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TITLE 650 – COASTAL RESOURCES MANAGEMENT COUNCIL

CHAPTER 20 – COASTAL MANAGEMENT PROGRAM

SUBCHAPTER 05 – OCEAN SPECIAL AREA MANAGEMENT PLAN

PART 8 – Renewable Energy and Other Offshore Development

8.1 Authority

A. As authorized by the federal Coastal Zone Management Act of 1972 (16 U.S.C. §§ 1451 through 1466) and R.I. Gen. Laws Chapter 46-23 the Coastal Resources Management Council may implement special area management plans.

B. The regulations herein constitute a RICR regulatory component of the Ocean Special Area Management Plan (SAMP) Chapter 8 - Renewable Energy and Other Offshore Development, and must be read in conjunction with the other RICR regulatory components and chapters of the Ocean SAMP for the full context and understanding of the CRMC's findings and policies that form the basis and purpose of these regulations. The other RICR regulatory components and chapters of the Ocean SAMP should be employed in interpreting the regulations herein and R.I. Gen. Laws § 46-23-1, *et seq*.

8.2 Purpose

The purpose of these rules is to carry out the responsibilities of the Coastal Resources Management Council in establishing the Ocean Special Area Management Plan (SAMP) for the offshore waters (beyond 3 nautical mile state water boundary) within the geographic location description (GLD) and to provide the regulatory framework for promoting a balanced and comprehensive ecosystem-based management approach to the development and protection of Rhode Island's ocean-based resources. In addition, these rules establish the regulatory standards and enforceable policies within the GLD for purposes of the federal Coastal Zone Management Act federal consistency provisions pursuant to 16 U.S.C. § 1456 and 15 C.F.R. Part 930.

8.3 Definitions

A. "Area of potential effect" or "APE" means the areas within which a project may directly or indirectly alter the character or use of historic properties as defined under the federal National Historic Preservation Act (36 C.F.R. §§ 800.1 through 800.16).

B. “Certified verification agent” or “CVA” means an independent third-party agent that shall use good engineering judgment and practices in conducting an independent assessment of the design, fabrication and installation of the facility.

C. “Construction and operations plan” or “COP” means a plan that describes the applicant’s construction, operations, and conceptual decommissioning plans for a proposed facility, including the applicant’s project easement area.

D. “Ecosystem based management” or “EMB” means an integrated approach to management that considers the entire ecosystem, including humans. The goal of EBM is to maintain an ecosystem in a healthy, productive and resilient condition that provides the services humans want and need.

E. “Enforceable policy” means State policies which are legally binding through constitutional provisions, laws, regulations, land use plans, ordinances, or judicial or administrative decisions, by which a State exerts control over private and public land and water uses and natural resources in the coastal zone.

F. “Geographic location description” or “GLD” means a geographic area in federal waters, consistent with the Ocean SAMP study area, where certain federal agency activities, licenses, and permit activities pursuant to 15 C.F.R. Part 930 Subparts D and E will be subject to Rhode Island review under the Coastal Zone Management Act (CZMA) federal consistency provisions.

G. “Large-scale offshore developments” means:

1. offshore wind facilities (5 or more turbines within 2 km of each other, or 18 MW power generation);

2. wave generation devices (2 or more devices, or 18 MW power generation);

3. instream tidal or ocean current devices (2 or more devices, or 18 MW power generation);

4. offshore LNG platforms (1 or more);

5. artificial reefs (1/2 acre footprint and at least 4 feet high); and

6. outer continental shelf (OCS) exploration, development, and production plans, except for projects of a public nature whose primary purpose is habitat enhancement.

H. “Marine spatial planning” or “MSP” means the process by which ecosystem-based management is organized to produce desired outcomes in marine environments.

I. “Site assessment plan” or “SAP” means a pre-application plan that describes the activities and studies the applicant plans to perform for the characterization of the project site.

8.4 Potential Effects on Existing Uses and Resources in the Ocean SAMP Area (formerly § 850)

A. Offshore renewable energy may potentially affect the natural resources and existing human uses of the Ocean SAMP area. Some effects may be negative, resulting in adverse impacts on these resources and uses. Alternatively, other effects may be neutral, producing no discernible impacts, while others may be positive, resulting in enhancements to the environment or to offshore human uses. The degree to which offshore renewable energy structures may affect the natural environment or human activities in the area varies in large part on the specific siting of a project. Careful consideration when planning the location of an offshore renewable energy facility, as well as the use of appropriate mitigation strategies during the construction, operation and decommissioning stages can minimize any potential negative impacts (MMS 2007a).

B. To date, most research on the potential effects of offshore renewable energy installations has been conducted in Europe, though some research has been conducted during the review of the proposed offshore wind farm project in Nantucket Sound by Cape Wind, LLC (MMS 2009a; U.S. Coast Guard 2009; Technology Service Corporation 2008). In anticipation of future offshore renewable energy development within the U.S., BOEM has identified potential impacts and enhancements of such development on marine transportation, navigation and infrastructure in the “Programmatic Environmental Impact Statement for Alternative Energy Development and Production” (PEIS) (MMS 2007a). These sources, as well as other scientific literature and relevant reports have informed this synthesis of the potential effects on existing resources and uses in the Ocean SAMP area. Where possible, research conducted as a part of the Ocean SAMP process has been incorporated to help further assess the potential for effects within the Ocean SAMP study area.

C. As presented in § 810.3, offshore wind energy currently represents the greatest potential for utility-scale offshore renewable energy in the Ocean SAMP area. For that reason, the focus of this section is mainly on the potential effects from the development of offshore wind energy facilities. However, many of the potential effects discussed may be similar across all forms of offshore renewable energy development and offshore marine construction in general.

D. While this section is meant to provide a summary of all potential effects of offshore renewable energy development, the potential effects of a particular project will be thoroughly examined as part of the review conducted under the National Environmental Policy Act (NEPA). The review process includes: an analysis of alternatives, an assessment of all environmental, social, and existing use impacts (i.e. ecological, navigational, economic, community-related, etc.), a review for regulatory consistency with other applicable federal laws and the implementation of mitigation measures. See § 820.4 and Chapter 10, Existing Statutes, Regulations, and Policies for more information on the NEPA review process, as well as other state and federal reviews and regulations relevant to offshore wind energy development.

E. This section begins with an examination of the potential effects of offshore renewable energy development on the physical environment through a discussion of the potential for avoided air emissions and the potential effects on coastal processes. Next, the potential effects of offshore renewable energy development on the ecological resources, including the benthic ecology, avian species, sea turtles, marine mammals and fish. Potential effects to human uses are then examined through a discussion of cultural and historic resources, commercial and recreational fishing activities, recreation and tourism and lastly marine transportation, navigation and infrastructure. The final section considers the potential cumulative effects of offshore renewable energy development.

8.4.1 Avoided Air Emissions (formerly § 850.1)

A. The development of an offshore wind farm or any other offshore renewable energy project would have implications for air emissions within the state. While the development of a project will produce some air emissions (especially during the construction stage), a renewable energy project, by not burning fossil fuels, will produce far fewer emissions of carbon dioxide and conventional air pollutants. This section summarizes the effects of air emissions produced and avoided by the development of an offshore renewable energy project.

B. Air emissions produced during conventional fossil fuel energy production include carbon dioxide, sulfur dioxide, nitrogen oxides, volatile organic compounds, particulate matter, and carbon monoxide. These pollutants have been demonstrated to have detrimental impacts to human health and the environment. Exposure to poor air quality is a major health risk and health cost in the United States. Smog and particle pollution are the cause of decreased lung function, respiratory illness, cardiovascular disease, increased risk of asthma, and the risk of premature death (U.S. Department of Energy 2008). The largest sources of sulfur dioxide emissions are from fossil fuel combustion at power plants; sulfur dioxide has been linked to respiratory illnesses and is a major contributor to acid rain (U.S. EPA Office of Air and Radiation 2009). Nitrogen oxides combine with volatile organic compounds (VOCs) to form ozone, a major component of smog. Ozone can cause a number of respiratory problems in humans, and can also have detrimental effects on plants and ecosystems, including acid rain. Additionally, nitrogen dioxide has also been shown to cause adverse respiratory effects (U.S. EPA Office of Air and Radiation 2009). The effects of carbon dioxide emissions, the major contributor to global climate change, are discussed in further detail in Chapter 3, Global Climate Change.

C. The process of siting, constructing, and decommissioning an offshore renewable energy project of any kind would entail some adverse impacts to air quality through the emission of carbon dioxide and conventional pollutants. Construction activity in the offshore environment would require the use of fossil fuel-powered equipment that will result in a certain level of air emissions from activities including pile installation, scour protection installation, cable laying, support structure and turbine installation, and other activities required for the development of a wind farm. During the pre-construction and installation stages, there would be some air emissions in the Ocean SAMP area from fossil fuel fired mobile sources such as ships, cranes, pile drivers and other equipment. Decommissioning would also result in some air emissions from the activities involved in the removal of the wind turbines, although emissions from decommissioning would be lower than those involved in construction (MMS 2009a). The size of an offshore renewable energy facility's carbon footprint will vary depending on the project, as the carbon footprint of a facility depends on project specific factors (e.g. size, location, technology, installation techniques, etc.) Any calculation of carbon footprint would include the pre-construction, construction, operation, and decommissioning phases of a project.

D. When considering the benefits of wind power displacing electricity generated from fossil fuels, the carbon dioxide (CO2) emissions of manufacturing wind turbines and building wind plants need to be taken into account as well. White and Kulsinski (1998) found that when these emissions are analyzed on a life-cycle basis, wind energy's CO2 emissions are extremely low—about 1% of those from coal and 2% of those from natural gas, per unit of electricity generated. The American Wind Energy Association has calculated that a single 1 MW wind turbine (operating at full capacity for one year) has the potential to displace up to 1,800 tons (1633 MT) of CO2 per year compared with the current U.S. average utility fuel mix (made up of oil, gas, and coal) burned to produce the same amount of energy (AWEA 2009). The generation of renewable wind energy will result in avoided future emissions of CO2 and will allow Rhode Island to meet targets set by the Regional Greenhouse Gas Initiative (RGGI) (See § 810.1).

E. Developing offshore renewable energy sources in the form of wind turbines would have a positive impact on air emissions by displacing future air emissions caused by generating electricity. The level of avoided air emissions, and the net impact from renewable energy, will be dependent upon the future demands for electricity in Rhode Island, and the proportion of this which can be met by offshore wind farms and other renewable energy sources. At the very least, an offshore wind farm would have the effect of reducing the need for adding capacity for fossil-fuel generating plants in Rhode Island and throughout New England. At present, roughly 99% of the energy generated within Rhode Island comes from combined cycle natural gas, which is considered a marginal generator, in that it provides variable output which can easily be adjusted to meet demand (ISO New England Inc. 2009c). NOx is the principal pollutant of concern for gas fired energy generation (MMS 2009a). Much of the electricity used within Rhode Island comes from the Brayton Point Power Station in Somerset, MA, the largest fossil-fueled generating facility in New England. The Brayton Point Power Station has three units that use coal and one that uses either natural gas or oil, for a combined output of over 1500 MW (Dominion 2010). The additional energy production from wind turbines would be more likely to result in avoided air emissions from natural gas plants, which are marginal and would produce less energy in the event demand was lowered because of the additional output of wind turbines. Wind energy is also a marginal source, because wind speeds and thus energy output varies. The Brayton Point Power Station, which because of its reliance on coal is mostly a baseload generator, or one that does not change short term output depending on demand (because of the difficulties in doing so), would likely continue to produce energy at the same rate. Thus air emissions from this plant would not be avoided, at least in the short term.

F. A second important benefit of switching to a zero-emission energy generation technology like wind power is impact on air quality through reduced levels of nitrogen oxides, sulfur dioxide, and mercury emitted in electrical energy generation using fossil fuels. The Cape Wind FEIS determined that a wind farm would result in the net reduction in emissions of NOx, a precursor of ozone, although only a slight reduction because of the levels of NOx still being produced by power sources elsewhere (MMS 2009a). The emissions of sulfur dioxide and nitrogen oxides have declined significantly since the early 1990s (ISO New England Inc. 2009c). However, there still may be a benefit in terms of avoided future increases in emissions of NOx and other pollutants if a project can meet increasing future energy demands. A reduction in these pollutants will have positive health effects for residents of the state of Rhode Island from the perspective of avoiding future respiratory illnesses.

8.4.2 Coastal Processes and Physical Oceanography (formerly § 850.2)

A. The following section summarizes the general potential effects of a renewable energy project on coastal processes and physical oceanography in the Ocean SAMP area. The introduction of a number of large structures into the water column may have an effect on coastal processes such as currents, waves, and sediment transport. The potential effects to coastal processes as a result of offshore renewable energy development are dependent on the size, scale and design of the facility, as well as site specific conditions (i.e., localized currents, wave regimes and sediment transport). As a result, the potential effects will vary between projects and may even vary between different parts of a project site.

B. The potential effect of offshore renewable energy structures in the water column on currents and tides have been examined using modeling techniques. Modeling of the proposed Cape Wind project found that the turbines would be spaced far enough apart to prevent any wake effect between piles; any effects would be localized around each pile (MMS 2009a). The analysis of Cape Wind demonstrated that the flow around the monopiles (which range in diameter from 3.6-5.5 m [11.8-18.0 feet] wide) would return to 99% of its original flow rate within a distance of 4 pile diameters (approximately 14.4-22 m [47.2-72.2 feet]) from the support structure (ASA 2005). Both of these studies, however, are representative of monopile wind turbine subsurface structure and may not be directly applicable to jacket-style foundations. The potential localized effects of lattice jacket structures on the hydrodynamics are likely to be even less compared to that found with monopiles as pile diameters for lattice jackets are much smaller (1.5 m [4.9 feet]) than monopiles (4-5 m [13-16.5 feet] diameter). Furthermore, the spacing between the turbines using lattice jacket support structures will be much greater than the 4 pile diameters. However, the effects of currents may be site-specific, as there could be localized currents or other conditions that could affect or be affected by the presence of wind turbines; site specific modeling may be necessary to determine impacts.

C. One predicted potential effect of wind turbines has been changes to the wave field from diffraction caused by the monopiles, and resulting changes to longshore sediment transport (CEFAS 2005). A study of the wave effects at Scroby Bank, located in the North Sea off the U.K., found no significant effects to the wave regime (CEFAS 2005). Modeling of the effects of wind farms on waves found a reduction in wave height on average of 1.5% in the region, and maximum localized amplification of wave heights at the site of the wind farm of about 0.0158 m (0.6 inches). As the modeled wind farm was moved further from shore, the wave height amplification decreased (ABP Marine Environmental Research Ltd 2002). Modeling for the Cape Wind project found that the largest wave diffraction occurred for small waves with low bottom velocities that did not cause significant sediment transport; larger waves were not affected by the presence of the turbines. Overall, the models found that the presence of turbines would have a negligible impact on wave conditions in the area (MMS 2009a). Because there are no significant changes predicted for tides and waves, there are not expected to be significant effects to sediment movement or deposition along the coastline (ABP Marine Environmental Research Ltd 2002).

D. Preliminary scaling estimates for the cumulative generation of water column turbulence due to wakes behind subsurface pilings, using parameters applicable to Ocean SAMP waters and a 100-turbine wind power generation field, suggests their influence on vertical mixing could be comparable to that due to bottom friction (Codiga and Ullman 2010c). The known persistence of stratification in much of the Ocean SAMP region during summertime suggests that bottom friction is relatively weak, and thus the effects of platform pilings are not expected to produce major, large scale changes in water column stratification. However, additional research is needed to address the extent to which the spatial patterns and seasonal cycle of stratification in Ocean SAMP waters could potentially be altered by the presence of arrays of various types (pilings, lattice jackets, etc.) of subsurface structures as infrastructure for renewable energy generation devices.

E. The turbine foundations may increase turbulence and disrupt flow around the structures, potentially causing local erosion around the structures, or “scour”. This process is caused by the orbital motion of water produced by waves and currents, and the vortices that result as the water flows around the pile of a wind turbine or another structure (MMS 2009a). Scour often results in the erosion of the sediments supporting the structure as they are transported elsewhere, forming a hole at the base. Scour can also affect sediments in areas between structures where multiple structures are present, also known as "global scour". However, because of the distances required between turbines, it has often been assumed that global scour will be limited (MMS 2007b). In addition, the use of scour protection such as boulders, grout bags or grass mattresses may be used to minimize the effects if scouring on the seafloor (MMS 2007a).

F. The seabed disturbance during construction and from scour may result in changes to sediment grain size. Smaller grains may be transported if suspended during disturbance, leaving only grains too large to be transported to remain. This could affect the structure of the benthic habitat and its associated community (MMS 2007b).

G. The placement of submarine cables will have limited and localized effects on seafloor sediments. Jet plowing, the method most likely to be used in the Ocean SAMP area, will likely result in the resuspension of bottom sediments into the water column. Heavier particles will settle in the immediate area of the activity, but finer particles are likely to travel from the disturbed area. These effects will be relatively small and short-term, however. Modeling of sedimentation during the cable laying process for the Cape Wind project found that sediment would settle within a few hundred yards of the cable route (MMS 2009a). In some cases, where suspended sediment levels are already high in the vicinity because of storms, areas of mobile surface sediment, or fishing activities such as trawling, the additional increase in sediments from cable-laying will probably not be significant. Once it is buried, the cable will not likely have any significant effect on sediments as long as it remains buried (ABP Marine Environmental Research Ltd 2002). If the cable becomes exposed, increased flow could occur above the cable, resulting in localized sediment scour (MMS 2009a).

H. The cable laying process would form a seabed scar from where the jet plow passed over. In some areas the scar may recover naturally, over a period of days to months or years depending on local tidal, current, and sediment conditions at various points along the cable route (MMS 2009a). However, depending on extent and depth of scars and the site specific conditions, areas which may not recover naturally may require the bathymetry to be restored to minimize impacts.

I. Studies on the effects of radiated heat from buried cables have found a rise in temperature directly above the cables of 0.19ºC [0.342 ºF] and an increase in the temperature of seawater of 0.000006ºC [0.0000108 ºF]. This is not believed to be significant enough to be detectable against natural fluctuations (MMS 2009a).

J. Overall, it is unlikely that wind farms will have a significant effect on wave, current, and sediment processes overall, with only small effects within the areas of the wind farms. The further to sea the wind farm is located, and the deeper water it is in, the lesser the effects to coastal processes are likely to be (ABP Marine Environmental Research Ltd 2002).

8.4.3 Benthic Ecology (formerly § 850.3)

A. Offshore renewable energy development in the Ocean SAMP area, especially offshore wind energy development, may potentially affect the benthic ecology of a project site by: disturbing benthic habitat during construction activities; introducing hard substrate that may be colonized and produce reef effects, or alter community composition; generate noise or electromagnetic fields that may affect benthic species; or impacting the water quality of an area during the installation or operation of a facility. This section summarizes the general potential effects of a renewable energy project on the Ocean SAMP area's benthic ecosystem; potential effects of these phenomena on species groups (e.g., birds, marine mammals, and finfish) are detailed below in separate sections.

B. Undoubtedly, the construction of large, offshore structures will result in effects to coastal processes and to benthic habitats and species, at least in the immediate vicinity of the turbine installation. However, it may be a challenge to accurately assess changes in the benthic ecology of the Ocean SAMP area unless a good baseline is established. Studies of European offshore renewable energy projects, the PEIS (MMS 2007a) and the Cape Wind FEIS (MMS 2009a) provide some insight into the range of potential ecological effects offshore wind energy development, though the specific effects produced within the Ocean SAMP area will vary depending on site specific conditions and the size and design of the proposed project.

C. Benthic habitat disturbance (formerly § 850.3.1)

1. The PEIS indicates that habitat disturbance may result through the construction of offshore renewable energy infrastructure (MMS 2007a). Here, habitat disturbance is used broadly to refer to sediment disturbance and settling; increased turbidity of the waters in the construction area; and the alteration or loss of habitat from installation of infrastructure including piles, anti-scour devices, and other structures.

2. Sediment disturbance caused by the installation of foundations or underwater transmission cables may result in the smothering of some benthic organisms as suspended sediments resettle onto the seafloor (MMS 2007a). Smothering would primarily affect benthic invertebrates as most finfish and mobile shellfish would move to nearby areas to avoid the construction site (MMS 2007a). The eggs and larvae of fish and other species may be particularly susceptible to burying (Gill 2005). Smaller organisms are more likely to be affected than larger ones, as larger organisms can extend feeding and respiratory organs above the sediment (BERR 2008). Sediment also has the potential to affect the filtering

mechanisms of certain species through clogging of gills or damaging feeding structures; however, most species in the marine environment likely have some degree of tolerance to sediment and this effect is likely to be minimal (BERR 2008). In the Ocean SAMP area, species that may be impacted by the settling of sediments include eastern oysters (Crassostrea virginica) and northern quahogs (Mercenaria mercenaria), among others, resulting in mortality or impacts to reproduction and growth (MMS 2009a).

3. In addition to the disturbance of sediments, construction of the foundation substructure and the installation of cables may result in increased turbidity in the water column. This may in turn affect primary production of phytoplankton and the food chain; however, these effects are likely to be short-term and localized, as sediments will likely settle out after a few hours or be flushed away by tidal processes (MMS 2009a). Increased turbidity in a project area is generally temporary and will subside once construction has been completed (Johnson *et al*. 2008). Sediment suspension times will vary according to particle size and currents. In Nantucket Sound, sediments were predicted to remain suspended for two to eighteen hours, and the amount of sediment suspended would be minimal compared with normal sediment transport within the region due to typical tidal and current conditions (MMS 2009a). This may impact the abundance of planktonic species by decreasing the availability of light in the water column. Sediment suspended during the construction or decommissioning activities and transported by local currents may result in impacts to neighboring habitats, perhaps posing a temporary risk of smothering to nearby benthic species. Sediment transport in the Ocean SAMP area will need to be further modeled to predict the potential effects to turbidity from construction of offshore wind turbines.

