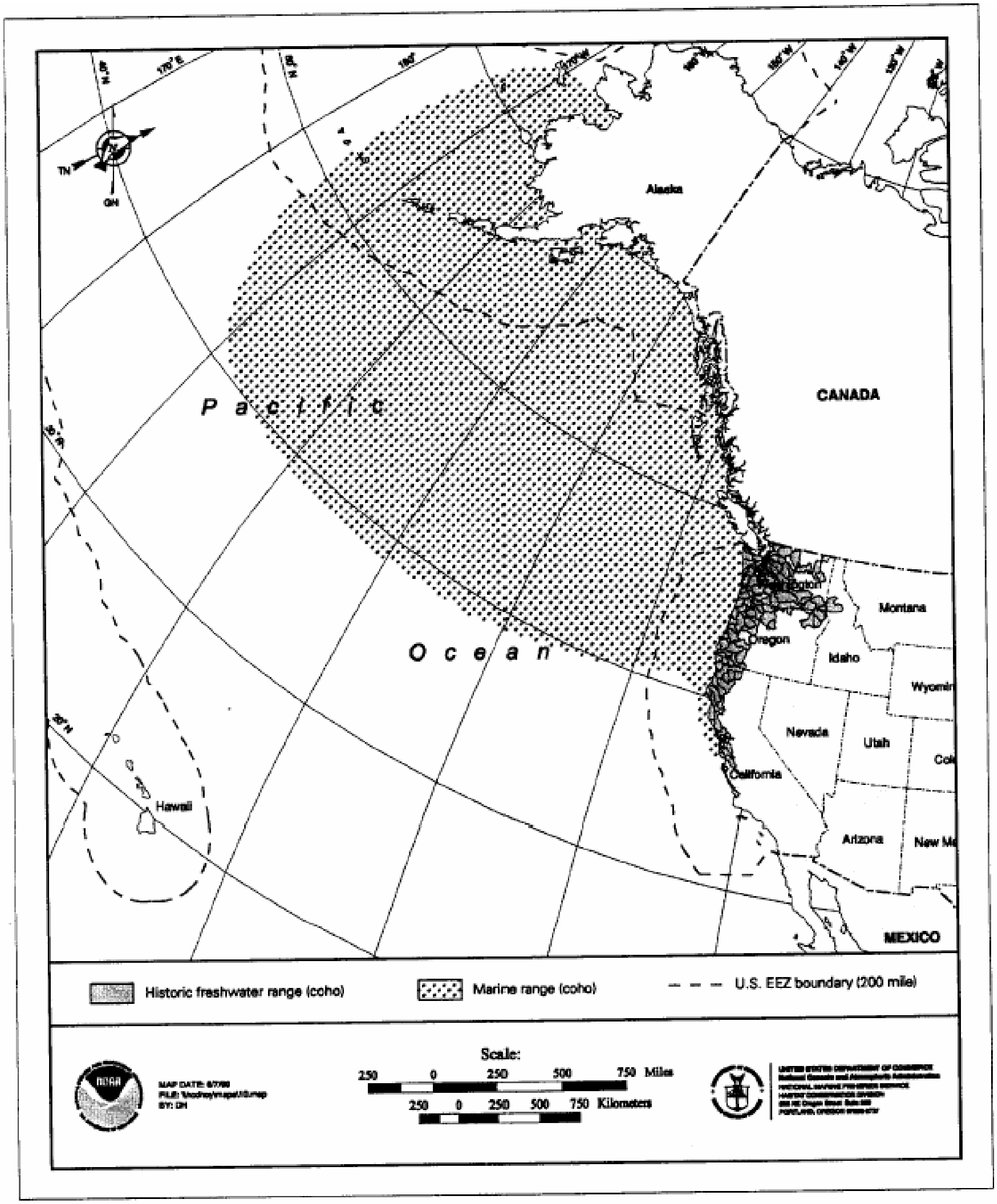

Figure 8. Map depicting the marine range of coho salmon in relation to the Exclusive Economic Zone boundary (Source: PFMC, 2000).

Highly Migratory Species

Highly migratory species represent a grouping of fish species that travel on a global scale and can be found in both the EEZ region (generally 200 nautical miles from shore) and the high seas (PFMC, 2003). For pelagic fish along the Oregon Coast, EFH for the common thresher shark and bigeye thresher shark occur in the project area (table 13).

Highly migratory species generally share similar life histories involving reproduction, development and migration within pelagic waters (PFMC, 2003). This trait means that it is less common for highly migratory species to reside in nearshore waters.

Coastal Pelagic Species

As shown in table 13, coastal pelagic species occurring in offshore waters along the Oregon Coast include five species: northern anchovy, Pacific sardine, Pacific mackerel, jack mackerel, and California market squid (PFMC, 2003). The geographic range of these species varies widely over time in response to the temperature of the mixed upper layer of the ocean (PFMC, 2003). Species range in water temperatures between 50°F to 78°F (PFMC, 2003). The longitudinal geographic boundary of EFH is defined to be all marine and estuarine waters from the shoreline along the coast of Oregon offshore to the limits of the EEZ boundary line and above the thermocline where sea surface temperatures range between 50°F to 78°F. Sardine and mackerels are seasonally more abundant in the Oregon to Alaska region during the summer and in warmwater years in comparison to the winter and coldwater years (PFMC, 2003). Further, the desirable sea surface temperatures and habitat boundaries extend farther north during the summer than during the winter. Variation in temperature and usable habitat vary from year to year, but seasonally is most pronounced during the summer months (PFMC, 2003).

Marine Mammals, Marine Reptiles, and Offshore Birds

Three federally listed marine mammals (Steller sea lion, humpback whale, and SRKW) are known or likely to occur within the project area. Four other marine mammals (blue, fin, sei, and sperm whale) could occur as transients, but are primarily associated with deeper water, farther from the coast. The North Pacific right whale (Eastern North Pacific Stock) could also occur as a transient, but we have not addressed it in this EA because the potential for its occurrence appears to be extremely rare, and NMFS does not believe it to occur within the project area.[24] Based on records

[24] On page A-12 of the Settlement Agreement, OPT references a personal communication from Bridgette Lohrman (NMFS) on October 10, 2007, stating that North Pacific right whales would not be expected in the project area.

summarized in the Monterey Bay National Marine Sanctuary database, a total of 40 individuals have been observed off the coast of North America between British Columbia and Mexico since 1856, with 19 of these whales observed in the past 50 years (Sanctuary Integrated Monitoring System, undated [b]). The NMFS stock assessment (Allen and Angliss, 2008) indicates that this is the most endangered stock of large whales in the world, but there is no reliable estimate of minimum population abundance, and current threats to this stock are unknown.

Pinnipeds

Steller Sea Lion—The Steller sea lion occurs in the Pacific Ocean from Japan to the Western Gulf of Alaska and along the West Coast of North America to northern California. There are two DPSs, the western and eastern stocks. The eastern stock, listed as federally threatened, is found along the northern California, Oregon, and Washington coastline north to the Gulf of Alaska. The estimated eastern DPS population size is 47,885. A total of 5,297 Steller sea lions were counted at the 10 Oregon rookeries and haul-outs during a survey in 2002.

In Oregon, Steller sea lion critical habitat is located at two rookeries: Pyramid Rock on the Rogue Reef, about 92 miles south of the project area, and Long Brown Rock and Seal Rock on the Orford Reef, approximately 66 miles to the south. The critical habitat designation includes an air zone that extends 3,000 feet above areas historically occupied by sea lions at each major rookery in Oregon, measured vertically from sea level, and an aquatic zone that extends 3,000 feet seaward.

During the fall and winter, many Steller sea lions disperse from rookeries and increase their use of haul-outs. Some haul-outs are used year-around, and others only on a seasonal basis. Oregon DFW identified Sea Lion Caves, located about 25 miles north of the project, and Cape Arago, about 30 miles south of the project, as significant haul-out sites. The Rogue Reef and Orford Reef rookeries are also used as haul-outs outside of the breeding season. Outside of the peak of breeding season (mid-June), the number of Steller sea lions on individual haul-outs can vary considerably from day to day.

Steller sea lions show high fidelity to their natal rookeries during June and July, but can travel great distances as adults for foraging during the non-breeding season, fall through spring. In general, adults and young-of-year pups remain within 300 miles of their natal grounds. However, some adult males have been known to travel more than 600 miles, and some pups with their mothers were documented almost 500 miles from their natal rookery. Juvenile Steller sea lions have been observed to travel the greatest distances—more than 1,100 miles—from their natal grounds.

Preferred terrestrial habitat is primarily on exposed rock shorelines associated with shallow, well-mixed waters, average tidal speeds, and gradual bottom slopes, although Steller sea lions can be found on gravel or cobbles beaches, as well. Potential haul-outs also include jetties, breakwaters, navigational aids, floating docks, and sea ice. The primary factor influencing habitat selection is prey availability. Other factors include substrate, exposure, oceanographic conditions, human disturbance, season, and prey availability.

Tagging studies have shown Steller sea lions may range far offshore over the continental shelf while foraging. Based on studies of California and Oregon populations, prey species consist of rockfish, hake, flatfish, salmon, herring, skates, cusk eel, lamprey, squid, and octopus. Steller sea lions also consume an occasional bird or other marine mammal.

The eastern DPS as a whole has been increasing steadily at an annual rate of 3 to 4 percent for the past 30 years or so. Although populations in central and southern California have experienced severe declines, the number of Steller sea lions in southeastern Alaska, British Columbia, and Oregon has doubled since the 1970s, and NMFS considers the DPS to be stable. Factors that may continue to affect populations include killer whale predation, incidental take from commercial fisheries, subsistence harvest, entanglement in marine debris, disease, contaminants, and global climate change.

Cetaceans

Humpback Whale—The humpback whale is a highly-migratory marine mammal that ranges along the West Coast and worldwide. While the humpback whale is listed as endangered, populations have increased at an estimated rate of 6 to 7 percent annually over the last 20 years. NMFS has not designated critical habitat for this species.

Research suggests there are at least three populations of humpback whales, including two (the Eastern North Pacific Stock and Central North Pacific Stock) that annually migrate through Oregon's coastal waters. Generally, humpback sightings in northwest coastal waters are uncommon, but humpback whales have been reported occasionally near the mouth of the Umpqua River. Recent efforts to tag humpback whales by OSU led to 10 observations in July and August of 2002 between Coos Bay and Newport. These observations occurred in highly productive foraging areas more than 5 miles offshore. Movement along the coastline occurs primarily during summer and fall; however, historical whale observations have been made in every month except February, March, and April.

Humpback whales can grow to a length of 15 meters and weigh 23,000 to 36,000 kg. Humpback whales are baleen whales, which feed on small crustaceans (known as krill), and various species of small fish. Each whale may consume nearly a ton of food per day by filtering huge volumes of seawater through its baleen plates. Feeding behavior can vary from deep diving in pursuit of prey, cooperative feeding such as herding and formation feeding (echelon feeding), and the use of "bubble clouds" produced by lobbing their tails at the surface to form a cloud of bubbles, followed by a lunge through the bubbles. Within summer feeding areas, humpback whales' distribution is likely driven by locations of dense patches of prey, which vary considerably between years, seasons, days, and even within days.

Threats to the humpback whale include ship strikes, harassment by whale watching vessels, displacement as a result of shipping, fishery, and aquaculture activity, and acoustic impacts from vessel operation, oceanographic exploration, and military operations. Entanglement in fishing gear is also a threat; NMFS has observed incidental take of humpback whales in the California/Oregon swordfish/thresher shark drift gillnet fishery. Humpbacks in Hawaii have been observed entangled in longline gear, crab pots, and other non-fishery related lines (NMFS, 2010b).

Southern Resident Killer Whale—Although not officially recognized as separate subspecies, there are three ecotypes of killer whales in the northeastern Pacific Ocean: resident, transient, and offshore. While their ranges overlap, these forms represent significant morphology, ecology, behavior, and genetic differences resulting from a lack of interchange between the groups. In the United States, resident killer whales occur from California to Alaska and can be further subdivided into four communities: Southern, Northern, Southern Alaska, and Western Alaska North Pacific Residents. The SRKW population, listed as endangered, can be found off the coast of Oregon. The SRKW population has never been large, perhaps numbering between 100 and 200 before 1960. The current (2007) estimate of SRKWs is 87. Critical habitat for the SRKW is located only in northern Washington State at: (1) the Summer Core Area in Haro Strait and waters around the San Juan Islands; (2) Puget Sound; and (3) the Strait of Juan de Fuca. No SRKW critical habitat exists on the Oregon Coast.

SRKWs consist of three family groups or pods. These are documented to range off the coasts of central California, Oregon, Washington, Vancouver Island, and as far north as the Queen Charlotte Islands. However, most sightings have occurred in the summer in inland waters of Washington and British Columbia.

From late spring through fall, the primary residence for the SRKW is in the inland waterways of Washington State and British Columbia (Strait of Georgia, Strait of Juan de Fuca, and Puget Sound). Winter and early spring movements and distribution are generally unknown.

There have been more than 40 confirmed coastal sightings during the last 25 years off the outer Pacific Ocean Coast (British Columbia and Washington outer coasts, Oregon, and California). Of these, four sightings occurred off the Oregon Coast in April 1999, March and April 2000, and March 2006. In addition, 10 sightings off the California Coast between 2000 and 2008 in January, February, March, and October represent whales that would have traversed Oregon waters. While SRKWs can occur throughout their range any time of the year, sightings of pods along the outer coast are most likely to occur between January and May. Offshore movements and distribution are largely unknown.

The killer whale is the largest member of the dolphin family, with males reaching up to 9.8 meters in length and nearly 10,000 kg in weight while females may reach 8.5 meters in length and 7,500 kg weight. The foraging behavior and prey species varies between killer whale populations. The SRKWs prey mainly on salmon and other fish from late spring through fall. Chinook salmon appear to be the preferred prey, even when other salmon species are more abundant. Little is known of their winter and early spring foraging patterns. Resident killer whales may spend 50 to 67 percent of their time foraging, using echolocation, passive listening, and well-developed vision to locate and capture prey.

Widespread declines in abundance of prey species may be contributing to limited growth of the SRKW population. Additional threats may include contaminants, oil spills, and noise disturbance from whale watching, industrial and military activities. Ship collisions and fishing gear entanglement are thought to be minor factors.

Blue Whale—The blue whale inhabits most oceans and seas of the world, with a world-wide population currently estimated at 8,000 to 14,000. The population of the eastern North Pacific stock, which occurs in Washington, Oregon, and California waters, is estimated at about 1,744 whales. NMFS has not designated critical habitat for this species.

The eastern North Pacific stock summers off the coast of California and migrates as far south as Costa Rica during the winter. This species inhabits and feeds in both coastal and pelagic environments (NMFS, 1998a). Blue whales are rarely sighted off the coast of Oregon.

The blue whale is the largest animal on earth, averaging 23 to 24.5 meters in length in the northern hemisphere. Females are larger than males and can weigh up to 136,000 kg. Like most baleen whales, blue whales feed on krill and possibly pelagic crabs. Blue whales are often concentrated near continental shelf breaks downstream of upwelling centers where krill are concentrated. Studies of four blue whales indicated they spent most of their time submerged. Dives were generally less than 16 meters deep, but may be as deep as 200 to 300 meters.

Threats to the blue whale include unauthorized take, ship strikes, and potential gillnet fisheries mortality. However, cetacean entanglement rates in the drift gillnet fishery have dropped considerably following the requirement to use pingers and efforts to educate fishermen. Additional threats may include low prey abundance due to habitat degradation and disturbance due to increasing levels of anthropogenic noise.

Fin Whale—Fin whales occur in the major oceans of the world and tend to be more abundant in temperate and polar waters. NMFS recognizes three populations in the United States, including one that is found in waters off California, Oregon, and Washington. Ship surveys conducted between 1991 and 2001 estimated 280 to 380 fin whales off the Oregon and Washington coasts, and 1,600 to 3,200 offshore of California. NMFS has not designated critical habitat for this species.

In general, fin whales are more numerous off the West Coast during summer and fall. Though it is not clear where they spend the winter and spring months, it is unlikely they make large-scale migrations. They generally travel alone or in small groups but aggregations can occur. They are able to communicate over vast distances due to their powerful song.

Second only to the blue whale in size, the fin whale can reach lengths of 24 meters in the northern hemisphere and 26.8 meters in the southern hemisphere and a weight of 45,360 to 63,500 kg. They feed on krill and small pelagic schooling fish and have been known to consume up to 1,800 kg of food per day. They have been observed circling schools of fish at high speed and then turning on their right side to consume the fish.

Threats to fin whales include unauthorized take, ship collisions, drift net entanglement, reduced prey abundance due to over harvest, and habitat degradation. Disturbance from low-frequency noise is also a factor that may influence fin whales.

Sei Whale—Sei whales occur in subtropical and tropical waters and into the higher latitudes. Sei whales in the eastern North Pacific (east of 180°W longitude) are considered a separate stock. They are rarely found off the Washington, Oregon, and California coasts; when observed, individuals are typically in oceanic waters, miles offshore. Surveys out to a distance of 300 nautical miles in 1996 and 2001 resulted in an abundance estimate of 56 sei whales along the coast of the western United States. NMFS has not designated critical habitat for the sei whale.

Like other baleen whales, sei whales forage on small fish, squid, krill, and copepods. The sei often feeds on plankton near the surface by skimming the surface with mouth open. The typical adult male can range from 13.7 to 16.8 meters and weigh 12,700 to 15,400 kg with females being slightly larger. Sei whales usually travel alone or in small groups though they are known to aggregate in areas of dense prey. Little is known of their behavior.

As with most whales, current threats to the sei whale include illegal take, ship collisions, and drift net entanglement. No actual net entanglements have been reported; however, the species is very rare and mortality from entanglement may go unobserved if individuals swim far out to sea or sink. Habitat degradation and noise disturbance may also threaten species recovery.

Sperm Whale—There are several sperm whale stocks found throughout the world, with an estimated population of about 360,000 animals. The West Coast stock resides primarily in California, but has been historically observed in Oregon and Washington in every season except winter (December through February). Based on survey data collected from 1996 to 2001, NMFS estimates the population of the West Coast stock at about 1,233 whales. Estimates have varied dramatically over time and show no apparent trend. NMFS has not designated critical habitat for this species.

Sperm whales spend their lives in waters averaging more than 1,300 feet deep and are uncommon in waters less than about 90 feet deep. They prey upon deepwater species such as squid, shark, skates, and other fish.

Adult males can reach lengths of 15 to 18 meters and weigh 31,750 to 40,800 kg while the smaller females rarely exceed 11 meters and 12,000 to 12,700 kg. This species often forms family groups of females and their young. Young males between the ages of 4 and 21 years may be found in "bachelor schools" whereas fully mature adult males often travel alone, though they can sometimes be found with female groups.

Threats to the sperm whale include incidental ship strikes and fishing gear entanglement (specifically, the California/Oregon offshore thresher shark/swordfish gillnet fishery), but are probably less of a concern for sperm whales than for more coastal cetaceans. Noise disturbance is also considered a potential threat.

Marine Reptiles

Leatherback Sea Turtle—The leatherback sea turtle has the widest distribution of all sea turtles, nesting on beaches in the tropics and sub-tropics and foraging in sub-polar waters. Following nesting, leatherbacks migrate along the West Coast of North America from Mexico to Alaska. In December 2009, NMFS proposed designation of critical habitat along the West Coast of the United States, including one area that extends from Cape Flattery, Washington, to the Umpqua River (Winchester Bay), Oregon, from mean high tide seaward to the 2,000 meter isobath. Critical habitat has also been proposed off the coast of California.

The leatherback is the most commonly observed sea turtle on the West Coast, but sightings are still infrequent and generally are made in open water, miles off the coast. Five leatherback turtles were observed off the coast of Oregon and 11 off the coast of Washington during surveys between 1989 and 1991. These sightings occurred along the continental slope between June and September. In August, 2007, tuna fishermen observed a leatherback offshore of Garibaldi, Oregon (about 150 miles north of the project area) (Salem News, 2007).

There are very few areas where leatherbacks are routinely encountered, and the timing and routing of migrations is unknown. Sightings along the coast of California peak in August, perhaps a reflection of adults moving southward for winter breeding. During migrations, leatherbacks feed primarily in the mid-water column on medusa, siphonophores, and salpae. Little is known about the dispersal and developmental habitats of hatchling, juvenile, and subadult leatherbacks.

The greatest causes of decline and continuing primary threats to leatherbacks worldwide are long-term harvest and incidental capture in fishing gear. Incidental capture occurs mainly in gillnets, but may also occur in trawls, traps and pots, longlines, and dredges. Reports of incidental catch in the eastern north Pacific include entanglement in gillnets and longline sets off the coasts of Washington, Oregon, and California.

Loggerhead Sea Turtle—The loggerhead sea turtle has a global distribution and primarily resides in waters south of San Diego, California, on the West Coast. The majority of loggerhead nesting occurs in the western rims of the Atlantic and Indian Ocean, and there are no known nesting sites on the West Coast of the United States. Sightings of juveniles have occurred in Washington and Alaska, but no documented sightings of loggerhead turtles have occurred in Oregon coastal waters, other than two strandings reported between 1997 and 2007. NMFS has not designated critical habitat for this species.

Loggerhead sea turtles undergo extensive migrations to feed on mid-water column organisms in the open ocean. They also feed on hard-shelled prey, such as whelks and conch.

The greatest cause of decline and primary threat to loggerhead turtle populations worldwide is incidental capture in fishing gear, primarily in longlines and gillnets, but also in trawls, traps and pots, and dredges. To reduce this threat, mandatory bycatch reduction measures have been incorporated into management plans for specific U.S. fisheries. There is limited information on mortality of loggerheads specific to the West Coast of the United States. Occasional stranding occurs in Washington and Oregon as a result of cold temperatures that interfere with metabolic pathways. Incidental bycatch probably also occurs.

Green Sea Turtle—The green sea turtle has a global distribution but resides primarily in warm coastal waters and is rarely observed on the West Coast of the United States. Over the last century, this species has declined in most areas and stands at only a fraction of its historical abundance. There are no known nesting sites on the West Coast and the primary area of observations is in marine waters south of San Diego, California. There have been no recent documented sightings of green sea turtle in Oregon waters, other than 15 strandings reported between 1997 and 2007. Critical habitat for the green sea turtle has only been designated in the Atlantic Ocean.

The green sea turtle is strictly herbivorous, feeding on seagrasses and algae. Like most other sea turtle species, they are highly mobile and undertake complex migrations. Most green sea turtles spend the majority of their lives in coastal foraging grounds, including open coastline and protected bays and lagoons. Pelagic habitats are used by oceanic-stage juveniles and migrating adults, although some adults reside and forage in the open ocean.

Threats to the green sea turtle include overharvest of eggs and adults, and by disease in some parts of the world. Like other sea turtle species, incidental bycatch in fishing gear poses a serious threat.

Olive Ridley Sea Turtle—The olive ridley sea turtle is thought to once have been the most abundant sea turtle, worldwide. This species nests in Central America, and while nesting does not occur in the United States, individuals have been identified as far north as southern Oregon. Sightings in Oregon have occurred when commercial fishers collected individuals as bycatch in setlines, and five strandings were reported between 1997 and 2007. NMFS has not designated critical habitat for this species.

The olive ridley sea turtle is primarily a pelagic sea turtle, but has been known to inhabit coastal areas, including bays and estuaries. The migratory pathways of the olive ridley sea turtle vary annually, and no apparent migration corridors exist. Similarly to the leatherback turtle, the olive ridley migrates in open ocean water feeding on mid-water organisms.

Similar to other sea turtle species, incidental bycatch is a serious threat to eastern Pacific populations of olive ridley sea turtles. Incidental captures have been reported in longline, purse seine, and gillnet fisheries.

Offshore Birds

Marbled Murrelet—The marbled murrelet is a small, fast-flying, seabird that forages at sea and nests in forests along the Pacific Coast from Alaska to central California. The majority of the population resides in British Columbia and Alaska, with lower numbers if Washington, Oregon, and California. A recent 5-year status review indicates a population of about 18,000 birds in these three states, a significant decline since 2002 (FWS, 2009).

Surveys between 2000 and 2003 estimated a population of 5,100 marbled murrelets along the Oregon Coast in Conservation Zone 3, Stratum 2, an approximately 100-mile stretch of nearshore waters that includes the area where the Reedsport Project would be located. Researchers estimated a density of 14.08 ± 2.49 murrelets per transect mile in this area. Marbled murrelets were abundant in central Oregon from Newport to Coos Bay, but variable in numbers south of Coos Bay.

Designated critical habitat includes forested habitat in the Umpqua Basin. The closest critical habitat is located approximately 6 miles east of the terminus of the proposed underground transmission line with the Douglas Electric Cooperative transmission line.

In Washington, Oregon, and California, the marbled murrelet nests in late-successional and old-growth forests as far as 50 miles inland from the coast. Marbled murrelets forage in near-shore marine areas, primarily within 1 to 2 kilometers from shore. Murrelet sightings off the Oregon Coast declined after a distance of a little over 0.5 mile offshore, and some research indicates that these seabirds would forage near shore during the day and move several miles offshore at night. As shown in table 14, the highest density of birds occurs in a narrow band close to shore (less than 0.3 mile), with a dramatic decrease at greater than 0.6 mile from the shore.

Table 14. Number of marbled murrelets per mile, surveyed by distance from shore near Newport, Oregon, in 1992 (Source: OPT, 2010).

		Distance Offshore (statute miles)				
		<0.3	**0.3–0.6**	**0.6–0.9**	**0.9–1.2**	**>1.2**
Date	**Time**	**Number of Birds per Mile, Transects Lateral to Shoreline**				
June 15	11:30–12:30	22.2	14.7	0.0	NA	NA
June 28	8:40–10:00	12.9	12.0	1.9	NA	NA
June 28	12:00–12:40	7.1	8.4	0.0	NA	NA
June 12	7:10–10:40	33.8	12.1	3.4	1.0	NA
July 16	7:30–8:00	11.9	1.3	0.0	NA	NA
August 1	10:20–11:50	14.4	20.2	6.8	5.4	1.7
August 7	9:00–10:50	3.3	2.9	0.0	NA	NA
August 10	9:00–10:50	13.5	13.7	3.0	1.3	0.0
Average		12.3	10.3	1.9	2.5	0.8

Marbled murrelets feed on small fish such as surf smelt and sandlance, as well as invertebrates. Diving depth appears to vary and may depend on where the prey species is located. Although murrelets are likely capable of dives up to 47 meters deep, most prey is caught between 3 and 5 meters of the surface.

Historically, population declines of marbled murrelets populations have been attributed to loss and degradation of nesting habitat. Adult mortalities related to gill netting activities have been severe as well in some areas, although it is not known to have occurred in Oregon. Continuing threats to recovery primarily include disturbance to nesting areas which affect nesting success, nest predation, and the decline in nesting habitat (old-growth forest stands). Additional threats include commercial and recreational fishing, ocean pollution, oil spills, changes in forage species distribution and abundance, and ocean conditions. Although collisions with transmission lines and vehicles have been reported for the species, no cases of murrelets colliding with structures at-sea have been documented.

Short-tailed Albatross—Thought to be extinct in the mid-twentieth century, short-tailed albatross numbers are currently estimated to be less than 2,000 birds. The species' breeding grounds are limited to Torishima Island, south of Japan, and the Senkaku Islands, northeast of Taiwan; although in recent years, non-breeding individuals and pairs have been observed during breeding seasons farther south on Minami-Kojima Island in the Ryukyu chain, as well as on Midway Island. FWS has not designated critical habitat for this species.

Short-tailed albatrosses spend most of their lives over the northern Pacific Ocean and the Bering Sea. They typically occur 20 to 30 miles or more offshore. In its May 7, 2010, comment letter, Oregon DFW provided a map showing satellite tracking locations of three juvenile short-tailed albatrosses. These records indicate that short-tailed albatrosses may fly within 10 miles of the shoreline from time to time, and it is possible that the species could fly through the Reedsport Project area.

Terrestrial Wildlife Species

Western Snowy Plover (Coastal)

The western snowy plover is a small shorebird that breeds along the West Coast of North America. The Pacific Coast population is found from southern Washington to Baja, Mexico, and winters as far south as Central America (FWS, 2007). For coastal Washington, Oregon and California combined, total adult plovers on coordinated breeding-season counts rose from 1,493 in 2002 to 2,017 in 2004 and subsequently declined to 1,537 and 1,541 in 2007 and 2008, respectively (Page et al., 2009). In 2006, surveyors counted about 2,500 adults during nesting surveys.

The plover is strongly associated with beach habitat and dunes. FWS has designated critical habitat for the snowy plover from the Siltcoos River to Tahkenitch Creek. The nearest critical habitat to the project area is located about 1 mile north of the proposed project.

Plovers nest between March and September in divots on sandy beaches. There are eight main western snowy plover nesting sites on the Oregon Coast. Five of the eight nesting sites are located within 15 miles of the terrestrial project area; these include Sutton Beach, Siltcoos Estuary, Oregon Dunes Overlook, Tahkenitch Estuary, and Tenmile Creek. All primary habitat for snowy plovers is located in Coos and northern Douglas counties. Nesting and observed individual plovers are not common in central or lower Douglas County.

Western snowy plovers forage by moving along wave breaks on sandy beaches, consuming insects, crabs, and small fish. They remain near the coastline and do not make distant seaward or inland flights. Colonies of birds can remain in one location year around, but some migrate from Oregon and Washington to over-winter in Baja California. Migration can occur in small groups or larger flocks of up to 300 individuals.

The plover's reliance on beach and dune habitat makes it increasingly susceptible to housing and industrial development. Continued effort toward protecting plover habitat is being applied to ensure full population recovery.

Northern Spotted Owl

The northern spotted owl ranges from southwestern British Columbia to central California. The total population is unknown. In 1994, there were 2,900 known sites in Oregon with nesting pairs or individual northern spotted owls, but populations have been declining in recent years. FWS designated critical habitat for this species in 1992, and issued a recovery plan in 2008. The nearest critical habitat is located approximately 6 miles east of the proposed shore substation and underground transmission line.

Northern spotted owls are strongly associated with late-successional and old-growth forest. They nest in tree cavities or existing platform nests built by other birds, and prey upon rodents, birds, and insects.

Previous studies have attributed the population decline to habitat loss with logging and deforestation falling under particular scrutiny. Recent evaluations, such as the 2007 Draft Recovery Plan for the Northern Spotted Owl, suggest that competition with barred owls (*Strix varia*), which have recently spread in range throughout Washington, Oregon, and northern California, is currently the greatest threat to recovery of the species.

