ENVIRONMENTAL ASSESSMENT

FOR HYDROPOWER PROJECT PILOT LICENSE

Cobscook Bay Tidal Energy Project—FERC Project No. 12711-005 (DOE/EA1916)

Maine

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

U.S. Department of Energy
Office of Energy Efficiency and Renewable Energy
Golden Field Office
1617 Cole Boulevard
Golden, Colorado 80401

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ACRONYMS AND ABBREVIATIONS

°C	degrees Celsius
°F	degrees Fahrenheit
ADCP	Acoustic Doppler Current Profiler
APE	area of potential effects
ASSRT	Atlantic Sturgeon Status Review Team
BGEPA	Bald and Golden Eagle Protection Act
CBRC	Cobscook Bay Resource Center
CER	Center for Ecological Research
CDOT	California Department of Transportation
Certification	Water Quality Certification
Coast Guard	U.S. Coast Guard
Commission	Federal Energy Regulatory Commission
Corps	U.S. Army Corps of Engineers
CWA	Clean Water Act
CZMA	Coastal Zone Management Act
dB	decibels
DIDSON	Dual-Frequency Identification Sonar
DNMS	drifting noise measurement system
DO	dissolved oxygen
DOE	U.S. Department of Energy
DPS	Distinct Population Segment
EA	environmental assessment
EFH	essential fish habitat
EPA	Environmental Protection Agency
ESA	Endangered Species Act
FERC	Federal Energy Regulatory Commission
FHWG	Fisheries Hydroacoustic Working Group
FPA	Federal Power Act
FWS	U.S. Fish and Wildlife Service
GoMOOS	Gulf of Maine Ocean Observing System
Gulf of Maine DPS	Gulf of Maine distinct population segment
GWh	gigawatt-hour
Hz	hertz
IHA	incidental harassment authorization
Interior	U.S. Department of the Interior
kHz	kilohertz
kW	kilowatt
kWh	kilowatt hours
LOU	letter of understanding
Magnuson-Stevens Act	Magnuson-Stevens Fishery Conservation and Management Act

Maine AIC	Maine Aquaculture Innovation Center
Maine DEP	Maine Department of Environmental Protection
Maine DIFW	Maine Department of Inland Fisheries and Wildlife
Maine DMR	Maine Department of Marine Resources
Maine DOC	Maine Department of Conservation
Maine GIS	Maine Office of Geographic Information Systems
Maine SHPO	Maine State Historic Preservation Office
Maine SPO	Maine State Planning Office
MBTA	Migratory Bird Treaty Act
MER	MER Assessment Corporation
MGS	Maine Geological Survey
MLW	mean low water
MLLW	mean lower low water
MRSA	Maine revised statutes
m/s	meters per second
MMPA	Marine Mammal Protection Act
MW	megawatt
MWh	megawatt-hour
MWPC	Maine Wetland Protection Coalition
National Register	National Register of Historic Places
NEPA	National Environmental Policy Act
NERC	North American Electric Reliability Corporation
NHPA	National Historic Preservation Act of 1966
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NPCC	Northeast Power Coordinating Council
NRPA	Natural Resources Protection Act
P&D cable	power and data cable
ppt	parts per thousand
OBIS	Ocean Biogeographic Information System
ORPC Maine	Ocean Renewable Power Company, Maine
O&M	operations and maintenance
rpm	revolutions per minute
RTE	rare, threatened, and endangered
SCADA	supervisory control and data acquisition
SCS	Seal Conservation Society
SEL	sound exposure level
SNMNH	Smithsonian National Museum of Natural History
TGU	turbine generator unit
USDA	U.S. Department of Agriculture
USGS	U.S. Geological Survey
WSDOT	Washington State Department of Transportation

EXECUTIVE SUMMARY

Proposed Action

On September 1, 2011, Ocean Renewable Power Company Maine, LLC (ORPC Maine) filed an application for an 8-year pilot license to construct and operate its proposed Cobscook Bay Tidal Energy Project (Cobscook Bay Project or project). The 300-kilowatt (kW) hydrokinetic project would be located in Cobscook Bay in Washington County, Maine. The project would not be located on federal lands.

Cooperating Agency Role

On August 31, 2010, ORPC Maine received financial assistance from the U.S. Department of Energy's (DOE) Office of Energy Efficiency and Renewable Energy to support the final design, construction, deployment and monitoring phases of their project. In order to satisfy DOE's requirements under the National Environmental Policy Act (NEPA) for this project, DOE is participating as a cooperating agency in the Commission's preparation of the EA.

Project Description

The proposed Cobscook Bay Project would use the tidal currents of Cobscook Bay to generate electricity via cross-flow Kinetic System turbine generator units (TGU) mounted on the seafloor. The TGUs would capture energy from the flow in both ebb and flood directions.

ORPC Maine proposes a two-phased development approach for the Cobscook Bay Project that would consist of: (1) a single, approximately 98.5-foot-long, TGU mounted on a bottom support frame, with a rated capacity of 60 kW, installed in year 1 (Phase 1); (2) four additional, approximately 98.5-foot-long, TGUs mounted on bottom support frames, with a total rated capacity of 300 kW, installed in year 2 (Phase 2); (3) a direct current power and data cable approximately 4,150 feet long (3,750 feet underwater and 400 feet on shore) extending from the TGUs to the onshore station house; (4) an on-shore modular building 16 feet wide by 20 feet long, housing a power inverter and a supervisory control and data acquisition (SCADA) system; (5) a transformer located adjacent to the station house; (6) a 60-foot-long transmission line connecting the onshore station house with the Bangor Hydro Electric Company system; and (7) appurtenant facilities for navigation safety and operation. The project would have an estimated annual generation between 1,200,000 and 1,300,000 kilowatt-hours.

Proposed Environmental Measures

ORPC Maine proposes the following measures:

- To provide an understanding of any environmental effects of the new technology project, implement: 1) an Acoustic Monitoring Plan; 2) a Benthic and Biofouling Monitoring Plan; 3) a Fisheries and Marine Life Interaction Monitoring Plan; 4) a Hydraulic Monitoring Plan; 5) a Marine Mammal Monitoring Plan; and 6) a Bird Monitoring Plan.

- To educate the public regarding the proposed project, maintain the information center at the ORPC Maine office in Eastport that includes educational displays and informational brochures.

- To improve and maintain the aesthetic values of the project area, select non-reflective colors that blend with the natural landscape and develop design guidelines for future project improvements.

- To ensure safe operation of the project and protect the public, implement: 1) a Project Operations and Monitoring Plan; 2) a Project Inspection and Maintenance Plan; 3) a Project and Public Safety Plan; 4) a Navigation Safety Plan; and 5) an Emergency Shutdown Plan.

- To restore the project site to a pre-project condition at the end of the license term if a new license is not obtained, implement a Project Removal and Site Restoration Plan.

Alternatives Considered

This environmental assessment (EA) considers the following alternatives: (1) ORPC Maine's proposal, as outlined above; (2) ORPC Maine's proposal with staff modifications (staff alternative); and (3) no action, meaning the pilot project would not be installed, DOE would not provide financial assistance to fund the project, and there would be no change to the existing environment (no-action alternative).

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

- Provisions within the Project Removal and Site Restoration Plan for filing with the Commission: 1) a specific timeline for the removal and site restoration activities 6 months prior to license expiration; 2) documentation of consultation with NMFS, FWS, Coast Guard, Maine DMR, and Maine DEP regarding planned removal and site restoration activities 6 months prior to

license expiration; and 3) documentation of completion of project removal and site restoration activities.

- To protect environmental resources and minimize any potential adverse effects from project construction and operation: 1) limit pile driving and power and data (P&D) cable burial activities to between November 8th and April 9th of any year; and 2) follow the FWS *Bald Eagle Management Guidelines* during construction and operation of the project.

- To ensure that the adaptive management strategies within the monitoring plans are sufficiently detailed so as to facilitate future modifications to the plans based on their preliminary results, develop and implement an Adaptive Management Plan.

- To further educate the public regarding the proposed project, install an interpretive display at the proposed on-shore station house that includes an educational display detailing the TidGen™ technology and the natural environment of the project area.

- Consult with the Maine State Historic Preservation Office (Maine 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 to be undertaken in the future.

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.

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, ORPC Maine conducted consultation under the hydrokinetic pilot project licensing procedures, which included numerous meetings and conference calls with a range of stakeholders, including resource agencies, tribes, and non-governmental organizations.[1] On October 6, 2011, we

[1] The Commission waived 18 CFR §§ 5.8 and 5.10, which specify the project scoping requirements of the Commission's Integrated Licensing Process, by letter issued July 12, 2011.

requested conditions and recommendations in response to the notice of ready for environmental analysis.

The primary issues associated with licensing this pilot project are potential effects on hydrodynamics; migratory fish; essential fish habitat; harbor seals; gray seals; harbor porpoises; Atlantic white-sided dolphin; Atlantic salmon; Atlantic sturgeon; diving birds; navigation; and recreation.

Staff Alternative

ORPC Maine 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; a remotely controlled braking system for the turbines that would allow for the project to be shut down quickly in the case of an emergency; and the design of the turbines to have blunt-shaped foils and relatively slow speeds,[2] minimizing the potential for turbine blade strikes on fish, diving birds, and marine mammals. In addition to these design features, the results of the studies ORPC Maine conducted during the barge-mounted deployment of its TGU, referred to as the Beta TidGen™, suggest that environmental impacts from the pilot project would be minor.[3] However, ORPC Maine's proposal includes monitoring measures that are designed to detect and address any unanticipated adverse effects.

General

The proposed Project Operations and Monitoring Plan and Project Inspection and Maintenance Plan include procedures for monitoring project operation and visually inspecting and maintaining project facilities. The proposed Project and Public Safety Plan includes measures for identifying and responding to emergencies at the project. The proposed Emergency Shutdown Plan includes procedures for the remote shutdown of the project turbines in response to emergencies at the project. These four safeguard plans would work interdependently to ensure that the project is operated and maintained in a safe manner that minimizes the potential for harm to the public and environmental resources in the project area.

The proposed Project Removal and Site Restoration Plan, which includes measures for removing the project and restoring the project site in the case that a new license is not obtained at the end of the pilot project license term, would ensure protection

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[2] The turbines would have a maximum operating rotational speed of 32 revolutions-per-minute (rpm), compared to boat propellers that have speeds of 2,000 to 6,000 rpm, and a maximum operating tip speed of 5 meters per second (m/s).

[3] ORPC Maine conducted fish, bird, and mammal observations during the barge-mounted deployment.

of the aesthetic and environmental resources in and around Cobscook Bay. A staff recommended modification to the proposed plan that includes provisions for a specific timeline for the removal and site restoration activities, as well as documentation of consultation with the appropriate agencies, 6 months prior to license expiration, and documentation of completion of project removal and site restoration activities prior to license expiration, would ensure that the project is removed and the site is sufficiently restored to near pre-project condition prior to license expiration.

A staff recommended Adaptive Management Plan, that would include protocols for consultation and modifications to the monitoring plans, as well as consultation and Commission approval regarding Phase 2 deployment based on the effectiveness of the monitoring and operation of the project in Phase 1, would ensure that the monitoring plans gather sufficient data to allow for the evaluation of the potential environmental effects of the Cobscook Bay Project.

Geologic Resources

Construction and operation of the project would likely have only minor effects on geologic resources, such as modifying localized sediment transport. The proposed Hydraulic Monitoring Plan, which includes visual and geophysical surveys of the seafloor in the project area, would help to identify any unanticipated adverse effects of the project on scouring or sediment transport processes.

Aquatic Resources

Construction and operation of the project would likely have only minor effects on aquatic resources, such as slightly modifying hydrodynamics and behavior of fish and marine mammals in the immediate project vicinity, as well as potentially harming some fish with turbine blade strikes. Staff's recommended restriction of pile driving and P&D cable burial activities associated with project construction between April 10th and November 7th of any year would help to avoid any adverse effects due to construction on aquatic resources. The proposed Acoustic Monitoring Plan, which includes the use of a drifting noise measurement system to measure noise related to project construction and operation, would help to identify and characterize noise radiated by the project. The proposed Benthic and Biofouling Monitoring Plan, which includes benthic surveys of the P&D cable burial route and regular inspections of project equipment for biofouling, would help to ensure recovery of the benthic community from construction-related disturbance in the project area. The proposed Hydraulic Monitoring Plan, which includes the measurement of tidal velocities in the project deployment area, would provide an increased understanding of the effects of the project on the hydrodynamics in Cobscook Bay during each phase of deployment. The proposed Fisheries and Marine Life Interaction Plan and Proposed Marine Mammal Monitoring Plan, which include measures to identify the use of the project area by fish and marine mammals, would help to

quantify any unanticipated adverse effects of the project on fish and marine mammal behavior.

Rare, Threatened, and Endangered Species

Construction and operation of the project would likely have only minimal effects on bald eagles, such as potentially disturbing nesting habitats or foraging behavior. Staff's recommendation for ORPC Maine to follow the FWS *Bald Eagle Management Guidelines* during project construction and operation would ensure the protection of bald eagles in Cobscook Bay.

Terrestrial Resources

Construction and operation of the project would likely have only minimal effects on terrestrial resources, such as potentially disrupting the feeding and resting habitats of migratory and diving birds. The proposed Bird Monitoring Plan that includes measures to observe bird species, number of birds, and behaviors of these birds in the proposed project area would allow further analysis of the use of the area by birds to ensure any effects of the proposed project are minimized.

Recreation

Construction and operation of the project would likely have only minimal effects on recreational resources, as there is little recreation that occurs in the proposed deployment area and abundant recreational resources are available outside of the project area. Staff's recommended interpretive display at the proposed on-shore station house that includes an educational display detailing the TidGen™ technology and the natural environment of the project area would enable the public to learn more about the new area of tidal energy development that the proposed Cobscook Bay Project represents.

Navigation

Construction and operation of the project would likely have only minimal effects on navigation, such as restricting navigation in this portion of Cobscook Bay during the short periods of project deployment and maintenance. The proposed Navigation and Safety Plan that includes measures to provide navigational markers and an exclusion zone around the project would ensure the safety of the public using this portion of Cobscook Bay.

Cultural Resources

Construction and operation of the project would not likely affect cultural resources since no cultural resource sites were identified near the proposed project area. Staff's recommendation for ORPC Maine to consult with the Maine SHPO on any 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 ensure the protection of any cultural resources in the project area for the term of any license.

Conclusions

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

In section 4.0, *Developmental Analysis*, 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 $1,327,800 (about 1,062.25 mills/kilowatt hour (kWh)) more than the cost of alternative power. Under the staff-recommended alternative, the project would produce power at a cost that is $1,329,200 (about 1,063.31 mills/kWh), more than the cost of alternative power. Although the cost of power that would be produced at the project is high, ORPC Maine is hopeful that building the project, in addition to generating electricity, would collect enough data to support development of more economic commercial-scale arrays. 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 (1.3 gigawatt hours annually); (2) provide 300 kW of electric energy generated from a renewable resource, which would not contribute to 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 tidal 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 costs of the recommended environmental measures.

ENVIRONMENTAL ASSESSMENT

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Washington, DC

Cooperating Agency
U.S. Department of Energy
Golden Field Office
Golden, CO

Cobscook Bay Tidal Energy Project
FERC Project No. 12711-005—Maine
DOE/EA1916

1.0 INTRODUCTION

1.1 APPLICATION

On September 1, 2011, Ocean Renewable Power Company Maine, LLC (ORPC Maine) filed an application for a pilot project license with the Federal Energy Regulatory Commission (Commission or FERC) for the proposed Cobscook Bay Tidal Energy Project (Cobscook Bay Project or project). The 300-kilowatt (kW) project would be located in Cobscook Bay in Washington County, Maine (figure 1). The project would not affect federal lands. The project would generate an estimated average of between 1.2 and 1.3 gigawatt-hours (GWh) of energy annually.

1.2 PURPOSE OF ACTION AND NEED FOR POWER

1.2.1 Purpose of Action

The purpose of the proposed Cobscook Bay 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 ORPC Maine for the Cobscook Bay 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

Figure 1. Location of Cobscook Bay Tidal Energy Project (Source: application, as modified by staff).

protection of recreational opportunities; and (4) the preservation of other aspects of environmental quality.

Issuing a pilot project license for the Cobscook Bay Project would allow ORPC Maine to generate electricity for an 8-year term, making electrical power from a renewable resource available to its customers. ORPC Maine's proposed monitoring programs would also provide important information on any unanticipated environmental effects of tidal energy developments, which would assist with the evaluation of other similar projects.

The DOE's Office of Energy Efficiency and Renewable Energy mission is to invest in clean energy technologies to strengthen the economy, protect the environment, and reduce dependence on foreign oil. The purpose for funding ORPC Maine's project is to further this mission and help advance the technological and operational readiness of marine and hydrokinetic water power technologies.

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 staff's recommended measures. Staff also considers the effects of the no-action alternative. Important issues that are addressed include potential effects on hydrodynamics; migratory fish; essential fish habitat; harbor seals; gray seals; harbor porpoises; white-sided Atlantic dolphin; Atlantic salmon; Atlantic sturgeon; birds; navigation; and recreation.

1.2.2 Need for Power

The Cobscook Bay Project is a demonstration project. ORPC Maine is using the project to demonstrate the technical feasibility of its patented turbine generator unit (TGU) design.

To assess the need for power, staff looked at the needs in the operating region in which the project is located. The proposed project would be located in the New England Subregion of the Northeast Power Coordinating Council (NPCC) Region[4] of the North

[4] The NPCC Region is composed of the states of Maine, Vermont, New Hampshire, Massachusetts, New York, Connecticut, Rhode Island, and the Canadian provinces of Ontario, Quebec, New Brunswick, Nova Scotia and Prince Edward Island. The NPCC is divided into the following five subregions: Maritimes, New England, New York, Ontario, and Quebec. Among the areas (subregions) of NPCC, Quebec and the Maritimes are predominately winter peaking areas; Ontario, New York, and New England are summer peaking systems.

American Electric Reliability Corporation (NERC).[5] According to NERC, summer peak demand in the region is expected to increase at an average rate of 1.4 percent per year over the 10-year planning period from 2010-2019 (NERC 2010). Therefore, project power would help meet base and summer peak demand.

The successful installation of the Cobscook Bay Project would demonstrate the potential of an emergent renewable energy industry segment with the goal of bringing clean, competitively-priced electricity to commercial and residential consumers in Maine and other U.S. states. The future use of the project's power, its displacement of non-renewable fossil-fueled generation, and its contribution to a diversified generation mix demonstrate that the project would help meet a need for power in the region.

1.3 COOPERATING AGENCY ROLES

Department of Energy (DOE)

The U.S. Department of Energy Office of Energy Efficiency and Renewable Energy Wind and Water Power Program's mission is to fund innovative marine and hydro-kinetic water power technologies. In furtherance of this mission, DOE has provided financial assistance in support of the preliminary engineering and design phase of ORPC Maine's Cobscook Bay Project and is now considering authorizing the expenditure of additional federal funds in support of the project. Specifically, the additional DOE funding would be used in support of the final design, construction, deployment, and monitoring phases of the project.

Granting of DOE financial assistance for this project would constitute a major federal action as defined by the National Environmental Policy Act of 1969 (NEPA). DOE must consider the possible environmental impacts from the project before committing to provide funding. In accordance with the provisions of NEPA and DOE implementing regulations (10 C.F.R. § 1021), DOE has determined that an EA must be completed for the proposed project to evaluate the potential environmental impacts that could result from the award of the funding. To satisfy this requirement, on June 6, 2011, DOE filed a request to be a cooperating agency in the Commission's preparation of this EA. A letter of understanding (LOU), signed by both agencies, was issued on October 11, 2011, establishing DOE's cooperating agency status.

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[5] The NERC is an international regulatory authority established to evaluate reliability of the bulk power system in North America. NERC develops and enforces Reliability Standards; assesses reliability annually via a 10-year assessment and winter and summer preseasonal assessments; monitors the bulk power system; and educates, trains, and certifies industry personnel (NERC 2010).

DOE's decision whether to provide financial assistance for the final design, construction, deployment and monitoring phases to ORPC Maine for this project will be made after the completion of this EA and DOE's NEPA review process. Upon completion of this EA, DOE will assess all comments, FERC's conclusions, and all agency recommendations and issue a NEPA determination. This determination along with the final EA will be posted at DOE Golden's Public Reading Room: http://www.eere.energy.gov/golden/Reading_Room.aspx

1.4 STATUTORY AND REGULATORY REQUIREMENTS

A license for the Cobscook Bay 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 Cobscook Bay Project.

Requirement	Agency	Status
Section 18 of the FPA (fishway prescriptions)	U.S. Department of the Interior (Interior)	Interior, by letter dated November 7, 2011, requests that a reservation of authority to prescribe fishways under section 18 be included in any license issued for the project.
Section 10(j) of the FPA	National Marine Fisheries Service (NMFS)	NMFS filed 10(j) recommendations on November 4, 2011.
Clean Water Act – Water Quality Certification	Maine Department of Environmental Protection (Maine DEP)	Application was received by Maine DEP on September 7, 2011. Certification is due by September 7, 2012.
Endangered Species Act Consultation	NMFS	Biological assessment concluded that the project is not likely to adversely affect listed species. NMFS concurred with this determination by letter filed November 4, 2011.

Requirement	Agency	Status
Marine Mammals Protection Act	NMFS	We conclude that the proposed project may adversely affect marine mammals during the pile driving phase of construction. ORPC Maine is currently negotiating an Incidental Harassment Authorization (IHA) with NMFS for marine mammals in Cobscook Bay.
Magnuson-Stevens Fishery Conservation and Management Act	NMFS	We conclude that the proposed project would not likely adversely affect Essential Fish Habitat (EFH).
Coastal Zone Management Act Consistency	Maine State Planning Office (Maine SPO)	A request for Coastal Zone Management Plan consistency determination was submitted to the Maine SPO on September 20, 2011. The Maine SPO has not yet acted on the request.
National Historic Preservation Act	Maine State Historic Preservation Office (Maine SHPO)	Maine SHPO concluded that no historic properties would be affected by the federal licensing action.

1.4.1 Federal Power Act

1.4.1.1 Section 18 Fishway Prescriptions

Section 18 of the FPA 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, by letter dated November 7, 2011, requests that a reservation of authority to prescribe fishways under section 18 be included in any license issued for the project.

1.4.1.2 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.

NMFS timely filed, on November 4, 2011, recommendations under section 10(j), as summarized in table 21, in section 5.4, *Fish and Wildlife Agency Recommendations.* In section 5.4, we also discuss how we address the agency recommendations and comply with section 10(j).

1.4.2 Clean Water Act

Under section 401 of the Clean Water Act (CWA), a license applicant must obtain certification from the appropriate state pollution control agency verifying compliance with the CWA. On September 5, 2011, ORPC Maine applied to the Maine DEP for water quality certification (certification) for the Cobscook Bay Project. The Maine DEP received this request on September 7, 2011. The Maine DEP has not yet acted on the request. The certification is due by September 7, 2012.

1.4.3 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. One federally listed species is known to occur, or may occur, in the vicinity of the proposed Cobscook Bay Project, the endangered Atlantic salmon. The Atlantic sturgeon, a species proposed for listing as endangered, may also occur in the project vicinity. Our analyses of project impacts on threatened and endangered species are presented in section 3.3.4, *Rare, Threatened, and Endangered Species*, and our recommendations in section 5.2, *Comprehensive Development and Recommended Alternative*.

We conclude that licensing of the Cobscook Bay Project, as proposed with staff-recommended measures, is not likely to adversely affect the Atlantic salmon, and is not likely to jeopardize the Atlantic sturgeon. We requested NMFS concurrence with our conclusion by letter dated September 16, 2011. NMFS concurred with our determination

on November 4, 2011 (letter from Patricia A. Kurkul, Regional Administrator, NMFS, Gloucester, Massachusetts, to Kimberly D. Bose, Secretary, FERC, Washington, D.C.).

1.4.4 Marine Mammal Protection Act

The 1972 Marine Mammal Protection Act (MMPA) prohibits, with certain exceptions, the "take" (defined under statute to include harassment)[6] of marine mammals in U.S. waters and the high seas. In 1986, Congress amended both the MMPA, under the 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 an Incidental Harassment Authorization has been applied for and issued.

Gray seal, harbor seal, harbor porpoise, and Atlantic white-sided dolphin, none of which are ESA-listed species, are expected to occur in the vicinity of the proposed project. Based on our analysis of potential project effects on non-listed marine mammals (presented in section 3.3.2.2 *Environmental Effects, Aquatic Resources*) we conclude that the proposed project may adversely affect marine mammals due to noise related to the pile driving phase of construction. Subsequently, ORPC Maine is currently negotiating an Incidental Harassment Authorization (IHA) with NMFS for marine mammals in Cobscook Bay.[7]

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[6] Under the 1994 Amendments to the MMPA, "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)." Marine Mammal Protection Act Amendments of 1994, Pub. L. No. 103-238, 108 Stat. 432 (1994); *see also* 50 CFR § 216.3 (2010) (regulation implementing the amendment).

[7] In 1994, MMPA section 101(a)(5) was amended to establish an expedited process by which citizens of the U.S. can apply for an authorization, referred to as an Incidental Harassment Authorization or IHA, to incidentally take small numbers of marine mammals by harassment.

1.4.5 Magnuson-Stevens Fishery Conservation and Management Act

The Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act) requires federal agencies to consult with NMFS on all actions that may adversely affect EFH.

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. Supplemental information pertaining to project effects on EFH is provided in an EFH assessment prepared by ORPC Maine and included in the final license application. The effects of the project on EFH are addressed in section 3.3.2.2 *Environmental Effects, Aquatic Resources*. In summary, we conclude that licensing the project would not likely adversely affect EFH for any of the 15 species located in the project area. As such, no consultation with NMFS is required.

1.4.6 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 September 20, 2011, ORPC Maine submitted a request for Coastal Zone Management Plan consistency determination to the Maine SPO. The letter was filed with the Commission on September 29, 2011. The Maine SPO has not yet acted on the request.

1.4.7 National Historic Preservation Act

Section 106 of the National Historic Preservation Act (NHPA) requires that every federal agency "take into account" how each of its undertakings could affect historic properties. Historic properties are districts, sites, buildings, structures, traditional cultural properties, and objects significant in American history, architecture, engineering, and culture that are eligible for inclusion in the National Register of Historic Places (National Register).

On August 7, 2009, the Commission designated ORPC Maine as a non-federal representative for the purposes of conducting section 106 consultation under the NHPA. Pursuant to section 106, and as the Commission's designated non-federal representative, ORPC Maine consulted with the Maine State Historic Preservation Office (SHPO) to

locate, determine National Register eligibility, and assess potential adverse effects to historic properties associated with the project. In a letter dated August 5, 2011, and August 27, 2011, the Maine SHPO concluded that no historic properties would be affected by the federal licensing action. As a result of these findings made by ORPC Maine, and the SHPO's concurrence that no historic properties would be affected by the project, the drafting of a programmatic agreement to resolve adverse effects to historic properties will not be necessary.

1.5 PUBLIC REVIEW AND COMMENT

The Commission's regulations (18 C.F.R., §§ 5.1-5.16) 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.[8]

1.5.1 Comments on the Draft License Application

On August 7, 2009, the Commission issued a notice that ORPC Maine had filed a draft license application for the Cobscook Bay Project. This notice set September 8, 2009, as the deadline for filing comments on the pre-filing materials. In response to the notice, the following entities commented:

[8] The Commission waived sections 5.8 and 5.10 of its regulations, which specify the project scoping requirements for the Commission's Integrated Licensing Process, by letter issued July 12, 2011.

Commenting Entities	Date Filed
Sunrise County Economic Council	August 19, 2009
Maine Department of Environmental Protection	August 21, 2009
Eastport Port Authority	August 24, 2009
Town of Perry, Maine	August 31, 2009
National Marine Fisheries Service	September 1, 2009
Maine Department of Marine Resources	September 3, 2009
U.S. Environmental Protection Agency	September 8, 2009
City of Eastport, Maine	September 8, 2009
Washington County Commissioners	September 9, 2009
Alan Stein	September 11, 2009
U.S. Fish and Wildlife Service	September 22, 2009
Maine Department of Marine Resources	September 23, 2009*

***** Maine Department of Marine Resources' comments filed on September 23, 2009, amended the comments that it filed on September 3, 2009.

1.5.2 Interventions

On October 6, 2011, the Commission issued a notice that ORPC Maine had filed an application to license the Cobscook Bay Project. This notice set November 5, 2011, as the deadline for filing protests and motions to intervene. In response to the notice, the following entities filed notices or motions to intervene:

Intervenors	Date Filed
U.S. Department of the Interior	October 25, 2011
National Marine Fisheries Service	November 4, 2011
Maine SPO	November 8, 2011*

* Late intervention granted on December 8, 2011.

1.5.3 Comments on the License Application

The notice that the Commission issued on October 6, 2011, also requested conditions and recommendations. The following entities commented:

Commenting Agency and Other Entity	Date Filed
Maine Department of Marine Resources	November 4, 2011
National Marine Fisheries Service	November 4, 2011
U.S. Department of the Interior	November 7, 2011

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. In addition, under the no-action alternative, DOE would not authorize the expenditure of federal funds for final design, construction, deployment, and monitoring of ORPC Maine's proposed project.

2.2 APPLICANT'S PROPOSAL

2.2.1 Project Facilities

The Cobscook Bay Project would consist of: (1) a single, approximately 98.5-foot-long, cross-flow Kinetic System turbine generator unit (TGU) mounted on a bottom support frame, with a rated capacity of 60 kilowatts (kW), installed in year 1, in Phase 1 (see figure 2); (2) four additional, approximately 98.5-foot-long, TGUs mounted on bottom support frames, with a total installed capacity of 300 kW, installed in year 2, in Phase 2; (3) a direct current power and data (P&D) cable approximately 4,150 feet long (3,750 feet underwater and 400 feet on shore) extending from the TGUs to the onshore station house; (4) an on-shore modular building 16 feet wide by 20 feet long, housing the power inverter and the supervisory control and data acquisition (SCADA) system; (5) a transformer located adjacent to the station house; (6) a 60-foot-long transmission line connecting with the Bangor Hydro Electric Company system; and (7) appurtenant facilities for navigation safety and operation.

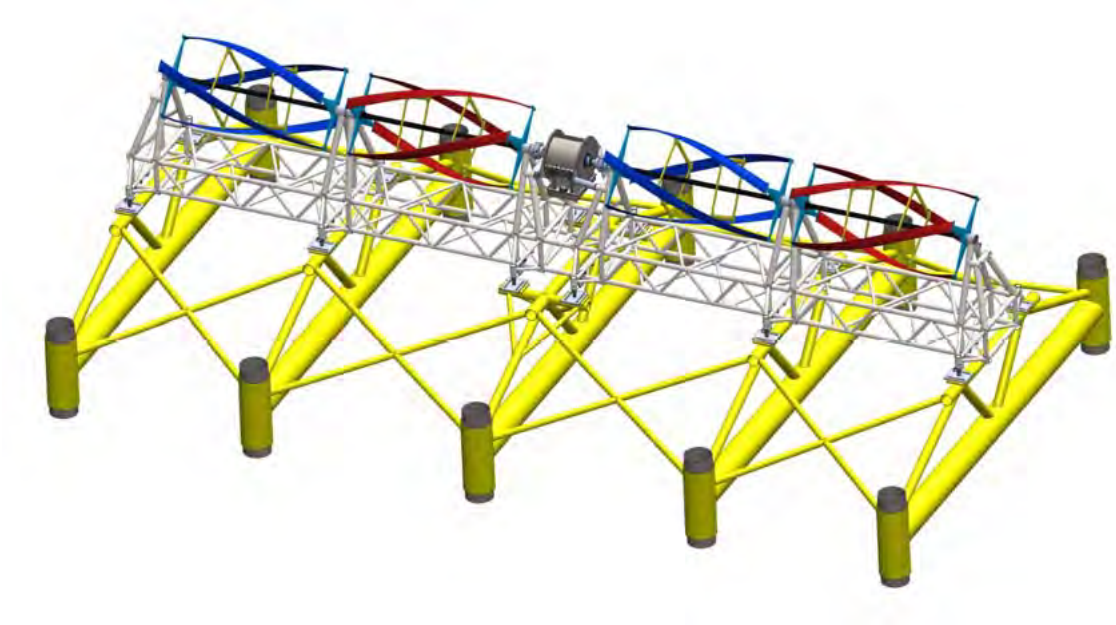

Figure 2. Illustration of the turbine generating unit mounted on the bottom support frame, collectively referred to as the TidGen™ device (Source: application).

2.2.2 Project Safety

As part of the licensing process, the Commission would review the adequacy of the proposed project facilities. Special articles regarding project safety and operation 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.

For the purposes of evaluating potential environmental impact, the Cobscook Bay Project safety concerns would involve the operation of a turbine generating unit mounted on a bottom support frame anchored to the sea floor of Cobscook Bay. ORPC Maine is proposing the following Safeguard Plans:

- Project and Public Safety Plan
- Project Removal and Site Restoration Plan
- Navigation Safety Plan
- Emergency Shutdown Plan

Each of these plans would be a central focus of Commission review prior to construction of the proposed project.

2.2.3 Project Operation

The proposed Cobscook Bay Project would operate using the natural tidal currents of Cobscook Bay. The TidGen™ Power System is designed to generate electrical output during a range of water currents present in a full tidal cycle, operating in a stationary orientation in both ebb and flood tides.

The turbine converts the kinetic energy of water flowing in currents from zero to 3 meters per second into rotational motion and delivers that energy through a shaft into the stub shaft of the permanent magnet generator. The turbine is the ORPC Maine proprietary advanced design cross flow turbine with multiple twisted foils attached by spokes to the shaft about which the turbine rotates.

As the turbine foil rotates it presents a varying angle to the oncoming flow known as the angle of attack measured between the relative flow and the mean chord line of the blade. At angles of attack less than a stall angle, the foil generates a lift force perpendicular to the relative flow direction and a drag force parallel to the relative flow direction. The relative positions of these forces generate a component of force tangential to the turbine, creating a net positive torque on the turbine and causing the turbine to rotate and transmit power to the generator. The rotational speed of the turbine is maintained at the required set point by application of a controllable load on the generator provided by the power electronics in the electronics case.

A supervisory computer running custom software acquires generator status and performance for each turbine in the overall array. This is used for power accounting and maintenance indications and the equipment will be housed in the on-shore modular building.

2.2.4 Proposed Project Maintenance

Although the TidGen™ Power System is designed to operate reliably with low maintenance demands, ORPC Maine proposes to implement a Project Inspection and Maintenance Plan that provides a detailed preventative maintenance schedule for the term of the license. The proposed plan would have three main components: 1) visual inspection, 2) simple maintenance, and 3) major maintenance. The equipment and facilities that would be inspected include the TGUs, the bottom support frame(s), the underwater P&D cables, and the onshore station.

Underwater visual inspections of the TidGen™ Power System would be conducted using a diver. These inspections would occur with all project components in place and operational, but with the generator locked in the brake position to ensure safety.

ORPC Maine personnel would perform visual inspections of the on-shore station on a monthly basis. For simple maintenance to the TGU the equipment would be raised off of the pilings to the surface and inspected on the barge above the deployment site to facilitate a closer examination than underwater visual inspection allows, with minor adjustments and repairs carried out on the barge. Major maintenance to the TGUs and other equipment would be scheduled yearly, and would also be performed whenever underwater visual inspections or simple maintenance inspections determine it is necessary. For major maintenance, the equipment would be raised to the surface and brought on a barge to the shore, where close inspections, adjustments, repairs and part replacement can be made in the appropriate shop facility.

Inspection and maintenance documentation would be integral to the early years of the project as standard maintenance intervals are developed for the TidGen™ Power System. All inspections and maintenance would be documented prior to and following the maintenance event. Visual inspections, whether conducted by diver or remotely operated vehicle, would include video and/or other images detailing the inspection.

To ensure safe management, operation, and maintenance of the Project, ORPC Maine would implement the following plans: 1) Project Operations and Monitoring Plan; 2) Project Inspection and Maintenance Plan; 3) Project and Public Safety Plan; 4) Project Removal and Site Restoration Plan; 5) Navigation Safety Plan; and 6) Emergency Shutdown Plan.

2.2.5 Proposed Environmental Measures

ORPC Maine proposes to construct and operate the project with the following environmental protection, mitigation, and enhancement measures:

- To provide an understanding of any environmental effects of the new technology project, implement: 1) an Acoustic Monitoring Plan; 2) a Benthic and Biofouling Monitoring Plan; 3) a Fisheries and Marine Life Interaction Monitoring Plan; 4) a Hydraulic Monitoring Plan; 5) a Marine Mammal Monitoring Plan; and 6) a Bird Monitoring Plan.

- To educate the public regarding the proposed project, maintain the information center at the ORPC Maine office in Eastport that includes educational displays and informational brochures.

- To improve and maintain the aesthetic values of the project area, select non-reflective colors that blend with the natural landscape and develop design guidelines for future project improvements.

- To ensure safe operation of the project and protect the public, implement: 1) a Project Operations and Monitoring Plan; 2) a Project Inspection and Maintenance Plan; 3) a Project and Public Safety Plan; 4) a Navigation Safety Plan; and 5) an Emergency Shutdown Plan.

- To restore the project site to a pre-project condition at the end of the license term if a new license is not obtained, implement a Project Removal and Site Restoration Plan.

2.3 STAFF ALTERNATIVE

After evaluating ORPC Maine'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 ORPC Maine's proposal, with modifications based on fish and wildlife recommendations under section 10(j) of the FPA, recommendations under section 10(a) of the FPA, and measures developed by Commission staff.

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

- Implement the Project Removal and Site Restoration Plan. *We modify this measure to require provisions for filing with the Commission: 1) a specific timeline for the removal and site restoration activities 6 months prior to license expiration; 2) documentation of consultation with NMFS, FWS, Coast Guard, Maine DMR, and Maine DEP regarding planned removal and site restoration activities 6 months prior to license expiration; and 3) documentation of completion of project removal and site restoration activities.*

In addition to ORPC Maine's proposed measures, including staff's recommended modifications listed above, we recommend including the following measures in any pilot project license issued:

- To protect environmental resources and minimize any potential adverse effects from project construction and operation: 1) limit pile driving and power and data (P&D) cable burial activities to between November 8th and April 9th of any

year;[9] and 2) follow the FWS *Bald Eagle Management Guidelines* during construction and operation of the project.

- To ensure that the adaptive management strategies within the monitoring plans are sufficiently detailed so as to facilitate future modifications to the plans based on their preliminary results, develop and implement an Adaptive Management Plan.

- To further educate the public regarding the proposed project, install an interpretive display at the proposed on-shore station house that includes an educational display detailing the TidGen™ technology and the natural environment of the project area.

- Consult with the Maine State Historic Preservation Office (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 to be undertaken in the future.

[9] Limitation window for Phase 2 pile driving activities may not be necessary based on the results of the proposed Acoustic Monitoring Plan.

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 proposed project area is located north and east of Seaward Neck and the west of Shackford Head State Park in Eastport, Maine. Seward Neck is located approximately 3 miles from downtown Lubec, Maine. The proposed project area is located in Washington County near the boundary separating the City of Eastport and the Municipality of Lubec.

Cobscook Bay is described as part of the Quoddy Region, which is located at the mouth of the Bay of Fundy and encompasses an area between Maine and New Brunswick, Canada. Cobscook Bay is a sub-basin that marks the entrance to the Bay of Fundy, which features the highest tidal range in the world, averaging 39 feet, with the Eastport area averaging 20 feet. This large tidal range comes from the semi-diurnal tides of the North Atlantic Ocean and the natural period of the Gulf of Maine and Bay of Fundy. The volume of water that empties out of the Bay of Fundy daily (100 billion tons) is more than the combined daily flow of every freshwater river on earth (Nova Scotia Department of Energy 2008). Cobscook Bay is a relatively shallow drowned river valley with an average depth of 98.4 feet mean low water (MLW),[11] with its deepest point being 147.6 feet MLW (Kelley and Kelley 2004). The surface area during high tide is approximately 42.5 square miles, with 201.9 miles of shoreline (Larsen 2004). Approximately one-third of the area of Cobscook Bay's benthic habitat is exposed to the air at low tide, while another significant portion remains covered only by very shallow water (Brooks 2004).