4. Habitat conversion and loss may result from the physical occupation of the substrate by foundation structures or scour protection devices. Steel foundations and scour protection devices, which may be made up of rock or concrete mattresses, may modify existing habitat, or create of new habitat for colonization (Johnson *et al*. 2008). The direct effects of these hard structures to the seabed are likely to be limited to within one or two hundred meters of the turbine (OSPAR 2006). Additionally, cables will need to be installed between turbines, and this will require temporarily disturbing the sediment between the turbines. The total area of seabed disturbed by wind turbine foundations is relatively small compared to the total facility footprint. The scour protection suggested for the Cape Wind project around each monopile vary depending on the pile and the location, though the total scour protection area of 47.82 acres (0.19 square kilometers). Compared to the total footprint of the Cape Wind project (64 km2 or 15,800 acres), the area affected by scour protection equals only 0.3% (MMS 2009a).

5. In addition to physically changing benthic habitat, the placement of wind turbines, especially in large arrays, may alter tidal current patterns around the structures (see § 8.4.2 of this Part, Coastal Processes and Physical Oceanography), which may affect the distribution of eggs and larvae (Johnson et al. 2008). However, a study of turbines in Danish waters found little to no impact on native benthic communities and sediment structure from a change in hydrodynamic regimes (DONG Energy *et al*. 2006). Studies conducted at wind farms in the North Sea did not find significant changes in the benthic community structure that could be related to changes in the hydrodynamics as a result of the placement of in-water wind turbine structures (DONG Energy *et al*. 2006). See Chapter 2, Ecology of the SAMP Region for more information on physical oceanography and primary production in the Ocean SAMP area.

6. The installation and burial of submarine cables can cause temporary habitat destruction through plowing trenches for cable placement, and may cause permanent habitat alteration if the top layers of sediment are replaced with new material during the cable-laying process, or if the cables are not sufficiently buried within the substrate. Likewise, cable repair or decommissioning can impact benthic habitats. The effect of the cables will depend on the grain size of sediments, hydrodynamics and turbidity of the area, and on the species and habitats present where the cable is being laid. Cables are usually buried in trenches 2 m (6.6 feet) wide and up to 3 m (9.8 feet) in depth (OSPAR 2008). Disturbance to the seabed during cable-laying may also result from anchor and chain damage from the installation barge, as the barge will have to repeatedly anchor along the length of the cable route (MMS 2007b). In addition, sediments disturbed in the cable-laying process may contain contaminants, and these may be dispersed in the process. However, most contaminated sediments are likely to be found close to the coast, unless the cable route passes close to a disposal site (BERR 2008).

7. In many cases, the seabed is expected to return to its pre-disturbance state after cable installation. The extent of the impacts from cable laying may depend on the amount of time it takes for the natural bathymetry to recover. Post-construction monitoring may be used to track the recovery of a project site. On rock or other hard substrates where the seabed may not recover easily, backfilling may be required, or else permanent scarring of the seabed may result. Scars along the bottom may impact migration for benthic animals. Species found in rock habitats tend to be sessile (permanently attached to a substrate), either encrusting or otherwise attached to the rock, and are therefore more susceptible to disturbance (BERR 2008). Clay, sand, and gravel habitats are typically less affected. Undersea cables can also cause damage to benthic habitat if allowed to "sweep" along the bottom while being placed in the correct location (Johnson *et al*. 2008). Initial re-colonization of the site by benthic invertebrates takes place rapidly, sometimes within a couple of months

(BERR 2008). In deeper waters, where disturbance of the seabed occurs with less frequency, recovery to a stable benthic community can take longer than in shallow waters, sometimes years. Generally, the effect on the benthic ecology will not be significant if the cabling is done in areas where the habitat is homogenous. However, if the cabling activity takes place in areas of habitat that are rare or particularly subject to disturbance, the effects could be greater (BERR 2008). The most serious threats are to submerged aquatic vegetation, which serves as an important habitat for a wide variety of marine species. Shellfish beds and hard-bottom habitats are also especially at risk (Johnson *et al*. 2008). Shellfish in particular are usually not highly mobile, and cannot relocate during the cable-laying process. Biogenic reefs made up of mussels or other shellfish may become destabilized if plowing for cable-laying damages the reefs (BERR 2008).

8. The magnitude of the habitat disturbance effects depends on the duration and intensity of the disturbance, and on the resilience of species living within the sediment (Gill 2005). The expected effects are a local loss of sedentary fauna living in the substrate, with mobile bottom-dwellers being displaced from the area (Gill 2005). During the construction and decommissioning phases of a project, the eggs and larvae of many fish species may be vulnerable to being buried or removed. After the activity has ceased, recolonization may take months or years (Gill 2005). Studies conducted on Danish wind farms found the effects on benthic communities from burial by sediment were minimal when monopiles were used, and the effects were both temporary and had limited spatial distribution. Effects to the benthic community were limited primarily to the area immediately surrounding the pile driving activity (DONG Energy *et al*. 2006). Studies of the effects of sediment displacement from cable laying found macro algae and benthic infauna were still recovering two years after the activity had ceased (DONG Energy *et al*. 2006).

9. The recovery period, or the time required for an area disturbed by construction related activities to return to its pre-construction state, will vary between sites. For example, research on the effects of trawling on the seabed have found that benthic communities in habitats already subject to high levels of natural disturbance will be less affected by trawling disturbance than more stable communities (Hiddink *et al*. 2006). Typically, habitats such as coarse sands are in general more dynamic in nature and therefore recover more rapidly after disturbance than more stable habitat types where physical and biological recovery is slow (Dernie *et al*. 2003). Disturbance from the construction of wind turbine towers and laying cable is likely to produce similar results. A few studies of dredging found that recovery times are roughly six to eight months for estuarine muds, two to three years for sand and gravel bottoms, and up to five to ten years for coarser substrates (e.g. Newell *et al*. 1998).

10. See below for the potential effects of benthic habitat disturbance on Ocean SAMP area species including birds, sea turtles, marine mammals, and fisheries resources.

D. Reef effects (formerly § 850.3.2)

1. Offshore renewable energy development, especially offshore wind development, will result in the presence of man-made structures in the water column and on the seafloor. These hard structures, such as the foundation structures and scour protection devices, will introduce new habitat into the area that did not previously exist. In this way, wind turbine structures may serve as artificial reefs, in providing surfaces for non-mobile species to grow on and shelter for small fish (Wilhelmsson *et al*., 2006). Any man-made structure in the marine environment is usually rapidly colonized by marine organisms (Linley *et al*., 2007). Fouling communities will colonize the hard structure and will create new pathways for nutrients to be moved from the water column to the benthos (Gill and Kimber 2005). Once a structure such as a wind turbine has been erected, it increases the heterogeneity of the habitat. The physical structure represents more colonization opportunities for invertebrates, as they have more surface area. This in turn increases the number of food patches available, as food resources generally are not uniformly distributed in coastal waters (Gill and Kimber 2005). This will cause a fundamental shift in the overall food web dynamics of the ecosystem, and may result in further shifts in benthic community diversity, biomass and organic matter recycling (Gill and Kimber 2005). Because some European offshore renewable energy facilities have been closed to fishing activity (see § 8.4.8 of this Part, Commercial and Recreational Fishing), the ecological effects observed in these facilities may be in part due to decreased fishing disturbances. Researchers in the North Sea (DONG Energy *et al*., 2006) found that a reduction in fishing activity complicates their ability to assess ecological change from wind farm development; there is no good information for ecosystem functioning prior to or without fishing activity impacts and therefore difficult to establish any cause-and-effect.

2. In places where the wind turbines are under threat from erosion, large boulders are often used as scour protection; these also serve as an artificial reef of their own (Petersen and Malm 2006). Scour protection also provides hard surfaces for colonization by fouling communities, as well as providing crevices and structural complexity likely to attract fish and invertebrate species seeking shelter (MMS 2007b).

3. It has been found that although colonizing communities on offshore structures may vary depending on geographic location and a number of other factors after initial colonization, the differences are likely to decrease over the years as more stable communities develop (Linley *et al*. 2007). Colonizing communities will develop through the process of succession,

where early colonizing species are subsumed by secondary colonizers, leading to what is known as the climax community, or the stable end point in the colonization process. It may take five to six years for the climax community to develop at a given site (Whomersley and Picken 2003, in Linley *et al*. 2007).

4. The changes likely to be brought about by the reef effect of the turbines are not universally considered to be beneficial. The changes in abundance and species composition could degrade other components of the system, potentially pushing out other species found in the particular habitat where construction is taking place. In particular, this could affect vulnerable or endangered species through factors such as loss of habitat, increased predation, or increased competition for prey as the composition of the benthic community shifts to that of a hard bottom community (Linley *et al*., 2007).

5. The diversity and biomass of the colonized structures will depend in part on the choice of material, its roughness (rugosity), and overall complexity. Concrete attracts benthic organisms; however, when used in sub-marine construction, it is often coated with silane or silicone, which deters the settling of organisms. Smooth steel monopiles, which are often painted, tend to attract barnacles (Balanus improvisus) and filamentous algae (Petersen and Malm 2006). The scaffolding used for oil and gas rigs provides more structural complexity than monopile foundations; the same is likely to be true for a jacketed structure for a wind turbine. These rougher, complex structures offer more protection from predators and from high velocities and scour (MMS 2009a).

6. Another factor influencing the colonization of wind turbine structures will be the orientation of the structures to the prevailing currents. Current speed and direction can influence food availability, oxygen levels and the supply of larval recruits to an area. As a result, structures more exposed to local currents may be more colonized than other installations within the facility. Furthermore, structures with more complex shapes will offer a greater range of localized hydrographic conditions, offering more potential for colonization and greater biodiversity (Linley *et al*. 2007). Colonization of structures will be dependent on sufficient numbers of larvae present in the area, and on suitable environmental conditions (Linley *et al*. 2007).

7. Often barnacles are the first colonizers of the intertidal zone, while algae such as red seaweeds and kelp, along with mussels, will dominate colonization starting at 1 to 2 meters below the surface. Colonies based on mussels will also attract scavengers such as starfish and flounder. In addition to mussels, some structures may instead be colonized by a grouping of species including anemones, hydroids, and sea squirts. The larvae present in the water column will vary depending on the time of year, so colonization may be dependent on the time of year in which the

structures are erected. Community structure will also be dependent on the presence of predators and on secondary colonizers (Linley *et al*. 2007). Other species found within the Ocean SAMP area that are likely to be early colonizers include algae, sponges, and bryozoans, and other secondary colonizers are likely to include polychaetes, oligochaetes, nematodes, nudibranchs, gastropods, and crabs (MMS 2009a). These substantial colonies of invertebrates will attract fish to the structures, resulting in a reef effect around the support structures. For more on reef effects and the attraction of fish, see § 8.4.7(G) of this Part below.

8. Studies conducted in Denmark (Dong Energy et al. 2006) at two wind farms sites (Nysted, 76 turbines; Horns Rev, 80 turbines) has shown major changes in community structure of the offshore ecosystem from one based on infauna, or invertebrates that live within the substrate, to that of a hard bottom marine community and a commensurate increase in biomass by 50 to 150 times greater.

9. Wind turbines in the Baltic Sea built on monopiles are almost entirely encrusted with a monoculture of blue mussels (Mytilus edulis), which may be the result of a lack of predation and competition from other species (Petersen and Malm 2006), as well as from low salinity in the area where the turbines have been constructed. Mussels provide a hard substratum used by macroalgae and epifauna, and therefore have the potential to induce further change in the ecosystem by providing more surface area for colonization. Colonization of wind farms will be determined partly through zonation, the distribution of various communities of organisms at different depths in the water column. A study of the Nysted offshore wind farm found high concentrations of blue mussels on the wind turbine foundations, with mussel biomass increasing closer to the surface, although in the highest zonation, in the upper one meter of depth, the foundation was instead colonized by barnacles. The biomass of barnacles was determined, through modeling techniques, to be seven to eighteen times higher on the foundation close to the surface than on the scour protection. The extent to which these mussels serve as an artificial reef and increase productivity and biomass will depend on the ecosystem feedback between the mussel colonies and the pelagic and benthic environments around them, such as whether other invertebrates colonize the mussels, and whether fish and other animals utilize these colonies for food and shelter (Maar *et al*. 2009). On oil and gas platforms in California, the structures are encrusted with mussels, at least at depths above 100 feet (30.5 m); as mussels are knocked off the platforms and accumulate at the bottom, they create shell mounds on the seafloor which provide a secondary habitat for fish and other species (Love *et al*. 2003).

10. A study of the effects of the Horns Rev wind farm in Denmark found a shift in the benthic community from the indigenous infaunal community to an epifouling community associated with hard bottom habitats as both the

monopiles and the scour protection were colonized by algae and invertebrates. Two species of amphipods (Jassa marmorata and Caprella linearis) were the most abundant species found on the turbines, and a total of seven species of invertebrates, including the two amphipods, the common mussel (Mytilus edulis), a barnacle species (Balanus cretanus), the common starfish (Asteria rubens), the bristle worm (Pomatoceros triqueter), and the edible crab (Cancer pagurus) made up 94% of the total biomass on the structures. There were also eleven taxa of seaweeds found on the monopiles and the scour protection. The monopiles and scour protection were found to be hatchery or nursery grounds for a number of invertebrates, including crabs. The wind turbine substructure and scour protection were found to house two species of worms new to this area, and considered threatened elsewhere in the region. The result of this new community has been an estimated 60-fold increase in the availability of food for fish and other organisms in the area compared with the original benthic community (Leonhard and Pedersen 2005). For information on the potential future uses associated with the epifouling communities formed on offshore wind energy turbines see Chapter 9, Other Future Uses.

11. Conversely, one study conducted at the Nysted offshore wind farm in Denmark, found an overall decline in biomass measured over three years. The encrusting community at this site had evolved to become almost a monoculture of mussels. This particular area is brackish; the lack of sea stars, an important mussel predator, was attributed to the low salinity. Similar changes were observed at a test site; it was concluded that these were the result of natural variations rather than an effect of the wind turbines (MMS 2007b).

12. If scour holes form in the sea bed adjacent to the turbines, these holes may be attractive habitat to species such as crab and lobster, and to some fish species, furthering the reef effect of the structures (Rodmell and Johnson 2002). For more on effects on scour and the physical oceanography of the Ocean SAMP area from wind turbines, see § 8.4.2(E) of this Part.

13. If periodic cleaning of the encrusting organisms on the structure base occurs, the community will be more or less permanently in the early-colonization phase, and will not develop through succession into a more mature climax community with greater biodiversity. Instead, after each cleaning a new community will redevelop on the structure, with the species composition varying based on the season, depending on which larval species are present in the water column at the time. Moreover, if shells are periodically removed, the discarded debris may attract scavenging animals, and may serve to create new habitat on the seafloor where they accumulate (Linley *et al*. 2007).

14. The reef effect is particularly relevant to fisheries resources as well as other species groups; see sections on marine mammals, fish, and sea turtles below for further discussion.

E. Changes in community composition (formerly § 850.3.3)

1. Wind energy and other offshore renewable energy projects could have indirect ecological effects that could affect the benthic community. A change in the type and abundance of benthic species can be expected at the turbine sites, which will change food availability for higher trophic levels. Studies of habitat disturbance resulting from fishing or dredging activity have shown effects on local species diversity and population density; the effects of offshore renewable energy projects are likely to be similar (as suggested by Gill 2005). The magnitude of these effects depends on the duration and intensity of the disturbance, and on the resistance and resilience of species living within the sediment. The expected effects are a local loss of sedentary fauna living in the substrate, with non-sedentary bottom-dwellers being displaced from the area.

2. Because the placement of wind turbines will increase habitat for benthic species, the structures will have the effect of increasing local food availability, which may bring some fish and other mobile species into the area. This may increase use of the area by immigrant fauna. More adaptable species will probably dominate the area under these new ecological conditions. The change in prey size, type, and abundance in the vicinity of the structures may also affect predators. Predators moving into the area may result in prey depletion (Gill 2005).

3. The PEIS (MMS 2007a) indicates that the removal and deposition of benthic sediments associated with construction may result in the smothering of some benthic organisms within the footprint of the towers or along the cable route. Smothering would be a problem primarily for sedentary invertebrates as most finfish and mobile shellfish would be expected to move out of the way of incoming sediment (MMS 2007a). Studies conducted on Danish wind farms found the impacts on benthic communities from burial by sediment were minimal when monopile substructures were installed, and the impacts were both temporary and had limited spatial impact (DONG Energy *et al*. 2006). The recolonization of an area disturbed during the construction process may take months or years (Gill 2005). Studies of the impacts of sediment displacement from cable laying found macro algae and benthic infauna were still recovering two years after the activity had ceased (DONG Energy *et al*. 2006).

4. If fishing pressure is reduced in the areas around the turbines as a result of fewer fishing vessels in the vicinity of the turbines, this could have impacts on the community as a whole, both from a reduction on fishing mortality of some species and a resulting increase in predation by these

species on others (MMS 2007b). For example, in the Horns Rev wind farm, an increase in bivalves and worms inside of the park was attributed to a decline in predation from scoters (a waterfowl species), who were avoiding the wind turbines (Leonhard and Pedersen 2005). At the Nysted wind farm in Denmark, densities of sand eels were found to increase by 300 percent between 2002 and 2004. The increase was likely attributable to either a decrease in sand eel predation, or a decrease in fishing mortality (Jensen *et al*. 2004, in MMS 2007b).

5. There is also a possibility that invasive species may colonize the structures (MMS 2007a). The disturbances caused by the placement of new structures may make the area more susceptible to invasion by non-native species (Petersen and Malm 2006). Monitoring at Denmark's Horns Rev wind farm in 2004 found an invasive species of tube amphipod, Jassa marmorata, not previously seen in Denmark, to be the most abundant invertebrate found on hard bottom substrate in the area (DONG Energy and Vattenfall 2006).

6. Didemnum spp., a particularly aggressive invasive tunicate (sea squirt) of unknown origin, arrived in the New England region in the late 1980s and has become firmly embedded in the aquatic community from Eastport, ME to Shinnecock, NY (Bullard *et al*. 2007). There are no known, consistent predators of this species, which grows rapidly on hard structure to depths of 80 m (262.5 feet). This sea squirt could be problematic on new subsurface structures placed in the Ocean SAMP area, potentially colonizing the structure and competing with native species for planktonic food resources. Furthermore, this species is known to be able to regenerate entire individuals from fragments (Bullard *et al*. 2007), such as might be formed during maintenance procedures to control biofouling on wind turbine support structures, for instance. Didemnum is known to grow particularly well in areas that are well-mixed (Valentine *et al*. 2007); it is unknown if the turbulence created downstream of subsurface structure, wind turbine pilings for instance, would further promote conditions that favor this organism. See Chapter 2, Ecology of the SAMP Region for more information on invasive species in the Ocean SAMP area.

7. One study of the North Hoyle wind farm in the UK found that variability in benthic organisms taken from surveys around the wind farm pre- and post-construction was more likely related to natural variability, such as localized sediment composition, than to any effects caused by the construction or operation of the wind farm (NWP Offshore Ltd. 2007).

8. The decommissioning of wind turbines would also have significant ecological effects, as the new habitat and accompanying species are removed. Habitat heterogeneity would be immediately reduced, removing a large component of the benthic community (Gill 2005).

9. In summary, the significant human activity resulting from the wind turbines would be likely to have significant effects upon the food web, but just what those effects are is unknown.

10. See § 8.4.7(G) of this Part below for the potential effects of changes in community composition on fisheries and fishery resources.

F. Noise (formerly § 850.3.4)

1. Underwater noise may be generated during all stages of an offshore renewable energy facility, including during pre-construction, construction, operation and decommissioning. The potential effects of noise from offshore renewable energy are especially a concern for marine mammals and fish species (see §§ 8.4.5 and 8.4.7 of this Part) It is not understood whether the noise generated in the construction, operation, and decommissioning of a wind turbine array would have an effect on invertebrate species in the benthic environment. Few marine invertebrates have the sensory organs to perceive sound pressure, although many can perceive sound waves (Vella *et al*. 2001 in MMS 2007b). Studies on the potential impact of air guns on squid have found few behavioral or psychological effects unless the organisms are within a few meters of the source (MMS 2007b). If there is any effect to these species, it is likely to be much less than any potential effects to fish or marine mammals (Linley *et al*. 2007).

G. Electromagnetic fields (EMF) (formerly § 850.3.5)

1. Underwater transmission cables used to carry the electricity from an offshore renewable energy facility back to shore produce magnetic fields around the cables, both perpendicularly and in a lateral direction around the cable. While the design of industry standard AC cables prevents electric field emissions, magnetic field emissions are not prevented. These magnetic emissions induce localized electric fields in the marine environment as sea water moves through them. Furthermore, in AC cables the magnetic fields oscillate, and thereby also create an induced electric field in the environment around the cables, regardless of whether the cable is buried. Thus the term electromagnetic field, or EMF, refers to both of these fields (Petersen and Malm 2006). While EMF is primarily an issue for fish, sharks and rays (see § 8.4.7 of this Part), some invertebrate species, such as a variety of crustacean species, have demonstrated magnetic sensitivity and could be affected by EMF. These animals may become disoriented; it is not known whether this will have a small or a significant impact on these animals, although the likely impact is believed to be small (BERR 2008). For more information on the effects of electromagnetic fields, see § 8.4.8 of this Part, Fish and Fisheries Resources.

2. If electromagnetic fields affect the presence or behavior of species likely to colonize wind turbine structures, this could have an effect on the potential reef effects of the structures. However, the interaction between most invertebrates and EMF is not known, and the existence of healthy communities of colonizing species on turbine structures in Europe indicates EMF will not have a significant impact on at least these species assemblages (Linley *et al*. 2007).

H. Water quality impacts (formerly § 850.3.6)

1. Offshore renewable energy facilities would result in increased vessel traffic through the site characterization, construction, operation, and decommissioning phases. The PEIS indicates that such an increase in traffic could increase the likelihood of fuel spills as a result of vessel accidents or mechanical problems, though it indicates that the likelihood of such spills is relatively small (MMS 2007a). In addition, wastewater, trash, and other debris may be generated at offshore energy sites by human activities associated with the facility during construction and maintenance activities (MMS 2007a, Johnson *et al*. 2008). The platforms may hold hazardous materials such as fuel, oils, greases, and coolants. The accidental discharge of these contaminants into the water column could affect the water quality around the facility; however these contaminants would likely remain at the surface and not impact benthic ecosystems (MMS 2007a). In the PEIS, BOEM indicates that the potential risk to water quality from offshore renewable energy development is negligible to minor (MMS 2007a).