3.3.6.2 Environmental Effects

Salmon

ESA-listed salmon may be attracted to the proposed project structures and/or the increased prey availability resulting from the presence of the project, and they may in turn be preyed upon by pinnipeds, seabirds, or other fish that also are attracted to the project area for the same reasons. There is also a concern that EMF emitted by the project may affect the migration of ESA-listed salmon. To address these concerns, as part of the proposed fish and invertebrates monitoring, OPT proposes to evaluate the potential for increased predation on ESA-listed Pacific salmon, and through EMF monitoring, OPT proposes to evaluate the potential for project-generated EMF to affect salmon migration.

Our Analysis

ESA-listed Pacific salmon—the Southern Oregon and Northern California, Oregon coastal, and Lower Columbia River coho, and Lower Columbia River, Upper Columbia River, Snake River spring/summer-run, and Snake River Fall-Run Chinook salmon stocks—are expected to occur in the proposed project area. From 6 months to 6 years, ocean-rearing salmon rapidly grow because they feed on schools of small pelagic fish and invertebrates (OSU, 2006). Generally, Pacific salmon marine movement is based on following available food resources. Hinke et al. (2005) found that Pacific salmon habitat use varied based upon changes to food resources by season. Therefore, unless there is a preponderance of available prey associated with the proposed project structures, we do not expect that salmon would be attracted to and congregate within the project vicinity.

While the proposed project would be placed within a project area of 0.5 mile x 0.5 mile (160 acres), the actual footprint of the constructed array is expected to be only about 1,000 feet x 1,300 feet or approximately 30 acres. We note that a project of this small size and design is unlikely to provide a significant enough amount of artificial structure/habitat to support aggregations of salmon prey species, such as herring, sardine, anchovy, sandlance, squid, eulachon, groundfish, and crab.

We conclude that the proposed preventative measures to eliminate pinniped haul-out would be adequate to prevent substantial attraction of pinnipeds to the project area. Any unanticipated increase in the number of pinnipeds in the project area would be identified by the pinniped monitoring efforts.

Based on our analysis in section 3.3.3.2, we agree with OPT that the effects of EMF on ESA-listed salmon would likely be minor and short term because the B and iE fields resulting from the proposed transmission cable would decrease rapidly with distance from the cable, and would be easily avoidable by ESA-listed salmon. As discussed in section 3.3.3.2, the Corps (2004), estimated the peak intensities of B fields anticipated from the proposed Cape Wind Energy Project[25] would quickly attenuate to

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[25] The project would have cables that would carry substantially more power than the Reedsport Project.

about 10 percent of the peak intensity within 10 to 20 feet directly above the seafloor (Corps, 2004). Based on this information, the Corps (2004) concluded that there were no anticipated adverse effects on fish species or the marine environment resulting from the 60-Hz B fields, as the magnitude of the B fields in the vicinity of the transmission cable would be limited to an extremely small space and decrease rapidly within a few feet of the cable.

In its environmental assessment for the wave energy project at Kaneohe Bay Hawaii, the Department of the Navy (2003) noted that pelagic species (such as salmon) could readily swim over the magnetic field generated by that project's wave energy conversion cable. The Department of the Navy (2003) concluded that since the cable occupies only a small area of the seafloor, the effect of avoidance behavior that could be potentially exhibited by marine organisms, in response to the presence of the wave energy conversion transmission cable, would be minor.

In addition to these findings, Yano et al. (1997, as cited by OPT) investigated the effects of artificial B fields on oceanic migrating chum salmon (*Oncorhynchus keta*). In this study, chum salmon were fitted with a tag that generated an artificial B field around the head of the fish. There was no observable effect on the horizontal and vertical movements of the salmon when the tag's magnetic field was altered. Quinn and Brannon (1982, as cited by OPT) further conclude that while salmon can apparently detect B fields, their behavior is likely governed by multiple stimuli as demonstrated by the ineffectiveness of artificial B field stimuli. Similar results were also found in studies conducted on another salmonid, Atlantic salmon (*Salmo salar*). Results of research of effects of EMF showed that navigation and migration of Atlantic salmon is not expected to be impacted by the magnetic field produced by an underwater transmission cable (Scottish Executive, 2007).

Based on the available information, we do not anticipate any adverse effects on ESA-listed salmon resulting from EMF; however, OPT's proposed EMF monitoring would collect additional information needed to evaluate the magnetic B fields generated by the proposed project and to determine whether the corresponding electric E fields are below the known thresholds of sensitive fish species, as expected. OPT's proposed monitoring and adaptive management provisions would also require OPT to review the monitoring results with the Aquatic Resources and Water Quality Implementation Committee to determine whether any additional actions are needed protect ESA listed salmon, if monitoring results indicate that EMF emissions are at levels that are of concern.

Based on these findings, we conclude that the proposed project (proposed action) is not likely to adversely affect the Southern Oregon and Northern California, Oregon coastal, and Lower Columbia River coho and Lower Columbia River, Upper Columbia River, Snake River spring/summer-run, and Snake River fall-run Chinook salmon stocks (table 2).

Green Sturgeon

As discussed in section 3.3.6.1, very little is known of the marine ecology of the southern DPS green sturgeon, although available information indicates that these fish make extensive long-shore migrations in coastal waters. Ongoing and proposed monitoring involving acoustic tagging would likely offer additional information regarding how sturgeon use nearshore habitats. Oregon DFW has deployed arrays of acoustic telemetry receivers near Seal Rock, which is approximately 50 miles north of the project area, and Siletz Reef, which is approximately 80 miles north of the project area to study tagged green sturgeon. Seventy-five different green sturgeon were detected by the array, some of which were Southern DPS, though the exact number was not determined (Lindley et al., 2008).

Our Analysis

After deployment of the PowerBuoy array, OPT proposes to deploy two hydrophone receivers. The receivers would be fastened to the array within safe SCUBA range (<50 meters) for 3 years. Receivers would be retrieved as appropriate but not more than two times per year for data recovery and maintenance. The detection of tagged sturgeon would suggest that these fish would on occasion encounter the project. These data, coupled with tag and release dates and detection data from other receiver arrays located along the West Coast, would provide researchers with information that can be used to inform survivorship, migration corridors, travel rates and limited habitat use by green sturgeon.

Based on the results of recent studies conducted on existing cables, we conclude that the effects of EMF on green sturgeon are expected to be minor (i.e., not deter the species from using the area). In addition, OPT's proposed EMF monitoring would allow for the collection of necessary information to evaluate the magnetic B fields generated by the project and to determine whether any electric E fields are of greater magnitude than anticipated. Comparison of the recorded EMF levels to known thresholds for sensitive species (such as green sturgeon) would allow for a determination of potential effects, if any, of EMF emitted by the project. We also note that OPT's proposed monitoring and adaptive management provisions require OPT to review the findings of this phased monitoring with the Aquatic Resources and Water Quality Implementation Committee to determine whether any additional actions are needed protect green sturgeon, if monitoring results indicate that EMF emissions are at levels that are of concern.

Therefore, we conclude that the proposed action is not likely to adversely affect green sturgeon or its designated critical habitat (table 2).

Eulachon

ESA-listed eulachon are likely to occur in the proposed project vicinity, as unidentified “smelts” were captured during trawl sampling at the Umpqua dredge site in 2007 (Marine Taxonomic, 2008); however, information describing their use of the project area is not available. In general, little is known concerning the distribution and habitat usage by eulachon in marine environments. They are reported to be present in the “food rich” “echo scattering layer” of coastal waters and “in near-benthic habitats in open marine waters” of the continental shelf at depths ranging between approximately 70 and 500 feet (NMFS, 2010a). The North Pacific Fishery Management Council has prohibited at-sea directed harvest of eulachon in U.S. West Coast waters, but eulachon are not an actively managed or monitored species; therefore, there is a paucity of data on at-sea distribution of eulachon off the U.S. West Coast.

Our Analysis

Similar to our findings for Pacific salmon, we conclude that a wave energy project of this small size and design is unlikely to provide a significant amount of artificial structure/habitat to support aggregations of eulachon. Further, a project of this size would not be expected to have a significant adverse effect on the species. Unless future data collected during OPT’s fish and invertebrates monitoring indicate that the proposed project area is used by a substantial number of eulachon or that they are adversely affected by project operations, we conclude that the proposed action is not likely to adversely affect eulachon (table 2).

Essential Fish Habitat

The proposed project area contains EFH for a number of fish species. Potential effects on the marine community may include changes in the marine community, changes to predator/prey interactions, EMF, underwater noise/vibration, and direct effects to the benthic community. As described above and in section 3.3.3.2, we anticipate the proposed project would have only minor effects on the local marine community.

Our Analysis

The anchoring system for the project would consist of approximately 16 concrete block anchors approximately 32.8 feet in diameter and 24.6 feet high (10 meters in diameter and 7.5 meters high), representing a total footprint on the seabed of 0.31 acre (13,760 square feet). The footprint of the anchors represents an impact on the 0.31-acre of seabed habitat. The 0.5-mile x 0.5-mile (160 acres, 0.65 square kilometers) project area represents the area within which the 10 PowerBuoy array would be deployed. The actual footprint of the constructed array is expected to be only about 1,000 feet x 1,300 feet or approximately 30 acres. As documented during the Marine Geophysical Survey conducted in September 2007, the seabed in the project area is homogenous, consisting of fine sand. This habitat is very prevalent offshore of Oregon and the small project footprint is not expected to adversely affect EFH.

Steller Sea Lion

In section 3.3.5.2, we discussed potential project effects on non-listed pinnipeds. These effects would be essentially the same for the federally listed Steller sea lion. Steller sea lion use of the PowerBuoys as haul-out sites could be detrimental to project operation because it could interfere with power production and could pose a risk to maintenance workers that would occasionally require access to the PowerBuoys. There is also a concern that federally listed salmon may be attracted to the PowerBuoy array's structure and that pinnipeds, including the Steller sea lion, could be drawn to the area to feed on them.

To address these concerns, OPT proposes to design the buoys to minimize the opportunity for pinnipeds to use them as haul-outs. OPT would also conducted pinniped monitoring in two phases. In the first phase, OPT would evaluate pinniped haul-out activity on the single PowerBuoy to be deployed in Phase I of the project. In the second phase, OPT would evaluate pinniped presence/absence in the project area around the 10-buoy array over a period of several years following project construction. We discuss this monitoring in more detail in section 3.3.5.2.

OPT proposes to seek an Incidental Harassment Authorization and Incidental Take Permit from NMFS and has developed a protocol for reporting marine mammal interactions. OPT would not approach within 100 yards of a buoy that is occupied by a Steller sea lion. If OPT needs to perform emergency maintenance, OPT staff would conduct such activities in compliance with the conditions of its permit, and provide an account of the activity to the appropriate staff at NMFS.

Our Analysis

The Aquatic Species Subgroup did not identify the Steller sea lion as being common in the project area. However, Steller sea lions use a variety of habitats and structures as haul-outs, including aids to navigation, so there is a possibility that they would attempt to use the PowerBuoys. Preventing their use of the PowerBuoys would help to maintain the units in good operating condition and minimize safety risks to OPT personnel. We conclude that regular surveys and opportunistic observations of pinniped use would be sufficient to evaluate whether the UHMWPE coating (or fencing, if installed) is effectively preventing use.

We also conclude that monitoring would be useful in examining Steller sea lion presence and abundance in the project area following deployment of the single and then the multiple-buoy array. Provision of periodic updates and annual reports to the Aquatic Resources and Water Quality Implementation Committee would ensure that information would be available to support adaptive management efforts, e.g., implementation of further monitoring or additional protective measures.

OPT's approach to compliance with the provisions of the MMPA and ESA should be adequate to prevent conflicts with Steller sea lions that could result in harm or harassment. If conflicts cannot be avoided (e.g., emergency maintenance must be conducted, and a Steller sea lion remains within the threshold distance of 100 yards), OPT's protocol ensures that NMFS would be promptly informed and could provide further guidance. Nevertheless, there would be a chance that project construction and operation would result in harassment. For this reason, we conclude the project may affect and is likely to adversely affect the Steller sea lion. The project would not affect critical habitat at the nearest rookeries, which are located more than 60 miles away at Orford Reef and more than 90 miles away at Rogue Reef.

Cetaceans

In section 3.3.5.2, we discussed potential project effects on non-listed cetacean species. The range of potential effects on federally listed cetaceans would be similar. Service vessels and equipment used to install and maintain the PowerBuoys and long-term project operation would produce underwater noise and vibration that would have the potential to adversely affect cetacean behavior. Installation of the PowerBuoy array could create the potential for entanglement or collision with project structures. Cetacean entanglement in derelict fishing gear that could accumulate on the PowerBuoys and mooring system is also a potential effect. Also in section 3.3.5.2, we discussed OPT's proposed approach to evaluating project effects on cetaceans, including Phases II and III of the cetacean monitoring, and inspection of the PowerBuoy array to assess the potential for accumulation of derelict fishing gear.

Humpback Whale

Humpback whales would be potentially affected by noise disturbance, collision, and entanglement, although their occurrence off the Oregon Coast in the vicinity of Reedsport is highly variable from year to year. In most years, they appear to be more common at least 3 miles from the coast, but they have been reported occasionally near the mouth of the Umpqua River, about 6 miles south of the project area. As mentioned in section 3.3.6.1, humpbacks have been observed along the Oregon Coast in every month except February, March, and April with observations being most common during the summer and fall.

Our Analysis

Like other baleen whales, the humpback whale is considered to be a low-frequency specialist. No direct studies of their hearing ability have been conducted, but studies of their calls indicate maximum sensitivity around 120 Hz to 4 kHz, with good sensitivity from 20 Hz to 8 kHz and higher (Erbe, 2002a). The lowest reported behavioral thresholds for humpbacks were 80–90 dB (received level) from pingers at 4 kHz.

During construction, the predominant source of noise would originate from the propellers of vessels used to deploy the PowerBuoys, USP, cables, and mooring system. Based on the analysis presented in section 3.3.5.2, we conclude that construction activity would not cause impulse noise exceeding a sound pressure level of 180 dB, the threshold NMFS currently would consider to cause Level A harassment, and would not be likely to cause temporary or permanent hearing loss in humpback whales.

Noise produced by work vessels would likely exceed 120 dB, the threshold NMFS currently would consider to cause Level B harassment, on a sporadic basis during the construction period, as vessels transit the work area, and as equipment starts up and shuts down. As mentioned above, humpback whales are thought to be most common in the project vicinity during the summer, so their occurrence would overlap with OPT's proposed construction schedule, but we conclude that effects of noise disturbance would be minor and temporary.

Once the PowerBuoys are installed, noise would be produced by vessels used for natural resource monitoring and regular maintenance inspections. The sounds of these activities would be similar to the sounds produced by commercial and recreational vessel traffic under current conditions. Use of equipment for maintenance of underwater structures would likely be louder than the noise produced by vessels underway, but would occur infrequently, and again, effects would be minor and temporary.

Based on PowerBuoy design, the project is expected to produce continuous low-frequency sounds during operation, which would be similar to ambient noise. In section 3.3.5.2, we concluded that the potential for PowerBuoy operation to adversely affect cetaceans as a result of underwater noise or vibration would be very low, but noted that acoustic monitoring of the PowerBuoys, together with shore-based and boat-based whale monitoring, would be useful in confirming noise levels in relation to ambient conditions and in evaluating cetacean response.

Under the Settlement Agreement, the cetacean Phase II acoustic monitoring program requires OPT to measure ambient noise and the sounds produced by the single PowerBuoy to be deployed in Phase I of the project, and review the results with the Aquatic Resources and Water Quality Implementation Committee to determine if additional monitoring is needed. The results of noise monitoring could be compared to the behavioral thresholds referenced above, as a means of determining how humpbacks, if present, might respond to operational sounds. In Phase III of the cetacean monitoring, OPT would evaluate whale movements through the project area, and would review the results with the Committee to determine whether additional shore-based or boat-based monitoring would be necessary to define project effects on humpback whales.

We conclude that this step-wise approach would minimize any potential for project-related noise to adversely affect humpback whales, because it would effectively address uncertainties about site-specific ambient noise conditions, project-related noise, and humpback behavior. Most important, it would provide a mechanism for NMFS, Interior, and Oregon DFW to work with the Aquatic Resources and Water Quality Implementation Committee to identify any further monitoring (e.g., monitoring acoustic production of the full PowerBuoy array, characterizing site-specific ambient noise conditions) or design additional protective measures (e.g., equipment design or operational modifications, insulation, bubble curtains, acoustic deterrent devices) that may be needed, in order to reduce effects to a point where they could be considered minor or discountable.

Little is known about the path that humpbacks may follow as they migrate along the Oregon Coast, but because most observations of this species are farther from the coast than the buoy array would be located, direct interactions with the structures would be unlikely. The 330-foot spacing between the buoys should minimize the potential for collision. High tension on the tethering system and the relatively large diameters of the mooring lines and cables should minimize the potential for entanglement with the PowerBuoy structures.

As discussed in section 3.3.5.2, entanglement in derelict fishing gear that could accumulate on the PowerBuoy array may be more of a concern than entanglement with the tethering system itself; lost crab pot lines would not be under tension, and their small diameters could make them difficult to avoid. Like many other baleen whales, humpbacks may swim with their mouths open, which would increase the potential for entanglement, if humpbacks were to encounter the array. NMFS identifies entanglement as a threat to this species' recovery, noting that humpbacks have been observed entangled in longline gear, crab pots, and other non-fishery related lines. For this reason, increased frequency or intensity of monitoring for derelict fishing gear would help to identify and remove any entangled fishing gear and reduce any potential for whale entanglement. These inspections may be especially important during the early phases of project operation, before information on whether whales avoid the array has been collected. For this reason, we include monthly inspections of the PowerBuoys and mooring systems through the first 12 months of project operation in the staff alternative, which we conclude would be adequate to protect whales from entanglement.

Phase III of the proposed cetacean monitoring involves shore-based observations that would be conducted from December 2012 through June 2013 (personal communication, R. Lurie, Vice President, North American Business Development, OPT, Pennington, NJ, and J. Hastreiter, Fishery Biologist, Commission, Portland, OR, August 16, 2010). Because this period does not overlap the time of year when humpbacks are most likely to be present, the monitoring would be unlikely to provide information about humpback movements in relationship to the PowerBuoy array. However, OPT's proposed supplemental boat-based monitoring would provide information about humpback use of the project area throughout the license period.

We conclude that construction and operation of the Reedsport Project is likely to adversely affect the humpback whale because the PowerBuoy array may produce noise that would cause disturbance, and there is a potential for collision and entanglement. However, the potential for disturbance, collision, or entanglement would be very low because this species is not common in the project area or within 3 miles of the coast. OPT's proposed monitoring would provide information about the noise produced by one PowerBuoy (and possibly by the array, if determined necessary by the Aquatic Resources and Water Quality Implementation Committee); the degree to which lost fishing gear may accumulate on the array; and site-specific humpback occurrence. As mentioned above, this information would enable the Aquatic Resources and Water Quality Implementation Committee to identify any further monitoring or additional protective measures that may be needed (e.g., acoustic deterrent devices), in order to reduce effects to a point where they could be considered discountable (i.e., extremely unlikely to occur).

Southern Resident Killer Whale

As mentioned in section 3.3.6.1, there have been more than 40 confirmed sightings of SRKWs off the outer Pacific Coast in the past 25 years, including 14 sightings since 1999 of whales that were observed in Oregon coastal waters or that would have traversed Oregon coastal waters en-route to California (i.e., were observed in California). Most sightings have occurred between January and May. The OSU Marine Mammal Institute gets from six to ten calls per year about killer whales that are visible from shore, and it is possible that SRKWs would occur in the project area, where they could be exposed to noise disturbance, collision, and entanglement.

Our Analysis

Like other toothed whales, the SRKW is considered a high-frequency specialist. Killer whale hearing is more sensitive than any other toothed whale tested so far, with a range from 1 to at least 120 kHz, and the greatest sensitivity in the range of 18-42 kHz (NMFS, 2008b). NMFS (2008b) indicates that hearing sensitivity declines below 4 kHz.

Using vessel sound modeling, Erbe (2002b) predicted that the sounds of whale watching boats (e.g., Zodiacs and motorboats that produced sounds between 145 dB and

169 dB) would be audible to killer whales at distances of up to 16 kilometers, mask their calls at distances up to 14 kilometers, elicit behavioral responses within 200 meters, and cause temporary hearing impairment after 30–50 minutes of exposure within 450 meters. Erbe found that the ranges fell to 1 kilometer for audibility and masking, 50 meters for behavioral reactions, and 20 meters for temporary hearing loss when boats were moving at slow speeds.

The sound modeling described above focused on whale watching boats, which actively target killer whales. Larger vessels that would be used for project construction are predicted to produce sounds at similar decibel levels, but at lower frequencies, to which killer whales may be less sensitive. We anticipate that vessel noise during construction could cause some disturbance during the construction period, and that killer whales would likely avoid the project area during that time. We conclude that effects of construction-related noise would be minor and temporary.

Based on project design, noise produced by the PowerBuoys during project operation would be low-frequency and would likely be similar to ambient conditions. As discussed above, we conclude that the potential for PowerBuoy operation to adversely affect cetaceans as a result of underwater noise or vibration would be very low, but monitoring would be useful in confirming this finding. The results of Phase II of the cetacean monitoring would provide important information about the sound signature of one PowerBuoy. As mentioned above, the need for measurements of the entire array in order to evaluate interactions between the buoys could be determined through the AMP.

Drowning from entanglement in nets and longlines is considered to be a minor source of mortality for killer whales (NMFS, 2008b). Whales are occasionally observed near fishing gear, but NMFS indicates that entanglements and death are rare except in the Bering Sea. Because SRKWs are not common in the project area and because entanglement has rarely been documented, we conclude that there would be a low potential for collision or entanglement with the PowerBuoy array.

As mentioned above, Phase III of the proposed cetacean monitoring involves shore-based whale monitoring that would be conducted from December, 2011 through June, 2012. This period overlaps the time of year when SRKWs are most likely to be present, so the monitoring could provide information about SRKW occurrence and movements in relation to the PowerBuoy array. In addition, OPT's proposed supplemental boat-based monitoring would provide information about SRKW use of the project area throughout the license period.

We conclude that construction and operation of the Reedsport Project is likely to adversely affect the SRKW, because the PowerBuoy array may produce noise that would cause disturbance. The potential for disturbance would be very low, because this species is not common in the project area. OPT's proposed Phase II monitoring would provide information about the noise produced by the single PowerBuoy to be deployed in Phase I of the project, and additional monitoring could be conducted to measure the noise produced by the 10-buoy array, if the initial monitoring indicates they are needed. If noise exceeds the thresholds considered by NMFS to cause harassment, the Aquatic Resources and Water Quality Implementation Committee could identify any further monitoring or additional protective measures (e.g., equipment design or operational modifications, insulation, bubble curtains, acoustic deterrent devices) that may be needed, in order to reduce effects to a point where they could be considered minor or discountable.

Blue, Fin, Sei, and Sperm Whales

Blue, fin, sei, and sperm whales are rarely seen in Oregon waters, and most sightings have been documented over 3 miles from shore. For this reason, it is unlikely they would interact directly with the PowerBuoy array, but because underwater sound travels great distances, there would be some potential for noise disturbance.

Our Analysis

Blue, fin, sei, or sperm whales traveling through the project area could encounter the PowerBuoy array, but we conclude their occurrence is so rare that the potential for collision would be extremely low, as would the risk of entanglement in fishing gear that may accumulate on the buoy array. Construction activity could cause noise disturbance to whales far outside the project area, but the disturbance would be temporary. Project operation is not expected to produce loud sounds. As discussed in section 3.3.5.2, measurements would be performed to confirm that sounds would not exceed 120 dB outside the footprint of a PowerBuoy. For these reasons, we conclude that the project may affect, but is not likely to adversely affect, the blue, fin, sei, or sperm whale.

It is possible that one or more of these whale species would become more common in the future, in response to changing climate, ocean conditions, and prey abundance. If shore-based monitoring that is intended to target the gray whale during migration or long-term supplemental boat-based monitoring (i.e., Phase III of the cetacean monitoring) indicates that any of these species are present in the project area, the Aquatic Resources and Water Quality Implementation Committee could identify any further monitoring or additional protective measures (e.g., equipment design or operational modifications, insulation, bubble curtains, acoustic deterrent devices) that may be needed.

Leatherback, Loggerhead, Green, and Olive Ridley Sea Turtles

Entanglement in fishing gear is one of the primary threats to populations of leatherback, loggerhead, green, and olive ridley sea turtles. OPT has not proposed any measures specifically for sea turtles, but would conduct regular surface and underwater surveys to determine whether derelict fishing gear is accumulating on the PowerBuoy array. OPT would report the findings of surveys to the Aquatic Resources and Water Quality Implementation Committee to determine whether additional monitoring or protective measures are needed. If necessary, OPT would work with the crabbing industry to evaluate options for minimizing the loss of fishing gear.

The Reedsport Project would be located within proposed designated critical habitat for the leatherback sea turtle. NMFS identified two primary constituent elements (PCEs) that are essential for the conservation of leatherbacks in marine waters of the U.S. West Coast: (1) occurrence of prey species of sufficient condition, distribution, diversity, and abundance to support individual, as well as population growth, reproduction, and development; and (2) migratory pathway conditions to allow for safe and timely passage and access to/from/within high use foraging areas.

Our Analysis

Leatherback, loggerhead, green, and olive ridley sea turtles are known to occur in Oregon waters, but sightings and strandings are very rare. For this reason, we conclude it is unlikely that any of these species would interact directly with the PowerBuoy array. If sea turtles encountered the array, project design features that include high tension on the tethering system and use of relatively large-diameter mooring lines and cables that could not form loops would prevent entanglement in the array itself.

There is a possibility that derelict fishing gear could accumulate on the array, where it would pose a threat of entanglement. OPT's proposals to conduct surface and underwater surveys for derelict fishing gear, promptly remove any gear that is observed, and consult with the Aquatic Resources and Water Quality Implementation Committee regarding further measures would help to address this potential impact, if the intensity and frequency of monitoring is adequate. OPT does not propose any mechanism for reporting sea turtle entanglement to NMFS, but use of the same protocol designed for marine mammal reporting could also be applied in the event of sea turtle interactions with the PowerBuoy array.

Because they are extremely rare and because OPT proposes measures to minimize the possibility of entanglement and consult with NMFS regarding any interactions that may occur, we conclude that the project may affect, but is not likely to adversely affect, the leatherback, loggerhead, green, or olive ridley sea turtle.

NMFS-proposed designation of critical habitat for the leatherback sea turtle identified eight groups of activities that may have the potential to affect the two PCEs (prey condition, distribution, diversity, and abundance; and unimpeded passage to and within foraging areas): pollution from point sources, runoff from agricultural pesticide use, oil spills, power plants, aquaculture, desalination plants, tidal energy or wave energy projects, and liquid natural gas projects.

Waters off the coast of Oregon and California are considered to include some of the most important leatherback foraging areas in the Pacific (NMFS, 1998b). These waters seasonally support large aggregations of jellyfish, including brown sea nettle. The brown sea nettle is one of the turtle's primary prey items and the most abundant jellyfish off the Oregon Coast. Ocean conditions, and temperatures in particular, are thought to be the primary influence on jellyfish distribution, as well as influencing the abundance of zooplankton on which they feed (Suchman and Brodeur, 2005). Construction and operation of the Reedsport Project would not affect water temperatures or zooplankton production, so we conclude that there would be no effect on the prey PCE for the leatherback turtle.

The Reedsport Project could affect the migratory pathway PCE because it would result in a potential entanglement hazard within proposed critical habitat. However, as discussed above, sea turtles are extremely rare in the project area, and we anticipate no adverse effects on the leatherback sea turtle.

Offshore Birds

In section 3.3.5.2, we discussed potential project effects on seabirds and other waterbirds, including attraction to artificial lighting on the PowerBuoy array and collision with the PowerBuoys. We also discussed OPT's proposed offshore avian use monitoring. Below, we evaluate project effects and proposed measures with regard to the marbled murrelet and short-tailed albatross.

Marbled Murrelet

Marbled murrelets nest on land, but spend most of their time resting and foraging in nearshore waters. The primary concern for marbled murrelets is collision with the PowerBuoy array because this species (and other migratory and resident seabirds) are habituated to flying through unobstructed habitats, when away from nesting and roost areas. Project impacts on terrestrial habitat for the marbled murrelet or noise disturbance during construction were not identified as concerns during scoping.

Our Analysis

As described in section 3.3.6.1, marbled murrelet nesting habitat occurs primarily in late-successional and old-growth forest, where trees have developed platforms that can support murrelet nests. Designated critical habitat is located about 6 miles east of the project in the Umpqua River Basin. Murrelets that nest in this area would likely forage in the project vicinity, including the Reedsport Project area. Densities of foraging murrelets are often highest near river mouths and tidal plumes, but foraging locations may change rapidly, especially along sandy coastlines, depending on currents, tides, and prey distribution (Varoujean and Williams, 1995).

The majority of marbled murrelet foraging takes places within approximately 1.25 miles of the coast during the breeding season; however, there are indications that birds may forage near shore during the day and move farther offshore, up to several kilometers, at night. Data on the distribution of murrelets during the non-breeding season is limited, but they may also forage farther from shore during winter.

During informal section 7 consultation for deployment of the single PowerBuoy to be deployed in Phase I of the project, FWS found that the action may affect, but is not likely to adversely affect marbled murrelets (letter from P. Henson, FWS to Colonel S.R. Miles, Corps, dated November 24, 2008). Rationale for the finding was based upon a probable non-adverse effect of displacement during buoy installation and maintenance, an adequate plan to prevent and limit detrimental effects of accidental fluid spills, and the low probability of individuals colliding with a single buoy structure placed within the specific array location.

We conclude that the potential for the project to adversely affect marbled murrelets is low, due to project design and configuration. The spacing of the buoys 330 feet apart should provide room for birds to safely maneuver between them. The 29.5-foot-high PowerBuoys have a relatively low profile (in comparison to offshore wind turbines that may be six times taller), which could minimize the risk that murrelets approaching the project area from terrestrial habitats would collide with them. The PowerBuoys would not be equipped with guy wires or stays, which would also reduce the potential for collision. Although the PowerBuoy array must be lit, the navigational lighting from the PowerBuoys would be much less intense than the lighting on commercial fishing vessels, lights would be shielded, and flash timing would be designed to reduce attraction. This combination of design factors (buoy spacing, low vertical profile of the buoys, absence of guy wires or stays, shielded lighting, appropriate flash timing) should minimize the potential for collision. However, marbled murrelets are known to occur in the project vicinity; may rest and forage within the project area at night; and have been documented to collide with transmission lines and vehicles. For these reasons, monitoring is needed to confirm the conclusion that effects of the Reedsport Project would be discountable (defined in the Endangered Species Act Consultation Handbook [FWS and NMFS, 1998] as “extremely unlikely to occur”). For this reason, we conclude that the project is likely to adversely affect the marbled murrelet.