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[10] Unless otherwise indicated, our information is taken from the application for license for this project (application) and additional information filed by ORPC Maine on September 1, 2011.

[11] MLW is a tidal datum that represents the average of all low water elevations.

The proposed project waters are primarily used for commercial fishing, marine resource harvesting and aquaculture, recreation, and marine vessel traffic. The onshore area is chiefly used for rural purposes. According to the U.S. Census Bureau's profile of selected economic characteristics for Washington County, Maine (2009), in 2000 the education, health, and social services sectors of the economy employed 26.3 percent of the population. Manufacturing employed 14 percent, and agriculture, forestry, fishing, hunting, and mining employed 10.9 percent.

3.2 SCOPE OF CUMULATIVE EFFECTS ANALYSIS

According to the Council on Environmental Quality's regulations for implementing the National Environmental Policy Act (40 C.F.R. § 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 aquatic resources and rare, threatened, and endangered species (Atlantic salmon and Atlantic sturgeon) as having the potential to be cumulatively affected by the proposed Cobscook Bay Project in combination with other activities in the proposed project area, such as commercial fishing, marine resource harvesting, aquaculture activities, and a potential tidal barrage project.

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 proposed Cobscook Bay Project, as well as the interests of the participants in this licensing process, the general geographic scope for the cumulatively affected resources encompasses the Cobscook Bay. We choose this geographic scope for these resources because the effects of project operations are primarily limited to Cobscook Bay, where these resources may directly and indirectly be affected by construction and operation of 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 aquatic resources. Based on the potential term of a license, the temporal scope looks 8 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 the resource.

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 cumulative and site-specific 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

Geomorphic or physiographic regions are broad-scale subdivisions based on terrain texture, rock type, and geologic structure and history. The project would be located within the Seaboard Lowland section of the New England Geographic Province. The Seaboard Lowland section generally consists of gently rolling hills, numerous lakes, and sandy beaches (USGS 2003). Specifically, the proposed project would be located within the East Coastal Biophysical Region. This region is characterized by low ridges surrounded by poorly drained, relatively flat terrain with elevations generally less than 100 feet (McMahon 1990).

In the proposed project area, the sea flooded a valley that cut across several other valleys parallel to each other, resulting in an unusually irregular and indented shoreline with many peninsulas, islands, and bays. The area near Eastport is of special geologic interest, for mixed in with layers of volcanic rocks are relatively unaltered sedimentary rocks containing fossils more closely related to those of Europe than to others in North America (Bennett 1988). This distinct geologic province is referred to as the Avalon terrane.[12] According to Caldwell (1998), the Avalon terrane is a continental mass that collided with the eastern margin of North America during Devonian time, sometime around 400 million years ago. The Norumbega fault separates the Avalon terrane from the rest of the state. The oldest rocks in coastal Maine are mostly volcanic rocks that erupted during the late Precambrian time, and sedimentary rocks composed of material

[12] A rock formation, or assemblage of rock formations, that share a common geologic history. A geologic terrane is distinguished from neighboring terranes by its different history, either in its formation or in its subsequent deformation and/or metamorphism. Terranes are separated by faults. An exotic terrane is one that has been transported into its present setting from some distance (USGS 2000).

eroded from them. These rocks grade upward into slates and sandstones that were deposited during early Paleozoic time (Caldwell 1998).

Many exposed outcrops near the proposed project area are volcanic rocks assigned to a number of formations of Silurian age, as well as some of Devonian age. These include black basalts and pink, maroon, and green rhyolite (Caldwell 1998).

Geologic History and Volcanic, Seismic, and Glacial Activity

Much of the bedrock in Washington County is plutonic igneous rock, mostly granite, with smaller areas of gabbro that formed during the Devonian time. Bedrock in a large area between Machias and Calais consists of volcanic rocks, rhyolite and basalt that erupted during the Silurian time. These igneous rocks are likely aspects of the Acadian mountain-building event, the collision of the Avalon terrane with North America (Caldwell 1998).

Bedrock in the East Coastal Biophysical Region is predominately igneous, except for outcrops of metavolcanic rocks near Columbia Falls and in the Cobscook Bay area. Gabbro, diorite, volcanic rhyolite, and basalt are common rock types near the project vicinity (McMahon 1990). On outer peninsulas and similar land features, soils are generally poorly developed, acidic (due to poor buffering capacity of the parent material), coarse-textured, and shallow. According to McMahon (1990), the East Coastal Biophysical Region is dominated by coarse-loamy Lyman soils and sandy-skeletal Schoodic soils, both of which tend to be excessively drained and less than 20 inches in depth. Low-lying areas in the region that were inundated by sea water as the glaciers receded, are covered with deep marine clays and glaciolacustrine deposits (McMahon 1990).

The geology of the proposed project area is shaped by tidal forces, the underlying bedrock geology, and the glacial action from the most recent ice age. Nathaniel S. Shaler, in 1886, was one of the first geologists to describe the bedrock geology of Cobscook Bay. His report identified the igneous rocks of the area and cataloged the local fossils (Maine Geological Survey (MGS) 2005). The geology of the proposed project area is dominated by the bedrock of the Eastport Formation.

The Eastport Formation comprises the latest Silurian rocks in the area and like older formations includes several kinds of sedimentary and volcanic rocks. According to Toppan (1932), the Eastport Formation is found occurring in a belt which varies from nearly 2 to about 4 miles in width and generally runs southeastward. The general character of the Eastport Formation as described by Bastin and Williams (1914) is as follows: *"The volcanic rocks of the formation comprise both rhyolitic and diabasic varieties, occurring as flows and associated tuffs. Some rhyolite that is probably intrusive is mapped as a part of the formation because it cannot be everywhere distinguished from extrusive rhyolite. In bulk the volcanic rocks greatly exceed the*

detrital sediments, among which are limestone, shales of several sorts, and very small amounts of conglomerate. With few exceptions the masses of sediments are small and represent thin beds intercalated between the volcanic rocks that make up the bulk of the formation."

Marine Geology

Cobscook Bay and Passamaquoddy Bay (located mostly in Canada) and their connecting passages lie at the entrance to the Bay of Fundy, on the eastern boundary between the United States and Canada where the mean tidal range is approximately 20 feet (6 meters). Vigorous tidal currents maintain cold temperatures and efficient exchange with offshore waters year-round (Brooks 2004).

Like many other estuaries in northern New England, Cobscook Bay is a rocky, macrotidal estuary that has only slight riverine input and contains an abundance of till and fine-grained glacial-marine sediment. More than 70 percent of the bottom of the estuary is floored by gravel and rock; mud deposits are located in shallow-water coves throughout Cobscook Bay. Almost 60 percent of the intertidal zone is composed of mudflats that are uniformly distributed within and along the outside margin of Cobscook Bay, with increasing abundance of bedrock in a landward direction. Small beaches occur wherever coarse-grained glacial sediment erodes from bluffs (Kelley and Kelley 2004).

Sedimentation at tidal energy deployment sites can be an important consideration for the foundation design and has an impact on the installation methods and scour protection methods associated with the foundation. The extremely high tides in the proposed project area influence the types of materials found on the seafloor and along the shoreline (MGS 2005). ORPC Maine conducted a marine geophysical survey in November 2010 to obtain additional site-specific details on bathymetry, seabed geology, and obstructions (natural or man-made, either existing or foreseeable) in Cobscook Bay. The survey was conducted throughout the proposed project area, including the proposed P&D cable route. The survey methodology consisted of single beam sonar for bathymetry, side-scan sonar, sub-bottom profilers, and a magnetometer survey.

The proposed project area is dominated by glaciomarine deposits (*i.e.*, silt, clay, sand, and gravel), many areas of bedrock outcrops and areas of near surface bedrock, glacial till, and many areas of undifferentiated thin drift material. Additional geotechnical data obtained by ORPC Maine for the proposed project area shows that the TidGen^{TM} Power Systems would be located in areas with up to 40 feet of marine clay (Presumpscot clay) and some thin layers of glacial till overlaying bedrock. Along the landward boundaries of the proposed project area, the intertidal/subtidal environments generally consist of beach, rock, mud, and gravel.

Navigational charts produced by NOAA show that the proposed project area ranges in depth from approximately 10 feet (3 meters) to 380 feet (116 meters) at mean lower low water (MLLW).[13]

Terrestrial Geology

Washington County, in the vicinity of the proposed project, generally consists of gently sloping valleys terminating in coastal lowlands. Glaciomarine or glaciolacustrine sediments cover the coastal valleys. Soils in the vicinity of the proposed project area are dominated by glaciomarine deposits and undifferentiated thin drift materials. One of the most dominant soil complexes occurring in the vicinity of the proposed project area is the Lamoine-Scantic complex. Dominated by fine glaciolacustrine deposits and/or fine glaciomarine deposits, this soil complex is generally found on coastal plains and footslopes. It is typically found on slopes ranging from 0 to 5 percent and is a somewhat poorly drained soil. Other dominant soil types occurring in the proposed project area are the Rawsonville Hogback complexes. These soils are dominated by coarse-loamy supraglacial meltout till derived from mica schist. They are typically located on footslopes, sideslopes, ridges, and knolls. These soil types are typically found on slopes ranging from 3 to 15 percent and are well-drained soils (United States Department of Agriculture (USDA) 2010).

Another major soil type found in the vicinity of the proposed project, near Pike Lands is Gouldsboro silt loam. This soil type is dominated by fine-silty glaciolacustrine deposits and is generally located at toeslopes and tidal marsh areas. According to the USDA (2010), this soil type is very poorly drained, is frequently flooded, and is located in areas with slopes from 0 to 1 percent.

There is one mapped fault in the vicinity of the proposed project; however, no offset has been seen on any area faults to indicate any fault movement since the Jurassic Period (Gates 1982). According to the MGS (2008), there are no “active” faults in Maine and there are no particular fault lines in Maine that are related to the modern earthquakes experienced in Maine. There are no known unstable geologic features, unique geologic features, or mineral resources in the proposed project area.

3.3.1.2 Environmental Effects

ORPC Maine proposes a Hydraulic Monitoring Plan to characterize the hydrological zone of influence for the project and understand its effects, if any, on flow and sediment transport in Cobscook Bay. As part of the plan ORPC would conduct monitoring for scouring, or sediment transport processes, within the deployment area.

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[13] MLLW is a tidal datum that represents the average of the lower low water height of each tidal day observed.

This would be conducted by performing a visual survey in the deployment area and P&D cable route, using a diver and video camera. Along the cable route video for different inspection periods would be compared to identify any changes in the surficial substrate. Each TidGen™ would have markings for conducting measurements on the bottom support frame to aid in the evaluation of sediment transport. Video inspection of the bottom support frame would provide indications as to whether sedimentation or scour is occurring around the feet of the frame. In addition, geophysical surveys would be conducted post-deployment and compared to the pre-deployment bathymetry survey data to identify any differences in the bathymetry and sediment thickness. A summary of the proposed monitoring schedule is provided in table 2.

Table 2. Proposed schedule for the sediment transport component of the Hydraulic Monitoring Plan (Source: application, as modified by staff).

Plan	**Phase 1 (1 TidGen™)**	**Phase 2 (5 TidGen™)**
Hydraulic Monitoring Plan (*Bathymetric and Sediment Thickness Survey*)	None	Conduct visual survey for scour and sediment transport in deployment area and P&D cable route after 6 months of operation; geophysical survey 1 year after installation

In a letter filed November 7, 2011, Interior states that it finds the proposed data collection methods, analyses, geographic scope, and schedule for monitoring hydraulic conditions in the project area to be appropriate. Similarly, NMFS recommends (10(j) recommendation 1), in a letter filed on November 4, 2011, that all of ORPC Maine's proposed environmental monitoring plans be incorporated into any license issued by the Commission. NMFS further recommends ORPC Maine meet the environmental monitoring goals and objectives of Phase 1 installation before proceeding to Phase 2 (10(j) recommendation 3), provide an annual report that details the progress, data, and status of all monitoring for that year (10(j) recommendation 4), and continue to consult with NMFS, as well as other state and federal resource agencies, to help guide the adaptive management measures and inform future conservation recommendations (10(j) recommendation 5).

Our Analysis

Hydraulic effects of hydrokinetic energy generation systems on the distribution and magnitude of water flows around a project installation have not been fully characterized due to limited empirical or analytical information on these devices.

Changes to the magnitude of tidal flows in the immediate vicinity of the proposed project could also affect sediment transport processes, which help to provide habitat for aquatic organisms

The proposed project is anticipated to remove only a small amount of energy from the tidal system. At a large scale, energy removal can lead to changes in tidal range, which in turn can affect water temperature, the behavior of some migratory fish, water quality, and sediment transport (DOE 2009 in Polagye et al. 2010). At the pilot scale, however, effects are expected to be immeasurably small. For example, a numerical model of a pilot project in northern Admiralty Inlet, Puget Sound (Polagye et al. 2010) suggests a maximum range reduction of 0.2 millimeters in South Sound. Such a small change is not anticipated to be detectable and is thus likely to be insignificant. The small amount of energy removed by the five turbines on the bottom of Cobscook Bay is not expected to have a measureable effect on tidal range and currents; therefore, the effects to the overall habitat would also be expected to be insignificant. However, the proposed Hydraulic Monitoring Plan would provide an increased understanding on the effects of arrays of these devices on hydrodynamics and sediment transport processes for use in the design and evaluation of larger commercial-scale arrays.

3.3.2 Aquatic Resources

3.3.2.1 Affected Environment

Water Use

Cobscook Bay has considerable commercial fishing, marine resource harvesting and aquaculture sites. Scallop dragging and urchin dragging are the primary marine resource-harvesting activities conducted in the vicinity of the proposed project. Sea urchin dragging is performed in the vicinity of Goose Island and Spectacle Island, just north of the proposed deployment area, with the dragging following the shore southeast toward Shackford Head. Scallop dragging is frequent in Cobscook Bay near Birch Point and off of Shackford Head. According to the Cobscook Bay Resource Center (CBRC), 112 scallop permits were issued within Cobscook Bay in 2007, with rockweed harvesting and lobstering also present in the vicinity of the proposed project, but at a lower rate.

Maine DMR has the authority to lease state-owned waters to private interests for the purposes of conducting aquaculture activities. Although aquaculture has been present within Maine coastal waters since the nineteenth century, the leasing of Maine waters for private aquaculture is more recent. As of March 2011, there are 77 molluscan shellfish leases (including experimental leases) totaling 610 acres, 1 experimental seaweed lease (0.86 acres), 3 green sea urchin leases totaling 8 acres, and 26 finfish leases totaling 620 acres located in marine and estuarine waters along the Maine coast. There are 17 standard leases for finfish aquaculture and 1 standard lease for shellfish aquaculture in

the vicinity of the proposed project (Maine DMR 2008). Standard leases, issued for bottom and suspended aquaculture for finfish, shellfish, and seaweed, allow up to 100 acres of aquaculture and 10-year terms that may be renewed and transferred. Although not all of the 18 aquaculture leases are actively used, they all have the potential to be used.

Recreational and commercial marine vessel traffic is important to Cobscook Bay. Vessel traffic includes recreational boating and fishing, whale watching cruises, commercial shipping, commercial fishing, and transportation ferries. Recreational fishing is light in Cobscook Bay; activities include lobstering, scalloping, and fin fishing.

The Eastport Port Authority has two deepwater facilities: the Breakwater Terminal and the Estes Head Cargo Terminal. The Breakwater Terminal has berthing for a vessel up to 700 feet. The Estes Head Cargo Terminal can accommodate a vessel of 900 feet at Berth A, and a vessel up to 550 feet at Berth B.

Water Quantity

Cobscook Bay is dominated by energetic tides of high amplitude. The average tidal range at the mouth of Passamaquoddy Bay is approximately 18 ft (5.5 meters) (Brooks 2005*b*), with extremes as high as 25 ft (7.6 meters) (FERC 2009). Extreme semi-diurnal tides and tidal upwelling attribute to the thorough mixing of the water column (Campbell 2004). This large tidal range is the result of the near resonance of the semi-diurnal tide of the North Atlantic Ocean with the natural period of the Gulf of Maine/Bay of Fundy, resulting in amplified tides that are among the largest in the world (Garrett 1972). Generally, two high tides and two low tides occur per solar day, but the times of high and low water are delayed each day by about 50 minutes because of the moon's prograde orbital motion (Brooks 2004). Figure 3 shows the predicted and observed tide at the NOAA tidal gage station (ID 8410140) located in the Passamaquoddy Bay in Eastport, Maine from July 2008 through July 2009 (NOAA 2009*a*).

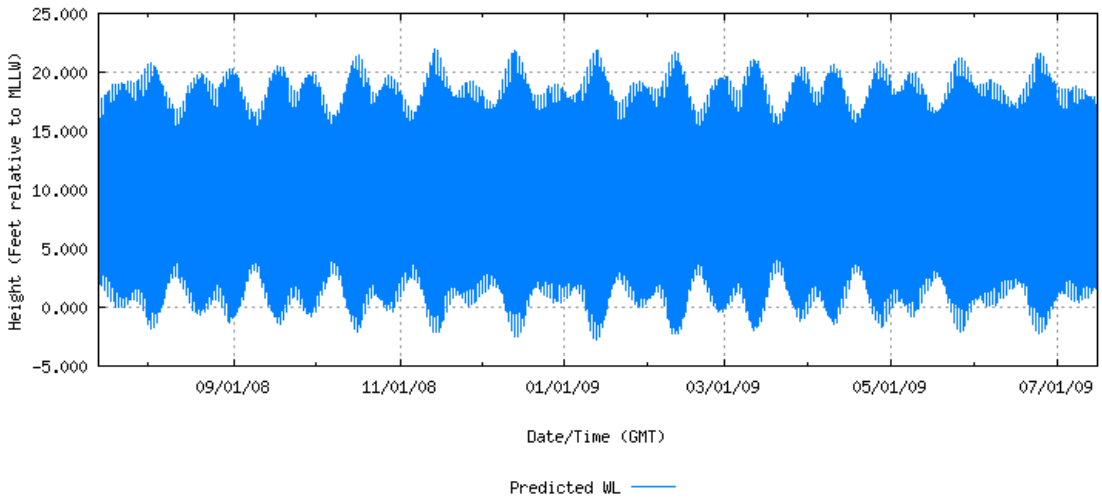

Figure 3. Predicted and observed tides at NOAA tidal gage station (ID 8410140) located in the Passamaquoddy Bay in Eastport, Maine from July 14, 2008, through July 15, 2009 (Source: application).

Water circulation in the proposed project area is clearly defined by the tides; however, other factors including wind and freshwater inflow interact with the tides. According to modeling efforts, the flood and ebb currents in Cobscook Bay generally follow a deep channel from the open boundary into the central bay, with maximum current speeds reaching about 4 knots (2 meters per second) (Brooks 2005*a*). This appears to be consistent with the Gulf of Maine Ocean Observing System (GoMOOS)[14] observational buoy in outer Cobscook Bay, which shows peak surface current speeds of approximately 4 knots (figure 4). Tidal-mean flushing times in Cobscook Bay vary from less than 1 day near the entrance, to over 1 week in the inner arms of the bay. Approximately one-third of the high-water volume of Cobscook Bay moves in and out with each tide (Brooks 2005*a*).

[14] GoMOOS is a national pilot program designed to bring hourly oceanographic data from the Gulf of Maine to users such as commercial mariners, coastal resource managers, scientists, educators, search-and-rescue teams, emergency response teams, and public health officials.

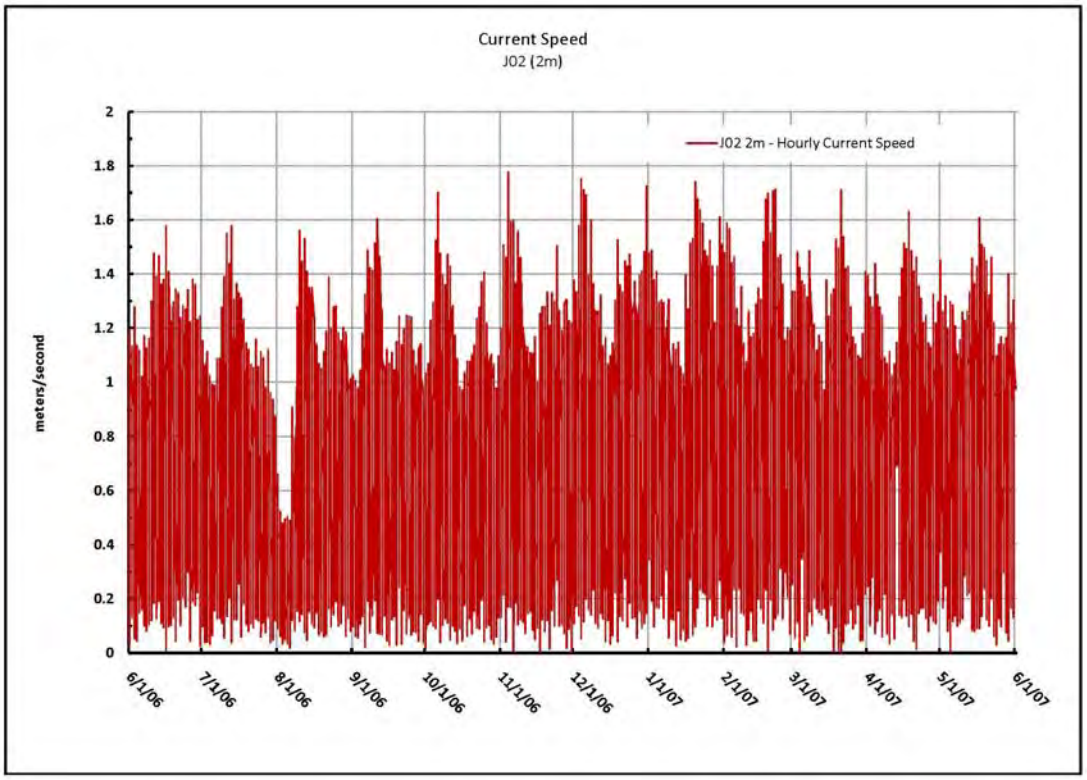

Figure 4. Flow velocity data for the proposed project area in Cobscook Bay from June 1, 2006, through June 1, 2007 (Source: application).

ORPC Maine collected site-specific velocity data and conducted an experimental hydraulic assessment of the flows at the proposed project site to provide information for estimating the site's energy generation and the operational loads applied to the structure. OPRC Maine has made several deployments of bottom-mounted acoustic Doppler current profilers (ADCP) for the purpose of measuring water flow speeds through the water column at various locations within the proposed project area. The ADCP deployments were made at different periods of the lunar cycle and for differing lengths of time. Figure 5 shows the locations of the ADCP deployments, and table 3 shows the dates that the ADCP deployments occurred.

Figure 5. Locations of ADCP deployments by ORPC Maine (Source: application).

Table 3. The location names, dates, and duration for each of ORPC Maine's ADCP deployments in Cobscook Bay (Source: application, as modified by staff).

Deployment Name	Deployment Date	Deployment Duration
Upper Cobscook	March 31, 2010	30 days
ADCP Center	May 11, 2010	58 days
ADCP SE	June 16, 2010	7 days
ADCP SW	June 2, 2010	7 days
ADCP NW	May 19, 2010	7 days
ADCP NE	June 24, 2010	7 days
ADCP South	July 1, 2010	7 days

An ADCP was deployed at the Upper Cobscook site for a 30-day period between March 31, 2010 and April 29, 2010. The water speed data are presented in figure 6 below for this period. Flood flow is presented as a positive water speed; ebb flow is presented as a negative flow speed.

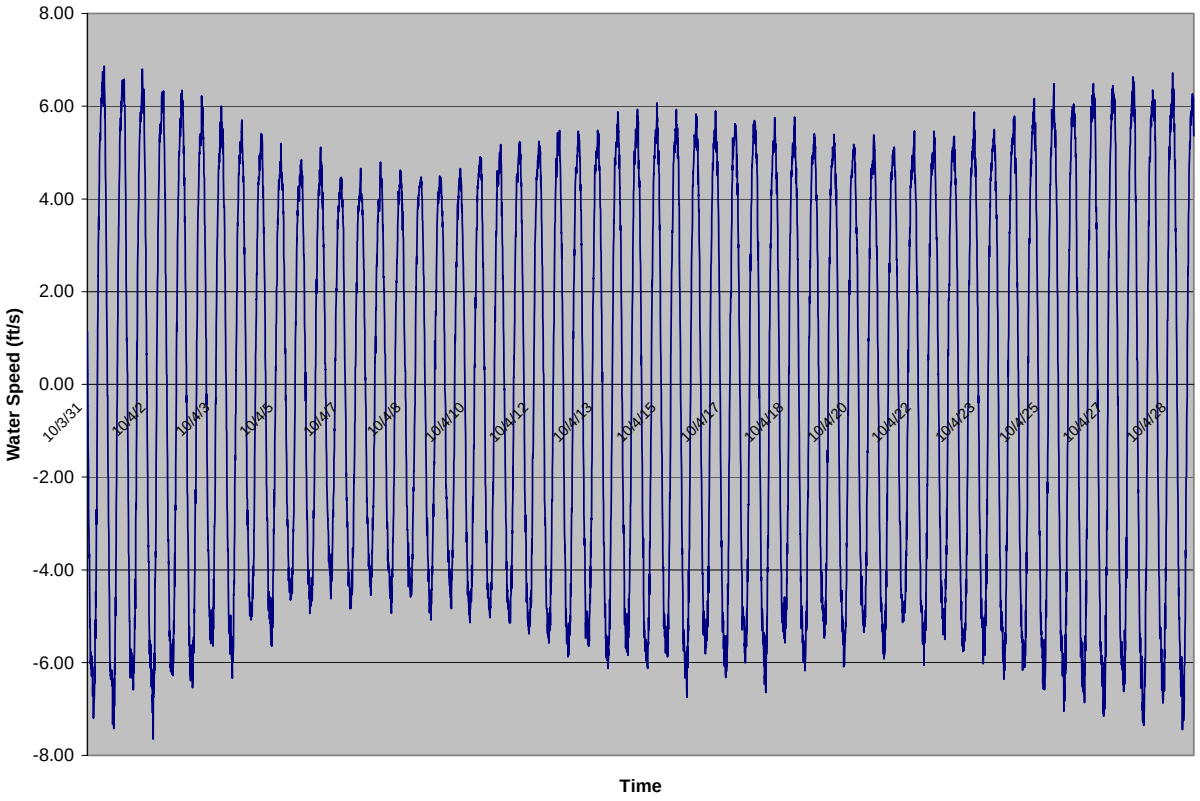

Figure 6. Water speed at the Upper Cobscook Bay ADCP deployment site during a 30-day period in April 2010 (Source: application).

Water Quality

The State of Maine's classification system for water quality is used to direct the state in the management of its surface waters, to protect the quality of those waters for their intended management purposes, and where standards are not achieved, to direct the state to enhance the quality to achieve those standards. Maine has three classes for marine and estuarine waters.

The highest classification of marine/estuarine waters is termed SA. This classification is for waters that are outstanding natural resources and which should be preserved because of their ecological, social, scenic, economic, or recreational importance. Class SA waters allow impoundments and very restricted discharges. Class SB waters have fewer restrictions on activities but still maintain high water quality criteria, while Class SC waters have the least restrictions on use and the lowest (but not low) water quality criteria. The proposed project area in Cobscook Bay is located in SB classified waters, which "are suitable for the designated uses of recreation in and on the water, fishing, aquaculture, propagation and harvesting of shellfish, industrial process and cooling water supply, hydroelectric power generation, navigation, and as habitat for fish and other estuarine and marine life" (MRSA, Title 38, §465-B).

The waters in the proposed project area of Cobscook Bay are well mixed with the Gulf of Maine and have limited freshwater inputs. The Dennys and Pennamaquan Rivers empty into Cobscook Bay, with Dennys River being the larger of the two, and slightly lower the salinity of inner Cobscook Bay from increased freshwater inputs. Water quality in Cobscook Bay reflects the dynamic tidal exchanges resulting in relatively uniform parameters throughout the outer bay.

A major controlling factor of water temperature is tidal mixing. The proposed project area is extremely well mixed both laterally and vertically by strong currents and vertical turbulence with no indications of significant stratification (Quoddy Bay LNG 2006). Mixing cools the surface waters in the summer, and limits the freezing temperatures and ice buildup in the winter.

The GoMOOS deployed an oceanographic buoy in outer Cobscook Bay until 2008. Water temperatures at the GoMOOS buoy varied seasonally from 33.2 to 55.0 degrees Fahrenheit (°F) (0.7 to 12.8 degrees Celsius (°C)) but were uniform with depth (figure 7) (GoMOOS 2010). Monthly average salinity ranged from 29.90 to 32.30 parts per thousand (ppt) (figure 8) (GoMOOS 2010).

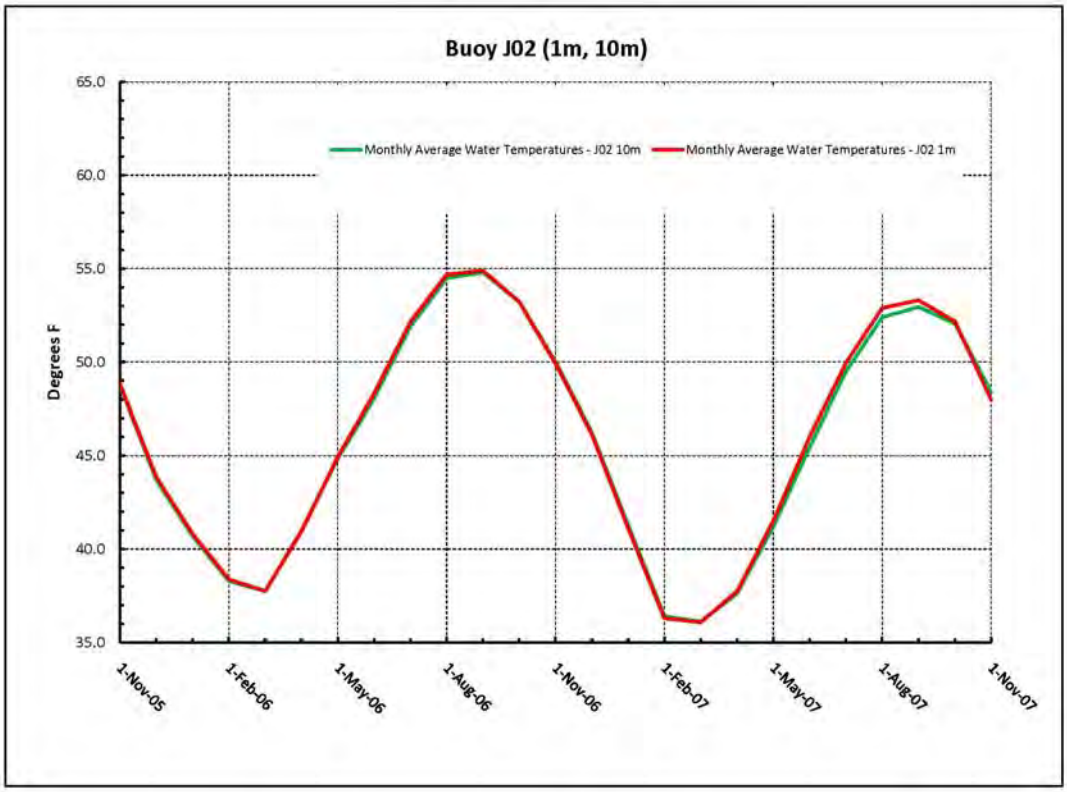

Figure 7. Monthly average water temperature at GoMOOS buoy, Cobscook Bay (Source: application).

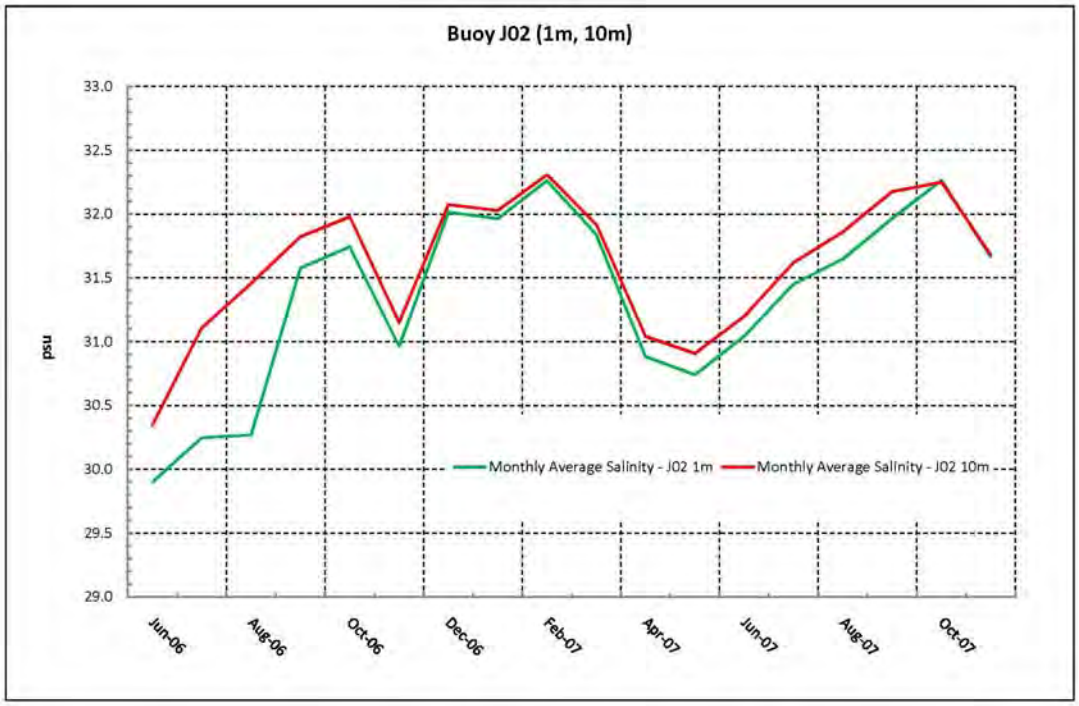

Figure 8. Monthly average salinity at GoMOOS buoy, Cobscook Bay (Source: application).

Water quality data collected in association with the Maine DMR Finfish Aquaculture Monitoring Program further demonstrates that water quality within the outer Cobscook Bay is relatively uniform by site and within the water column. The mean values of the parameters sampled in 2001 are shown in table 4 and station locations are presented in figure 9. The water quality profile data for Birch Point, the sampling station located nearest the proposed project area, demonstrates the uniformity of water quality parameters (table 5).

Table 4. Summary of profile means from water quality sampling in Cobscook Bay conducted on October 3, 2001 (Source: application).

Location	Station Depth (m)	Temp (°C)	Salinity (ppt)	DO Concentration (mg/L)	DO (percent)	pH
Shackford Head	10.0	12.0	32.8	8.4	95.3	7.8
Deep Cove	10.5	12.3	32.8	8.4	96.1	7.8
Broad Cove	8.6	12.1	32.7	8.2	94.0	7.8

Comstock Point	8.2	12.0	32.9	8.2	93.7	7.8
Cooper's Ledge	7.7	12.1	32.8	8.2	93.6	7.8
Birch Point	8.2	12.2	32.8	8.6	98.4	7.8

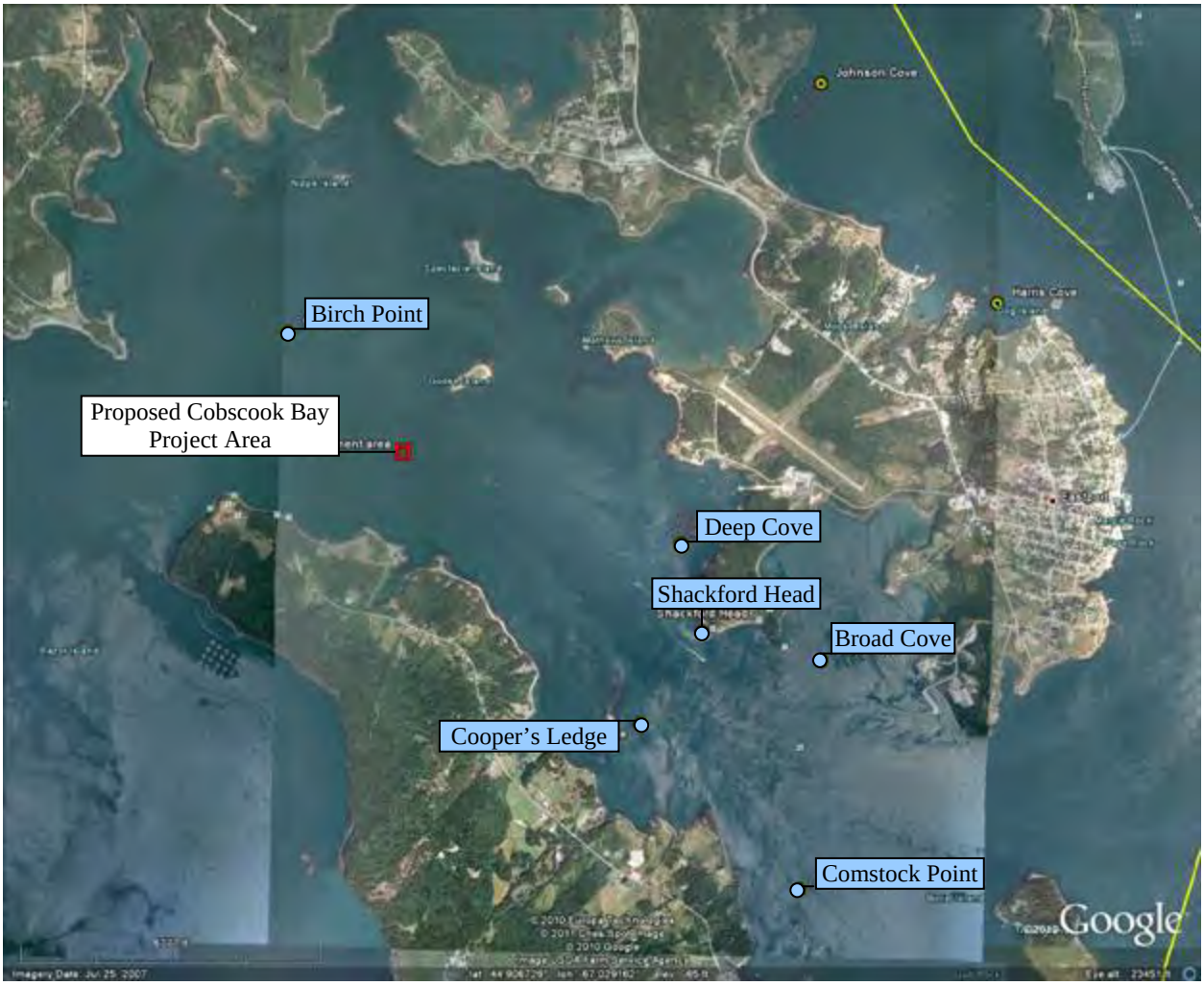

Figure 9. Location of Maine DMR water quality sampling stations in vicinity of proposed project area (Source: application).

Table 5. Water quality profiled data collected from Maine DMR's Birch Point sampling station on October 3, 2001 (Source: application).