2. Water quality may also be impacted during the construction process by re-suspending bottom sediments, increasing the turbidity within the water column. For the potential effects of water quality impacts on birds, marine mammals, and fish, see sections below.

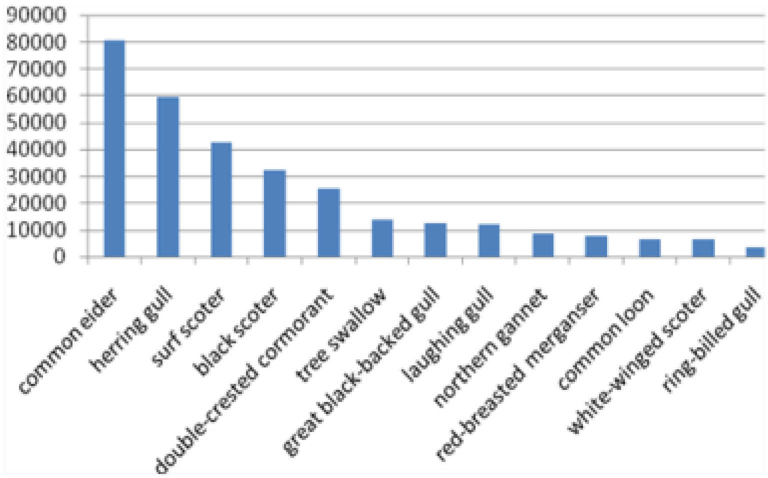
8.4.4 Birds (formerly § 850.4)

A. Offshore renewable energy may have a variety of potential effects on avian species in the Ocean SAMP area. Some effects may be negative, resulting in adverse impacts, other effects may be neutral, producing no discernible impacts, while others may be positive, resulting in enhancements. The purpose of this section is to provide an overview of all the potential effects of offshore renewable energy development on birds, including the potential for habitat displacement or modification; disturbances associated with construction activities and/or vessel traffic; avoidance behavior or changes in flight patterns; risk of collision with installed structures; the risk of exposure to pollutants accidentally discharged during construction, operation or decommissioning. Potential affects to birds in the Ocean SAMP area will vary based on the species, as well as on the particular site, and size of the project. The timing of construction or decommissioning of an offshore renewable energy facility, along with the cumulative impacts of other offshore developments will also have an effect on the degree of impact.

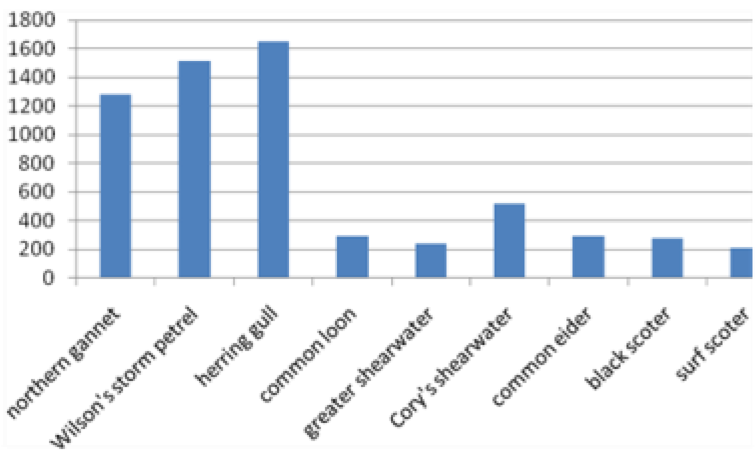
B. Key to measuring and understanding the effects of offshore renewable energy development on avian species requires first sufficient baseline data on the abundance, distribution, habitat use and flight patterns in the project area. Baseline studies provide an important comparison point for assessing the effects of pre-construction, construction, operation or decommissioning activities. The duration of baseline studies may vary between project areas to account for 'natural variability' observed in avian use of an area. Locations that experience large fluctuations in avian densities over time may require additional baseline monitoring to accurately assess pre-construction conditions (Fox *et al*. 2006).

C. Research conducted by Paton et al. (2010) for the Ocean SAMP has collected baseline data on species occurrence and distribution in the Ocean SAMP area through land-based, ship-based and aerial surveys, as well as through radar surveys from 2009 to 2010, although the exact time period of surveys varied by survey technique. The goal of this research is to assess current spatial and temporal patterns of avian abundance and movement ecology within the Ocean SAMP boundary. Preliminary analysis of the surveys conducted in nearshore habitats during land-based point counts from January 2009 to February 2010 recorded 121 species and over 460,000 detections in the nearshore portion of the Ocean SAMP area (Figure 8.37 in § 8.4.4(C)(1) of this Part; Paton et al. 2010). Observations during these nearshore surveys have demonstrated that a wide range of birds use the Ocean SAMP area, including seaducks (e.g., eiders and scoters), other seabirds (e.g., loons, cormorants, alcids and gannets), pelagic seabirds (e.g., storm petrel and shearwaters), terns and gulls, shorebirds, passerines and other land birds (e.g., migrating species and swallows). The most abundant bird species observed in nearshore habitats in the Ocean SAMP area during land-based surveys were Common Eider (Somateria mollissima), Herring Gull (Larus argentatus), Surf Scoter (Melanitta perspicillata), Black Scoter (Melanitta nigra), Double crested Cormorant (Phalacrocorax auritus), Tree Swallow (Tachycineta bicolor), Great Black-backed Gull (Larus marinus), Laughing Gull (Leucophaeus atricilla), and the Northern Gannet (Morus bassanus) (see Figure 8.37 in § 8.4.4(C)(1) of this Part) (Paton et al. 2010). Farther offshore, more pelagic species were detected during boat-based surveys conducted from June 2009 to March 2010. During boat-based surveys, which sampled eight 4 by 5 nm grids, 55 species were detected from 10,422 detections (see Figure 8.38 in § 8.4.4(C)(2) of this Part). In offshore areas, Herring Gulls, Wilson's Storm-Petrels (Oceanites oceanicus), Northern Gannets, Great Black-backed Gulls, White-winged Scoters (Melanitta fusca) were among the most commonly detected species.

1. Figure 8.37: Most abundant species observed in nearshore habitats of the Ocean SAMP study area based on land-based point counts from January 2009 to January 2010 (Paton *et al*. 2010). (Note: Total detections = 465,039)



2. Figure 8.38: Most abundant species observed in offshore habitats based on ship-based point counts in the Ocean SAMP study area from Mar 2009–Jan 2010 (Paton *et al*. 2010).



D. Species distribution and abundance varied both spatially and seasonally in the Ocean SAMP area. Most birds that use the Ocean SAMP area are migratory, so that their occurrence is highly seasonal. Paton *et al*. (2010) have found high inter-annual variability in the abundance and distribution of avian species in the Ocean SAMP area, suggesting that the collection of long-term baseline data prior to construction and operation of an offshore renewable energy facility will be important in examining any potential effects to avian species. For further discussion of the findings of Paton *et al*. (2010) see Chapter 2, Ecology of the SAMP Region.

E. In addition to recording occurrence and abundance in the Ocean SAMP area, Paton *et al*. (2010) have also identified potential foraging habitat for avian species. Based on a literature review performed by Paton *et al*. (2010) nearshore habitats, with water depths of less than 20 m [66 ft], are believed to be the primary foraging habitat for seaducks (see Table 8.13 in § 8.4.4(E)(1) of this Part). Figure 8.39 in § 8.4.4(F)(1) of this Part illustrates the areas within the Ocean SAMP boundary with water depths less than 20 m (66 feet) and therefore is thought to represent the primary foraging habitat for the thousands of seaducks that winter in the Ocean SAMP waters. Preferred sea duck foraging areas are strongly correlated with environmental variables such as water depth, bottom substrate, bivalve community, and bivalve density (Vaitkus and Bubinas 2001). Currently, bathymetric data (water depth, bottom substrate) of the Ocean SAMP area is well known, but relatively little is known about bivalve community and bivalve density, especially further offshore. Foraging depths of seaducks differ among species and are a function of preferred diet, but average depths tend to be less than 20 meters (66 feet) for most species. Common eiders forage in water less than 10 m (33 feet) during the winter when diving over rocky substrate and kelp beds (Goudie *et al*. 2000; Guillemette *et al*., 1993). Preferred diet of common eider changes with season and foraging location, but mainly consists of mollusks and crustaceans (Goudie *et al*. 2000; Palmer 1949; Cottam 1939). Maximum diving depths of scoters are about 25 m (82 feet), although most birds probably forage in water less than 20 meters (66 feet) deep, particularly during the winter months (Vaitkus and Bubinas 2001; Bordage and Savard 1995). Scoter diet in marine environments predominantly consists of mollusks (Bordage & Savard 1995; Durinck *et al*. 1993; Madsen 1954; Cottam 1939). Paton *et al*. (2010) did detect seaducks in waters up to 25 meters (82 feet) deep during aerial surveys, although it was unclear from the aerial surveys if the seaducks were foraging or engaging in other behaviors such as roosting. Paton *et al*. (2010) suggest more detailed research be conducted to better understand the depths used for foraging by scoters or eiders in the Ocean SAMP area.

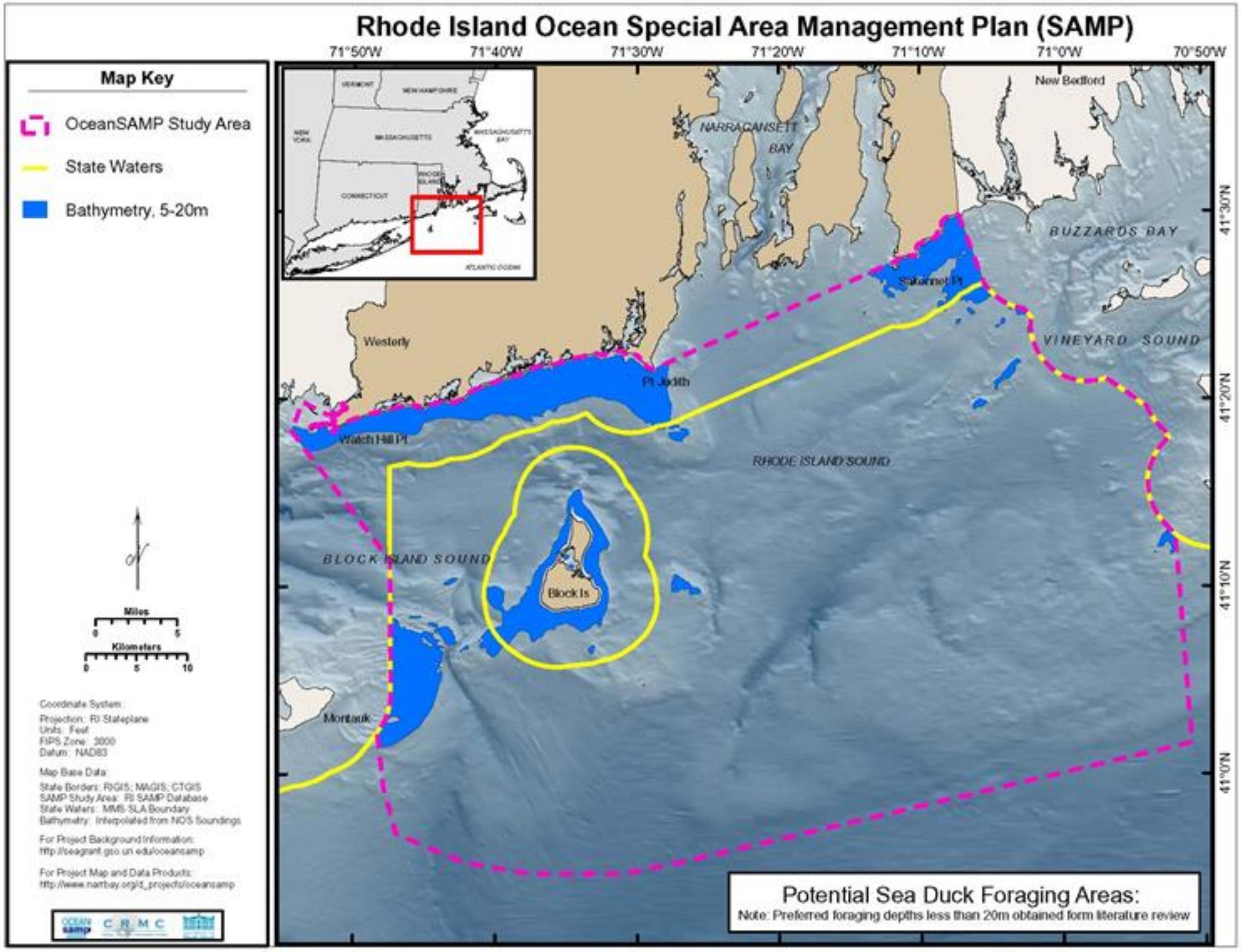
1. Table 8.13: Foraging depths of seaducks based on a literature review (Paton *et al*. 2010).

Species	**Dive depth**	**Source**
Common eider	0-15 m (0-49 feet).	Ydenberg and Guillemetter 1991
Surf Scoter - day	90% of dives <20 m (66 feet) depth during diurnal period – used deeper waters at night – but rarely dived at night.	Lewis *et al*. 2005
White-winged Scoter-day	~90% of diver <20 m (66 feet) depth - used deeper waters at night – but rarely dived at night.	Lewis *et al*. 2005

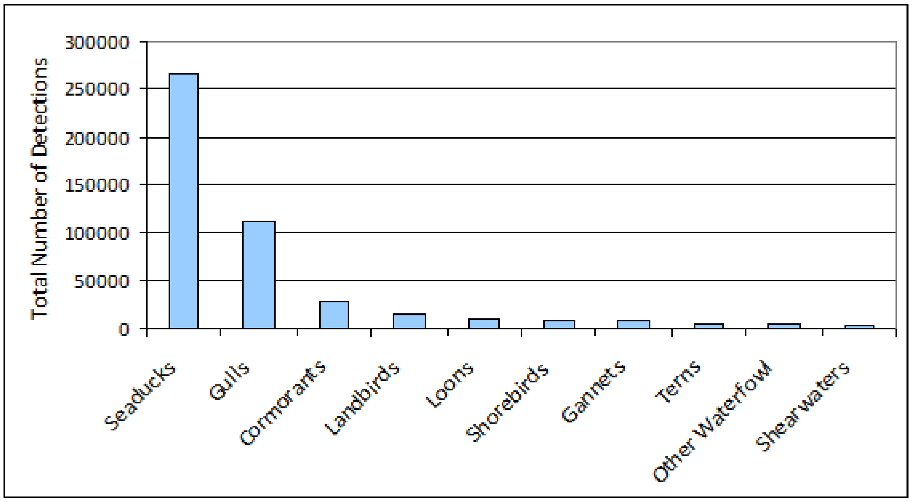
Black Scoter	>95% of observations were in waters <20m (66 feet) deep.	Kaiser *et al*. 2006
Common Eider	100% <16 m (52.5 feet) deep.	NERI Report 2006
Black Scoter	100% <20 m (66 feet) deep.	NERI Report 2006

F. Land-based surveys conducted by Paton et al. (2010) support the findings of the literature review, as large concentrations of seaducks (e.g. scoters and eiders) have been recorded in these nearshore areas, particularly off Brenton Point (see Figure 8.39 in § 8.4.4(F)(1) of this Part). Because one potential effect of offshore renewable energy development may include permanent habitat loss, identifying and avoiding potentially important foraging habitat prior to siting future projects may help to minimize any adverse impacts.

1. Figure 8.39: Potential foraging areas for seaducks within and adjacent to the Ocean SAMP boundary (based on a literature review by Paton *et al*. 2010)

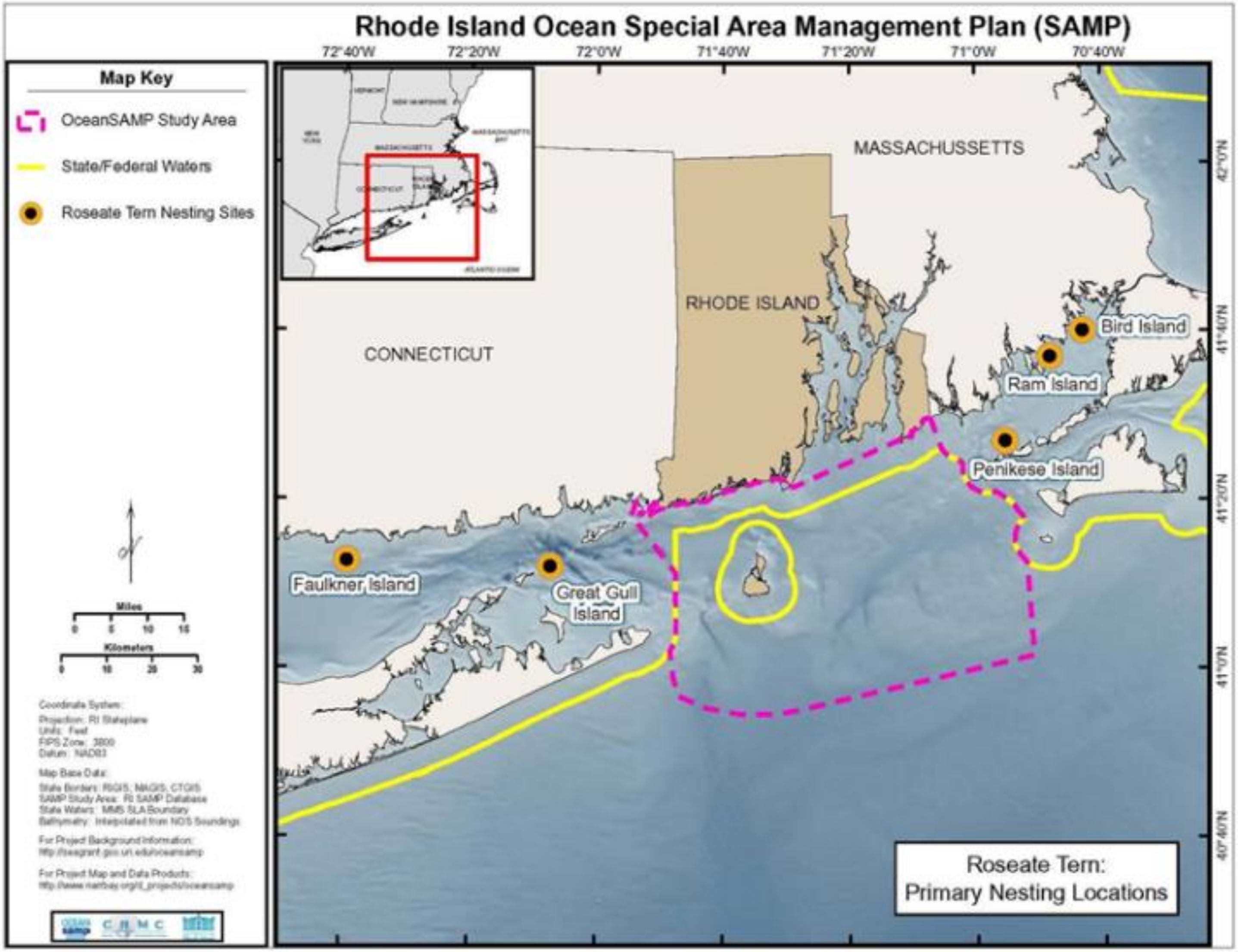


2. Figure 8.40: Total number of detections for the most abundant guilds observed in nearshore habitats during land-based point counts, Jan 2009-Feb 2010 (Paton *et al*., 2010). (Note: Total Number of detections = 465,039; Total Number of Species Recorded= 121)



G. When assessing the potential effects of offshore renewable energy development, the impact on endangered or threatened species are of particular concern, mainly because the magnitude of the potential impact may be much more severe to these species due to their low population numbers (MMS 2007a). The one federally-listed endangered bird using the Ocean SAMP area is Roseate Tern (*Sterna dougalli dougalli*). This species is a long-distance migrant that spends the summer months in New England, including within the Ocean SAMP area (Paton *et al*. 2010). Although this species does not nest in Rhode Island, there are nesting colonies in Connecticut, New York, and Massachusetts that are close enough that foraging adults from nesting colonies may use Ocean SAMP waters (see Figure 8.41 in § 1.4.4(G)(1) of this Part). Terns may travel substantial distances, 25.8 to 30.6 km [16 to 19 miles] from their breeding locations to access foraging habitat, and therefore Roseate Terns may use portions of the Ocean SAMP area (Paton *et al*. 2010). As of 2007, about 85% of the population was concentrated at Great Gull Island, NY (1,227 pairs); Bird Island, Marion, MA (1,111 pairs); and Ram Island, Mattapoisett, MA (463 pairs). There was a small colony (48 pairs) on Penikese Island and 26 pairs nesting on Monomoy National Wildlife Refuge (Mostello 2007). Areas located in the northeast and northwest of the Ocean SAMP area lie within the foraging range of the Roseate Tern, and may potentially be used by for foraging adults.

1. Figure 8.41: Roseate tern nesting locations in Southern New England (Paton *et al*. 2010).



H. In addition to foraging activity, migrating Roseate Terns may also pass through the Ocean SAMP area on their way to and from their nesting colonies (Harris 2009). Recent studies of post-breeding staging by Roseate Terns documented 20 sites on Cape Cod where Roseate Terns congregate in the fall before migrating south. Many uniquely color-banded birds from Great Gull Island in NY at the western edge of the Ocean SAMP area were located on Cape Cod (Harris 2009), thus it is probable that many terns are migrating through the Ocean SAMP area in July and August, but their migratory routes, the diurnal variation of this migration, and flight elevations are uncertain. Paton *et al*. (2010) conducted surveys specifically to record Roseate Tern use of the Ocean SAMP area during summer (July, August), and detected relatively few birds during systematic ship and land-based surveys (total detections equaled 29 and 125 observations respectively). Alternatively, observations near Great Salt Pond on Block Island during July and August of 2009 recorded relatively high numbers of individuals, with up to 100 observations per day. It is believed that these birds are likely individuals that breed in New York or Connecticut and are transiting through the Ocean SAMP area; however more research is needed on post-breeding movement of Roseate Terns (Paton *et al*. 2010).