OPT’s proposed offshore avian use monitoring, discussed in section 3.3.5.2, would provide a valuable step-wise approach to quantifying risks and impacts. OPT would first evaluate bird presence and behavior in the project area, and then conduct modeling to evaluate the potential for bird interactions with the array. OPT would periodically review the modeling results with the Aquatic Resources and Water Quality Implementation Committee. If the collision risk is deemed sufficiently low, future monitoring would not be conducted; otherwise, OPT would initiate a behavioral-avoidance/fatality evaluation in order to assess more precise estimates of risk and impact. The observed avoidance rates would then be applied to the models to derive precise fatality estimates. The Aquatics Resources and Water Quality Implementation Committee may also determine whether additional fatality monitoring should be undertaken to further evaluate rates of collisions/fatalities following deployment or whether additional measures (e.g., modified lighting, installation of markers or diverters) to mitigate or reduce fatality rates need to be evaluated.

Short-tailed Albatross

As discussed in section 3.3.6.1, the short-tailed albatross, which does not nest in the project vicinity, is found primarily in the north Pacific and Bering Sea, 20 to 30 miles offshore. If present in the project area, potential effects would include collision with the PowerBuoys and attraction to navigational lighting that could increase the potential for collision.

Our Analysis

Although the short-tailed albatross is typically associated with open ocean, recent satellite tracking studies have documented occurrences much closer to the coast than were previously known (FWS, 2008); two of five hatch-year short-tailed albatross that were tagged in Alaska traveled along the west coasts of Canada and the United States, indicating that many dispersing individuals may follow the same pattern. During the non-breeding season, they range as far south as northern California, primarily along the continental shelf margins. The distribution of squids may influence the distribution of short-tailed albatross. For this reason, short-tailed albatross may be relatively common nearshore, but only where upwelling hotspots occur in proximity to the coast.

The short-tailed albatross is adapted to flying low over the water surface, and if present in the project area, could encounter the PowerBuoy array. However, its occurrence appears to be rare, and we conclude that the project may affect, but is not likely to adversely affect, this species. As discussed above for the marbled murrelet, results of the offshore avian use monitoring program would provide additional site-specific information about this species occurrence in the project area, and if present, its behavior in relation to the PowerBuoy array. If this species is present, results of the monitoring program would also be valuable in quantifying the potential for collision.

Terrestrial Listed Wildlife Species

Western Snowy Plover

The western snowy plover is expected to use beach and nearshore habitat in the project area. The primary concerns identified during consultation were the potential for the project to alter the beach and nearshore habitat that support this species, and damage to habitat if one or more of the PowerBuoys were to break free and wash ashore. OPT proposes to address these concerns through implementation of wave, current, and sediment transport monitoring and the Emergency Response and Recovery Plan.

The wave, current, and sediment transport monitoring program (see section 3.3.1, *Geologic and Soil Resources*) is designed to investigate the near-field effects of the PowerBuoys. It includes monitoring the bathymetry and shoreline contours that could affect the suitability of plover habitat.

The Emergency Response and Recovery Plan outlines the protocols that OPT would follow to prevent any potential adverse effects on plover habitat that might otherwise occur during recovery of lost equipment. The plan identifies a Response Coordinator who would be responsible for consulting with FWS, Forest Service, and Oregon Parks Department regarding access, habitat maps, and (in the breeding season) nest site maps to determine the access route that would minimize contact with snowy plovers, their habitat, or another ecologically sensitive area.

Our Analysis

Western snowy plovers forage along the water's edge and would not be expected to fly over the PowerBuoy array. For this reason, there would be no potential for collision with the PowerBuoy array.

Construction activities that would occur within beach and nearshore habitat are limited to work needed to pull the subsea transmission cable from the PowerBuoy array into the wastewater pipe. There would be no impacts on surface habitat, however, because the wastewater pipeline is buried underground where it traverses the beaches. Work that would be needed to access the wastewater pipeline at the proposed underground vault would occur in the roadbed of Sparrow Park Road, approximately 500 feet from the beach. Topography and vegetation would provide screening between the work area and the beach, and no disturbance would be expected. Construction would not directly affect designated critical habitat, which is located about 1 mile to the north.

As discussed in section 3.3.1, *Geologic and Soil Resources*, the PowerBuoys are designed to extract and absorb power from passing waves, and could therefore affect shoreline erosion and accretion. Erosion along beaches could affect habitat that could be used by western snowy plovers for nesting. Depending on the size and other characteristics of the array (e.g., porosity), an array of PowerBuoys could cause changes in wave height and direction in its lee, at length scales similar to the spacing between the devices (about 330 feet). These variations could persist shoreward to the outer edge of the surf zone and could affect nearshore currents, potentially resulting in changes to the stability and configuration of the beach (i.e., erosion or accretion). The wave, current, and sediment transport monitoring would investigate project effects in more detail, by focusing on identifying the near-field effects of the PowerBuoys, and monitoring the bathymetry, shoreline contour, and water column properties to capture anomalous nearshore effects. Due to the small scale of the proposed installation and it distance offshore, it is unlikely that nearshore effects would be substantial.

OPT states that the preferred approach to recovering a PowerBuoy, if one breaks free and washes ashore, would be to float it back out into the ocean and bring it ashore at the most desirable location. Implementation of the Emergency Response and Recovery Plan would minimize any potential adverse effects, if land-based recovery were required. The Emergency Response and Recovery Plan would provide a mechanism for consultation with the agencies to identify an access route that would be least likely to damage habitat or, during the breeding season, individual nest sites.

We conclude that the project may affect, but would not likely adversely affect, the western snowy plover, because this species would not be at risk of collision with the PowerBuoy array and would not be disturbed by construction activities. It is possible that long-term project operation could affect beach habitat. If results of the wave, current, and sediment transport monitoring indicates that project operation is altering snowy plover habitat, OPT would address any potential adverse effects through the proposed AMP.

Northern Spotted Owl

The northern spotted owl is strongly associated with late-successional and old-growth forest, although it may use younger stands for foraging and dispersal. Potential impacts on terrestrial habitat would be limited to noise disturbance because no trees would be removed to construct the project.

Our Analysis

The project's transmission line would generally follow Sparrow Park Road, contained within a wastewater pipeline that is buried within the road prism. Forested habitat along the road and near the shore substation at Gardiner is fragmented as a result of timber harvest and road construction, and is characterized by a mix of second-growth Sitka spruce/western hemlock, mixed conifer/deciduous forest, regenerating conifer stands, and alder that has filled in along the edge of the road right-of-way. Installation of the project transmission line would affect only the existing roadway and small areas of shrub and herbaceous vegetation.

OPT would use conventional construction equipment to access the existing wastewater pipeline, pull the transmission line through the pipeline, and construct a small (garage-sized) shore substation. No blasting would be required. Based on threshold guidelines developed by FWS, construction activity can cause disturbance to northern spotted owls if heavy equipment is used within 35 yards of a nest (FWS, 2003). Our review of aerial photographs and observations during the site visit indicate that there is no suitable nesting habitat within 35 yards of the road. Work required to pull transmission line at various access points would be similar to noise produced by periodic maintenance (e.g., brushing, grading). For these reasons, we conclude that project construction would not affect the northern spotted owl.

3.3.6.3 Cumulative Effects

As described in sections 3.3.3.2 and 3.3.3.3, results of OPT's proposed fish and invertebrates, EMF, and green sturgeon monitoring and AMP would facilitate the evaluation and characterization of proposed project effects on ESA-listed salmon and green sturgeon and provide a more thorough understanding of potential future cumulative effects.

Cumulative effects on federally listed marine mammals and offshore birds would be the same as discussed above in section 3.3.4.3. The only federally listed terrestrial wildlife species for which potential cumulative effects were identified is the western snowy plover.

As described in section 3.3.5.2, project construction would not directly affect snowy plover beach habitat, and implementation of OPT's proposed Emergency Response and Recovery Plan would minimize direct effects that could otherwise occur if a PowerBuoy were to break free, wash ashore, and require beach access for retrieval. OPT would consult with the resource management agencies to identify the access route with the lowest potential for adverse impacts on snowy plover habitat, and on nest sites, in particular.

Project operation could indirectly contribute to cumulative effects if the PowerBuoy array alters waves, currents, and sediment transport and interact with similar effects of any reasonably foreseeable actions. Alteration or loss of snowy plover beach habitat would contribute to the adverse impacts that have resulted from commercial and residential shoreline development and associated domestic predators; introduced beach grass used to stabilize shorelines; and recreational activities, such as driftwood collection, beach fires, camping, and driving. If the results of the wave, current, and sediment transport monitoring indicate that the project is adversely affecting snowy plover habitat, OPT would work through the AMP to identify any potential mitigation measures that might be needed. As discussed in section 3.3.1.3, sediment transport would not be cumulatively affected by the proposed Reedsport Project because the project would have only minor effects on sediment transport, and we have not identified any reasonably foreseeable actions, including other wave energy projects, that could affect sediment transport.

3.3.7 Recreation, Ocean Use, and Land Use

3.3.7.1 Affected Environment

Recreation

Coastal Recreation

Natural resources, scenic views, and diverse recreational opportunities make Oregon's shore a nationally known destination for tourists and recreationists. More than 6 million beach visits to the coastal regions occur annually, 70 percent of which are by Oregon residents. The tourism industry plays an important role in the Reedsport-area economy.

In Oregon, the public owns the beach up to the ordinary high tide line, and the public has a perpetual easement to use the dry sand beach up to the statutory vegetation line or the line of established upland shore vegetation, whichever is more inland.

The proposed project area would be located at the approximate mid-point of the Oregon Dunes National Recreation Area, which extends 53 miles from Florence to Coos Bay and is the dominant recreational site in the project vicinity. North of the Umpqua River, the Oregon Dunes National Recreation Area consists of about 23 miles of continuous undeveloped, natural beach with no adjacent settlements and a few small access sites and campgrounds (Oregon PRD, 2005). During a recreation use study conducted June 29 to September 3, 2001,[26] along the southern portion of the Central Coast, which includes the beaches from Newport to Reedsport, 520 people were surveyed about the recreation activities they pursued along the coast's beaches (Shelby and Tokarczyk, 2002). The primary recreational activities that survey participants reported are presented in table 15. People visiting the portion of the coast where the project would be located engage in a variety of activities with walking, enjoying the scenery, and picnicking representing the main activities, and exercising, camping, flying kites, walking dogs, swimming, and building bonfires also being popular activities.

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[26] Sampling included all weekend days, holidays, and all but one day during the week.

Table 15. Top beach recreation activities pursued in the southern portion (Newport to Reedsport) of the Central Coast (n=520) (Source: Shelby and Tokarczyk, 2002).

Activity[a]	**Percent**	**Prime Activity**	**Percent**
Walking	89	Walking	29
Scenic enjoyment	72	Picnicking	21
Picnicking	59	Scenic enjoyment	9
Exercising	35	Camping	6
Camping	34	ATVing	5
Flying kites	34	Flying kites	5
Exercising Dogs	26	Exercising Dogs	4
Other	26	Exercising	4
Swimming	25	Beachcombing	4
Driftwood fires	17	Sandplay	3
Collecting driftwood	11	Swimming	2
Birding	9	Fishing	2
ATVing	8	Driftwood fires	1
Fishing	8	Surfing	1
Beachcombing	7	Boogie boarding	1

Note: ATV – All-terrain vehicle

[a] Survey participants frequently indicated that they engaged in more than one activity.

The 2008–2012 Oregon Statewide Comprehensive Outdoor Recreation Plan (SCORP) (Oregon PRD, 2008) includes a series of studies designed to provide outdoor recreation managers and planners across Oregon with usable knowledge to proactively address key statewide demographic and social changes affecting recreation in Oregon. For Oregonians between the ages of 42 and 80, as well as Oregonians with disabilities, ocean beach activity was the fifth most popular outdoor recreation activity in terms of percent participation.[27] However, when sorted in terms of the average number of days a person was engaged in an activity, ocean beach activity did not show up as a top activity (10 top activities listed).

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[27] The top four activities were walking, picnicking, sightseeing, and visiting historic sites, respectively.

In its evaluations of recreational use, the Oregon PRD divides the Oregon Coast into three distinct regions: the North Coast, the Central Coast, and the South Coast. The Reedsport Project occurs at the southern end of the Central Coast region. The Central Coast experiences fewer visitations than the North Coast and more than the South Coast. The Central Coast draws visitors primarily from the central to south Willamette Valley, as well as a moderate number of Washington State residents and residents of the Central Coast. Main population centers from which this area draws visitors include Eugene/Springfield, Corvallis, and Salem, Oregon (Oregon PRD, 2005).

The Central Coast provides more opportunities to find seclusion than along the North Coast, particularly in the Oregon Dunes National Recreation Area, south of the project area (Oregon PRD, 2005). Public access to Douglas County beaches is provided at 10 locations along the coast (Oregon PRD, 2004).

Oregon PRD operates 14 campgrounds that have easy access to beaches along the state's coast. Most ocean-shore state park campgrounds are at capacity during summer weekends, and many are full during summer weekdays.

Ten Forest Service and Oregon Dunes National Recreation Area campgrounds are located in the Central Coast region (Oregon PRD, 2005) with three coastal state parks located in the greater project area. The Umpqua River Lighthouse State Park is located on the south side of the mouth of the Umpqua River. Oregon PRD estimated day use visitation at Umpqua Lighthouse State Park at 357,902 people and overnight visitation at 29,868 people. Honeyman State Park is located about 17 miles north of Reedsport in Lane County. Tugman State Park is located about 8 miles south of Reedsport (Oregon PRD, 2004).

The Douglas County Parks Department offers recreation vehicle (RV) and tent camping at Windy Cove Campground, located next to Salmon Harbor. Next to Honeyman State Park, Salmon Harbor Marina provides the most campsites in the area. Private businesses also provide recreational opportunities and services in the Reedsport/Winchester Bay area, with at least 11 campgrounds and several all-terrain vehicle (ATV) rental businesses (Oregon PRD, 2004).

Oregon PRD (2005) conducted surveys to gather specific-use information for the beach segments in the project area. Oregon PRD defines this undeveloped area as scattered residential and minor recreation. The Sparrow Park Road (also referred to as Sparrow Creek Road) provides access to the beach in the vicinity of Three Mile Creek for emergency vehicles and people with disabilities (Oregon PRD, 2005).

Recreation use along this segment of beach, based on a 2005 Oregon PRD survey, showed that 18 percent of people observed were relaxing/swimming, 25 percent were walking/running, and 10 percent were driving vehicles. Surfing is not common along this beach; surfing typically occurs near jetties, points, and headlands because these areas create optimal surfing wave conditions (Oregon PRD, 2005). Winchester Bay, located on the south side of the mouth of the Umpqua River, is the premier surf spot in the project vicinity.

The Oregon Coast Trail runs along the beach from Tahkenitch Creek southward to Sparrow Park Road (adjacent to Three Mile Creek). The Oregon Coast Trail continues southward following Sparrow Park Road east to Route 101, crossing the Umpqua River in Reedsport, and then rejoins the coast near Umpqua Light State Park.

Marine Recreation

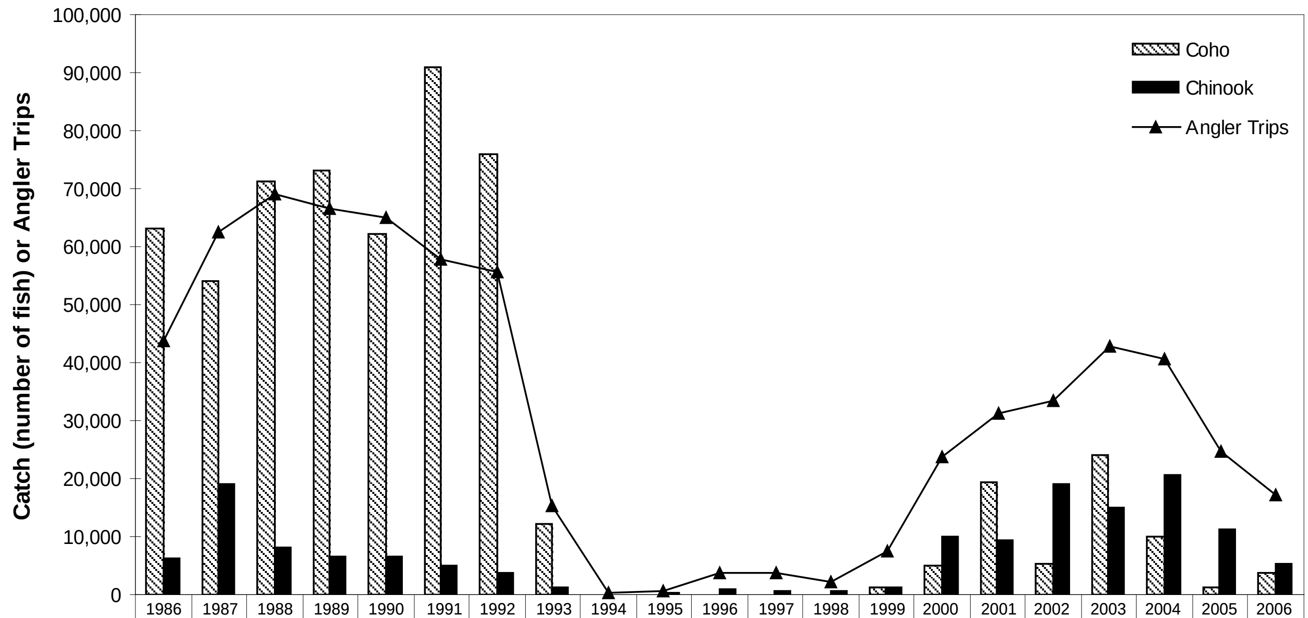
Marine recreational uses of the project area include sport fishing, recreational boating, and whale watching. Winchester Bay and Salmon Harbor, both located at the mouth of the Umpqua River, support a recreational fishing industry that is important to the local economy (EPRI, 2004a). Salmon Harbor has one of the largest and most modern recreational facilities on the Oregon Coast, with 900 moorage slips, 300 RV camping sites, 27 land leases, and two boat launch stations.

The general vicinity of the project area supports a robust local sport fishery, concentrated in the summer months. Although groundfish represent the largest portion of the total catch, the salmon fishery appears to be the most economically important (Davis and Radtke, 2005). In 2003, four registered sport fishing outfitters and four charter vessels operated out of Reedsport, and one outfitter guide and five charter vessels operated out of Winchester Bay.

As shown in figure 9, ocean recreational salmon catch and effort, as measured by angler trips, for the Coos Bay catch area, which includes the project area, have fluctuated due to stock declines and fishery management restrictions.

The nearshore Pacific halibut season occurs from the summer through early fall. For all other ground fish, including rockfish and lingcod, the fishery is generally open year-round but is subject to in-season changes due to harvest limits. There are also seasonal closures for some crab species. Recreational Dungeness crab harvest occurs primarily in nearshore areas and bays.

In the project area, whale watching occurs from the Umpqua Lighthouse north to Sea Lion Caves. The species most often identified by visitors is the gray whale. The Umpqua Lighthouse receives moderately low use (200–800 people per week) compared to other locations such as Depoe Bay, which can receive more than 6,000 people a week. The southern whale migration starts in December and peaks the first week of January. The northern migration starts in late February and continues through June.



	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Coho	63,200	54,100	71,200	73,100	62,200	90,800	76,000	12,200	0	0	0	0	100	1,100	5,100	19,300	5,200	24,100	10,100	1,400	3,600
Chinook	6,100	19,000	8,100	6,700	6,600	5,100	3,800	1,100	0	200	800	700	500	1,400	10,100	9,500	19,100	15,000	20,700	11,200	5,200
Angler Trips	43,600	62,500	69,000	66,600	65,000	57,700	55,600	15,300	400	700	3,900	3,900	2,300	7,600	23,600	31,100	33,300	42,800	40,500	24,600	17,100

Figure 9. Ocean recreational salmon catch and effort for the Coos Bay catch area (1986–2006) (Source: Oregon DFW, 2007, as cited by OPT).

Inland Recreation

The Oregon Dunes National Recreation Area is part of the Siuslaw National Forest, which includes more than 630,000 acres of diverse ecosystems extending from Tillamook to Coos Bay along the Oregon Coast.

In addition to fishing and other types of recreation use along the coast in the project area, there are a variety of additional outdoor recreation opportunities in the greater Reedsport area, including:

- Umpqua Discovery Center—an educational and art exhibits highlighting the heritage of the area;
- DuneFest—a 5-day event that draws thousands of ATV enthusiasts to Winchester Bay;
- Dean Creek Elk Viewing Area—a 1,000-acre reserve of protected timber and pastureland managed by the Bureau of Land Management;
- Tsalila Festival—a celebration of Native American culture in coordination with the Tribes;

- Ocean Festival—an annual event that draws thousands of visitors each year and includes activities such as Coast Guard rescue demonstrations and a seafood BBQ;

- Dune Musher's Mail Run—the world's longest organized, non-competitive, dry-land run for dog teams during which teams with up to 12 dogs cover a distance of 75 miles (from North Bend to Florence) in 2 days crossing roads, trails, beaches, and sand dunes; and

- Riverfront Rhythms Summer Concert Series—a weekly free summer concert series held at the Umpqua Discovery Center.

In the 2003–2007 SCORP, Oregon PRD (2003) assessed statewide and regional information on outdoor recreation activities. The project area is in SCORP Region 4, which encompasses Curry and Coos counties and the coastal portion of Douglas County. In terms of recreational activities that occur in the project area, Oregon PRD (2003) identified the following trends that occurred between 1987 and 2002:

- ATV riding increased by 144.6 percent;

- Beach activities (freshwater and saltwater) increased by 38.5 percent;

- Nature and wildlife observation activities increased by 74.8 percent;

- RV and trailer camping increased by 130.8 percent;

- Car camping with tents decreased by 4.5 percent; and

- Day hiking decreased by 45.4 percent.

Ocean Use

The project vicinity is used by a variety of boats including recreation, charter and commercial fishing, and commercial crabbing vessels. Boat traffic and navigation concerns are more concentrated south of the proposed project area, near the mouth of the Umpqua River. The Port of Umpqua is a shallow-draft port and a navigable channel is maintained from the Umpqua River mouth upstream to Reedsport, which is located at RM 11. Regular dredging maintains shipping channel depths, with dredged material dumped in the ocean outside the river mouth.

The Coast Pilot 7 (NOAA, 2007a, as cited by OPT) recommends that vessels traveling along the Oregon Coast proceed along rhumb lines from Cape Blanco (approximately 65 miles south of the project site) to the Columbia River entrance. This suggested travel path falls approximately 17 miles to the west of proposed boundary for the PowerBuoy array. Vessels of 300 gross tons or larger are encouraged by the West Coast Offshore Vessel Traffic Risk Management Project to voluntarily stay a minimum distance of 25 miles from the shoreline, or well outside the project boundary.

The Coast Guard is responsible for providing the Commission with an evaluation of the potential effects of the proposed project on the safety of navigation and the traditional uses of the waterway and other Coast Guard missions. The Coast Guard must also offer recommendations to provide for navigational safety and minimize potential adverse impacts. The Coast Guard's authority comes from the Ports and Waterways Safety Act (33 U.S.C. 1221 et seq.), which requires the Coast Guard to take into account all possible uses of a waterway to reconcile the need for safe access routes with the needs of all other waterway uses. The Coast Guard is also authorized to approve private aids to navigation, such as those that would be used to mark the PowerBuoy array area. The characteristics of a private aid to navigation must conform to the requirements of the U.S. Aids to Navigation System at 33 CFR 62 Subpart B.

Federal law grants Oregon jurisdiction of the ocean and seabed from the shoreline to 3 nautical miles offshore (1953 Submerged Lands Act, 43 USC 1301–1315). The Oregon Department of Land Conservation and Development (Oregon DLCD) has exclusive jurisdiction over all tidal submerged lands owned by the state that have not been sold or otherwise conveyed out of public ownership (ORS 274.710). Oregon's statewide planning goals and guidelines, State Goal 19 (Ocean Resources), were established to help Oregon conserve marine resources and their ecological functions. The goals establish that Oregon's primary ocean policy objectives are conservation oriented and that the proper long-term management of renewable marine resources be given higher priority than the development of non-renewable ocean resources. The goal also defines important marine habitat and important fishery areas and includes criteria for evaluating whether an action complies with Goal 19. Goal 19 further states that other beneficial uses of ocean resources are protected and encouraged, provided they do not adversely affect important marine habitat and important fishery areas and avoid to the greatest extent possible conflicts with other ocean uses and activities.

Management Plan for the Territorial Sea

The 1991 Oregon Legislature established the Ocean Policy Advisory Council to, among other duties, prepare a plan for managing the resources and activities in the state's territorial sea, an area defined as the ocean and seafloor from mean low water seaward for 3 nautical miles (Oregon DLCD, 2009). The preamble to the Territorial Sea Plan states that the State of Oregon holds the lands, waters, and living resources within its boundaries in trust for the public and acting through local, state, and federal laws, it seeks to ensure that these ocean resources, values, and benefits are conserved for current and future generations. Based on this premise, the State of Oregon established in law a program of ocean-resources planning and management that includes ocean-resource goals and policies and seeks to integrate the ocean-management responsibilities of all levels of government, involve the public and users of ocean resources, and promote the conservation of all ocean resources. Oregon places special emphasis on conserving renewable ocean resources because these are expected to provide greater long-term benefits to the state from food production, recreation, aesthetic enjoyment, navigation, and ecosystem stability than non-renewable marine resources.

The following goals and policies define and assert Oregon's long-term interests in the sustainable use of ocean resources (Oregon DLCD, 2009).

Territorial Sea Plan Goals

The Territorial Sea Plan states that the following goals and policies of the State of Oregon are mandatory for ocean resources planning and management; all actions by local, state, or federal agencies that affect the ocean resources of the state shall be consistent with them. The overall ocean-management goal of the State of Oregon is to conserve the long-term values, benefits, and natural resources of the nearshore ocean and the continental shelf.

To achieve this goal, the State of Oregon will:

1. give higher priority to the protection of renewable marine resources than to the development of non-renewable ocean resources;

2. support development of ocean resources that is environmentally sound and economically beneficial to coastal communities and the state;

3. protect the diversity of marine life, the functions of the marine ecosystem, the diversity of marine and estuarine habitats, and the overall health of the marine environment; and

4. seek the conservation of ocean resources within the larger marine region that is of ecologic and economic interest to the State of Oregon.

Policies

Among several policy statements, the Territorial Sea Plan includes the following: It is the policy of the State of Oregon that all local, state, and federal plans, programs, and activities that affect the resources and uses of the Oregon territorial sea shall:

A. be developed, managed, and conducted to maintain and, where appropriate, restore the long-term benefits derived from Oregon's renewable marine resources;

B. meet the requirements of the Territorial Sea Plan for inventory information and effects-analysis;

C. protect:

- renewable marine resources from adverse effects of development of non-renewable resources;
- the biological diversity of marine life and the functional integrity of the marine-ecosystem;
- important marine habitat, including estuarine habitat;
- areas important to fisheries; and
- beneficial uses of ocean resources, such as navigation, food production, recreation, and aesthetic enjoyment that do not adversely affect the resources to be protected in policy items 1-4, above.

Part Five of the Territorial Sea Plan describes the process for making decisions concerning the development of renewable energy facilities (e.g., wind, wave, current, thermal, etc.) in the state territorial sea, and specifies the areas where that development may be sited.

Land Use

Land ownership in Douglas County, Oregon, includes areas managed by federal and state agencies, local municipalities, and private entities. The dominant land use outside of urban areas is forest management for the production of wood products. Recreational activity is also common on forest lands and is the dominant use of the beach area and forest land immediately adjacent to the Pacific Ocean. The project area includes land owned, or administered by, the State of Oregon, Forest Service, Douglas County, and several private entities.

In Oregon, the public owns the beach up to the ordinary high tide line, and the public has a perpetual easement to use the dry sand beach (even those privately owned) up to the statutory vegetation line or the line of established upland shore vegetation, whichever is more inland. Oregon PRD is responsible for managing and making permitting decisions for activities and improvements on the ocean shore, as specified in Oregon's Beach Laws (ORS 390.605 390.770). Oregon DLCD shares jurisdiction over beaches in managing the beds and banks of state waters and is responsible for managing the seabed within 3 nautical miles of the shoreline (Oregon DLCD, 2001).

Oregon typically defines shoreland boundaries as 50 feet landward from the shoreline. The boundary may be less if there is a road within 50 feet of the shoreline or greater if important resources, such as significant habitats, riparian vegetation, or public access points, are present. Restrictions in shoreland zones include protection of wetlands and riparian vegetation, and maintenance of public access to coastal areas (Oregon DLCD, 2001).

The Siuslaw National Forest encompasses an area along the central Coast Range in Oregon and abuts the Pacific Ocean in Douglas County. It includes the Oregon Dunes National Recreation Area along the shoreline north and south of Reedsport. Land use actions on this federal land are governed by the objectives and guidance provided in the Forest Plan for the Siuslaw National Forest, the Northwest Forest Plan, and the Oregon Dunes National Recreation Area Management Plan.

3.3.7.2 Environmental Effects

During consultation with stakeholders through the Oregon Solutions meetings, concerns about the effects of deploying and operating the project on recreational and commercial fishing, navigation safety, and other recreational resources were raised. We analyze the effects of the proposed project on these target resources and issues below.

Recreation

Beach Access

During construction of the project, OPT anticipates the need to close Sparrow Park Road and other roads accessing the wastewater pipeline for approximately 2 weeks, so the transmission line can be pulled through the pipeline. OPT proposes to schedule the transmission line pull through the wastewater pipeline to minimize effects on beach access.

Our Analysis

Sparrow Park Road provides the only vehicular access point to the beach between the Umpqua River and the Siltcoos River, approximately 14 miles. Although the state holds a legislated easement on the beaches themselves, it has no such easement on adjacent lands for providing access to the beach. Because of the limited access to the beach in this segment, the recreational setting is secluded and habitat values are high (Oregon PRD, 2005). Recreation use concentrates at a moderate level on peak weekends within half a mile of the end of Sparrow Park Road. This is an area that recreationists drive to for camping on the beach, reportedly to enjoy the low key setting and get away from crowds (Oregon PRD, 2005).