Depth (m)	Temperature (°C)	Salinity (ppt)	DO Concentration (mg/L)	DO (percent)	pH
0.6	12.23	32.77	8.63	98.8	7.79
1.1	12.24	32.78	8.62	98.8	7.79
2.1	12.24	32.78	8.62	98.8	7.78
3.1	12.24	32.78	8.62	98.7	7.79
4.2	12.23	32.78	8.61	98.7	7.79
5.0	12.23	32.78	8.61	98.6	7.79
6.1	12.23	32.78	8.61	98.6	7.79
7.1	12.22	32.78	8.60	98.5	7.78
8.1	12.22	32.79	8.60	98.5	7.78
9.1	12.22	32.79	8.59	98.4	7.79
10.1	12.22	32.78	8.59	98.4	7.79
11.1	12.21	32.78	8.59	98.4	7.80
12.0	12.19	32.80	8.57	98.1	7.79
13.1	12.19	32.80	8.57	98.1	7.80
13.3	12.19	32.80	8.56	98.0	7.78

More recent salinity and temperature data collected in 2007 by Cooke Aquaculture at Birch Point demonstrate relatively consistent salinities throughout the summer and a typical temperature curve (table 6).

Table 6. Temperature and salinity data collected by Cooke Aquaculture at Birch Point in 2007 (Source: application).

Month	Temperature (°C)	Salinity (ppt)
June	8.0	30.7
July	9.6	31.9
August	12.4	31.4
September	12.2	31.6
October	10.4	31.9

Marine Habitat

Cobscook Bay is characterized by a narrow opening to the sea and a very convoluted shoreline. The surface area during high tide is approximately 42.5 square miles with 201.9 miles of shoreline. The bathymetry of Cobscook Bay is very uneven, but becomes generally shallower from sea to land and towards the smaller bay margins (Quoddy Bay LNG 2006). Cobscook Bay is dominated by energetic tides of high

amplitude that result in thorough mixing of the water column. Extreme semi-diurnal tides, tidal upwelling, high incidence of summer fog shielding the intertidal zone from solar radiation, and unusually varied habitats, both intertidal and subtidal, all attribute to the extreme energy imparted by the tides (Campbell 2004).

Cobscook Bay is a rock-framed macrotidal estuary with extreme tidal range that creates an ecosystem with biodiversity unsurpassed at lower latitudes. The interaction of the large tidal range with the structural geology of Cobscook Bay results in a very large intertidal zone where approximately one-third of the area of Cobscook Bay is exposed to the atmosphere at low tide while another significant portion remains covered by only very shallow water. In many places, the intertidal zone is 1 kilometer or more in width (Larsen 2004; Larsen et al. 2004).

As noted previously, the tidal range in Cobscook Bay is large, with a mean value of 5.7 meters. The tidal flow over the narrow outer portion of the bay is equivalent to the mean outflow of the Mississippi River over the duration of both the ebb and flood tides (Larsen 2005). Peak current speeds are on the order of 2 meters per second (m/s) and the mean depth of the outer bay is approximately 30 meters, with pockets to approximately 45 meters deep (Larsen 2005). These high tidal flows remove fine landward-derived sediments and result in gravel being the most abundant seafloor material in each arm of Cobscook Bay, with gravel and rock accounting for 90 percent of the subtidal bottom in the outer Cobscook Bay region (Kelley and Kelley 2004).

Results of the marine geophysical survey conducted by ORPC Maine indicate that depths within the proposed project area range between 35 and 150 feet (figure 10). The maximum depth at Grove Point, where the TidGen™ devices would be sited, is 85 feet, which gradually shallows approaching the on-shore connection point. The bottom contour gradually increases as it curves toward Shackford Head, with the general depths ranging between 80 and 140 feet; however, there are also pockets of shallower depths, 35 to 50 feet, and deeper depths, 105 to 150 feet, within this section.

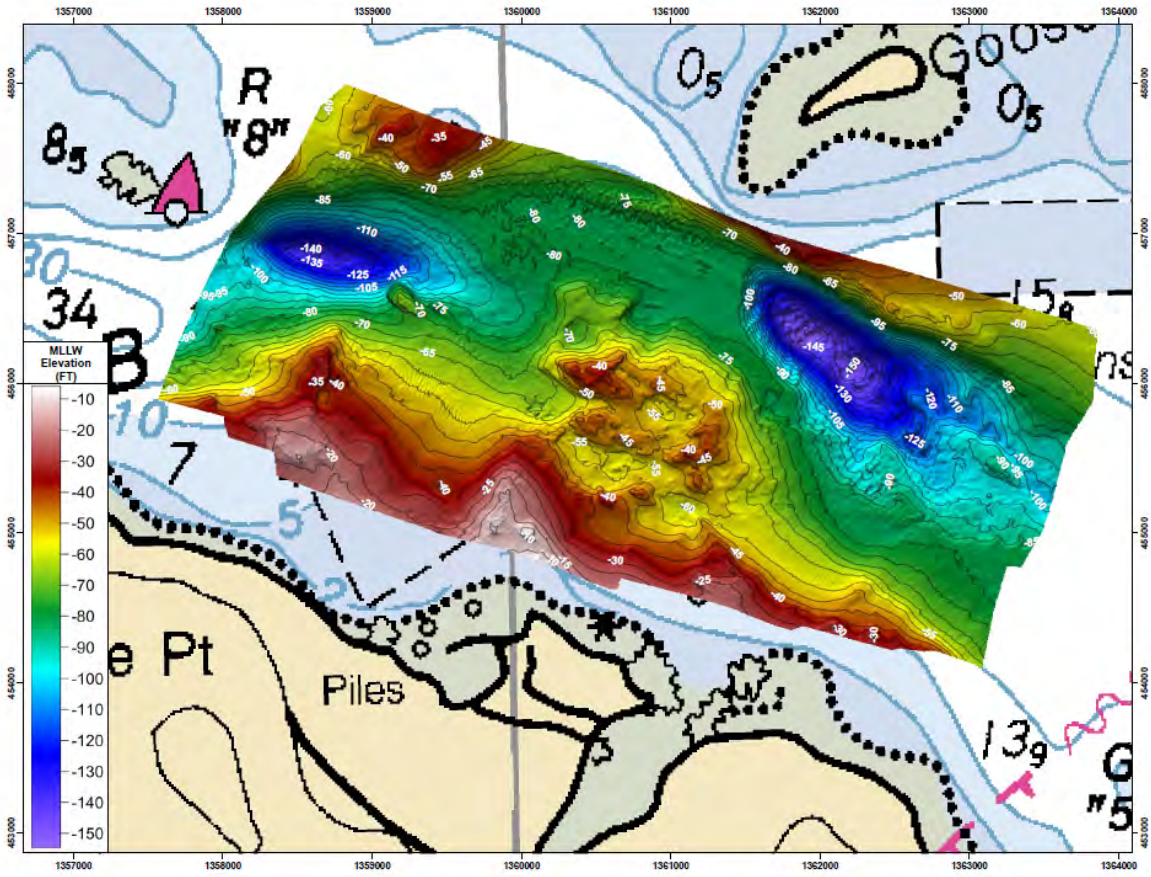

Figure 10. Bathymetric surface and 5-foot contours in the proposed project area at mean low water elevations (Source: application).

Invertebrates

Based on collection records spanning the past 162 years, nearly 800 species of macroinvertebrates with representatives from phylums Porifera, Cnidaria, Ctenophora, Platyhelminthes, Nemertea, Nemata, Priapula, Sipuncula, Annelida, Arthropoda, Mollusca, Ectoprocata, Brachiopoda, Echinodermata, Chaetognatha, Hemichordata, Chordata, have been found in Cobscook Bay (Trott 2004b).

MER Assessment Corporation (MER) conducted subtidal benthic video and benthic infauna surveys in Cobscook Bay from June 17 to 19, 2009. The results of the survey showed that the epifauna community along the seafloor in the outer Cobscook Bay and Deep Cove area consists of firmly attached sessile and mobile benthic epifauna capable of strong anchoring to withstand the strong tidal currents affecting the area. The dominant species are sea cucumbers, green sea urchins, common sea star, purple sunstar, stalked ascidians, invasive white encrusting colonial tunicate, northern red anemones, blue mussel, and numerous sponges, including bread crumb sponge, finger sponge, and palmate sponge. Other less common species found along the seafloor include the waved whelk, hermit crab, sea scallop, Jonah crab, and sculpins.

The Beta TidGen™ was deployed in the vicinity of Shackford Head in Cobscook Bay on February 15, 2010. During its retrieval and relocation of the mooring system from September 15 to 19, 2010, marine bioaccumulation on the first mooring lines consisted of brittle stars, juvenile clusters of sea peaches and sea potatoes, sea cucumbers, sea urchins, scallop and blue mussel spuds, star fishes, spiny sun stars, and northern red sea anemones and frilled anemones. Most of the organisms, especially the brittle stars, were concentrated in the links between the chain and not on the outside areas exposed to the high tide velocities. The remaining three moorings were retrieved under similar conditions, but had very low diversity and density of organisms and consisted of a few sea urchins and sea peach juveniles. All of the lines were deployed in the same general location, water depths, and exposure to tidal flows.

Fish

The Cobscook Bay is recognized as a region of high biological productivity and biomass. Cobscook Bay habitats serve as nursery grounds for juveniles, foraging and spawning sites for adults, and migratory routes for anadromous and catadromous species (Arens 2007). However, data specific to Cobscook Bay and the proposed project area are limited as most studies were conducted in the lower Bay of Fundy and Passamaquoddy Bay regions.

Table 7 presents fish survey data from two different studies (MacDonald et al. 1984; Arens 2007) with sample locations closest to the proposed project area, and therefore represents species most likely to inhabit or pass through the vicinity of the proposed project. Survey results for these locations showed 50 species of fish captured during the study periods. Winter flounder was the dominant flatfish species captured, while the remainder of the flatfish species was rare in the region. Of the gadoid species captured, Atlantic cod, pollock, and silver hake were abundant in the region, and all pollock captured were juveniles. Clupeid and osmerid species captured were dominated by Atlantic herring, with rainbow smelt commonly caught throughout the region. Blennioid-like species were dominated by ocean pout, with rock gunnel regularly captured in the nearshore/beach stations. Little skate was the dominant rajidae species captured, with thorny and big skate also common throughout the region (MacDonald et al. 1984). Atlantic salmon were only occasionally collected at one station in Head Harbor Passage. No Atlantic or shortnose sturgeon were reported in the MacDonald et al. (1984) and Arens (2007) survey reports. In general, the summer offshore, hard-bottom assemblage within Passamaquoddy Bay, closest to the proposed project area, consists of adult gadids (*i.e.*, Atlantic cod, haddock, and white and red hake), adult flounders (*i.e.*, winter and yellowtail), ocean pout, adult sculpins, and skates. Sea raven, longhorn sculpin, ocean pout, and little skate remained throughout the winter months, along with juvenile fishes that move in from the more shallow zones of the estuary (MacDonald et al. 1984).

Table 7. Fish species known to occur in the vicinity of the proposed project area (Source: application, as modified by staff).

Common Name (*Scientific Name*)	**Common Name (*Scientific Name*)**
Hagfish *(Myxine glutinosa)*	Ocean pout *(Macrozoarces americanus)*
Spiny dogfish *(Squalus acanthias)*	Lumpfish *(Cyclopterus lumpus)*
Thorny skate *(Raja radiate)*	Gulf snailfish *(Liparis coheni)*
Smooth skate *(Raja senta)*	Inquiline snailfish *(Liparis inquilinus)*
Little skate *(Raja erinacea)*	Acadian redfish *(Sebastes fasciatus)*
Big skate *(Raja ocellata)*	Longhorn sculpin *(Myoxocephalus octodecemspinosus)*
Alewife *(Alosa pseudoharengus)*	Grubby *(Myoxocephalus aenaeus)*
American shad *(Alosa sapidissima)*	shorthorn *(Sculpin Myoxocephalus scorpius)*
Atlantic herring *(Clupea harengus)*	Sea raven *(Hemitripterus americanus)*
Rainbow smelt *(Osmerus mordax)*	Moustache sculpin *(Triglops murrayi)*
Atlantic salmon *(Salmo salar)*	Arctic hookear sculpin *(Artediellus uncinatus)*
Capelin	Alligatorfish

(Mallotus villosus)	*(Aspidophoroides monopterygius)*
Fourbeard rockling *(Enchelyopus cimbrius)*	Butterfish *(Poronotus triacanthus)*
Atlantic cod *(Gadus morhua)*	Winter flounder *(Pseudopleuronectes americanus)*
Atlantic tomcod *(Microgadus tomcod)*	Witch flounder *(Glyptocephalus cynoglossus)*
Pollock (juvenile) *(Pollachius virens)*	American plaice *(Hippoglossoides platessoides)*
Haddock *(Melanogrammus aeglefinus)*	Yellowtail flounder *(Limanda ferruginea)*
Silver hake *(Merluccius bilinearis)*	Atlantic halibut (juvenile) *(Hippoglossus hippoglossus)*
White hake *(Urophycis tenus)*	Four-spotted flounder *(Paralichthys oblongus)*
Red hake *(Urophycis chuss)*	Windowpane flounder *(Scophthalmus aquosus)*
Atlantic wolffish *(Anarhichas lupus)*	American angler *(Lophius americanus)*
Radiated shanny *(Ulvana subbifurcata)*	Threespine stickleback *(Gasterosteus aculeatus)*
Wrymouth *(Cryptacanthodes maculates)*	Blackspotted stickleback *(Gasterosteus wheatlandi)*
Rock gunnel *(Pholis gunnellus)*	American sand lance *(Ammodytes americanus)*
Snake blenny	Atlantic silverside

(Lumpenus lumpretaeformis)	*(Menidia menidia)*
Daubed shanny *(Lumpenus maculates)*	Atlantic mackerel *(Scomber scombrus)*

Essential Fish Habitat

The Magnuson-Stevens Act, as amended by the Sustainable Fisheries Act of 1996 (Public Law 104-297, 110 Stat. 3559), 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.

- 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 (2010)). 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 C.F.R. § 600.810(a)).

EFH consultation with NMFS is required for 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.

A total of 14 finfish and one shellfish species are currently designated as EFH species within the proposed project area. Each EFH-designated species and the corresponding life stages are presented in table 8.

Table 8. Fish species with designated EFH in the proposed project area (Source: application, as modified by staff).

Species	**Eggs**	**Larvae**	**Juveniles**	**Adults**
American plaice *(Hippoglossoides platessoides)*	X	X	X	X
Atlantic cod *(Gadus morhua)*		X	X	X
Atlantic halibut *(Hippoglossus hippoglossus)*	X	X	X	X
Atlantic mackerel *(Scomber scombrus)*			X	X
Atlantic salmon *(Salmo salar)*			X	X
Atlantic sea herring *(Clupea harengus)*		X	X	X
Ocean pout *(Macrozoarces americanus)*	X	X	X	X
Pollock *(Pollachius virens)*		X	X	X
Red hake *(Urophycis chuss)*			X	X
White hake *(Urophycis tenuis)*			X	X
Whiting *(Merluccius bilinearis)*			X	X
Windowpane flounder *(Scopthalmus aquosus)*	X	X	X	X

Winter flounder *(Pseudopleuronectes americanus)*	X	X	X	X
Yellowtail flounder *(Pleuronectes feruginea)*	X	X		
Atlantic sea scallop *(Placopecten magellanicus)*	X	X	X	X

Marine Mammals

Gray seal (*Halichoerus grypus*), harbor seal (*Phoca vitulina*), harbor porpoise (*Phocoena phocoena*), and Atlantic white-sided dolphin (*Lagenorhynchus acutus*) are commonly observed in Cobscook Bay (NMFS 2009c) are expected to occur in the vicinity of the proposed project.

Gray seal

Gray seals have a cold temperate to subarctic distribution in the North Atlantic Ocean, with three major stocks: Eastern Canada, Northwestern Europe, and the Baltic Sea (MarineBio 2009; OBIS 2009c; Waring et al. 2009). The western North Atlantic population is equivalent to the Eastern Canada population, and ranges from North Labrador down to New England and occasionally as far south as Virginia (MarineBio 2009; Smithsonian National Museum of Natural History (SNMNH) 2009; Waring et al. 2009). In the mid 1980s, small numbers of animals and pupping were observed on several isolated islands along the Maine coast and in Nantucket-Vineyard Sound, Massachusetts. Resident colonies and pupping has been documented in Maine since 1994 (Waring et al. 2009).

Current estimates of the total Western Atlantic gray seal population are not available; although estimates of portions of the stock are available for select time periods. For the Canadian population, the 1993 survey estimated the population at 144,000 individuals, the 1997 survey estimated the population at 195,000 individuals, and the 2004 survey had an estimated range between 208,720 to 223,220 individuals, depending on the model used (Waring et al. 2009). Gray seal population in U.S. waters is also increasing. Maine coast-wide summer surveys revealed 597 individuals in 1993 and 1,731 individuals in 2001 (Waring et al. 2009). In 2002, the maximum counts of breeding colonies on Seal Island, Maine were 193 individuals with 9 pups and on Green Island, Maine were 74 individuals with 31 pups (Waring et al. 2009). ORPC Maine's collection of observation data for marine mammals during the testing of the Beta TidGen^{TM} and acoustic and subtidal surveys resulted in 15 observations of gray seals in or adjacent to the project area.

Gray seals feed on a wide variety of benthic and demersal species in coastal areas. They also feed on schooling fish in the water column, and occasionally take seabirds. Prey species consumed include sand lance, whiting, saury, smelt, various kinds of skates, capelin, lumpfish, pollock, cod, haddock, saithe, plaice, flounder, salmon, and a variety of cephalopod and molluscan invertebrates. This species can dive to about 30 to 70 meters while feeding, with a maximum reported diving depth of approximately 300 meters (MarineBio 2009; OBIS 2009c).

Gray seals are usually solitary or found in small dispersed groups, but gather together for hauling out, breeding, and molting. Many, but not all, gray seals disperse from their rookeries during the non-breeding season, but gather again at traditional sites to haul-out for the annual molt (Ocean Biogeographic Information System (OBIS) 2009c). Most prefer exposed areas such as remote islands, rocky coasts and reefs on which to haul-out (SCS 2009b). Studies have shown that grey seals are very individualistic and that their preferred prey, haul-out sites, and feeding locations and techniques differ greatly between individuals (SCS 2009b). They are usually quite gregarious at haul-outs with groups of 100 or more being common, and they will share haul-outs with harbor seals (OBIS 2009c). Occasional gray seals were observed during the winter harbor seal haul-out survey (Nelson et al. 2006). However, the months during which the aerial surveys were conducted coincided with pupping and mating season for gray seals, thus the majority of gray seals were likely at other, more suitable haul-out sites (Nelson et al. 2006).

The breeding season varies between populations, generally taking place between mid-December and early February in Canada (MarineBio 2009; OBIS 2009c). Breeding rookeries also vary by population in the Atlantic and are established on rocky islands and coasts, in caves, sandy islands, and beaches (MarineBio 2009; Seal Conservation Society (SCS) 2009b). Females reach sexual maturity at 3 to 5 years and males at 4 to 6 years, although males may not attain territorial status until 8 to 10 years of age (MarineBio 2009). Females usually give birth at the rookery about a day after coming ashore and pups nurse for about 17 to 18 days before weaned and left to fend for themselves (MarineBio 2009; SCS 2009b).

Harbor seal

Harbor seals are generally non-migratory and occur on both the east and west coasts of the U.S. On the east coast, this species is found from the Canadian Arctic to southern New England, New York, and occasionally end up in the Carolinas. On the west coast, this species is found in the coastal and estuarine waters off Baja, California, north to British Columbia, west through the Gulf of Alaska and in the Bering Sea (NOAA 2009c; Waring et al. 2009). NMFS manages seven stocks of harbor seals throughout the U.S.: Bering Sea, California, Gulf of Alaska, Oregon/Washington coastal, Southeast Alaska, Washington Inland, and Western North Atlantic. Based on recent genetic

findings, NMFS is reevaluating the structure of the Southeast Alaska, Gulf of Alaska, and Bering Sea stocks (NOAA 2009c).

Harbor seal are found in all nearshore waters of the Atlantic Ocean and adjoining seas above about 30°N latitude. Specifically, this species is distributed from the eastern Canadian Arctic and Greenland south to southern New England and New York, and occasionally to the Carolinas (Waring et al. 2009). A general southward movement from the Bay of Fundy to southern New England waters occurs in autumn and early winter. A northward movement from southern New England to Maine and eastern Canada occurs prior to pupping season, which takes place from mid-May through June along the Maine coast (Waring et al. 2009).

Harbor seals live in temperate coastal habitats and can be found commonly in bays, rivers, estuaries, and intertidal areas (OBIS 2009b), with movements associated with tides, weather, season, food availability, and reproduction. This species uses rocky shores, reefs, sand and gravel beaches, skerries (small, rocky islands), and drifting glacial ice as haul out and pupping sites (NOAA 2009c; SCS 2009a). Haul outs on land are needed for rest, thermal regulation, social interaction, birthing, and predator avoidance (NOAA 2009c). This species haul-out patterns tend to be strongly influenced by tidal cycles and many seals haul-out on the falling tide in areas below the high tide mark (SCS 2009a). Studies have shown that seals in groups tend to spend less time scanning for predators than those that haul out alone (NOAA 2009c). Nelson et al. (2006) conducted an aerial survey of potential winter haul-out sites within Cobscook and Passamaquoddy Bays from 2001 to 2003 and identified haul-out locations in Denny's Bay, Whiting Bay, Straight Bay, South Bay, and the Lincoln Cove portion of Cobscook Bay. Haul-out locations identified in Passamaquoddy Bay were the southern tip of Campobello Island and the island complex east (ocean side) of Deer Island.

ORPC Maine's collection of observation data for marine mammals during the testing of the Beta TidGen™ and acoustic and subtidal surveys resulted in 42 observations of harbor seals in or adjacent to the project area.

Harbor seals are generalist feeders taking a wide variety of fish, cephalopods, and crustaceans obtained from surface, mid-water, and benthic habitats. The emergence of aquaculture in the State of Maine has coincided with substantial increase in regional seal populations. The high densities of fish concentrated in relatively small areas, such as net pens, inevitably appeal to fish-eating wildlife (Nelson et al. 2006). Pinnipeds, in particular, exhibit plasticity in their feeding strategies and prey consumption, and individual seals and sea lions have learned to exploit situations where salmonids are concentrated and vulnerable (Nelson et al. 2006). However, a study conducted by Nelson et al. (2006) demonstrated that although seals may not specifically focus their foraging activities in areas where marine salmon farms are concentrated, they may take advantage of the available food source if it is located near their haul-out sites.

Harbor porpoise

Harbor porpoises occur in relatively discrete regional populations throughout northern temperate and subarctic coastal and offshore waters of the Northern Hemisphere. They are commonly found in bays, estuaries, harbors, and fjords less than 200 meters (650 feet) deep (NOAA 2009b). In the North Atlantic, they range from west Greenland to Cape Hatteras, North Carolina (but do not enter Hudson Bay), and from the Barents Sea to West Africa (NOAA 2009b). There are 10 stocks of harbor porpoises in US waters: Bering Sea, Gulf of Alaska, Southeast Alaska, Inland Washington, Monterey Bay, Morro Bay, Northern California/Southern Oregon, Oregon/Washington Coastal, San Francisco/Russian River, and Gulf of Maine/Bay of Fundy (Waring et al. 2009). For the Gulf of Maine/Bay of Fundy stock, harbor porpoises are concentrated in the northern Gulf of Maine and southern Bay of Fundy region during summer months (July to September) and are generally found in waters less than 150 meters deep (Waring et al. 2009). During the fall (October to December) and spring (April to June), harbor porpoises are widely dispersed from New Jersey to Maine, with lower densities farther north and south, and can be seen from the coastline to deep waters (greater than 1,800 meters) with a majority of the population found over the continental shelf (Waring et al. 2009).

ORPC Maine collected observation data for marine mammals during the testing of the Beta TidGen™, and during acoustic and subtidal surveys in outer Cobscook Bay from December 2007 to December 2010. Of the 252 observation periods of varying duration over 222 days, 47 observations of harbor porpoise were noted in or adjacent to the proposed project area.

Estimation of the population size of harbor porpoises in the Gulf of Maine and Bay of Fundy region were conducted during the summers of 1991, 1992, 1995, 1999, 2002, 2004, and 2006. The best current abundance estimate for the Gulf of Maine and Bay of Fundy region harbor porpoise was based on the 2006 aerial and ship survey results with the stock population at approximately 89,054 individuals (Waring et al. 2009). The 2006 estimate is the most current and the survey covered the largest portion of the harbor porpoise range, 10,676 kilometers of trackline in the region from the 2,000 meter depth contour on the southern edge of Georges Bank to the upper Bay of Fundy and to the entrance of the Gulf of St. Lawrence (Waring et al. 2009).

Most harbor porpoise are observed in small groups, generally consisting of less than five or six individuals. However, during feeding or migration, they can aggregate into large, loose groups of 50 to several hundred animals. Harbor porpoises rarely approach boats to ride bow waves, and often actively avoid vessels. They sometimes lie at the surface for brief periods between submergences and the reason for this behavior is unknown (OBIS 2009a). This species reach sexual maturity at 3 to 4 years of age, with geographic and density-dependent variation. Gestation lasts approximately 10.6 months with most calves being born from spring through mid-summer (OBIS 2009a). This is a

relatively short-lived species, in which specimens living past 20 years are rarely found (OBIS 2009a).

The main prey items for the harbor porpoise appear to vary regionally. In general, this species consumes a wide variety of fish and cephalopods, with small, non-spiny schooling fish (*i.e.*, herring and mackerel) the most common prey in many areas. They also feed on a wide variety of benthic and/or demersal species (OBIS 2009a). The main threats to the harbor porpoise include: fisheries bycatch, entanglement in fishing gear, harvest, and organochlorine contamination (OBIS 2009a).

Atlantic white-sided dolphin

Atlantic white-sided dolphins inhabit the oceanic waters of the continental shelf and slope only in the temperate waters of the North Atlantic Ocean. They are found in the western North Atlantic, from North Carolina to Greenland. This species exhibits seasonal movements, moving closer inshore and north in the summers and offshore and south in the winters (NOAA 2011). In 2007, the estimated population size of Atlantic white-sided dolphins in the western North Atlantic was about 63,000 animals, which is insufficient information to determine population trends (NOAA 2011). ORPC Maine's collection of observation data for marine mammals during the testing of the Beta TidGen™ and acoustic and subtidal surveys resulted in only two Atlantic white-sided dolphins being observed in or adjacent to the project area.

Atlantic white-sided dolphins are capable of holding their breath for nearly 5 minutes. They dive to feed on prey, such as fish (*e.g.*, mackerel, herring, and hake), as well as squid and shrimp. They are often seen in association with long-finned pilot whales, humpback whales, and fin whales while feeding (NOAA 2011).

A primary threat to Atlantic white-sided dolphins is incidental capture and entanglement in fisheries gear such as trawls, gillnets, and driftnets. Mass strandings of them are common occurrences in the northeastern U.S., although the cause of stranding is often unknown.

3.3.2.2 Environmental Effects

Construction and operation of the Cobscook Bay Project has the potential to affect the presence, abundance, spatial distribution, and behavior, as well as injury and mortality, of fish and marine mammals in Cobscook Bay. Operation of the project also has the potential to affect the hydrodynamics in the vicinity of the project by dampening the water velocities associated with the tidal currents in Cobscook Bay.

Pile Driving Activities

ORPC Maine proposes to monitor in-water and ambient noise levels during pile driving activities as part of its proposed Acoustic Monitoring Plan. In addition, to minimize any noise effects of the pile driving activities, ORPC Maine proposes to evaluate the use of alternative hammer types, such as vibratory, diesel impact, drop weight, as well as mitigation measures, such as sound absorption cushion and bubble curtains. ORPC Maine is also currently negotiating an IHA with NMFS relating to construction activities for marine mammals in Cobscook Bay.

In a letter filed on November 4, 2011, NMFS recommends (10(j) recommendation 8) that ORPC Maine conduct project construction activities as proposed to mitigate noise impacts on fisheries resources. NMFS also states that ORPC Maine should not conduct any pile driving activities from April 10th through November 7th of any year and, if such activities extend into this time of year restriction window, mitigative measures should be implemented if deemed necessary based on the results of the proposed Acoustic Monitoring Plan.

In a letter filed December 4, 2011, ORPC Maine notes that it understands NMFS concerns and need for the no-work window, but expressed concern over the need to obtain all of its necessary permits by March 1, 2012, in order to deploy Phase 1 of the project prior to April 10th.

Our Analysis

The foundation design for the TidGen™ devices would consist of a pile bent arrangement consisting of 10 piles, each with a 3-foot diameter. Each of the piles would be placed into the seabed using a driving template as well as pile driving equipment located on a moored barge, after which the bottom support frame would be lowered and bolted to the piles. ORPC Maine would also install the single pile necessary for the environmental monitoring equipment (hydroacoustics, ADCP) using the same methodology.

Hydroacoustic effects associated with pile driving activities can kill, injure, or affect the behavior of fish. Extreme changes in pressure can be especially damaging to species that have swim bladders, such as salmonids, and can cause severe injury or mortality, either instantaneously or over the course of a few days, in individuals exposed for any length of time (NMFS 2003). An interagency workgroup, including the U.S. Fish and Wildlife Service (FWS) and NMFS, has developed criteria for assessing the potential of pile driving activities to cause direct injury to fish (Fisheries Hydroacoustic Working Group (FHWG) 2008). The workgroup established dual sound criteria for injury, measured 10 meters away from a pile, of 206 decibels (dB) peak and 187 dB accumulated sound exposure level (SEL) (183 dB SEL for fish weighing less than 2 grams). Pacific

salmon, a species very similar to Atlantic salmon, which occur in the project area, were considered in developing this guidance.

Sound levels are dependent not only on the pile and hammer characteristics, but also on the geometry and boundaries of the surrounding underwater and benthic environment. As the distance from the source increases, underwater sound levels produced by the pile driving are known to dissipate rapidly. Noise from pile driving is anticipated to attenuate at approximately 0.07 dB per meter in freshwater and 0.15 dB per meter in saltwater (Nedwell and Edwards 2002).

The substrate where the piles would be placed is thick marine clay (approximately 40 feet deep) with areas of gravel; it is not anticipated that it will take a significant amount of energy to drive the piles down to the bedrock. Although ORPC Maine has stated that it is still exploring alternatives, the majority of pile driving would likely occur with a vibratory hammer. Vibratory hammers work by causing the sediment surrounding the pile to liquefy, allowing the pile to be driven through the sediment. They are designed in such a way that horizontal vibrations of the hammer cancel out, and are often chosen to mitigate noise associated with the pile driving activity. The use of an impact hammer on the metal piles is expected to be minimal (5 minutes per pile) but may be necessary to secure them adequately in the substrate. Impact hammers rely solely on the impact of the hammer to drive the pile through the substrate, resulting in them having a higher noise potential than vibratory hammers. Despite the short duration, the driving of hollow metal pipe piles with an impact hammer could produce noise levels sufficient to cause direct injury to fish. The California Department of Transportation (CDOT) summarized pile driving noise impacts for several projects in California, and indicated that the average peak noise produced by the driving of a 36-inch diameter hollow steel pipe pile in 15-feet of water as 208 dB Peak (CDOT 2009). Likewise, recent monitoring of impact hammer pile driving in the Columbia River in Washington indicated that nearly 100 percent of pile strikes on 48-inch steel piles exceeded the 206 dB peak threshold for injury (David Evans and Associates, Inc. 2011). The same study determined that approximately 50 percent of strikes on 24-inch piles exceeded this threshold. Given the results from Washington and California, it is anticipated that the driving of fifty 36-inch steel piles associated with the TidGen^{TM} devices, and one 72-inch steel pile associated with the environmental monitoring equipment, in Cobscook Bay with an impact hammer would lead to noise levels in excess of the 206 dB peak threshold for fish injury as described by the FHWG.

Limited data are available on the effectiveness of vibratory hammers in reducing the noise generated by the pile installation. The vibratory hammer's action causes the sediment surrounding the pile to liquefy and the pile can be driven through the sediment. The best available science indicates that vibratory driving sound levels are generally 10 to 20 dB lower than impact hammer driving. The thresholds for harm related to impact driving are likely much lower than the thresholds for the non-impulsive continuous

sounds produced by vibratory hammers. Therefore, the FHWG threshold for SEL described above does not apply to the use of vibratory hammers (CDOT 2009). Research is currently being conducted to update the existing FHWG guidance to include thresholds for vibratory hammers. Although FHWG guidance does not exist for this threshold at this point, CDOT (2009) have used information provided by Popper et al. (2006) to conclude that the threshold for "harm" when using a vibratory hammer is between 187 dB and 220 dB SEL. Given the higher thresholds of effect and the relatively low noise levels, it is not anticipated that the driving of piles with a vibratory hammer would cause physical injury to listed fish.

Pile driving that occurs within Cobscook Bay between November 8th and April 9th would not affect ESA-listed Atlantic salmon because they are not anticipated to be present in the action area during that period of time. However, it would be unlikely that OPRC Maine would be able to install all 40 of the additional piles required for the Phase 2 deployment within this time window due to the environmental conditions present in Cobscook Bay during this period. ORPC Maine's proposed acoustic monitoring during the driving of the Phase 1 piles would determine if noise levels are below the thresholds of injury to fish as described above, and whether there would be a need to restrict pile driving activities for the Phase 2 deployment to the recommended November 8th to April 9th work window. If it is determined that the noise levels exceed these thresholds, ORPC Maine would work within the recommended November 8th to April 9th work window and/or use a combination of attenuation devices (cushion or bubble curtain), as proposed, to reduce levels to a point where they will not harm listed fish.

It is anticipated that the use of a wooden cushion would bring the noise levels produced by an impact hammer down by 11-26 dB, while other materials (micarta down by 7-8 dB, nylon down by 4-5 dB) would reduce noise levels by lesser amounts (CDOT 2009). The efficacy of a bubble curtain varies due to water depth, current, substrate, bathymetry and whether it would be confined or not. In a study of the efficacy of attenuation devices, the Washington State Department of Transportation (WSDOT) determined that the average noise reduction due to the use of bubble curtains on several bridge projects was 9 dB (WSDOT 2008). It is not anticipated that the driving of steel pipe piles with sufficient attenuation methods would cause injury to Atlantic salmon in Cobscook Bay.

The FHWG has not yet provided criteria for sound levels that would affect the behavior of fish and, therefore, might be considered to cause fish to experience behavioral modifications, such as avoidance. However, sound pressure levels in excess of 150 dB can cause temporary behavioral changes, such as elicitation of a startle response, disruption of feeding, or avoidance of an area (Hastings 2002). NMFS and FWS have previously used the 150 dB level when determining whether pile driving activities lead to harassment of Pacific salmon. Although more research is needed, there are several studies that support this level as a conservative threshold for behavioral

effects. Observations by Feist et al. (1992) suggest sound levels greater than 150 dB may disrupt normal migratory behavior of salmon and steelhead. They observed that salmonids respond by avoiding the area of greatest sound levels and attempt to swim along the opposite side of the channel or along the shoreline furthest away from the active pile driving operation. Turnpenny et al. (1994) and Wysocki et al. (2007) documented that salmonids exposed to noise levels up to 150 dB did not exhibit signs of stress. Given these studies, 150 dB is a conservative estimate of what sound levels might result in behavioral modifications, such as avoidance, by listed Atlantic salmon.

If during Phase 2, piles are installed between April l0th to November 7th, noise levels could lead to an avoidance response in listed Atlantic salmon that are in the vicinity. However, the measures proposed by ORPC Maine would minimize the effect so that there would not be a significant disruption of normal behavioral patterns. Given the width of Cobscook Bay there would be sufficient space around the project area to allow affected fish to swim freely around while avoiding areas where noise levels may be above l50 dB. If a fish is forced to hold upstream or downstream of the pile during driving activities, it is anticipated that the delay would be minor as pile driving activities would not be able to proceed at certain parts of each tide cycle due to high velocities. A temporary cessation of migration for no more than a few hours would not impair the ability of a fish to complete any essential behaviors, such as migration, foraging, spawning, or overwintering. Therefore, any behavioral effects of increased sound levels on Atlantic salmon from the proposed pile driving activities would be insignificant.

Restricting pile driving activities to occur only between November 8th and April 9th of any year, as recommended by NMFS, would help to minimize any potential effects on marine mammals and Atlantic salmon, due to their relative absence in Cobscook Bay during this time period. The results of the proposed Acoustic Monitoring Plan during Phase 1 would provide an understanding of the noise levels associated with the pile driving activities and whether such activities would need to be performed in the restricted window for the Phase 2 deployment.

P&D Cable Burial

ORPC Maine proposes to install an approximately 3,850-foot-long P&D cable (3,575 feet of it below mean lower low water (MLLW),[15] 275 feet of it above MLLW (intertidal zone)) from the proposed on-shore station to the Phase 1 TidGen™. The P&D cable would consist of three cables (power cable, engineering monitoring cable, environmental monitoring cable) bundled in two flexible conduits. To reduce environmental effects from the installation and securing of the cable, ORPC Maine has

[15] MLLW is a tidal datum that represents the average of the lower low water height for each tidal day observed.

designed the cable assembly so that it can be installed in Phase 1 and would be compatible with connecting to the five TidGen™ array in Phase 2.

In a letter filed on November 4, 2011, NMFS recommends (10(j) recommendation 6) that ORPC Maine bury the P&D cable by means of trenching within the intertidal zone (above MLLW), and by means of jet plow below MLLW (10(j) recommendation 7). NMFS further recommends (10(j) recommendation 7) that any jet plow activities should be conducted between November 8 and April 9 of any year to avoid impacts on various life stages and forage species for federally managed finfish and shellfish. In burying the P&D cable within the intertidal zone, NMFS recommends (10(j) recommendation 6) that ORPC Maine restore all intertidal gravel and cobble habitat to pre-construction condition before the project begins operation. NMFS also recommends that, because the surface substrate layer may not reflect the subsurface condition, ORPC Maine should adopt measures to avoid altering the nature of the substrate (*i.e.*, adopting measures that would prevent the conversion of habitat type). Examples of such measures include storing excavated materials on mats; not allowing stored material to be exposed to tidal action; and possibly sequestering the surface layer of material to be replaced during the backfill process. NMFS states that ORPC Maine should use the pre- and post-construction photographic documentation to demonstrate that the habitat has been restored to pre-construction condition.

In a letter filed December 4, 2011, ORPC Maine notes its agreement with burying the P&D cable by means of trenching in the intertidal zone and restoring all benthic habitat to pre-construction conditions before commencement of project operation. However, it states that, after consultation with its contractors and NMFS, it is proposing to use a shear plow to bury the P&D cable below MLLW. ORPC Maine notes that the shear plow would generate significantly less turbidity than a jet plow, by cutting a slit approximately 5 inches wide and 2 feet deep into the sea floor, pushing the cable to the bottom of the slit, which naturally closes up behind the plow. ORPC Maine also notes that it is its understanding, based on consultation with NMFS, that the restriction window recommended by NMFS for the jet plow activities does not apply to shear plow activities.

Our Analysis

Studies of the effects of turbid waters on fish suggest that concentrations of suspended solids can reach thousands of milligrams per liter before an acute toxic reaction is expected (Burton 1993). The studies reviewed by Burton demonstrated lethal effects to fish at concentrations of 580 milligrams per liter (mg/L) to 700,000 mg/L depending on species. Sublethal effects have been observed at substantially lower turbidity levels. For example, prey consumption was significantly lower for striped bass larvae tested at concentrations of 200 and 500 mg/L compared to larvae exposed to 0 and 75 mg/L (Breitburg 1988 in Burton 1993). Studies with striped bass adults showed that

prespawners did not avoid concentrations of 954 to 1,920 mg/L to reach spawning sites (Summerfelt and Moiser 1976 and Combs 1979 in Burton 1993).