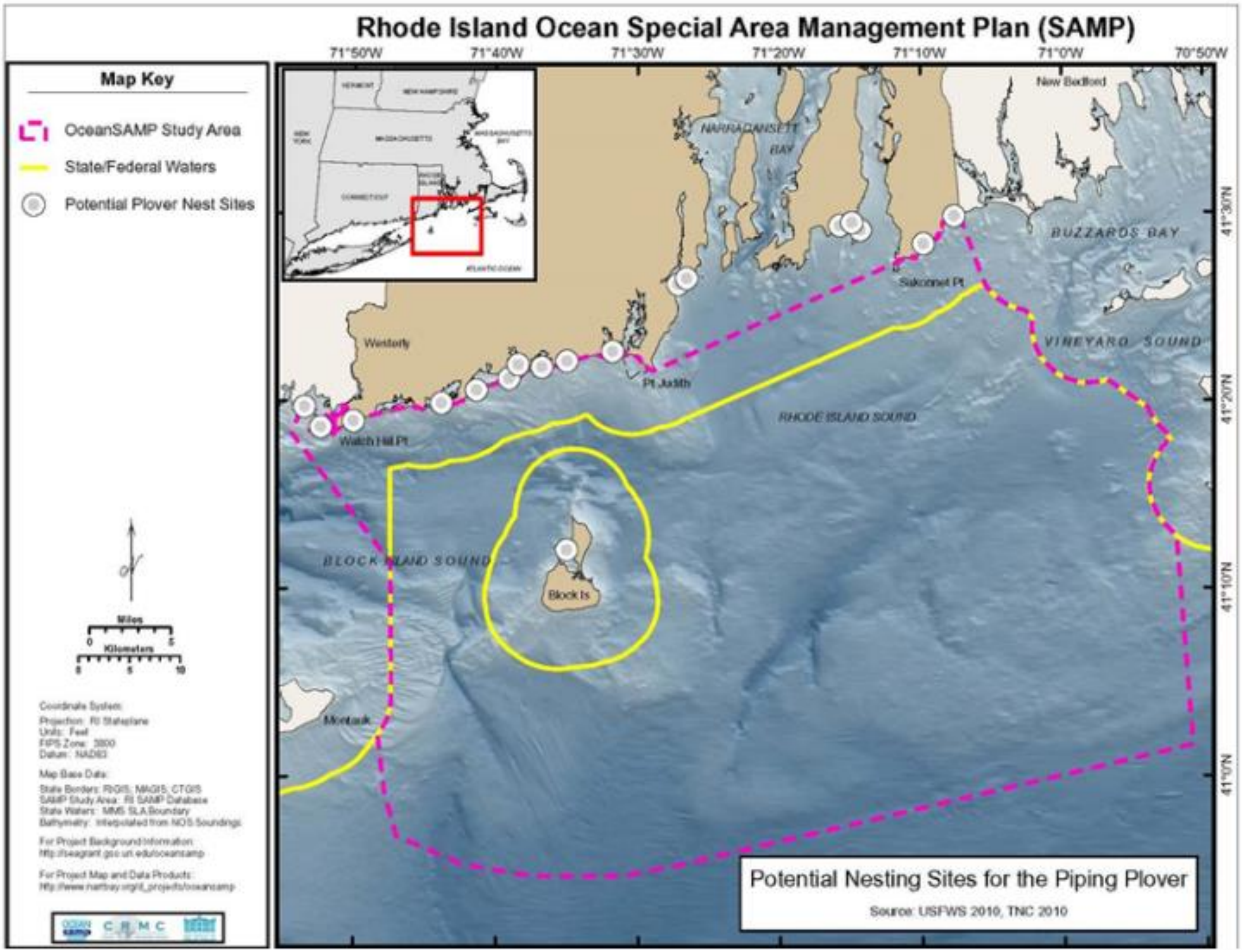
I. The Piping Plovers (*Charadrius melodus*) is another federally-listed species threatened species that nests on coastal beaches in Rhode Island and on Block Island, adjacent to the Ocean SAMP area (see Table 8.14 in § 8.4.4(I)(1) of this Part and Figure 8.42 in § 8.4.4(I)(2) of this Part). While there is uncertainty surrounding the migratory routes taken by Piping Plovers, the U.S. Fish and Wildlife Service (1996) presumes that the majority of the migratory movements of Atlantic Coast Piping Plovers occur along a narrow flight corridor above the outer beaches of the coastline. Moreover, inland and offshore migratory observations are rare (U.S. Fish and Wildlife Service 1996). However, further investigation into Piping Plover movements in a project area prior to construction would help minimize the impact of avoidance behavior.

1. Table 8.14: 2009 Piping plover nesting sites (USFWS 2010)

Beach	Nesting Pairs	Chick Total
Block Island	2	0
Charlestown Beach	0	0
East Beach Watch Hill	22	53
East Matunuck	1	2
Green Hill	1	2

Napatree	10	16
Narragansett Town Beach	0	0
Narrow River	2	4
Ninigret Conservation Area	4	5
Ninigret NWR and Arnolda	2	2
Norman Bird Sanctuary	0	0
Sachuest Point National Wildlife Refuge	1	0
Sandy Point	2	4
Third Beach	1	0
Trustom Pond National Wildlife Refuge	12	9
Quonochontaug	9	8
Total	69	105

2. Figure 8.42: Potential piping plover nesting sites adjacent to the Ocean SAMP boundary (Data from U.S. Fish and Wildlife Service 2010)



J. Under Section 7 of the Endangered Species Act all federal agencies are directed to consult with the U.S. Fish and Wildlife Service (USFWS) to ensure that their actions do not jeopardize listed avian species or, destroy or adversely modify critical habitat of such species. If the USFWS determines that a federal action is likely to adversely affect a species, formal consultation is required, and the issues are examined thoroughly through the preparation of a Biological Assessment by the lead federal agency and a Biological Opinion by the USFWS. Each addresses whether any part of the proposed action is likely to jeopardize the existence of the listed species, and may outline any necessary binding, and/or discretionary recommendations to reduce impacts (MMS 2009a). Compliance with the ESA regulations and coordination with the USFWS ensures that project activities are conducted in a manner that greatly minimizes or eliminates impacting listed species or their habitats (MMS 2007a). See Chapter 10, Existing Statutes, Regulations and Policies for more information on the ESA.

K. Existing federal legislation also provides protection to migratory bird species under the Migratory Bird Treaty Act and the Migratory Bird Executive Order 13186. Consequently, when a proposed offshore renewable energy project undergoes NEPA review, the USFWS will be consulted to determine impacts to migratory species. As a result of the Migratory Bird Executive Order 13186, BOEM (formerly the Minerals Management Service) and USFWS have produced a Memorandum of Understanding that identifies specific areas for cooperative action between the agencies and will inform the review process of offshore wind energy facilities in federal waters, and contribute to the conservation and management of migratory birds and their habitats (MMS and U.S. Fish and Wildlife Service 2009). For more information on the Migratory Bird Treaty Act and the Migratory Bird Executive Order 13186, see Chapter 10, Existing Statutes, Regulations and Policies.

L. Past studies have shown that passerine species use Block Island as a migratory stopover and also as a breeding area (Reinert *et al*., 2002). Radar surveys on Block Island as part of the research conducted by Paton *et al*. (2010) has supported these findings. Preliminary analysis of radar data suggests that large numbers of passerines are flying over the Ocean SAMP area, especially during the fall. Further analysis of the radar data by Paton *et al*. (2010) will provide some evidence of the directional movements, abundance and flight elevations. Little is known regarding offshore passerine migration, though the work of Paton *et al*. (2010) will provide greater insight into the use of the Ocean SAMP area.

M. The current understanding of the potential effects of offshore renewable energy development on birds is based primarily on monitoring performed at European offshore wind energy facilities, particularly Horns Rev and Nysted Offshore Wind Energy Facilities in Denmark (see Table 8.15 in § 8.4.4(M)(1) of this Part). It should also be noted that at three of the operational sites where bird surveys have taken place (Horns Rev, Nysted and North Hoyle) bird numbers were relatively low prior to construction. Therefore, while the overall conclusions of these reports are useful in identifying potential effects, the authors caution that the results may be applicable to other sites only on a very general level (Petersen *et al*. 2006; Michel *et al*. 2007). In addition to European reports, the Final Environmental Impact Statement for the Cape Wind Energy Project, LLC (MMS 2009a) and the PEIS (MMS 2007a) have also identified potential effects of offshore wind energy development to avian species. Ultimately, the nature and magnitude of effects of offshore wind energy development on marine and coastal birds depends on the specific location of the facility and its transmission cable (e.g., proximity to nesting sites or foraging habitat), the scale and design of the facility, and the timing of construction-related activities (OSPAR 2006; MMS 2007a).

1. Table 8.15: Summary of European monitoring of avian species.

Offshore Wind Energy Facility	**Survey Years**	**Summary of Findings**	**Citation**
Tuno Knob, Denmark: 10 turbines; online since 1995	1994-1997 1998-1999	Displacement/Changes in Distribution: Common Eiders declined by 75% and Black Scoters* by more than 90% during post-construction Flight Activity/Avoidance: Nocturnal flight activity of eiders and scoters occurred within and near the project site Nocturnal flight activity was 3-6 times greater on moonlit nights compared to dark nights Flight activity inside and in the vicinity the facility was lower than outside the facility	Guillemette *et al*., 1998, 1999 Tulp *et al*. 1999
Nysted, Denmark: 72 turbines; online since 2004	1999-2005	Displacement/Changes in Distribution: Significant reduction in long-tailed duck staging in the project area post-construction Gulls and cormorants demonstrated attraction behavior to the structures within the facility Flight Activity/Avoidance: 91-92% of all birds recorded avoided the offshore wind energy facility	Dong Energy and Vattenfall 2006

		Lateral deflection averaged .5 km (0.3 miles) at night and 1.5 km (0.9 miles) or greater during the day Moderate reactions in flight routes were observed 10-15 km (6.2-9.3 miles) outside the facility For eiders, minor flight adjustments were made at 3 km (1.9 miles)and marked changes to orientation within 1 km of the facility Collision Risk: One collision was recorded using a Thermal Animal Detection System	
Horns Rev, Denmark: 80 turbines; online since 2002	1999-2005	Displacement/Changes in Distribution: Loons and alcids avoided foraging and staging in the facility during construction Gulls demonstrated attraction behavior to the structures within the facility Flight Activity/Avoidance: Several species of seabirds showed avoidance of the facility and adjacent areas (2-4 km [1.2-2.5 miles]) post-construction, though this was not significantly different** There was a significant decrease in the percentage of loons using the area in the vicinity of the wind farm post-construction	Dong Energy and Vattenfall 2006

		The number of scoters increased in the area near the wind farm post-construction; however, the distribution of scoters indicated they were avoiding the wind farm area, and were observed to avoid flying between the turbines Collision Risk: No collisions were observed	
Utgrunden and Yttre Stengrund, Kalmar Sound, Sweden: 12 turbines total; online since 2001	1999-2003	Displacement/Changes in Distribution: Staging waterfowl declined throughout the study period Flight Activity/Avoidance: Eider spring migration paths were altered through the project area post-construction Lateral deflection occurred 1-2 km (0.6-1.2 miles) away from the facility (in good visibility) 15% of the autumn flocks and 30% of the spring flocks altered flight paths around facility Collision Risk: Out of the 1.5 million waterfowl observed migrating through Kalmar Sound, no collisions were observed	Pettersson 2005
North Hoyle, U.K.: 30 turbines; online since 2003	2001-2004	Displacement/Changes in Distribution: Red-throated loon and cormorant shifted their distribution toward the wind park during construction	National Wind Power 2003

		Cormorant avoided the wind park during and after construction No significant change in distribution was observed in the common scoter, terns, guillemots, auks***	
Blyth, U.K.: 2 turbines offshore, 9 turbines on the breakwater; offshore online since 2000; onshore online since 1993	1991-2001	Displacement/Changes in Distribution: No evidence of significant long-term displacement of birds from their habitats (either feeding areas or flight routes). Temporary displacement of cormorants was observed. Flight Activity/Avoidance: Approximately 80% of observed flight activity was below rotor height Gulls were the primary species flying at rotor height and feeding between turbines Collision Risk: Overall collision rate from 1991-2001 was 3% Eider collision rates declined over the monitoring period, suggesting adaptive behavior	U.K. Department of Trade and Industry 2006
Kentish Flats, U.K. 30 turbines; online since 2005	2001-2005	Displacement/Changes in Distribution: No significant changes in abundance of bird population were observed between pre- and post-construction periods	Gill, Sales, and Beasley, 2006

		Though not statistically significant, observational data suggested that red-throated loons and great and lesser black-backed gulls decreased in abundance, and herring gulls increased in abundance at the study site Flight Activity/Avoidance: Observational data showed fewer common terns were observed flying through the facility (though not statistically significant)	

* Guillemette *et al*. 1998 and 1999 also found decreased scoter abundance in the control site.

** Authors stated that low overall bird numbers at the Horns Rev site, high variability between surveys and limited observations during poor visibility conditions prevented sufficient observance to assess avoidance.

*** Authors stated that low overall bird numbers at North Hoyle made detecting changes in abundance difficult.

N. Habitat displacement or modification (formerly § 850.4.1)

1. Offshore renewable energy development may result in temporary or permanent habitat displacement or modification during the construction, operation or decommissioning of a facility. Depending on the location of the facility, birds may potentially be displaced from offshore feeding, nesting, migratory staging, or resting areas. Displacement may be caused by the visual stimulus of rotating turbines, or the boat/ helicopter traffic associated with construction or maintenance activities (Fox *et al*., 2006). Habitat loss or modification on avian species may result in increased energy expenditures as birds may need to fly farther to access alternate habitat (MMS 2009a). Increased energy expenditures if severe may result in decreased fitness, nesting success, or survival (MMS 2009a). Current research suggests that the permanent loss of habitat, particularly foraging habitat, has the potential to significantly impact certain avian species. However, the severity of the effects of displacement from foraging habitat depends on the amount of habitat lost, the distance to alternate habitat, and the food resources available at the nearest alternate site (MMS 2009a). Siting offshore renewable energy facilities in areas to avoid important bird foraging areas may minimize any potential adverse impacts on birds (OSPAR 2006; MMS 2007a).

2. Changes in species distribution have been observed at a number of offshore wind energy facilities in Europe. Studies of the Horns Rev and Nysted wind farms in Denmark generally found birds to demonstrate avoidance behavior of the wind farms, although the responses were highly species specific. Diving ducks, in particular, avoided the turbines, and few birds were observed in the area within the turbines (see Table 8.15 in § 8.4.4(M)(1) of this Part). This displacement of birds represents effective habitat loss for a number of species, although it is important to evaluate habitat loss in terms of the total proportion of feeding habitat available (DONG Energy and Vattenfall 2006). One reported example of habitat displacement was found to occur at the Nysted Offshore Wind Energy Facility in Denmark. Long-tailed ducks (*Clangula hyemalis*) at this site showed statistically significant reductions in density within and 2 km (1.2 miles) around the wind farm post-construction. Prior to construction the same area had shown higher than average densities, suggesting that the facility had resulted in the displacement of this species from formerly favored feeding areas. However, the observed number of long-tailed ducks was relatively low and therefore of no significance to the overall population (DONG Energy and Vattenfall 2006).

3. At the Horns Rev Demonstration Project, Red-throated and Arctic Loons (*Gavia stellata* and *Gavia arctica*), Northern Gannets (*Sula bassana*), Black Scoters (*Melanitta nigra*), Common Murre and Razorbills (*Uria aalge* and *Alca torda*) decreased their use of the wind farm area after the

installation of the wind turbines, including also zones of 2 and 4 km (1.2 and 2.5 miles) around the wind farm (DONG Energy and Vattenfall 2006). The reason for this avoidance was unknown, though the researchers suggest that perhaps disturbance effects from the turbines or from increased human activity associated with maintenance of the facility may be possible reasons. However, changes in the distribution of food resources in the study area may have also played a role. In contrast, Herring Gulls (*Larus argentatus*) showed a decreased avoidance of the wind farm area, while Great Black-backed Gulls (*Larus marinus*), Little Gulls (*Larus minutus*) and Arctic and Common Terns (*Sterna paradisaea/hirundo*) showed a general shift from preconstruction avoidance to post construction preference of the wind farm area. Gulls and terns recorded within the facility were mainly observed at the edges of the wind farm and far less in the central parts of the facility. The presence of the turbines and the associated vessel activity in the area were suggested as possible reasons for increased use of the project areas by the gulls (DONG Energy and Vattenfall 2006).

4. Additional evidence of displacement or changes in distribution patterns of birds post-construction were reported in the monitoring reports from Tuno Knob (eiders and scoters), Yttre Stengrund and Utgrunden wind parks in Kalmar Sound (waterfowl), North Hoyle (shag, a species of cormorant), Blyth (cormorant), and Kentish Flats (loons and gulls) (Guillemette *et al*.1998; DONG Energy and Vattenfall 2006; Pettersson 2005; National Wind Power 2003; U.K. Department of Trade and Industry 2006; Gill, Sales, and Beasley 2006) though the statistical significance of displacement varied widely among studies (Michel *et al*. 2007) (see Table 8.15 in § 8.4.4(M)(1) of this Part). Changes in distribution or displacement of avian species from an area as a result of an offshore renewable energy facility may be difficult to detect in some situations, especially when there is a large annual or seasonal fluctuations in densities, or when prey availability also varies spatially or temporally (Fox *et al*. 2006; Petersen *et al*. 2006).

5. Alternatively, changes in species distribution in an area may result from the attraction to an offshore wind energy facility. For species who do not avoid the project area, the reef effects caused by the underwater structures of an offshore renewable energy facility may increase prey availability. At the Nysted Offshore Wind Energy Facility observations suggested that both Great Cormorants (*Phalacrocorax carbo*) and Red-breasted Mergansers (*Mergus serrator*) were attracted to the project site. Cormorants were observed roosting on the meteorological masts and the foundation of the turbines, suggesting that this species was not avoiding the area but instead using the installed structures (DONG Energy and Vattenfall 2006). Observations of the Red-breasted Mergansers showed indications of an increased preference of the wind farm site and peripheral areas (within 4 km [2.5 miles]) after the installation of the wind farm.

Increased fish availability in the area in the post-construction phase was suggested as a possible explanation for this increase (Petersen *et al*. 2006). For a more detailed discussion of the potential for reef effects around offshore renewable energy facilities see § 8.4.3(D) of this Part.

6. Temporary or permanent habitat modification may result from construction activities such as foundation or turbine installation, cable laying, or onshore installations. For example, during construction periods, installation activities associated with substructures and cable laying may increase temporarily the turbidity in the project area. Increased total suspended solids may limit a birds' ability to see under water and thereby search for food by sight, especially seaducks that depend on benthic invertebrates as food. The Cape Wind FEIS predicts that sediment suspended by the cable installation will be localized (within 457 m [1,500 ft] of the trench) and may result in levels of 20 mg/liter. However, the turbidity effects caused by cable laying and other construction related activities will be highly site specific. Any impacts to turbidity are likely to be localized and temporary (MMS 2009a).

7. Onshore construction associated with offshore renewable energy development may result in the loss or alteration of coastal habitat used by birds for foraging, roosting, nesting, migratory staging or resting. While the impacts of habitat modification on most birds would be expected to be temporary (lasting only until construction was completed), modifications to some coastal habitats (e.g., near onshore substations) may be long-term (MMS 2007a).

O. Human disturbance (formerly § 850.4.2)

1. Construction, operation and decommissioning activities may cause a temporary or long-term disturbance to birds in the vicinity of an offshore renewable energy facility, or in coastal areas where underwater transmission cables are connected to the grid. Vessel traffic, noise associated with pile driving or other construction of above-water portions of the towers and the substation may result in the disturbance of birds offshore. Affected birds would be expected to leave the area during the construction period, and some may permanently abandon the area due to the subsequent presence and operation of the completed offshore renewable energy facility (MMS 2009a; Petersen *et al*., 2006). One observed example of disturbance at the Horns Rev site involved a passing service helicopter through an area outside of the wind farm where a congregation of Black Scoters was present. The helicopter activity resulted in a massive flush of birds which took to the air in avoidance. However, this reaction was only temporary as most of the disturbed birds were recorded landing in the same area after the helicopter had left (Petersen *et al*. 2006). Onshore, coastal construction involved in connecting the transmission cable to the grid, may disturb shorebirds in

the area (MMS 2009a). Particularly sensitive species, such as the Piping Plover, may be disturbed from their nests or from foraging activities which may have consequences on individual health or breeding success (MMS 2009a). Siting onshore transmission cable connections away from known nesting habitats when possible and scheduling onshore construction activities during non-breeding seasons may minimize any potential adverse impacts to shorebirds.

P. Avoidance/flight barrier (formerly § 850.4.3)

1. Avoidance behavior or the alteration of flight patterns may also result from the presence of an offshore renewable energy facility, as studies have shown that some birds chose to fly outside an offshore wind energy facility rather than fly between the turbines (MMS 2007b; Fox *et al*., 2006; Petersen *et al*. 2006; Desholm and Kahlert 2005). Such avoidance behavior may reduce the risk of collision, however the offshore wind energy facility may also present a barrier to movement, increase distances to foraging habitats, or increase migratory flight distances (Tulp *et al*., 1999, Kahlert *et al*. 2004, Desholm and Kahlert 2005; Fox *et al*., 2006). The level of impact may depend on the size of the facility, the spacing of the turbines, the extent of extra energetic cost incurred by avoiding the area (relative to the normal flight costs pre-construction) and the ability of the bird to compensate for this degree of added energetic expenditure. In extreme conditions, increased energy exerted by a bird to avoid a project site may potentially result in a reduced physical condition (Fox *et al*., 2006).

2. Avoidance behavior and changes in flight orientation were reported for Tuno Knob (1 to 1.5 km [0.6 to 0.9 miles] from turbines), Nysted (0.5 to 3 km [0.3 to 1.9 miles] from turbines, and sometimes moderate adjustments were observed 10 to 15 km [6.2 to 9.3 miles] away), Horns Rev (0.2 to 1.5 km [0.1 to 0.9 miles]), and Kalmar Sound (1 to 2 km [0.6 to 1.2 miles]) (Tulp *et al*. 1999; DONG Energy and Vattenfall 2006; Pettersson 2005). Extra energetic costs as a result of alterations to flight paths were calculated and considered to be negligible at Nysted (0.5 to 0.7 percent) and Kalmar Sound (0.4 percent). In addition, decreased numbers of migrant flocks were observed crossing Nysted, Horns Rev, and the Kalmar Sound offshore wind energy facilities when compared to baseline periods (DONG Energy and Vattenfall 2006; Pettersson 2005). To date, all studies that have monitored lateral deflection of migrating flocks reported active avoidance of turbines (Michel *et al*. 2007).