OPT's proposal to pull the transmission line through the existing pipeline in order to minimize effects lacks clarity to determine the actual effect on recreation users and implies that the closure may be for a continuous period. A continuous 2-week closure of Sparrow Park Road during the summer season would have a greater effect on recreation users, than an intermittent closure during weekday work hours in the winter season. The effects on recreation users from construction-related road closures could be reduced if road closures were not to occur during the summer recreation season, if the road were closed only during weekday work hours, and if the public were to be notified that the road would be open for beach access during the day at specific periods.

Whale Watching

Stakeholders have concerns that the number of gray whales visible from the Umpqua Lighthouse may be reduced if whales avoid the PowerBuoy array area due to noise generated by the buoys because of increased noise from service vessels during maintenance periods, or if acoustic guidance devices are deployed to deter whales around the project site.

OPT worked with the Aquatic Species Subgroup to design a three-phased study plan to evaluate project effects on cetaceans. As described in section 3.3.4.2, subsection *Effects of Underwater Noise and Vibration on Cetacean Behavior*, OPT proposes to conduct a three-phase study to document the baseline conditions and behavior of gray whales, measure the acoustic conditions generated by the PowerBuoys and service vessels, and monitor the behavior of whales following deployment of the array. Phase I of the study measures baseline conditions and was completed in October 2008. Phase II of the study would occur immediately prior to the deployment of the single PowerBuoy in Phase I of the project, and during the first winter after the single buoy deployment. Phase III of the study would occur after installation of the 10 buoy array. Phase III of the study addresses cetacean behavior in response to the presence of the structures (i.e., whether they detect and avoid the structures) and entanglement in the mooring lines or in derelict fishing gear.

Our Analysis

The Umpqua Lighthouse is one of the 28 whale watching sites organized by the Oregon PRD Whale Watching Center along the Oregon Coast, and it is the closest site to the proposed PowerBuoy array. Attendance for whale watching at the Umpqua Lighthouse site has ranged from 200 to almost 800 people per week (Oregon PRD, 2010, as cited by OPT). From 2005 to 2010, visitors have seen from 0 to 257 whales per week during the spring and winter whale watching week events at the Umpqua Lighthouse (Oregon PRD, 2010).

Because the lighthouse is located more than 6 miles southeast of the proposed PowerBuoy array, it is anticipated that the project would not affect the distance whales are swimming offshore near the lighthouse. If whales are deterred from the project area, it is unclear if they may move further out to sea rather than moving nearshore and therefore be less visible from the lighthouse. However, as discussed in section 3.3.4.2, subsection *Effects of Underwater Noise and Vibration on Cetaceans*, because of the small footprint of the PowerBuoy array (1,000 feet by 1,300 feet), any change in the migration route of whales passing the project is likely to be minor and would not affect viewing opportunities. If the results of OPT's proposed cetacean monitoring, which would be provided in the quarterly and annual reports proposed under the AMP, indicate that effects on migration are substantial, these effects and potential measures to address them would be addressed through the proposed AMP.

Sport Fishing

The designation of a fishing exclusion zone would reduce the area available along the Oregon Coast for recreational sport fishing. OPT does not propose to mitigate for the loss of area for sport fishing.

Our Analysis

Data from the Oregon Recreational Boat Survey and the 2004 ODFW economic study provide data that characterize the regional sport fishery. These studies do not provide information of precisely where, or at what depths, the majority of sport fishing occurs. As discussed above in section 3.3.3.2, *Effects of Alteration of Habitat on the Marine Community Composition and Predator/Prey Interactions*, the proposed project is not likely to affect coho or Chinook salmon. Salmon are highly mobile and therefore would not be affected during installation of the PowerBuoys, associated moorings, and the subsea transmission cable. Members of the Aquatic Species Subgroup have expressed concern that juvenile salmonids may be attracted to the PowerBuoys for food or cover, which may increase the potential effects of predation by pinnipeds or other fish that also are attracted to the project area for the same reasons. As described in section 3.3.3.2, OPT proposes to conduct fish and invertebrates monitoring to address uncertainty regarding the potential effects of the proposed project structures on the fish and invertebrate community.

From discussions with local charter boat operators, it appears that the project area is not typically targeted for sport fishing. Given the small size of the PowerBuoy array footprint (approximately 30 acres), this loss of area would not have a substantial effect on marine sport fishing.

Shark Attraction

As noted above, members of the elasmobranch family (sharks, skates, and rays) can sense the weak EMF that emanate from their prey's muscles and nerves during muscular activities, such as respiration and movement. Surfers and fishermen have expressed concern that the EMF may attract sharks. To address these concerns, OPT proposes to conduct EMF monitoring. The EMF monitoring would be conducted in three phases. Phase I would be conducted prior to deployment of any buoys to measure baseline conditions. Phase II would measure the EMF resulting from the deployment of a single PowerBuoy during Phase I of the project. Phase III would measure the EMF resulting from deployment of the 10 buoy array.

Our Analysis

In our analysis of the potential effects of EMF on aquatic biota in section 3.3.3.2, subsection on *Effects of Electromagnetic Fields on Aquatic Resources*, we concluded that effects of EMF on sharks and other potentially sensitive species would likely be minor and restricted to the immediate vicinity of the project facilities because the magnetic and electric fields resulting from the proposed subsea transmission cable would decrease rapidly with distance from the cable. As a result, it is unlikely that the project would attract sharks from greater distances.

The proposed EMF monitoring would allow for the collection of information needed to evaluate the magnitude of EMF fields generated by the project and confirm that the corresponding E fields are lower than known thresholds for sensitive species. Where threshold levels are not available in the literature for species of concern or other surrogates, the Aquatic Resources and Water Quality Implementation Committee would be convened to determine appropriate steps through adaptive management to understand the effects of the EMF on these species and determine whether additional study or any potential mitigation measures may be warranted.

Electrocution Risk

During pre-filing consultation meetings, stakeholders raised concerns regarding the risk of electrocution to recreational water users. The mechanical and electrical systems of the PowerBuoy are equipped with an electrical fault detection and circuit interruption system that would shunt any leaked electrical current to load resistors within 6 to 20 milliseconds, limiting the duration of any electrical discharge to the saltwater environment. OPT does not propose any additional measures to prevent or reduce the risk of electrocution to recreational water users.

Our Analysis

The potential dangers of an underwater electrical leak associated with operation of wave energy converters was previously evaluated by the Office of Naval Research in an EA of the installation of up to six 40-kW OPT PowerBuoys offshore a Marine Corps base in Kaneohe Bay, Hawaii. As summarized in that EA (Department of the Navy 2003), an electrical fault or short could result from damage to the cable, resulting in a short period, measured in milliseconds, during which the electrical current generated by the

PowerBuoy system would leak to seawater. The PowerBuoy system is, however, equipped with an electrical fault detection and circuit interruption system, which would shunt the leaked electrical current to the load resistors within 6 to 20 milliseconds, limiting the duration of the electrical field to a duration proven to cause only mild transient discomfort to divers at fault currents of up to 5 millivolts.

To prevent electrical faults or shorts from occurring, the PowerBuoy subsea cable would be armored to make it resistant to damage. Protection from electrical leakage has been designed into the transmission system, whereby a computer-controlled fault detection and interruption system would divert the electric current from the cable and store it in load resistors in the event of a fault. Because the PowerBuoy system and subsea transmission cable would be ground-fault protected and designed to prevent the risk of electrocution in the event of the electrical system coming in contact with the seawater, the project would not be an electrical hazard to public users of the project area.

Surfing Opportunities

Stakeholders raised the concern that because PowerBuoys extract and absorb power from passing waves, the project could cause changes in wave height and direction in its lee. This loss of wave energy could reduce surf energy at Winchester Bay, which is the closest recreational surfing location to the project site at approximately 6 miles south of the array installation. OPT proposes to conduct the wave, current, and sediment transport monitoring to evaluate changes to the wave field and water column characteristics due to the placement of the PowerBuoy array.

Our Analysis

As discussed in section 3.3.1.2, subsection on *Waves, Current, and Sediment Transport*, OPT estimates that wave energy would be attenuated by about 12 percent behind the PowerBuoys and by a maximum of about 2.1 percent at the beach. In addition to this evaluation, Surfrider provided an independent analysis at a February 5, 2007, Oregon Solutions Recreation/Public safety meeting that confirmed an attenuation of less than 15 percent, given the current level of wave energy conversion technology and the density and placement of the proposed PowerBuoys. In a letter to OPT dated February 5, 2007, Surfrider stated that it expects the proposed project to cause minimal wave reduction at Winchester Bay.

The proposed wave, current, and sediment transport monitoring would provide an effective means to obtain site-specific data and evaluate, through associated modeling of acquired data, whether there are any unanticipated effects of the project on waves and currents. In the event that substantial effects on waves, currents, and sediment transport are observed, OPT would conduct additional evaluations as needed to identify appropriate measures within an adaptive management framework.

Ocean Use

During development of the license application and Settlement Agreement, OPT consulted with local stakeholders and state and federal agencies concerning the potential effects of deploying and operating the Reedsport Project on commercial crabbing and fishing. Appendix C (Crabbing and Fishing Plan) of the Settlement Agreement describes several measures to minimize or mitigate for the potential effects of the project on commercial crabbing and fishing. The measures listed in appendix C address several issues as described in the following sections.

Crabbing Area

The installation of the PowerBuoy array would result in a reduction to the area available for commercial crabbing. To limit the potential for crabbing vessel collisions with project structures and the potential loss of fishing gear, OPT recommends the designation of the buoy deployment area as a No Fishing Zone by Oregon FWC, and as a Restricted Navigation Area by the Coast Guard. Closure of this area to vessels and fishing would reduce the area available for crab fishing by approximately 30 acres. OPT also proposes to locate the PowerBuoy array in the deepest possible area within the licensed project boundary to minimize the potential for entanglement of fishing gear with the project facilities.

Our Analysis

The fishing and navigation closure associated with the proposed project would cause a direct loss of approximately 30 acres of commercial crabbing area in the proposed project area. Additional area may be lost to commercial crabbing if an additional buffer zone (for safety, or to prevent fishing gear entanglement) is imposed by the Oregon FWC, the Coast Guard, or the fishermen themselves.

Although detailed data are not available describing specific use of the proposed project area by commercial fishermen, stakeholder involvement to date suggests that this area is of primary concern to commercial crabbing. Local fishermen have identified that waters with depths of 150 to 240 feet near the Reedsport coastline are some of the most productive crabbing areas. OPT's proposal to place the PowerBuoys at the deepest area within the area defined within its preliminary permit would minimize conflicts with crabbers. It would place the PowerBuoy array at the far western edge of the project area bordering the 3-mile territorial sea boundary. This location would place the PowerBuoys in water depths ranging from 204 to 225 feet, which is within the deeper part of the depth range identified by commercial crabbers as the most productive crabbing area. OPT concluded that moving the buoys to water depths of 240 feet or greater to avoid the productive crab fishing area was not technically feasible at the current stage of technology.

Although the size of the No Fishing Zone and the Restricted Navigation Area would be relatively small compared to the fishable area for commercial crabbing, there is potential for drifting crab pots to become entangled in project features, thereby resulting in a larger area of effect. However, excluding harvest from the PowerBuoy deployment area may have a localized beneficial effect on the abundance, size, and distribution of Dungeness crab in the project vicinity, which could increase catch rates adjacent to the project. As described in section 3.3.3.2, in the subsection *Effects of Alteration of Habitat on the Marine Community Composition and Predator/Prey Interactions*, OPT would monitor the marine community (including the distribution and abundance of adult Dungeness crab) in the PowerBuoy array before and after project deployment as part of its fish and invertebrates monitoring. This monitoring would help define any effects on Dungeness crab populations and determine whether any additional monitoring or any potential mitigation measures, which could be implemented through the AMP, are warranted.

Vessel Traffic

The construction and maintenance of the project would require a number of vessels transiting to and from the PowerBuoy deployment area from the Port of Umpqua, as well as other ports of commerce. The movement of large vessels, including towed barges and PowerBuoys, has been identified as a potential risk to crab pots. Specifically, crabbers have expressed concern that large strings of pots could be damaged by such vessel movement.

OPT proposes to develop a plan, in consultation with a Crabbing and Fishing Implementation Committee, to identify procedures for initiating a moratorium on project vessel transport during the first 8 weeks of the Dungeness crab season, establishing a predetermined transit lane from the port to the project area for project-related vessels traffic, and providing a 2-week advance notification of PowerBuoy transport associated with scheduled maintenance.

Our Analysis

Table 16 shows that the majority of the commercial crab catch landed at Winchester Bay occurs during the first 8 weeks of the season (beginning December 1). Therefore, a moratorium on project vessel transport during this period, as proposed by OPT, would minimize the potential for conflicting vessel traffic between commercial crabbing boats and project vessels and avoid damage to fishing gear by project vessels during the peak of the crabbing season.

Table 16. Commercial Dungeness crab (ocean) landings at Winchester Bay, Oregon (Source: Oregon DFW, 2010b).

Year	**Percent of Yearly Catch Landed in the First Eight Weeks Of The Season**
2004	67 %
2005	48 %
2006	4 %
2007	58 %
2008	70 %
2009	73 %

The establishment and use of predetermined transit lanes by project vessels between the port and the project area and the provision of a 2-week advance notification of PowerBuoy transport associated with scheduled maintenance would help reduce the potential for project vessels to damage fishing gear (pots, lines, and buoys). Fishermen would also be able to assess the potential for gear loss associated with placing pots in the vicinity of the transit lanes and retrieve or reposition gear prior to planned maintenance operations.

Fishing Gear Entanglement

During storms, the effect of the wind and waves may cause crab pots to move, and they may drift into the project area and become entangled in the moorings lines or the PowerBuoy. Members of the Crabbing and Fishing Subgroup have stated that pots have been known to move several miles during a storm, and in many cases, they are never found. Members of the Crabbing and Fishing Subgroup have expressed particular concern about lost productivity from lost pots and have an interest in developing procedures for timely recovery of pot tags and fishing gear. Recently implemented pot limits inhibit a crabber's ability to replace a lost pot, as the current process to replace a lost pot tag is 45 days, a significant portion of the crabbing season (Crabbing and Fishing Subgroup, 2007, as cited by OPT).

At the November 12, 2007, Crabbing and Fishing Subgroup meeting, it was recommended that OPT mark the perimeter subsurface floats with surface buoys. OPT does not want to introduce any small-diameter line, which may serve to entangle passing marine life. OPT proposes to develop a plan in consultation with the Crabbing and Fishing Implementation Committee to identify ways to minimize the potential for loss of fishing gear and develop a protocol to recover or provide mitigation for gear that becomes entangled in project mooring lines.

Our Analysis

It is uncertain how many crab pots may potentially become entangled in the project features annually. Some crabbers have stated that they would deploy pots next to the PowerBuoy array, anticipating drawing crabs out of the protected area. While other crabbers have expressed a concern about not being able to deploy pots near the array for potential for pot drift and entanglement with project features. The Crabbing and Fishing Subgroup estimates that as many as 300 pots may be lost each year in the buoy array. This estimate is consistent with a report by Oregon Sea Grant indicating that up to 10 percent of the commercial crab pots that leave Oregon ports are never recovered (Oregon Sea Grant, 2009).

OPT proposes to work with the Crabbing and Fishing Implementation Committee to identify ways to minimize the potential for losing fishing gear in the PowerBuoy array and improve recovery or mitigation for gear that becomes entangled in the project array. Any measures that can be developed to reduce fishing gear entanglement would benefit crabbers by reducing lost gear and fishing time, would benefit OPT by reducing gear mitigation and maintenance requirements, and would also reduce risks to marine mammals associated with potential entanglement in lost fishing gear. Potential measures that might be developed include: (1) establishing an appropriate distance to place fishing gear away from the array according to expected sea conditions during different portions of the crabbing season; (2) establishing a protocol for moving fishing gear away from the array when storms are expected; (3) modifying gear that is fished near the array to minimize drift; and (4) monitoring the array for entanglement immediately following large storms during the peak of crabbing season. We consider the cooperative approach proposed by OPT to be an appropriate approach to minimize any damages for lost fishing gear.

Navigation

The Coast Guard is responsible for providing the Commission with an evaluation of the potential effects of the proposed project on navigational safety and making recommendations to minimize potential adverse effects. The Coast Guard's authority comes from the Ports and Waterways Safety Act (33 USC 1221 et seq.), which requires the Coast Guard to take into account all possible uses of a waterway to reconcile the need for safe access routes with the needs of all other waterway uses (Coast Guard, 2007). The Coast Guard is also authorized to approve private aids to navigation, such as those that will be used to mark the PowerBuoy array area. The characteristics of a private aid to navigation must conform to the requirements of the U.S. Aids to Navigation System at 33 CFR 62 Subpart B.

Commercial and recreational boats have previously used the area that the PowerBuoy array would occupy. Construction of the project may restrict or impede these uses and has the potential to adversely affect public safety if vessel operators are not aware of the project's location. OPT proposes to develop a plan that would include several measures to identify the location and extent of the PowerBuoy array; including identifying the project area on navigation charts, illuminating the buoys, and implementing a marine use/public information plan to inform the community about the project, its location, and hazards. To protect public safety and project facilities, the plan would also include designating the PowerBuoy array as a No Fishing Zone and a Restricted Navigation Area.

Our Analysis

Commercial and recreational boaters and other public safety personnel need to know the location and extent of the project facilities, and the hazards associated with navigation adjacent to, or within, the project area. The measures OPT proposes would make this information available to a large percentage of the potential boaters that would normally use the area. To provide for navigational safety, the 10-PowerBuoy array area would be designated as a restricted navigation area by the Coast Guard. Project location information would also be provided to the National Oceanic and Atmospheric Administration's (NOAA's) Office of Coast Survey, which publishes the Local Notice to Mariners on a weekly basis, identifying critical updates to charts. This information would then be updated immediately on NOAA's master electronic version of the chart (NOAA, 2010).

Coast Guard regulations require that the project have adequate lighting as aids for navigation to minimize the potential of collisions. OPT has consulted with the Coast Guard and has incorporated Coast Guard input on the selection of specific aids for navigation. OPT would light the eight perimeter PowerBuoys in the array, and the inside two PowerBuoys would also have a flashing light of less intensity, as requested by the Coast Guard. The final lighting flash pattern would be developed in consultation with stakeholders and the light manufacturer. The final flash pattern would aid in depth perception, visibility in a variety of sea states, and the ability to distinguish individual PowerBuoys at the periphery and within the interior of the array. OPT would file its Private Aids to Navigation application with the Coast Guard to adhere to this requirement.

The placement of the subsurface floats and other anchoring components a minimum of 30 to 50 feet below the surface should minimize the potential for collision between surface vessels and subsurface components, if a vessel were to accidentally stray into the project area.

NOAA's recommended vessel travel path falls approximately 17 miles west of proposed project boundary, and vessels of 300 gross tons or larger are encouraged to voluntarily stay a minimum distance of 25 miles from the shoreline. As a result, we conclude that the project would have no effect on navigation of larger ocean-going vessels. Although there is potential that smaller vessels, such as commercial and recreational fishing boats, could collide with a buoy, this potential would be minimized by the measures identified above.

Emergency Response and Recovery

Although the PowerBuoy array is designed to withstand all ocean conditions that are expected to occur in the project area, there is a possibility of an unforeseen event that could compromise the mooring system of one or more buoys. OPT developed an Emergency Response and Recovery Plan that establishes specific procedures for the notification of agencies that have jurisdiction over the resources that may be affected by an unexpected event. This plan also establishes response actions for emergency situations or system failure.

Our Analysis

OPT's Emergency Response and Recovery Plan provides notification procedures and preparedness actions for six types of situations:

1. The PowerBuoy has moved outside of pre-set boundaries or the PowerBuoy has sunk.

2. An electrical fault has occurred either offshore or onshore.

3. Oil has leaked from the PowerBuoy.

4. A navigation light is not working.

5. An electrical cable has been damaged or exposed on shore.

6. A vessel has collided with one or more PowerBuoy components.

The plan addresses all the major types of emergency conditions that might occur during normal operation and maintenance activities and identifies lines of communication with regulatory agency personnel. Implementation of procedures described in the Emergency Response and Recovery Plan should minimize the potential effects on other resources, if one of the situations described in this plan were to occur.

Site Security and Protection

The PowerBuoy array would be an unattended collection of power generating and anchoring structures located approximately 2.5 miles offshore. Due to the nature of the open ocean, access to the project area and facilities would not be restricted by a physical barrier, and no personnel would be present at the site full time to monitor activity near the project structures. Personnel would be present at the site to conduct planned preventative maintenance and site inspection activities on a monthly basis.

OPT proposes the establishment of a Restricted Navigation Area by the Coast Guard and a No Fishing Zone by the Oregon FWC around the PowerBuoy deployment area. The boundaries of these administrative designations would be included on updated marine navigation charts, and the public would be informed through the marine use/public information plan. OPT also proposes to monitor the project facilities remotely with on-board sensors and communication systems. These sensors would monitor the electrical and mechanical components of the buoys allowing OPT staff to identify any failures to system components and respond accordingly. GPS sensors on each buoy would allow OPT staff to identify potential problems with the anchoring system.

Our Analysis

The establishment of a Restricted Navigation Area and a No Fishing Zone around the site by the Coast Guard and Oregon FWC would serve to discourage entry into the project area. However, these administrative restrictions would have no effect on someone with the intent of damaging the structures, or the risk that a vessel that has lost power might collide with the PowerBuoys.

The remote monitoring of electrical and mechanical system components, and GPS location information should allow OPT's staff to quickly identify if there are site security issues that need to be addressed. The procedures identified in OPT's Emergency Response and Recovery Plan would be implemented to respond to security risks to project facilities. Such procedures include re-securing a buoy, stopping any fluid leak, repairing navigation lights and equipment sensors, and notifying state and federal agency representatives of the condition of the system. Incorporation of equipment that could detect the entry of a vessel into the array, if feasible, would enhance project security and would allow OPT to alert the Coast Guard if a vessel in distress were to enter the PowerBuoy array.

Decommissioning Plan

Oregon DFW, FWS, and NMFS recommend that OPT prepare a decommissioning plan in the event that the project is decommissioned for any reason. The decommissioning plan would be developed at the time in which license surrender and project retirement is proposed. The plan would include the following elements:

- A proposed decommissioning schedule;
- A description of removal and containment methods;
- Description of site clearance activities;

- Plans for transporting and recycling, reusing, or disposing of the removed facilities;
- A description of those resources or conditions;
- Activities that could be affected by or could affect the proposed decommissioning activities;
- Results of any recent biological surveys conducted in the vicinity of the structure and recent observations of marine mammals at the structure site;
- Any potential mitigation measures to protect archaeological and sensitive biological features during removal activities;
- A statement as to the methods that would be used to survey the area after removal to determine any effects on marine life; and
- Identification of how the licensee would restore the site to the natural condition that existed prior to the development of the site, to the extent practicable.

Forest Service condition 2 prescribes that OPT prepare a Forest Service-approved restoration plan at least 1 year prior to filing an application for license surrender. The plan would identify improvements to be removed, restoration measures, and time frames for implementation.

Our Analysis

A plan for decommissioning the project is not proposed by OPT, or identified in the Settlement Agreement. Commission licenses for unconstructed minor projects affecting navigable waters and lands of the United States include L-Form 19 with standard article 25 addressing site restoration as part of the surrender of a license with the intent to decommission the project. This article includes the requirement that the licensee remove any or all structures, equipment and power lines within the project boundary and to take any such other action necessary to restore the project waters, lands, and facilities remaining within the project boundary to a condition satisfactory to the United States agency having jurisdiction over its lands, or the Commission's authorized representative. The elements of a decommissioning plan recommended by FWS, NMFS, and Oregon DFW and the restoration plan prescribed by the Forest Service would be addressed in the decommissioning plan, if the licensee proposes to surrender the license and retire the project.

Consistency with Oregon Territorial Sea Plan

In March 2008, the Commission entered into an MOU with the State of Oregon, the purpose of which is to coordinate the procedures and schedules for review of wave energy projects in the Territorial Sea of Oregon and ensure that there is a coordinated review of proposed wave energy projects that is responsive to environmental, economic, and cultural concerns while providing a timely, stable, and predictable means for developers of such projects to seek necessary approvals. The MOU acknowledges the intent of Oregon to prepare a comprehensive plan (Oregon Plan) for the siting of wave energy projects, noting that if Oregon develops and files with the Commission a comprehensive plan for siting wave energy projects in the Territorial Sea of Oregon under section 10(a)(2)(A)(ii) of the FPA and 18 CFR 2.19, the Commission would, in issuing any preliminary permit, pilot project license, or other license for a wave energy project in Oregon's Territorial Sea, consider the extent to which the proposed project is consistent with the Oregon Plan.

Commission staff has determined that the Oregon Plan does not meet the criteria of a comprehensive plan set forth under section 10(a)(2)(A) of the FPA because it is not a comprehensive study of one or more of the beneficial uses of a waterway or waterways (letter from A. Miles, Director, Division of Hydropower Licensing, Commission, to K. Homolka, Oregon DFW, Salem, OR, issued November 23, 2010) However, the Oregon Plan is designated a resource plan under section 10(a)(1) of the FPA and is considered as part of our public interest analysis under section 10(a)(1) for the Reedsport Project.

In scoping comments, a representative of the SOORC noted that project consistency with the Oregon Plan should be considered in this EA.

Our Analysis

The proposed project is consistent with the Oregon Plan because it achieves the overall ocean-management goals and policies of the State of Oregon to conserve the long-term values, benefits, and natural resources of the nearshore ocean, while demonstrating responsible, phased development of commercial wave energy facilities. Protection of marine resources would be provided by the proposed project's limited scope (10 PowerBuoys) and by its strategic siting, design, deployment, and operation. The results of OPT's proposed monitoring plans for this small project would provide useful information for making decisions concerning the development of renewable energy facilities with respect to any project expansion or new proposed projects in the future.

Land Use

Ownership, or Rights to Use the Area Occupied by the Project.

The Reedsport Project would occupy an area of the territorial sea within 3 nautical miles of the Oregon coastline, and a narrow corridor of land for approximately 2 miles inland to the point of interconnection with the electrical grid. FERC regulations require that a project licensee acquire fee title or the right to use the area occupied by the project. OPT is working with the Oregon DLCD to obtain authorization to use the area that would be occupied by the PowerBuoy array. OPT is also negotiating with International Paper for the rights to use the wastewater pipeline as a conduit for the transmission line.

Our Analysis

The use of the ocean and seabed within 3 nautical miles of the coastline is under the jurisdiction of the State of Oregon, and is managed by the Oregon DLCD. The state has the authority to enter into a lease agreement for the use of the area occupied by the project. OPT indicates that the state is working cooperatively with OPT in permitting the project and it anticipates that a lease agreement for the site would be reached.

The transmission line for the project would be routed within an existing wastewater pipeline owned by International Paper. The wastewater pipeline crosses land owned by private entities, and county, state, and federal agencies, and International Paper has an easement, or use permit, for the segments of the wastewater pipeline that cross land owned by other entities. OPT anticipates reaching an agreement with International Paper prior to construction of the transmission line for the use of the wastewater pipeline.

The Commission includes as a standard license article that the project owner acquire the rights to use the area occupied by the project, either by fee title, easement, or use permit, and that these rights shall not be voluntarily relinquished during the life of the project without approval of the Commission. This standard article would address the ownership or control of all portions of the project area, including the seaward portion.

Project-Related Emergency Activities on National Forest System Lands

The PowerBuoy array would be located approximately 2.5 miles seaward from the Oregon Dunes National Recreation Area administered by the Forest Service. In the event that there is a mechanical or electrical failure of the buoy systems, or it breaks free of its anchorage and mooring system, there is a possibility that the effects of these failures could impact the resources of the National Forest System lands. Impacts could include the grounding of a buoy on recreation use areas, sensitive wildlife habitat, or the dispersal of oils along the shoreline. OPT prepared an Emergency Response and Recovery Plan, and an SPCC Plan to address the categories of issues that require emergency response.

Our Analysis

OPT's Emergency Response and Recovery Plan provides notification procedures and preparedness actions for six types of situations, as noted above in *Emergency Response and Recovery*.

The plan addresses all the major types of emergency conditions that might occur during normal operation and maintenance activities, and identifies lines of communication with regulatory agency personnel. Implementation of procedures described in the Emergency Response and Recovery Plan should minimize the potential effects on other resources if one of the situations described in this plan were to occur.

OPT's SPCC Plan provides facility specific information relating to oil-filled equipment, containment, and transfer operations. The plan outlines procedures for spill prevention, control, and containment activities. The establishment of an SPCC Plan and the training to staff to properly implement the plan would minimize the risk to other resources if one of situations described in this plan were to occur.

3.3.7.3 Cumulative Effects

Construction and operation of the Reedsport Project would restrict or eliminate access to the PowerBuoy deployment area by commercial and recreational crabbers and fishermen and boat traffic, if the area is designated as a No Fishing Zone and as a Restricted Navigation Area, as recommended by OPT. The 30-acre footprint of the deployment area is small compared to the area available to commercial and recreational crabbers and fishermen; however, this loss of accessible area could contribute to a cumulative loss of access associated with future marine reserves, aquaculture, and wave energy projects.

Because the transmission cable would pass under the surf zone, dunes and terrestrial areas through an existing wastewater pipeline, the project would not contribute to cumulative effects on shore or land-based recreation.

3.3.8 Aesthetic Resources

3.3.8.1 Affected Environment

Project Setting

The Oregon Coast is a visual jewel to residents of the Pacific Northwest, with stunning rock formations, sandy beaches, and dense temperate forests. The coastal reach off which the OPT PowerBuoy array would be installed is unique in this setting—the Oregon Dunes National Recreation Area is the largest expanse of coastal sand dunes in North America. Dunes tower 500 feet in some areas, with lakes and wetlands in other low elevation areas. Approximately half of the 31,500-acres Oregon Dunes National Recreation Area is accessible to motorized vehicles, where off-road vehicle use is very popular. The remainder is considered primitive, with parking areas typically set back more than a mile from the beach, preserving the natural character of the dunes. The Oregon Coast Trail, spanning the length of the state's coastline, is routed along the beach in the vicinity of the proposed project from Tahkenitch Creek to Sparrow Park Road/County Road 247, from where the Coast Trail joins Highway 101. About 6.5 miles south of the proposed PowerBuoy array is Umpqua Lighthouse State Park, a very popular campground and day-use area at one of the few remaining operating lighthouses on the Oregon Coast. The primary project setting is, however, open ocean.