Sediment in the project area consists primarily of silt, sand, clay and gravel, with several areas of bedrock outcrops. Installation of the P&D cable may disturb substrate and could result in a temporary increase in turbidity. NMFS anticipates that the primary source of turbidity associated with this installation would be the jet plow that would be used to bury the cable. The restriction window for conducting the cable installation recommended by NMFS would ensure that the cable installation, and any turbidity effects associated with it, would occur during a period in which Atlantic salmon are not present in the proposed project area.

Although ORPC Maine originally proposed to utilize jet plow technology to bury the P&D cable, it has since modified its proposal to instead use a shear plow to reduce the turbidity effects associated with the cable burial. While a jet plow creates the trench to lay the cable by using a water nozzle to loosen the soil, a shear plow cuts a slit in the sea floor with its shearing edge. The shear plow method would appear to minimize the turbidity associated with the cable installation and any adverse effects to aquatic resources, however, it is not clear whether the turbidity would be reduced to below the threshold for harm to Atlantic salmon. Although OPRC Maine interprets NMFS' recommended cable burial restriction window to only apply to jet plow activities, and not to the more recently proposed use of the shear plow, some turbidity would still occur using the shear plow methodology. Restricting cable burial to occur only between November 8th and April 9th of any year would help to avoid any adverse effects to Atlantic salmon due to project construction activities.

Acoustic Monitoring

Underwater deployments, such as the proposed pilot project, have the potential to produce noise levels that can cause injury to fish and marine mammals. ORPC Maine proposes an Acoustic Monitoring Plan to identify and characterize the noise radiated by the project in the high-velocity environment of the proposed project area, by gathering acoustic data under various environmental conditions both prior to and during project deployment. As part of the plan, ORPC Maine would: 1) conduct ambient noise measurements in the deployment area prior to the Phase 1 deployment; 2) conduct noise measurements on the Beta TGU to gather preliminary data and gain experiences with the equipment and methodologies; 3) conduct noise measurements during pile driving activities; 4) conduct noise measurements on the TidGen^{TM} following Phase 1 deployment; and 5) conduct noise measurements on all TidGen^{TM} devices following Phase 2 deployment. ORPC Maine has developed a drifting noise measurement system (DNMS) that would be used to measure the acoustic ambient noise in the environment where the TidGen™ devices would be installed, as well as the noise created by the power system itself. ORPC Maine would use all of these data to characterize the project's

acoustic footprint. ORPC Maine proposes, as part of the plan, to issue reports on monitoring progress to the appropriate regulatory agencies for technical review biannually. Should altered marine mammal or fish activity be noted at any time during the monitoring, ORPC Maine proposes to notify the appropriate federal and state resource agencies for immediate consultation. A summary of the proposed monitoring schedule is provided in table 9.

Table 9. Proposed schedule for the Acoustic Monitoring Plan (Source: application, as modified by staff).

Plan	**Phase 1 (1 TidGen™)**	**Phase 2 (5 TidGen™)**
Acoustic Monitoring Plan	Conducted during pile driving activities and within 6 months of deployment; frequency of measurements would be driven by the changing environmental and mechanical conditions; measurements would include different tidal periods.	Conducted during pile driving activities and immediately following deployment; frequency of measurements would be driven by the changing environmental and mechanical conditions; measurements would include different tidal periods.

In a letter filed on November 7, 2011, Interior recommends that ORPC Maine monitor noise levels during construction activities, particularly related to pile driving, as part of the Acoustic Monitoring Plan. NMFS recommends (10(j) recommendation 1), in a letter filed on November 4, 2011, that all of ORPC Maine's proposed environmental monitoring plans be incorporated into any license issued by the Commission. NMFS further recommends ORPC Maine meet the environmental monitoring goals and objectives of Phase 1 installation before proceeding to Phase 2 (10(j) recommendation 3), provide an annual report that details the progress, data, and status of all monitoring for that year (10(j) recommendation 4), and continue to consult with NMFS, as well as other state and federal resource agencies, to help guide the adaptive management measures and inform future conservation recommendations (10(j) recommendation 5).

In a letter filed on November 4, 2011, Maine DMR recommends that the acoustic monitoring include frequencies used by harbor porpoise and Atlantic white-sided dolphin, 40 hertz (Hz) to 150 kilohertz (kHz), to identify any communication masking[16]

[16] Masking is the interference of an organism's ability to interpret a specific signal due to the presence of other noises (ambient or transient, natural or anthropogenic).

or disruption in foraging abilities. In addition, Maine DMR recommends that, if the project generates sound in this frequency range, ORPC Maine should determine how far away from the site the noise attenuates and whether masking is occurring. In a response letter filed on December 4, 2011, ORPC Maine notes that, although there is no evidence that radiated noise from the project TGU is above 40 Hz, the DNMS is being reconfigured to measure above 40 Hz and in the frequencies used by harbor porpoise and Atlantic white-sided dolphin. In addition, ORPC Maine notes that it would consult with NMFS if sound levels are determined to disrupt or change behaviors of any marine mammals in the area.

Our Analysis

The direct and indirect interaction of hydrokinetic turbine technology and aquatic resources, including marine mammals, has not been fully characterized. Due to the TidGen™ device's passive mechanics and low rotational foil speeds, it is unlikely that radiated noise levels from the TidGen™ devices would induce physical harm, trauma, or dramatic behavioral response. Because the system's dynamic pressures are well below acoustic cavitation boundaries, its generation of noise would be anticipated to be well below that of other motorized systems, such as a powered vessel, whose rotational blades generate significant cavitation, turbulence, and high source levels.

There is, however, some concern over the TidGen™ device's potential to create long-term change in the usability of a habitat region, due to masking. In addition, the pile driving activity associated with the construction of the project would likely cause some adverse effects to aquatic resources in the vicinity of the activity (described in detail above).

All noise sources do not contribute equally to the phenomenon of masking. Rather, each source's impact on marine life is measured in various bandwidths based on the species in question, and on how high the source is over the background noise for a given bandwidth (Greene et al. 1998). When analyzing the potential for masking, it is therefore critical to consider not only the ambient and contributed noise levels, but also the spectral levels across the relevant frequency ranges. As with any mechanical device with moving parts, the TidGen™ device would generate some degree of vibration energy and radiated noise, but due to its low rotational speeds and passive system mechanics its masking potential would be expected to be negligible.

The Acoustic Monitoring Plan proposed by ORPC Maine would effectively monitor the noise levels emitted by project construction and operation activities to provide a better understanding of any potential adverse effects to marine resources. The methods and reporting proposed in the plan would allow for an adequate assessment of these potential effects and the need for any mitigative measures. The results of the acoustic monitoring would also help to identify whether the pile driving activities

associated with the Phase 1 deployment rise above the designated threshold for harm (206 dB), and whether the Phase 2 deployment would also have to be restricted to occur between November 8th and April 9th to avoid any adverse effects on Atlantic salmon. However, any effect of the project on the local underwater noise environment would be expected to be minimal due to the short duration of pile driving activities during construction (28 days for total installation of Phase 1) and low rotational foil speeds and dynamic pressures during operation. The filing of biannual reports, as proposed by ORPC Maine, would also provide agencies the opportunity to evaluate the effectiveness of the monitoring and allow for the potential to modify the study plan based on preliminary results.

Benthic and Biofouling Monitoring

ORPC Maine proposes a Benthic and Biofouling Monitoring Plan to evaluate any effects of the proposed project on the benthic community and to evaluate whether the project structures have the potential to allow biofouling accumulation that may alter the habitat within the project area. As part of the plan ORPC Maine would: 1) characterize the existing benthic community (pre-deployment, has already been conducted July 14-15, 2011); 2) examine the recovery of the benthic resources disturbed during the installation of the P&D cable; 3) examine the benthic community near the deployed TidGen™ devices; and 4) examine the presence and relative extent of coverage of biofouling organisms on the deployed devices. Divers would inspect the cable route as part of the operations and maintenance plan to ensure that buried sections remain covered and relatively immobile. During the regular inspections the divers would conduct video recordings and look for recovery to the benthic community at locations where the cable is buried. Divers would also visually inspect project structures for any biofouling, which would be photo-documented to determine the rate and extent of growth. Although prominent marine debris on the TGUs is not expected, ORPC notes that it would remove any existing prominent debris from the TGUs when they are brought to the surface during their quarterly maintenance. ORPC Maine proposes, as part of the plan, to issue full summary reports on an annual basis to the appropriate regulatory agencies for technical review. A summary of the proposed monitoring schedule is provided in table 10.

Table 10. Proposed schedule for the Benthic and Biofouling Monitoring Plan (Source: application, as modified by staff).

Plan	Phase 1 (1 TidGen™)	Phase 2 (5 TidGen™)
Benthic and Biofouling Monitoring Plan	Conduct benthic survey during first growing season after deployment; conduct inspections monthly	Conduct benthic survey during first growing season after deployment; conduct inspections 6 times a year for first year of deployment, once every 2 to 3 years for remainder of license term (frequency would be modified based on field experience)

In a letter filed November 4, 2011, Maine DMR recommends that ORPC Maine collect sediment samples similar to those collected and analyzed in the pre-deployment study, and include a study of the benthic community in the immediate footprint of the TidGen™ devices in Phases 1 and 2. In a letter filed on November 7, 2011, Interior recommends that ORPC Maine conduct long-term benthic inspections with a frequency of 2 to 3 years between each, which could be modified based on consultation with the resource agencies, as part of the Benthic and Biofouling Monitoring Plan. NMFS recommends (10(j) recommendation 1), in a letter filed on November 4, 2011, that all of ORPC Maine's proposed environmental monitoring plans be incorporated into any license issued by the Commission. NMFS further recommends ORPC Maine meet the environmental monitoring goals and objectives of Phase 1 installation before proceeding to Phase 2 (10(j) recommendation 3), provide an annual report that details the progress, data, and status of all monitoring for that year (10(j) recommendation 4), and continue to consult with NMFS, as well as other state and federal resource agencies, to help guide the adaptive management measures and inform future conservation recommendations (10(j) recommendation 5).

Our Analysis

The TidGen™ devices have the potential to provide habitat for marine life including biofouling organisms. Hard structures introduced into marine systems have the potential to allow biofouling accumulation, which may alter the habitat, and the installation and operation of the project components have the potential to affect the benthic community.

While ORPC Maine proposes to examine the recovery of benthic resources in the P&D cable burial area and near the TidGen™ devices, they do not propose to conduct additional sediment sampling or study the benthic community in the immediate footprint of the TidGen™ devices as recommended by Maine DMR. Due to the strong tidal velocities and short duration of slack tides, divers conducting the pre-deployment sampling had to be tethered, restricting their ability to move great distances. According to ORPC Maine, this made the collection of benthic samples very difficult.

The pre-deployment benthic sampling conducted by ORPC Maine provides an understanding of the existing environment, with ORPC Maine proposing to conduct inspections along the cable route and TidGen™ deployment area for the term of the license to evaluate the recovery of the benthic community. The collection of additional sediment samples in the proposed project area during Phases 1 and 2, as recommended by Maine DMR, would provide limited additional information in comparison to what ORPC Maine is proposing as part of its Benthic and Biofouling Monitoring Plan. Interior's recommendation that ORPC Maine conduct long-term benthic inspections once every 2 to 3 years during the Phase 2 deployment is consistent with ORPC Maine's proposal.

The Benthic and Biofouling Monitoring Plan proposed by ORPC Maine would not only provide an understanding of the effects of the project on the benthic habitat, the rate of its subsequent recovery, and effects to habitat associated with biofouling, but it would also help to ensure effective project operation by reducing any adverse effects of such biofouling on the efficiencies of the TidGen™ devices. The filing of annual reports, as proposed by ORPC Maine, would also provide agencies the opportunity to evaluate the effectiveness of the monitoring and allow for the potential to modify the study plan based on preliminary results.

Hydraulic Monitoring

ORPC Maine proposes a Hydraulic Monitoring Plan to characterize the hydraulic zone of influence for the project and understand its effects, if any, on flow and sediment transport in Cobscook Bay. As part of the plan ORPC Maine would: 1) conduct measurements of pre- and post-deployment flow fields in the deployment area; and 2) provide experimental inputs into a large-scale computational circulation model for the estimation of far-field impacts. ORPC Maine would use ADCPs to collect data from multiple locations within the deployment area and compare the results to pre-deployment data to characterize flow and any flow disturbance in the deployment area. The wake of the TidGen systems would also be measured to estimate their total flow drag, which would then be input into a large-scale circulation model of the Quoddy region to determine the project's larger scale hydraulic effects. ORPC Maine proposes, as part of the plan, to issue full summary reports on a biannual basis to the appropriate regulatory agencies for technical review. A summary of the proposed monitoring schedule is provided in table 11.

Table 11. Proposed schedule for the flow measurement component of the Hydraulic Monitoring Plan (Source: application, as modified by staff).

Plan	Phase 1 (1 TidGen™)	Phase 2 (5 TidGen™)
Hydraulic Monitoring Plan (Flow Measurement)	Conduct ADCP deployments at 6 sites, for a minimum of 7 days and a maximum of 28 days	Conduct ADCP deployments at 6 sites, for a minimum of 7 days and a maximum of 28 days; modeling would be completed in year 3 of the project

In a letter filed on November 7, 2011, Interior notes that the proposed data collection methods, analyses, geographic scope, and schedule for monitoring hydraulic conditions in the Hydraulic Monitoring Plan are appropriate. NMFS recommends (10(j) recommendation 1), in a letter filed on November 4, 2011, that all of ORPC Maine's proposed environmental monitoring plans be incorporated into any license issued by the Commission. NMFS further recommends ORPC Maine meet the environmental monitoring goals and objectives of Phase 1 installation before proceeding to Phase 2 (10(j) recommendation 3), provide an annual report that details the progress, data, and status of all monitoring for that year (10(j) recommendation 4), and continue to consult with NMFS, as well as other state and federal resource agencies, to help guide the adaptive management measures and inform future conservation recommendations (10(j) recommendation 5).

Our Analysis

Hydraulic effects of hydrokinetic energy generation systems on the distribution and magnitude of water flows around a project installation have not been fully characterized due to limited empirical or analytical information on these devices.

The proposed project is anticipated to remove only a small amount of energy from the tidal system. At a large scale, energy removal can lead to changes in tidal range, which in turn can affect water temperature, the behavior of some migratory fish, water quality, and sediment transport (DOE 2009 in Polagye et al. 2010). At the pilot scale, however, effects are expected to be immeasurably small. For example, a numerical model of a pilot project in northern Admiralty Inlet, Puget Sound (Polagye et al. 2010) suggests a maximum range reduction of 0.2 mm in South Sound. Such a small change is not anticipated to be detectable and is thus likely to be insignificant. The small amount of energy removed by the five turbines on the bottom of Cobscook Bay is not expected to have a measureable effect on tidal range and currents; therefore, the effects to the overall

habitat would also be expected to be insignificant. However, the proposed Hydraulic Monitoring Plan would provide an increased understanding on the effects of arrays of these devices on hydrodynamics, flow-field disturbances, and sediment transport processes for use in the design and evaluation of larger commercial-scale arrays. The filing of biannual reports, as proposed by ORPC Maine, would also provide agencies the opportunity to evaluate the effectiveness of the monitoring and allow for the potential to modify the study plan based on preliminary results.

Fisheries and Marine Life Interaction

ORPC Maine proposes a Fisheries and Marine Life Interaction Monitoring Plan to collect post-deployment information on fish distribution and relative abundance within Cobscook Bay and to characterize fish and marine life movements associated with interactions with the project TGUs. As part of the plan, ORPC Maine would use acoustic technologies and netting efforts to characterize fish presence and vertical distribution in Cobscook Bay and conduct stratified sampling to evaluate any tidal cycle, diel, and seasonal trends. In evaluating fish and marine life interaction with the project TGUs, ORPC Maine would produce a three-dimensional view of an area adjacent to the TGU by: 1) using data collected from a bottom-mounted acoustic sonar; 2) processing the data with a modified automated software data package; and 3) evaluating the data to statistically characterize distribution and movements of observed marine life near-field of the TGU. ORPC Maine proposes, as part of the plan, to issue full summary reports on a biannual basis to the appropriate regulatory agencies for technical review. ORPC Maine also proposes to meet with the appropriate agencies after the results of the Phase 1 sampling are available to discuss any changes that may be needed for the monitoring schedule. A summary of the proposed monitoring schedule is provided in table 12.

Table 12. Proposed schedule for the Fisheries and Marine Life Monitoring Plan (Source: application, as modified by staff).

Fish and Marine Life Interaction Monitoring Plan		
Phase 1 (1 TidGen™)	Year 1	Five monthly 24-hour hydroacoustic sampling events (March & May – Sept.) Four monthly netting efforts (May – Sept.) Continuous interaction monitoring
Phase 2 (5 TidGen™)	Year 2	Six monthly 24-hour hydroacoustic sampling events (March & May, Aug. – Nov.) Three monthly netting efforts (May, Aug., Sept.) Continuous interaction monitoring

	Year 3	Three monthly 24-hour hydroacoustic sampling events (May, June, Sept.) Continuous interaction monitoring
	Years 4-7	Two monthly 24-hour hydroacoustic sampling events (May & Sept.) Continuous interaction monitoring
	Year 8	Continuous interaction monitoring

In a letter filed on November 4, 2011, Maine DMR recommends that ORPC Maine maintain or increase the number of 24-hour sampling events during year 2, immediately following the Phase 2 deployment. Maine DMR also notes that additional monitoring would be warranted if adverse impacts to resources are observed. In its response letter, filed on December 4, 2011, ORPC Maine notes that the reason that the sampling effort is proposed to be decreased immediately following Phase 2 deployment is because they would have collected 3 years worth of winter sampling data by that time. The data to date indicate that fish densities in Cobscook Bay are very low during the winter months and ORPC Maine would like to concentrate the monitoring effort on the months in which higher densities of fish would be expected. ORPC Maine further note that if the winter sampling data show that the fish densities are higher than expected during the winter months, it would reevaluate the proposed sampling schedule and may conduct additional sampling, as deemed necessary.

NMFS recommends (10(j) recommendation 1), in a letter filed on November 4, 2011, that all of ORPC Maine's proposed environmental monitoring plans be incorporated into any license issued by the Commission. NMFS further recommends ORPC Maine meet the environmental monitoring goals and objectives of Phase 1 installation before proceeding to Phase 2 (10(j) recommendation 3), provide an annual report that details the progress, data, and status of all monitoring for that year (10(j) recommendation 4), and continue to consult with NMFS, as well as other state and federal resource agencies, to help guide the adaptive management measures and inform future conservation recommendations (10(j) recommendation 5).

In a letter filed on November 7, 2011, Interior recommends that commercial trawlers with experience in Cobscook Bay be employed for the netting efforts in the deployment area to ensure that fish are collected in this portion of the study so as to ground-truth the collected hydroacoustics data. In its response letter filed on December 4, 2011, ORPC Maine notes that it has been using a commercial trawler in its survey work and intend to continue to do so under the proposed plan. In addition, ORPC states that even commercial trawlers who have worked in Cobscook Bay refuse to trawl in

certain areas of the bay, and although every effort would be made to ground-truth the hydroacoustics data, they must consider the safety of the people involved.

Our Analysis

Information on the fish of Cobscook Bay is critical to understanding the potential effects, which may include alterations in movement patterns, foraging, distribution, and spawning activities, or physical injury, associated with the proposed project. The direct and indirect interaction of hydrokinetic turbine technology and aquatic resources has not been fully characterized. Accordingly, there are concerns that the equipment involved with the project may alter movement patterns or cause physical injury to aquatic resources.

If fish approach the TGUs while they are operating there is a possibility that they could be struck by a blade and injured, or possibly killed. However, in an Electric Power Research Institute study conducted at the Alden Research Laboratory in 2011, it was determined that rainbow trout avoided swimming through a turbine (Lucid spherical turbine) similar to ORPC Maine's TidGen™ system, by swimming upstream or by passing around the margins of the turbine (Jacobson 2011). It was determined that 83 percent to 94 percent of fish released within 12 inches of the turbine were able to avoid it by swimming around. Video observations of the experiment indicated that struck fish were not stunned or severely injured, and that survival was near 100 percent. This was likely due to the slow speed of the turbine, which at 64 to 127 rpm, was 2 to 4 times faster than the maximum speed (32 rpm) anticipated for ORPC Maine's TGUs. Likewise, work done by Amaral et al. (2008) tested the effects of leading edge turbine blades on fish strike survival and injury. Amaral also indicated that strike mortality is not anticipated if strike speeds are less than 4.8 meters/second. Given the low blade speeds associated with the proposed TGUs, it is anticipated that they would be significantly less likely to harm fish than either of the above turbines.

The sampling schedule proposed by ORPC Maine's plan appears to be adequate to effectively identify and understand the presence, distribution, and behavior of fish and marine mammals in and around the TidGen™ devices. The pre-deployment sampling to date has indicated that the fish densities are very low in the winter months. Collecting 3 years of sampling data, during those winter months, as proposed by ORPC Maine, should provide sufficient information to draw conclusions regarding seasonal abundance. Concentrating the sampling effort in the spring and summer months after Phase 2, if the 3 years of winter sampling data continue to indicate low abundances, would appear to be a reasonable sampling strategy. In addition, consultation with the appropriate agencies after the results of the Phase 1 sampling are available would provide the opportunity for any modifications to the study plan related to sampling during the Phase 2 deployment.

EFH

ORPC Maine developed an EFH assessment that it included in Appendix D of the Cobscook Bay Project license application. As noted in the EFH assessment, Cobscook Bay has been designated as EFH for a variety of species and life stages of federally managed resources (see table 8). The assessment further characterized potential effects of the project on EFH, including habitat alteration, biofouling and species attraction, foil strike and entrainment, noise, and the introduction of electromagnetic fields (EMF). In a letter filed on October 4, 2011, NMFS notes the adequacy of the EFH assessment.

Section 305(b)(2) of the Magnuson-Stevens Act requires all federal agencies to consult with NMFS on any action authorized, funded, or undertaken by that agency that may adversely affect EFH and provide an explanation for not adopting any EFH recommendations made by NMFS. NMFS states that conservation recommendations that it would typically provide regarding EFH are addressed within OPRC Maine's proposed monitoring, construction, restoration, and safety plans, as well as recommendations NMFS made under section 10(j) of the FPA. NMFS noted that all of its recommendations under section 10(j) of the FPA should also be considered EFH recommendations under 50 C.F.R. 600.920. For clarity, these recommendations are listed below:

- Incorporate as license requirements the environmental monitoring, safety, and removal and restoration plans that have been identified in the license application. These plans are integral to the pilot project and should be enforceable in the license articles.

- Require that the applicant meet the technical goals and objectives of each installation phase and complete the phase before proceeding to the next phase. For the purposes of this pilot project, NMFS intends this to mean that the turbines are functioning at intended design levels and that all monitoring studies are progressing within acceptable parameters.

- Require that the applicant meet the environmental monitoring goals and objectives of each installation phase and complete the phase before proceeding to the next phase. For the purposes of this pilot project, NMFS intends this to mean that all monitoring plans are providing the data necessary to inform future activity at the site.

- Require the licensee provide an annual report to FERC that details the progress, data, and status of all monitoring during that year. Before filing with FERC, the licensee must provide the report to NMFS and other state and federal resource agencies for comments at least 45 days prior to the filing with FERC. The Applicant must include agency's comments when filing with FERC.

- Require continued consultation with NMFS, as well as whatever other state and federal resource agencies are appropriate. This consultation process will help guide adaptive management measures to ensure the required information is collected and analyzed to inform future conservation recommendations.

- The P&D cable will be buried by means of trenching within the intertidal zone (above MLLW). All intertidal gravel and cobble habitat should be restored to pre-construction condition before the project begins operation. Because the surface substrate layer may not reflect the subsurface condition, the project proponent should adopt measures to avoid altering the nature of the substrate (*i.e.*, adopting measures that would prevent the conversion of habitat type). These measures may include storing excavated material on mats; not allowing stored material to be exposed to tidal action; and possibly sequestering the surface layer of material to be replaced last during the backfill process. The licensee must use the pre-and post-construction photographic documentation to demonstrate that the habitat has been restored to pre-construction condition.

- The underwater portion of the P&D cable will be buried utilizing a jet plow.[17] Jet plow activities below MLLW should be conducted between November 8 and April 9 of any year to avoid impacts on various life stages and forage species for federally managed finfish and shellfish. Accordingly, we recommend that FERC prohibit jet plow activities below Mean Lower Low Water from April 10th through November 7th of any year.

- Construction activities shall be required as proposed in the project description for the mitigation of noise impacts on fisheries resources. Specifically, FERC shall prohibit pile driving activity from April 10th through November 7th of any year. Where pile driving activities may extend into this time of year restriction window, mitigative measures as described in section IV(B) of this document shall be implemented if deemed necessary based on acoustic monitoring results.

Our Analysis

NMFS recommendations have been addressed and discussed in other appropriate sections of this EA

As stated previously, ORPC Maine 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;

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[17] NMFS' recommendation for the utilization of a jet plow in burying the P&D cable was made prior to ORPC Maine modifying its proposal to use a shear plow for the purpose of reducing turbidity.

a remotely controlled braking system for the turbines that would allow for the project to be shut down quickly in the case of an emergency; and the design of the turbines to have blunt-shaped foils and relatively slow speeds,[18] minimizing the potential for turbine blade strikes on fish, diving birds, and marine mammals. In addition to these design features, the results of the studies ORPC Maine conducted during the Beta TidGen™ testing suggest that any environmental impacts from the pilot project would be minor.[19] The additional monitoring that ORPC Maine is proposing to conduct for the pilot project, specified in the Benthic and Biofouling Monitoring Plan, Acoustic Monitoring Plan, Hydraulic Monitoring Plan, and the Fish and Marine Life Interaction Plan, would sufficiently monitor any unanticipated effects of the proposed project operation on the presence, abundance, and behavior of fish migrating through the project area. The combination of the proposed monitoring plans, and the interrelated data that each of them would collect, would provide an adequate assessment of effects of the proposed project on Cobscook Bay fish communities, including those designated EFH in the vicinity of the proposed project area.

Marine Mammal Monitoring

ORPC Maine proposes a Marine Mammal Monitoring Plan to characterize changes in marine mammal use in and around the project deployment area. The plan would include conducting multi-season marine mammal observations around the TidGen™ Power System(s) during Phase 1 and Phase 2 deployment as well as prior to and during major deployment, maintenance, and retrieval activities. As part of the plan, ORPC would consult with NMFS regarding the credentials of observers and follow work stop and avoidance procedures to be approved by NMFS to assure minimal harassment and risk to marine mammals. Additional information on potential direct interactions between marine mammals and the TidGen™ Power System would be monitored as part of the proposed Fisheries and Marine Life Interaction Monitoring Plan. The potential effects of noise produced by the project installation and operation on marine mammals would be addressed in the proposed Acoustic Monitoring Plan. ORPC Maine proposes, as part of the plan, to issue full summary reports on a biannual basis to the appropriate regulatory agencies for technical review. A summary of the proposed monitoring schedule is provided in table 13.

[18] The turbines would have a maximum operating rotational speed of 32 rpm, compared to boat propellers that have speeds of 2,000 to 6,000 rpm, and a maximum operating tip speed of 5 m/s.

[19] ORPC Maine conducted fish, bird, and mammal observations during the barge-mounted deployment.

Table 13. Proposed schedule for the Marine Mammal Monitoring Plan (Source: application, as modified by staff).

Plan	Phase 1 (1 TidGen™)	Phase 2 (5 TidGen™)
Marine Mammal Monitoring Plan	Dedicated marine observers during periods of deployment, maintenance, and retrieval activities Incidental observations by ORPC Maine staff while performing other activities associated with equipment testing, as well as fish and bird monitoring plans	Dedicated marine observers during periods of deployment, maintenance, and retrieval activities Incidental observations by ORPC Maine staff while performing other activities associated with equipment testing, as well as fish and bird monitoring plans

NMFS recommends (10(j) recommendation 1), in a letter filed on November 4, 2011, that all of ORPC Maine's proposed environmental monitoring plans be incorporated into any license issued by the Commission. NMFS further recommends ORPC Maine meet the environmental monitoring goals and objectives of Phase 1 installation before proceeding to Phase 2 (10(j) recommendation 3), provide an annual report that details the progress, data, and status of all monitoring for that year (10(j) recommendation 4), and continue to consult with NMFS, as well as other state and federal resource agencies, to help guide the adaptive management measures and inform future conservation recommendations (10(j) recommendation 5).

Our Analysis

A number of marine mammals are known to occur in the vicinity of the project, including the Atlantic white-sided dolphin, harbor seal, gray seal, and harbor porpoise. The proposed project has the potential to harm marine mammals from construction activities (pile driving, laying cable) as well as direct interaction with the foils of the TidGen™ devices.

Behavioral responses of marine mammals to sound vary greatly and depend on a number of factors. However, NMFS has identified the following noise levels as thresholds for marine mammal harassment: 1) cetaceans and pinnipeds exposed to impulsive sounds of 180 and 190 dB or above, respectively, are considered to have been taken by Level A (i.e. injurious) harassment; 2) marine mammals exposed to impulsive sounds at or above 160 dB and continuous noise at or above 120 dB are considered Level B (behavioral) harassment.

Acoustic sampling of the Beta TidGenTM in July 2011 demonstrated that the acoustic footprint of the device was very small. Extrapolating these measured readings to the full Phase 2 deployment under the pilot license, the predicted overall sound increase over ambient conditions of the proposed project would be 10 dB. Operation of the project would not represent a significant increase in the ambient noise in Cobscook Bay nor result in behavioral harassment of marine mammals. Therefore, ORPC Maine is not obtaining an IHA for project operations.

ORPC Maine is, however, seeking an IHA for construction activities associated with the proposed Phase 1 deployment. The substrate where the piles would be placed is thick marine clay (approximately 40 feet deep) with areas of gravel; it is not anticipated that it would take a significant amount of energy to drive the piles down to the bedrock. Although ORPC Maine has stated that it is still exploring alternatives, the majority of pile driving would likely occur with a vibratory hammer. The use of an impact hammer on the metal piles is expected to be minimal (5 minutes per pile) but may be necessary to secure them adequately in the substrate. Despite the short duration, the driving of hollow metal pipe piles with an impact hammer could produce noise levels sufficient to cause direct injury to fish. CDOT summarized pile driving noise impacts for several projects in California, and indicated that the average peak noise produced by the driving of a 36-inch diameter hollow steel pipe pile in 15-feet of water as 208 dB Peak (CDOT 2009). Likewise, recent monitoring of impact hammer pile driving in the Columbia River in Washington indicated that nearly 100 percent of pile strikes on 48-inch steel piles exceeded the 206 dB peak threshold for injury (David Evans and Associates, Inc. 2011). The same study determined that approximately 50 percent of strikes on 24-inch piles exceeded this threshold. Given the results from Washington and California, it is anticipated that the driving of fifty 36-inch steel piles associated with the TidGen™ devices, and one 72-inch steel pile associated with the environmental monitoring equipment, in Cobscook Bay with an impact hammer would lead to noise levels in excess of the harassment thresholds defined by NMFS above.

The direct and in-direct interaction of tidal turbines and aquatic resources, including marine mammals, has not been fully characterized. There is also limited information on marine mammal use of the deployment area. Information collected from the Marine Mammal Monitoring Plan would be used in conjunction with the results of the Fish and Marine Life Interaction Plan and Acoustic Monitoring Plan to provide an understanding of the presence, abundance, and behavior of marine mammals in the vicinity of the proposed project. The filing of biannual reports, as proposed by ORPC Maine, would also provide agencies the opportunity to evaluate the effectiveness of the monitoring and allow for the potential to modify the study plan based on preliminary results.

Adaptive Management Plan

ORPC Maine proposes to use an adaptive management strategy within its environmental monitoring plans to allow for future modifications to the plans based on preliminary results. This adaptive management strategy would entail the filing of reports (annual or biannual) with the appropriate resource agencies that detail the preliminary results of each of the monitoring plans, with the opportunity for agencies to provide comments and recommend any necessary modifications.

NMFS recommends (10(j) recommendations 2 and 3) that ORPC Maine meet the technical and environmental goals and objectives of Phase 1 deployment before proceeding to the Phase 2 deployment. NMFS further clarifies that the technical goals and objectives would be that the turbines are functioning at intended design levels and the environmental goals and objectives would be that all of the monitoring plans are providing the data necessary to inform future activity at the site.

Our Analysis

The purpose of the Commission's hydrokinetic pilot project license is to allow for the deployment of new technology marine and hydrokinetic projects in which the environmental effects are not yet well understood, while managing the uncertainty through required post-license monitoring and safeguard plans that ensure the protection of the public and environment. Due to the learning curve of monitoring these types of projects in their often volatile environments (*i.e.*, strong currents, extreme tidal fluctuations), the ability to utilize an adaptive management strategy to receive feedback from stakeholders and modify plans as necessary is imperative. ORPC Maine proposes to use such an adaptive management strategy within its environmental monitoring plans to allow for future modifications to the plans based on preliminary results. NMFS recommends (10(j) recommendations 2 and 3) that ORPC Maine use such adaptive management to ensure that the technical and environmental goals and objectives of Phase 1 deployment are met before proceeding to the Phase 2 deployment.

Although ORPC Maine proposes to file regular reports, with the intention of receiving feedback from the resource agencies on any necessary modifications to the environmental monitoring plans, a separate Adaptive Management Plan may be beneficial in clarifying the adaptive management process; specifically the protocols for consultation and subsequent modifications. This clarification may limit the need for explicit Commission approval for minor modifications (*i.e.*, change in location, frequency) to the monitoring plans that are agreed upon by the resource agencies, in which only documentation of such agreements would need to be provided in the monitoring plan reports filed with the Commission. A clarification on the protocols may also address NMFS' concerns regarding the technical and environmental goals of Phase 1 being met before proceeding to Phase 2. Further, including protocols within the plan for handling disputes over recommended modifications would provide the resource agencies

assurance that any recommendations regarding monitoring plan modifications would be fully considered.

3.3.2.3 Cumulative Effects

Although it is unclear to what extent the proposed project would affect aquatic resources until the results of the proposed monitoring plans have been analyzed, aquatic resources have the potential to be cumulatively affected by the proposed project in conjunction with other past, present, and reasonably foreseeable actions in Cobscook Bay. The environmental effects of new technology hydrokinetic projects would be evaluated through the effective monitoring of pilot projects such as is being proposed by ORPC Maine.

In addition to the extensive commercial fishing, marine resource harvesting, and aquaculture sites in Cobscook Bay, a tidal barrage project, the Half Moon Cove Project, is proposed to be installed over Half Moon Cove in Cobscook Bay. The Half Moon Cove Project would involve the construction of a 1,200-foot-long, 31-foot-high dam connecting Moose Island (Eastport, Maine) to the mainland at Perry, Maine. There is a level of uncertainty regarding the effects of the proposed Cobscook Bay Project and Half Moon Cove Project, in conjunction with other marine activities, on aquatic resources, particularly in regards to fish behavior modification, fish injury/mortality due to turbine blade strikes, underwater noise, and alteration of habitat. However, ORPC Maine has designed the Cobscook Bay Project in a manner that would minimize the potential for environmental effects during construction and operation including: the small scale of the project; a phased installation plan; a remotely controlled braking system for the turbines that would allow for the project to be shut down quickly in the case of an emergency; and the design of the turbines to have blunt-shaped foils and relatively slow speeds,[20] minimizing the potential for turbine blade strikes on fish, diving birds, and marine mammals. In addition to these design features, the results of the studies ORPC Maine conducted during the barge-mounted deployment of its TGU, referred to as the Beta TidGen™, suggest that any environmental impacts from the pilot project would be minor.[21] Any unanticipated adverse effects of these projects on aquatic resources would be expected to be minimized through the monitoring plans and mitigation measures that would be required in an issued license.

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[20] The turbines would have a maximum operating rotational speed of 32 rpm, compared to boat propellers that have speeds of 2,000 to 6,000 rpm, and a maximum operating tip speed of 5 m/s.

[21] ORPC Maine conducted fish, bird, and mammal observations during the barge-mounted deployment.

3.3.3 Rare, Threatened, and Endangered Species

3.3.3.1 Affected Environment

Seven federally listed threatened or endangered marine species (one fish, two reptiles, and four mammals) may occur in the general project vicinity (table 14). Of these, only the Atlantic salmon is known to use the proposed project area. The remaining species (marine turtles and whales) inhabit offshore marine areas and rarely use nearshore areas such as those found in the proposed project area. The Atlantic sturgeon, which is proposed for listing, has the potential to occur in the project vicinity given its distribution range. No federally listed threatened or endangered terrestrial wildlife species and federally designated critical habitats are likely to occur in the proposed project area. In addition, none of these species was documented by OPRC Maine during a November 2010 site visit within the project vicinity, or during opportunistic observation events performed between December 2007 and December 2010.

Table 14. Federally listed threatened and endangered species with potential to occur in proposed project area (Source: application, as modified by staff).

Species	Federal Status	State Status
Atlantic sturgeon (Gulf of Maine Distinct Population Segment (DPS)) (Acipenser oxyrinchus)	P	N/A
Atlantic salmon (Gulf of Maine DPS) (Salmo salar)	E	N/A
Leatherback sea turtle (Dermochelys coriacea)	E	E
Loggerhead sea turtle (Caretta caretta)	T	E
Sei whale (Balaenoptera borealis)	E	E
Fin whale (Balaenoptera physalus)	E	E
North Atlantic right whale (Eubalaena glacialis)	E	E
Humpback whale (Megaptera novaeangliae)	E	E

E = Federal and/or state listed endangered
T = Federal and/or state listed threatened
P = Proposed for listing under ESA

The shortnose sturgeon is listed as endangered under ESA, and similar to the Atlantic sturgeon no records of this species have been recorded within Cobscook Bay. There is, however, a small population of shortnose sturgeon in the Penobscot River.

Recent information indicates shortnose sturgeon may move out of their natal rivers, so there is a small potential for a transient shortnose sturgeon to move into Passamaquoddy Bay.

Atlantic Salmon (Salmo salar)

The Atlantic salmon Gulf of Maine DPS was listed as a federally endangered species in 2000. In 2009, the Gulf of Maine DPS was expanded to include all watersheds with Atlantic salmon to specific impassable barriers from the Androscoggin River and north to the Dennys River. Hatchery-reared Atlantic salmon that are stocked to help restore the Gulf of Maine DPS are considered protected, but their numbers are not considered toward reclassifying the protected status of the Gulf of Maine DPS Atlantic salmon. The Gulf of Maine DPS of Atlantic salmon was listed as endangered primarily due to declines resulting from anthropocentric land and water use practices that has hindered the completion of their life cycle (Baum 1997). The NMFS, Maine DMR, FWS, and the Penobscot Indian Nation are currently devising updated approaches for successful Atlantic salmon recovery (NMFS et al. 2010).

Suitable freshwater and estuarine habitats within the Gulf of Maine DPS were designated as Atlantic salmon critical habitat under ESA in 2009. This habitat is protected for the essential qualities it offers Atlantic salmon for completing their life cycles. The proposed location of the project within Cobscook Bay is not within the designated Atlantic salmon critical habitat. However, designated critical habitat does exist in perennial streams, rivers, and estuaries connected to the western and southern portions of Cobscook Bay, including the Dennys River watershed that accommodates a relatively small spawning population of Atlantic salmon. Primary constituent elements are habitat qualities important to a species for spawning, rearing, and migration that are used by NMFS and FWS to define critical habitat. Critical habitat has not been designated in marine waters due to the difficulty in determining and mapping these essential features. As the proposed project would not be within critical habitat as determined in the current Atlantic salmon status review (Fay et al. 2006), spawning and rearing habitat qualities are not present in the proposed project area. However, this area does serve as an important migratory corridor for Atlantic salmon migrating to the Dennys River.