3. Researchers at Tuno Knob, Nysted, Horns Rev, and Kalmar Sound also examined how the effect of reduced visibility (at night or in poor weather conditions) affected flight patterns around an offshore wind energy facility (Tulp *et al*. 1999; DONG Energy and Vattenfall 2006; Pettersson 2005). The researchers concluded that flight adjustments often were made closer

to the edge of the wind park at night or in low visibility conditions than during the day or in clear weather. Observations using the Thermal Animal Detection Systems (TADS) at Nysted provided infra-red monitoring over extended periods of nighttime and detected no movements of birds below 120 m (393.7 feet) during the hours of darkness, even during periods of heavy migration. This suggests birds flying in the vicinity of the wind farm are doing so at higher altitudes at night (up to 1500 m (0.9 miles) altitude), and that even at heights above the rotor swept zone a lateral response can be detected amongst night migrating birds (DONG and Vattenfall 2006; Blew *et al*. 2006).

Q. Collision with structures (formerly § 850.4.4)

1. The risk of collision with offshore renewable energy structures, such as offshore wind turbine blades and towers, by birds is based on: the frequency of species occurrence in the project area, visibility conditions during encounters with structures, and the flight behavior or height of birds when in the vicinity of a facility (MMS 2009a, Petersen *et al*. 2006). Monitoring at European offshore wind energy facilities has reported relatively few collisions, perhaps in part due to the avoidance reaction many species exhibit prior to reaching the facility (Michel *et al*. 2007).

2. Out of a total 1.5 million migrating waterfowl observed during the monitoring of the Swedish offshore wind energy facilities in Kalmar Sound, no collisions were observed (Pettersson 2005). Similarly, no collisions were observed at the Horns Rev facility throughout the monitoring period (2002-2005). While no collisions were observed, the risk was modeled and predicted to equal approximately 14 birds per year or 1.2 birds per turbine per year at Kalmar Sound (Pettersson 2005).

3. At Nysted thermal imaging equipment was mounted to a turbine during operation to capture bird movement and collisions. One bird collision was recorded during the 2005 monitoring period which covered all four seasons of that year. However, the equipment was only stationed at one site, limiting the probability of capturing a collision (DONG Energy and Vattenfall 2006). Because not all turbines could be outfitted with thermal imaging equipment, a collision model was used to estimate the numbers of Common Eiders, the most common species in the project area, likely to collide with the sweeping turbine blades each autumn at the Nysted offshore wind farm. Using parameters derived from radar investigations and TADS, and 1,000 iterations of the model, it was predicted with 95% certainty that out of 235,000 passing birds, 0.018 to 0.020% would collide with all turbines in a single autumn (41 to 48 individuals), equivalent to less than 0.05% of the annual hunt in Denmark (currently approximately 70,000 birds) (DONG Energy and Vatenfall 2006).

4. The collision rate at Blyth Offshore Wind Energy Facility was more accurately measured since nine of the turbines are located on a breakwater and the entire facility is relatively close to shore and therefore more easily accessible. From 1991 to 1996, the collision rate was calculated to equal less than 0.01 percent. During 10 years of monitoring (1991 to 2001), only three percent of the 3,074 bird carcasses collected were directly attributed to collisions with turbines (Still *et al*., 1996 as cited in Michele *et al*. 2007). Researchers suggested that mortality events may have correlated with reduced visibility or poor weather conditions. Eider collision rates declined during the monitoring period, possibly because of adaptive behavior. Approximately 80 percent of observed flight activity was below rotor height; gulls were the primary species flying at rotor height and feeding between turbines.

5. Research conducted by Paton *et al*. (2010) will provide baseline information on the frequency of occurrence of different avian species in the Ocean SAMP area, as well as information on the flight elevation of individuals traveling through the Ocean SAMP area. This information will help to assess the risk of bird collisions in the Ocean SAMP area if an offshore wind energy facility were to be developed.

R. Water quality (formerly § 850.4.6)

1. Water quality around an offshore renewable energy facility may potentially be impacted if illegal dumping or accidental spills occurs from vessels or equipment. Because many marine and coastal birds follow behind vessels to forage in their wake, individuals may be exposed to accidental discharges of liquid wastes (such as bilge water, operational discharges). Dumping and oil spills are already subject to standard operating procedures and discharge regulations (30 C.F.R. § 250.300 and MARPOL, Annex V, Public Law 100-220 [101 Statute 1458]), and the discharge of any legally allowed waste is not expected to pose any threat to avian species (MMS 2007a). Substances that are legally discharged from vessels offshore are rapidly diluted and dispersed posing negligible risk to birds in the area (MMS 2007a). Accidental spills from offshore renewable energy facilities may pose a potential hazard to birds if they result in the release of large volumes of hazardous materials (MMS 2007a). For example, transformers, used to transmit energy generated from the offshore renewable energy facilities to shore, may contain reservoirs of electrical insulating oil or other fluids. The accidental release of these materials may impact the health and survival of waterbirds exposed to the spill, or may indirectly impact avian species by adversely affecting prey species in the area (MMS 2009a). The severity of these impacts depend on the location of the facility, the volume and timing of the spill, the toxicity of the material and the species exposed to the spill (MMS 2007a; MMS 2009a). An assessment performed on the Cape Wind Project found that the potential risk associated with accidental spills is insignificant

to minor, and that precautionary measures such as developing an oil spill response plan may minimize any adverse impacts on avian species (MMS 2009a).

2. If solid waste is released, marine and coastal birds may become entangled in or ingest floating, submerged, and beached debris, potentially resulting in strangulation, the injury or loss of limbs, entrapment, or the prevention or hindrance of the ability to fly, swim or ingestion food, or release toxic chemicals (Dickerman and Goelet 1987; Ryan 1988; Derraik 2002). These adverse impacts may potentially reduce the growth of an individual or may be lethal in severe cases (MMS 2007a). Bird species utilizing the Ocean SAMP area are already exposed to the potential risks associated with marine debris resulting from existing uses of the Ocean SAMP area.

8.4.5 Marine Mammals (formerly § 850.5)

A. Offshore renewable energy may have a variety of effects on marine mammals in the Ocean SAMP area. The purpose of this section is to provide an overview of all of the potential effects of offshore renewable energy facilities on the marine mammal species that are known to occur within the Ocean SAMP area. It should be noted that these potential effects may vary widely depending on the species as well as the particular site or project. In addition, it should be noted that scientific inquiry into the interactions between offshore wind farms and marine mammals is relatively new, and in most cases still under development. This section provides an overview of the best information available to date. It is expected that this section and the entire Ocean SAMP document will be updated in the future, as new information is made available.

B. Understanding the responses of marine mammals to offshore renewable energy facilities requires sufficient data on the abundance, distribution, and behavior of marine mammals, which are difficult to observe because they spend most of their time below the sea surface (Perrin *et al*. 2002). Data on abundance in particular are difficult to come by; there is a lack of baseline data for many species, and some of the baseline data in use may be outdated. In order to understand the context in which a specific development site is being used by target species (e.g., for feeding, breeding or migration) baseline data should be collected before any human activity has started (OSPAR 2008). A desk-based study conducted by Kenney and Vigness-Raposa (2009) for the Ocean SAMP, has synthesized all available information on marine mammal occurrence, distribution and usage of this area, providing valuable background of the importance of this area to marine mammal species. This report also ranks marine mammal species found within the Ocean SAMP area according to conservation priority, taking into account such factors as overall abundance of the population, the likelihood of occurrence in the Ocean SAMP area, endangered or threatened status, sensitivity to specific anthropogenic activities, and the existence of other known threats to the population (Kenney and Vigness-Raposa 2009).

C. Marine mammal species in the Ocean SAMP area are either whales (cetaceans), a scientific order which includes dolphins and porpoises, or seals (pinnipeds). Marine mammals are highly mobile animals, and for most of the species, especially the migratory baleen whales, the Ocean SAMP area is used temporarily as a stopover point during their seasonal movements north or south between important feeding and breeding grounds. The Ocean SAMP area overlaps with the Right Whale Seasonal Management Area, although the typical migratory routes for right whales and other baleen whales lie further offshore and outside of the Ocean SAMP area (Kenney and Vigness-Raposa 2009; see Chapter 7, Marine Transportation, Navigation and Infrastructure). However, in one event in April 2010, nearly 100 right whales were spotted feeding in Rhode Island sound, indicating that they do sometimes appear within the Ocean SAMP boundary area (NEFSC 2010). Right whales and other baleen whales have the potential to occur in the SAMP area in any season, but would be most likely during the spring, when they are migrating northward and secondarily in the fall during the southbound migration. In most years, the whales would be expected to transit through the Ocean SAMP area or pass by just offshore of the area.

D. While the impact on any species of marine mammal within the vicinity of an offshore renewable energy facility is important, endangered or threatened species are of particular concern, mainly because the magnitude of the potential impact may be much more severe to these species due to their low population numbers (MMS 2007a). The following marine mammals are of highest concern because they are listed as endangered under the federal Endangered Species Act (ESA) and may also occur within the Ocean SAMP area: the North Atlantic Right whale (*Eubalaena glacialis*), the humpback whale (*Megaptera novaeangliae*), and the fin whale (*Balaenoptera physalus*). Other marine mammal species that occur commonly or regularly within the Ocean SAMP area are listed in Table 8.16 in § 8.4.5(D)(1) of this Part. Three very abundant species that are likely to occur frequently in the Ocean SAMP area include the Harbor Porpoise (*Phocoena phocoena*), the Atlantic White-Sided Dolphin (*Lagenorhynchus acutus*) and the Short-Beaked Common Dolphin (*Delphinus delphis*) (Kenney and Vigness-Raposa 2009).

1. Table 8.16. Marine mammal species most commonly occurring in the Ocean SAMP area (Kenney and Vigness-Raposa 2009)

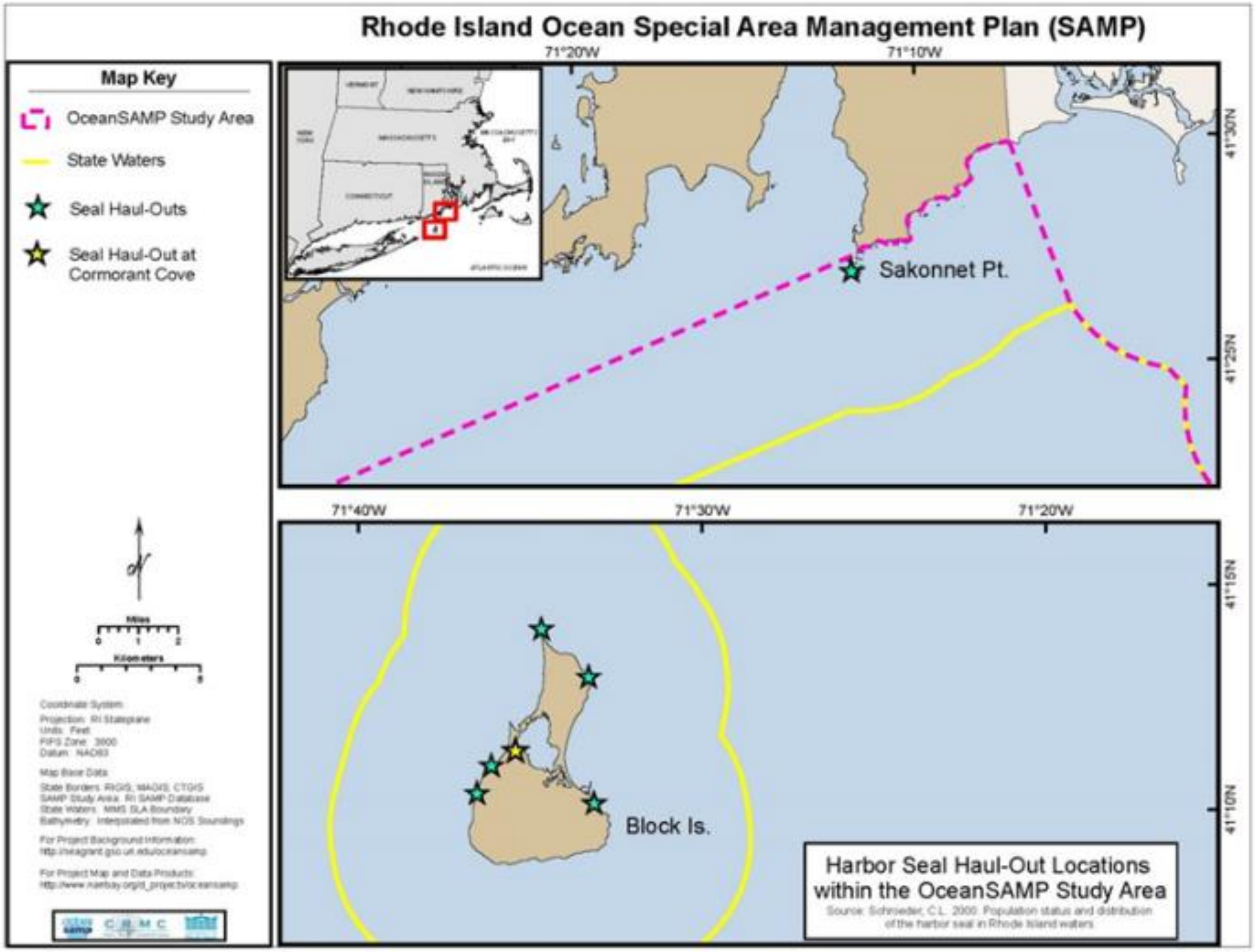
	Season Most Abundant in Ocean SAMP Area†	**Comments on Distribution or Activity in the Ocean SAMP Area**
North Atlantic Right Whale (*E*)	Spring & Fall	Mostly transits through outer regions of the Ocean SAMP area as individuals migrate south in the fall and north in the spring; occasionally

		individuals will linger for days or weeks to feed in Ocean SAMP area.
Humpback Whale (*E*)	Spring & Summer	Abundance varies year to year in response to prey distribution.
Fin Whale (*E*)	Summer	More abundant outside the Ocean SAMP boundary.
Sperm Whale (*E*)	Summer	More abundant outside the Ocean SAMP boundary, primarily in deeper water.
Harbor Porpoise	Spring	Can occur in the Ocean SAMP area during all seasons, but are most abundant in the spring when they are moving inshore and northeastward toward feeding grounds. They are among the most abundant marine mammal species within the Ocean SAMP area.
Atlantic White-Sided Dolphin	All seasons	Most abundant outside Ocean SAMP boundary.
Short-beaked Common Dolphin	All seasons	Likely to occur frequently in the Ocean SAMP area.
Harbor Seal	Fall, Winter and Spring	Regular haul-out sites along the periphery of Block Island (October through early May). These haul-out sites are thought to be used primarily by younger animals that are foraging in the area prior to migrating further north.
Sei Whale (*E*)	Spring	Irregular abundance in Ocean SAMP area.
Common Minke Whale	Spring and Summer	More abundant outside the Ocean SAMP boundary.
Long-Finned Pilot Whale	Spring	More abundant outside the Ocean SAMP boundary.

Risso's Dolphin	Spring and Summer	More abundant outside the Ocean SAMP boundary.
Bottlenose Dolphin	Summer	Likely only to be seen in outer part of Ocean SAMP area.
† In many cases marine mammal species may be present in all seasons. Seasons listed are those with the greatest probability of occurrence. Seasons are defined as: Winter (December, January, February); Spring (March, April, May); Summer (June, July, August); Fall (September, October, November) (*E)* Marine Mammal is listed as Endangered under the Endangered Species Act		

E. The only species that can be classified as a seasonal resident marine mammal in the Ocean SAMP area is the Harbor Seal (*Phoca vitulina*). Harbor seals are known to regularly occupy haul-out sites on the periphery of Block Island (along with other sites outside of the Ocean SAMP area within Narragansett Bay) during the winter and early spring (Kenney and Vigness-Raposa 2009). The haul-out site used most frequently on Block Island is a wooden raft located in Cormorant Cove within the Great Salt Pond, located near the center of the island (See Figure 8.43 in § 8.4.5(E)(1) of this Part) (Kenney and Vigness-Raposa 2009; Schroeder 2000). Because the site is at the center of the island, it is unlikely to be disturbed by activities associated with the development of offshore renewable energy.

1. Figure 8.43. Seal haul-out sites in the Ocean SAMP area (Schroeder 2000; Kenney and Vigness-Raposa 2009).



F. The degree to which offshore renewable energy facilities may affect marine mammals depends in large part on the specific siting of a project, as well as the use of appropriate mitigation strategies to minimize any adverse effects (MMS 2007a). All potential adverse impacts and enhancements posed by any future project within the Ocean SAMP area to marine mammals will undergo rigorous review under the National Environmental Policy Act (NEPA) to comply with the standards under the Marine Mammal Protection Act (MMPA) and the Endangered Species Act (ESA). Under the MMPA all marine mammals are protected, and acts that result in the taking (a take is defined as "harass, hunt, capture, collect, or kill, or attempt to harass, hunt, capture, collect, or kill any marine mammal") of marine mammals in U.S. waters is prohibited without authorization from the National Marine Fisheries Service (NMFS). Further protection is granted under the ESA by the NMFS for marine mammals that are listed as threatened or endangered. The ESA prohibits any person, including private entities, from "taking" a "listed" species. "Take" is broadly defined as "to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect or to attempt to engage in any such conduct." As a result, any proposed project will require consultation under the ESA and MMPA to examine all potential effects on marine mammals prior to development in order to ensure that potential adverse impacts are minimized. For more information on the MMPA and the ESA see Chapter 10, Existing Statutes, Regulations, and Policies.

G. The principle impacts identified in the PEIS include potential effects of increased underwater noise, impacts to water quality, vessel strikes and displacement (MMS 2007a). Of these potential impacts, increased underwater noise may pose the greatest risk to marine mammals, especially to baleen whales (e.g. humpback whales and the North Atlantic right whale), who are in theory most sensitive to the low frequency sounds produced during construction activities (see below for further discussion).

H. Noise (formerly § 850.5.1)

1. Marine mammals have highly-developed acoustic sensory systems, which enable individuals to communicate, navigate, orient, avoid predators, and forage in an environment where sound propagates far more efficiently than light (Perrin *et al*. 2002) Evaluating noise effects on marine mammals can be challenging, as information on hearing sensitivity for most marine mammal species is currently not available (Richardson *et al*. 1995; Southall *et al*. 2007). As a result, when analyzing potential noise effects from offshore renewable energy installations, the hearing sensitivities of most marine mammal species need to be inferred.

2. In principle, marine mammals can be expected to be most sensitive to sounds within the frequency range of their vocalizations (Richardson *et al*. 1995). For example, baleen whales produce low frequency sounds (~10Hz to 10 kHz), that travel long distances under water, and therefore, it is

expected that these whales would also be most acoustically sensitive at lower frequencies (Richardson *et al*. 1995). However, there is no data on hearing sensitivities in any baleen whale species to date, making assessments on noise effects quite difficult. It is known that smaller toothed whales can hear frequencies over a range of 12 octaves, with a hearing range that overlaps the frequency content of their echolocation clicks and their vocalizations used for communication (Hansen *et al*. 2008; Au 1993; Richardson *et al*. 1995; Southall *et al*. 2007). In addition, as with any mammal, hearing sensitivity varies between individuals within a species (Houser and Finneran, 2006). Consequently, as a result of the incomplete data on marine mammal hearing, it can be difficult to predict the potential impact of noise from offshore renewable energy facilities on marine mammal species. There have been a number of studies conducted in Europe on the effects of pile driving as well as the effects of noise from operating wind farms on marine mammals. However, Europe has very few species of marine mammals, and only rare occurrences of baleen whales in the wind farm areas, leaving significant data gaps in the noise effects of offshore wind energy on marine mammals.