Visual Resource Management

The Oregon Beach Laws (ORS 390.605–390.770) designate the coastal shoreline for public recreational use and resource management. Coastal shorelands are designated state recreation areas (ORS 390.615); their use must be approved by the Oregon Parks and Recreation Department to ensure preservation of scenic and recreation values (ORS 390.715). Overlaying this state jurisdiction is the Forest Service-managed Oregon Dunes National Recreation Area, 23 miles of undeveloped beach that are part of the Suislaw National Forest.

Visual Quality Objectives identified in the Management Plan for the Oregon Dunes National Recreation Area (Forest Service, 1994) describe the desired condition of the landscape and how much modification is permitted. By comparing the effects from a project to the established visual objective for the area, the visual acceptability and need for any potential mitigation measures can be determined. In its approved Management Plan, the Forest Service designates the portion of the project area adjacent to Sparrow Park Road within the Dunes National Recreation Area as Retention for visual quality.

3.3.8.2 Environmental Effects

OPT's PowerBuoys would be anchored in open ocean about 2.5 miles off the Oregon Dunes National Recreation Area and 6.5 miles from the Umpqua Lighthouse State Park, the two most popular recreation use areas in the project vicinity. The PowerBuoys would extend 29.5 feet above the water surface. Each would be equipped with Coast Guard-approved LED marine lights that would be deployed at night in a required flashing pattern for 3-nautical mile visibility. The subsea cable and its transition to an underground transmission line at the proposed underground vault would introduce no new visual elements. From the underground vault, OPT proposes to install the approximately 3-mile-long terrestrial segment of transmission line in an existing pipeline within the right-of-way of a county road, interconnecting to an existing transmission line at a newly constructed shore substation about 2.5 miles from the shoreline.

Conduct Visual Assessment Review

OPT proposes to conduct a visual assessment review after it installs the single PowerBuoy to be deployed in Phase I of the project, in advance of installing the rest of the proposed 10 buoy array. This assessment would enable the project's Recreation and Public Safety Implementation Committee to determine if OPT has accurately identified project effects on visual resources.

Our Analysis

The potential visual effect of the above-water component of the PowerBuoys would be a function of the viewer's location and orientation at sea level. As the majority of potential viewers would be onshore, OPT assessed to what extent the deployed PowerBuoys would be visible from shore at four key viewing locations:

- The nearest point of land, which is on the beach in the Oregon Dunes National Recreation Area and is where the power conduit would come ashore 2.5 miles from the PowerBuoy array;

- The top of sand dunes behind the beach observation location (locations included an approximately 70-foot dune about 0.25 mile from shore and an approximately 150-foot-high dune about 0.5 mile from shore) (personal communication, R. Hartmann, Oregon Shores, with OPT, August 29, 2008); and

- The Umpqua Lighthouse State Park, a prominent elevated viewpoint at elevation of 100 feet and 6.5 miles southeast PowerBuoy array site.

OPT calculated the visible distance to the horizon from these four locations. Using a Distance to the Horizon table (Bowditch 1995, as cited by OPT), a person with a 5-foot (1.5 meter) eye height on the beach would see the horizon as 3.0 statute miles (4.5 kilometers) away. A person atop the cliffs near Umpqua River Lighthouse State Park with an eye height of 105 feet (32 meters) can see approximately 13 statute miles (21 kilometers). Therefore, the entire 29.5-foot PowerBuoy (maximum height above water surface) would theoretically be visible from all the selected locations.

Having established that the PowerBuoy array would be within the horizon viewshed, OPT calculated its potential visibility. As a simple assessment, using a measurement at arm's length for scale, the apparent size of the PowerBuoys would be shown in table 17 from the selected key viewing sites:

Table 17. Distance of PowerBuoys from key viewpoints and their apparent size to viewers (Source: OPT, 2010).

View Point	Approximate Distance from PowerBuoy Array (statute miles)	Size of PowerBuoy as Measured at Arm's Length (for scale)
Beach within Oregon Dunes National Recreation Area	2.5 miles	1.6 mm
Top of 70-foot dune beyond the beach site	2.75 miles	1.5 mm
Top of 150-foot dune beyond the beach site	3.0 miles	1.4 mm
Top of cliffs at Umpqua Lighthouse State Park	6.5 miles	0.6 mm

A PowerBuoy would appear to be between 0.6 and 1.6 mm high, at arm's length, depending on where one is viewing the array. The open steel truss superstructure of the above-water portion of the PowerBuoy would result in the array being even less visible from these key viewpoints.

Under clear sky conditions during daylight, the project would add a minor and obscured built element to daytime views of the seascape. Considering (1) the distance of the PowerBuoys from shore, (2) the resulting small size of the PowerBuoys as viewed from shore, and (3) the potential for fog and haze present along the Oregon Coast much of the year, it is anticipated that the installation would be visually unobtrusive.

At night, the PowerBuoys would be lit for navigational safety. These lights would appear as pinpoints on the horizon, creating a minor visual change to relatively unbroken nighttime ocean views off the Oregon Coast. Greatest nighttime visibility would occur from undeveloped or lightly developed areas, such as the Oregon Dunes National Recreation Area. From developed areas, ambient light would diminish the contrast of the navigation lighting against the night sky.

OPT proposes to conduct a visual analysis review with representatives of the project's Recreation and Public Safety Implementation Committee following installation of the single PowerBuoy in Phase I of the project. Both daytime and nighttime assessments are proposed. The conclusions and recommendations of this group to minimize adverse visual effects would be considered for the nine-unit array as a component of the AMP agreed to by the project Settlement Agreement parties. Any changes in visual conditions would be considered at the annual Recreation and Public

Safety Implementation Committee meeting and recommended modifications would be evaluated by OPT and the Commission.

The underground vault and initial 3,300 feet of the subsurface transmission line are proposed in a forested area with a designated Visual Quality Objective of Retention of the Oregon Dunes National Recreation Area. The Forest Service management objectives for scenic Retention areas are that activities may create a slightly altered appearance and changes may include roads and parking areas (Forest Service, 1994). By installing the terrestrial segment of transmission line within an existing pipeline under Sparrow Park Road, visual effects on the Oregon Dunes National Recreation Area would effectively be minimized. The remainder of the 3-mile-long transmission line up to the shore substation site would be installed within the same existing buried pipeline in the County road right-of-way, passing through actively managed, private timber lands. The proposed 20,000-square-foot shore substation, where the transmission line would transition above ground, would be located in a cleared area adjacent to an unused industrial wastewater pond. The project transmission line would interconnect with an existing line adjacent to the shore substation in an expansive, former mill site now cleared of most structures. A new structure in such a setting would be visually apparent but not detrimental.

Based on OPT's analysis, staff concludes that the project is unlikely to have a negative effect on the aesthetic values from the identified key viewpoints. OPT's proposal to conduct the visual assessment review with the participation of the project's Recreation and Public Safety Implementation Committee viewing the single PowerBuoy to be deployed in Phase I of the project from the beach, the top of two dunes near the beach, and Umpqua Lighthouse, within the framework of the proposed AMP would allow stakeholders to confirm the validity of this conclusion.

During Phase II of the project, when the additional 9 PowerBuoys and their mooring systems would be installed, most of the construction activity would take place more than 2 miles offshore. As a result, the work vessels that would be present during construction are not likely to be visually obtrusive when viewed from shore.

3.3.9 Socioeconomic Resources

3.3.9.1 Affected Environment

The Commission generally evaluates socioeconomic effects only for major new construction projects or the retirement of a project (FERC, 2001). This project includes new construction, and it would have a direct socioeconomic effect on Douglas County and, more specifically, the Reedsport/Gardiner area.

The project would be located in a sparsely populated area on the coast of Douglas County, which covers approximately 5,134 square miles within west-central Oregon.

The terrestrial portion of the project would be in the unincorporated town of Gardiner. The nearest incorporated municipality is the city of Reedsport, which is located on the southwest bank of the Umpqua River, 10 miles upstream of the river mouth. The town is a station on the railroad and the principal town in the area. The unincorporated community of Winchester Bay is located 4 miles south of Reedsport. Coastal portions of the project area are adjacent to the Oregon Dunes National Recreation Area.

Demographics

Information about recent population trends, median household income, per capita income, geographic area, housing units, poverty levels, and unemployment rates for Douglas County and the city of Reedsport is presented in table 18. The total population for Douglas County in 2000 was 100,399, and the population for the city of Reedsport was 4,378. The town of Winchester Bay had 488 people and Gardiner had 283 people in the same year. While the population for Douglas County increased 6.1 percent over the prior decade, the city of Reedsport saw an 8.7 percent decrease in population over the same period (U.S. Census Bureau, 2007, as cited by OPT).

Table 18. Project area demographic information (U.S. Census Bureau, 2007, as cited by OPT).

Item	Douglas County	Reedsport
1990 total population	94,649	4,796
2000 total population	100,399	4,378
Percent change in population 1990–2000	6.1%	–8.7%
Land area (square miles)	5,038	2.1
Population density per square mile		
Median household income, 2000	$33,223	$26,054
Per capita income—1999	$16,581	$16,093
Poverty status, percent of population, 2000	13.1%	16.0%
Annual average unemployment rate	4.3%	4.6%

Reedsport's per capita income in 1999 was $16,093, compared to $16,581 in Douglas County, $20,940 in the state of Oregon, and $21,587 for the country as a whole. The median household income for Reedsport in the same year was $26,054, compared to $33,223 for Douglas County, $40,916 for the state of Oregon, and $41,994 for the country (U.S. Census Bureau, 2007, as cited by OPT). More recent Census data indicate that median household income in 2006–2008 equaled $40,212 in Douglas County,

$49,863 in Oregon, and $52,175 in the U.S. (U.S. Census Bureau, 2010a, 2010b). Comparable data are not available for Reedsport.

Overall Economy

Per capita income on the coast has lagged behind the state as a whole. The gap's trend has been decreasing in recent years, but personal net earnings have been lower than the rest of the state. The coast also tends to have higher unemployment than Oregon overall. There has been movement away from extractive natural resource industries and other manufacturing, while tourism, retail trade, and service industries are increasing (Oregon DFW, 2006).

Oregon's commercial nearshore fishery contributes to local economies. There are generally 1 to 10 buyers, processors, and distributors of nearshore species in any given port. Many nearshore fish buyers purchase small quantities of fish for local markets while other, especially on the Southern Coast, purchase nearshore fish (live or dead) for markets in the Willamette Valley or San Francisco. Many ports also support recreational fishing. Visiting fishermen and their families contribute substantially to local economies by purchasing licenses, fishing gear, and boating accessories, along with food, lodging, and other services. Although it is difficult to measure economic contributions directly related to nearshore marine resources because of diverse aspects of tourism, most coastal counties are experiencing steady growth in tourism (Oregon DFW, 2006).

In Douglas County, manufacturing, health care, and retail trade are the largest employment sectors, together providing more than 15,000 jobs or more than 50 percent of jobs in the county. The forest products industry is also important: major employers within this industry include a number of sawmills; veneer plants; a pulp and particle board plant; and shingle, shake, pole, and other wood plants. The Research Group (2006) reported that the timber industry is responsible for an estimated 1,478 jobs and $12.8 million in total income for the county and that tourism and tourism-related retail enterprises generated about $93 million in wages and salaries and $7.2 million in personal income.

The top three employment sectors in Reedsport include retail trade (14.7 percent), hospitality and recreation services (13.9 percent), and health care and social assistance (12.0 percent). These service industries provide more than 900 jobs and make up more than 47 percent of the employed workforce (U.S. Census Bureau 2007, as cited by OPT). The tourism industry is an important component of the economy, particularly since the decline of the timber industry in the 1990s. Reedsport is also home to the Oregon Dunes National Recreation Area headquarters, which oversees the 53-mile-long stretch of sand dunes extending from Florence to Coos Bay.

Commercial Fishing

The Port of Umpqua is one of 22 coastal and river port districts established by the state of Oregon. The shallow-draft port extends from the mouth of the Umpqua River upstream to the town of Reedsport at river mile 11 (Port of Umpqua, 2007, as cited by OPT). Regular dredging activities maintain the navigable channel at a depth of between 22 and 26 feet (EPRI, 2004a, as cited by OPT). The Port of Umpqua owns two docks, one in the Reedsport shipyard and the other in Winchester Bay, where a small commercial fishing fleet is located. East Basin, located on the east side of the Umpqua River, 2.3 miles upstream of the river mouth, also has port facilities.

In 2000, Reedsport residents owned 19 commercial fishing vessels, and these vessels participated in the following West Coast fisheries: 9 in the Oregon crab fishery, 11 in the Washington salmon fishery, 1 in the California salmon fishery, and 1 in the Oregon shrimp fishery (NOAA, 2007b, as cited by OPT). Winchester Bay had 17 registered commercial fishing vessels operating along the West Coast that participated in the following fisheries: 7 in the Oregon crab fishery, 14 in the Washington salmon fishery, and 2 in the California salmon fishery.

As of 2000, Winchester Bay had two commercial processors that serviced 57 vessels that year. Five fish buyers purchased salmon, tuna, crab, and groundfish from the boats that moor in Salmon Harbor (Port of Umpqua, 2007). There are no processors located in Reedsport, so no vessels delivered their landings to this location. Table 19 shows the landings for Winchester Bay in 2000. By contrast, overall salmon landings for all of Douglas County were 50 tons in 2003, for a value of $163,000 (The Research Group, 2006). The Research Group also notes that there has been a statewide shift in harvesting patterns from salmon and groundfish to Dungeness crab, Pacific whiting, and sardines. Dungeness crabs represent a $53.3 to $81.0 million contribution to the coastal community and are the single most valued species on the coast (personal communication, Nick Furman, Dungeness Crab Commission, September 12, 2008, as cited by OPT). The 10-year average of ex-vessel (to-the-boat) catch value is $32.4 million for all of the ports in Oregon. The total value of fish and crabs sold in Winchester Bay was $1,471,911 in 2005, $1,277,072 in 2006, and $1,414,088 as of November 1, 2007 (letter from the Port of Umpqua to Dr. George Taylor, OPT, December 17, 2007, as cited by OPT, 2010).

The project boundaries fall within the larger Coos Bay port area, which is defined as including the cities and towns of Coos Bay, Florence, Charleston, Winchester Bay, and Bandon. In 2007, the economic contribution of commercial salmon fishing for the Coos Bay port area was approximately $1.8 million while the recreational contribution was $1.0 million (The Research Group, 2009).

Table 19. Commercial fish landings in Winchester Bay, 2000 (NOAA 2007b, as cited by OPT).

Fishery	Landings (Metric Tons)	Value of Landing ($)	Number of Vessels Landing
Coastal pelagic	Confidential	Confidential	1
Crab	250.8	1,170,610	23
Groundfish	33.6	129,193	20
Highly migratory species	44.4	105,495	10
Salmon	44.1	159,668	33
Shellfish	Confidential	Confidential	3
Shrimp	0.1	711	4
Other species	30.8	196,940	12

Many of the commercial crabbers that crab in or near the proposed project area keep their vessels in Coos Bay. The combined Dungeness crab value of the Winchester Bay and Coos Bay fleet has been reported as $12.2 million dollars for the 2003/2004 season, $13.8 million dollars for 2004/2005, $10.0 million for the 2005/2006 season, $8.6 million for 2006/2007, and $5.0 million for the 2007/2008 season (personal communication, Nick Furman, Dungeness Crab Commission, September 12, 2008, as cited by OPT).

Sport Fishing

Winchester Bay and Salmon Harbor, both located at the mouth of the Umpqua River, primarily support the area's economically important recreational fishing interests, although they also provide for some commercial vessels (EPRI, 2004b, as cited by OPT). The Port of Umpqua manages a commercial dock at Salmon Harbor. The annual income derived from the usage of the Port's hoist and a percentage of the poundage of sales totaled $17,621 in 2005; $14,085 in 2006; and 17,309 as of November 1, 2007 (letter from Port of Umpqua to Dr. George Taylor, OPT, December 17, 2007, as cited by OPT). Salmon Harbor has one of the largest and most modern sport facilities on the Oregon Coast, with 900 moorage slips, 300 RV camping sites, 27 land leases, and 2 boat launch stations (Reedsport/Winchester Bay Chamber of Commerce 2007, as cited by OPT). Annual moorage fees for 2007/2008 equaled $37,513 (letter from Port of Umpqua to Dr. George Taylor, OPT, December 17, 2007, as cited by OPT).

In 2003, four registered outfitters and four charter vessels operated out of Reedsport. In the same year, Winchester Bay had only one outfitter guide but five charter vessels. Agents sold 2,059 licenses at a value of $34,526 to Reedsport residents in 2000, while no licenses were sold in Winchester Bay during that same year (NOAA, 2007b, as cited by OPT).

The Oregon DFW and Oregon Coastal Zone Management Association sponsored studies of the economic contributions of Oregon's marine recreational fisheries (The Research Group, 2009, 2005). The total economic contribution for Oregon ocean (non-estuary) recreational fisheries in 2004 was $13.1 million (2005 dollars), representing $7.9 million for ocean salmon recreational fishing, $1.6 million for halibut, and $3.7 million for other groundfish species such as rockfish (The Research Group, 2005, as cited by OPT). According to the later study, the total economic contribution for the same recreational fisheries in 2008 was $8.3 million (2008 dollars), representing $1.3 million for ocean salmon recreational fishing, $1.5 million for halibut, $0.6 million for tuna, and $5.0 million for other groundfish species (The Research Group, 2009).

In 2004, of the $7.9 million generated by ocean salmon recreational fishing, 27 percent or $2.1 million was attributed to the port region between Bandon and Florence (including Reedsport), while the remaining 63 percent was ascribed to areas farther north (The Research Group, 2005, as cited by OPT). By comparison, in 2007, of the $4.3 million generated by ocean salmon recreational fishing, 24 percent or $1.0 million was attributed to the port region between Bandon and Florence (including Reedsport), while the remaining 66 percent was ascribed to areas farther north (The Research Group, 2009). The lower economic contribution of recreational salmon fishing in both 2007 and 2008, compared to 2004, is consistent with the commercial salmon fishery during the same time period. The Department of Commerce declared the 2006 and 2008 ocean salmon seasons to be fisheries disasters; the 2007 commercial season also had low harvest rates (The Research Group, 2009).

3.3.9.2 Environmental Effects

Stakeholders have indicated a need to evaluate the proposed project's effects on the local economy. The primary positive project effects identified by stakeholders include economic development and development of renewable energy generation. The primary potential negative effects identified by stakeholders are related to the potential for conflict with competing uses of the ocean space. In its review of environmental concerns related to wave power, EPRI (2004b, as cited by OPT) noted that coastal waters are subject to a wide variety of uses, including commercial and sport fishing, recreation and tourism, and navigation and marine traffic.[28] Stakeholders have identified these potential issues as having socioeconomic repercussions.

Economic Development

The Federal Energy Policy Act of 2005 encourages the development of renewable energy resources, including ocean energy, as a means of reducing the country's dependence on foreign oil and other fossil fuel energy sources. The State of Oregon has also implemented a number of initiatives to promote renewable energy and wave energy specifically, including the Oregon Wave Energy Trust and the Oregon Renewable Portfolio Standard.

OPT does not propose any measures specifically addressing economic development, nor have such measures been recommended by other parties.

Our Analysis

As part of a series of studies related to the feasibility of wave energy projects in North America, EPRI concluded that the use of this technology offered a host of public benefits such as job creation (construction, operation, and maintenance of wave power plants), economic development, and increased energy self-sufficiency (EPRI, 2005, as cited by OPT).

In December 2009, OPT and Oregon Iron Works signed a contract for construction of the single PowerBuoy to be deployed in Phase I of the project. OPT estimates that deployment of the single PowerBuoy would provide jobs for 30 employees at Oregon Iron Works and that the deployment of the additional 9 PowerBuoys could provide work for an additional 180 skilled workers for 7 months. OPT estimates that project deployment, including anchoring and mooring system fabrication, could provide 6 new local jobs and help maintain 10 to 12 existing jobs, contributing $1 million in wages to the local.

During project operation, OPT estimates that the project would support 8 full-time employees, including 1 supervisor, 5 operations personnel, and 2 technical/maintenance positions. Periodic major overhauls would provide temporary positions for about 5 additional maintenance personnel.

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[28] The same report identified other activities competing for space in coastal waters, such as submarine and other communication cables, designated dump sites, national marine sanctuaries, and scientific research reserves, although none of these currently apply to the project site.

We have not attempted to estimate the possible multiplier effects associated with new jobs provided by project construction and operation. However, a recent report to the Oregon Wave Energy Trust (EcoNorthwest, 2009) estimated multiplier effects for three hypothetical levels of wave energy development on the Oregon Coast, as follows:

- constructing and operating a wave research and development facility, which would include construction, installation, and operations of prototype wave energy buoys in the size range of 7 to 10 MW;
- constructing and operating a 500-MW wave farm; and
- developing and operating a manufacturing cluster that provides wave energy equipment and expertise to other national and international markets.

Using the economic modeling framework known as input-output modeling, EcoNorthwest estimated the direct, indirect, and induced effects associated with each of the three wave energy development scenarios, where *direct effects* are related to the goods and services purchased by the project within the region; *indirect effects* result as those purchases, in turn, generate purchases of intermediate goods and services from other sectors of the economy; and *induced effects* result as the direct and indirect increases in employment and earnings enhance overall purchasing power and induce further consumption and investment (EcoNorthwest, 2009). EcoNorthwest estimates that the first scenario, constructing and operating a wave research and development facility, would provide total construction employment for 45 workers. The operations phase would include 40 direct jobs and another 51 jobs associated with facility and employee spending for goods and services, implying an employment multiplier of 2.28 for that type of facility.

Thus, although the precise extent of the project's potential employment impact is not known, we conclude that project construction and operation would add to employment and earnings in the affected economic sectors.

Commercial and Sport Fishing

Commercial and sport fishing activities are not restricted to a particular area, and commercial vessels tend to shift the species they target from year to year depending on current prices and population levels. It is therefore not possible to determine how heavily the area within the proposed project boundary is fished. However, as indicated by Nick Furman of the Dungeness Crab Commission (personal communication, September 12, 2008, as cited by OPT), "the crab fishery is the 'mainstay' fishery on the Oregon Coast and participation and reliance on it economically, does not fluctuate regardless of the population levels. Fishermen use all of the available sandy bottom habitat from Brookings to Astoria every crab season." Fishermen, and particularly commercial crabbers, have expressed concern about the loss of productive fishing/crabbing grounds, loss of crabbing pots to large vessels transiting to and from the PowerBuoys, fishing gear entanglement in the array, and navigational safety in the project area.

As noted in section 3.3.7.2, *Environmental Effects*, in subsection *Ocean Use*, OPT proposes to ask Oregon FWC to designate the buoy deployment area as a No Fishing Zone and to ask the Coast Guard to designate the area as a Restricted Navigation Area. OPT also proposes to identify the area on navigation charts, illuminate the buoys, and implement its Crabbing and Fishing Plan, which includes:

- locating the PowerBuoy array within the project boundary to minimize the potential for entanglement of fishing gear;
- working with Oregon DFW, the SOORC, and the Crabbing and Fishing Implementation Committee to identify ways to minimize the potential for loss of fishing gear and develop a protocol to recover or provide mitigation for gear that becomes entangled in the PowerBuoy array;
- implementing a Crabbing and Fishing Plan that would include a transport moratorium during the first 8 weeks of every crab season, establishment of a predetermined transit lane from the port to the PowerBuoy array for project vessels, and 2-week's notice of PowerBuoy transport;
- joining the Oregon Fishermen's Cable Committee and following relevant procedures for the buried cable;
- locating subsurface floats at a depth of 30 to 50 feet to avoid potential vessel strikes;
- implementing a marine use/public information plan; and
- conducting a meeting of the Crabbing and Fishing Implementation Committee at least annually and more often as necessary to assess project effects on commercial crabbing and fishing.

Our Analysis

While fishermen have stated in scoping sessions that there would be a loss in productivity, the small size of the project and the ease with which vessels could move to other potential fishing grounds makes it unlikely that the presence of 10 PowerBuoys would pose any substantial economic harm to most fishing vessels.

With regard to commercial crabbing, we noted in section 3.3.7.2, *Environmental Effects*, in subsection *Ocean Use*, that we are unable to quantify the potential degree of conflict among user groups or the potential for a reduced crab harvest related to the proposed No Fishing Zone and Restricted Navigation Area. Although harvest in the restricted area would be eliminated, the crab population in the restricted area may increase, which could improve catch rates in the vicinity of the project. However, OPT's proposed measures, such as implementing the Crabbing and Fishing Plan and marine use/public information plan, would help reduce conflicts among user groups and resulting economic harm to fishermen. Additionally, as part of the fish and invertebrates monitoring, OPT proposes to evaluate whether the project affects the local distribution and abundance of adult Dungeness crab, which would help determine whether the project adversely affects the crab harvest and crabbers' income.

Similarly, we are not able at this time to estimate the potential economic losses from fishing gear entanglement. OPT's proposal to work with Oregon DFW, the SOORC, and the Crabbing and Fishing Implementation Committee to identify ways to minimize the potential for loss of fishing gear and develop a protocol to recover or provide mitigation for gear that becomes entangled in the PowerBuoy array appears to be a reasonable approach to minimizing the economic impact of such losses.

Recreation and Tourism

OPT suggest that that the project may represent the first commercial-scale wave energy project in the United States, and as such, it may attract people to the shore to view it. OPT proposes to develop, in consultation with Oregon PRD, an interpretive and education plan that would include the design and installation of an interpretive display on shore near the Sparrow Park Road terminus.

As discussed in section 3.3.7, *Recreation, Ocean Use, and Land Use,* in the subsection *Whale Watching,* stakeholders have raised the concern that the number of gray whales visible from the Umpqua Lighthouse may be reduced if whales avoid the project because of noise generated by the PowerBuoys or if the results from the cetacean monitoring (see section 3.3.3.2 in the subsection *Effects of Underwater Noise/Vibration on Aquatic Resources*) result in deployment of acoustic guidance devices to deter whales around the project. If whales were deterred from the project area, and if they moved farther out to sea rather than moving nearshore, they could be less visible from the lighthouse. In this scenario, fewer people might go to the Umpqua Lighthouse for whale watching.

Our Analysis

We note in section 3.3.7.2, *Environmental Effects,* in the subsection *Beach Access,* that OPT's proposed closure of Sparrow Park Road during project construction would have some negative impact on those seeking beach access, but there are options for minimizing the impact on summer users. We expect there to be little or no adverse economic impact associated with the closure. Installation of an interpretive display on shore near the Sparrow Park Road terminus could add to the enjoyment of visitors to the site, but would not be likely to attract more recreationists to the area or increase local recreational spending.

Similarly, we conclude in section 3.3.7.2, *Environmental Effects*, in the subsection *Whale Watching*, that the project would not affect the distance whales are swimming offshore near the Umpqua Lighthouse, and therefore should not affect recreational whale watching and the associated local spending.

Navigation and Marine Traffic

To provide for navigational safety, OPT proposes to request designation of the PowerBuoy array as a Restricted Navigation Area and a No Fishing Zone. Requirements for these designations have been defined and would be applied for as appropriate.

Our Analysis

We note in section 3.3.7.2, *Environmental Effects*, in the subsection *Navigation and Public Safety*, that NOAA's recommended vessel travel path falls approximately 17 miles west of proposed project boundary and that vessels of 300 gross tons or larger are encouraged by the West Coast Offshore Vessel Traffic Risk Management Project to voluntarily stay a minimum distance of 25 miles from the shoreline. We conclude that the project would have little or no effect on navigation, and therefore little or no effect on the costs of vessel operation.

3.3.10 Cultural Resources

3.3.10.1 Affected Environment

NHPA section 106 requires that the Commission evaluate the potential effects on properties listed or eligible for listing in the National Register of Historic Places (National Register). Such properties listed or eligible for listing in the National Register are called historic properties. In this document, we also use the term "cultural resources" for properties that have not been evaluated for eligibility for listing in the National Register. Cultural resources represent things, structures, places, or archeological sites that can be either prehistoric or historic in origin. In most cases, cultural resources less than 50 years old are not considered historic. Section 106 also requires that the Commission seek concurrence with the Oregon SHPO on any finding involving effects or no effects to historic properties, and allow the Advisory Council on Historic Preservation (Council) an opportunity to comment on any finding of effects to historic properties. If Native American (i.e., aboriginal) properties have been identified, section 106 also requires that the Commission consult with interested Indian tribes that might attach religious or cultural significance to such properties. In this case, the Commission must take into account whether any historic property could be affected by a proposed new license within the project's APE, and allow the Council an opportunity to comment prior to issuance of any new license for the project.

Area of Potential Effects

Pursuant to section 106, the APE is determined in consultation with the Oregon SHPO and is defined as the geographic area or areas within which an undertaking (i.e., relicensing) may directly or indirectly cause alterations in the character or use of historic properties, if any such properties exist. The APE for this project is defined as all lands and facilities located within the proposed project boundary and any other area outside the boundary, where project activities might affect historic properties.

In its January 2010 APEA, the applicant proposed the APE as follows:

- An approximate 0.5-mile x 0.5-mile area would be located in the Pacific Ocean (PowerBuoy array area) about 2.5 nautical miles west of the coast at Gardiner.

- An approximate 2-mile-long corridor for a subsea transmission cable that would be buried under the seabed to a minimum depth of 3 to 6 feet would run from the PowerBuoy array to the outfall of an wastewater discharge pipe located at a water depth of 35 feet about 0.5 mile from shore.

- From shore, the subsea cable then would run through the wastewater pipeline beneath the intertidal zone, the beach, and the sand dunes, to the underground vault located at the turn-around at the end of Sparrow Park Road, just inland of the sand dunes. At the proposed underground vault, the subsea transmission cable would exit the wastewater pipe, transition to an underground transmission line, re-enter the wastewater pipe, and continue underground within the existing wastewater pipeline.

- The underground transmission cable would continue within the existing wastewater pipeline within roadway for 3 miles before reaching the shore substation.

- The transmission line would terminate at the shore substation, which would be constructed close to the existing Douglas Electric Cooperative transmission line (terrestrial transmission line totals about 3 miles).

In January 2010, OPT submitted a letter to the Oregon SHPO requesting section 106 review and concurrence on the APE (letter from G. Wolff, Manager, Utility Business Development, OPT, Pennington, NJ, to R. Roper, Deputy SHPO, Oregon PRD, Heritage Programs, Salem, OR, January 19, 2010). Included in the submittal was a description of the proposed APE. In its response, the Oregon SHPO concurred with the APE (letter from D. Griffin, State Archaeologist, Oregon PRD, State Historic Preservation Office, Salem, OR, to G. Wolff, Utility Business Development, Ocean Power Technologies, Inc., Pennington, NJ, January 25, 2010).