Atlantic salmon spend 2 to 3 years in suitable freshwater tributaries where they begin their life cycle as parr (juvenile stage). Smoltification begins after about 2 years of growing in their natal tributaries, which prepares them for traveling to sea. It takes between 2 to 3 weeks for smolts to travel to sea as they face increased predation and the physiological osmoregulation adaptation that allows them to survive in saline conditions (McCormick et al. 1998 and Mather 1998). As smolts migrate to sea they utilize the ebbing tides, are associated with the upper water column, and congregate in schools in the open ocean (LaBar et al. 1978; Shelton et al. 1997). A 2005 telemetry study by NMFS found that smolts travel within the upper 1.5 meters of the water column on

average in Penobscot Bay. Smolt migration timing is variable depending on differences in annual environmental factors like increasing water levels and temperatures in spring (Daine et al. 1984), but consistently occurs as temperatures and flows increase in April, May, and into early June in the Denny's River (NMFS unpublished data; Spencer et al. 2010; McCormick et al. 1998; Lacroix and Knox 2005). These postsmolts become adults in the northern Atlantic Ocean where they spend another 2 to 3 years feeding along the southeastern coast of Greenland and Labrador (Baum 1997). Very few studies examine adult activity and habitat utilization while living in the open ocean (Fay et al. 2006).

Adults migrate back to their original tributaries in the Gulf of Maine in early fall to spawn (Bigelow and Schroeder 2002). Salmon homing mechanisms for returning to their natal rivers has been attributed to their olfactory senses that detect water chemical signatures (amino acids) from natal rivers that are established when juveniles, which are used to guide them back to these rivers (Hasler and Wisby 1951; Scholz et al. 1976; Yamamoto and Ueda 2007). Regardless of genetic origin, hatchery reared smolts will return to the rivers they were released in (Hansen et al. 1993). Peak adult upstream migration occurs in Maine during June and into the fall (Fay et al 2006). After spawning, adults are referred to as kelts, and migrate back to sea in late fall to continue feeding and prepare to migrate and spawn again in following years, however, some males overwinter in the rivers before migrating downstream in the spring (Baum 1997; Scott and Crossman 1973).

Atlantic Sturgeon (Acipenser oxyrinchus oxyrinchus)

The Atlantic sturgeon Gulf of Maine DPS was proposed as a federally threatened species in 2010 by NMFS. The Atlantic sturgeon was listed as a candidate species in 1991, and then qualified as a Species of Special Concern in 1998 after NMFS and FWS denied listing the species as threatened or endangered. Also in 1998, a commercial fishing moratorium was issued for the species that may be abolished once 20 age classes of females are confirmed for each spawning population. A workshop held by NMFS and FWS in 2003 to review the species status resulted in a subsequent status review, completed in 2007, and the proposed threatened status listing for the Gulf of Maine DPS under the ESA in 2010. This proposal is currently open for public comment and under further agency review before a final ruling is determined.

NOAA has proposed five Atlantic sturgeon DPSs including: Gulf of Maine, New York Bight, Chesapeake Bay, Carolina, and South Atlantic. Critical habitat for each DPS will be defined by the associated agencies if the listing determination is finalized, and the necessary data is collected.

The Atlantic sturgeon is an anadromous fish that returns to natal rivers from the Atlantic Ocean to spawn. Atlantic sturgeon are benthic feeders that filter through soft substrates to find food. Juveniles commonly feed on small aquatic invertebrates, while adults feed on larger mollusks, gastropods, amphipods, isopods, and some bottom

dwelling fishes (Atlantic Sturgeon Status Review Team (ASSRT) 2007). Atlantic sturgeon can reach over 800 pounds and live for about 60 years (ASSRT 2007). Males reach sexual maturity before females and all mature at a late age depending on the population location. Northern populations in the St. Lawrence River reach maturity between 22 and 34 years for males and 27 and 28 years for females (Scott and Crossman 1973), while males reach maturity between 5 and 13 years and females between 7 and 19 years in South Carolina (Smith et al. 1985). Individuals do not always return to spawn in consecutive years, as males return every 1 to 5 years and females every 2 to 5 years.

Spawning occurs during the spring months, beginning as early as February in the southern extent (Florida) of the sturgeon's range, and in May in their northern range of Canada (Scott and Crossman 1973). Migration upstream starts between May and June in the Gulf of Maine (Bigelow and Schroeder 2002), and spawning is most frequent during June and July in the Kennebec River (ASSRT 2007). Spawning is known to take place between the "salt front" (where salt/brackish water begins in coastal rivers) and "fall line" (geomorphological feature where upland regions transition to coastal plains, creating rapids and waterfalls in rivers) of rivers, and is likely triggered by increased precipitation and associated temperature changes (Smith 1985). Spawning has been observed in water flows between 18 and 30 inches per second and water depths between 36 and 89 feet. Eggs are deposited on hard substrates (*i.e.*, cobble, large gravel) and are highly adhesive (Gilbert 1989, Smith and Clugston 1997).

Larval and juvenile Atlantic sturgeon move progressively downstream to estuarine habitat. Juveniles have been observed moving into freshwater in spring and brackish water in fall within their natal rivers for up to 6 years before migrating to sea (Smith 1985; Baum 1997). Juveniles have also been documented traveling great distances (between Winyah Bay in South Carolina to Chesapeake Bay in 80 days) in short time periods (Smith 1985) and have been frequently observed in coastal areas at depths of 20 meters (66 feet) or less (Dunton et al. 2010). Generally, juveniles stay in estuaries for up to 6 years when they move to the continental shelf to reach sexual maturity (Smith 1985).

Bald Eagle (Haliaeetus leucocephalus)

The bald eagle, a species protected under the Bald and Golden Eagle Protection Act (BGEPA) of 1940, as amended (16 USC §§ 668-68d), as well as the Migratory Bird Treaty Act (MBTA) of 1918 (16 USC §§ 703-12) (FWS 1999, 2005), is known to occur in the vicinity of the proposed project. Bald and golden eagles were delisted as endangered species in the lower 48 states on August 8, 2007 by an amendment to 50 C.F.R. Part 17 (72 Federal Register 37346 at 37372, July 9, 2007), but remain protected under the BGEPA and MBTA. The MBTA protects all migratory birds year-round, but only protects nests during the time when intact eggs, live chicks, or an adult on nest are present (FWS 2005).

After years of significant decline, bald eagle populations have rebounded throughout the United States and Canada. Although still listed as a species of special concern in Maine, there are 441 documented breeding pairs in Maine (up from a low of 23 pairs in the late 1960s) (Maine DIFW 2008). Bald eagles breed in forested areas adjacent to large bodies of water (within 2 kilometers) and typically nest in large conifer or deciduous trees. Aside from direct loss of habitat, disturbance from human activity is a leading factor in nest abandonment and reproductive failure (Buehler 2000). Eagles commonly forage by plunging into open water to capture fish.

Bald eagles have been reported during every bird survey conducted in the greater Cobscook Bay area between 2004 and 2008 and were confirmed in the Eastport area in 2008 (Downeast Birding Festival 2008a, b). Bald eagles were documented on numerous occasions during random observation events performed by ORPC Maine between December 2007 and December 2010 and were also observed by the Center for Ecological Research (CER) during bird studies in the proposed project area. Bald eagles are known to commonly forage in open marine waters in the Kendall Head area. Although several bald eagle nests exist in the general vicinity of the proposed project, no nests have been observed within the proposed project boundary.

3.3.3.2 Environmental Effects

Atlantic Salmon and Atlantic Sturgeon

The largest potential for the proposed project to affect marine endangered and candidate species, such as Atlantic salmon and Atlantic sturgeon, would be if an individual(s) of a species moving through the area was directly struck by a turbine blade, potentially causing injury or mortality. In August 2009, the Commission designated ORPC Maine as the non-federal representative to pursue consultation under the ESA with respect to the proposed Cobscook Bay Project. ORPC Maine consulted with NMFS and prepared Draft Biological Assessments on the Atlantic salmon and Atlantic sturgeon, which was included in Appendix D of the Cobscook Bay Project license application. ORPC Maine determined that the project is not likely to adversely affect the habitat or individual Atlantic salmon and not likely to jeopardize the Atlantic sturgeon.

Although the project is not likely to adversely affect or jeopardize these species, ORPC Maine proposes several monitoring plans that would evaluate the potential effects of the project on these species. These plans include the Acoustic Monitoring Plan, which would evaluate the underwater noise radiated by the project construction and operation, and the Fish and Marine Life Interaction Monitoring Plan, which would evaluate the presence, abundance, and behavior of fish and marine mammals in and around the TidGen^{TM} devices.

As discussed in detail above, NMFS recommends that ORPC Maine conduct any pile driving and jet plow (cable burial) activities during the period of November 8th to

April 9th of any year to reduce the potential to effect fish, including Atlantic salmon and Atlantic sturgeon, due to underwater noise levels and turbidity.

Our Analysis

The proposed project area does not serve as primary resident Atlantic salmon habitat, but does provide limited use as a migration corridor for Atlantic salmon smolts and adults. These routes are only used for very short periods in spring, as the smolts pass through the proposed project area during the strongest ebbing tides, and primarily migrate near shore (Lacroix et al. 2004). In addition, salmon smolts and adults are expected to migrate in the upper 1.5 meters of the water column on average (Fay et al. 2006), and while smolts outmigrate in small schools, adults are likely to migrate individually (Fay et al. 2006). These migration behaviors and the extremely low abundances of Atlantic salmon within the proposed project area indicates that Atlantic salmon do not likely use the habitat at the depths of the proposed turbines during migration, as the turbines are proposed in the central portion of the channel and deeper portion of the water column.

Little information is available to indicate Atlantic sturgeon use habitat in and around the project area, and spawning migrations to rivers feeding into Cobscook Bay are not documented, as spawning populations known in the Gulf of Maine are possibly limited to only the Kennebec River (ASSRT 2007). Anecdotal information from the St. Croix River, which empties to Passamaquoddy Bay several miles north of Cobscook Bay, indicates that a small population of unidentified sturgeon may be spawning below a hydroelectric dam, but it is not confirmed and additional evidence of Atlantic sturgeon in this river is not available (ASSRT 2007).

The proposed project area does not support the substrate types preferred by foraging Atlantic sturgeon. Atlantic sturgeon sift through soft sediment for prey (Scott and Crossman 1973) and have been commonly found in greatest abundances along soft and fine sediments (Sweka et al. 2007) typically found in lower velocity areas. Sweka et al. (2007) found Atlantic sturgeon at their greatest abundances and highest sampling catch per unit effort in areas with soft sediments in deep locations in the Hudson River estuary, where only 25 percent of available Atlantic sturgeon habitat contained this sediment type. On the other hand, the proposed project area is dominated by larger hard sediments, such as bedrock, cobble, and gravel.

Due to their periodic diving behavior, Atlantic salmon migrating in Cobscook Bay could potentially interact with ORPC Maine's TGU (NMFS 2011). Direct interactions with the unit could involve Atlantic salmon collisions and strikes with the turbine. Indirect interactions could involve attraction, avoidance, or migration behavioral changes due to altered estuarine hydraulics. Once deployed, the five TidGen™ devices would occupy approximately 3 percent (or 200 feet) of the width of the suitable migration corridor (approximately 6,600 feet) for post smolts off Shackford Head. Therefore, 97 percent of the channel width would be left unobstructed for migrating fish.

As the turbines are only expected to be rotating 82 percent of the time, it is possible that fish will swim by or through the turbines when there is no risk of blade strike. If fish approach the TGU while it is operating there is a possibility that they could be struck by a blade and injured, or possibly killed. However, in an Electric Power Research Institute study conducted at the Alden Research Laboratory in 2011, it was determined that rainbow trout avoided swimming through a similar turbine (Lucid spherical turbine) to ORPC Maine's TidGen™ system, by swimming upstream or by passing around the margins of the turbine (Jacobson 2011). It was determined that 83 to 94 percent of fish released within 12 inches of the turbine were able to avoid it by swimming around. Video observations of the experiment indicated that struck fish were not stunned or severely injured, and that survival was near 100 percent. This was likely due to the slow speed of the turbines, which at 64 to 127 rpm, was 2 to 4 times faster than the maximum speed (32 rpm) anticipated for ORPC Maine's TGUs. Likewise, work done by Amaral et al. (2008) tested the effects of leading edge turbine blades on fish strike survival and injury. For white sturgeon ranging in size from 100 to 150 mm, blade strike survival at mean blade speeds of 10.6-12.2 meters/second (proposed turbines would have a speed of 0-4.4 meters/second) was 100 percent for sturgeon struck in the head and caudal region and 97.4 percent for those struck in the midsection. Amaral also indicated that strike mortality is not anticipated if strike speeds are less than 4.8 meters/second. Given the low blade speeds associated with the proposed TGUs, it is anticipated that they would be significantly less likely to harm fish than either of the above turbines.

It is not presently known whether the TGUs would illicit attraction or avoidance behavior for Atlantic salmon or Atlantic sturgeon. ORPC Maine's proposed post-deployment fisheries monitoring would further the understanding of fisheries interactions with this new technology. However, with only five TidGen^{TM} devices proposed to be deployed, interaction with the TGUs by any post-smolts or adult Atlantic salmon, or Atlantic sturgeon would not be anticipated.

Bald Eagle

Construction noise and human activity during installation of the underwater facilities and construction of the onshore facilities could disturb bald eagles. Bald eagles have been reported during every bird survey conducted in the greater Cobscook Bay area between 2004 and 2008 and were confirmed in the Eastport area in 2008 (Downeast Birding Festival 2008a, b). In addition, they have been documented on numerous occasions during random observation events performed by ORPC Maine between December 2007 and December 2010 and were also observed by the CER during bird studies in the proposed project area. Although several bald eagle nests exist in the general vicinity of the proposed project, no nests have been observed within the proposed project boundary.

OPRC Maine does not propose any specific measures to protect bald eagles during construction activities. No recommendations from the agencies or other stakeholders were filed regarding bald eagle protection measures.

Our Analysis

The FWS has issued *Bald Eagle Management Guidelines*, dated May 2007, to advise landowners, land managers, and the general public of the potential for various activities to disturb bald eagles, and encourage land management practices that benefit bald eagles and their habitat (FWS 2007). Within these guidelines the FWS recommends a primary 330-foot buffer zone and a secondary 660-foot buffer zone around eagle nest trees (FWS 2007). The primary zone is established to provide protection of the juvenile eagles in the nest tree and to buffer the tree from human activities during nesting season (March through August), when nests are most vulnerable to disturbance by human activity. The secondary buffer zone protects the nest from noise and obstructive activities and to protect nesting habitat within the primary zone. The secondary zone extends from the primary zone to a distance of 660 ft from the nesting tree. The actual size of the buffer zone could vary depending on site specific characteristics and the eagle's tolerance for human disturbance (FWS 2007).

While project construction and operation could affect bald eagles, any construction noise and increased human activity related to project construction and operation would be minimal and short term and is not expected to create a greater disturbance than what is already present in Cobscook Bay. However, following the FWS *Bald Eagle Management Guidelines* would ensure that this important species is protected.

3.3.3.3 Cumulative Effects

Although it is unclear to what extent the proposed project would affect Atlantic salmon, Atlantic sturgeon, and bald eagles until the results of the proposed monitoring plans have been analyzed, these species have the potential to be cumulatively affected by the proposed project in conjunction with other past, present, and reasonably foreseeable future actions in Cobscook Bay. The environmental effects of new technology hydrokinetic projects would be evaluated through the effective monitoring of pilot projects such as is being proposed by ORPC Maine.

In addition to the extensive commercial fishing, marine resource harvesting, and aquaculture sites in Cobscook Bay, a tidal barrage project,[22] the Half Moon Cove Project, is proposed to be installed over Half Moon Cove in Cobscook Bay. The Half Moon Cove Project would involve the construction of a 1,200-foot-long, 31-foot-high dam connecting

[22] A tidal barrage is a dam-like structure used to capture the energy from water moving in and out of a bay or river due to tidal forces.

Moose Island (Eastport, Maine) to the mainland at Perry, Maine.[23] There is a level of uncertainty regarding the effects of the proposed Cobscook Bay Project and Half Moon Cove Project, in conjunction with other marine activities, on Atlantic salmon, Atlantic sturgeon, and bald eagles, particularly in regards to behavior modification, injury/mortality due to turbine blade strikes, underwater noise, and alteration of habitat. However, ORPC Maine has designed the Cobscook Bay Project in a manner that would minimize the potential for environmental effects during construction and operation including: small scale of the project; a phased installation plan; a remotely controlled braking system for the turbines that would allow for the project to be shut down quickly in the case of an emergency; and the design of the turbines to have blunt-shaped foils and relatively slow speeds, minimizing the potential for turbine blade strikes on fish, diving birds, and marine mammals. In addition to these design features, the results of the studies ORPC Maine conducted during the Beta TidGen™ deployment, suggest that any environmental impacts from the pilot project would be minor. Any unanticipated adverse effects of these projects on Atlantic salmon, Atlantic sturgeon, or bald eagles would be expected to be minimized through the monitoring plans and mitigation measures that would be required in an issued license.

3.3.4 Terrestrial Resources

3.3.4.1 Affected Environment

The proposed Cobscook Bay Project is located on Seward Neck in Cobscook Bay, which is characterized by low ridges surrounded by poorly drained, relatively flat terrain with elevations generally less than 100 feet (30.5 meters) (McMahon 1990). The proposed project area includes the marine waters to the southeast of Grove Point where the TidGen™ devices would be deployed, the P&D cable route between the TidGen™ devices and the on-shore station, and the on-shore station.

Botanical Resources

The vegetation on Seward Neck is dominated by upland mixed and evergreen forest types. Secondary cover-types include some deciduous forested areas, many areas classified as grassland communities, and upland scrub-shrub communities. Unconsolidated shore areas occur along the peninsula with other mapped wetland types (*e.g.*, palustrine emergent and palustrine scrub-shrub wetlands) (FWS 2009; Maine Office of Geographic Information Systems (Maine GIS) 2009). Intertidal areas along the perimeter of Seward Neck are dominated by extensive mudflats, rocky intertidal zones, and estuarine wetlands. Terrestrial areas in the proposed project area are dominated by

[23] Tidewalker Associates currently holds a FERC preliminary permit for the proposed Half Moon Cove Project (P-12704). There is not an active licensing proceeding for this project proposal.

evergreen and mixed forested areas, grasslands (*i.e.*, pasture and hay meadows), shrub habitats, extensive mudflats, and estuarine wetlands (FWS 2009; Maine GIS 2009).

The cover types within the proposed project area, which were interpreted from aerial photography and electronic cover-type data and ground-truthed during field visits, can be classified into five broad categories: upland forest (coniferous and hardwood), early successional, grassland, wetland (forested, scrub-shrub, emergent, and tidal wetlands), and developed (residential, commercial and industrial). Cover types within and adjacent to the proposed project area are depicted in figure 11. The predominant cover type was then used to define and describe the associated wildlife habitat (Gawler & Cutko 2010).

Six upland (non-aquatic/wetland) habitat types have been documented in and adjacent to the proposed project area, including maritime spruce-fir forest, spruce-fir forest, mixed forest, open land-early successional, grassland, and developed areas. Of these six habitats, mixed forest and developed areas are the most common community type, open land – early successional and grassland are relatively common, and spruce-fir forest is uncommon.

State Special Status Botanical Species

Based upon consultation with federal and state natural resource agencies and background data collection that included documented occurrences of rare plant species, species range information, and habitat availability, no state or federally listed plant species or natural communities are likely to occur in the proposed project area; however, ORPC Maine identified smooth woodsia (*Woodsia glabella*) and gaspe arrow-grass (*Triglochin gaspensis*) as sensitive species that occur within a 4-mile radius of the project.

Smooth woodsia is typically found on calcareous cliffs, often at crests of shaded cliffs. Cliff ferns (Woodsia) are typically slender ferns found on cliffs, ledges, and talus slopes. They are generally identified by their distinctive indusia and petioles (Maine DOC 2004). Due to the habitat requirements of smooth woodsia, however, it is unlikely that the species exists in the project area and no occurrence records have been located.

Gaspe arrow-grass typically grows within inner tidal zones of salt marshes. The species is "grassy" looking, and flowers are borne on a leafless stalk (scape) in a spike-like raceme. This species is very rare and is only found in a few salt marshes in Downeast coastal Maine. The species is critically imperiled in Maine because of its extreme rarity or vulnerability to extirpation and there are fewer than ten locations of the species currently known in Maine. Gaspe arrow-grass was found in the Roque Bluffs Focus Area located several miles southwest of the project area; however, no occurrence records have been located that indicate the species has been documented in the proposed project area. Based on the November 2010 and June 2011 site visits, it is unlikely that

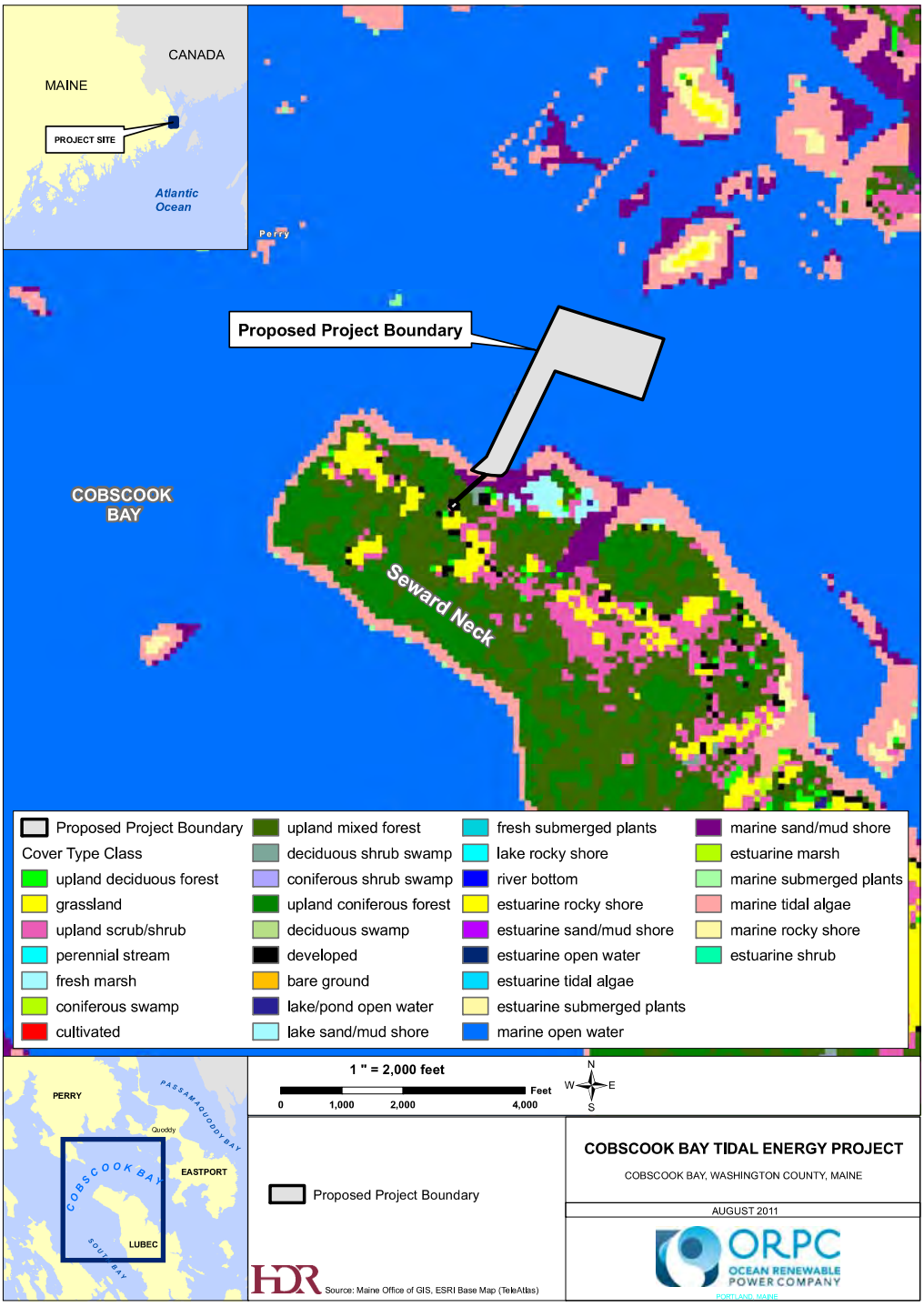

Figure 11. Cover-type map (Source: application).

gaspe arrow-grass occurs in the proposed project area due to the lack of salt marsh habitat adjacent to and within the deployment area.

Wetland Habitats

The proposed project would cross mostly coastal wetlands and sections of freshwater wetland, which are both regulated by the U.S. Army Corps of Engineers and Maine DEP under such regulations as the Clean Water Act, the Rivers and Harbors Act, and the Maine Natural Resources Protection Act (NRPA). Coastal wetlands, as defined by Maine DEP, include estuarine intertidal and subtidal wetlands, which support vegetation tolerant of saline water. Intertidal wetlands are transitional vegetated areas along the shoreline that are periodically flooded by the tide. Subtidal habitats have substrates that are continuously flooded by tidal water. Vegetation commonly found in coastal wetlands consists of various seagrass species. Macroalgae, such as kelp species, are also commonly found in coastal wetlands (Ward 1999).

On November 23, 2010, ORPC Maine conducted a wetland determination and site reconnaissance survey within the property where transmission facility improvements were originally proposed to be located for the project. After that time, ORPC Maine refined the P&D cable route (*i.e.*, moved the proposed route further to the north) and additional wetland investigations were conducted in the area on June 22, 2011. Based on satellite imagery, National Wetland Inventory data, and site visits conducted within the proposed project area, wetland communities and vegetated intertidal areas and mudflats in particular are uncommon due to the water depth and strong tidal currents. Tidal wetlands are common elsewhere along the shorelines near the proposed deployment area and include extensive tidal mudflats, rocky intertidal areas, and tidally influenced wetlands. Figure 12 provides the results of National Wetland Inventory for the proposed project area and table 15 provides mapping code descriptions for the dominant National Wetland Inventory codes found on figure 12.

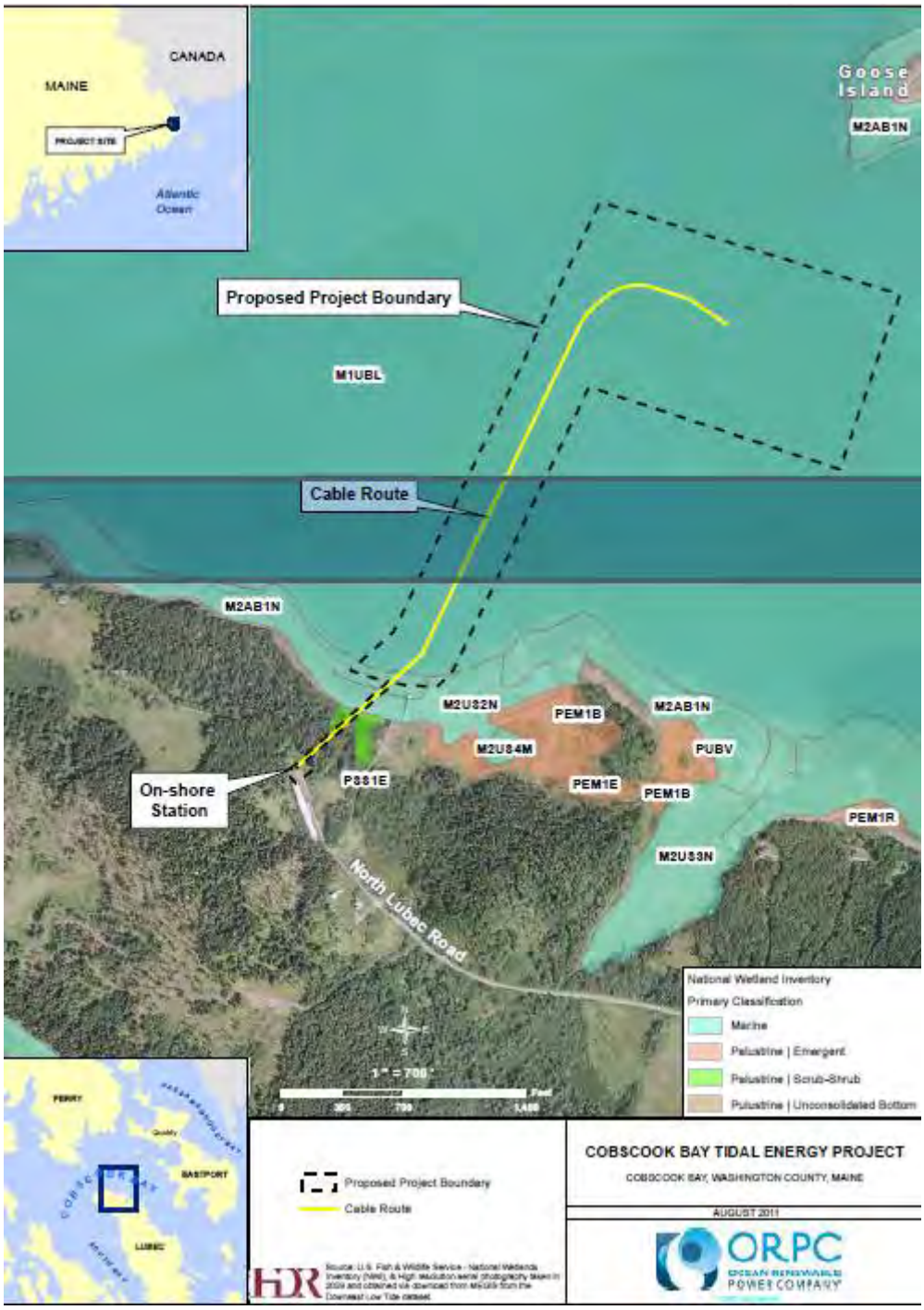

Figure 12. Cobscook Bay, Maine National Wetland Inventory Map (Source: application)

Table 15. National wetland inventory mapping code descriptions (Source: application).

NWI Code	Mapping Code Description
PSS1E	Palustrine, Scrub-Shrub, Broad Leaved Deciduous, Seasonally Flooded/Saturated
M1UBL	Marine, Subtidal, Unconsolidated Bottom, Subtidal
M2AB1N	Marine, Intertidal, Aquatic Bed, Algal, Regularly Flooded
M2US3N	Marine, Intertidal, Unconsolidated Shore, Mud, Regularly Flooded
M2US2N	Marine, Intertidal, Unconsolidated Shore, Sand, Regularly Flooded
M2US4M	Marine, Intertidal, Unconsolidated Shore, Organic, Irregularly Exposed
PEM1B	Palustrine, Emergent, Persistent, Saturated
PEM1E	Palustrine, Emergent, Persistent, Seasonally Flooded/Saturated
PUBV	Palustrine, Unconsolidated Bottom, Permanent-Tidal
PEM1R	Palustrine, Emergent, Persistent, Seasonal-Tidal

Important Natural Communities

ORPC Maine consulted with federal and state agencies to determine the location of any important natural communities in the vicinity of the proposed project area. Based on consultation with Maine DEP and FWS, no unique or unusual natural features such as rare plants, rare natural communities, or unusual areas were identified within 0.5 mile of the proposed project area. Several important natural communities, however, are located in the project vicinity, including one state park (Shackford Head State Park) and one land parcel (Pike Lands Conservation Area) managed by a non-profit organization (figure 13). Shackford Head State Park is located on Moose Island, Eastport, to the east of the proposed deployment area and sea ducks and common terns are abundant along the shoreline of the park and spotted sandpipers and several other bird species are available in season at low tide. The Pike Lands Conservation Area is managed by the Quoddy Regional Land Trust and is located on Seward Neck, Lubec south of the deployment area. During late summer migrations, bald eagles cruise the shores and a variety of shorebirds frequent the water's edge.

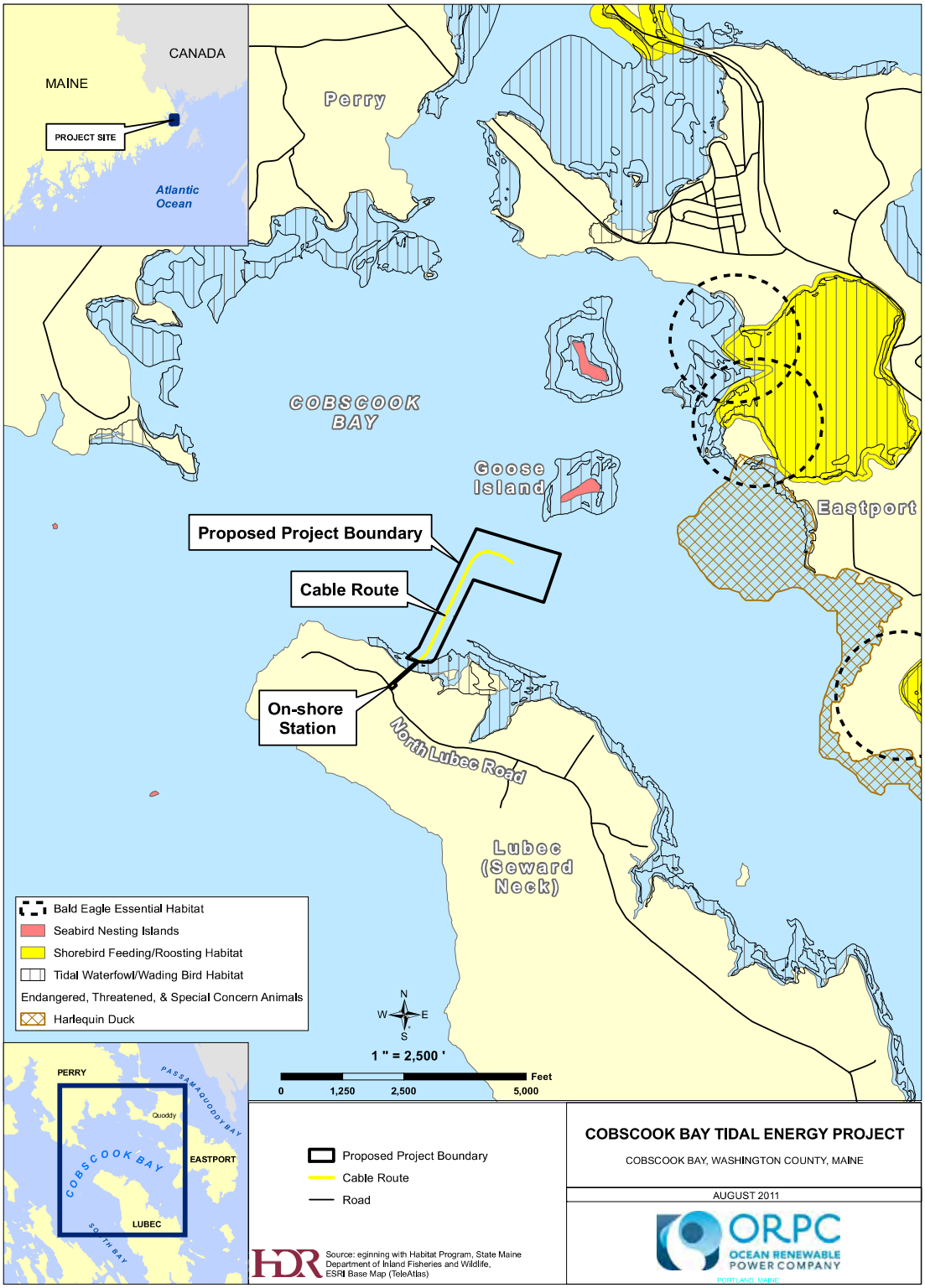

Figure 13. Significant wildlife habitats in the project vicinity (Source: application).

Terrestrial Wildlife

Avian Species

Over 400 bird species are known to occur in Maine, and nearly 300 of these are known to inhabit Cobscook Bay during some part of the year (EPA 1976; DeGraaf & Yamasaki 2001). The broader region of the proposed project area supports the largest concentration of Bonaparte's gulls in eastern North America during the fall migration (Braune 1987). Tens of thousands of Bonaparte's gulls linger in this region because abundant prey provides the necessary food resources to go through a full post-breeding molt (Braune 1987). Similarly, large numbers of common terns and Arctic terns also gather in Passamaquoddy Bay in August and September. Bonaparte's gulls and both species of terns are surface feeders, taking small prey from or just below the surface.

Cobscook Bay is also considered an important area for wintering ducks, especially American black ducks (Longcore & Gibbs 1988). Large numbers of razorbills are also known to occur during winter in the Bay of Fundy and nearby Grand Manan Island, New Brunswick (Huettmann et al. 2005).

Based on surveys conducted from 2004 through 2008, 213 species have been confirmed in the Cobscook Bay area (Downeast Birding Festival 2008a). Avian surveys conducted in similar shoreline habitats of Passamaquoddy Bay, located approximately 12 miles to the north of the Cobscook Bay project area, support these findings, as do documented observations from birding events in the Eastport area (eBird 2009). Most of the identified species, however, are not expected to breed or nest within the proposed project area due to limited availability of suitable habitat. The most commonly represented guilds (in order of dominance) are perching birds, shorebirds, waterfowl, hawks and falcons, and gulls and terns. Most of the avian species expected to occur within the project area are migratory species that typically use open water and coastal areas seasonally as breeding and feeding grounds during the summer, and as stopover locations for foraging and resting during spring and fall migration.

The importance of the Cobscook Bay region to birds and other wildlife is evident by initiatives taken to protect the resources. The Cobscook Bay region has been identified as a priority site for protection by the Maine Wetland Protection Coalition (MWPC) due to large numbers of nesting bald eagles, and internationally important populations for migratory shorebirds and waterfowl, and large concentrations of wintering black ducks that are known to utilize the area (National Wetlands 2007). In addition, much of the coastal habitat in the vicinity of the proposed project is designated as significant wildlife habitat and is regulated by Maine DEP (Maine DEP 2007a, b, c).

During consultation with agencies and stakeholders about the proposed Cobscook Bay Project, the main issues raised about impacts on terrestrial resources were concerns for migrant and wintering seabirds. In order to obtain a better understanding of the use of

the proposed project area by migrant and wintering seabirds, ORPC Maine contracted the Center for Ecological Research to conduct seabird inventories off the waters of the proposed project area. The Center for Ecological Research monitored the waters off North Lubec within the proposed deployment area for migrant and wintering seabirds and waterfowl from August 2010 through May 2011.

The purpose of these inventories was to determine the species and numbers of seabirds, and other birds that use the proposed area, the on-shore landing site where the P&D cables from the deployment area would come ashore in North Lubec, and the waters immediately off the landing site. Although the Center for Ecological Research recorded all bird observations during their field efforts, the study focused on Bonaparte's gulls, Arctic and common terns, diving birds, and wintering waterfowl and seabirds (*e.g.*, black guillemots, common eiders, common loons, and red-necked grebes).

Bonaparte's Gulls and Terns

Large numbers of Bonaparte's gulls were observed within the general vicinity of the deployment area in mid-August and later in the fall in early November 2010. Bonaparte's gulls were only observed in the mid-channel of Cobscook Bay within the deployment area and were not observed in the nearshore area adjacent to the landing site. When Bonaparte's gulls were present, they were observed actively surface feeding in the mid-channel area. The study findings indicate that Bonaparte's gulls are surprisingly irregular within the study area. Initial observations in mid-August indicated that the species would be regularly observed in the mid-channel area prior to low tide; however, this was not observed during the study. Bonaparte's gulls feed on invertebrate prey near the surface, and it appears that foraging conditions are better in Passamaquoddy Bay than in the study area. Although the Center for Ecological Research did not survey Passamaquoddy Bay systematically, the Center for Ecological Research repeatedly observed thousands of Bonaparte's gulls in Passamaquoddy Bay.

No terms were observed in the deployment area or in the intertidal zone adjacent to the landing site. While conducting transects at Head of Harbor Passage, however, which is a section of Passamaquoddy Bay approximately 3,000 feet from the study area in Cobscook Bay, between 15 and 85 terns were observed.