3. Underwater noise may be generated during all stages of an offshore renewable energy facility, including during pre-construction, construction, operation and decommissioning. The strength and duration of the noise varies depending on the activity (see Table 8.17 in § 8.4.5(H)(3)(a) of this Part). For example, some construction activities, such as pile driving, result in short periods of intense noise generation, compared with long-term, low level noise associated with operational activities. While the intensity and duration of the noise produced by pile driving activities and operational wind turbines vary, both produce low frequency noise, and therefore potentially pose a risk in particular to large whales, such as the North Atlantic right whale, humpback whales, and fin whales, as these species are thought to be most sensitive in this frequency range (Southall *et al*. 2007; see Figure 8.44 in § 8.4.5(H)(3)(b) of this Part). In order to minimize the risk of causing hearing impairment or injury to any marine mammal during activities of high noise, monitoring the project area for the presence of marine mammals and maintenance of an exclusion zone has been required (MMS 2009a; JNCC 2009). Furthermore, scheduling construction activities to avoid periods when marine mammals may be more common in the project area is one precautionary measure to minimize any potential adverse impacts (OSPAR 2006). Information on the potential long-term impacts of displaced individuals, or on the potential effects under water noise may cause to resident marine mammal populations, is not currently available (MMS 2007a, OSPAR 2008).

a. Table 8.17: Above and below water noise sources associated with offshore renewable energy development (MMS 2007a; OSPAR 2009a)

Above Water Noise					
Noise Source	**Duration**	**Frequency Range**	**Frequency of Peak Level (Hz)**	**Peak Sound Intensity Level (dB re-20 µPa)**	**Reference Distance (m)**
Ship/barge/ boat[a,b,d]	Intermittent to continuous, up to several hours or days	Broadband, 20−50,000 Hz	250−2,000	68−98	Near source
Helicopter	Intermittent, short duration	Broadband with tones	10−1,000	88	Near source
Pile driving [a,d]	50-100 millisecond pulses/beat, 30−60 beats/min, 1−2 hours/pile	Broadband	200	110	15 m (49.2 feet)
Construction equipment[d]	Intermittent to continuous	Broadband	Broadband	68–99	15 m (49.2 feet)
Underwater Noise Sources					
Noise Source	Duration	Frequency Range	Frequency of Peak Level (Hz)	Peak Sound Intensity Level	Reference Distance (m)

				(dB re-1 μPa)	
Ship/barge/ boat[a,b,c,,f]	Intermittent to continuous, up to several hours or days	Broadband, 20−50,000 Hz	250−2,000	150-180 rms	1m (3.3 feet)
**Pile driving[a,d,f]	50-100 millisecond pulses/beat, 30−60 beats/min, 1−2 h/pile	Broadband, 20- above 20,000 Hz	100-500	228 peak, 243-257 peak to peak	1m (3.3 feet)
Seismic air-gun array [b,f]	30-60 millisecond pulses, repeated at 10 -15 sec intervals	Mainly low frequency, but some 10-100,000 Hz	10-125	Up to 252 downward, up to 210 horizontally	1m (3.3 feet)
Seismic explosions TNT (1-100lbs)[e,f]	~1-10 milliseconds	2-1,000 Hz	6-21	272-287	1m (3.3 feet)
Dredging [c,f]	Continuous	Broadband, 20-20,000 Hz	100-500	150-186	1m (3.3 feet)
Drilling [b,c,f]	Continuous	Broadband, 10-10,000 Hz	20-500	154	1m (3.3 feet)

Operating Turbine (1.5 MW operating in winds of 12 m/s) [a]	Continuous		50 Hz/ 150 Hz	120-142	1m (3.3 feet)

[a] Thomsen *et al*. (2006)

[b] LGL (1991)

[c] Richardson *et al*. (1995)

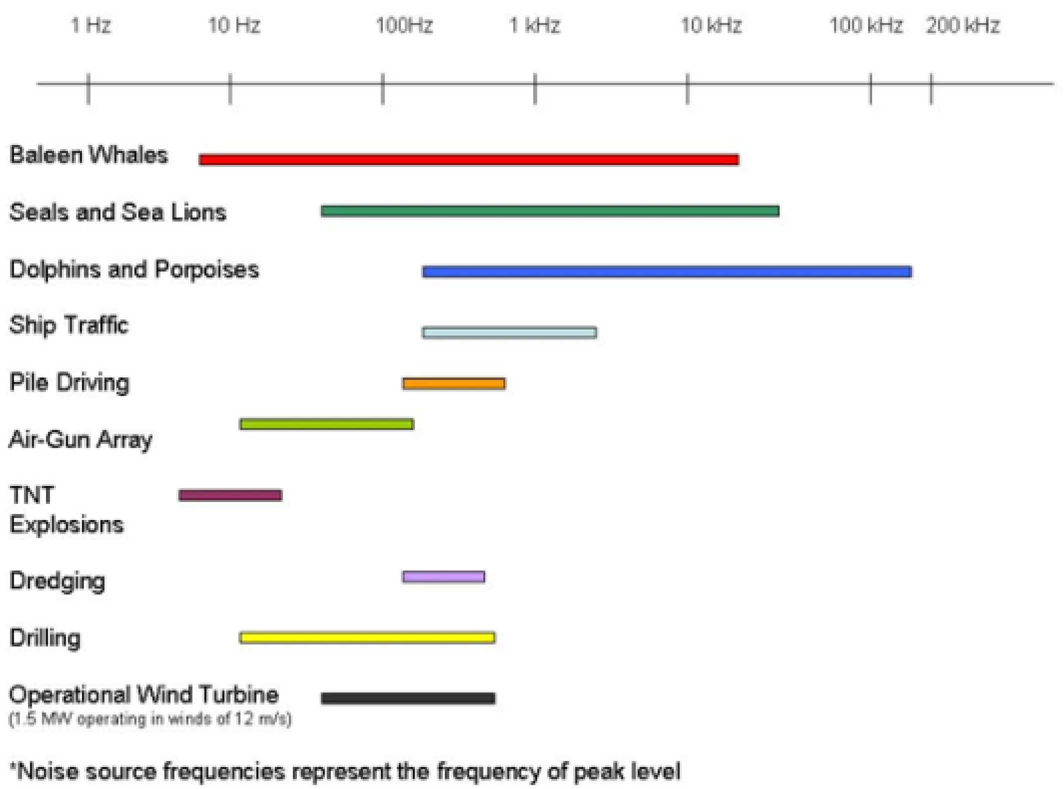
[d] Washington DOT (2005)

[e] Ross (1976)

[f] OSPAR (2009a)

**(note: noise associated with pile driving will vary greatly depending on the size of the pile and hammer used)

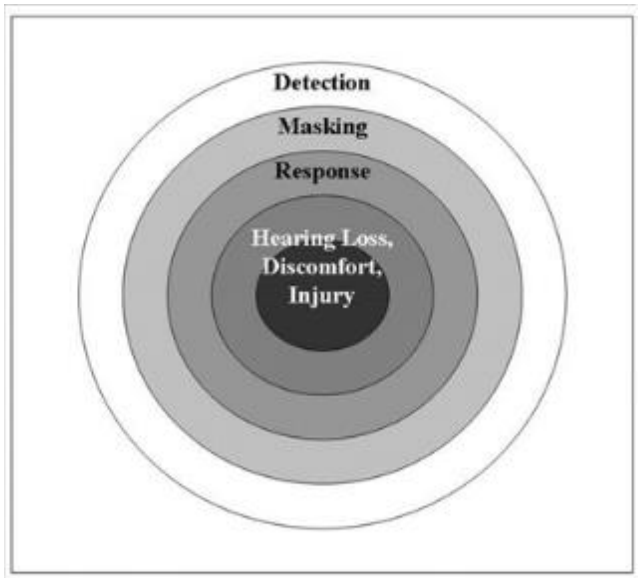
b. Figure 8.44: Typical frequency bands of sounds produced by marine mammals compared with the main frequencies associated with offshore renewable energy development (OSPAR 2009a).



4. When examining acoustic impacts on marine mammals, four overlapping impact zones are commonly used (see Figure 8.45 in § 8.4.5(H)(4)(a) of this Part; Richardson *et al*. 1995), corresponding to the different effect levels: the zone of hearing loss, discomfort, or injury, the zone of responsiveness, the zone of masking and, the zone of detection/ audibility. The zone closest to the sound source usually has the highest sound levels, which may result in physical damage or injury to a marine mammal if sound levels are sufficiently high (OSPAR 2009a). In the zone of responsiveness, noise exposure may result in behavioral reactions such as avoidance, disruption of feeding behavior, interruption of vocal activity or modifications of vocal patterns. In the zone of masking, the overlap in the frequencies of sounds produced by a sound source and those used by marine mammals has the potential to mask vocalizations, interfering with their reception and inhibiting the efficient use of sound. The detection zone is the area in which the noise generated from the sound source is audible

to a marine mammal, and above ambient noise levels (Richardson *et al*. 1995).

a. Figure 8.45: Theoretical zones of noise influence (Richardson *et al*. 1995).



5. Regarding the impacts of offshore renewable energy construction on marine mammals, the MMPA considers the zone of physical impairment, responsiveness and masking when determining a proposed project's compliance. Under the MMPA: "Level A Harassment means any act of pursuit, torment, or annoyance which has the potential to injure a marine mammal or marine mammal stock in the wild. Level B Harassment means any act of pursuit, torment, or annoyance which has the potential to disturb a marine mammal or marine mammal stock in the wild by causing 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 marine mammal stock in the wild." See Table 8.18 in § 8.4.5(H)(5)(a) of this Part for the criteria used to define Level A and Level B affects under the MMPA.

a. Table 8.18: Criteria for estimating the effects of noise on marine mammals under the Marine Mammal Protection Act (U.S. Department of Commerce 2008).

Criteria	NMFS Criteria
Level A Injury (Pinnipeds)	190 dB re 1 µPa rms (impulse, e.g. pile-driving)

Level A Injury (Cetaceans)	180 dB re 1 µPa rms (impulse)
Level B Harassment/Behavior	160 dB re 1 µPa rms (impulse)
Level B Harassment/Behavior	120 dB re 1 µPa rms (non-pulse noise, e.g. vibratory pile driving)

6. Prior to construction, geophysical surveys performed to characterize ocean-bottom topography or geology may include the use of air gun arrays or side-scan sonar. Survey techniques using high-energy air gun arrays pose a greater risk to marine mammals in the vicinity of the sound source, as opposed to side-scan sonar, and may result in temporary hearing impairment or in extreme cases physical injury very close to the source. Side-scan sonar, which uses a more focused beam of sound, is the most common survey technique used in the siting of offshore wind facilities. Side-scan sonar was found to result in only temporary behavior changes, even during the more extreme cases, and is unlikely to result in any hearing impairment or physical injury (MMS 2007a; NMFS 2002a). It is possible that individual animals will leave the area or change behavior temporarily as a result of the noise disturbance (MMS 2007a). In particular, behavioral reactions of whales (cetaceans) may include: avoidance or flight from the sound source, disruption of feeding behavior, interruption of vocal activity, or modifications of vocal patterns. However, the response of an individual cetacean may be unpredictable, as it depends on the animal's current activity, its ability to move away quickly (especially a concern with regard to North Atlantic Right whales), and the animal's previous experience around vessels (MMS 2009a). It is unknown what long-term effects these changes in behavior may have on the individual animal or entire cetacean populations.

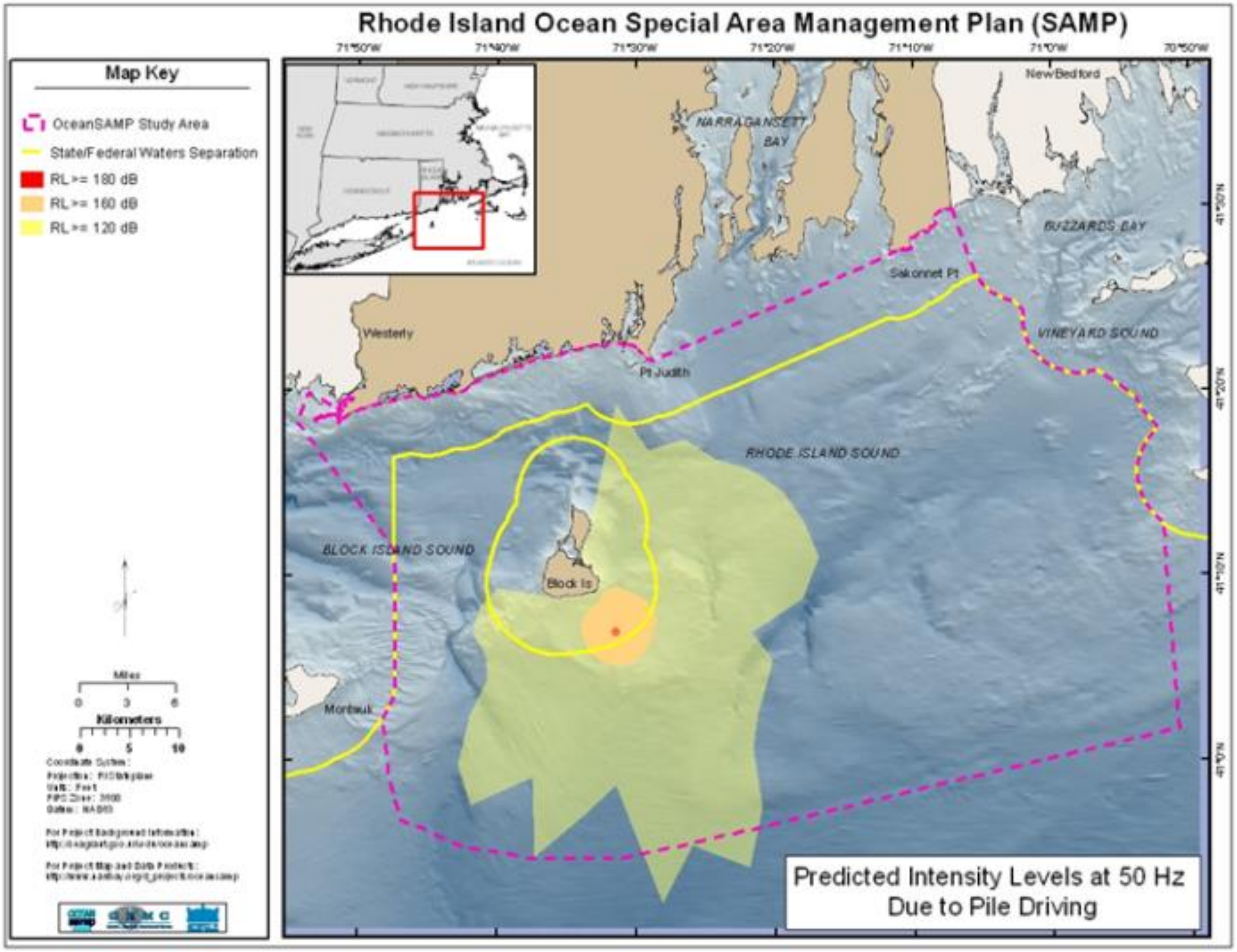
7. Seals (pinnipeds) have shown avoidance in response to noise generated by geophysical surveys (NMFS 2002b; Thomson *et al*. 2001; MMS 2003; OSPAR 2009a). Since harbor seals regularly haul-out on sites around Block Island (Kenney and Vigness-Raposa 2009), survey activities in these areas may cause a temporary disturbance. The PEIS states that any displacement from the study area as a result of these surveys is likely to be temporary, resulting in negligible impacts to marine mammals (MMS 2007a; MMS 2009a). Siting facilities away from important marine mammal congregation, mating or feeding areas and taking into account marine mammal activity in the area when scheduling surveys will further minimize any potential negative impacts (MMS 2007a).

8. Underwater noise from the construction of an offshore renewable energy facility is generated during the installation of the foundation piles used to support the turbines and transformer platforms. Most offshore turbines are

placed on steel foundations, which are affixed to piles driven into the seabed. Piles can range in diameter from 1 to 5 m [3.3-16.4 ft], with the larger piles being used for monopile turbines and smaller piles used for jacketed structures. The piles are driven into the bottom by powerful hydraulic hammers, causing very loud noise emissions, which may be audible for marine mammals over distances of several tens of kilometers (Thomsen *et al*. 2006; Nedwell *et al*. 2007). The zone of audibility may extend beyond 80 km [49.7 mi] to perhaps hundreds of kilometers for some marine mammal species (e.g. harbor porpoises and harbor seals) (Thomsen *et al*. 2006). Yet pile driving for one single turbine is of relatively short duration. The level of noise emitted by pile driving operations is dependent on a variety of factors such as pile dimensions, seabed characteristics, water depth, and the strength and duration of the hammer's impact on the pile (Nedwell *et al*. 2007; OSPAR 2009a).

9. Research conducted by Miller *et al*. (2010) modeled the extent of pile-driving noise within the Ocean SAMP area and mapped the areas subject to sound intensities of concern under the MMPA (see Table 8.18 in § 8.4.5(H)(5)(a) of this Part and Figure 8.46 in § 8.4.5(H)(9)(a) of this Part). This analysis was calculated for a 1.7 m [5.5 foot] diameter pile (similar to those used in lattice jacket structures) driven into the bottom with an impact hammer. The red shaded area represents the zone of injury, the orange area represents the zone of harassment or potential behavior response, and the yellow area represents the zone of audibility or detection by marine mammals. It should be noted that this is an estimate and that the zones may be larger or smaller depending on the actual size of the pile and method of installation.

a. Figure 8.46: Estimate of the affected area in the vicinity of pile driving (Miller *et al*. 2010).



10. Pile driving may create noise that may adversely affect marine mammal feeding or social interactions, or alter or interrupt vocal activity (MMS 2007; Thomsen *et al*. 2006). However, these impacts will vary within, as well as between, species. Any marine mammal that remains within the project area at the start of pile driving activities are subject to the increased risk of hearing impairment that may occur within close range (Madsen *et al* 2006; Thomsen *et al*. 2006). Placing marine mammal observers onboard construction vessels and halting construction activity once a marine mammal has been spotted within a designated exclusion zone are precautionary measures that can be taken to reduce this potential risk (MMS 2007a). In addition, acoustic isolation of the ramming pile may reduce the noise level of pile driving activities. Acoustic deterrent devices and ramp-up pile-driving procedures may also help to protect individuals from impairment or injury by encouraging them to leave the construction site (Thomsen *et al*. 2006; Tougaard *et al*. 2003; Tougaard *et al*. 2005).

11. In Denmark, the construction of two offshore wind farms, Nysted and Horns Rev 1, have provided opportunities for monitoring the behavioral reactions of two marine mammal species, harbor porpoises and harbor seals, to pile driving activities. Evidence of temporary avoidance behavior during pile-driving at Horns Rev was found in harbor porpoises up to approximately 20 km [12.4 mi] away, both visually, through fewer observed individuals, and acoustically, through temporarily decreased acoustic activity (Tougaard *et al*. 2003). This reduction in echolocation clicks suggests that either pile-driving affected the porpoises' behavior causing individuals to go silent, or the porpoises left the area during this activity. Tougaard *et al*. (2003) observed a return to previous acoustic activity after 3-4 hours. At the Nysted site, where piling only occurred for a brief period of time, harbor porpoises left the area during construction and stayed away for several days (Tougaard *et al*. 2005). Overall lower abundance of harbor porpoises was observed at the Nysted site after construction when compared to baseline data, lasting at least until the second year of operation (Tougaard *et al*. 2005). However, it should be noted that researchers are uncertain if the observed long-term avoidance of the Nysted site by harbor porpoises was caused by the noise effects of construction. Porpoise abundance was relatively low in the area before the start of construction, so the decrease in abundance may have been unrelated to installation activities (Thomsen *et al*. 2006). Edren *et al*. (2004) found a 10 – 60% decrease in the number of hauled out harbor seals on a sandbank 10 km [6.2 mi] away from the Nysted construction site during days of ramming activity. This effect was of short duration but does suggest that both harbor porpoises and seals demonstrate behavioral changes or avoidance during pile-driving activity, and that these effects can span large distances.

12. In addition to surveying and pile-driving activities, noise associated with ships engaged in construction, operations and maintenance activities may potentially impact marine mammals in the project area (Köller *et al*. 2006; OSPAR 2009a) (see Table 8.17 in § 8.4.5(H)(3)(a) of this Part). Overall, the ambient noise created by marine transportation, including ships associated with the wind farms as well as other ship traffic in the area, will be of a higher intensity than what would likely be created by wind turbines (OSPAR 2009a). Shipping noise should be taken into account when considering the overall levels of ambient noise underwater where wind turbines are in place. The use of ships in servicing the turbines and other activities should be accounted for when predicting the overall noise levels from the wind farms (Wahlberg and Westerberg 2005). Shipping noise is likely to be significantly higher during the construction phase (BMT Cordah Limited 2003). It is estimated that each turbine will require one to two days of maintenance each year; depending on the size of a wind farm, ship noise could be present in the vicinity of the turbines often (Thomsen *et al*. 2006). However, given the existing levels of shipping in the Ocean SAMP area and resulting background noise (see Chapter 7, Marine Transportation, Navigation and Infrastructure) the added noise from maintenance vessels is likely to be negligible. Observed reactions of marine mammals to vessel noise have included apparent indifference, attraction (e.g. dolphins' attraction to moving vessels), cessation of vocalizations or feeding activity, and vessel avoidance (Richardson *et al* 1995; Nowacek and Wells 2001). Noise may also be caused by transit of helicopters used to support offshore renewable energy facilities far offshore (MMS 2007a). Marine mammal behavior would likely return to normal following the passage of the vessel (Richardson *et al*. 1995). Edren *et al*. (2004) conducted video monitoring during the construction of the Nysted offshore wind farm and found no discernible changes in harbor seal behavior as a result of the increased ship traffic, although ship movements were controlled to avoid the seal sanctuary. In the Ocean SAMP area, the most heavily used seal haul out site on Block Island is located within a protected cove (see Figure 8.43 in § 8.4.5(E)(1) of this Part) and therefore would not be affected by the noise from construction traffic. However, the other haul out sites surrounding Block Island may be affected if vessel routes pass in their vicinity or during winter seasons when these sites are most frequently used (Kenney and Vigness-Raposa 2009). Prior to construction, all potential impacts (including noise impacts) to marine mammals by a proposed offshore renewable energy facility in the Ocean SAMP area will be reviewed under the MMPA to determine if incidental take or harassment authorization, or specific mitigation measures are required.

13. Underwater noise may also result from cable laying activities, including cable laying vessels or jet plowing techniques (OSPAR 2009b). Noise measurements are not available for cable laying activities in Europe associated with offshore wind energy facilities (OSPAR 2009b). However,

research conducted to assess the potential noise impacts associated with the laying of submarine cables for the Cape Wind Energy Project found that the jet plowing embedment process would not add appreciable sound into the water column (MMS 2009a). However, the nature of the seabed will dictate the type of cable installation procedures used, and thus the noise profiles that will result will depend on the physical characteristics of the seafloor (MMS 2007a). In areas with unconsolidated sediments, only the sound associated with the cable laying vessels will likely be produced, as the sediments insulate the cable laying noise (MMS 2009a).

14. Operational noise generated from offshore renewable energy structures, such as by the spinning offshore wind turbines, may be transmitted into the water column via the turbine support structures (OSPAR 2006). The level of noise emitted into the water column by an operational turbine varies based on wind speed, the speed of the spinning blades, and the type of foundation structure (Wahlberg and Westerberg 2005; Ingemansson AB 2003). The operational noise produced by wind turbines is significantly less than the levels of noise produced during the construction phase. Underwater noise generated by the turbines is mostly the result of the movement of mechanical components within the generator and gearbox, which result in vibrations in the tower, rather than sounds from the turbine blades themselves. Both the frequency and intensity of sound generated by the turbines increases with wind speed. To date, the available data on the effects of noise from operating wind turbines are sparse, but suggest that behavioral effects, if any, are likely to be minor and to occur close to the turbines (review by Madsen *et al*. 2006; Nedwell *et al*. 2007). For example, Koschinski *et al*. (2003) reported behavioral responses in harbor porpoises and harbor seals to playbacks of simulated offshore turbine sounds at ranges of 60-200 m [196.8-656.2 ft], suggesting that the impact zone for these species is relatively small. In addition, because noise emissions from operating wind turbines are of low frequencies and low intensity (Nedwell *et al*. 2007), operational noise is not thought to be audible to many marine mammal species over distances greater than a few tens of meters, as the hearing abilities of most marine mammals are better at higher frequencies (Richardson *et al*. 1995; Southall *et al*. 2007). One exception may be baleen whales, such as the North Atlantic Right whale, whose hearing abilities are thought to include very low frequency sounds (Madsen et. al. 2006). Scientists predict that individuals of this species may respond to noise from operating turbines at ranges up to a few kilometers in quiet habitat (Madsen *et al*. 2006). However, no studies have been performed to date on the effect of noise from operational offshore wind turbines on right whales, or baleen whales in general, and these predictions have been based primarily on the results of related acoustic studies (Nowacek *et al*. 2004; Richardson *et al*. 1995; Madsen *et al*. 2006).