Cultural Overview

The following cultural background information is as cited by OPT.

Historically, at least four tribal groups inhabited the Umpqua River Basin. The Southern Molalla Tribe inhabited areas that surrounded the headwaters of the South Umpqua River. The Lower Umpqua Tribe (Kalawatset) occupied the coastal lands and tributaries from the Siltcoos River south to Tenmile Creek. The Upper Umpqua Tribe and the Cow Creek Band of the Umpqua Tribe lived along the Umpqua River, occupying the majority of the basin.

It remains unknown when these area tribes settled their respective lands. Archaeological remains suggest that the Native American settlement in the Umpqua Watershed began at least some 8,000 years before the arrival of early European/American settlers and explorers in the late 1700s.

Beginning in the middle of the sixteenth century, foreign diseases such as small pox were introduced through contact and trade with Spanish explorers sailing the Pacific Coast from Mexico. In the early 1800s, the estimate of Native Americans in the Umpqua Watershed was 3,000 to 4,000 in the Umpqua Valley and about 500 people at the coast and estuaries. It is unclear whether introduced disease significantly reduced the population prior to census. By the mid-1800s, white settlers began building permanent housing and promoting wide-scale settlement in the river basin.

As white settlers populated the Umpqua Watershed, relationships with the Tribes deteriorated. Relocation and neglect of treaty agreements resulted in the Coos, Lower Umpqua, and Siuslaw tribes collaborating in their efforts to pursue land claims beginning in 1916. The CTCLUSI weathered the changing political landscape over the following decades, including termination initiatives to cease government-to-government relations with the federal government. In 1984, federal recognition was restored and today, the CTCLUSI have a 6.1-acre reservation and tribal hall in Empire, as well as the Three Rivers Casino in Florence, Oregon.

The ancestral lands of the CTCLUSI extend over the central and southern coast of Oregon and include the Reedsport Project area. The CTCLUSI's ancestral lands extend from Tenmile Creek in Lane County south to Fivemile Point in Coos County, and from the crest of the Coast Range to 12 nautical miles beyond the continental shelf. There are no Indian reservation lands within the proposed project boundary or immediate project vicinity.

Previous Cultural Resources Studies

Although cultural resource sites have been documented in the vicinity of the proposed project, OPT has been unable to obtain copies of previous survey reports and details of these studies are not known.

Prehistoric and Historic Archaeological Resources

OPT conducted a systematic marine geophysical survey of the ocean subfloor and sub-bottom in the offshore APE. The study included bathymetric, side-scan sonar, magnetometer, sub-bottom, sediment sample, towed video, and diver surveys (Sea Engineering, 2007). No sub-bottom structure was detected other than the existing wastewater pipe (Sea Engineering, 2007). The geophysical data were later reviewed by an archaeologist to evaluate the geoarchaeological potential of the submerged area.

In December 2009, OPT provided the CTCLUSI with a revised project description, description of the proposed APE, and the results of a geoarchaeological review. In its January 2010 response, the CTCLUSI reviewed its cultural resources database and responded that there were no known sites within the transmission line route (letter from A. Coyote, Cultural Resource Protection Coordinator, CTCLUSI, Coos Bay, OR, to G. Wolff, Manager, Utility Business Development, OPT, Pennington, NJ, dated January14, 2010). However, the CTCLUSI stated that three sites (35DO03, 35DO07, and 35DO08) are located in the vicinity of the shore substation location.

As discussed in section 1.3.5, the Commission requested that OPT undertake a cultural resources survey of the project APE. The results of the survey were presented in a report entitled Reedsport OPT Wave Park, Cultural Resources Survey Report (Coyote, 2010) filed with the Commission on October 5, 2010. No cultural materials were observed.

Traditional Cultural Properties

The CTCLUSI have not identified any potential traditional cultural properties within the project APE.

3.3.10.2 Environmental Effects

OPT initiated informal consultation with the CTCLUSI through the Oregon Solutions process in October 2006. In a letter to OPT and other Oregon Solutions partners dated October 9, 2006, CTCLUSI expressed conditional support for the project. The CTCLUSI's main concerns about the projects are disturbance of terrestrial archaeological sites and potential effects on marine resources, although the CTCLUSI have decided to defer to the state and natural resource agencies on marine and other natural resource issues. In spring 2007, OPT spoke with the CTCLUSI Cultural Resources Protection Coordinator and the Oregon SHPO about potential archaeological properties in the terrestrial portion of the project area, and in June 2007, the CTCLUSI and OPT signed an MOU between Reedsport OPT Wave Park, LLC and the CTCLUSI for the Monitoring and Mitigation of Impacts to Cultural Sites Associated with the Reedsport OPT Wave Park.

In September 2007, the Oregon SHPO stated that its office was unaware of any previous cultural resource surveys completed near the proposed project area, but that the terrestrial portion of the project area has a high probability for the occurrence of archaeological sites or buried human remains (Oregon SHPO to OPT September 17, 2007, as cited by OPT, 2010). The Oregon SHPO recommended exercising extreme caution during construction activities and developing procedures for consultation triggered by the discovery of cultural material during future ground-disturbing activities.

A geoarchaeological review of the data recovered from the marine geophysical survey resulted in a recommendation that the project was unlikely to affect submerged archaeological resources (Davis, 2009). In its application, OPT pointed out that the changing nature of the Oregon coastline can quickly erase archaeological evidence of human activity, and OPT believes that construction of the project in the marine and dune portions of the APE are therefore not expected to threaten cultural materials. As such, OPT concludes in its license application that there would be no unavoidable adverse effects on cultural resources as a result of the project.

In January 2010, the CTCLUSI agreed that construction of the offshore portion of the project would be unlikely to affect submerged archaeological resources (letter from A. Coyote, Cultural Resource Protection Coordinator, CTCLUSI, Coos Bay, OR, to G. Wolff, Manager, Utility Business Development, OPT, Pennington, NJ, dated January 14, 2010). With regard to the terrestrial portion of the project, the CTCLUSI concluded that there would be no impact to potentially unknown cultural resources as a result of installation of the new transmission line because it would be within the existing wastewater pipeline, thereby eliminating the need for trenching or above ground power lines. However, because three sites had been recorded in the vicinity of the shore substation location, the CTCLUSI recommended that any ground disturbance in the vicinity of the station be monitored. The CTCLUSI also recommended that because changes had been made to project since the execution of the 2007 MOU, the MOU should be revised, and stated that adherence to the revised MOU would "suffice to protect the Confederated Tribe's cultural resource interests."

OPT submitted a letter in January 2010 to the Oregon SHPO requesting review under section 106 of the NHPA (letter from to G. Wolff, Manager, Utility Business Development, OPT, Pennington, NJ, to Roger Roper, Assistant Director/Deputy SHPO, Oregon DPR, State Historic Preservation Office, Salem, OR, dated January 19, 2010). In its letter, OPT included the proposed APE, the geoarchaeological review (Davis, 2009), and the January 14, 2010, CTCLUSI letter. OPT stated that it would construct and operate the project consistent with the CTCLUSI recommendations. In its January 25, 2010, response, the Oregon SHPO stated that it believed that the offshore portion of the project would have no effect on any known cultural resources, but requested a copy of the Sea Engineering, Inc. (2007) geophysical survey. It its letter, the Oregon SHPO stressed the need for an archaeological monitor during terrestrial construction activities because of the project's proximity to three known archaeological sites (letter from letter from D. Griffin, State Archaeologist, Oregon DPR, State Historic Preservation Office, Salem, OR, to G. Wolff, Manager, Utility Business Development, OPT, Pennington, NJ, filed May 18, 2010). Finally, the Oregon SHPO stated that if cultural resources were identified during construction, all work would need to cease until the find could be assessed. OPT had previously agreed to monitor ground disturbance associated with construction of the underground vault and the shore substation (letter from to G. Wolff, Manager, Utility Business Development, OPT, Pennington, NJ, to R. Roper, Assistant Director/Deputy SHPO, Oregon PRD, State Historic Preservation Office, Salem, OR, January 19, 2010). In its letter, OPT also agreed to revise the MOU developed between the CTCLUSI and OPT in 2007 to reflect subsequent project changes.

In its comments on SD1, the Forest Service states that much of the area where the underground vault is proposed has been previously disturbed, and as a result, it has no concerns about potential adverse impacts on cultural resources or other resources from this aspect of the project. However, the Forest Service encouraged the Commission and OPT to work closely with the CTCLUSI and honor their scoping comments, requests, and recommendations to the greatest extent possible.

In a letter to the Commission in May 2010, the Oregon SHPO concurred that the offshore portion of the project would have no effect on any known cultural resources (letter from D. Griffin, State Archaeologist, Oregon DPR, State Historic Preservation Office, Salem, OR, to the Commission, Washington, DC, filed May 7, 2010). In its letter, the Oregon SHPO reiterated the need for archaeological monitoring of construction work in the vicinity of the proposed shore substation because of its proximity to known cultural resource sites.

In its March 19, 2010, additional information request, Commission requested that OPT provide copies of any terrestrial archaeological survey reports for studies conducted within the APE within the previous 5 years. The Commission stated that if copies of any such surveys were not available, OPT should conduct a survey and provide the results to the Commission by May 18, 2010. On May 17, 2010, OPT filed a letter stating that it was contracting to undertake the survey and that the results would be submitted to Commission when the survey was complete (letter from P. Pellegrino, Vice President, OPT, Pennington, NJ, to the Commission, Washington, DC, filed May 18, 2010). Commission responded that the results of the survey must be filed by no later than July 30, 2010 (letter from the Commission, Washington, DC, to P. Pellegrino, Vice President, OPT, Pennington, NJ, dated June 9, 2010).

The cultural resources survey report filed on October 5, 2010, concluded that ground-disturbing activities would take place in previously disturbed areas associated with fill, roads, or dikes, and that it was likely that sites 35DO03, 35DO07, and 35DO08 have either been destroyed by construction or lie deeply buried (Coyote, 2010). As such, the report concludes that they are unlikely to be disturbed by project construction, but recommends implementation of the Inadvertent Discovery Plan attached to the report that requires suspension of work and consultation with the Oregon SHPO and CTCLUSI if cultural resources are encountered during construction.

Based on the findings of the cultural resources inventory report, OPT requested relief from Oregon SHPO of the previous requirement to have a professional archaeologist monitor ground-disturbing construction activities (letter from R. Lurie, Vice President, North American Business Development and Marketing, Member, Ocean Power Technologies, Inc. Pennington, NJ, to D. Griffin, State Archaeologist, Oregon PRD, State Historic Preservation Office, Salem, OR, filed October 5, 2010). In its letter dated October 26, 2010, the Oregon SHPO concurred with this request and stated that no further archaeological research was needed (letter from letter from D. Griffin, State Archaeologist, Oregon DPR, State Historic Preservation Office, Salem, OR, to R. Lurie, OPT, Pennington, NJ, filed November 1, 2010).

Our Analysis

Commission staff agrees with OPT's assessment that no known historic properties would be affected by this proposed project. Commission staff also agrees with the Oregon SHPO that monitoring during construction activities is not necessary. As with other hydropower licenses where no historic properties have been located, if the Commission decides to issue a license for the proposed project, Commission staff would craft a license article describing the procedures to be followed regarding cultural resources. Among other things, the article would state that: (1) following construction of the project, but prior to any new land-clearing or ground-disturbing activity that may be necessary over the license term, the licensee would consult with the Oregon SHPO and CTCLUSI in compliance with section 106; and (2) in the event that cultural materials or human remains are inadvertently discovered during the course of constructing or developing project works or other facilities at the project, or over the license term, the licensee would stop all land-clearing and land-disturbing activities in the vicinity of the discoveries and consult with the Oregon SHPO and CTCLUSI. If historic properties are identified, a Historic Properties Management Plan would be crafted by the licensee in consultation with the Oregon SHPO and CTCLUSI, depending on the nature of historic properties were identified.

3.4 NO-ACTION ALTERNATIVE

Under the no-action alternative, the Reedsport Project would not be constructed. There would be no changes to the physical, biological, or cultural resources of the area and electrical generation from the project would not occur. The power that would have been developed from a renewable resource may/would likely be replaced by nonrenewable fuels.

4.0 DEVELOPMENTAL ANALYSIS

In this section, we look at the Reedsport Project's use of the Oregon State territorial waters about 2.5 nautical miles off the coast near Reedsport, in Douglas County, Oregon, for hydropower purposes to see what effect various environmental measures would have on the project's costs and power generation. Under the Commission's approach to evaluating the economics of hydropower projects, as articulated in *Mead Corp.*,[29] the Commission compares the current project cost to an estimate of the cost of obtaining the same amount of energy and capacity using the likely alternative source of power for the region (cost of alternative power). In keeping with Commission policy as described in *Mead Corp.*, our economic analysis is based on current electric power cost conditions and does not consider future escalation of fuel prices in valuing the hydropower project's power benefits.

For each of the licensing alternatives, our analysis includes an estimate of: (1) the cost of individual measures considered in the EA for the protection, mitigation and enhancement of environmental resources affected by the project; (2) the cost of alternative power; (3) the total project cost (i.e., for construction, operation, maintenance, and environmental measures); and (4) the difference between the cost of alternative power and total project cost. If the difference between the cost of alternative power and total project cost is positive, the project produces power for less than the cost of alternative power. If the difference between the cost of alternative power and total project cost is negative, the project produces power for more than the cost of alternative power. This estimate helps to support an informed decision concerning what is in the public interest with respect to a proposed license. However, project economics is only one of many public interest factors the Commission considers in determining whether, and under what conditions, to issue a license.

4.1 POWER AND ECONOMIC BENEFITS OF THE PROJECT

Table 20 summarizes the assumptions and economic information we use in our analysis. This information was provided by OPT in its license application. We find that the values provided by OPT are reasonable for the purposes of our analysis. Cost items common to all alternatives include taxes and insurance costs; net investment (the total investment in power plant facilities remaining to be depreciated); estimated future capital investment required to maintain and extend the life of plant equipment and facilities; relicensing costs; normal operation and maintenance cost; and Commission fees.

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[29] See *Mead Corporation, Publishing Paper Division*, 72 FERC ¶ 61,027 (July 13, 1995). In most cases, electricity from hydropower would displace some form of fossil-fueled generation, in which fuel cost is the largest component of the cost of electricity production.

Table 20. Parameters for the economic analysis of the Reedsport Project (Source: OPT, 2010).

Parameter	**Value**
Period of analysis (years)[a]	30
Federal income tax rate (%)[b]	35
Initial construction cost ($)[c]	$50,000,000
Future operation and maintenance ($/year)[d]	$1,000,000
Energy value ($/MWh)[e]	40
Interest rate (%)[f]	4.5
Discount rate (%)[b]	8

[a] Regardless of the potential license term (30, 40 or 50 years), we perform a 30-year economic analysis.

[b] Assumed by staff.

[c] Initial construction cost was provided by OPT in the license application.

[d] OPT cited an estimates of potential operation and maintenance costs to be proprietary information, and declined to provide an estimate. Therefore, we have estimated an overall O&M cost for the operation of the project as part of the baseline costs prior to the addition of environmental measures. Given that this is new technology and there is no comparable historical data from other projects to rely on, we have estimated what we consider to be a conservative value of $1,000,000 per year.

[e] OPT did not provide an anticipated energy rate because no firm power purchase agreements are in place. We estimated a rate of $40/MWh, based on forecasts from the Energy Information Administration's 2010 Annual Energy Outlook for the region in which the project would be sited.

[f] This value was provided by OPT in its May 17, 2010, response to FERC's additional information request.

4.2 COMPARISON OF ALTERNATIVES

Table 21 compares the installed capacity, annual generation, cost of alternative power, estimated total project cost, and difference between the cost of alternative power and total project cost for each of the alternatives considered in this EA: no action, OPT's proposal, the staff alternative, and staff alternative with mandatory conditions.

From our comparison, both OPT's proposal and the staff alternative would have an initial annual cost that far exceeds the current power value. As discussed in section 1.2.1, the development OPT currently proposes is the second phase of a three-phased development approach. OPT is hopeful that building the current phase, in addition to generating electricity, will collect enough data to support development of more economic commercial-scale arrays, with installed capacities up to 50 MW. Based on the Commission's policy under the Mead decision, OPT must decide whether to accept any license the Commission issues for the current proposal and the financial risk that entails.

Table 21. Summary of the annual cost of alternative power and annual project cost for the alternatives for the Reedsport Project (Source: staff).

	No Action	OPT's Proposal	Staff Alternative
Installed capacity (MW)	0.00	1.5	1.5
Annual generation (MWh)	0	4,140	4,140
Annual cost of alternative power	$0	$165,600	$165,600
($/MWh)	NA	40.00	40.00
Annual project cost	NA	$3,496,940	$3,502,190
($/MWh)	NA	844.67	845.94
Difference between the cost of alternative power and project cost	NA	($3,331,340)[a]	($3,336,590)[a]
($/MWh)	NA	(804.67)[a]	(805.94)[a]

[a] A number in parentheses denotes that the difference between the cost of alternative power and project cost is negative, thus the total project cost is more than the cost of alternative power by that amount.

4.2.1 No-action Alternative

Under the no-action alternative, the project would not be constructed as proposed, and would not produce any electricity.

4.2.2 OPT's Proposal

OPT proposes to develop the Reedsport OPT Wave Park Project, located offshore and onshore near Reedsport, Oregon. The project would include the installation of 10 PowerBuoy units located in the Pacific Ocean off the coast of Oregon. The 10 PowerBuoy units would be connected to a single USP via power/fiber-optic lines. A subsea transmission cable, buried in the seabed to a depth of 3 to 6 feet, would extend from the USP to terminus of an existing wastewater discharge pipeline, about 0.5 mile offshore. The subsea transmission cable would extend through the wastewater pipeline to an underground vault, which would be constructed inland of the sand dunes. At the vault, the subsea transmission cable would transition to an underground transmission line, re-enter the wastewater pipeline, and then be routed through the pipeline to the point where it would connect via a proposed shore substation to the Douglas Electric Cooperative transmission line, which connects to the Bonneville Power Administration's Gardiner substation. As a new technology, the project would require significant capital investment. OPT also proposes various environmental measures to protect existing environmental resources in the vicinity of the project features.

Under OPT's proposed alternative, the project would generate an average of 4,140 MWh annually. The annual cost of alternative power under OPT's proposal would be $165,600, or $40.00/MWh. The average annual project cost would be $3,496,940, or $844.67/MWh. Overall, the project would produce power at a cost that is $3,331,340, or $804.67/MWh, more than the cost of alternative power.

4.2.3 Staff Alternative

The staff alternative includes the same project as proposed by OPT and, therefore, would have the same capacity and energy attributes. Table 22 shows the staff recommended modifications and additions to OPT's proposed environmental protection and enhancement measures and the estimated cost of each.

As recommended by staff, the project would generate an average of 4,140 MWh annually. The annual cost of alternative power under the staff alternative would be $165,600, or $40.00/MWh. The average annual project cost would be $3,502,190, or $845.94/MWh. Overall, the project would produce power at a cost that is $3,336,590, or $805.94/MWh, more than the cost of alternative power.

4.3 COST OF ENVIRONMENTAL MEASURES

Table 22 gives the cost of each of the environmental enhancement measures considered in our analysis. We convert all costs to equal annual (levelized) values over a 30-year period of analysis to give a uniform basis for comparing the benefits of a measure to its cost.

Table 22. Cost of environmental mitigation and enhancement measures considered in assessing the environmental effects of constructing and operating the Reedsport Project (Source: staff).

Enhancement/Mitigation Measures	Entities	Capital Cost (2010$)	Annual Cost (2010$)[a]	Levelized Annual Cost (2010$)[b]
1. Implement the Adaptive Management Process	OPT, Staff, Settlement Parties[c]	$0	$36,170[d]	$23,510
2. Implement the Operation & Maintenance Plan	OPT, Staff, Settlement Parties[c]	$0[e]	$0	$0
3. Conduct underwater inspection of the PowerBuoys, USP, cables and mooring system for entangled fishing gear every month for the first 12 months after deployment of the 10-buoy array	Staff	$102,000	$0	$5,260[f]
4. Install the transmission cable through the existing wastewater discharge pipeline to eliminate effects crossing nearshore, intertidal, and dune habitat	OPT, Staff, Settlement Parties[c]	$0[g]	$0	$0
5. Install the terrestrial portion of the transmission line within the existing wastewater discharge pipeline to minimize potential visual, cultural and environmental effects	OPT, Staff, Settlement Parties[c]	$0[g]	$0	$0
6. Develop a decommissioning plan if a license surrender is proposed in the future	Interior, Oregon DFW, NMFS, Staff[h]	$0[i]	$0	$0

Enhancement/Mitigation Measures	Entities	Capital Cost (2010$)	Annual Cost (2010$)[a]	Levelized Annual Cost (2010$)[b]
Water Resources				
7. Implement the Spill Prevention, Control, and Countermeasure Plan	OPT, Staff, Settlement Parties[c]	$0[j]	$0	$0
8. Conduct wave, current, and sediment transport monitoring	OPT, Staff, Settlement Parties[c]	$861,450	$0	$44,390
9. Consult with the Aquatic Resources and Water Quality Implementation Committee concerning the use of any materials, not originally listed in the license application or Settlement Agreement, that could cause harmful effects to fish, wildlife or the environment if released into the environment.	Interior, Oregon DFW, NMFS, Staff	$0	$0	$0
Aquatic Resources				
10. Conduct fish and invertebrates monitoring	OPT, Staff, Settlement Parties[c]	$1,751,040	$0	$90,240
11. Conduct EMF monitoring	OPT, Staff, Settlement Parties[c]	$299,910	$0	$15,460
12. Equip PowerBuoys with devices or materials to prevent pinniped haul-out	OPT, Staff, Settlement Parties[c]	$0[g]	$0	$0
13. Conduct cetacean monitoring	OPT, Staff, Settlement Parties[c]	$195,790[k]	$0	$10,090

Enhancement/Mitigation Measures	Entities	Capital Cost (2010$)	Annual Cost (2010$)[a]	Levelized Annual Cost (2010$)[b]
14. Conduct pinniped monitoring	OPT, Staff, Settlement Parties[c]	$0[l]	$0	$0
15. Conduct offshore avian use monitoring	OPT, Staff, Settlement Parties[c]	$469,880	$0	$24,220
16. Notify agencies in the event of fish or wildlife emergency circumstances	Interior, Oregon DFW, NMFS, Staff	$0	$0[m]	$0
Recreation, Ocean Use and Land Use				
17. Light PowerBuoys in accordance with Coast Guard regulations with consideration of protection for offshore birds and recreational and commercial fishing vessels	OPT, Staff, Settlement Parties[c]	$0[g]	$0	$0
18. Implement the Emergency Response and Recovery Plan	OPT, Staff, Settlement Parties[c]	$0[i]	$0	$0
19. Implement the Crabbing and Fishing Plan, which includes a marine use/public information plan	OPT, Staff, Settlement Parties[c]	$75,000[n]	$0	$3,870
20. Bury the subsea transmission cable to minimize hazards to navigation and fishing	OPT, Staff, Settlement Parties[c]	$0[g]	$0	$0
21. Locate the subsurface floats (underwater mooring floats) at depths of 30 to 50 feet to avoid potential vessel strike	OPT, Staff, Settlement Parties[c]	$0[g]	$0	$0

Enhancement/Mitigation Measures	Entities	Capital Cost (2010$)	Annual Cost (2010$)[a]	Levelized Annual Cost (2010$)[b]
22. Develop and implement an interpretive and education plan (including design and installation of interpretive displays on shore)	OPT, Staff, Settlement Parties[c]	$10,000	$0	$520
23. Conduct a visual assessment review from the beach, from the top of a dune near the beach and from the Umpqua lighthouse following installation of the single PowerBuoy to be deployed in Phase I of the project	OPT, Staff, Settlement Parties[c]	$0[o]	$0	$0
Cultural Resources				
24. Implement the Terrestrial and Cultural Resources Plan, including a Cultural Resources Survey, Monitoring, and Contingency Mitigation Plan consistent with the MOU signed with CTCLUSI.	OPT, Staff, Settlement Parties[c]	$0[e]	$0	$0
25. Consult with the Oregon SHPO and CTCLUSI regarding the discovery of cultural materials and/or human remains identified during project construction and over the license term, and regarding any new ground-disturbing activities undertaken post-construction over the license term.	Staff	$0[e]	$0	$0

[a] OPT would not provide estimated O&M costs, citing it as proprietary information. Therefore, we estimated an overall O&M cost for the operation of the project as part of the baseline costs prior to the addition of environmental measures. Given that this is new technology and there are no comparable historical data from other projects on which to rely, we estimated what we consider to be a conservative value.

[b] Because of savings related to tax incentives, the resulting levelized annual cost shown is lower than the annualized cost of the capital and annual expenditures by the amount of the tax savings.

[c] Settlement parties include: Reedsport OPT Wave Park, LLC; FWS; NMFS; U.S. Department of Agriculture, Forest Service; Oregon DLCD; Oregon DEQ; Oregon DLCD; Oregon Water Resources Department; Oregon DFW; Oregon Parks and Recreation Department; Oregon Department of Energy; Oregon State Marine Board; Oregon Shores Conservation Coalition; Surfrider Foundation; and SOORC.

[d] OPT did not provide costs for this measure, so we assumed a cost of $80,000 per year for four meetings each year in years 1–5 and $20,000 per year for one meeting each year in years 6–30.

[e] OPT did not provide costs for this measure, so we assume that it is included in the project construction capital cost.

[f] Staff added additional survey events with surveys being conducted each month during year 1. The cost was estimated to be $17,000 per event for six events, for a total of $102,000.

[g] OPT stated that the cost to implement this measure is included in the project construction capital cost.

[h] Commission licenses for unconstructed minor projects affecting navigable waters and lands of the United States include L-Form 19 with standard article 25 addressing site restoration as part of the surrender of a license with the intent to decommission the project. The elements of a decommissioning plan recommended by FWS, NMFS, and Oregon DFW and the restoration plan prescribed by the Forest Service would be addressed in the decommissioning plan, if the licensee proposes to surrender the license and retire the project.

[i] No cost estimated—plan would not need to be developed unless the project is decommissioned.

[j] OPT stated that there would be no cost unless the plan needs to be implemented at some point in the future and that other costs would be included in routine operation and maintenance costs.

[k] OPT stated that the cost to implement this measure does not include the cost of a Phase I study, which would be funded by others.

[l] OPT stated that the cost to implement this measure would be synergistic with the cost of other measures.

[m] No cost estimated—costs would be dependent on the frequency and nature of any fish and wildlife emergencies that occur.

[n] OPT stated that the cost shown to implement this measure is only a placeholder pending further discussion with appropriate stakeholders.

[o] OPT stated that the cost to implement this measure is synergistic with the cost of deployment.

5.0 CONCLUSIONS AND RECOMMENDATIONS

5.1 COMPARISON OF ALTERNATIVES

In this section, we compare the developmental and non-developmental effects of OPT's proposal, the staff alternative, and the no-action alternative.

We estimate the annual generation of the project under the three alternatives identified above. Our analysis shows that the annual generation would be 4,140 MWh for the proposed action and the staff alternative and 0 MWh for the no-action alternative.

We summarize the environmental effects of the project under the applicant's proposal and the staff alternative below (table 23). Under the no-action alternative, the project would not be constructed and environmental conditions would not be altered by the project.

Table 23. Comparison of OPT's proposal and staff alternative for the Reedsport OPT Project (source: staff).

OPT's Proposal	Staff Alternative
Generation	
• 4,140 MWh	• 4,140 MWh
Geologic and Soils Resources	
• Effects of changes in wave energy on sediment transport would be minor. • Proposed wave, current, and sediment transport monitoring would help identify and quantify any unanticipated effects and identify potential mitigation measures.	• Same as applicant's proposal.
Water Resources	
• A minor increase in turbidity would occur during project construction. • There would be some risk of spills of hydraulic fluids from buoys and fuel from work vessels, but these risks would be minimized by implementing the SPCC Plan. • Proposed wave, current and sediment transport and fish and invertebrate monitoring would help identify and quantify the scale of any unanticipated effects on water currents or water quality and identify	• Same as applicant's proposal, plus: • Identification of any hazardous liquids in the underwater substation pod (USP) and methods to detect leaks in the SPCC plan would help prevent any potential adverse effects on water quality.

OPT's Proposal	Staff Alternative
potential mitigation measures.	
Aquatic Resources	
• Placement of underwater components would likely cause some changes in the composition and abundance of the fish and invertebrate community, reducing the amount of habitat for species adapted for burrowing in the seabed and creating habitat for structure-oriented species. • Designation of the project area as a No Fishing Zone would benefit many aquatic species by providing a refuge from harvest and from habitat damage associated with some types of fishing gear. • Enhanced habitat conditions for larger fish of some species would likely increase predation on smaller fish. • Proposed fish and invertebrate and EMF monitoring, as well as acoustic monitoring, would help identify and quantify any unanticipated adverse effects and identify potential mitigation measures.	• Same as applicant's proposal, plus: • Review of monitoring data from the single PowerBuoy before additional PowerBuoys are installed would allow for project modifications, if needed, to address any unanticipated adverse effects from EMF or acoustic emissions.
Marine Mammals, Reptiles, and Birds	
• PowerBuoy array has the potential to affect gray whales because it is within their migration route, but construction activities would be scheduled outside of the gray whale migration period. • Noise level caused by project operation is not expected to adversely affect whales; construction-related noise may have a minor, temporary effect on whales. • Some potential exists for whale entanglement on project structures, especially if any derelict fishing gear accumulates on project components; this risk would be reduced by the removal of any entangled gear that is found during periodic underwater inspections that would be conducted under OPT's proposed O&M Plan.	• Same as applicant's proposal, plus: • Increasing the frequency of underwater inspections from every 2 to 3 months to monthly during the first year of project operation and removal of any fishing gear snagged on project components would reduce potential for whale entanglement. • Review of monitoring data from the single PowerBuoy before additional PowerBuoys are installed would allow for project modifications to address any unanticipated adverse effects from EMF or acoustic emissions.