Waterfowl and Seabirds

Generally few ducks or seabirds were observed utilizing the deployment area. Ten to 20 black guillemots were observed in the mid-channel area of the deployment area from August until early October 2010, but the number of black guillemots declined after that period. Although common eiders breed on Goose Island, few common eiders or other seaducks were observed within the study area. Most of the common eiders were observed near the aquaculture salmon pen that is located near the deployment area. During the Center for Ecological Research's November 2010 through May 2011 bird

survey period, common eider was the only species observed to use the mid-channel and near shore area off North Lubec in any numbers and was mostly observed in the mid-channel area. The maximum count of common eider in the near shore area was 25 individuals on January 15, 2011. They were present consistently in the mid-channel area from November 7, 2010 to January 30, 2011 but were nearly absent on February 5, 2011 before appearing once more on February 12, 2011. Eider numbers diminished on March 5, 2011 (average of 4.5 individuals) but increased by March 13, 2011. Common loons were present in small numbers, typically two to four individuals, throughout the survey period. The Center for Ecological Research observed that red-necked grebes arrived within the study area in early October and one to three individuals were regularly observed within the general vicinity of the deployment area. Long-tailed ducks were uncommon and occurred in small numbers, with a maximum of 5.5 individuals in the mid-channel on January 15, 2011. Large gull species were composed of great black-backed gulls and herring gulls. Large gulls were present in small numbers except in the mid-channel on January 15, 2011, when an average of 5.3 great black-backed gulls and 34.5 herring gulls were observed. Late migrant Bonaparte's gulls were observed in the mid-channel area on November 13, 2010. The only ring-billed gull was seen in the near shore area off North Lubec on January 30, 2011 (CER 2011b).

Diving Behavior

The Center for Ecological Research observed common loons, red-necked grebe's, long-tailed ducks, red-breasted mergansers, common goldeneye, and black guillemot's diving frequently within the study area. While these species fed primarily on fish at the time the study was conducted, they also consume other marine invertebrates. Black guillemots were commonly observed from August through October (peak count of 18 on October 3, 2010) but diminished thereafter. Common loons and red-necked grebes occurred in small numbers only. Common eiders dive for invertebrate prey such as blue mussels and other invertebrates. In general, the percentages of time spent feeding in the mid-channel area and the near shore area were very similar for all species except common eiders, which fed in the mid-channel 48 percent of the time and in the near shore area off North Lubec 80 percent of the time.

Mammals

Open and early successional habitats and some areas of mixed forest are the dominant wildlife habitats in the vicinity of the proposed project. The most common mammals likely to occur in the area are considered generalist species, in that they are able to utilize a variety of habitats and tend to be tolerant of human disturbance and activity. Based on species habitat, natural history, and distribution information for Maine (Gawler et al. 1996; DeGraaf & Yamasaki 2001; DeGraaf et al. 1992) some mammal species likely to occur in the terrestrial portion of the project area include snowshoe hare, eastern chipmunk, woodchuck, gray squirrel, red squirrel, red fox, raccoon, ermine, and striped skunk. Site visits conducted from 2009 through 2011 confirm that although the

project area is moderately developed, suitable habitat exists to support these generalist species. Wetland areas of the project vicinity provide habitat for mink, beaver, and muskrat. The wetlands located in the project area may provide necessary habitat to support some of these species. Additionally, the area only provides marginal habitat for medium and large terrestrial mammals due to developed lands of the area; however, occasional occurrences of highly mobile species such as coyote, white-tailed deer, and moose are possible.

Reptiles and Amphibians

Reptile and amphibian species are expected to occur in the project area due to the presence of freshwater wetland habitat. Based on species habitat, natural history, and distribution information for Maine (Gawler et al. 1996; DeGraaf & Yamasaki 2001), some reptile species that may occur in the proposed project area include common garter, northern ringneck, and northern redbelly snakes. Wetland areas and permanent ponds in the larger project vicinity are likely to provide habitat for amphibians such as blue-spotted salamander, spotted salamander, eastern American toad, northern spring peeper, bullfrog, green frog, minke frog, wood frog, leopard frog, pickerel frog, snapping turtle, wood turtle, and pained turtle. The wetlands located along the proposed transmission line route likely provide habitat for some of the amphibians and reptiles identified above.

State Special Status Wildlife Species

Based on consultation with federal and state natural resource agencies, background data collection that included documented occurrences of rare species, species range information, and habitat availability, 8 state-listed threatened or endangered species (all birds), and 41 state species of special concern (38 birds, 3 mammals), may occur in the general project vicinity at some point during their life cycle. Special status species observed in the project vicinity during the Center for Ecological Research's bird studies include peregrine falcon, great blue heron, Bonaparte's gull, Arctic and common tern, razorbill, and bald eagle.

Only the breeding populations of great cormorant (threatened), Bonaparte's gull (special concern), and peregrine falcon (endangered) are state-listed species (Maine DIFW 2009). Within the past 5 years, great cormorants have been documented during survey efforts in May (presumably during the breeding season) in 3 of the 5 years, and peregrine falcons have been documented in 2 of the 5 years (Downeast Birding Festival 2008a). Survey efforts cover the greater Cobscook Bay region, including Eastport. Great cormorants and peregrine falcons were not documented in the Eastport area in 2008, but it is unknown if these species have been sighted in the immediate project area during previous survey events. As part of the Center for Ecological Research's bird studies within the proposed project area, Bonaparte's gulls and a single peregrine falcon were observed within the study area in 2010 (CER 2011a). Habitats in the project area provide foraging opportunities for all of these species, but likely only provide suitable breeding

habitat for the Bonaparte's gull (Hatch et al. 2000; DeGraaf & Yamasaki 2001; White et al. 2002).

Many of the listed species are considered forest species that may utilize the project area for foraging and use wooded areas for breeding and nesting activities. Potential suitable breeding/nesting habitat for these species may occur along the P&D cable route. Species found primarily in forested habitats include eastern screech owl, eastern wood-peewee, whip-poor-will, olive-sided flycatcher, least flycatcher, wood thrush, veery, Cape May warbler, Canada warbler, as well as eastern, hoary and silver-haired bats (DeGraaf & Yamasaki 2001; DeGraaf et al. 1992).

Other species that were observed in the Eastport area during 2008 bird surveys and may inhabit the project area include the upland sandpiper, tree swallow, northern rough-winged swallow, barn swallow, veery, chestnut-sided warbler, black-and-white warbler, yellow warbler, black-crowned night heron, common tern, and great blue heron (Downeast Birding Festival 2008b). Additional state-listed threatened species identified as birds that may utilize intertidal shoreline areas and marine open water habitats within the deployment area include shorebirds, wading birds, gulls, terns, and waterfowl, such as Nelson's sharp-tailed sparrow, black tern, arctic tern, and razorbill (Maine DIFW 2007). The bald eagle also utilizes open marine water for foraging and large trees of coastal shorelines for nesting and has been observed in the proposed project area.

Significant Wildlife Habitats

Significant wildlife habitats that may occur within the terrestrial and intertidal components of the proposed project area include:

- Significant shorebird nesting, feeding and staging areas;
- High and moderate value waterfowl and wading bird habitats;
- Seabird nesting islands;
- Significant vernal pools;
- Bald eagle nest sites;
- Habitat for state-listed and federally listed species;
- Critical spawning areas for Atlantic salmon; and
- High to moderate value deer wintering areas and travel corridors.

Based on consultation with natural resource agencies and an assessment of GIS data and maps of significant habitats in the project vicinity (Maine DEP 2007 a, b, c; Maine GIS 2009), the following were found to occur in the general vicinity of the proposed project: seabird nesting islands, significant shorebird habitat, tidal waterfowl and wading bird habitat, and bald eagle nest sites (figure 13). Seabird nesting islands are unforested, rocky islands that provide isolated areas for seabirds to nest and are home to puffins, murres, razorbills, common eiders, gulls, and numerous species of terns during

the breeding season from early April to late August. Significant shorebird habitat includes feeding and staging areas that provide migrating shorebirds with the food resources they need to acquire the large fat reserves necessary to fuel their transoceanic migration to wintering areas. Significant shorebird habitat is located within coves and protected areas along the western shoreline of Eastport, but none occurs within the proposed deployment area. Tidal waterfowl and wading bird habitats include eelgrass beds that are at least 2.5 acres in size, mussel bars/beds, emergent wetlands at least 2.5 acres in size, and mudflats at least 12.5 acres in size or are adjacent to one of the above habitats such that the resulting complex is at least 2.5 acres in size. Designated tidal waterfowl and wading bird habitat is present along the western shoreline of Eastport. Eelgrass beds also occur within mapped tidal waterfowl and wading bird habitat that is located several hundred feet to the north of the proposed deployment area and based on current project designs, designated tidal waterfowl and wading bird habitat may be affected.

3.3.4.2 Environmental Effects

Components of the proposed Cobscook Bay Project that could affect terrestrial and wetland communities and associated species include the construction and operation of the on-shore station and associated appurtenances, and the installation of the P&D cables through the intertidal zone to the on-shore station.

Botanical, Wetland, and Wildlife Resources

The proposed project area and surrounding vicinity support a number of upland, marine, freshwater, and intertidal habitats which in turn support a diverse mix of flora and fauna. The project has the potential to most directly affect terrestrial species that depend upon coastal and marine open water, intertidal areas, and shoreline habitats of the deployment area as well as those that inhabit the upland communities found in the vicinity of project infrastructure features (e.g., on-shore station and the P&D cable).

Specific terrestrial components of the project include the construction, operation, and maintenance of the on-shore station and the burial of the P&D cables. The on-shore station, located off of North Lubec Road in Lubec, Maine, would measure 16-feet by 20-feet, and would be located approximately 400 feet from the shore (mean high water). A 30-foot by 30-foot fence would be constructed around the building. Gravel would be used in the yard surrounding the on-shore station and would extend outside of the perimeter fence for a total impacted area of 1,300 square feet. A propane tank and generator would be located within the fenced area and a 6-foot by 6-foot (36 square feet) concrete pad would be located just outside of the fenced area. The project's grid connection transformer would be positioned on the concrete pad.

Habitat alteration associated with Phase 1 construction activities include the temporary effects associated with construction of the on-shore station, placement of the

P&D cable in nearshore and intertidal areas, and habitat conversion and alteration associated with clearing of the right-of-way for the cable route. ORPC Maine proposes to use an existing industrial facility in Eastport, Maine for the staging of project components.

During Phase 2, four additional TidGen™ devices would be deployed and the associated underwater P&D cables would be connected to the power system. No further on-shore construction activity is anticipated for Phase 2 activities. Therefore, no further environmental effects related to construction are anticipated for terrestrial resources.

Based on responses received from agency staff, background data collection, and comments received on the draft application, the potential environmental effects to terrestrial botanical and wildlife species associated with project components primarily include:

- Habitat alteration (loss, conversion, [temporary effects]);
- Potential for collision with Project components;
- Discharges during construction activities; and
- Changes in species behavior due to Project structures.

Intertidal areas of the project would be temporarily affected during installation of the P&D cable. ORPC Maine proposes to bury the underwater P&D cable in the intertidal area (+/- 275 feet) and this burial would be performed at low tide using an excavator. The excavator would work off of standard swamp or timber mats that are adequate to support the equipment in such a way as to minimize disturbance of intertidal soils. The cable would be buried up the beach at a depth of 3 feet and re-covered with the excavated beach material. ORPC Maine states that the disturbed portion of the intertidal area would be no wider than the excavator footprint of 8 feet and extend the length of the intertidal zone. The width of the trench would be approximately 3 feet. From the beach, trenching would continue directly inland to the on-shore station, located approximately 400 feet from the mean high water line. ORPC Maine does not anticipate the use of foreign materials for trench filling or any of the cable laying activities.

Electricity generated by the proposed project would be delivered via the P&D cable to the on-shore station, where it would be power-conditioned and connected to the power grid through an existing transmission line. ORPC Maine states that vegetative disturbance may occur at a width of 20 feet along the P&D cable route; however, based on studies conducted by ORPC Maine, habitats affected by these activities include primarily disturbed open areas, road edges, intertidal habitat, mixed upland forest, and scrub-shrub and forested wetland vegetation.

For project decommissioning and removal, ORPC Maine states that specific requirements would be outlined in the contract between ORPC Maine and the landowner; however, the modular building and all project equipment, including the P&D cables, are

expected to be removed from the site. This removal would require the intertidal and on-shore cable corridor to be excavated and the cables removed. ORPC Maine states that the corridor then would be back-filled with the excavated materials and the area returned to existing grade. The P&D cables would be disposed of in an appropriate manner, including recycling where possible.

Our Analysis

Of the state-listed species, habitats, and communities identified above as occurring or potentially occurring in the proposed project area, none were specifically identified by state or federal natural resource agencies as likely to be affected by the proposed project. During the pre-filing consultation, resource agencies expressed concerns related to the design and installation of the power system, as well as its potential interaction with wildlife (e.g., diving birds). Concerns for operational effects of the proposed project were associated with the potential effects of animal movements near the TidGen™ devices and the possibility for the power system to act as a fish aggregation structure that could change the concentration of the forage base, potentially resulting in the increased susceptibility of seabirds (and other marine animals) to entrainment. As noted above, several state wildlife species of special concern (primarily birds), occur in the project vicinity and use nearshore/intertidal marine habitats found within the proposed project area for foraging and resting activities. Forested habitats occur in the project area, and portions of forested habitat would need to be cleared for the P&D cable route.

Construction and maintenance activities for the proposed project, including installation and removal of on-shore cables and facilities, would impact botanical, wetland, and wildlife species; however, these effects are expected to be temporary. As a majority of the project is underwater, there is a minimal land footprint and most land-disturbing activities would occur in a previously disturbed area. Mobile species are expected to avoid the project area during construction and would utilize similar habitats, which are in abundance nearby, to conduct their life cycle activities following placement of the project components. Due to the small land-based footprint of the project, species' standard behavioral responses, including normal avoidance measures, are not expected to significantly affect species' larger behavior patterns such as foraging, breeding and nesting.

Clearing, grading, trenching, and backfilling activities associated with project deployment could potentially cause erosion during project construction; however, while vegetation, soils and substrates would be disturbed, there would be minimal grading needed, and only a minor displacement of soil would be associated with terrestrial components of the project. In addition, the terrestrial soils in the proposed project area have low erosion potential based on soil characteristics and slope gradients and ORPC Maine proposes to implement appropriate erosion control measures for terrestrial construction activities that would limit the effects of erosion during project construction and deployment. Specifically, ORPC states that approximately 1,300 square feet of

habitat would likely be affected by construction of the on-shore station, and an additional 13,500 square feet of habitat would be temporarily and permanently affected by the burial of the P&D cable, of which only about 2,300 square feet would be wetland effects.

For safety and maintenance access, the area within the transmission line right-of-way would be maintained as low-growing herbaceous or shrub habitat within a 30-foot-wide transmission line corridor following construction activities. A conversion of cover type from palustrine forested wetland to palustrine scrub-shrub wetland would result from this activity measuring approximately 0.03 acre.

Immobile species may incur damage or mortality during construction. The terrestrial habitats in the proposed project area that would be permanently affected by construction of the on-shore station and installation of the P&D cable include primarily open herbaceous and shrubby areas, mixed forest associated with the P&D cable route, and areas of palustrine scrub-shrub and forested wetland habitat. Based on site visits, however, portions of these habitats have been previously disturbed and are not known to provide habitat for any species of special concern. Through implementation of the proposed safeguard and erosion-control measures, any effects to botanical, wetland, or wildlife resources during project deployment, operation, and removal are expected to be minimal.

Avian Species

Large congregations of waterfowl, including several species of special concern, are known to forage and rest in sheltered marine waters of Cobscook Bay. To address the concerns related to possible effects of the proposed project on avian species, ORPC Maine developed a Bird Monitoring Plan that includes provisions for filing full summary reports of all monitoring with the regulatory agencies three times per year for the first 3 years of project operations, beginning 6 months after the deployment of Phase 1. Reports would be issued after surveys of: 1) fall migration during and after deployment of the TidGen™ devices, 2) migrant and wintering seabirds, and 3) spring and summer seabirds. ORPC Maine's plan states that these reports would be submitted for agency review after they are prepared and a summary report of all environmental data would be submitted to FERC annually. Table 16 summarizes the monitoring schedule as proposed in ORPC Maine's plan.

Table 16. Proposed schedule for the BirdMonitoring Plan (Source: application, as modified by staff).

Plan	Phase 1 (1 TidGen™)	Phase 2 (5 TidGen™)
Bird Monitoring Plan	Until deployment, monitor 1-2 times per month; during deployment, monitor 2-3 times per week; after deployment, continue monitoring 1-2 times per month for a year.	During deployment, monitor 2-3 times per week; after deployment, monitor 1-2 times per month for a year.

While the FWS agrees that the proposed Bird Monitoring Plan is sufficient to collect necessary data; it is concerned that the data analyses are not fully discussed. FWS requests that the data be summarized by season and location with descriptions of typical behaviors and special attention to deep diving species, as it has in previous studies and at the same level of detail. FWS also requests that, in addition to deep diving species, winter usage of the study area by eider ducks (*Somateria sp*.) should be discussed.

ORPC Maine responds that the reports produced for the Bird Monitoring Plan would be similar to those produced previously, and although a special section of the plan was devoted to diving birds, common eiders also were discussed, as they are common species in the area. ORPC Maine states that the proposed monitoring would continue to report on common eiders and diving birds, as well as other species that are observed during survey periods.

NMFS recommends (10(j) recommendation 1), in a letter filed on November 4, 2011, that all of ORPC Maine's proposed environmental monitoring plans be incorporated into any license issued by the Commission. NMFS further recommends ORPC Maine meet the environmental monitoring goals and objectives of Phase 1 installation before proceeding to Phase 2 (10(j) recommendation 3), provide an annual report that details the progress, data, and status of all monitoring for that year (10(j) recommendation 4), and continue to consult with NMFS, as well as other state and federal resource agencies, to help guide the adaptive management measures and inform future conservation recommendations (10(j) recommendation 5). Maine DMR, in a letter filed November 4, 2011, made similar recommendations, but did not label them as 10(j) recommendations.

Our Analysis

Environmental monitoring and fish studies observed no diving birds interacting with the power system. Additionally, current surveys indicate that diving bird foraging activity in the deployment area is very low and the power system is located well below the water surface (minimum 45 feet), which limits most species interactions. As such, no adverse effects to diving birds are anticipated during the project deployment and operation.

Although significant numbers of wading birds and waterfowl use near-shore marine areas in the proposed project vicinity over the winter and during migration, portions of the terrestrial components of the project area have been previously disturbed and do not offer these birds' preferred habitat. Further, the upland communities in the project area do not offer notable habitat for species of special concern. Species using habitats of the project area are primarily generalists that are relatively common throughout their range and that use a wide variety of habitats for breeding, nesting, and foraging activities and the species utilizing the habitats of the proposed project area are accustomed to human disturbance. Using typical avoidance behavior, species found within the project area are expected to disperse from the area during the temporary construction activities and return to the area following construction activities without any significant disruption to foraging, resting, or nesting activities. Ample comparable habitat is located near the project area for the species to use during construction phases. Also, the small footprint of the land-based components of the proposed project limits the opportunities for avian species to collide with land-based project components (i.e., the on-shore station).

While ORPC Maine's studies did not indicate that many avian species relied on the proposed project area for feeding and resting, it is important to note that avian migration patterns are extremely variable. While the proposed project is not expected to cause significant behavioral changes in avian species, this finding cannot be verified until the project is deployed and further studies are completed. As such, continued monitoring, as proposed by ORPC Maine and recommended by Maine DMR and NMFS, would increase the viability of the data to ensure that avian species, especially diving birds, are not affected by the project. The proposed Bird Monitoring Plan, in conjunction with the proposed Emergency Shutdown and companion Project Removal and Site Restoration Plan, would provide an effective means of evaluating and addressing any project effects that arise during or after project deployment. This continued monitoring would allow for a more adaptive approach to develop mitigation measures if any effects from the proposed project are identified as ORPC Maine installs more units. In addition, ORPC Maine states that the reports produced for the Bird Monitoring Plan would be similarly detailed and organized in a similar fashion to reports already produced for sea and shorebird monitoring, which should address FWS concerns and produce thorough and easily understand documents.

3.3.5 Recreation

3.3.5.1 Affected Environment

The Cobscook Bay region of Eastern Maine features the highest tides in the eastern U.S., abundant marine life, and a cultural heritage based on natural resources (Athearn & Bartlett 2008). Today, Cobscook Bay is admired for its natural beauty and is utilized as a recreational and cultural destination by Maine's residents, visitors, and artists seeking the promise of tranquil outdoor life and creative synergy. Due to its focus on natural resources, the Cobscook Bay region provides marine recreational activities such as recreational fishing and boating as described below. Coastal recreation in the Cobscook Bay region includes activities such as cycling, hiking, canoeing, kayaking, sailing, boating, sport fishing, sport hunting, bird watching, camping, snowmobiling, cross-country skiing, snow-shoeing, wildlife viewing, and festivals. Existing recreational facilities in the vicinity of the proposed Cobscook Bay Project are depicted in figures 14 and 15.

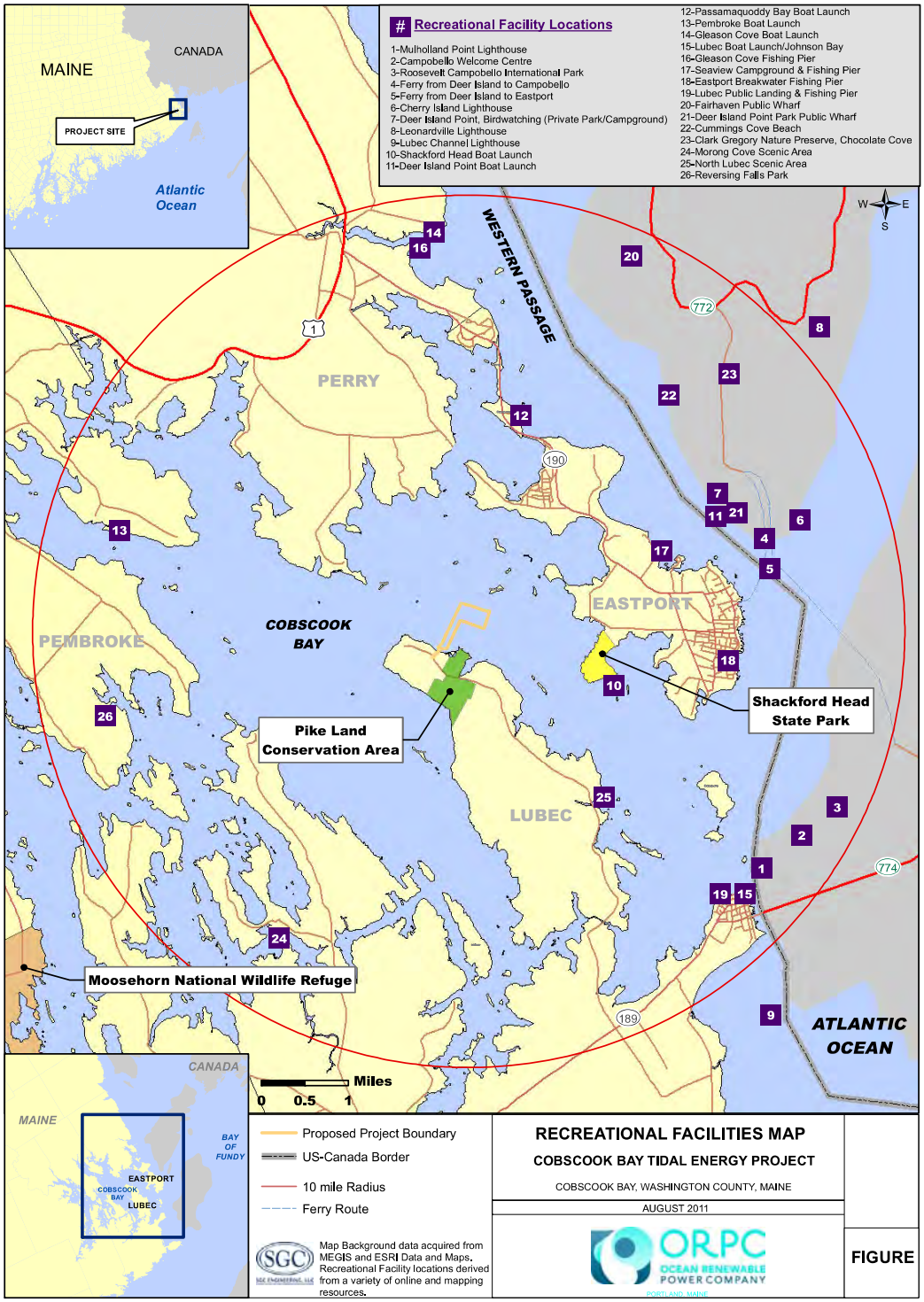

Figure 14. Recreational resources in the vicinity of proposed Cobscook Bay Project (Source: application).

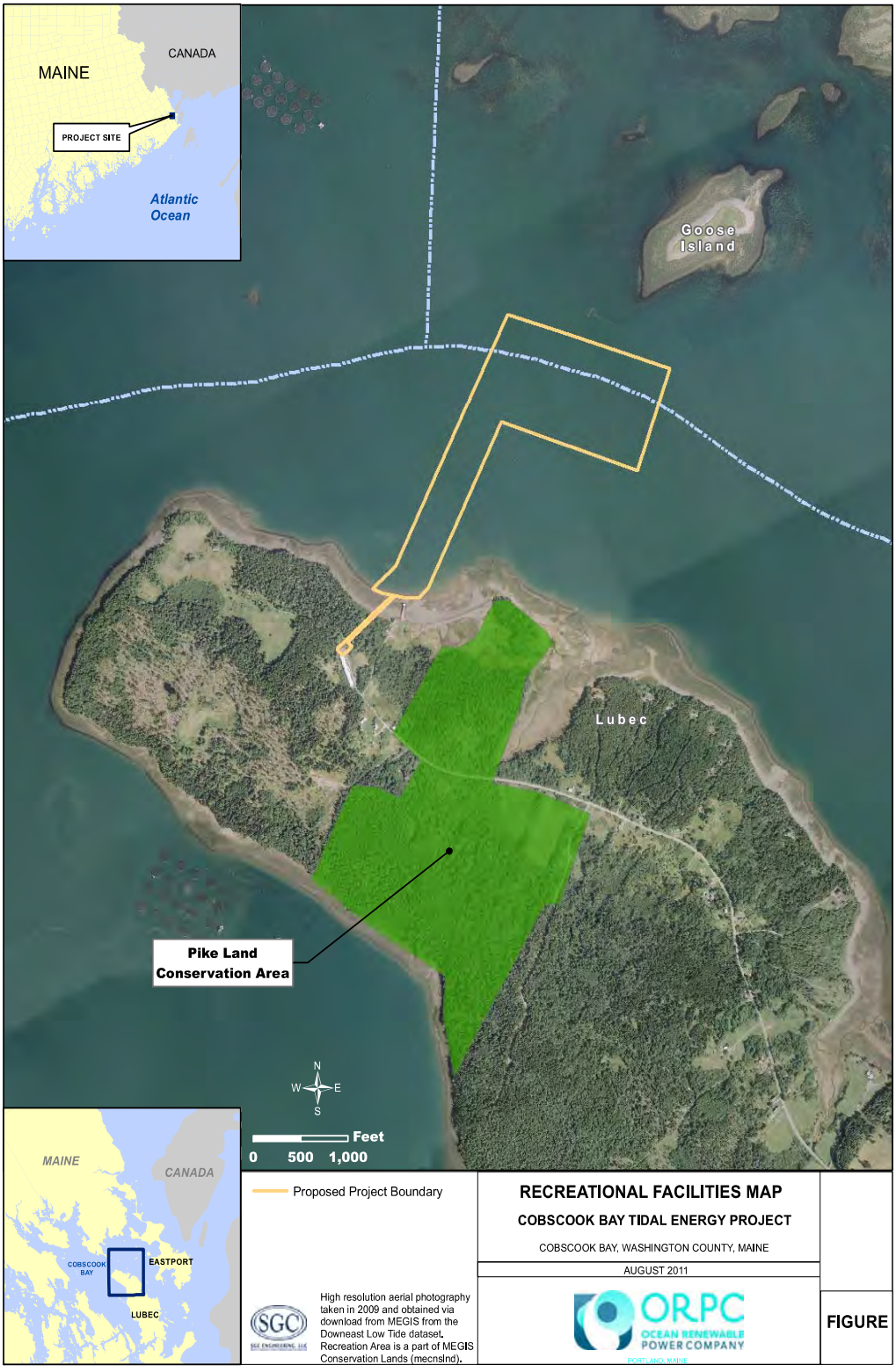

Figure 15. Detailed view of recreational resources near the proposed Cobscook Bay Project (Source: application).

Regional Recreational Opportunities

Within the Cobscook Bay Project area, a number of recreation sites exist that allow residents and visitors to take advantage of the Cobscook Bay region. Most of the public parks are located several miles outside of the proposed project area; however, the Pike Lands Conservation Area is located on Sewards Island adjacent to the proposed Cobscook Bay Project and Shackford Head State Park is located across Cobscook Bay on Eastport, about 1 mile east of the proposed project site. Table 17 provides a summary of information on the recreation opportunities provided near the proposed project.

Table 17. Recreational Resources and their Relation to the Proposed Project (Source: application, as modified by staff).

Facility and Operator	Location	Acres	Distance from Proposed Project	Recreational Amenities and Activities
Shackford Head State Park (State of Maine)	Eastport	90	1 mile east	Hiking trails, beaches, protected coves, and woodland areas
Pike Lands Conservation Area (State of Maine)	Seward Neck	136	Adjacent	Shore access, hiking trails, bird and mammal habitat, fishing, clamming, apple-picking, hunting, and nature observation
Roosevelt Campobello International Park (U.S. and Canada)	Campobello Island	2,800	4 miles southeast	Tours of Franklin D. Roosevelt's summer cottage, picnic areas, driving roads, and hiking trails
Reversing Falls Park (Town of Pembroke)	Pembroke	n/a	4 miles southwest	Picnicking, hiking, and wildlife viewing

Moosehorn National Wildlife Refuge (FWS)	Southwest of Calais	24,400	6 miles southwest	Hiking trails, wildlife observation, tours and programs, fishing, and hunting

Recreational Activities

Regional Fishing

The Cobscook Bay region offers abundant opportunities for shore side recreational fishing. Several public boat ramps and charter fishing opportunities are based in Eastport, approximately two miles from the proposed deployment site. The most popular marine recreational fishing location in the region is the Eastport Breakwater (figure 16, table 18). In a 2007 study completed by the University of Maine at Machias and the Maine Sea Grant Program, there were an estimated total of 2,690 anglers fishing at the Eastport Breakwater between May 26 and September 30, 2007. Anglers arrived in large numbers in mid-July, and August was the most popular fishing month with an average daily count of 63 anglers on weekends and 43 anglers on weekdays (Athearn & Bartlett 2008). The Eastport Breakwater is used as a docking location for commercial fishing boats, private boats, and the Coast Guard. Most fishing occurs from the outer edge of the Eastport Breakwater, facing Western Passage and Campobello Island. Recreational fishing in the Cobscook Bay region is most frequently done with rod and reel and hard lines. Species most often caught from the Eastport Breakwater consist of mackerel, harbor pollock, herring, flounder, and shark (Athearn & Bartlett 2008). Table 18 lists other popular fishing sites within the surrounding area with a brief description for each.

Regional Boating

Recreational boating is popular in the Cobscook Bay region. Sea kayaking has continued to rise in popularity, and Cobscook Bay offers a variety of world-class paddling areas including Pennamaquan Estuary and Bay; Young's and Ox Cove; Gleason's Cove, Little River, and Pleasant Point's Dennys Bay; Whiting Bay and Hobart Stream estuary; Sipp's Bay and Perry shores; and several locations within the Roosevelt Campobello International Park. Canoeing also is popular on the Dennys River, Cathance Stream, and the Saint Croix River. Table 18 identifies boat launch facilities within the Cobscook Bay region.

Table 18. Popular Recreational Fishing Sites and Boat Launches in Cobscook Bay (Source: application).

Fishing Site/Boat Launch	**Description**
Eastport Breakwater	Located in Eastport with a boat ramp. Most popular recreational fishing spot in the region.
Seaview Campground	Located in Eastport with a floating dock and boat ramp. Utilized by campers and recreational fishermen. Flounder, mackerel, cod, and halibut are popular catches.
Gleason's Cove	Located in Perry with a boat ramp that is popular among anglers fishing for flounder, mackerel, shark, and striped bass.
Lubec Public Landing	Located in Lubec with a boat ramp, floating dock, and pier. Flounder and mackerel are the most popular catches.
Robbinston Public Landing	A boat ramp and floating dock are located at this facility.
Calais Public Landing	Located in Calais with a boat ramp, small pier, and a floating dock.
Passamaquoddy Reservation	A saltwater boat ramp and picnic area are located on the Reservation.
Pleasant Point	A public boat ramp is located at this facility.
Cobscook Bay State Park	A public boat ramp is located within this State Park along with other pertinent recreational facilities.

Project Area Recreation

Recreational activities in the Cobscook Bay near the proposed project are minimal. While fishing, whale watching, sailing, diving, water-skiing, and kayaking may occur, recreationists rarely utilize the proposed project area for these activities because of the abundance of more ideal locations in the region. Within the proposed deployment area, boat traffic also is light. Anchoring in this area is not likely to occur due to the depth and the availability of better anchoring locations nearby. Favorable areas for anchoring can be found in the coves of Cobscook Bay; however, in the bay's channel, the strong tidal currents and rocky bottom are not favorable to anchoring. For recreational boaters who find themselves in Cobscook Bay, they are directed to anchor at the protected anchorages

in Deep Cove (approximately 1 mile south of the proposed project area) and Broad Cove (more than 2 miles south of the proposed project area).

Swimming and fishing also are not likely to occur in the area due to the cold water temperatures and the availability of more accessible locations nearby.

Commercial Fishing

Cobscook Bay is home to considerable commercial fishing, marine resource harvesting and aquaculture sites. Scallop dragging and urchin dragging are the primary marine resource harvesting activities done in the vicinity of the proposed project area. Urchin dragging is done in the vicinity of Goose Island and Spectacle Island, just north of the project area, and the dragging follows the shore southeast toward Shackford Head. Scallop dragging is frequent within Cobscook Bay near Birch Point and off of Shackford Head. Rockweed harvesting and lobstering are done within the vicinity of the project. Figure 16 depicts the project area and prominent commercial fishing and marine harvest areas. Commercial fishing licenses were the greatest number of marine licenses issued in Cobscook Bay in 2009 followed by lobster/crab, scallops, commercial shellfish, and urchins respectively (CBRC 2011). Licenses for seaweed harvesting, eel, dive tenders, mussels, green crab, sea cucumber drag, and commercial shrimp were also issued in Cobscook Bay in 2009, but at a significantly lower number.

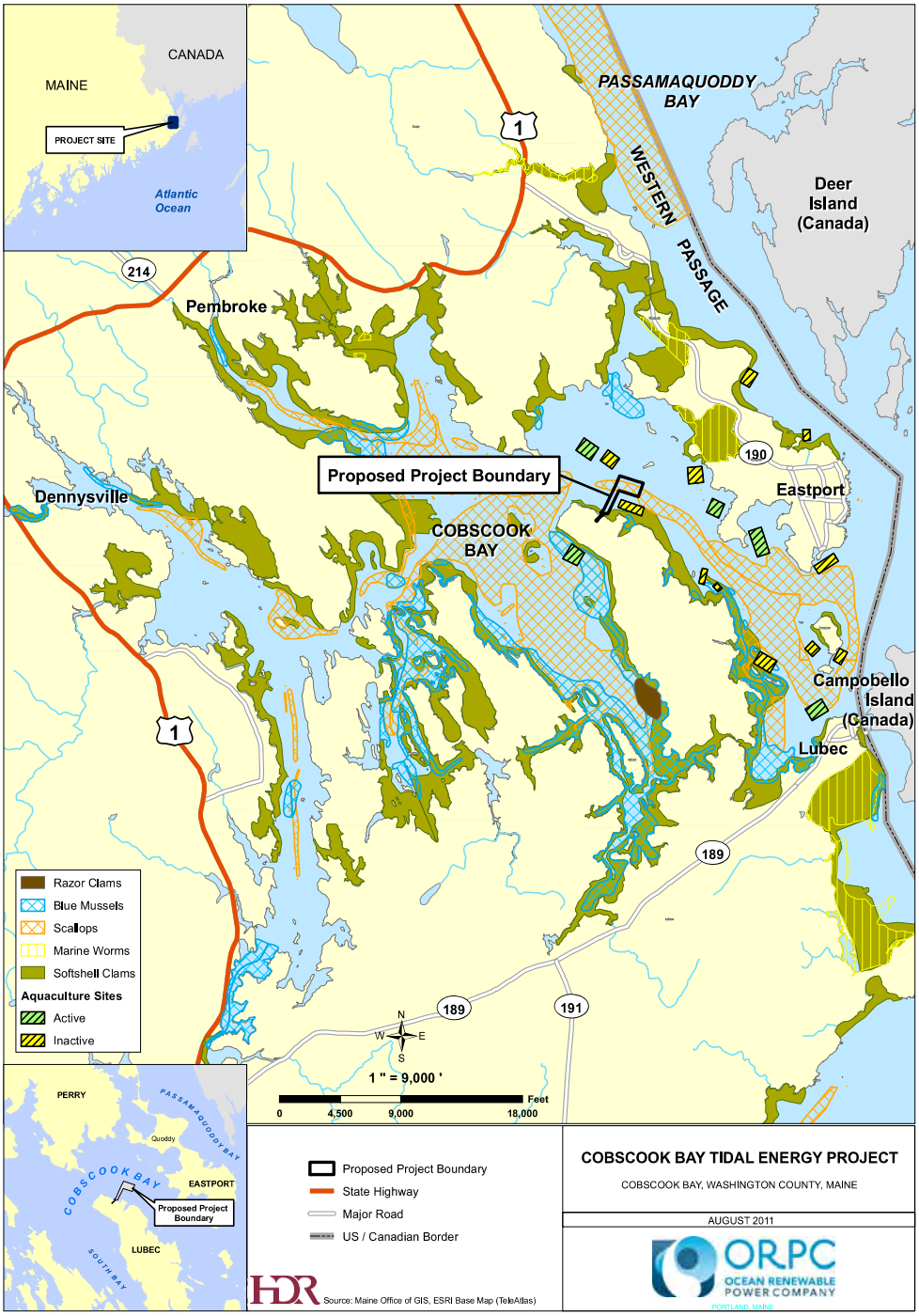

Figure 16. Commercial harvest and marine fishing areas in the vicinity of the proposed Cobscook Bay Project (Source: application).

Aquaculture

In the U.S., aquaculture is a small, yet growing industry designed to reduce the U.S. trade deficit and replenish depleted wild fish stocks (Maine Aquaculture Innovation Center (Maine AIC) n.d.). Aquaculture in Maine comprises a significant service sector and in 2008 the estimated value of harvest was $35 million (Maine AIC n.d.). The aquaculture industry in Maine is composed of finfish, shellfish, and sea vegetable farms. The finfish farms produce Atlantic salmon and steelhead trout. The shellfish farms produce eastern oysters, clams (hard and soft-shell), bay scallops, surf clams, and mussels. Maine also has one aquaculture company that grows seaweed. As of March 2009, 137 farm lease sites were present along all coastal Maine counties (Maine AIC n.d.). While there are current finfish aquaculture leases in the Cobscook Bay and Eastern Bay area, none of these leases are active.

Within the vicinity of the proposed project's deployment site there currently are only standard finfish aquaculture leases. One shellfish aquaculture lease is located in Cobscook Bay, but it is located between Hog and Long Islands in the South Bay. All of these sites have the potential to be utilized; however, they may also be vacant at various points throughout the year depending on conditions. There are no experimental leases or limited purpose license sites within the vicinity of the project's deployment area (Maine DMR 2008*d*). There also are no pending aquaculture leases in the area.