15. Recent measurements by Nedwell *et al*. (2007) at five operational wind farms off the U.K. indicate that wind farm sound could not be detected at a hydrophone at distances of a few kilometers outside the wind farm. Measurements taken at a range of 110 meters from a 1.5 MW monopile GE turbine in Utgruden, Sweden in water depths of approximately 10 meters found operational noise measured 118 dB re 1 mPa2 in any 1/3 octave band at a range of 100 meters at full power production (Betke *et al*. 2004). Based on these measurements and measurements of the ambient noise in the waters just southwest of Block Island, Miller *et al*. (2010) determined that the additional noise from an operational offshore wind turbine is significantly less than noise from shipping, wind and rain in the region. Miller *et al*. (2010) calculated that the noise would be greater than the ambient noise present within 1 km of the wind turbines and at ranges of 10 km operational noise would be below the ambient noise in the region.

16. The decommissioning of offshore renewable installations will also temporarily generate underwater noise. However, because an offshore renewable energy facility has not yet been decommissioned, the activities and duration of the removal is not yet known (Nedwell and Howell 2004). Abrasive jet cutting (using the force of highly pressurized water) is likely to be used to cut piles from the seafloor, while the destruction of the concrete foundations and scour protection may require some blasting or the use of pneumatic hammers, if the protective structures cannot be lifted from the seafloor after dismounting the turbine support structure. Currently, no sound measurements are available on the use of abrasive jet cutting when decommissioning offshore structures. While explosives may be a loud point source of underwater sound, and consequently pose a serious risk of physical damage to any marine mammals in the detonation area (MMS 2007a), non-explosive removal techniques are expected to cause short-term, negligible to minor impacts (MMS 2007a). Therefore, the PEIS suggests the use of these alternative methods to minimize any adverse effects (MMS 2007a). If explosives are used, following BOEM guidelines (NTL No. 2004-G06) may reduce the potential for negative impacts (MMS 2007a).

17. In summary, noise impacts associated with offshore renewable energy facilities are currently thought to affect marine mammals. The nature and scale of effects will depend on: the hearing ability of the species and the individual animal; the distance the individual is from the sound source; the frequency and intensity of the noise source; the activities of the marine mammals at the time of noise exposure; the duration of the noise-producing activity (i.e. hours, days, months); and transmission through the area (dependent upon physical conditions of the area such as topography, geology, sea state, etc.). To date, only a limited number of studies have been published documenting effects of construction and operation of offshore wind energy facilities on two species of marine mammals, harbor

porpoises and harbor seals (Carstensen *et al*. 2006; Tougaard *et al*. 2006; Koschinski *et al*. 2003). Additional studies have inferred potential effects based on theoretical models or findings from similar activities in other industries (the most comprehensive review of observed effects can be found in OSPAR 2009a). It should be noted, however, that the range of effects may vary between installations.

I. Vessel Strikes (formerly § 850.5.2)

1. Increased vessel traffic associated with the construction, operation, or decommissioning of an offshore renewable energy facility may increase the risk of ship strikes. Impacts are expected to be minor for most species, especially seals and smaller cetaceans that are agile enough to avoid collisions (MMS 2007a). Of all the whale species present within the Ocean SAMP area, the species considered at the greatest risk of vessel strikes are fin whales, humpback whales, North Atlantic right whales and sperm whales, based on the findings of the Large Whale Ship Strike Database (Jensen and Silber 2004; MMS 2007a). However, the response of an individual animal to an approaching vessel may be unpredictable, as it depends on the animal's behavior at the time, as well as its previous experience around vessels (MMS 2009a).

2. Of all whale species within the Ocean SAMP area, the population-level impacts of a vessel strike would be most severe to the North Atlantic right whale (MMS 2007a). Ship strikes more commonly result in whale fatalities when a ship is travelling at speeds of 14 knots [16 mph] or more. In fact, the number of ship strikes recorded decreases significantly for vessels travelling less than 10 knots [11.5mph] (Jensen and Silber 2004), which suggests that reducing ship speeds to this level may reduce the risk of vessel strikes even further (NOAA National Marine Fisheries Service 2008). As a result of this finding, the PEIS suggests vessels reduce ship speed and maintain a safe operating distance when a marine mammal is observed (MMS 2007a; MMS 2009a). In addition, by locating offshore renewable energy installations away from migratory routes, the risk of vessel strikes is further minimized (MMS 2007a). It should also be noted that there is already a vessel speed restriction in place during parts of the Ocean SAMP area during certain times of the year to minimize the risk of right whale ship strikes; this speed restriction is part of the Right Whale Seasonal Management Area and is enforced by NMFS (NOAA National Marine Fisheries Service n.d.). See Chapter 7, Marine Transportation, Navigation, and Infrastructure for further discussion.

J. Turbidity & Sediment Resuspension (formerly § 850.5.3)

1. Water quality within a project area may be affected by the construction and decommissioning activities, including cable laying, associated with an offshore renewable energy facility. Specifically, construction or

decommissioning activities may re-suspend bottom sediments, which may in turn increase concentrations of total suspended solids (TSS) in the water column (MMS 2009a; OSPAR 2008). The level of impact caused by increased TSS is primarily dependent upon the sediment composition of the project site, grain size distributions, and the hydrodynamic regime (OSPAR 2006). Areas composed of fine grained, loose sediment, accustomed to frequent increases in turbidity (associated with storms, tidal or wave action) will likely not be substantially impacted by the temporary disturbances caused by these activities (MMS 2009a). Increased TSS concentrations may impact prey abundance in an area (i.e. zooplankton or fish species), and therefore indirectly impact marine mammals which depend on those species as a food source (MMS 2009a; Köeller *et al*. 2006). However, because individuals can move to adjoining areas not affected by the temporary increases in TSS, these impacts are not expected to pose a threat to marine mammals (MMS 2009a). In the case of the Cape Wind Project, while TSS concentrations were anticipated around construction and decommissioning time periods, the increases were predicted to be temporary and localized (MMS 2009a). Pre-construction modeling may be useful in predicting the importance of sediment resuspension at a particular site, and monitoring programs during the construction can be used to validate model predictions of the potential TSS effects (OSPAR 2006). Monitoring programs may help to ensure that TSS levels remain within an acceptable range (OSPAR 2006).

2. The PEIS also identifies the potential risk posed by re-suspending contaminated sediments into the water column (MMS 2007a). The suspension of contaminated sediments from construction activities may in some instances result in bioaccumulation of toxins in marine mammal tissue, due to the consumption of contaminated prey (MMS 2009a; see also Hooker *et al*. 2008)

3. Water quality around an offshore renewable energy facility may potentially be impacted if illegal dumping or accidental spills occurs from vessels or equipment. Vessel discharges and oil spills are already subject to standard operating procedures and discharge regulations (30 C.F.R. § 250.300 and MARPOL, Annex V, Public Law 100-220 [101 Statute 1458]), and the discharge of any legally discharged waste is not expected to pose any threat to marine mammals (MMS 2007a). Substances that are legally discharged from vessels offshore are rapidly diluted and dispersed posing negligible risk to marine mammals (MMS 2007a). Accidental spills from offshore renewable energy facilities may pose a potential hazard to marine mammals if they result in the release of large volumes of hazardous materials (MMS 2007a). For example, transformers, used to transmit energy generated from the offshore renewable energy facilities to shore, may contain reservoirs of electrical insulating oil or other fluids. The accidental release of these materials may impact the health and survival of marine mammals exposed to the spill, or may indirectly impact marine

mammals by adversely affecting prey species in the area (MMS 2009a). The severity of these impacts depend on the location of the facility, the volume and timing of the spill, the toxicity of the material and the species exposed to the spill (MMS 2007a; MMS 2009a). An assessment performed on the Cape Wind Project found that the potential risk associated with accidental spills is insignificant to minor (MMS 2009a), and that precautionary measures such as producing an oil spill response plan may minimize any adverse impacts on marine mammals (NOAA 2009).

K. Electromagnetic Fields (EMF) (formerly § 850.5.4)

1. Cetaceans have received attention with respect to induced magnetic fields around underwater transmission cables as it is hypothesized that they use the Earth's magnetic field to navigate during migration (Gill *et al*. 2005). However, there is very little data supporting the theory of magnetic orientation in cetaceans. If an effect does exist, transient mammals would likely only be temporarily affected by an induced magnetic field (Gill 2005). Moreover, since migration generally occurs in open water and away from the seabed (Kenney and Vigness-Raposa 2009), electromagnetic fields are unlikely to have a detrimental effect on whale migration (Gill *et al*. 2005). Research conducted by Miller *et al*. (2010) examined the potential electromagnetic fields that may be created from submarine cables used to support offshore renewable energy development in the Ocean SAMP area and found that the effects of EMF will be confined to within 20 meters [65.6 feet] of the cable. No adverse impacts to marine mammal behavior or navigation is expected from the undersea transmission cables (MMS 2009a; Gill 2005). EMF associated with offshore wind energy projects may have potential effects on some fisheries resources; see § 8.4.7 of this Part below.

L. Habitat alteration & reef effects (formerly § 850.5.5)

1. Offshore renewable energy installations sited in soft sediment might locally change the sea bed characteristics from soft, mobile sediments to a harder substrate by introducing hard structures for scour protection (rock, concrete mattresses, grout bags etc. Underwater structures are soon overgrown by sessile, benthic animals and algae which may increase the biomass locally, and attract fish and marine mammals as their predators (Wilhelmsson *et al*. 2006; OSPAR 2006; NOAA 2009). Similarly, the steel piles introduce a hard substrate into the water column, and provide a surface that can be colonized by species that might not ordinarily be present in soft sediment environments (OSPAR 2006). The offshore wind farm foundations at Horns Rev and Nysted have been readily colonized with epifouling communities, causing a local increase in biodiversity compared to amounts recorded prior to construction (DONG Energy *et al*. 2006; Bioconsult A/S 2003; Energi E2 A/S 2004). However, no evidence

has been found to date to suggest that these reef effects enhance or alter the prey availability of marine mammal species in the area. For a more detailed discussion of this potential effect see § 8.4.3 of this Part.

8.4.6 Sea Turtles (formerly § 850.6)

A. The observed effects of offshore renewable energy development on sea turtles are unknown, as sea turtles are not present in any of the areas where wind turbines are currently in place (MMS 2007a). According to Kenney and Vigness-Raposa (2009), the sea turtles that may be found in the Ocean SAMP area include the following:

1. Table 8.19. Abundance and conservation status of Ocean SAMP area sea turtles (Kenney and Vigness-Raposa 2009)

Turtle	Status	Abundance
Leatherback Sea Turtle (*Dermochelys coriacea*)	Endangered	The sea turtle most likely to be found in Ocean SAMP area, found in Ocean SAMP area in summer and early fall when water is warmest. Dispersed; higher abundance outside Ocean SAMP area.
Loggerhead Sea Turtle (*Caretta caretta*)	Threatened	More abundant in the Northeast than Leatherbacks, but less likely to be found in the Ocean SAMP area – not often seen in cool or nearshore waters. May be seen occasionally in summer or fall.
Kemp's Ridley Sea Turtle (*Lepidochelys kempii*)	Endangered	Small juveniles known to use habitats around Long Island and Cape Cod, and may pass through Ocean SAMP area but are not detected in surveys.
Green Sea Turtle (*Chelonia mydas*)	Threatened	Small juveniles known to use habitats around Long Island and Cape Cod, and may pass through Ocean SAMP area but are not detected in surveys.

2. Sea turtles may use the Ocean SAMP area for foraging. They are capable of diving to great depths, although a study of sea turtles off Long Island found them primarily foraging in waters between 16 and 49 feet (4.9 and 14.9 meters) in depth. Leatherback turtles, likely the most abundant sea

turtles in the Ocean SAMP area, have been shown to dive to great depths and may spend considerable time on the bottom, sometimes holding their breath for as long as several hours. Some sea turtles, particularly green sea turtles, feed on submerged aquatic vegetation (NOAA National Marine Fisheries Service 2009). While the placement of wind turbines will be at depths greater than where this foraging takes place, if cables are placed through areas of submerged aquatic vegetation, this could have an effect on sea turtles. Similarly, many sea turtles may feed on benthic invertebrates such as sponges, bivalves, or crustaceans, all of which are likely be found in the Ocean SAMP area (NOAA National Marine Fisheries Service 2009). Sea turtles may be affected by any loss of these food species during the cable-laying process; again, turtles are unlikely to forage at the depths where the turbine bases are likely to be located. Leatherback turtles are known to consume Lion's mane jellyfish (*Cyanea capillata*) as a mainstay of their diet; these jellyfish are plentiful in the Ocean SAMP area during the summer and fall (Lazell 1980).

3. Additionally, any of these turtle species may migrate through the Ocean SAMP area as part of their northward or southward migration in spring and fall, respectively (NOAA National Marine Fisheries Service 2009). While sightings of most of these species are infrequent, sea turtles, particularly juveniles, are not routinely detected during surveys, meaning they may be more common in the Ocean SAMP area than survey data would suggest. All of the species of sea turtles noted in the table are likely to be present in the Ocean SAMP area from late spring/early summer through late fall.

B. Noise (formerly § 850.6.1)

1. Little is known about the hearing capabilities of sea turtles. Existing data estimate the hearing bandwidth of the four species of turtles found within the Ocean SAMP area at between 50 and 1,000 Hz, with a maximum sensitivity around 200 Hz. They are thought to have very high hearing thresholds, at around 130 dB re 1 µPa (MMS 2009a). It is believed that pile driving and vessel noises are within the range of hearing of turtles, although they may have a limited capacity to detect sound underwater. Observed reactions from sea turtles exposed to high intensity sounds include startle responses such as head retraction and swimming towards the surface, as well as avoidance behavior (MMS 2007a). For more detailed information on the effects of noise within the SAMP area, see § 8.4.5(H) of this Part, Effects of Noise on Marine Mammals.

2. The Cape Wind FEIS (MMS 2009a) predicts that no injury during the pile driving process is likely to occur to sea turtles, even if the turtle were as close as 30 m (98.4 feet) from the source. This prediction is based on noise estimates created assuming the use of monopiles, and based on the particular sound characteristics of the proposed location for the Cape Wind project; estimates for the Ocean SAMP area would differ. The noise

generated by pile driving is likely to cause avoidance behavior in sea turtles, which may move to other areas. Sea turtles migrating through the area may also be affected, as they may avoid the construction area. The Cape Wind FEIS predicted these effects to be short-term and minor (MMS 2009a). The noise created during construction, and thus the effects of noise on sea turtles, may vary depending on the size of the piles and the characteristics of the particular site.

3. Any seismic surveys used in the siting process have the potential to affect individual sea turtles by exposing them to levels of sound high enough to cause disturbance if a turtle is within a certain distance of the sound source (1.5 km [0.9 miles]). While the Cape Wind EIS predicted only minimal effects to sea turtles from seismic surveys (MMS 2009a), the effects to sea turtles from seismic surveys in the Ocean SAMP area will depend on the type of survey device used, the water depths, and other factors.

4. The Cape Wind EIS predicted that levels of noise generated by construction and maintenance vessels are expected to be below the levels that would cause any behavioral reaction in sea turtles except at very short distances. Likewise, the Cape Wind EIS predicted that sound generated by wind turbines during operation is not expected to affect the behavior or abundance of sea turtles in the area (MMS 2009a).

5. The levels of sound generated by the turbines during operation could have the ability to interfere with communication, the location of prey or the orientation of sea turtles if the sounds are in the same frequency ranges heard by sea turtles. As it is not well understood what the hearing capacity of sea turtles is, more studies would be needed to understand whether the sound generated by wind turbines would have any effect (MMS 2007a).

C. Habitat disturbance (formerly § 850.6.2)

1. Cable-laying activities may cause sea turtles to temporarily change swimming direction, and may disturb sea turtles as they typically like to rest on the bottom. The increased turbidity as a result of cable-laying and construction, however, may interfere with the ability of sea turtles to forage by obscuring or dispersing prey (MMS 2009a).

2. Sea turtles could be harmed by marine debris generated from the personnel working on the construction, operation, or decommissioning stages, particularly plastics that may be accidentally or purposely discarded, which may be mistaken for prey items by turtles, or which may cause them to become entangled (MMS 2009a). The dumping of marine debris and other waste is already strictly regulated under existing statutes (30 C.F.R. § 250.300 and MARPOL, Annex V, Public Law 100-220 [101

Statute 1458]), and if followed marine debris will likely not pose a great threat to sea turtles.

3. Sea turtles may be at increased risk of ship strike from increased vessel traffic in the Ocean SAMP area, particularly during construction activities. However, ship strikes are relatively rare, and increased vessel traffic will not necessarily lead to an increase in ship strikes. Vessels engaged in construction activities are probably moving too slowly to present a risk, as turtles can easily move to avoid them. Collision risks will be greater with vessels moving to and from the construction site (MMS 2009a). Sea turtles may avoid areas of high vessel activity, or may dive when approached by a vessel (MMS 2007a). Turtles engaged in feeding are at less of a risk for collision, as they spend most of their time submerged. Loggerhead and Kemp's ridley turtles are bottom feeders, so spend most of their time well below the surface, but leatherback turtles feed at or near the surface, and so are at greater risk of collision (MMS 2009a).

4. Lights from construction activities during non-daylight hours could affect sea turtle hatchlings, which are known to be attracted to light (MMS 2007a). However, sea turtle hatchlings are not expected to be found within the SAMP area, as sea turtles do not nest in this area.

D. Electromagnetic fields (formerly § 850.6.3)

1. Sea turtles have been found to use the earth's geomagnetic field for orientation and migration (MMS 2007a). However, the Cape Wind FEIS anticipated no adverse impacts from electromagnetic fields on sea turtles (MMS 2009a). Electromagnetic fields may have potential effects on some fisheries resources; see § 8.4.7(D) of this Part below for further information.

E. Reef effects (formerly § 850.6.4)

1. The potential reef effects of the turbines, attracting finfish and benthic organisms to the structures, could affect sea turtles by changing prey distribution or abundance in the Ocean SAMP area. Sea turtles that eat benthic invertebrates, particularly loggerhead and Kemp's ridley turtles, which consume crustaceans and mollusks, may be attracted to the structures as an additional food source. Sea turtles may also be attracted to wind turbine structures for shelter; loggerheads in particular have been observed using oil rig platforms for this purpose (NRC 1996 in MMS 2009a). Loggerheads are the species most likely to be attracted to the wind turbines for both food and shelter, and they are frequently observed around wrecks and underwater structures (NRC 1996 in MMS 2009a). For more on reef effects, see § 8.4.3(D) of this Part, Reef Effects and Benthic Ecology.

8.4.7 Fisheries Resources and Habitat (formerly § 850.7)

A. Offshore renewable energy development may have several potential effects on fisheries resources and habitat. Generally, the effects of offshore renewable energy projects on fisheries resources are difficult to interpret given the lack of scientific knowledge and consensus in several relevant subject areas. Given the information available, potential effects to fisheries resources and habitat are discussed below in general terms, but it is important to note that site-specific impacts of an offshore renewable energy project in the Ocean SAMP area will require separate, in-depth evaluation as part of the permitting process. It also must be noted that if threatened or endangered species are found in the project area, additional consultation with relevant federal agencies in accordance with the Endangered Species Act would be necessary to evaluate any potential impacts to these species (MMS 2007a). For areas where Essential Fish Habitat has been designated, the Magnuson-Stevens Fishery Conservation and Management Act requires federal agencies to consult with the National Marine Fisheries Service (MMS 2007a). See Chapter 5, Commercial and Recreational Fisheries for more information on endangered or threatened fish species and on Essential Fish Habitat. See also Chapter 10, Existing Statutes, Regulations and Policies for more information on the ESA as well as the Magnuson-Stevens Fishery Conservation and Management Act.

B. With regard to fisheries resources, potential effects may take place at any phase of the project, including pre-construction testing and site characterization, construction, operation, and decommissioning. Some of these effects may include, but are not limited to: underwater sound associated with increased vessel traffic, scientific surveys, construction, operation, and decommissioning; electromagnetic fields created by the cables connecting the turbines and carrying the electricity to land; construction-related habitat disturbance; water quality impacts; changes in benthic community composition; other effects of structures, including the reef effect; and the effects of decommissioning offshore renewable energy developments.

C. Underwater sound (formerly § 850.7.1)

1. As noted above in § 8.4.5(H) of this Part, an offshore renewable energy project would generate underwater sound in all phases of development. Noise generated by pile driving activities during construction may be most significant and potentially harmful to fish individuals and then onto populations. For more detailed information on sound produced in the construction and operation of an offshore wind facility, please see § 8.4.5(H) of this Part, Effects of Noise on Marine Mammals.

2. Fish vary greatly in their hearing structures and auditory capabilities, so it is difficult to generalize about the effects of noise generated by wind farm construction and operation on fish. There is lack of knowledge about the hearing capacities of most fish species. Certain fish species are thought to

be hearing specialists, and may have enhanced hearing sensitivity and bandwidth, while others may be hearing generalists, and may be less sensitive to sound (Popper and Hastings 2009). Similar to marine mammals, the effect of noise will depend on the overlap between the frequency of the noise and the level of hearing of the species, and whether the sound exceeds the level of ambient noise (Thomsen *et al*. 2006). The impact of the sound produced will also vary greatly depending upon the environmental setting and conditions at the time and place where the sound is being produced (Popper *et al*. 2006).

3. The potential effects of sound from wind farm surveying, construction, decommissioning, and operation, on fish can be divided into three general categories:

   a. temporary or permanent hearing damage or other physical injury or mortality;

   b. behavioral responses; for example, the triggering of alarm reactions, causing fish to flee or interrupting activities necessary for survival (e.g. feeding) and reproduction, and potentially inducing stress in the fish;

c. masking acoustic signals, which may be communication among individuals, or may be information about predators or prey (Thomsen *et al*. 2006).