OPT's Proposal	Staff Alternative
• Some potential exists for birds to be injured or killed if they collide with above-water portions of the PowerBuoys; given the proposed project configuration and buoy design and the features built into the navigation lighting system to minimize bird attraction, the potential for bird collision is low. • Any unanticipated effects on whales and seabirds, and potential methods to address them, would be identified by monitoring.	
Terrestrial Resources	
• Because the only areas that would be altered by the project are in previously disturbed areas, no adverse effects on terrestrial resources are anticipated.	• Same as applicant's proposal, plus: • Modification of the Terrestrial and Cultural Resources Plan to address potential effects on terrestrial resources would provide additional protection if new information identifies any potential for adverse effects on these resources.
Threatened and Endangered Species and Essential Fish Habitat	
• Minor potential that attraction of predacious fish, seals, sea lions, and birds to the project would result in increased predation on listed species of salmon. • Minor potential exists for entanglement or injury to listed species of whales that pass through the project area and for collision to marbled murrelets. • Unanticipated adverse effects on threatened and endangered species and essential fish habitat would be identified through fish and invertebrate, pinniped, cetacean, and offshore avian use monitoring. • Unlikely to affect beach habitat which supports the western snowy plover, and any unanticipated effects would be identified through the proposed wave, current, and sediment transport monitoring.	• Same as applicant's proposal, plus: • Increasing the frequency of inspections for fishing gear snagged on project components during the first year of project operation would reduce any potential for whale entanglement. • Review of monitoring data from the single PowerBuoy would allow for any project modifications to address any unanticipated adverse effects from EMF or acoustic emissions before additional PowerBuoys are installed.

OPT's Proposal	Staff Alternative
Recreation, Ocean Use, and Land Use	
• Access to the PowerBuoy area for crabbing and commercial and recreational fishing would be precluded if the area is designated as a No Fishing Zone by the Oregon FWC or access is restricted by FERC to protect public safety. • Crabbers would likely experience some loss of fishing gear and fishing time associated with gear entanglement on project structures and gear damage caused by vessels needed to construct and maintain the project. • Loss of fishing area would likely be mitigated to some extent by increased catch rates in areas adjacent to the project, and the measures proposed in the Crabbing and Fishing Plan should help minimize any adverse effects on navigation, crabbing and fishing; measures include developing a protocol to recover or provide mitigation for fishing gear that becomes entangled in project mooring lines. • Adverse effects on shore recreation and land use would be minor because only limited shore-based construction would occur, the construction period would be brief, and all activities would occur in previously disturbed areas.	• Same as applicant's proposal, plus: • Restricting the timing of closures of Sparrow Park Road would reduce adverse effects on public access to the beach and refining several elements of the Crabbing and Fishing Plan for commission approval would help ensure that any adverse effects on recreation and ocean use are minimized. These refinements would include developing a protocol for recovering fishing gear, establishing procedures for initiating a transport moratorium during the first 8 weeks of the Dungeness crab season, establishing a predetermined project transit lane and providing a 2-week notice of PowerBuoy transport, developing a plan and schedule for designation of the project area as a Restricted Navigation Area by the Coast Guard and as a No Fishing Area by Oregon FWC, and implementing a marine use/public information plan to inform commercial and recreational users of the about the project.
Aesthetic Resources	
• Aesthetic effects would be minor—the size of the PowerBuoys when viewed from shore would be approximately 1.6 mm at arm's length when viewed from the shoreline; at night, the PowerBuoys would be lit for navigational safety; under clear conditions, these lights would appear as pinpoints on the horizon, creating a minor visual change to relatively unbroken night-time ocean views off the Oregon Coast. Because most construction activities would take place at least 2 miles offshore, work vessels would not be visually obtrusive from shore.	• Same as the applicant's proposal.

OPT's Proposal	Staff Alternative
Cultural Resources	
• Implementation of the Terrestrial and Cultural Resources Plan, which would include implementation of a Cultural Resources Survey, Monitoring, and Contingency Plan, would ensure that no unanticipated cultural resources properties or human remains would be disturbed.	• Same as applicant's proposal, plus: • Additional consultation with the CTCLUSI and Oregon SHPO regarding unanticipated discoveries of cultural materials or human remains during construction activities and over the license term, and regarding any new post-construction land clearing or ground disturbing activities undertaken in the future, would provide additional protection to cultural resources.
Socioeconomics	
• Construction and periodic maintenance activities associated with the project would provide temporary employment for up to 180 skilled workers for 6 months. • Operation of the project would provide 8 full-time jobs. • Measures identified above would mitigate for any adverse effects to the crabbing and fishing industry.	• Same as the applicant's proposal.

5.2 COMPREHENSIVE DEVELOPMENT AND RECOMMENDED ALTERNATIVE

Sections 4(e) and 10(a)(1) of the FPA require the Commission to give equal consideration to the power development purposes and to the purposes of energy conservation; the protection, mitigation of damage to, and enhancement of fish and wildlife; the protection of recreational opportunities; and the preservation of other aspects of environmental quality. Any license issued shall be such as in the Commission's judgment will be best adapted to a comprehensive plan for improving or developing a waterway or waterways for all beneficial public uses. This section contains the basis for, and a summary of, our recommendations for licensing the Reedsport Project. We weigh the costs and benefits of our recommended alternative against other proposed measures.

Based on our independent review of agency and public comments filed on this project and our review of the environmental and economic effects of the proposed project and its alternatives, we selected the staff alternative, as the preferred option. We recommend this option because: (1) issuance of an original hydropower license by the

Commission would allow OPT to construct and operate the project as a dependable source of electrical energy for the region (4,140 MW annually); (2) the 1.5 MW of electric energy generated from a renewable resource may offset the use of fossil-fueled, steam-electric generating plants, thereby conserving nonrenewable resources and reducing atmospheric pollution; (3) the recommended measures would adequately protect, mitigate, and enhance fish and wildlife resources affected by the project; and (4) the monitoring proposed for the project would provide an improved understanding of the environmental effects of wave energy projects, which would be instrumental in assessing the potential effects of future projects of this type and identifying measures to minimize adverse environmental effects.

In the following section, we make recommendations as to which environmental measures proposed by OPT or recommended by agencies and other entities should be included in any license issued for the project. In addition to OPT's proposed environmental measures, we recommend the inclusion of additional staff-recommended environmental measures in any license issued for the project.

Measures Proposed by OPT

Based on our environmental analysis of OPT's proposal discussed in section 3.0 and the costs discussed in section 4.0, we recommend including the following environmental measures proposed by OPT in any license issued for the project. Our recommended modifications to OPT's proposed measure are shown in *italics*

General

- Implement the Adaptive Management Process, or AMP (included in sections 3.3, 4.2, and 7.5 and exhibit B of the Settlement Agreement). *We modify this measure to require that results from monitoring of EMF and acoustic emissions at the single PowerBuoy be reviewed to assess the need for project modifications to address any unanticipated adverse effects before additional PowerBuoys are installed. We require OPT to file the monitoring results and any proposed project modifications for Commission approval.*

- Implement the Operation & Maintenance Plan (included in appendix B of the APEA, incorporated by reference on page 9 of the Settlement Agreement). *We modify this measure to require that underwater inspections for derelict fishing gear snagged on underwater project components be conducted every month, weather and ocean conditions permitting, for the first year after deployment of the 10-buoy array.*

Geologic and Soil Resources

- Install the transmission cable through the existing wastewater discharge pipeline to eliminate effects of crossing nearshore, intertidal, and dune habitat.

- Install the onshore portion of the transmission line within the existing wastewater discharge pipeline to minimize potential visual, cultural, and environmental effects.

Water Resources

- Implement the Spill Prevention Control and Countermeasure (SPCC) Plan (included in appendix F of the APEA, incorporated by reference on page 9 of the Settlement Agreement). *We modify this measure to require OPT to file an addendum to the plan, for Commission approval, that identifies any fluids that would be used in the USP and identifies monitoring provisions that would be used to detect leakage of any fluids from the USP that could cause adverse environmental effects*.

- Implement wave, current, and sediment transport monitoring (included in appendix A of the Settlement Agreement).

Aquatic Resources

- Implement fish and invertebrates monitoring (included in appendix A of the Settlement Agreement).

- Implement EMF monitoring (included in appendix A of the Settlement Agreement).

Marine Mammals, Reptiles, and Birds

- Equip PowerBuoys with devices or materials to prevent pinniped haul-out.

- Implement cetacean monitoring (included in appendix A of the Settlement Agreement).

- Implement pinniped monitoring (included in appendix A of the Settlement Agreement).

- Implement offshore avian use monitoring (included in appendix A of the Settlement Agreement).

- Light PowerBuoys in accordance with Coast Guard regulations with consideration of protection for offshore birds and recreational and commercial fishing vessels.

- Implement OPT's proposed protocols for reporting marine mammal injury (included in appendix A of the Settlement Agreement). *We modify this measure to include implementing the same protocol for marine turtles.*

Recreation, Ocean Use, and Land Use

- Implement the Emergency Response and Recovery Plan (included in appendix I of the APEA, incorporated by reference on page 9 of the Settlement Agreement).

- Implement the Crabbing and Fishing Plan (included in appendix A of the Settlement Agreement). *We modify this measure to require that OPT consult with Oregon DFW, Southern Oregon Ocean Resource Coalition (SOORC), and the Crabbing and Fishing Committee to complete the following elements of the plan and file them with the Commission for approval:*

    1. *Methods to minimize the potential for loss of fishing gear and a protocol to recover or provide mitigation for fishing gear that becomes entangled in the PowerBuoy array.*

    2. *Procedures for initiating a transport moratorium during the first 8 weeks of the Dungeness crab season.*

    3. *Establishment of a predetermined transit lane from the port to the PowerBuoy array for project-related vessels during construction and normal maintenance and a plan for providing a 2-week notice of PowerBuoy transport associated with scheduled maintenance.*

    4. *A plan and schedule for the process that would be followed to obtain designation of the project area as a Restricted Navigation Area by the Coast Guard and as a No Fishing Area by Oregon FWC, including filing a report on the outcome of the process prior to the start of project construction.*

    5. *A marine use/public information plan to inform commercial and recreational users of the changes in use designation and provide information about location, hazards, and how to manage a vessel that inadvertently enters the PowerBuoy array area.*

- Bury the subsea transmission cable in the seabed to minimize hazards to navigation and fishing.

- Locate subsurface floats (underwater mooring floats) at depths of 30 to 50 feet to avoid potential vessel strike.

- Develop and implement an interpretive and education plan (including design and installation of interpretive displays on shore) (included in appendix B of the Settlement Agreement).

Aesthetic Resources

- Conduct a visual assessment review from the beach, from the top of a dune near the beach, and from the Umpqua Lighthouse following installation of the single PowerBuoy to be deployed in Phase I of the project (included in appendix B of the Settlement Agreement).

Cultural Resources

- Implement the Terrestrial and Cultural Resource Plan (appendix D of the Settlement Agreement), including a Cultural Resources Survey, Monitoring, and Contingency Mitigation Plan consistent with the MOU signed with the CTCLUSI. *We modify this measure to require that: (1) OPT would consult with the Oregon SHPO and the CTLUSI if additional ground-disturbing activities are proposed over the license term; (2) in the event that human remains or cultural resources are inadvertently discovered during the course of project construction or over the license term, all land-clearing and land-disturbing activities in the vicinity of the discoveries would cease and OPT would consult with the Oregon SHPO and the CTCLUSI to determine appropriate actions; and (3) OPT would consult with Oregon DFW and FWS if new information indicates any potential effects on terrestrial wildlife, plants, or their habitats as affected by project features, and any measures that are needed to address these effects would be submitted for Commission approval.*

Additional Measures Recommended by Staff

In addition to OPT's proposed measures listed above, we recommend including the following staff-recommended measure in any license issued for the Reedsport Project:

- *Require OPT to consult with the Aquatic Resources and Water Quality Implementation Committee concerning the use of any materials, not originally listed in the license application or Settlement Agreement, that* *could cause harmful effects to fish, wildlife or the environment if released into the environment.*

- *Require that any closures on Sparrow Park Road during project construction be scheduled to occur outside of the summer recreation season, any road closures occur only during weekday work hours, and the public be notified in advance of any road closures.*

The following discussion provides the basis for our recommendations for licensing the OPT Wave Park Project.

Emergency Response and Recovery

Although the PowerBuoy array is designed to withstand all ocean conditions that might occur at the Reedsport site, there is a possibility that an unforeseen event could compromise the mooring system of one or more buoys or otherwise create a hazardous situation. If a buoy were to be displaced out of the deployment area, it could pose a navigation hazard, and it could cause a range of problems if it drifted to the shore before it was recovered (e.g., hazard to public safety, damage to shoreline structures or habitat, or spill of hydraulic fluid). OPT developed an Emergency Response and Recovery Plan that provides notification procedures and preparedness actions for six types of situations: (1) the PowerBuoy has moved outside of pre-set boundaries, or the PowerBuoy has sunk; (2) an electrical fault has occurred either offshore or onshore; (3) oil has leaked outside of the PowerBuoy; (4) navigation lights are not working; (5) an electrical cable has been damaged or exposed onshore; and (6) a vessel has collided with one or more PowerBuoy components.

The plan addresses the major types of emergency conditions that might occur during normal operation and maintenance activities, identifies lines of communication with regulatory agency personnel, and establishes response actions for emergency situations or system failure. Implementation of procedures described in the Emergency Response and Recovery Plan should minimize the potential for causing adverse effects, if one of the situations described in this plan were to occur. The cost of the Emergency Response and Recovery Plan is included in OPT's O&M costs, and we expect that implementing the plan would be a minor component of the overall O&M costs. We conclude that the benefits described above outweigh the costs and recommend that the plan be adopted.

Spill Prevention and Containment

A potential exists for spills of fuel, lubricants and hydraulic oil from vessels during project construction and maintenance, and a vessel strike on a PowerBuoy could result in the release of hydraulic fluids. OPT's proposed SPCC Plan provides facility-specific information relating to oil-filled equipment, containment, and transfer operations, and outlines procedures for spill prevention, control, and containment activities.

In section 3.3.2, *Water Resources*, we describe design features that OPT incorporated to minimize the potential for leakage or spills of hydraulic fluid from the PowerBuoys. These include: (1) containment of the hydraulic system within the steel PowerBuoy structure, with the spar acting as a secondary containment system capable of holding more than 110 percent of the fluid in the hydraulic system; (2) lack of hydraulic components located external to the PowerBuoy; (3) the absence of any hydraulic seals exposed directly to the ocean, with each seal being backed up with an end cap that captures any fluid leakage; and (4) hydraulic fluid pressure and volume monitored by the PowerBuoy computer and available via radio and fiber optic link, with sensors inside the bottom of the spar that would detect fluid leakage and trigger an alarm to alert OPT and initiate its proposed SPCC Plan. We also note in section 3.3.2 that the SPCC plan does not describe any fluids in the USP that could cause environmental damage if released, or any method to monitor for leaks from the USP. We therefore recommend that OPT file an addendum to the SPCC plan, for Commission approval, to list any such fluids that would be in the USP and methods that would be used to monitor for leakage if such fluids are used.

SPCC plans are required by Coast Guard regulations for facilities having the potential to spill oil into a navigable waterway or a stream/river leading to a navigable waterway. Accordingly, development and implementation of the SPCC Plan would be required for the operation of the project. The use of licensed, insured operators with their own spill response plans, in combination with implementing the proposed SPCC Plan, would minimize the potential for spills and associated impacts during construction and operation of the project. The cost of the SPCC Plan is included in OPT's O&M costs for the project. However, we expect that the cost of the SPCC Plan would be a minor component of the overall O&M costs. We conclude that the benefits described above outweigh the costs and recommend that the plan be adopted.

Adaptive Management

In section 3.0 of the EA, we conclude that constructing and operating the project would be likely to have only minor adverse effects on environmental resources. This conclusion is based on the small scale and location of the project, design features that have been incorporated to minimize adverse effects, and our review of the best available scientific information. However, because the project would be the first multi-unit deployment of wave-energy conversion devices in the United States, monitoring with regard to any unanticipated effects may be warranted. We evaluate the specific monitoring elements proposed by OPT in following sections.

To guide implementation of the monitoring proposed by OPT and address any unforeseen effects, OPT and the other settlement parties agree to participate in an ongoing AMP. The AMP would be guided and implemented by a Coordinating Committee and four Implementation Committees (Aquatic Resources and Water Quality, Recreation and Public Safety, Crabbing and Fishing, and Terrestrial and Cultural Resources). Key functions of the Implementation Committees would be to: (1) review quarterly status reports on monitoring results and monitoring plans for the coming quarter; (2) review monitoring results to determine whether results are properly characterized and whether any relevant screening criteria (which would trigger a review of potential management actions) have been met; (3) determine resource management objectives and formulate or revise screening criteria; (4) evaluate response plans prepared by OPT when an Implementation Committee determines that a change in the project is required; (5) determine any actions needed to address critical adverse effects that require an immediate response; (6) provide input on annual reports to be filed with the Commission; and (7) participate in dispute resolution procedures when unable to reach consensus.

OPT's proposal includes collection and reporting of baseline EMF data and sound and EMF measurements from the single buoy that would be initially installed as a "test project."[30] OPT would review the findings of this initial monitoring with the Aquatic Resources and Water Quality Implementation Committee to determine whether any additional actions are needed, if monitoring results indicate that EMF or acoustic emissions are at levels that are of concern. To ensure any actions that are needed to protect aquatic resources, including listed species, are implemented before additional PowerBuoys are installed, we recommend that OPT file the initial monitoring report, any agency comments on the monitoring report, and any actions that are recommended by the committee for Commission review and approval before any additional PowerBuoys are installed.

We conclude that the AMP defined in OPT's proposal provides an appropriate framework to guide implementation of monitoring efforts, modify these efforts as needed, and identify appropriate potential measures to address any unanticipated adverse effects. The feedback loop that the AMP provides is especially important given the very limited amount of information that is available from constructed wave energy conversion projects. We estimate that hosting and supporting meetings to implement the AMP would have an annualized cost of $23,510. Based on the benefits described above, we recommend implementation of the plan and conclude that the cost of implementing the AMP is warranted.

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[30] *Verdant Power LLC,* 111 FERC ¶ 61,024 (2005)

Wave, Current, and Sediment Transport Monitoring

Because PowerBuoys extract and absorb power from passing waves, the project could affect nearshore currents and aquatic habitat, erosion and accretion at the beach, and surfing opportunities. To address these concerns, OPT proposes to monitor waves, currents, and sediment transport.

Based on numerical modeling, OPT estimates that the maximum attenuation of wave amplitude would be about 12 percent directly behind the PowerBuoys and 2.1 percent at the beach. The proposed monitoring is designed to evaluate project effects in more detail, including identifying the near-field effects of the PowerBuoys, and assessing the bathymetry, shoreline contour, and water column properties to capture anomalous nearshore effects. The monitoring would include *in situ* observations of the wave field, the vertical structure of horizontal currents and water column properties, and synoptic observations of the wave field near the PowerBuoys (with an X-band radar system). Changes to the topography and bathymetry would also be monitored using regular beach surveys, as well as a video-based monitoring system. A numerical model of the effects of the PowerBuoys on the wave field would then use these measurements to predict project effects, if any, on waves, currents, and sediment transport in the project vicinity.

The proposed wave, current, and sediment transport monitoring would provide information about sediment transport and any unanticipated effects of the project on wave energy, ocean currents, shoreline aquatic habitats, and erosion or accretion of the shoreline. Because of the small scale of the proposed installation and the substantial distance offshore that the PowerBuoy array would be deployed, we consider it unlikely that substantial nearshore effects would occur. However, information gained from the monitoring would be useful for evaluating the effects of larger wave energy projects proposed along the Oregon Coast. In the event that any adverse effects from changes in waves and currents are observed, further evaluation of these effects could be developed through the proposed AMP. Based on the benefits described above, we recommend this monitoring and conclude that the estimated annualized cost of $44,390 is warranted.

Fish and Invertebrates Monitoring

Construction and operation of the Reedsport Project would alter seabed, pelagic, and surface habitats in the project vicinity. Effects on the marine community could include direct effects on the benthic community from placement of project mooring components on the seabed and trenching of the subsea transmission cable, and changes to marine community composition and predator/prey interactions throughout the water column from the creation of new habitat features.

Over time, the proposed project’s anchoring and mooring systems would likely provide habitat for a variety of aquatic biota, including structure-oriented fish, such as rockfish. In particular, concern has been expressed that juvenile ESA-listed salmonids may be attracted to the PowerBuoys for food or cover, potentially increasing their potential for predation by pinnipeds, seabirds, or other fish that are attracted to project structures.

We conclude in section 3.3.3, *Aquatic Resources*, that the potential for attraction of juvenile salmonids to the project area is very limited due to the small scale of the array and the distance between the PowerBuoys and mooring components. OPT's proposal to conduct monitoring to characterize and describe the abundance of key fish and invertebrate species in the project area prior to and following deployment of the PowerBuoy array would help to confirm the expected limited nature of this effect. Additional information about the potential attraction of seals and sea lions to project structures would be provided from OPT's proposed pinniped monitoring. As discussed in section 3.3.3, *Aquatic Resources*, we find that OPT's monitoring proposal would provide information about any unanticipated project effects on the existing aquatic community, including the potential effects of attraction of predatory fish on juvenile salmonids. Based on these benefits, we recommend monitoring and conclude that the estimated annualized cost of $90,240 is warranted.

Electromagnetic Field Monitoring

OPT proposes to conduct monitoring to determine the physical characteristics of EMFs that are generated by the PowerBuoy array and transmission cable, evaluate which marine organisms might be affected, and estimate the magnitude of potential effects. Based on our analysis in section 3.3.3, *Aquatic Resources*, we conclude that the magnitude of EMFs and their potential effects on aquatic biota would likely be minor because the design of the PowerBuoys would reduce electromagnetic emissions from devices inside the enclosure/cage and the shielding and burying of the transmission cable would minimize EMF from this source. However, wave energy conversion devices such as PowerBuoys are a new technology, and there is no experience with wave energy projects along the Pacific Coast. As a result, monitoring may be warranted to confirm that EMF levels are not high enough to cause adverse effects on aquatic resources or attract sharks to the project area. Based on these benefits, we recommend this monitoring and conclude that the estimated annualized cost of $15,460 is warranted.

Noise and Vibration

Human-caused underwater noise and vibration have the potential to adversely affect cetaceans (whales) by interfering with communication, prey and predator detection, and navigation and by causing temporary or permanent hearing loss. Noise has the potential to alter migration patterns, if cetaceans respond to noise by avoiding it, or increase the potential for collision or entanglement, if cetaceans respond to it by investigating. Sources of noise associated with project include vessels and equipment used to install and maintain the PowerBuoy array and transmission cable, and noise associated with the PowerBuoys during operation.

As discussed in section 3.3.4, *Marine Mammals, Reptiles and Birds,* as many as 6 ESA-listed and 17 non-ESA-listed cetaceans have the potential to occur in the project area, but under current conditions, only the harbor porpoise and gray whale are common. Based on the types of vessels and activities that would occur during construction, we expect that source levels of noise during construction would exceed 120 dB, the level that NMFS currently considers as a threshold for continuous and intermittent sources of noise that can cause harassment by altering marine mammal behavior. In section 3.3.4, *Marine Mammals, Reptiles and Birds,* we conclude that cetaceans may be exposed to noise levels exceeding 120 dB within a relatively small area as a result of most construction activities, but within a wider area for a short duration during trenching. Scheduling installation of the PowerBuoys during the summer (outside the gray whale migration period), as OPT proposes, would prevent disturbance to migrating gray whales.

We expect that any effects of noise and vibration during construction on other cetaceans would be minor, based on the small area where high noise levels would occur and limited duration of construction activities. Because noise levels generated by the PowerBuoys during project operation are expected to be close to ambient ocean noise levels, we conclude that the potential for adverse affects on cetaceans would also be very low.

OPT's proposed cetacean monitoring efforts would help to identify any unanticipated adverse impacts. Phase I monitoring, which has already been conducted, included monitoring the gray whale migration at Yaquina Head, summarizing the key findings from the October 2008 workshop, and developing a strategy to avoid whale collisions and entanglement and a draft approach for monitoring the behavior of whales near the project. The information gathered during Phase I formed the basis for Phases II and III of OPT's proposed cetacean monitoring program.

In Phase II of the cetacean monitoring, OPT would measure acoustic emissions from the first installed PowerBuoy under a range of sea states. If sound pressure levels of 120 dB or higher (the level of continuous noise NMFS currently considers to be the threshold for Level B harassment) are detected, the process defined in the AMP would be used to determine whether any additional steps, including measuring the acoustic emissions of the 10-buoy array, are needed.

Phase III of the cetacean monitoring would provide information about how whales move through the project area. OPT proposes shore-based monitoring during the first migration season following deployment of the 10 PowerBuoy array and boat-based monitoring to supplement these observations throughout the life of the project.

We agree that shore-based monitoring would allow OPT to document whether and how whales deflect their migration paths to avoid the array, but limiting the shore-based surveys to one migration season may not be adequate to capture the variability of responses that cetaceans may have to the array. Boat-based surveys have the potential to alter cetacean behavior and would not be scheduled to cover all months of the gray whale migration. Additional shore-based monitoring (i.e., in years 2 and 3, post-deployment) would provide OPT and the Aquatic Resources and Water Quality Implementation Committee with information needed to determine whether acoustic deterrence measures (e.g., acoustic devices known as pingers) should be used to deter gray whales and other cetaceans from entering the buoy array. The potential need to extend the duration of shore-based monitoring beyond the first migration season could be addressed through the proposed AMP.

Phases II and III of the cetacean monitoring would help determine whether there are any unanticipated adverse effects of acoustic emissions associated with the project on whale migration and would help determine whether acoustical deterrence measures may be needed to reduce the potential for whale entanglement. Acoustic monitoring conducted during Phase II would also provide information that would help confirm that noise and vibration associated with operation of the project do not occur at levels that could adversely affect the fish community in the project vicinity. Based on the benefits described above, we recommend this monitoring and conclude that the estimated annualized cost of $10,090 is warranted.

Pinniped Monitoring

Use of the PowerBuoys as haul-out sites by pinnipeds (seals and sea lions) may adversely affect power production, pose a risk to maintenance workers that would occasionally require access to the PowerBuoys, and may increase predation rates on any ESA-listed salmon that are attracted to the PowerBuoy array's structure.

To address these concerns, OPT proposes to design the buoys to minimize the opportunity for pinnipeds to use them as haul-outs and monitor pinniped haul-out activity and the abundance of pinnipeds in the project area. As discussed in section 3.3.4, *Marine Mammals, Reptiles and Birds,* OPT proposes to coat the float of the single PowerBuoy to be deployed in Phase I with a slippery, ultra-high molecular weight polyethylene coating material to prevent pinnipeds from using the buoy as a haul-out. If haul-out activity is observed, OPT would consult with the Aquatic Resources and Water Quality Implementation Committee to consider additional measures, such as fences, that could be implemented to prevent haul-out on the buoys. We expect that these measures would be effective in preventing haul-out, thereby minimizing the attraction of pinnipeds to the project area. If a marked increase of pinnipeds in the area is found, the Aquatic Resources and Water Quality Implementation Committee would have the information needed to evaluate the results, in conjunction with results of other monitoring, to assess the need for further monitoring or identify any potential mitigation measures. Pinniped monitoring, which would be conducted in association with other monitoring and maintenance activities, would have no incremental cost. Given its nominal costs and the benefits described above, we conclude that the proposed pinniped monitoring is warranted.

Whale Entanglement

Among the cetaceans that may occur in the project area, gray whales are particularly vulnerable to collision and entanglement because they would migrate past the project area, and they often swim with their mouths open, which presents a potential adverse effect that mooring lines could become entangled in their mouths. If derelict fishing gear snags on project moorings, these lines could increase the potential for cetacean entanglement.

OPT's proposed O&M Plan includes inspection of the PowerBuoys for the accumulation of fishing gear and cetacean entanglement. Preventive maintenance/site inspection would occur monthly from the sea surface. Subsurface inspections would be completed every 2 or 3 months, weather permitting, in years 1 and 2 following deployment and then annually, while underwater inspections (by SCUBA or ROV) associated with cetacean monitoring would be performed every 3 to 4 months, weather permitting, in years 1, 2 and 5, and then annually. In the event that derelict fishing gear is found on the project array, OPT would remove it by any practicable means as soon as possible after it is detected. As part of the Crabbing and Fishing Plan, OPT would also work with the crabbing industry to identify ways to minimize the potential for entanglement of fishing gear on project structures.

If results of monitoring indicate that cetaceans are colliding with or becoming entangled with the mooring system, OPT would work with marine mammal experts and the Aquatics Resources and Water Quality Implementation Committee to identify measures (e.g., acoustic deterrence systems) and then monitor their effectiveness. As an immediate response to cetacean injury or entanglement, OPT proposes to implement the NMFS marine mammal injury response protocols included in appendix A of the Settlement Agreement. OPT also developed a protocol for reporting evidence of entanglement, collision, or injury to the Aquatic Resources and Water Quality Implementation Committee.

As discussed in section 3.3.4, *Marine Mammals, Reptiles and Birds,* the results of Phase III of the cetacean monitoring (post-deployment monitoring of cetacean movements through the project area) would not be available for at least 1 year following installation of the full array. In the absence of data to determine whether cetaceans are avoiding the array, inspections for lost fishing gear would be especially important. To ensure that any fishing gear that becomes snagged on project structures is promptly identified and removed during this period, we recommend conducting, on a monthly basis, underwater inspections of all underwater project structures, weather and ocean conditions permitting, during the first year of operation. The frequency of underwater inspections would be reduced to every 2 to 3 months in year 2 and then annually thereafter, as proposed in OPT's Operations and Maintenance Plan, unless more frequent inspections are determined to be necessary through the AMP.

Based on our analysis in section 3.3.4, *Marine Mammals, Reptiles and Birds,* we conclude that the design features of the project, including the 330-foot spacing between the buoys, the high tension on the tethering system, and the relatively large diameters of the mooring lines and cables should minimize the potential for entanglement with the PowerBuoy structures. Further, the more frequent underwater inspections that we recommend should minimize the potential for derelict fishing gear collecting on project structures, increasing the risk of whale entanglement.

OPT did not provide a cost estimate for conducting the underwater inspections that it recommends within the O&M Plan; it appears that OPT has included this cost estimate in the costs of constructing and operating the project. We estimate that the additional inspections that we recommend would have an annualized cost of $5,260, and we conclude that the reduced potential for whale entanglement provided by these additional inspections is worth this added cost.