3.3.5.2 Environmental Effects

Recreation Activities

Near the proposed project, Cobscook Bay is not considered an extremely popular marine recreational resource due to its strong currents, navigational dangers, and the availability of far superior recreation opportunities in other parts of the bay. As ORPC Maine does not anticipate that the deployment, maintenance, and retrieval efforts would impede the current, low-level recreational activity in the vicinity of the proposed project, it does not propose to conduct any additional recreational monitoring or studies. ORPC Maine, however, has set up an information center within its office that includes educational displays and informational brochures in order to accommodate the growing interest in hydrokinetic projects.

Our Analysis

ORPC Maine proposes that all marine-based project components be located underwater, including the TidGen™ devices and the underwater P&D cables. Temporary effects to coastal recreation, such as visual impact, may occur when equipment, such as tugs, barges, cranes, and support vessels, install or perform maintenance of the submerged components of the project. In addition, during construction, coastal recreation may be affected by large infrastructure such as construction vehicles, transport vessels,

and cranes that would be necessary to perform work activities. These impacts, however, would be temporary and minimized by a timely project construction schedule, which states that installation of the TidGen™ devices would be completed in 62 days for Phase 1 and a similar schedule for Phase 2.

To prevent anchoring or deployment of fishing gear, dredging equipment, surface or submarine scientific equipment, or any other surface or submarine equipment in the proposed project's deployment area, ORPC Maine has proposed a 61-acre underwater activity exclusion zone. The exclusion zone would be marked in accordance with the Coast Guard's Aid to Navigation standards and requirements (using marking lights or other indicators), as described in the Navigation Safety Plan. The Coast Guard also has initiated a process for creating tidal energy generator icons for use on future navigational charts of the area and the Coast Guard would mark any permanent installations and associated exclusion zones, including those for the proposed Cobscook Bay Project, on future charts.

Tourism is Maine's second largest private sector employer and this area of Maine is very scenic and does attract a fair amount of tourism. The information center and educational brochures that have been developed by ORPC Maine would provide an added benefit to visitors to the area by educating them about this new energy resource. This information center, however, is located in Eastport and not at the actual project site. While the proposed location of the Cobscook Bay Project receives only minimal recreational usage, the existence of this hydrokinetic project could further increase the interest in the area. As such, providing an informational kiosk near the proposed on-shore station house that details the hydrokinetic technology used for the project, as well as the project's relation to the natural environment and the species that inhabit the project area would enhance the visitor experience and provide a new educational opportunity.

Commercial Fishing

Cobscook Bay is home to considerable commercial fishing, marine resource harvesting, and aquaculture activities. The TidGen™ devices would be placed approximately 49 feet below the surface at MLLW. During deployment and retrieval of the project, ORPC Maine expects there would be equipment and vessels present in the deployment area. Commercial fishing vessels would not likely be permitted to pass through or fish in the deployment area during these events. ORPC Maine does not anticipate that the deployment, maintenance, or retrieval efforts would impede commercial fishing activity, but it proposes to continue to consult with the Cobscook Bay Fishermen's Association to minimize any potential impact to the affected fisheries from the proposed project. ORPC Maine also proposes to submit, when possible, a schedule of activities to be published in a Local Notice to Mariners when possible.

Our Analysis

Since the TidGen™ devices would be deployed 49 feet below MLLW, operation of the proposed project would not likely interfere with commercial fishing vessels navigating through the deployment area. Commercial fishing, anchoring, or deployment of fishing gear, dredging equipment, surface or submarine scientific equipment, or any other surface or submarine equipment would be excluded from the 61 acres contained within the underwater activity exclusion zone. Although these activities would be excluded from this area throughout the term of any license issued for this project, the exclusion area would be only 61 acres and there are no active or pending leases located within the proposed project area. As such, any effects to commercial fishing activities are expected to be minimal.

3.3.6 Navigation

3.3.6.1 Affected Environment

Cobscook Bay is a sub-basin that marks the entrance to the Bay of Fundy and experiences approximately a 25-foot tidal range. Cobscook Bay is a relatively shallow, drowned river valley with an average depth of 98.4 feet MLW, with its deepest point being 147.6 feet MLW. The closest ports to the proposed Cobscook Bay Project are located at the city of Eastport, Maine, approximately 2 miles from the proposed deployment site. Smaller vessels also travel from Lubec, Maine, approximately 3 miles from the proposed deployment site.

The city of Eastport is home to Eastport Port Authority, which was created in 1977 and is a deep-water port capable of handling large cargo ships. Eastport is the easternmost port in the U.S., is utilized by multiple shipping companies and the greater Eastport community, and consists of two terminals – Breakwater Terminal and Estes Head Cargo Terminal. The Breakwater Terminal is used by the aquaculture industry, cruise lines, commercial fishermen, and recreational boaters and fishermen. Estes Head Cargo Terminal was recently upgraded to accommodate the cruise ship and large yacht markets. A cargo handler, Federal Marine Terminal, also is located in Eastport and commodities handled at the terminal consist of forest products, breakbulk, and project cargo. There are two pilot associations within the area: Quoddy Pilots, USA and Eastport Pilots, USA. Quoddy Pilots, USA is based in Eastport, Maine, and Eastport Pilots USA is based in Perry, Maine.

Navigational dangers exist within the vicinity of the proposed Cobscook Bay Project because of the large tidal fluctuation. Whirlpools and eddies located between Dog Island and Deer Island are dangerous at times for small boats. Old Sow, the largest whirlpool in the Western Hemisphere, is located in this area and transit of large ships through the area is only planned for periods of relatively slack current.

Ferry routes exist throughout Western Passage, on the other side of Eastport from the proposed project's deployment area. The routes consist of Deer Island, New Brunswick (Deer Island Point) to Campobello Island, New Brunswick and Deer Island Point to Eastport, Maine. The ferries, operated by East Coast Ferries Ltd, traditionally run June to mid-September, but are subject to change depending on traffic volume. According to NOAA navigation charts, no ferry routes are depicted within Cobscook Bay.

3.3.6.2 Environmental Effects

Due to the navigational dangers and large tidal fluctuations, navigation in Cobscook Bay is limited; however, development of the Cobscook Bay Project could potentially restrict the navigation that does occur within Cobscook Bay. As the proposed project would involve vessels and infrastructure for the deployment and retrieval of the TidGen™ devices, the presence of this infrastructure would present a temporary hazard to navigation. In addition, as part of its Navigation Safety Plan, ORPC Maine is proposing an underwater exclusion area to be utilized during all project construction activities, including periods of device deployment and retrieval. The underwater exclusion area would encompass approximately 61 acres, which includes 17.5 acres for the submerged cables and 43.5 acres for the TidGen™ devices.

ORPC Maine consulted with the Coast Guard, local harbormaster, Bureau of Maine Patrol officer, Town Administrator, members of the Board of Selectman, and local pilots associations to determine navigation traffic concerns. Based on those consultations, ORPC Maine developed a Navigation Safety Plan that contains provisions ensuring navigation and public safety. As part of the plan, ORPC Maine designed the underwater exclusion zone to minimize potential conflicts with other existing uses. ORPC Maine also proposes to deploy all project structures below navigation traffic depth to ensure project structures do not interfere with commercial or recreational vessels' navigation. During project deployment, maintenance, and retrieval, ORPC Maine proposes to mark all equipment in accordance with the Coast Guard's Aid to Navigation standards and requirements (using marking lights or other indicators) and to publish deployment and retrieval schedules to minimize conflict with other vessels. The plan also includes provisions for continued consultation with the Coast Guard, local pilots associations, and other navigation interest organizations.

Our Analysis

While the proposed project has the potential to impact navigation in Cobscook Bay, most of these impacts would be minimal because the area receives little navigation traffic and the TidGen™ devices would be located below navigation traffic depth. The small footprint of the project and ORPC Maine's proposal to implement the Navigation

Safety Plan, which includes provisions for the exclusion zone, publishing deployment and retrieval schedules and installing navigational safety markings would mitigate any of the minor effects of the project on navigation in Cobscook Bay.

3.3.7 Aesthetic Resources

3.3.7.1 Affected Environment

Maine's coast is one of the state's most distinctive features and is defined by its ragged cliffs, rocky headlands, and numerous peninsulas, harbors, and islands. Adding to Maine's coastal complexity and attraction are sandy beaches, broad salt marshes, pine forests, and inlet fishing villages. Such picturesque scenery is synonymous with the aesthetic experience and holds a strong appeal not only for its residents but also tourists, seasonal residents, and artists.

The proposed Cobscook Bay Project is located at the easternmost area of Maine's coast and is in the Bay of Fundy. The Bay of Fundy has long been recognized for its aesthetic merits, and its scenic vistas have been depicted by numerous, major American artists. Today, Cobscook Bay is admired for its natural beauty and is utilized as a recreational and cultural destination by Maine's residents, visitors, and artists seeking the promise of tranquil outdoor life and creative synergy.

The dominant aesthetic resources surrounding the proposed Cobscook Bay Project is Maine's scenic coastline, the town of Lubec to the southeast, and Shackford Head State Park and the town of Eastport to the east. They also include the waters and tidal flats of Cobscook Bay, which are dominated by extensive mudflats, rocky intertidal zones, estuarine wetlands, and in some areas, submergent aquatic vegetation. Shackford Head State Park is located on Moose Island in Eastport adjacent to the campus of the Boat School, an affiliate of Husson University, and offers spectacular panoramic views of Cobscook Bay and the Canadian islands of Campobello and Grand Manan. Cobscook Bay has generally avoided the heavy development experienced by most estuaries on the eastern seaboard due to its navigational hazards, and remains a relatively intact marine system.

Cobscook Bay has become a choice destination for people who love the outdoors and are seeking opportunities for outdoor recreation and affordable services and amenities. Tourists, recreational and seasonal visitors, and an increasing number of retirees are drawn to the area by the scenic natural beauty and opportunities for beach walking, boat cruises, whale watching, bird watching, recreational hunting and fishing, and trail usage.

3.3.7.2 Environmental Effects

No specific concerns relating to aesthetics were expressed by agencies or interested parties during project consultation; however, seascapes and the landscape along the Maine and Canadian coasts are valued by residents, tourists, and the cultural community. Tourists are likely to have a high level of concern for aesthetic issues because of expectations of a high-quality travel experience. In addition, Maine and Canadian coastal residents generally have a high concern for visual quality, as evidenced by a long history of opposition to certain utilities and some types of power generation projects.

Land-based project components would consist of the buried P&D cable and an on-shore station. The on-shore station is a modest building with dimensions of 16 feet by 20 feet, which would be located on the end of a rural road in North Lubec, Maine and not easily visible. To minimize the visual impact, ORPC Maine proposes to include "naturalized" design measures in building specification (e.g., earth-tone colors, non-reflective paints, and minimization of structure heights that extend above the canopy). ORPC Maine also proposes to leave existing, natural vegetation intact as much as possible during site preparation activities to further conceal project structures. In addition to the structures, ORPC Maine would provide signage and markers at the on-shore station, on shore, and on navigational charts to ensure public safety. Also, warning signs stating "Caution: High Voltage" would be displayed on all sides of the fencing surrounding the on-shore station. On shore, signs would be posted indicating the shore-side exit of the power transmission cable from the water and the presence of tidal turbines in the water.

The marine-based project components, including the TidGen™ devices, the shore cable termination anchor, environmental monitoring equipment, and the underwater P&D cables, would be underwater. Temporary effects to aesthetics would occur during deployment and retrieval activities when equipment, such as tugs, barges, cranes, and support vessels, would install the submerged components of the project in the deployment area.

Our Analysis

The proposed project would be located in a very scenic area characterized by its rugged coastline and valued for its naturalness. Although the applicant is proposing to install five TidGen™ devices, a shore cable termination anchor, environmental monitoring equipment, and underwater P&D cables, these structures would not detract greatly from the existing setting because they would be submerged. Additionally, although the on-shore station would be visible, it would be located on private land in a remote section of Cobscook Bay. Designing the structure to blend with the natural environment and leaving existing, natural vegetation intact as much as possible during site preparation activities, as proposed by ORPC Maine, would further conceal project

structures and limit any aesthetic impacts. While the signage may impact aesthetic resources, it is necessary to ensure public safety at the project and can be used as an educational component to further increase its benefit to the public. Finally, while construction vehicles, transport vessels, and cranes necessary to perform work activities may affect aesthetic resources during deployment and retrieval activities, these effects would be short-term and minimized by a timely project construction schedule, which states that installation of the TidGen™ devices would be completed in 62 days for Phase 1 and a similar schedule for Phase 2.

3.3.8 Cultural Resources

3.3.8.1 Affected Environment

Section 106 of the NHPA, as amended, requires the Commission to take into account the effects of the licensing of a hydropower project on any historic properties and allow the Advisory Council on Historic Preservation a reasonable opportunity to comment if any adverse effects to historic properties are identified within the project's Area of Potential Effect (APE). For the proposed Cobscook Bay Project, the APE is determined to be the proposed project boundary. The Maine SHPO concurred with the APE on April 15, 2011.[24]

Cobscook Bay, which is a geographical portion of the traditional homeland to the Passamaquoddy Tribe, has a pre-contact period archaeological record that extends at least 3,000 years into prehistory. Evidence for this occupation is derived from artifacts found in shell midden sites that dot the mainland coast. Surveys of these sites were conducted by Dr. David Sanger (University of Maine) in the 1980s and he documented that many of these sites had been eroded or looted (Sanger 1983). None of the known pre-contact period sites are located on shore in the vicinity of the project, although there are several sites known in the northern reaches of Cobscook Bay near Pleasant Point.

Historic period sites include both terrestrial and near shore locations. The historic terrestrial sites relate to the military history of the area and include sites such as Prince Regent Redoubt, Fort Sullivan [listed in the National Register of Historic Places (National Register)], and "Mud Battery" in Eastport, well outside the proposed project's APE. Submerged sites in the proposed project vicinity include American wrecks, such as, the *A.P. Parkhurst* and the *Henrietta Whitney* schooners, and the American brig, the

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[24] *See* ORPC Maine's Draft License Application, Attachment 10, the April 13, 2010 letter entitled: *Cobscook Bay Tidal Energy Project (FERC No. 12711) – Project Update and Assessment of Potential Effects to Historic Properties Pursuant to Section 106 of the National Historic Preservation Act*, stamped by the Maine SHPO on April 27, 2011.

Alexandria. A review of Maine SHPO files, however, indicates that no terrestrial or submerged historic period archaeological sites are located in the proposed project area.

Review of pre-contact period and historic period archaeological site locations on file with the Maine SHPO indicate that no known historic properties are located within the project area. In November 2010 and August 2011, ORPC Maine contracted Dr. Rick Will to conduct a Cultural Resource Assessment for the proposed Cobscook Bay Project (Will 2011). Dr. Will confirmed during the site reconnaissance that no known historic properties are located within the proposed project's APE.

In his report, Dr. Will also assessed the probability of shipwrecks or archeological sites within the off-shore deployment area of the proposed project. Dr. Will concluded that the tidal flow analysis conducted in support of the license application demonstrates that the any shipwrecks that may have sunk in the project area likely were carried away by the significant hydrokinetic energy in Cobscook Bay, which explains why there are no known shipwrecks listed in the Maine SHPO archaeological site record files. Dr. Will also concluded that the submerged portion of the project area possesses low archeological sensitivity for pre-contact period archeological resources based on current bathymetry and geological evidence (Will 2011a). Dr. Will concluded that there were no known cultural resources within the proposed Cobscook Bay Project APE.

Tribal Resources

On January 19, 2011, the Commission sent letters to five Native American tribes that may have an interest in lands within the proposed project's vicinity, asking the tribes if they were interested in participating in the licensing process for the proposed Cobscook Bay Project. Letters were sent to the Passamaquoddy Tribe of Maine, Passamaquoddy Tribe of Maine – Pleasant Point Reservation, Penobscot Tribe of Maine, Aroostook Band of Micmac Indians, and Houlton Band of Maliseet Indians (Tribes). No Tribes responded.

3.3.8.2 Environmental Effects

Based on detailed investigations of the proposed project site and land-based components within the project boundary, ORPC Maine concluded that there were no known cultural resources within the proposed Cobscook Project APE and determined that the proposed project would not impact historic resources and does not propose further studies or mitigation. The Maine SHPO concurred with Dr. Will's initial findings of no

effect on April 27, 2011 and with his subsequent findings on August 5, 2011.[25] ORPC Maine does not propose any further cultural resource studies or monitoring.

Our Analysis

Installation of the TidGen™ and construction of the land-based features could disturb cultural artifacts; however, field studies determined that there are no cultural artifacts in the proposed Cobscook Project APE. Furthermore, there are no sites listed on the National Register in the project vicinity. As the field investigations did not locate any cultural resources, it is unlikely that any historic properties would be affected by this proposed project. Additionally, as no National Register-listed properties are located within the project boundary, monitoring during construction activities does not appear to be necessary.

As with any project, however, there is a chance that construction activities could lead to unanticipated discoveries of historic resources. To ensure protection of these resources in the event they are uncovered, it would be beneficial for any license order issued by the Commission to include a license article describing the procedures to be followed regarding cultural resources. Among other things, the article could 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 Maine SHPO 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 Maine SHPO. If historic properties are identified, a Historic Properties Management Plan could be crafted by the licensee in consultation with the Maine SHPO, depending on the nature of the historic properties identified.

3.4 NO-ACTION ALTERNATIVE

Under the no-action alternative, the Cobscook Bay Project would not be installed and DOE would not provide financial assistance to fund the project. 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 this pilot project would not be available to the grid.

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[25] *See* ORPC Maine's Final License Application, Appendix A, the August 2, 2010 letter entitled: *Cobscook Bay Tidal Energy Project (FERC No. 12711) - Assessment of Potential Effects to Historic Properties Pursuant to Section 106 of the National Historic Preservation Act - MHPC# 2140-06*, stamped by the Maine SHPO on August 5, 2011.

4.0 DEVELOPMENTAL ANALYSIS

In this section, we look at the Cobscook Bay Project's use of the natural tidal currents of Cobscook Bay 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*.,[26] the Commission compares the current project cost to an estimate of the cost of obtaining the same amount of energy and capacity using a 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 19 summarizes the assumptions and economic information we use in our analysis. This information was provided by ORPC Maine in its license application. We find that the values provided by ORPC Maine 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; normal operation and maintenance cost; and Commission fees.

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[26] 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 19. Parameters for the economic analysis of the Cobscook Bay Tidal Energy Project (Source: ORPC Maine and staff).

Parameter	Value
Period of analysis (years)[a]	30
Federal income tax rate (%)[b]	35
Estimated first year of operation[c]	2013
Initial construction cost ($)[d]	11,500,000
Future operation and maintenance ($/year)[e]	146,600
Alternative energy value ($/MWh)[f]	72.35
Cost of developing FERC license application ($)	2,500,000
Interest rate (%)[b]	8.0
Discount rate (%)[b,g]	8.0

[a] Regardless of the potential license term (30, 40 or 50 years), in the FERC Mead analysis we perform a 30-year economic analysis.

[b] Assumed by staff.

[c] In the FERC Mead analysis the first year of the analyses is the year the project is expected to become operational.

[d] Initial construction cost was provided by ORPC Maine in the license application.

[e] ORPC Maine provided operation and maintenance costs for the entire field of turbines. The total cost of project operation and maintenance over the 8-year period of operations is $2,400,000. The cost shown in the table is levelized over the 30-year period used for the FERC Mead analysis.

[f] In the FERC Mead analysis the value of energy is based on the current energy values. Alternative energy value is based on an average of the daily energy value for the past year for the ISO New England. See: http://iso-ne.com/markets/hst_rpts/hstRpts.do

[g] Assumed by staff to be the same as the interest rate.

4.2 COMPARISON OF ALTERNATIVES

Table 20 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, ORPC Maine's proposal, and the staff alternative.

The Cobscook Bay Project is a proposed pilot project. Pilot projects are small, short-term, removable, and carefully-monitored projects intended to test technologies, sites, or both. From our comparison, both ORPC Maine's proposal and the staff alternative would have an initial annual cost that far exceeds the current power value.

The costs associated with the project are not indicative of future and larger-scale projects. In order to help manage the capital costs, ORPC Maine is working with public and private partners to reduce project costs.

Table 20. Summary of the annual cost of alternative power and annual project cost for the alternatives for the Cobscook Bay Project (Source: staff).

	No Action	ORPC Maine's Proposal	Staff Alternative
Installed capacity (kW)	0.00	300	300
Annual generation (MWh)	0	1,250,000	1,250,000
Annual cost of alternative power	$0	$90,400	$90,400
(mills/kWh)	NA	72.35	72.35
Annual project cost	NA	$1,418,200	$1,419,600
(mills/kWh)	NA	1,134.60	1,135.66
Difference between the cost of alternative power and project cost	NA	($1,327,800)[a]	($1,329,200)[a]
($/kWh)	NA	(1,062.25)[a]	(1,063.31)[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, and DOE would not provide financial assistance to fund the project.

4.2.2 ORPC Maine's Proposal

Under ORPC Maine's proposed alternative, the project would generate an average of 1,250,000 kWh annually. The annual cost of alternative power under ORPC Maine's proposal would be $90,400, or 72.35 mills/kWh. The average annual project cost would be $1,418,200, or 1,134.60 mills/kWh. Overall, the project would produce power at a cost that is $1,327,800, or 1,062.25 mills/kWh, more than the cost of alternative power.

4.2.3 Staff Alternative

The staff alternative includes the same project as proposed by ORPC Maine and, therefore, would have the same capacity and energy attributes. Table 21 shows the staff recommended modifications and additions to ORPC Maine's proposed environmental protection and enhancement measures and the estimated cost of each.

As recommended by staff, the project would generate an average of 1,250,000 kWh annually. The annual cost of alternative power under the staff alternative would be $90,400, or 72.35 mills/kWh. The average annual project cost would be $1,419,600, or 1,135.66 mills/kWh. Overall, the project would produce power at a cost that is $1,329,200, or 1,063.31 mills/kWh, more than the cost of alternative power.

4.3 COST OF ENVIRONMENTAL MEASURES

Table 21 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 21. Cost of environmental mitigation and enhancement measures considered in assessing the environmental effects of constructing and operating the Cobscook Bay Project (Source: staff).

Enhancement/Mitigation Measures	Entities	Capital Cost	Annual Cost	Levelized Annual Cost
Operation and Maintenance				
1. Project Operations and Monitoring Plan	ORPC Maine, Staff	0[a]	0	0
2. Project Inspection and Maintenance Plan	ORPC Maine, Staff	0[a]	0	0
Safeguard Plans				
3. Project and Public Safety Plan	ORPC Maine, MFS, Interior, Maine DMR, Staff	0[a]	0	0
4. Project Removal and Site Restoration Plan	ORPC Maine, NMFS, Interior, Maine DMR, Staff	250,000[b]	0	20,700

Enhancement/Mitigation Measures	Entities	Capital Cost	Annual Cost	Levelized Annual Cost
5. Provisions within the Project Removal and Site Restoration Plan for filing with the Commission: 1) a specific timeline for the removal and site restoration activities 6 months prior to license expiration; 2) documentation of consultation with NMFS, FWS, Coast Guard, Maine DMR, and Maine DEP regarding planned removal and site restoration activities 6 months prior to license expiration; and 3) documentation of completion of project removal and site restoration activities prior to license expiration.	Staff	0	0	0
6. Navigation Safety Plan	ORPC Maine, NMFS, Interior, Maine DMR, Staff	0[a]	0	0
7. Emergency Shutdown Plan	ORPC Maine, NMFS, Interior, Maine DMR, Staff	0[a]	0	0

Enhancement/Mitigation Measures	Entities	Capital Cost	Annual Cost	Levelized Annual Cost
Aquatic Resources				
8. Conduct P&D cable burial by means of shear plow below MLLW	ORPC Maine, Staff	0	0	
9. Conduct P&D cable burial by means of jet plow below MLLW	NMFS	0	0	
10. Conduct pile driving and P&D cable burial between November 8th and April 9th.	NMFS, Staff	0[c]	0	
11. Bury P&D cable by means of trenching within intertidal zone, with intertidal gravel and cobble habitat restored to pre-construction condition before commencement of project operation.	ORPC Maine, NMFS, Staff	0[c]	0	
12. Acoustic Monitoring Plan – conduct monitoring during first 3 years of project operation.	ORPC Maine, Interior, Staff	40,000	6,900[d]	7,800
13. Benthic and Biofouling Monitoring Plan – pre-deployment monitoring of a representative transect of the TGU deployment area; conduct post-deployment monitoring of underwater cable during first 2 years of project operation, and every 2 to 3 years for remaining term of license.	ORPC Maine, Interior, Maine DMR, Staff	50,000	11,100[e]	11,300

Enhancement/Mitigation Measures	Entities	Capital Cost	Annual Cost	Levelized Annual Cost
14. Benthic and Biofouling Monitoring Plan – additional pre-deployment monitoring to cover entire TGU area; post-deployment monitoring should include collection and analyses of sediment samples and should include monitoring of immediate TGU footprint.	Maine DMR	0	2,400[f]	1,500
15. Hydraulic Monitoring Plan – conduct monitoring during first 3 years of project operation.	ORPC Maine, Interior, Maine DMR, Staff	85,000	11,500[g]	14,500
16. Fisheries and Marine Life Interaction Monitoring Plan – marine life interaction monitoring conducted continuously for term of license; fisheries monitoring to include eight 24-hour sampling events in year 1 (Phase 1), four sampling events in year 2 (Phase 2), three sampling events in year 3, and two sampling events per year for remaining term of license.	ORPC Maine, Interior, Maine DMR, NMFS, Staff	370,000	63,800[h]	72,100

Enhancement/Mitigation Measures	Entities	Capital Cost	Annual Cost	Levelized Annual Cost
17. Fisheries and Marine Life Interaction Monitoring Plan – fisheries monitoring should include four additional 24-hour sampling events in year 2 following the Phase 2 deployment, with additional sampling in subsequent years if adverse impacts observed.	Maine DMR	0	7,200[i]	4,700
18. Marine Mammal Monitoring Plan – conduct monitoring during first 3 years of project operation, and opportunistic monitoring for remaining term of license.	ORPC Maine, Maine DMR, Staff	10,000	5,700[j]	4,500
Rare, Threatened, and Endangered Species				
19. Follow the FWS *Bald Eagle Management Guidelines* during construction and operation of the project.	Staff	0	0	0
Terrestrial				
20. Bird Monitoring Plan	ORPC Maine, Interior, Maine DMR, Staff	10,000	1,800[k]	2,000

Enhancement/Mitigation Measures	Entities	Capital Cost	Annual Cost	Levelized Annual Cost
Recreation				
21. Install interpretive display near on-shore station house.	ORPC Maine, Staff	500	0	40
Aesthetics				
22. Improve and maintain aesthetic values of project area through the selection of non-reflective colors that blend with the natural landscape and develop design guidelines for future project improvements.	ORPC Maine, Staff	2,500	260[l]	370
Cultural				
23. Consult with the Maine SHPO and Native American Tribes regarding unanticipated discoveries of cultural materials or human remains.	Staff	0	0	0
General				
24, Develop and Implement an Adaptive Management Plan	Staff	10,000	770[m]	1,330

[a] No cost estimated—included in total operation and maintenance costs ($2.4 million).

[b] Estimated total cost for removal of the project and restoration of the site.

[c] No cost estimated—included in total installation costs ($11.5 million).

[d] ORPC Maine would conduct 3 years of acoustic monitoring occurring in years 1, 2, and 3 of the license at a cost of $30,000 per year. The cost is levelized over the 30-year period of the Mead analysis.

[e] ORPC Maine would conduct 2 years of benthic and biofouling monitoring in years 1 and 2 of the license at a cost of $70,000 per year. The cost is levelized over the 30-year period of the Mead analysis.

[f] ORPC Maine would conduct 2 years of benthic and biofouling monitoring in years 1 and 2 of the license at a cost of $15,000 per year. The cost is levelized over the 30-year period of the Mead analysis.

[g] ORPC Maine would conduct 3 years of hydraulic monitoring in years 1, 2, and 3 of the license at a cost of $50,000 per year. The cost is levelized over the 30-year period of the Mead analysis.

[h] ORPC Maine would conduct 8 years of fisheries and marine life interaction monitoring over the 8-year period at a cost of $125,000 per year. The cost is levelized over the 30-year period of the Mead analysis.

[i] ORPC Maine would conduct an additional 1 year of fisheries and marine life interaction monitoring following phase 2 deployment of the TidGen™ at a cost of $95,000. The cost is levelized over the 30-year period of the Mead analysis.

[j] ORPC Maine would conduct 3 years of marine mammal monitoring in years 1, 2, and 3 of the license at a cost of $25,000 per year. The cost is levelized over the 30-year period of the Mead analysis.

[k] ORPC Maine would conduct 3 years of sea and shorebird monitoring in years 1, 2, and 3 of the license at a cost of $35,000 per year. The cost is levelized over the 30-year period of the Mead analysis.

[l] ORPC Maine would conduct 8 years of monitoring, at a cost of $500 per year. The cost is levelized over the 30-year period of the Mead analysis.

[m] ORPC Maine would implement the adaptive management plan over the 8-year license term, at a cost of $1,500 per year. The cost is levelized over the 30-year period of the Mead analysis.

5.0 CONCLUSIONS AND RECOMMENDATIONS

5.1 COMPARISON OF ALTERNATIVES

In this section, we compare the developmental and non-developmental effects of ORPC Maine'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 1.30 GWh for the proposed action and the staff alternative and 0 GWh for the no-action alternative.

We summarize the environmental effects of the project under the applicant's proposal and the staff alternative below (table 22). Under the no-action alternative, the project would not be constructed, DOE would not provide financial assistance to fund the project, and environmental conditions would not be altered by the project.

Table 22. Comparison of ORPC Maine's proposal and staff alternative for the Cobscook Bay Project (Source: staff).

ORPC Maine's Proposal	Staff Alternative
Generation	
• 1.3 GWh	• 1.3 GWh
General	
• Proposed Operations and Monitoring Plan and Inspection and Maintenance Plan would help to ensure the effective operation of the project. • Proposed Project and Public Safety Plan and Emergency Shutdown Plan would help to ensure environmental and public safety. • Proposed Project Removal and Site Restoration Plan would help to ensure protection of the aesthetic and environmental resources in and around Cobscook Bay.	• Same as applicant's proposal, plus: • Provisions in the Project Removal and Site Restoration Plan for providing a specific timeline for the removal and site restoration activities, as well as documentation of consultation with the appropriate agencies, 6 months prior to license expiration, and documentation of completion of project removal and site restoration activities prior to license expiration, would ensure that the project is removed and the site is sufficiently restored to near pre-project condition by the end of the license term. • Develop and implement an Adaptive Management Plan that specifies the

ORPC Maine's Proposal	Staff Alternative
	protocol for consultation with federal and state agencies on preliminary results of monitoring studies and any necessary modifications, with documentation of consultation and any recommended or proposed modification included in each environmental monitoring plan report filed with the Commission. The Adaptive Management Plan would also require consultation and Commission approval on the effectiveness of the monitoring and the operation of the project in Phase 1 prior to commencing with Phase 2 deployment.
Geologic and Soils	
• Proposed Hydraulic Monitoring Study would help to identify any unanticipated adverse effects of the project on scouring or sediment transport processes.	• Same as applicant's proposal
Aquatic Resources	
• Proposed Acoustic Monitoring Study would help to identify and characterize noise radiated by the project. • Proposed Benthic and Biofouling Monitoring Study would help to ensure effective project operation and health of the benthic community in the project area. • Proposed Hydraulic Monitoring Study would provide an increased understanding of the effects of the project on the hydrodynamics in Cobscook Bay during each phase of deployment. • Proposed Fisheries and Marine Life Interaction Study and Proposed Marine	• Same as applicant's proposal, plus: • Conduct pile driving and P&D cable burial activities between November 8th and April 9th to avoid effects due to noise and habitat disturbance on various life stages of federally managed finfish and shellfish and forage species.

ORPC Maine's Proposal	Staff Alternative
Mammal Monitoring Study would help to identify the use of the project area by fish and marine mammals and quantify any unanticipated adverse effects of the project on them.	
Rare, Threatened, and Endangered Species	
• The project is not likely to adversely affect the Atlantic salmon and Atlantic sturgeon.	• Same as applicant's proposal, plus: • Follow the FWS *Bald Eagle Management Guidelines* during construction and operation of the project.
Terrestrial Resources	
• Implement Bird Monitoring Plan to monitor and protect sea and shorebird species in the project area…	• Same as applicant's proposal.

ORPC Maine's Proposal	Staff Alternative
Recreation	
• Maintain the information center at the ORPC Maine office in Eastport that includes educational displays and informational brochures.	• Same as applicant's proposal, plus: • Install interpretive display near the proposed on-shore station house to enable the public to learn more about the new area of energy development that the proposed Cobscook Bay Project represents.
Navigation	
• Implement the Navigation and Safety Plan that includes an exclusion zone and safety system consisting of six lighted buoys and two lighted danger signs to ensure public safety in the project area.	• Same as applicant's proposal.
Aesthetic Resources	
• Include "naturalized" design measures in building specification (e.g., earth-tone colors, non-reflective paints, and minimization of structure heights that extend above the canopy) to minimize the visual impact of the project.	• Same as applicant's proposal.
Cultural Resources	
• None	• Consult with the Maine 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.

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 Cobscook Bay 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 pilot project and its alternatives, we selected the staff alternative, as the preferred option. We recommend this option because: (1) issuing a pilot license to ORPC Maine would allow them to test the generating equipment's dependability as a source of electrical energy for the region; (2) the 300 kW of electric energy generated during the 8-year pilot project license would come from a renewable resource, which would not contribute to atmospheric pollution; (3) the recommended environmental 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 tidal 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 ORPC Maine or recommended by agencies and other entities should be included in any pilot project license issued for the project. In addition to ORPC Maine's proposed environmental measures, we recommend the inclusion of some additional measures in any pilot project license issued for the project.

Measures Proposed by ORPC Maine

Based on our environmental analysis of ORPC Maine's proposal as discussed in section 3.0 and the costs discussed in section 4.0, we recommend including the following environmental measures proposed by ORPC Maine in any pilot project license issued.

General

- Implement the Project Operations and Monitoring Plan.

- Implement the Project Inspection and Maintenance Plan.
- Implement the Project and Public Safety Plan.
- Implement the Project Removal and Site Restoration Plan.
- Implement the Emergency Shutdown Plan.

Aquatic Resources

- Implement the Acoustic Monitoring Plan.
- Implement the Benthic and Biofouling Monitoring Plan.
- Implement the Fisheries and Marine Life Interaction Monitoring Plan.
- Implement the Hydraulic Monitoring Plan.
- Implement the Marine Mammal Monitoring Plan.

Terrestrial Resources

- Implement the Bird Monitoring Plan.

Recreation

- Maintain the information center at the ORPC Maine office in Eastport that includes educational displays and informational brochures. .

Navigation

- Implement the Navigation Safety Plan.

Aesthetics

- Improve and maintain aesthetic values of the project area through the selection of non-reflective colors that blend with the natural landscape and develop design guidelines for future project improvements.

Additional Measures Recommended by Staff

In addition to ORPC Maine's proposed measures, we recommend including the following measures in any pilot project license issued:

- Modification of the Project Removal and Site Restoration Plan to include, if a new license is not being sought, provisions for filing with the Commission: 1) a specific timeline for the removal and site restoration activities 6 months prior to license expiration; 2) documentation of consultation with NMFS, FWS, Coast Guard, Maine DMR, and Maine DEP regarding planned removal and site restoration activities 6 months prior to license expiration; and 3) documentation of completion of project removal and site restoration activities prior to license expiration.

- To protect environmental resources and minimize any potential adverse effects from project construction and operation: 1) limit pile driving and power and data (P&D) cable burial activities to between November 8th and April 9th of any year; and 2) follow the FWS *Bald Eagle Management Guidelines* during construction and operation of the project.

- To ensure that the adaptive management strategies within the monitoring plans are sufficiently detailed so as to facilitate future modifications to the plans based on their preliminary results, develop and implement an Adaptive Management Plan.

- Install an interpretive display at the proposed on-shore station house that includes an educational display detailing the TidGen™ technology and the natural environment of the project area.

- Consult with the Maine 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.

The following discussion provides the basis for our recommendations for licensing the Cobscook Bay Project.

Project Removal and Site Restoration Plan

Integral to the Commission's hydrokinetic pilot project license is the requirement that pilot projects be removed with their sites restored at the end of the license term unless a new license is obtained. ORPC Maine proposes a Project Removal and Site Restoration Plan that provides general information on the facilities that would be removed, the monitoring that would take place during removal, and the length of time that removal would take. Provisions in the Project Removal and Site Restoration Plan for providing a specific timeline for the removal and site restoration activities, as well as documentation of consultation with the appropriate agencies, 6 months prior to license expiration, and documentation of completion of project removal and site restoration activities prior to license expiration, would ensure that the project is removed and the

site is sufficiently restored to near pre-project condition by the end of the license term. We estimate that the costs of these provisions would be minimal and therefore conclude that the benefits outweigh any costs.

Pile Driving and P&D Cable Burial Schedule

Underwater noise associated with the pile driving activities during project construction may adversely affect fish and marine mammals in the vicinity of the construction area. Increased turbidity associated with the plowing activities necessary for burying the P&D cable may adversely affect fish, particularly the endangered Atlantic salmon. Due to the potential adverse effects of these activities, NMFS recommends (10(j) recommendation 8) that ORPC Maine not conduct any pile driving or plowing activities from April 10th through November 7th of any year. NMFS further states that if pile driving activities extend into this restriction window, mitigative measures should be implemented if deemed necessary based on the results of the proposed Acoustic Monitoring Plan. ORPC Maine has recently changed its proposed method for cable burial, from a jet plow to a shear plow, to reduce turbidity, and interprets NMFS restriction window to only apply to its previously proposed jet plow activities. Although this may be correct, it is not clear from the public record of communication. Due to this, and the sensitivity of ESA-listed Atlantic salmon to plowing activities during the period of April 10th to November 7th, the restriction window would appear to still be necessary under the modified proposal to ensure that cable burial activities do not adversely affect this species. In addition, restricting pile driving activities to occur only between November 8th and April 9th of any year, as recommended by NMFS, would help to minimize any potential effects on marine mammals and Atlantic salmon, due to their relative absence in Cobscook Bay during this time period. We estimate that the costs of this activity restriction window would be minimal and therefore conclude that the benefits outweigh any costs.

Bald Eagle

Construction noise and human activity during installation of the underwater facilities and construction of the onshore facilities could disturb bald eagles. Bald eagles have been reported in the greater Cobscook Bay area as well as within the proposed project area. Although several bald eagle nests exist in the general vicinity of the proposed project, no nests have been observed within the proposed project boundary. OPRC Maine does not propose any specific measures to protect bald eagles during construction activities. No recommendations from the agencies or other stakeholders were filed regarding bald eagle protection measures.

The FWS has issued *Bald Eagle Management Guidelines*, dated May 2007, to advise landowners, land managers, and the general public of the potential for various activities to disturb bald eagles, and encourage land management practices that benefit bald eagles and their habitat (FWS 2007). Within these guidelines the FWS

recommends a primary 330-foot buffer zone and a secondary 660-foot buffer zone around eagle nest trees (FWS 2007). The primary zone is established to provide protection of the juvenile eagles in the nest tree and to buffer the tree from human activities during nesting season (March through August), when nests are most vulnerable to disturbance by human activity. The secondary buffer zone protects the nest from noise and obstructive activities and to protect nesting habitat within the primary zone. The secondary zone extends from the primary zone to a distance of 660 ft from the nesting tree. The actual size of the buffer zone could vary depending on site specific characteristics and the eagle's tolerance for human disturbance (FWS 2007).

Although any construction noise and increased human activity related to project construction and operation would be minimal and short term and not expected to create a greater disturbance than what is already present in Cobscook Bay, following the FWS *Bald Eagle Management Guidelines* would ensure that this important species is protected. We estimate the cost of this measure to be minimal and conclude that the benefits outweigh the costs.

Recreation Resources

Tourism is Maine's second largest private sector employer and this area of Maine is very scenic and does attract a fair amount of tourism. The information center and educational brochures that have been developed by ORPC Maine would provide an added benefit to visitors to the area by educating them about this new energy resource. This information center, however, is located in Eastport and not at the actual project. While the proposed location of the Cobscook Bay Project receives only minimal recreational usage, the existence of this hydrokinetic project could further increase the interest in the area. As such, providing an informational kiosk near the proposed on-shore station house that details the TidGen^{TM} devices and technology used for the project, as well as the project's relation to the natural environment and the species that inhabit the deployment area, would enhance the visitor experience and provide a new educational opportunity. As ORPC Maine has already developed this information for the Eastport office, the cost of adding an interpretive display at the on-shore station house that includes similar information, we estimate that the costs of this activity should be minimal and therefore the conclude that the benefits outweigh any costs.

Cultural Resources

As with any project, there is a chance that construction activities could lead to unanticipated discoveries of historic resources. To ensure protection of these resources in the event they are uncovered, it would be beneficial for any license order issued by the Commission to include 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 Maine SHPO 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 Maine SHPO. If historic properties are identified, a Historic Properties Management Plan could be crafted by the licensee in consultation with the Maine SHPO, depending on the nature of the historic properties identified. We estimate that the costs of these measures would be minimal and conclude that the benefits outweigh any costs.

Adaptive Management Plan

The purpose of the Commission's hydrokinetic pilot project license is to allow for the deployment of new technology marine and hydrokinetic projects in which the environmental effects are not yet well understood, while managing the uncertainty through required post-license monitoring and safeguard plans that ensure the protection of the public and environment. Due to the learning curve of monitoring these types of projects in their often volatile environments (i.e. strong currents, extreme tidal fluctuations), the ability to utilize an adaptive management strategy to receive feedback from stakeholders and modify plans as necessary is imperative. ORPC Maine proposes to use such an adaptive management strategy within its environmental monitoring plans to allow for future modifications to the plans based on preliminary results. NMFS recommends (10(j) recommendations 2 and 3) that ORPC Maine use such adaptive management to ensure that the technical and environmental goals and objectives of Phase 1 deployment are met before proceeding to the Phase 2 deployment.

Although ORPC Maine proposes to file regular reports, with the intention of receiving feedback from the resource agencies on any necessary modifications to the environmental monitoring plans, a separate Adaptive Management Plan may be beneficial in clarifying the adaptive management process; specifically the protocols for consultation and subsequent modifications. This clarification may limit the need for explicit Commission approval for minor modifications (i.e. change in location, frequency) to the monitoring plans that are agreed upon by the resource agencies, in which only documentation of such agreements would need to be provided in the monitoring plan reports filed with the Commission. A clarification on the protocols may also address NMFS' concerns regarding the technical and environmental goals of Phase 1 being met before proceeding to Phase 2. Further, including protocols within the plan for handling disputes over recommended modifications would provide the resource agencies assurance that any recommendations regarding monitoring plan modifications would be fully considered.

An Adaptive Management Plan would ensure that the monitoring plans gather sufficient data to allow for the evaluation of the potential environmental effects of the Cobscook Bay Project. We estimate the levelized annual cost of developing and

implementing the Adaptive Management Plan would be $1,330 and conclude that the benefits of this measure outweigh the costs.

Measures Not Recommended

The following discusses the basis for staff's conclusion not to recommend some of the measures recommended by agencies and other interested parties.

Jet Plow Use for Cable Burial below MLLW

In its license application, ORPC Maine proposed to use a jet plow for burying the P&D cable below MLLW. NMFS also recommends (10(j) recommendation 7) that ORPC Maine use a jet plow for burying the P&D cable below MLLW. In a letter filed on December 8, 2011, in response to agency comments, ORPC Maine notes that it is now proposing to use a shear plow for P&D cable burial MLLW, to reduce the turbidity effects of the plowing activity. While a jet plow uses a high pressured water jet to remove the soil for the cable trench, a shear plow mechanically cuts a slit in the sea floor with a shearing edge. NMFS has noted the potential adverse effects of the turbidity related to cable burial on the endangered Atlantic salmon and the proposed use of a shear plow would minimize the level of such turbidity. Therefore, we conclude that the use of a jet plow for burying the P&D cable would not be justified at any cost, and the use of the shear plow, as proposed by ORPC Maine, would effectively address NMFS' concerns.

Additional Benthic and Biofouling Monitoring

Maine DMR recommends that ORPC Maine conduct additional pre-deployment monitoring to cover the entire TGU deployment area. Maine DMR also recommends that the proposed post-deployment monitoring should include the collection and analyses of sediment samples, as collected in the pre-deployment sampling, and the study of the benthic community in the immediate footprint of the TidGen™ devices. While ORPC Maine proposes to examine the recovery of benthic resources in the P&D cable burial area and near the TidGen™ devices, they do not propose to conduct any additional pre-deployment monitoring or any additional sediment sampling as part of the post-deployment monitoring. ORPC Maine also proposes to examine the benthic community near the TidGenTM devices, as opposed to the studying the immediate footprints of the TidGenTM devices, as recommended by Maine DMR. Due to the strong tidal velocities and short duration of slack tides, divers conducting the pre-deployment sampling had to be tethered, restricting their ability to move great distances. According to ORPC Maine, this made the collection of benthic samples very difficult. The pre-deployment benthic sampling conducted by ORPC Maine provides a sufficient understanding of the existing environment, with ORPC Maine proposing to conduct inspections along the cable route and TidGen™ deployment area for the term of the license to evaluate the recovery of the benthic community. The collection of additional

sediment samples in the proposed project area during Phases 1 and 2, as recommended by Maine DMR, would provide limited additional information in comparison to what ORPC Maine is proposing as part of its Benthic and Biofouling Monitoring Plan.

For the above reasons, we conclude that modifying the monitoring plan at this time to require additional pre- and post-deployment monitoring would not be worth the additional levelized annual cost of $1,500.

Additional Fisheries and Marine Life Interaction Monitoring

Maine DMR recommends that ORPC Maine conduct four additional 24-hour sampling events in year 2 after the Phase 2 deployment, with additional sampling in subsequent years if adverse impacts are observed. ORPC Maine proposes, as part of its plan, to meet with the appropriate agencies after the results of the Phase 1 sampling are available to discuss any changes that may be needed for the monitoring schedule.

The sampling schedule proposed by ORPC Maine would appear to be adequate to effectively identify and understand the presence, distribution, and behavior of fish and marine mammals in and around the TidGen™ devices. The pre-deployment sampling to date has indicated that the fish densities are very low in the winter months. Collecting 3 years of sampling data, during those winter months, as proposed by ORPC Maine, should provide sufficient information to draw conclusions regarding seasonal abundance. Concentrating the sampling effort in the spring and summer months after Phase 2, if the 3 years of winter sampling data continue to indicate low abundances, would appear to be a reasonable sampling strategy. In addition, consultation with the appropriate agencies after the results of the Phase 1 sampling are available would provide the opportunity for any modifications to the study plan related to sampling during the Phase 2 deployment.

For the above reasons, we conclude that modifying the monitoring plan at this time to require additional sampling during the winter months in year 2 after Phase 2 deployment would not be worth the additional levelized annual cost of $4,700.

5.3 UNAVOIDABLE ADVERSE IMPACTS

It is not yet clear if there are unavoidable adverse impacts that would occur as a result of the proposed pilot project. The purpose of the proposed environmental monitoring plans would be to better understand such potential impacts.

5.4 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 the federal and state fish and wildlife agencies for the protection, mitigation, and enhancement of fish and wildlife resources affected by the project.

Section 10(j) of the FPA states that whenever the Commission finds that any fish and wildlife agency recommendation is inconsistent with the purposes and the requirements of the FPA or other applicable law, the Commission and the agency shall attempt to resolve such inconsistency, giving due weight to the recommendations, expertise, and statutory responsibilities of the agency. In response to the ready for environmental analysis notice, the NMFS recommended (letter filed November 4, 2011) eight fish and wildlife measures. Table 23 lists the 10(j) recommendations, and whether the measures are recommended by staff. 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.

Table 23. Analysis of fish and wildlife agency recommendations for the Cobscook Bay Project (Source: staff).

Recommendation	Agency	Within the scope of section 10(j)	Annual Cost	Recommend Adopting?
1. Implement the environmental monitoring, safety, and removal and restoration plans proposed by ORPC Maine.[a]	NMFS	Yes	$132,900[b]	Yes
2. Meet the technical goals and objectives of Phase 1 deployment and complete the phase before proceeding to Phase 2 deployment.	NMFS	No	$0	Yes
3. Meet the environmental monitoring goals and objectives of Phase 1 deployment and complete the phase before proceeding to Phase 2 deployment.	NMFS	Yes	$0	Yes
4. Develop an annual report that details the progress, data, and status of all monitoring; provide the report to NMFS and	NMFS	No	$0	No. Commission staff prefers to receive individual reports for each monitoring plan.

Recommendation	Agency	Within the scope of section 10(j)	Annual Cost	Recommend Adopting?
other state and federal agencies for comments at least 45 days prior to filing it with FERC. Agency comments should be included in annual report.				
5. Continue to consult with NMFS and other state and federal agencies to guide adaptive management measures.	NMFS	No	$0	Yes
6. Bury P&D cable by means of trenching within the intertidal zone (above MLLW), restoring all gravel and cobble habitat to pre-construction condition prior to commencement of project operation.	NMFS	Yes	$0	Yes
7. Use jet plow for burying the P&D cable below MLLW; jet plow activities below MLLW should not occur from April 10 to November 7 of any year.	NMFS	Yes	$0	No. Although we recommend the restriction window for P&D cable burial, we do not recommend the use of a jet plow to do so. Instead, we recommend the use of a shear plow as proposed by ORPC Maine.
8. Pile driving activity should not occur from April 10 to November 7 of any year; if pile driving activity extends into this restriction window, mitigative measures may	NMFS	Yes	$0	Yes

Recommendation	Agency	Within the scope of section 10(j)	Annual Cost	Recommend Adopting?
be necessary based on the results of the proposed Acoustic Monitoring Plan.				

[a] The environmental monitoring, safety, and removal and restoration plans referenced by NMFS include the proposed Project and Public Safety Plan; Project Removal and Site Restoration Plan; Navigation Safety Plan; Emergency Shutdown Plan; Acoustic Monitoring Plan; Benthic and Biofouling Monitoring Plan; Hydraulic Monitoring Plan; Fisheries and Marine Life Interaction Monitoring Plan; Marine Mammal Monitoring Plan; and Bird Monitoring Plan.

[b] The annual cost was calculated using the sum of the annual costs provided in table 21 for the referenced plans listed above.

Using Jet Plow to Bury the P&D Cable below MLLW

We do not recommend adopting NMFS' recommendation for ORPC Maine to use a jet plow for burying the P&D cable below MLLW. Although ORPC Maine initially proposed to use a jet plow for burying the P&D cable below MLLW in its license application, it subsequently modified this proposal to instead use a shear plow (letter filed on December 8, 2011). While a jet plow uses a high pressured water jet to remove the soil for the cable trench, a shear plow mechanically cuts a slit in the sea floor with a shearing edge. NMFS has noted the potential adverse effects of the turbidity related to cable burial on the endangered Atlantic salmon and the proposed use of a shear plow would minimize the level of such turbidity. For this reason, we conclude that the use of the shear plow, as proposed by ORPC Maine, would effectively serve the purpose of NMFS' recommendation. Therefore, we find that the use of a jet plow for burying the P&D cable may be inconsistent with the substantial evidence standard of section 313(b) of the FPA.

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 Maine. We determined that 14 comprehensive plans are relevant to the Cobscook Bay Project (table 24). We found no inconsistencies.

Table 24. Comprehensive plans relevant to the Cobscook Bay Project.

Comprehensive Plan	Agency
Federal	
Fishery Management Plan for Inshore Stocks of Winter Flounder (Report No. 21). May 1992.	Atlantic States Marine Fisheries Commission
Fishery Management Plan for Atlantic Striped Bass (Report No. 24). March 1995.	Atlantic States Marine Fisheries Commission
Amendment 1 to the Interstate Fishery Management Plan for Atlantic Sturgeon (*Acipenser oxyrhynchus oxyrhyncus*) (Report No. 32). July 1998.	Atlantic States Marine Fisheries Commission
Amendment 1 to the Interstate Fishery Management Plan for Shad and River Herring (Report No. 35). April 1999.	Atlantic States Marine Fisheries Commission
Technical Addendum 1 to Amendment 1 of the Interstate Fishery Management Plan for Shad and River Herring. February 9, 2000.	Atlantic States Marine Fisheries Commission
Interstate Fishery Management Plan for American eel (*Anguilla rostrata*) (Report No. 36). April 2000.	Atlantic States Marine Fisheries Commission
Amendment 2 to the Interstate Fishery Management Plan for Shad and River Herring, Arlington, Virginia. May 2009.	Atlantic States Marine Fisheries Commission
Amendment 3 to the Interstate Fishery Management Plan for Shad and River Herring, Arlington, Virginia. February 2010.	Atlantic States Marine Fisheries Commission

Comprehensive Plan	Agency
Final Amendment #11 to the Northeast Multi-species Fishery Management Plan; Amendment #9 to the Atlantic sea scallop Fishery Management Plan; Amendment #1 to the monkfish Fishery Management Plan; Amendment #1 to the Atlantic salmon Fishery Management Plan; and Components of the proposed Atlantic herring Fishery Management Plan for Essential Fish Habitat. Volume 1. October 7, 1998.	National Marine Fisheries Service
Fisheries USA: the recreational fisheries policy of the U.S. Fish and Wildlife Service. Washington, D.C. 11 pp. No Date.	U.S. Fish and Wildlife Service
Atlantic Salmon Restoration in New England: Final Environmental Impact Statement 1989-2021. Department of the Interior, Newton Corner, Massachusetts. May 2009.	U.S. Fish and Wildlife Service
North American waterfowl management plan. Department of the Interior. Environment Canada. May 1986.	U.S. Fish and Wildlife Service, Canadian Wildlife Service
State	
Maine State Outdoor Recreation Plan (SCORP), 2009-2014. Augusta, Maine. December 2009.	Maine Department of Conservation
Strategic Plan for Management of Atlantic Salmon in the State of Maine. Augusta, Maine. July 1984. 52pp.	Maine Atlantic Sea-Run Salmon Commission

6.0 FINDING OF NO SIGNIFICANT 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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8.0 LIST OF PREPARERS

Federal Energy Regulatory Commission

Timothy Konnert—Project Coordinator, Geology and Soil Resources, Water Resources, Aquatic Resources, Threatened and Endangered Species (Fisheries Biologist, M.S., Aquatic Ecology)

Timothy Looney—Need for Power, Developmental Analysis, Socioeconomics (Civil Engineer; M.S. Engineering)

Emily Carter—Terrestrial Resources, Threatened and Endangered Species, Recreation, Navigation and Land Use, Aesthetics, Cultural Resources (Environmental Biologist, B.A., Environmental Studies)

APPENDIX A

LICENSE ARTICLES RECOMMENDED BY STAFF

We recommend including the following license articles in any license issued for the project:

Article 2XX. *Administrative Annual Charges.* The licensee shall pay the United States annual charges, effective as of the date of commencement of project construction, and as determined in accordance with the provisions of the Commission's regulations in effect from time to time for the purposes of:

(a) reimbursing the United States for the cost of administration of Part 1 of the Federal Power Act. The authorized installed capacity for that purpose is 300 kilowatts. Under the regulations currently in effect, projects with authorized installed capacity of less than or equal to 1,500 kW will not be assessed an annual charge.

Article 2XX. *Exhibit Drawings.* Within 45 days of the date of issuance of this license, the licensee shall file the approved exhibit drawings in aperture card and electronic file formats.

(a) Three sets of the approved exhibit drawings shall be reproduced on silver or gelatin 35mm microfilm. All microfilm shall be mounted on type D (3-1/4" X 7-3/8") aperture cards. Prior to microfilming, the FERC Project-Drawing Number (i.e., **P-12711-####** through **P-12711-####**) shall be shown in the margin below the title block of the approved drawing. After mounting, the FERC Drawing Number shall be typed on the upper right corner of each aperture card. Additionally, the Project Number, FERC Exhibit (i.e., F-1, G-1, etc.), Drawing Title, and date of this license shall be typed on the upper left corner of each aperture card.

Two of the sets of aperture cards shall be filed with the Secretary of the Commission, ATTN: OEP/DHAC. The third set shall be filed with the Commission's Division of Dam Safety and Inspections New York Regional Office.

(b) The licensee shall file two separate sets of exhibit drawings in electronic raster format with the Secretary of the Commission, ATTN: OEP/DHAC. A third set shall be filed with the Commission's Division of Dam Safety and Inspections New York Regional Office. Exhibit F drawings must be segregated from other project exhibits and identified as Critical Energy Infrastructure Information (CEII) material under 18 C.F.R. § 388.113(c)(2011). Each drawing must be a separate electronic file, and the file name shall include: FERC Project-Drawing Number, FERC Exhibit, Drawing Title, date of this license, and file extension in the following format [**P-12711-####**, G-1, Project Boundary, MM-DD-YYYY.TIF]. Electronic drawings shall meet the following format specification:

IMAGERY - black & white raster file

FILE TYPE – Tagged Image File Format, (TIFF) CCITT Group 4

RESOLUTION – 300 dpi desired, (200 dpi min)

DRAWING SIZE FORMAT – 24" X 36" (min), 28" X 40" (max)

FILE SIZE – less than 1 MB desired

Each Exhibit G drawing that includes the project boundary must contain a minimum of three known reference points (i.e., latitude and longitude coordinates, or state plane coordinates). The points must be arranged in a triangular format for GIS geo-referencing the project boundary drawing to the polygon data, and must be based on a standard map coordinate system. The spatial reference for the drawing (i.e., map projection, map datum, and units of measurement) must be identified on the drawing and each reference point must be labeled. In addition, each project boundary drawing must be stamped by a registered land surveyor.

c) The licensee shall file two separate sets of the project boundary data in a geo-referenced electronic file format (such as ArcView shape files, GeoMedia files, MapInfo files, or a similar GIS format) with the Secretary of the Commission, ATTN: OEP/DHAC. The filing shall include both polygon data and all reference points shown on the individual project boundary drawings. A single electronic boundary polygon data file is required for the project boundary. Depending on the electronic file format, the polygon and point data can be included in a single file with multiple layers. The geo-referenced electronic boundary data file must be positionally accurate to ±40 feet in order to comply with National Map Accuracy Standards for maps at a 1:24,000 scale. The file name(s) shall include: FERC Project Number, data description, date of this license, and file extension in the following format [**P-12711**, boundary polygon/or point data, MM-DD-YYYY.SHP]. The data must be accompanied by a separate text file describing the spatial reference for the geo-referenced data: map projection used (i.e., UTM, State Plane, Decimal Degrees, etc.), the map datum (i.e., North American 27, North American 83, etc.), and the units of measurement (i.e., feet, meters, miles, etc.). The text file name shall include: FERC Project Number, data description, date of this license, and file extension in the following format [**P-12711**, project boundary metadata, MM-DD-YYYY.TXT].

Article 3XX. *Start of Construction*. The licensee shall commence construction of the project works within two years from the issuance date of the license and shall complete construction of the project within 5 years from the issuance date of the license.

Article 3XX. *Cofferdam Construction Drawings and Deep Excavations.* Before starting construction, the licensee shall review and approve the design of contractor-

designed cofferdams and deep excavations and shall make sure construction of cofferdams and deep excavations is consistent with the approved design. At least 30 days before starting construction of the cofferdam, the licensee shall submit one copy to the Commission's Division of Dam Safety and Inspections (D2SI) – New York Regional Engineer and two copies to the Commission (one of these copies shall be a courtesy copy to the Commission's Director, D2SI), of the approved cofferdam/deep excavation drawings and specifications and the letters of approval.

Article 3XX. *Contract Plans and Specifications.* At least 60 days prior to the start of any construction, the licensee shall submit one copy of its plans and specifications and supporting design document to the Commission's Division of Dam Safety and Inspections (D2SI) – New York Regional Engineer, and two copies to the Commission (one of these shall be a courtesy copy to the Director, D2SI). The submittal to the D2SI New York Regional Engineer must also include as part of preconstruction requirements: a Quality Control and Inspection Program, Temporary Construction Emergency Action Plan, and Soil Erosion and Sediment Control Plan. The licensee may not begin construction until the D2SI – New York Regional Engineer has reviewed and commented on the plans and specifications, determined that all preconstruction requirements have been satisfied, and authorized start of construction.

Article 3XX. *As-built Drawings.* Within 90 days of completion of construction of the facilities authorized by this license, the licensee shall file for Commission approval, revised exhibits A, F, and G, as applicable, to describe and show those project facilities as built. A courtesy copy shall be filed with the Commission's Division of Dam Safety and Inspections (D2SI) – New York Regional Engineer, the Director, D2SI, and the Director, Division of Hydropower Administration and Compliance.

Article 3XX. *Project Financing Plan.* At least 60 days before starting construction, the licensee shall file with the Commission, for approval, three copies of a project financing plan. The plan must show that the licensee has acquired the funds, or commitment for funds, necessary to construct, operate, and maintain the project in accordance with the license. The plan must include, at a minimum, financial statements, including a balance sheet, income statement, and a statement of actual or estimated cash flows over the license term which provide evidence that the licensee has sufficient assets, credit, and projected revenues to cover project construction, operation, and maintenance expenses, and any other estimated project liabilities and expenses.

The financial statements must be prepared in accordance with generally accepted accounting principles and signed by an independent certified public accountant. The licensee shall not start any project construction or ground-disturbing activities that are associated with the project, before the project financing plan is approved.

Article 3XX. *Project Operations and Monitoring Plan*. Upon license issuance, the licensee shall implement the *Project Operations and Monitoring Plan*, filed September 1, 2011.

Article 3XX. *Project Inspection and Maintenance Plan.* Upon license issuance, the licensee shall implement the *Project Inspection and Maintenance Plan*, filed September 1, 2011.

Article 4XX. *Project and Public Safety Plan*. Upon license issuance, the licensee shall implement the *Project and Public Safety Plan*, filed September 1, 2011.

Article 4XX. *Project Removal and Site Restoration Plan.* Upon license issuance, the licensee shall implement the *Project Removal and Site Restoration Plan*, filed September 1, 2011, with the following modifications: 1) a detailed timeline for the removal and site restoration activities shall be filed with the Commission 6 months prior to license expiration; 2) documentation of consultation with National Marine Fisheries Service, U.S. Fish and Wildlife Service, U.S. Coast Guard, Maine Department of Marine Resources, and Maine Department of Environmental Protection regarding planned removal and site restoration activities shall be filed with the Commission 6 months prior to license expiration; and 3) documentation of completion of project removal and site restoration activities shall be filed with the Commission prior to license expiration.

As part of the plan, at least 60 days prior to commencing project construction and installation, the licensee shall file proof of purchase of a surety bond, or equivalent financial assurance instrument, to cover the entirety of the costs of removing the project. The licensee shall file proof of the maintenance of the bond, or equivalent financial assurance, by December 31 of each year.

Article 4XX. *Emergency Shutdown Plan.* Upon license issuance, the licensee shall implement the *Emergency Shutdown Plan*, filed September 1, 2011.

Article 4XX. *Restriction Period for Pile Driving and Cable Burial.* The licensee shall not conduct any pile driving or cable burial activities between April 10 and November 7 of any year. The need for this restriction window in Phase 2 deployment shall be determined based on the results of the Acoustic Monitoring Plan and the consultation specified in the Adaptive Management Plan.

Article 4XX. *Adaptive Management Plan.* Within 3 months of license issuance, the licensee shall file with the Commission for approval an Adaptive Management Plan. The plan shall include: 1) protocols for consultation with federal and state agencies on preliminary results of monitoring studies and any necessary modifications, with documentation of consultation and any recommended or proposed modification included in each environmental monitoring plan report filed with the Commission; 2) the allowance for minor modifications (i.e. location, frequency) to the monitoring plans

without prior Commission approval in cases where all consulted entities are in agreement, with modifications and record of consultation included in the required reports of the affected monitoring plans; 3) the allowance for major modifications (i.e. termination of monitoring, change in reporting schedule) to the monitoring plans upon Commission approval; and 4) a provision for consultation and Commission approval on the effectiveness of the monitoring and the operation of the project in Phase 1 prior to commencing with Phase 2 deployment.

Article 4XX. *Acoustic Monitoring Plan.* Upon license issuance, the licensee shall implement the *Acoustic Monitoring Plan*, filed September 1, 2011, and amended on December 1, 2011.

As part of the plan, the licensee shall submit annual reports by December 31 of each year that monitoring occurs. Prior to filing the report with the Commission, the licensee shall submit the report to the Maine Department of Environmental Protection, Maine Department of Marine Resources, U.S. Fish and Wildlife Service, and National Marine Fisheries Service and allow a minimum of 30 days for the agencies to review and comment on the report. The final report shall include copies of any comments received and the licensee shall address all comments and recommendations received from the agencies. If the licensee does not adopt a recommendation, the report shall include the licensee's reasons based on project-specific information. The Commission reserves the right to modify the monitoring plan and project operations in order to protect environmental resources at the project.

Article 4XX. *Benthic and Biofouling Monitoring Plan.* Upon license issuance, the licensee shall implement the *Benthic and Biofouling Monitoring Plan*, filed September 1, 2011.

As part of the plan, the licensee shall submit annual reports by December 31 of each year that monitoring occurs. Prior to filing the report with the Commission, the licensee shall submit the report to the Maine Department of Environmental Protection, Maine Department of Marine Resources, U.S. Fish and Wildlife Service, and National Marine Fisheries Service and allow a minimum of 30 days for the agencies to review and comment on the report. The final report shall include copies of any comments received and the licensee shall address all comments and recommendations received from the agencies. If the licensee does not adopt a recommendation, the report shall include the licensee's reasons based on project-specific information. The Commission reserves the right to modify the monitoring plan and project operations in order to protect environmental resources at the project.

Article 4XX. *Fisheries and Marine Life Interaction Monitoring Plan.* Upon license issuance, the licensee shall implement the *Fisheries and Marine Life Interaction Monitoring Plan*, filed September 1, 2011.

As part of the plan, the licensee shall submit annual reports by December 31 of each year that monitoring occurs. Prior to filing the report with the Commission, the licensee shall submit the report to the Maine Department of Environmental Protection, Maine Department of Marine Resources, U.S. Fish and Wildlife Service, and National Marine Fisheries Service and allow a minimum of 30 days for the agencies to review and comment on the report. The final report shall include copies of any comments received and the licensee shall address all comments and recommendations received from the agencies. If the licensee does not adopt a recommendation, the report shall include the licensee's reasons based on project-specific information. The Commission reserves the right to modify the monitoring plan and project operations in order to protect environmental resources at the project.

Article 4XX. *Reservation of Authority to Prescribe Fishways*. Authority is reserved to the Commission to require the licensee to construct, operate, and maintain, or to provide for the construction, operation, and maintenance of such fishways as may be prescribed by the Secretary of the Interior pursuant to section 18 of the Federal Power Act.

Article 4XX. *Hydraulic Monitoring Plan.* Upon license issuance, the licensee shall implement the *Hydraulic Monitoring Plan*, filed September 1, 2011.

As part of the plan, the licensee shall submit annual reports by December 31 of each year that monitoring occurs. Prior to filing the report with the Commission, the licensee shall submit the report to the Maine Department of Environmental Protection, Maine Department of Marine Resources, U.S. Fish and Wildlife Service, and National Marine Fisheries Service and allow a minimum of 30 days for the agencies to review and comment on the report. The final report shall include copies of any comments received and the licensee shall address all comments and recommendations received from the agencies. If the licensee does not adopt a recommendation, the report shall include the licensee's reasons based on project-specific information. The Commission reserves the right to modify the monitoring plan and project operations in order to protect environmental resources at the project.

Article 4XX. *Marine Mammal Monitoring Plan.* Upon license issuance, the licensee shall implement the *Marine Mammal Monitoring Plan*, filed September 1, 2011.

As part of the plan, the licensee shall submit annual reports by December 31 of each year that monitoring occurs. Prior to filing the report with the Commission, the licensee shall submit the report to the Maine Department of Environmental Protection, Maine Department of Marine Resources, U.S. Fish and Wildlife Service, and National Marine Fisheries Service and allow a minimum of 30 days for the agencies to review and comment on the report. The final report shall include copies of any comments received and the licensee shall address all comments and recommendations received from the agencies. If the licensee does not adopt a recommendation, the report shall include the

licensee's reasons based on project-specific information. The Commission reserves the right to modify the monitoring plan and project operations in order to protect environmental resources at the project.

Article 4XX. *Bald Eagle Management Guidelines*. The licensee shall follow the U.S. Fish and Wildlife Service's *Bald Eagle Management Guidelines*, issued May 2007, for the protection of bald eagles and their habitat during construction and operation of the project.

Article 4XX. *Bird Monitoring Plan*. Upon license issuance, the licensee shall implement the *Bird Monitoring Plan*, filed September 1, 2011.

As part of the plan, the licensee shall submit annual reports by December 31 of each year that monitoring occurs. Prior to filing the report with the Commission, the licensee shall submit the report to the Maine Department of Environmental Protection, Maine Department of Marine Resources, U.S. Fish and Wildlife Service, and National Marine Fisheries Service and allow a minimum of 30 days for the agencies to review and comment on the report. The final report shall include copies of any comments received and the licensee shall address all comments and recommendations received from the agencies. If the licensee does not adopt a recommendation, the report shall include the licensee's reasons based on project-specific information. The Commission reserves the right to modify the monitoring plan and project operations in order to protect environmental resources at the project.

Article 4XX. *Recreation Resources.* Within 3 months of license issuance, the licensee shall install an interpretive display within the project boundary near the on-shore station house that includes an informational project board detailing the TidGen™ devices, the hydrokinetic technology, and the natural environment of the project area. Within 6 months of license issuance, the licensee shall file documentation of the installation of the kiosk. The documentation shall include: the text and graphics included on the kiosk, photographs of the installed kiosk, and a map showing the location of the kiosk. In addition, the filing shall include location point data that is representative of the kiosk. The location point(s) must be positionally accurate to ±40 feet in order to comply with National Map Accuracy Standards for maps at a 1:24,000 scale. The location point(s) must include latitude/longitude in decimal degrees, based on the horizontal reference datum of the North American Datum of 1983 (NAD 83). The attribute table for each point must include at least the development name and recreational feature.

Article 4XX. *FERC Form 80 Exemption*. There is little or no potential for recreation facilities within the project boundary. Therefore, upon the issuance date of the license, the licensee is exempt from 18 § C.F.R. 8.11, the filing of the FERC Form 80 recreation report, for the Cobscook Bay Tidal Energy Project.

Article 4XX. *Navigation and Safety Plan.* Upon license issuance, the licensee shall implement the *Navigation and Safety Plan,* filed September 1, 2011.

Article 4XX. *Aesthetic Resources.* All land-based facilities shall be designed as relatively low profile structures to minimize any aesthetic impact. The licensee also shall maintain aesthetic values of the project area through the selection of materials and non-reflective colors that blend with the natural landscape.

Article 4XX. *Cultural Resources.* Prior to beginning any land-clearing or land-disturbing activities within the project boundary, other than those specifically authorized in this license, the licensee shall consult with the Maine State Historic Preservation Officer (SHPO). If the licensee discovers previously unidentified archeological or historic properties during the course of constructing or developing project works or other facilities at the project, the licensee shall stop all land-clearing and land-disturbing activities in the vicinity of the properties and consult with the Maine SHPO.

In either instance, the licensee shall file a historic properties management plan (plan) for Commission approval. The plan shall be prepared by a qualified cultural resource specialist after having consulted with the SHPO. The plan shall include the following items:

(1) a description of each discovered property indicating whether it is listed on or eligible to be listed on the National Register of Historic Places;

(2) a description of the potential effect on each discovered property;

(3) proposed measures for avoiding or mitigating effects;

(4) documentation of the nature and extent of consultation; and

(5) a schedule for mitigating effects and conducting additional studies.

The Commission may require changes to the plan. The licensee shall not begin land-clearing or land-disturbing activities, other than those specifically authorized in this license, or resume such activities in the vicinity of a property discovered during construction, until informed by the Commission that the requirements of this article have been fulfilled.

Article 4XX. *Project Land Rights Progress Report.* No later than four years after license issuance, the licensee shall file a report with the Commission describing the status

of acquiring title in fee or the rights for all the lands within the project boundary. The report must provide an overview map of each parcel and summary table identifying the licensee's rights over each parcel within the project boundary. The report shall also include specific supporting documentation showing the status of the land rights on all parcels of land within the project boundary that: (1) have been acquired up to the date of filing of the report, including pertinent deeds, lease agreements, and/or bill of sale information that specifically verify the licensee's rights; and (2) the licensee's plan and schedule for acquiring all remaining project lands prior to the five-year deadline, including a history of actions taken, current owner information, the type of ownership to be acquired whether in fee or by easement, and the timeline for completing property acquisition

Article 4XX. *Use and Occupancy*. (a) In accordance with the provisions of this article, the licensee shall have the authority to grant permission for certain types of use and occupancy of project lands and waters and to convey certain interests in project lands and waters for certain types of use and occupancy, without prior Commission approval. The licensee may exercise the authority only if the proposed use and occupancy is consistent with the purposes of protecting and enhancing the scenic, recreational, and other environmental values of the project. For those purposes, the licensee shall also have continuing responsibility to supervise and control the use and occupancies for which it grants permission, and to monitor the use of, and ensure compliance with the covenants of the instrument of conveyance for, any interests that it has conveyed, under this article. If a permitted use and occupancy violates any condition of this article or any other condition imposed by the licensee for protection and enhancement of the project's scenic, recreational, or other environmental values, or if a covenant of a conveyance made under the authority of this article is violated, the licensee shall take any lawful action necessary to correct the violation. For a permitted use or occupancy, that action includes, if necessary, canceling the permission to use and occupy the project lands and waters and requiring the removal of any non-complying structures and facilities.

(b) The type of use and occupancy of project lands and waters for which the licensee may grant permission without prior Commission approval are: (1) landscape plantings; (2) non-commercial piers, landings, boat docks, or similar structures and facilities that can accommodate no more than 10 water craft at a time and where said facility is intended to serve single-family type dwellings; (3) embankments, bulkheads, retaining walls, or similar structures for erosion control to protect the existing shoreline; and (4) food plots and other wildlife enhancement. To the extent feasible and desirable to protect and enhance the project's scenic, recreational, and other environmental values, the licensee shall require multiple use and occupancy of facilities for access to project lands or waters. The licensee shall also ensure, to the satisfaction of the Commission's authorized representative, that the use and occupancies for which it grants permission are maintained in good repair and comply with applicable state and local health and safety requirements. Before granting permission for construction of bulkheads or retaining

walls, the licensee shall: (1) inspect the site of the proposed construction, (2) consider whether the planting of vegetation or the use of riprap would be adequate to control erosion at the site, and (3) determine that the proposed construction is needed and would not change the basic contour of the impoundment shoreline. To implement this paragraph (b), the licensee may, among other things, establish a program for issuing permits for the specified types of use and occupancy of project lands and waters, which may be subject to the payment of a reasonable fee to cover the licensee's costs of administering the permit program. The Commission reserves the right to require the licensee to file a description of its standards, guidelines, and procedures for implementing this paragraph (b) and to require modification of those standards, guidelines, or procedures.

(c) The licensee may convey easements or rights-of-way across, or leases of project lands for: (1) replacement, expansion, realignment, or maintenance of bridges or roads where all necessary state and federal approvals have been obtained; (2) storm drains and water mains; (3) sewers that do not discharge into project waters; (4) minor access roads; (5) telephone, gas, and electric utility distribution lines; (6) non-project overhead electric transmission lines that do not require erection of support structures within the project boundary; (7) submarine, overhead, or underground major telephone distribution cables or major electric distribution lines (69-kV or less); and (8) water intake or pumping facilities that do not extract more than one million gallons per day from a project impoundment. No later than January 31 of each year, the licensee shall file three copies of a report briefly describing for each conveyance made under this paragraph (c) during the prior calendar year, the type of interest conveyed, the location of the lands subject to the conveyance, and the nature of the use for which the interest was conveyed.

(d) The licensee may convey fee title to, easements or rights-of-way across, or leases of project lands for: (1) construction of new bridges or roads for which all necessary state and federal approvals have been obtained; (2) sewer or effluent lines that discharge into project waters, for which all necessary federal and state water quality certification or permits have been obtained; (3) other pipelines that cross project lands or waters but do not discharge into project waters; (4) non-project overhead electric transmission lines that require erection of support structures within the project boundary, for which all necessary federal and state approvals have been obtained; (5) private or public marinas that can accommodate no more than 10 water craft at a time and are located at least one-half mile (measured over project waters) from any other private or public marina; (6) recreational development consistent with an approved report on recreational resources of an Exhibit E; and (7) other uses, if: (i) the amount of land conveyed for a particular use is five acres or less; (ii) all of the land conveyed is located at least 75 feet, measured horizontally, from project waters at normal surface elevation; and (iii) no more than 50 total acres of project lands for each project development are conveyed under this clause (d)(7) in any calendar year. At least 60 days before

conveying any interest in project lands under this paragraph (d), the licensee must submit a letter to the Director, Office of Energy Projects, stating its intent to convey the interest and briefly describing the type of interest and location of the lands to be conveyed (a marked Exhibit G map may be used), the nature of the proposed use, the identity of any federal or state agency official consulted, and any federal or state approvals required for the proposed use. Unless the Director, within 45 days from the filing date, requires the licensee to file an application for prior approval, the licensee may convey the intended interest at the end of that period.

(e) The following additional conditions apply to any intended conveyance under paragraph (c) or (d) of this article:

(1) Before conveying the interest, the licensee shall consult with federal and state fish and wildlife or recreation agencies, as appropriate, and the State Historic Preservation Officer.

(2) Before conveying the interest, the licensee shall determine that the proposed use of the lands to be conveyed is not inconsistent with any approved report on recreational resources of an Exhibit E; or, if the project does not have an approved report on recreational resources, that the lands to be conveyed do not have recreational value.

(3) The instrument of conveyance must include the following covenants running with the land: (i) the use of the lands conveyed shall not endanger health, create a nuisance, or otherwise be incompatible with overall project recreational use; (ii) the grantee shall take all reasonable precautions to ensure that the construction, operation, and maintenance of structures or facilities on the conveyed lands will occur in a manner that will protect the scenic, recreational, and environmental values of the project; and (iii) the grantee shall not unduly restrict public access to project waters.

(4) The Commission reserves the right to require the licensee to take reasonable remedial action to correct any violation of the terms and conditions of this article, for the protection and enhancement of the project's scenic, recreational, and other environmental values.

(f) The conveyance of an interest in project lands under this article does not in itself change the project boundaries. The project boundaries may be changed to exclude land conveyed under this article only upon approval of revised Exhibit G drawings (project boundary maps) reflecting exclusion of that land. Lands conveyed under this article will be excluded from the project only upon a determination that the lands are not necessary for project purposes, such as operation and maintenance, flowage, recreation, public access, protection of environmental resources, and shoreline control, including shoreline aesthetic values. Absent extraordinary circumstances, proposals to exclude lands conveyed under this article from the project shall be consolidated for consideration when revised Exhibit G drawings would be filed for approval for other purposes.

(g) The authority granted to the licensee under this article shall not apply to any part of the public lands and reservations of the United States included within the project boundary.