Offshore Bird Collision

Migratory and resident waterbirds are habituated to flying through unobstructed habitats, when away from nesting and roost areas. Because the OPT PowerBuoys would rise 29.5 feet above the water surface, and the array would be located in a migratory corridor along the Oregon Coast, where large numbers of waterbirds are sometimes present, and the project area experiences a high incidence of rain, mist, fog, and low cloud cover, there is the potential for bird collisions. Required navigational lighting of the PowerBuoys is also a concern because lights have the potential to attract some bird species.

To minimize the potential for seabird attraction, OPT would shield the navigation lights on the PowerBuoys to direct light only toward approaching watercraft, not directly upward. Flash intensity would be designed to meet the minimum Coast Guard requirement for navigational safety, and the flash timing would be equal to or greater than 4 seconds. These measures, in conjunction with the relatively low height of the PowerBuoys, are expected to result in a low potential for adversely affecting offshore avians.

OPT also proposes to conduct monitoring to identify any unanticipated adverse impacts to offshore avians. The monitoring would include: (1) assessing avian use of the PowerBuoy array by the bird community as a whole; (2) conducting risk-assessment modeling to estimate the annual fatality of seabirds at the array; and (3) evaluating behavioral-avoidance/collision rates to collect information about avian avoidance behavior and fatality at the array. If a problem is identified with avian collision, OPT proposes to work on conducting additional monitoring or identify any appropriate potential mitigation measures, such as reconfiguring the PowerBuoy array, modifying the lighting system's flash timing, installing markers or diverters, with the Aquatics Resources and Water Quality Implementation Committee at that time.

As discussed in section 3.3.4, *Marine Mammals, Reptiles and Birds,* we expect that several design factors, including low vertical profile of the buoys, absence of guy wires or stays, shielded lighting, and appropriate flash timing, are likely to result in a low potential for avian collision. The offshore avian use monitoring proposed by OPT would help identify any additional potential mitigation measures that may be needed if any unanticipated adverse effects are identified. Based on the benefits described above, we recommend this monitoring and conclude that the estimated annualized cost of $24,220 is warranted.

Crabbing, Fishing, and Navigation

The installation of the PowerBuoy array would reduce the area available for commercial crabbing and commercial and recreational fishing; it also has the potential to impede or present a hazard to navigation. To limit the potential for vessel collisions with project structures and the loss of fishing gear, OPT proposes the buoy deployment area be designated as a No Fishing Zone by the Oregon FWC and as a Restricted Navigation Area by the Coast Guard. Because NOAA's recommended vessel travel path falls approximately 17 miles west of proposed project boundary, and vessels of 300 gross tons or larger are encouraged to voluntarily stay a minimum distance of 25 miles from the shoreline, we conclude that the project would have no effect on navigation of larger ocean-going vessels.

To address potential effects on crabbing, fishing, and navigation, OPT proposes to identify the buoy deployment area on navigation charts, illuminate the buoys, and implement its Crabbing and Fishing Plan, which includes: (1) locating the PowerBuoy in an area within the proposed project boundary that would minimize the potential for entanglement of fishing gear; (2) working with Oregon DFW, SOORC, and the Crabbing and Fishing Implementation Committee to identify ways to minimize the potential for loss of fishing gear and develop a protocol to recover or mitigate for gear that becomes entangled in the PowerBuoy array; (3) imposing a transport moratorium on project vessels during the first 8 weeks of every crab season, establishing a predetermined transit lane from the port to the PowerBuoy array for project vessels, and providing a 2-week notice of PowerBuoy transport; (4) joining the Oregon Fishermen's Cable Committee and following relevant procedures for the buried cable; (5) locating subsurface floats at a depth of 30 to 50 feet to avoid potential vessel strikes;

(6) developing and implementing a marine use/public information plan; and (7) conducting a meeting of the Crabbing and Fishing Implementation Committee at least annually and more often as necessary to assess project effects on commercial crabbing and fishing. OPT also proposes to develop and implement an interpretive and education plan, which would include the design and installation of an interpretive display on shore near the Sparrow Park Road terminus.

As we discuss in section 3.3.7, *Recreation, Ocean Use, and Land Use*, designating a No Fishing Zone by Oregon FWC or restricting access by the Commission for public safety purposes would preclude crabbing in approximately 30 acres of prime crabbing area. However, we expect that this effect on the crab fishery would be at least partially offset by an increase in catch rates due to increased densities of crabs adjacent to the project. Measures included in the Crabbing and Fishing Plan would reduce adverse effects of fishing gear loss and navigation hazards by ensuring that crabbers and other users are aware of the project location and of potential project-related hazards, minimizing conflicts with project vessels during construction and operation of the project, recovering or providing mitigation for fishing gear that becomes entangled in the PowerBuoy array, and working with stakeholders to identify other methods to reduce gear loss and otherwise reduce user conflicts. Developing and implementing the interpretive and education plan would also help to inform the public about the location and composition of project facilities.

OPT proposes that several elements of the proposed Crabbing and Fishing Plan be further developed and refined after consultation with Oregon DFW, SOORC and the Crabbing and Fishing Committee. These elements include: (1) identifying ways to minimize the potential for loss of fishing gear and developing a protocol to recover or provide mitigation for fishing gear that becomes entangled in the PowerBuoy array; (2) developing procedures for initiating a transport moratorium during the first 8 weeks of the Dungeness crab season; (3) establishing a pre-determined transit lane from the port to the PowerBuoy array for project-related vessels during construction and normal maintenance and a plan for providing a 2-week notice of PowerBuoy transport associated with scheduled maintenance; (4) obtaining designation of the project area as a Restricted Navigation Area by the Coast Guard and as a No Fishing Area by Oregon FWC, and (5) implementing a marine use/public information plan to inform commercial and recreational users of the changes in designation and provide information about location, hazards, and how to manage a vessel that inadvertently enters the PowerBuoy array area. We recommend that OPT develop these elements in consultation with the Oregon DFW, SOORC, and the Crabbing and Fishing Committee and file the completed plans with the Commission for approval. We also recommend that any closures on Sparrow Park Road occur outside of the summer recreation season and any closures occur only during weekday work hours, as well as define a process for notifying the public in advance of any closures that are required.

With implementation of these measures, we expect that any adverse effects of the project on crabbing, fishing, and navigation would be minor. Because of the importance of navigation safety and of the crabbing industry to the local economy, and the benefits of reducing adverse effects on navigation safety and the crabbing industry, we conclude that the estimated annualized costs of $3,870 for finalizing and implementing the Crabbing and Fishing Plan and $520 for developing and implementing an interpretive and education plan are warranted.

5.3 UNAVOIDABLE ADVERSE EFFECTS

Given the size and location of the proposed project—10 PowerBuoys and located 2.5 nautical miles offshore—the overall scale of any adverse effects on most resource are expected to be minor. Any effects on waves, current, and sediment transport processes are unlikely to be detectable within the range of natural variation of conditions that occur along this section of the Oregon Coast. We draw the same conclusion for any effects on water quality.

Unavoidable adverse effects on fisheries biota include covering a small area of the sea bottom with anchors, which would kill or displace some marine organisms. Because this bottom structure and preclusion of commercial fishing would likely increase the abundance of some predacious species such as rockfish, some increase in predation on smaller fish may occur.

Location of the PowerBuoy array within the migration route of gray whales creates a potential for whale entanglement or injury, and of impeding whale migration if whales alter their migration route to avoid the array. Similarly, there is the potential for some birds to be injured or killed if they collide with above-water portions of the PowerBuoys.

Unavoidable adverse effects on the crabbing and fishing industry include the loss of area associated with the array footprint (30 acres) and the loss of fishing gear or fishing time associated with gear entanglement on project structures and gear damage caused by project vessels used during construction and maintenance of the project. However, OPT proposes several measures that would minimize or mitigate for these impacts.

Other than a minor loss of area available for recreational fishing, no unavoidable adverse effects on recreation, land use, or cultural resources are anticipated.

5.4 SUMMARY OF SECTION 10(J) RECOMMENDATIONS AND 4(E) CONDITIONS

5.4.1 Fish and Wildlife Agency Recommendations

Under the provisions of section 10(j) of the FPA, each hydroelectric license issued by the Commission shall include conditions based on recommendations provided by federal and state fish and wildlife agencies for the protection, mitigation, or enhancement of fish and wildlife resources affected by the project.

Section 10(j) of the FPA states that whenever the Commission believes that any fish and wildlife agency recommendation is inconsistent with the purposes and the requirements of the FPA or any other applicable law, the Commission and the agency shall attempt to resolve any such inconsistency, giving due weight to the recommendations, expertise, and statutory responsibilities of such agency.

In response to our REA notice, the following fish and wildlife agencies submitted recommendations for the project: Interior (filed on August 30, 2010), Oregon DFW (filed on August 30, 2010), and NMFS (filed on August 31, 2010). Table 24 lists the federal and state recommendations filed pursuant to section 10(j) and whether the recommendations are adopted under the staff alternative. Environmental recommendations that we consider outside the scope of section 10(j) have been considered under section 10(a) of the FPA and are addressed in the specific resource sections of this document and the previous section. We recommend adopting all 10 of the agencies' fish and wildlife recommendations that we consider to be within the scope of section 10(j).

Table 24. Fish and wildlife agency recommendations for the Reedsport Project (Source: staff).

Recommendation	Agency	Within the Scope of 10(j)?	Annualized Cost	Adopted or Not Adopted
1. Implement monitoring to identify any unanticipated potential effects on cetaceans	Interior, Oregon DFW, NMFS	Yes	$10,090	Adopted
2. Implement monitoring to identify any unanticipated potential EMF effects	Interior, Oregon DFW, NMFS	Yes	$15,460	Adopted

Recommendation	Agency	Within the Scope of 10(j)?	Annualized Cost	Adopted or Not Adopted
3. Implement monitoring to identify any unanticipated effects on pinniped abundance and use of PowerBuoys	Interior, Oregon DFW, NMFS	Yes	$0[a]	Adopted
4. Implement monitoring to identify any unanticipated effects of project installment on fish and invertebrate communities	Interior, Oregon DFW, NMFS	Yes	$90,240	Adopted
5. Implement monitoring to identify any unanticipated effects on offshore avians	Interior, Oregon DFW, NMFS	Yes	$24,220	Adopted
6. Implement monitoring of waves, currents, and sediment transport to identify any unanticipated effects on nearshore aquatic habitat and snowy plover beach habitat	Interior, Oregon DFW, NMFS	Yes	$44,390	Adopted
7. Implement the AMP, including consultation and approval requirements to address any unanticipated adverse effects on fish and wildlife habitat	Interior, Oregon DFW, NMFS	No. Not a specific measure to protect, mitigate, or enhance fish and wildlife resources	$23,510	Adopted

Recommendation	Agency	Within the Scope of 10(j)?	Annualized Cost	Adopted or Not Adopted
8. Develop a decommissioning plan	Interior, Oregon DFW, NMFS	No. Not a specific measure to protect, mitigate, or enhance fish and wildlife resources	$0[b]	Adopted[c]
9. Notify agencies in the event of fish or wildlife emergency circumstances	Interior, Oregon DFW, NMFS	No. Not a specific measure to protect, mitigate, or enhance fish and wildlife resources	$0[d]	Adopted
10. Implement the O&M Plan and consult with the Aquatic Resources and Water Quality Implementation Committee concerning the use of any materials, not originally listed in the license application or Settlement Agreement, that could cause harmful effects to fish, wildlife or the environment if released into the environment.	Interior, Oregon DFW, NMFS	Yes	$0[e]	Adopted
11. Implement the Spill Prevention Control and Countermeasure Plan	Interior, Oregon DFW, NMFS	Yes	$0[f]	Adopted
12. Implement the Emergency Response/Recovery Plan	Interior, Oregon DFW, NMFS	Yes	$0[f]	Adopted

Recommendation	Agency	Within the Scope of 10(j)?	Annualized Cost	Adopted or Not Adopted
13. Implement the Terrestrial and Cultural Resources Plan and consult with Interior and Oregon DFW if new information indicates any potential effects on terrestrial wildlife, plants, or their habitats as affected by the project features, including cable routes or transmission lines	Interior, Oregon DFW	No. Not a specific measure to protect, mitigate, or enhance fish and wildlife resources	$0[e]	Adopted
14. Implement the Crabbing and Fishing Plan (includes a marine use/public information plan)	Oregon DFW	Yes	$3,880	Adopted

[a] OPT stated that the cost to implement this measure is synergistic with the cost of deployment.

[b] No cost estimated—plan would not need to be developed unless the project is decommissioned.

[c] Commission licenses for unconstructed minor projects affecting navigable waters and lands of the United States include L-Form 19 with standard article 25 addressing site restoration as part of the surrender of a license with the intent to decommission the project. The elements of a decommissioning plan recommended by FWS, NMFS, and Oregon DFW would be addressed in the decommissioning plan, if the licensee proposes to surrender the license and retire the project.

[d] No cost estimated—costs would be dependent on the frequency and nature of any fish and wildlife emergencies that occur.

[e] OPT did not provide costs for this measure, so we assume that it is included in the project construction capital cost.

[f] OPT stated that there would be no cost unless the plan needs to be implemented at some point in the future and that other costs would be included in routine operation and maintenance costs.

[g] No cost estimated.

5.4.2 Land Management Agencies' Section 4(e) Conditions

In section 2.2.5, *Modifications to Applicant's Proposal—Mandatory Conditions*, we list the preliminary 4(e) conditions submitted by the Forest Service, and note that section 4(e) of the FPA provides that any license issued by the Commission "for a project within a federal reservation shall be subject to and contain such conditions as the Secretary of the responsible federal land management agency deems necessary for the adequate protection and use of the reservation." Thus, any 4(e) condition that meets the requirements of the law must be included in any license issued by the Commission, regardless of whether we include the condition in our staff alternative.

Of the Forest Service's 4 preliminary conditions, we consider 3 of the conditions (conditions 1, 3 and 4) to be administrative or legal in nature and not specific measures requiring detailed analysis in this EA. We, therefore, do not analyze these conditions in this EA. Below, we summarize our conclusions with respect to the remaining preliminary 4(e) condition. This preliminary condition is included in the staff alternative.

Condition	**Annualized Cost**	**Adopted?**
2—Prepare a site restoration plan for National Forest System lands if the project license is surrendered	$0	Yes

5.5 CONSISTENCY WITH COMPREHENSIVE PLANS

Section 10(a)(2)(A) of the FPA, 16 U.S.C.§803(a)(2)(A), requires the Commission to consider the extent to which a project is consistent with the federal or state comprehensive plans for improving, developing, or conserving a waterway or waterways affected by the project. Under section 10(a)(2)(A) of the FPA, federal and state agencies filed comprehensive plans that address various resources in Oregon. We determined that 28 comprehensive plans are relevant to the Reedsport Project (table 25). We found no inconsistencies.

Pursuant to section 10(a)(1) of the FPA, we reviewed the following documents that are relevant to the Reedsport Project: (1) Oregon Territorial Sea Plan; (2) Coastal Pelagic Species Fishery Management Plan; (3) Pacific Coast Groundfish Fishery Management Plan; (4) Douglas County Oregon Comprehensive Plan; (5) Oregon Native Fish Status Report; (6) Umpqua Lighthouse State Park Master Plan; and (7) Oregon Wildlife and Commercial Fishing Codes.

Table 25. Comprehensive plans relevant to the Reedsport Project.

Comprehensive Plan	Agency
Federal	
Siuslaw National Forest Land and Resource Management Plan, 1990	U.S. Forest Service, Department of Agriculture, Corvallis, Oregon
Final Environmental Impact Statement and Fishery Management Plan for Commercial and Recreational Salmon Fisheries off the Coasts of Washington, Oregon, and California Commencing in 1978, 1978	National Marine Fisheries Service and Pacific Fishery Management Council, Seattle, Washington.
Eighth Amendment to the Fishery Management Plan for Commercial and Recreational Salmon Fisheries off the Coasts of Washington, Oregon, and California Commencing in 1978, 1988	Pacific Fishery Management Council, Portland, Oregon
Amendment 14 to the Pacific Coast Salmon Plan (1997), 2000. Available at: http://www.pcouncil.org/salmon/fishery-management-plan/adoptedapproved-amendments/amendment-14-to-the-pacific-coast-salmon-plan-1997/	Pacific Fishery Management Council, Portland, Oregon
Appendix A—Identification and Description of EFH, Adverse Impacts, and Recommended Conservation Measures for Salmon: Amendment 14 to the Pacific Coast Salmon Plan, 1999. Available at: http://www.pcouncil.org/salmon/fishery-management-plan/adoptedapproved-amendments/amendment-14-to-the-pacific-coast-salmon-plan-1997/	Pacific Fishery Management Council, Portland, Oregon

Comprehensive Plan	Agency
Appendix B—Description of the Ocean Salmon Fishery and its Social and Economic Characteristics: Amendment 14 to the Pacific Coast Salmon Plan, August 1999. 109 pages. Available at: http://www.pcouncil.org/salmon/fishery-management-plan/adoptedapproved-amendments/amendment-14-to-the-pacific-coast-salmon-plan-1997/	Pacific Fishery Management Council, Portland, Oregon
State	
Columbia River Basin Fish and Wildlife Program, October 2009. Council Document 2009-09	Northwest Power and Conservation Council, Portland, Oregon
The Sixth Northwest Conservation and Electric Power Plan, February 2010. Council Document 2010–09	Northwest Power and Conservation Council, Portland, Oregon
Comprehensive Plan for Production and Management of Oregon's Anadromous Salmon and Trout: Part I. General considerations, June 1, 1982	Oregon Department of Fish and Wildlife, Portland, Oregon
Comprehensive Plan for Production and Management of Oregon's Anadromous Salmon and Trout: Part I. Coho Salmon Plan, June 1, 1982	Oregon Department of Fish and Wildlife, Portland, Oregon
North Umpqua River Fish Management Plan, May1986	Oregon Department of Fish and Wildlife, Portland, Oregon
Comprehensive Plan for Production and Management of Oregon's Anadromous Salmon and Trout: Coastal Chinook Salmon Plan, 1991	Oregon Department of Fish and Wildlife, Portland, Oregon
Oregon Wildlife Diversity Plan, 1993. Available at: http://www.dfw.state.or.us/wildlife/diversity/.	Oregon Department of Fish and Wildlife, Portland, Oregon
Comprehensive Plan for Production and Management of Oregon's Anadromous Salmon and Trout: Part III. Steelhead Plan, 1995	Oregon Department of Fish and Wildlife, Portland, Oregon

Comprehensive Plan	Agency
Biennial Report on the Status of Wild Fish in Oregon, 1995. Available at: http://www.dfw.state.or.us/ODFWhtml/Research&Reports/WildFishRead.html	Oregon Department of Fish and Wildlife, Portland, Oregon
Species at Risk: Sensitive, Threatened, and Endangered Vertebrates of Oregon, June 1996	Oregon Department of Fish and Wildlife, Portland, Oregon
Oregon Coastal Salmon Restoration Initiative, Vols. 1–5, 1997. Available at: http://www.oregon.gov/OPSW/archives/reports-subpage.shtml	Oregon Department of Fish and Wildlife, Roseburg, Oregon
Oregon Plan for Salmon and Watersheds, 1997. Available at: http://www.oregon-plan.org/OPSW/archives/archived.shtml#Anchor-Plan	Oregon Department of Fish and Wildlife, Salem, Oregon
An Interim Management Plan for Oregon's Nearshore Commercial Fisheries, October 11, 2002	Oregon Department of Fish and Wildlife, Salem, Oregon
Oregon Conservation Strategy, February 2006	Oregon Department of Fish and Wildlife, Salem, Oregon
Oregon Nearshore Strategy, January 2006	Oregon Department of Fish and Wildlife, Salem, Oregon
Oregon Coast Coho Conservation Plan for the State of Oregon, March 16, 2007	Oregon Department of Fish and Wildlife, Salem, Oregon
25-Year Recreational Angling Enhancement Plan, February 2009	Oregon Department of Fish and Wildlife, Salem, Oregon
Oregon Natural Heritage Plan, 2003	Oregon Department of State Lands, Salem, Oregon
Oregon Coastal Management Program, 1984.	Oregon Land Conservation and Development Commission, Salem, Oregon
Oregon Shore Management Plan, January 2005	Oregon Parks and Recreation Department, Salem, Oregon

Comprehensive Plan	Agency
Recreational Values on Oregon Rivers. April 1987	Oregon State Parks Recreation Division, Salem, Oregon
Fishery Management Plan for U.S. West Coast Fisheries for Highly Migratory Species, June 2007	Pacific Fishery Management Council, Portland, Oregon

6.0 FINDING OF NO SIGFICANT IMPACT

On the basis of our independent analysis, we conclude that approval of the proposed action, with our recommended measures, would not constitute a major federal action significantly affecting the quality of the human environment. Preparation of an environmental impact statement is not required.

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APPENDIX A

U.S. Forest Service Preliminary 4(e) Terms and Conditions for the Reedsport Project, FERC No. 12713

APPENDIX A

U.S. Forest Service Preliminary Terms and Conditions for the Reedsport OPT Wave Park Project

License articles contained in the Federal Energy Regulatory Commission's (Commission's or FERC's) Standard Form L-19 issued by Commission Order in October 1975, cover those general requirements that the Secretary of Agriculture, acting by and through the USDA Forest Service, considers necessary for adequate protection and utilization of the land and related resources of the Siuslaw National Forest. Under authority of section 4(e) of the Federal Power Act (16 U.S.C. § 797(e», the following terms and conditions are deemed necessary for adequate protection and utilization of National Forest System lands and resources. These terms and conditions are based on those resources enumerated in the Organic Administration Act of 1897 (30 Stat. 11), the Multiple-Use Sustained Yield Act of 1960 (74 Stat. 215), the National Forest Management Act of 1976 (90 Stat. 2949), and any other law specifically establishing a unit of the National Forest System or prescribing the management thereof (such as the Wilderness Act or Wild and Scenic Rivers Act), as such laws may be amended from time to time, and as implemented by regulations and approved Land and Resources Management Plans prepared in accordance with the National Forest Management Act. Therefore, pursuant to section 4(e) of the Federal Power Act, the following conditions covering specific requirements for protection and utilization of the National Forest System lands shall also be included in any license issued for the Reedsport Project (Project) and any license amendment issued.

USDA Forest Service Terms and Conditions

Condition No. 1—Implementation of the License on National Forest System Lands
Condition No. 2—Surrender of License or Transfer of Ownership
Condition No. 3—Indemnification
Condition No. 4—Reservation of Authority
Condition No. 5—Emergency Action Plans

Condition No. 1—Implementation of the License on National Forest System Lands

The Licensee shall not commence implementation of habitat or ground-disturbing activities on National Forest System (NFS) lands until the USDA Forest Service has approved site-specific project designs and issued a notice to proceed.

Additional NFS Lands. If long term occupancy of NFS lands is required for Project related purposes and such occupancy is not authorized by including such lands within the FERC Project boundary, the Licensee shall obtain a special-use authorization for occupancy and use of such NFS lands from the USDA Forest Service. Within three months of License issuance and before conducting any habitat or ground-disturbing activities on such NFS lands, the Licensee shall apply to the USDA Forest Service for a special-use authorization for occupancy and use of NFS lands, and shall file the special-use authorization with the Commission once obtained.

Additional lands authorized for use by the Licensee in a new special-use authorization shall be subject to laws, rules, and regulations applicable to the NFS. The terms and conditions of the USDA Forest Service special-use authorization are enforceable by the USDA Forest Service under the laws, rules, and regulations applicable to the NFS. Should additional NFS lands be needed for this Project over the License term and such lands are not included within the FERC Project Boundary, the special-use authorization shall be amended to include any additional NFS lands.

Approval of Changes on NFS Lands after License Issuance. Notwithstanding any License authorization to make changes to the Project, the Licensee shall receive written approval from the USDA Forest Service prior to making changes in the location of any constructed Project features or facilities on NFS lands, or in Project uses of NFS lands, or any departure from the requirements of any approved exhibits for Project facilities located on NFS lands filed by the Licensee with the Commission. Following receipt of such approval from the USDA Forest Service, and at least 60 days prior to initiating any such changes or departure, the Licensee shall file a report with the Commission describing the changes, the reasons for the changes, and showing the approval of the USDA Forest Service for such changes. The Licensee shall file an exact copy of the report with the USDA Forest Service at the time it is filed with the Commission.

Coordination with Other Authorized Uses on NFS Lands. In the event that portions of the Project area are under federal authorization for other activities and permitted uses, the Licensee shall consult with the USDA Forest Service to coordinate such activity with authorized uses before starting any activity on NFS land that the USDA Forest Service determines may affect another authorized activity.

Site-Specific Plans. The Licensee shall prepare site-specific plans subject to review and approval by the USDA Forest Service for habitat and ground-disturbing activities on NFS lands affected by the Project required by the License, including such activities contained within resource management plans required by the License to be prepared subsequent to License issuance. The Licensee shall prepare site-specific plans for planned activities one year, or as otherwise agreed to by USDA Forest Service, in advance of implementation dates required by the License, except for those activities planned in the first year after license issuance where the Licensee shall prepare site-specific plans for activities timely to allow USDA Forest Service review in advance of implementation. For emergency situations, where corrective or mitigation actions must be implemented immediately, the Licensee will coordinate with the USDA Forest Service to expedite approvals and/or permits.

Site-specific plans shall include:

1. A map depicting the location of the proposed activity and GPS coordinates.

2. Draft biological evaluations or assessments including survey data as required by regulations applicable to habitat or ground-disturbing activities on NFS lands in existence at the time the plan is prepared.

3. An environmental analysis of the proposed action consistent with the USDA Forest Service policy and regulations for implementation of the National Environmental Policy Act (NEPA) in existence at the time the plan is prepared for FERC Licensed projects on NFS lands. Environmental Analysis completed by the Commission or others may be relied upon as appropriate on a project specific basis as agreed to by USDA Forest Service.

4. A Spill Prevention and Control, and Hazardous Materials Plan for hazardous materials storage, spill prevention and cleanup on NFS lands, as needed, will be provided to USDA Forest Service for review and approval before work commences.

Surveys and Land Corners: The Licensee shall avoid disturbance to all public land survey monuments, private property corners, and forest boundary markers. In the event that my such land markers or monuments are destroyed by an act or omission of the Licensee, in connection with the use and/or occupancy authorized by the license, depending on the type of monument destroyed, the Licensee shall reestablish or reference same in accordance with (1) the procedures outlined in the "Manual of Instructions for the Survey of the Public Land of the United States," (2) the specifications of the County Surveyor, or (3) the specifications of the USDA Forest Service. Further, the Licensee shall ensure that any such official survey records affected are amended as provided for by law.

Justification

See Justification for Condition No.1 below in the Justification statement for Condition No. 2.

Condition No. 2—Surrender of License or Transfer of Ownership

At least 1 year in advance of filing an application for license surrender, the Licensee shall prepare a restoration plan for NFS lands approved by the USDA Forest Service. The restoration plan shall identify improvements to be removed, restoration measures, and time frames for implementation and shall be filed with the Commission as part of the surrender application.

Justification for Conditions Nos. 1 and 2.

The USDA Forest Service retains overall land management responsibility for activities that affect NFS lands, resources and programs required by the Project License. The USDA Forest Service must also be assured that acts or omissions of a Licensee related to the use and/or occupancy on NFS lands authorized by the License are the Licensee's responsibility. Condition No. 1 addresses administration, coordination and planning for Project-related activities and is intended, among other things, to provide for integration of the Project operations and activities with other land management activities and programs occurring within and adjacent to the Project area on NFS lands. Condition No.2 ensures that NFS lands will be restored consistent with 18 CFR § 6.2.

Condition No. 3—Indemnification

The Licensee shall indemnify, defend, and hold the United States harmless for any costs, damages, claims, liabilities, and judgments arising from past, present, and future acts or omissions of the Licensee in connection with the Licensee's use and/or occupancy of National Forest System lands authorized by this License. This indemnification and hold harmless provision applies to any acts and omissions of the Licensee or the Licensee's assigns, agents, employees, affiliates, subsidiaries, fiduciaries, contractors, or lessees in connection with the Licensee's use and/or occupancy of National Forest System lands authorized by this License which result in: (1) violations of any laws and regulations which are now or which may in the future become applicable, and including but not limited to environmental laws such as the Comprehensive Environmental Response Compensation and Liability Act, Resource Conservation and Recovery Act, Oil Pollution Act, Clean Water Act, Clean Air Act; (2) judgments, claims, demands, penalties, or fees assessed against the United States; (3) costs, expenses, and damages incurred by the United States (other than as contemplated by the license); or (4) the release or threatened release of any solid waste, hazardous substances, pollutant, contaminant, or oil in any form in the environment.

Justification

USDA Forest Service Condition No. 3 incorporates indemnification language used by the USDA Forest Service in authorizations for occupancy of NFS lands. This language is properly broader in scope than FERC's L-19 Article 20, which is expected to be included in the Project's License by the Commission, and addresses the full scope of Project related uses and activities (including public use of onshore recreational sites in proximity to the Project) that will occur under the new Project License.

Condition No. 4—Reservation of Authority

The Licensee shall implement, upon order of the Commission, such additional conditions as may be identified by the Secretary of Agriculture, pursuant to the authority provided in Section 4 (e) of the Federal Power Act, as necessary for the adequate protection and utilization of the public land reservations under the authority of the USDA Forest Service, provided that such additional conditions are necessary, based on compelling evidence, to address changed circumstances.

Justification

The USDA Forest Service has prepared Preliminary FPA § 4(e) Terms and Conditions in response to the Commission's Ready for Environmental Analysis (REA) notice and based on the proposals contained in the Final License Application. If any proposal is modified as a result of the licensing proceeding or after licensing, then the Department of Agriculture, acting through the USDA Forest Service, will require adequate opportunity to reconsider each term and condition and make modifications it deems appropriate and necessary for the protection and utilization of the federal reservations managed by the USDA Forest Service, and to ensure consistency with the Siuslaw Forest Plan, as amended.

Condition No. 5—Emergency Action Plans

The Licensee shall implement the Spill Prevention Control and Countermeasure Plan and Response and Recovery Plan submitted as part of the Project's Final License Application as they relate to NFS lands. Revision of the components of the plans relating to actions on NFS lands shall be subject to consultation with and approval by the USDA Forest Service. Justification USDA Forest Service staff worked collaboratively with Reedsport OPT personnel to develop the Spill Prevention Control and Countermeasure Plan and Response and Recovery Plan submitted as part of the Project Final License Application. Incorporation of these plans into the Project License is necessary to ensure that in the unlikely event of a spill, prompt measures are taken by the Licensee to minimize adverse impacts to NFS beaches and uplands and that where impacts do occur, affected NFS lands are promptly restored.