4. As noted in 8.4.5(H) of this Part, activities in the pre-construction phase generating underwater noise may include side-scan sonar and air guns used in seismic surveying. Studies on fish exposed to air gun blasts have found damage to sensory cells in the ear. While air guns are not likely to be used in the construction or operation of wind farms, they may be used in pre-construction seismic surveys for determining geological hazards and soil conditions in siting a wind farm (MMS 2007a). Side-scan sonar is likely to have little impact on fish, as it is unlikely to cause hearing impairment or physical injury (MMS 2007a).

5. The construction phase is most likely to produce levels of sound that could generate temporary and permanent hearing loss for fish near the source. Injuries of tissues or auditory organs can also occur at close range. Pile driving creates an impulsive sound when the driving hammer strikes the pile, resulting in a rapid release of energy (Hastings and Popper 2005). Peak sound levels produced by pile driving have been measured at anywhere from 228 dB re-1 μPa to 257 dB re-1 μPa, at frequency levels ranging from 20 to more than 20,000 Hz; peak sound levels will vary depending on pile size, material, and equipment used (see Table 8.17 in § 8.4.5(H)(3)(a) of this Part). Only a handful of studies have been conducted on fish in the vicinity of pile driving, and while some have found evidence

of injury or mortality in the fish near the source of the sound, others have found no mortality or injury. One study of pile driving found fish of several different species were killed within at least 50 m [164 feet] of the pile driving activity; it also found an increase in the number of gulls in the area, indicating additional fish mortality (Caltrans 2001). Another study found that the noise levels produced by pile driving during wind tower construction and cable-laying could damage the hearing of species within 100m [328 feet] of the source (Nedwell *et al*. 2003).

6. Impacts to fish from sound can be in the form of damage to organs such as the swim bladder, or damage to the auditory sensor in the ears. Sound can also cause permanent or temporary threshold shift in hearing (PTS or TTS respectively), meaning fish lose all or part of their hearing, on either a permanent or temporary basis. There is some evidence that fish, unlike mammals, can repair their sensory cells used for hearing, and may recover from hearing loss caused by underwater noise. Popper *et al*. (2005) found the effects from even substantial TTS to have worn off for fish within eighteen hours of exposure. However, hearing loss, even if temporary, could render the fish unable to respond to environmental sounds that indicate the presence of predators or that allow the location of prey or potential mates (Popper and Hastings 2009).

7. A review and modeling study conducted by Thomsen *et al*. (2006) based on measurements of wind turbines in the German Bight and Sweden found that sound levels created during pile driving for construction of wind turbines was loud enough to be heard at long distances by some fish species - perhaps as far as 80 km [49.7 mi] from the source for cod and herring, which are considered to be sensitive to sound. Salmon and dab, which have a poor sensitivity for sound pressure, could in theory detect pile driving sound over large distances as well. Flatfish might detect sound that is partly transported through the sediment. Pile driving noise may have the effect of masking other biological noises out to this distance. The nature and scale of behavioral response cannot be determined; however, behavioral responses to the construction noise might happen anywhere within the zone of audibility and could affect fish reproduction and population levels if biologically important activities such as migration, feeding, and spawning are interrupted. The authors determined that injury and mortality may occur in the vicinity of the activity (Thomsen *et al*. 2006). One playback study of pile driving sounds at relatively low pressure levels found sole to increase their swimming speeds during the playback, while cod were found to freeze their movements at the start of the playback (Mueller-Blenkle *et al*. 2010). While studies have generally found that impacts on fish will decrease the further from the source of the sound, this effect is not clearly understood because the relationship between distance and sound level is not straightforward. In some cases sound levels may be higher at some distances from the source due to

propagation through the seabed and sound reflections from objects (Hastings and Popper 2005).

8. The relationship between sound exposure and physiological damage with regard to fish is not well understood, and more research is required to determine the potential effects of pile driving on fish (Thomsen *et al*. 2006). Little is known about potential long-term effects, including later death from injury, predation, or behavioral changes that may affect the individual fish or their populations, nor have studies examined the potential cumulative impacts from pile driving. The effects that noise may have on eggs and larvae have been little studied. Research is also lacking on the impacts on fish at larger distances from the source, where they are unlikely to be killed but may suffer from other physiological effects such as damage to the swim bladder or internal bleeding (Hastings and Popper 2005).

9. The noise created during the construction and decommissioning processes may cause some fish species to leave the area. This could cause a disruption in feeding, breeding, or other essential activities, and may have significant impacts if fish are removed from a spawning area. Less mobile species are likely to be more susceptible (Gill and Kimber 2005). The effect on fish populations would be greater if they are dispersed during the times of year when they would be naturally congregating for spawning or other purposes (Gill and Kimber 2005). Thus, effects will be determined in part by the timing of the project, such as the time of year when the noise disturbance occurs and for how long it occurs. Some studies have found that fish displaced from an area by noise during construction processes are likely to return following construction activity (Hvidt *et al*. 2006 referenced in MMS 2007a). This may be dependent upon duration of the construction project; if construction occurs over a prolonged period, some fish species may not return. The length of time will in turn be dictated by a number of factors including the number of turbines, the availability of vessels, and access to the site as a result of weather conditions. The cumulative effects are likely to be more significant for a larger wind farm where more turbines would be constructed and the period of construction is longer. Miller *et al*. (2010) predicted that pile driving activity within the Ocean SAMP area could have observable behavioral effects on fish within 4000 m (2.5 miles) of the pile driving activity. As described in § 8.4.5(H) of this Part, this analysis was calculated for a 1.7 m [5.5 foot] diameter pile (similar to those used in lattice jacket structures) driven into the bottom with an impact hammer. If explosives were used in the decommissioning process, the noise produced could have a serious impact on any marine life within 500 m (0.3 miles) of the activity (Miller *et al*. 2010) (see § 8.4.5 of this Part for more information).

10. Fish of different species produce a variety of sounds, many of which may be used for mating or other communication purposes. The sounds produced by wind turbines, particularly in the construction phase, may mask some of these sounds produced by fish, as the frequencies of pile driving and fish signals overlap. For example, cod, which are found in the Ocean SAMP area, produce a number of grunting sounds that are used in defensive and aggressive behaviors, and in courting mates. Masking these sounds with construction noise could have implications for mating and other behaviors. Because the transmission of the sounds could be audible by some species over great distances, the masking effects may also occur over great distances (Thomsen *et al*. 2006). The effect may depend on the signals produced by the fish; in species where only a single sound makes up a communication signal the effect may be negligible, because the duration of the pile driving sound is very short. However, some fish produce sequences of sounds that might be disrupted by pile driving pulses. Where a large number of turbines are being installed and the length of construction is longer, the masking effect may be appreciable (Thomsen *et al*. 2006). The noise produced in construction and operation could also mask the sounds of approaching predators or prey. Detecting those sounds may be crucial for survival (Wahlberg and Westerberg 2005). However, because neither the hearing capabilities of most fish nor the function of sounds produced by the fish is well understood, the effects of masking cannot yet be determined (Thomsen *et al*. 2006).

11. One potential effect on fish from noise could be stress; while this is difficult to quantify, some studies have shown that exposure to stressors can result in opportunistic infections, or may make fish more susceptible to predation or other environmental effects. Some studies on fish exposed to noise found no significant change in stress levels, but these results cannot necessarily be extrapolated to predicting the overall effects of exposure to noise on fish stress levels (Popper and Hastings 2009).

12. If the effects of noise on fish are poorly understood, the effects on invertebrates are even less well understood. One study found that shrimp demonstrated decreases in growth and reproductive rates when exposed to noise for an extended period (Popper and Hastings 2009).

13. Research on existing offshore wind farms in the Baltic Sea has found that the operation of the turbines adds to the existing array of underwater sound, and that the acoustic disturbance caused by the turbines is most likely a function of the number of turbines and their operation procedure (studies reviewed by Gill 2005). As noted above, operational noise produced by wind turbines is significantly less than the levels of noise produced during the construction phase. Even within ten meters of the turbine, the noise created is not likely to be sufficient to cause temporary or permanent hearing loss in any species of fish (Wahlberg and Westerberg 2005). One study found that the noise created by a 1.5 MW

turbine was merged with ambient noise within one kilometer from the source (Thomsen *et al*. 2006). Miller *et al*. (2010) predicted that within the Ocean SAMP area where eight wind turbines are proposed south of Block Island, the operational noise of the turbines would contribute 424 pW/m2 or 88 dB re 1 mPa of additional noise, significantly less than the noise produced by shipping, wind, and rain in the area. This level would be greater than ambient noise within one kilometer (0.6 miles) of the source, and would be below ambient noise levels at a distance of ten kilometers (6 miles) from the source (Miller *et al*. 2010). Underwater noise created by offshore wind turbines in Europe has been measured at 118 dB re 1 mPa2 for a 1/3 octave band at a range of 100 meters during full power production (Betke *et al*. 2004).

14. Thomsen *et al*. (2006) predicted the noise generated by wind turbine operation might be heard up to four or five kilometers from the source by fish with exceptional hearing such as cod and herring, and maybe less than one kilometer by fish with less specialized hearing capabilities such as dab and salmon. Any behavioral or physiological effects on fish for levels of noise created by turbine operation would likely be restricted to very short ranges (Thomsen *et al*. 2006). However, it is important to note that most of these studies have been for 1.5 MW turbines, while those proposed for the Ocean SAMP area would likely be 3.6 or 5.0 MW. Additional studies are needed on the noise levels generated by these larger turbines.

15. As noted above, another source of sound from wind turbine projects is ship traffic, from ships carrying parts and maintenance equipment during the construction, operation, and decommissioning processes. The noise levels of sound created by vessels will not cause physical harm to fish, but may cause avoidance of the area (MMS 2007a). The duration of avoidance may be determined by the duration of construction activity and the accompanying period of increased vessel traffic.

D. Electromagnetic fields (formerly § 850.7.2)

1. Producing electricity with a wind turbine requires it to be moved over long distances by means of a submarine cable. The transmission is either via high voltage Direct Current (DC) or Alternating Current (AC) cables, with AC being the favored for short distances and DC for longer distances between the project and shore. These cables will necessarily produce magnetic fields around the cables. The intensity of the magnetic field increases with the electric current, and decreases with distance from the cable. The design of industry standard AC cables prevent electric field emissions, but do not prevent magnetic field emissions. These magnetic emissions induce localized electric fields in the marine environment as sea water moves through them. Furthermore, in AC cables the magnetic fields oscillate, and thereby also create an induced electric field in the

environment around the cables, regardless of whether the cable is buried. Thus the term electromagnetic field, or EMF, refers to both of these created fields (Petersen and Malm 2006).

2. Exposure to magnetic fields is not unique to undersea cables; the earth has its own geomagnetic field, which many organisms utilize for orientation. Little is understood about the orientation of animals in response to the geomagnetic field, but evidence of geomagnetic orientation has been observed in a number of marine species, including fish, mollusks, and other crustaceans. In laboratory experiments conducted on a number of different marine animals in response to static magnetic fields generated by electrical current, most demonstrated no short-term change in behavior when the magnetic field was introduced. In one experiment by Bochert and Zettler (2004) where several organisms were exposed to EMF generated by a DC power source, of four crustacean species, blue mussels, and flounder studied, only one crustacean species, an isopod, demonstrated any avoidance of the magnetic field. In other experiments by the same authors on the long-term effects of magnetic fields on crustaceans and flounder, no significant effects were demonstrated. The authors conclude that the static magnetic fields of submarine cables produced by DC currents have no clear influence on the orientation, physiology, or movement of the benthic animals they tested (Bochert and Zettler 2004).

3. However, some evidence exists supporting the argument that EMF may have detrimental effects. Other studies have shown that some species of sharks, rays, and bony fishes detect electromagnetic fields and have demonstrated sensitivity to these EMFs (Gill *et al*. 2005). The induced electrical fields created by the magnetic fields from the cables are within the range of electrical transmissions detectable by sharks and rays (Gill and Kimber 2005). Exposure to certain magnetic fields was found to delay the development of embryos in fish and sea urchins (Cameron *et al*. 1985; Cameron *et al*. 1993; Zimmerman *et al*. 1990). Barnacle larvae exposed to high frequency AC EMF were found to retract their antennae, which would interfere with settlement (Leya *et al*. 1999). In another study, brown shrimp (Crangon crangon) were found to be attracted to magnetic fields of the magnitude that would be expected to be present around wind farms (ICES 2003). Little is known about the effects of EMF on lobsters. However, because effects have been demonstrated on brown shrimp and other crustaceans, an effect on lobsters can be anticipated.

4. Species using the Earth's magnetic field for navigation or orientation may be affected by the EMF, possibly becoming confused, but this effect will likely be short-lived as the animal moves through the area. Species that are magnetosensitive may either be attracted to or avoid the area (Gill 2005). If elasmobranchs (sharks, rays or skates) and other fish are sensitive to the electromagnetic fields and avoid passing over the cables,

this could prevent movement from one location to another, trapping fish either within our outside of the cables (BMT Cordah Limited 2003). It is generally thought that the magnetic fields created by the cables will be much lower than the earth's geomagnetic field and will therefore cause no significant response (Gill and Kimber 2005). One study on the European eel (*Anguilla anguilla*) found that eels significantly decrease their swimming speed when passing over an AC cable (Westerberg and Lagenfelt 2008). A study of cables at Danish wind farms found some effects on fish behavior from the presence of the cables, but the effects included both avoidance and attraction, and could not be correlated with the strength of the EMFs (DONG Energy *et al*. 2006). Catch studies on some species of fish (Baltic herring, common eel, Atlantic cod and flounder) at the Nysted wind farm in Denmark found the catches of these species were reduced in the vicinity of the cables, indicating the migration of fish across the cables may be reduced, but not blocked. In a separate study, they also found cod accumulating close to the cables however this was not when the cables were energized so there may be some other stimuli that the fish were responding to such as the physical presence of the cable trench (DONG Energy and Vattenfall 2006).

5. If the electric fields being emitted by the cables approximate the bioelectric fields of some species, there is a possibility that certain electro-sensitive species, particularly elasmobranchs (sharks, skates, and rays) and sturgeon species, will be attracted to the cables, thinking them to be prey. The same species may be repelled by stronger electric fields closer to the cables, depending on the power sent through the cable and the characteristics of the cable itself. Because the cables will be buried in sediment or laid along the bottom, benthic species are most likely to encounter them (Gill and Kimber 2005). There is one report of sharks biting an unburied cable on the seafloor that was emitting induced AC electric fields (Marra 1989); however, there is little other data on interactions between sharks or other species and cables.

6. Miller *et al*. (2010) predict the electromagnetic fields that would be produced by the 26 kVA power cables likely to be used for the wind turbines proposed south of Block Island could have behavioral effects on marine life within 20 m (66 feet) of the cables.

7. There is no conclusive evidence at present on whether EMFs may have an impact on marine species (Johnson *et al*. 2008). However, because the effects of electromagnetic fields on fish and other species are poorly understood, more research is needed in this field. The effects of EMFs on species present within the Ocean SAMP area should not be assumed until further research is completed. It is not known whether resident species will be able to habituate to EMF, but this could be important for helping to determine appropriate mitigation measures.

E. Habitat disturbance (formerly § 850.7.3)

1. Disturbance to existing habitat is likely to result through the construction of offshore renewable energy infrastructure. Here, habitat disturbance is used broadly to refer to sediment disturbance and settling; increased turbidity of the waters in the construction area; and the installation of infrastructure including piles, anti-scour devices, and other structures (MMS 2007a). The period of time and the extent of the disturbance, and thus its severity, will depend on the size of the wind farm and the amount of time necessary to construct it. For the proposed large-scale project in the Ocean SAMP area, this is likely to be a year or two. The total area of the seafloor affected will be only a small percentage of the entire Ocean SAMP area; however, the overall effect will depend in part upon the relative prevalence or scarcity of the habitat type(s) affected, and the availability of similar habitat in the adjacent area. For more on the effects of offshore renewable energy on habitat and the benthic ecology of the Ocean SAMP area, see § 8.4.3 of this Part.

2. The construction of wind turbines is likely to have both short- and long-term effects on habitat. Habitat conversion and loss can result because of physical occupation of the substrate, and includes both changes to existing habitat and the creation of new habitat. Scour protection around the structures, which is made up of rock or concrete mattresses, increases the loss or conversion of habitat (Johnson *et al*. 2008). Direct effects to the seabed are likely to be limited to within one or two hundred meters of the structure, and there are likely to be areas between turbines which remain undisturbed (OSPAR 2006). For more on the creation of new habitat, see §§ 8.4.7(I) (Reef Effects and Fisheries) and 8.4.3(D) (Reef Effects and Benthic Ecology) of this Part.

3. Construction of the wind turbine foundations and the installation of cables can result in increased turbidity in the water column as well. This may in turn affect primary production of phytoplankton and the food chain, which could lead to an increased likelihood of eutrophic conditions. However, these effects are likely to be short-term and localized, and the overall impact on fish resources would be negligible (MMS 2007a). Removal of sediments may result in habitat loss (Gill 2005). These are generally short-term impacts which will subside once construction has been completed (Johnson *et al*. 2008). Any sediment resuspended in the construction or decommissioning processes are likely to be transported by water movement, and may smother the neighboring habitats of sedimentary species. These sediments may also carry contaminants with them if the area has a history of industrial processes emitting into the adjacent waters (Gill 2005).

4. The interference in water flow caused by the wind turbine substructures may accelerate local tidal currents and wave action around the structures,

forming scour holes in the sea bed adjacent to the pilings. These holes may be attractive habitat to species such as crab and lobster, and to some fish species (Rodmell and Johnson 2005).

5. Additional impacts from wind turbines would come from the eventual decommissioning and removal of the undersea structures, immediately reducing habitat heterogeneity and removing a large component of the benthic community that has established since the wind farm has been in operation (Gill 2005).

6. The installation and burial of submarine cables causes temporary habitat destruction through plowing and from barge anchor damage, and can cause permanent habitat alteration if the top layers of sediment are replaced with new material during the cable-laying process, or if the cables are not sufficiently buried within the substrate. Likewise, cable repair or decommissioning can impact benthic habitats. The effect of the cables will depend on the grain size of sediments, hydrodynamics and turbidity of the area, and on the species and habitats present where the cable is being laid (OSPAR 2008). Undersea cables can also cause damage if allowed to "sweep" along the bottom while being placed in the correct location. The most serious threats are to submerged aquatic vegetation, which serves as an important habitat for a wide variety of marine species. Shellfish beds and hard-bottom habitats are also especially at risk (Johnson *et al*. 2008).

7. The placement of wind turbines, especially in large arrays, may affect flow regimes by altering tidal current patterns around the structures, which may affect the distribution of eggs and larvae (Johnson *et al*. 2008). Because the structures are likely to affect currents, the settlement of new recruits may be locally affected. These effects on habitat will be most harmful if they affect the spawning or nursery areas of species whose populations are depleted, especially if the spawning or nursery areas used by these species are limited and the species have long maturation periods, such as sharks and skates (Gill 2005). A study of turbines in Danish waters found little to no impact on native benthic communities and sediment structure from a change in hydrodynamic regimes (DONG Energy *et al*. 2006). For more on the effects of wind turbines on coastal processes, see § 8.4.2 of this Part.

F. Water quality impacts (formerly § 850.7.4)

1. Offshore renewable energy facilities would result in increased vessel traffic through the pre-construction site characterization, construction, operation, and decommissioning phases. The PEIS indicates that such an increase in traffic could increase the likelihood of fuel spills as a result of vessel accidents or mechanical problems, though it indicates that the likelihood of such spills is relatively small because of the small amount of

vessel traffic that would be associated with the project (MMS 2007a). The risk of fuel spills could also increase because of the increased likelihood of vessel collisions with the wind turbine structures.

2. Wastewater, trash, and other debris can be generated at offshore energy sites by human activities associated with the facility (in construction and maintenance processes). The platforms may hold hazardous materials such as fuel, oils, greases, and coolants. The discharge of these contaminants into the water column could affect the water quality around the facility. Large-scale offshore renewable energy projects are likely to have one or more transformers, which will contain dielectric fluid, such as mineral oil, which could pose a threat to water quality through leakage or in the event of a collision (MMS 2009a). Vessels traveling to and from the platforms may dump gray water or sewage, or may release plastics and other debris (Johnson *et al*. 2008).

3. Water quality may also be impacted during the construction process by re-suspending bottom sediments, increasing the sedimentation within the water column. This may impact the abundance of planktonic species, and could lead to eutrophication.

G. Changes in community composition (formerly § 850.7.5)

1. Wind energy and other offshore renewable energy projects could have indirect ecological effects that could affect the composition of fish species within the area. During the construction and decommissioning phases of a project, highly mobile fauna, including fish and large crustaceans, are likely to be displaced from the area, and there may be changes to some habitats, either through habitat loss or through enhancement. These factors may affect the composition of species found in the area. For more on the effects of changes in community composition, see § 8.4.3(E) of this Part.

2. During the construction and decommissioning phases of a project, the eggs and larvae of many species of fish may be vulnerable to being buried or removed. Some species, such as herring and sand eels, lay their eggs in the substrate; if wind farm construction took place within the spawning grounds of these species, it would likely impact the species (BMT Cordah Limited 2003). Other benthic organisms may also be buried in the process, which could affect finfish and shellfish that rely on these organisms for food. Individual fish are likely to move out of the area during construction because of the disturbance and because of the loss of food (MMS 2007a). After the activity has ceased, recolonization may take months or years (Gill 2005).

3. No detailed, long-term analyses have yet been conducted on entire fish assemblages around either decommissioned oil platforms (a suitable

comparable development of the coastal environment) or wind energy projects (Ehrich *et al*. 2006). Ehrich *et al*. (2006) hypothesize that any effects on fish densities and diversity resulting from newly installed wind turbines will be restricted to the immediate vicinity of the structures, and will not have wide-reaching effects, unless rare species are directly affected, which could have effects at the population level. The authors also note that in cases where wind turbines are constructed in areas with a sandy bottom, there may be localized removal of species dependent on soft-bottom habitat, favoring species which prefer hard bottoms, as the hard structures serve as habitat for these species. As most wind farms thus far have been constructed in areas of sandy bottom, there is little data on changes to other types of benthic habitats. They suggest that the wind farms will also favor large predators, particularly if fishing pressure among the turbines is reduced (Ehrich *et al*. 2006).

4. There may also be changes in predator-prey relationships, in which some predators move out of the area temporarily or have their numbers temporarily reduced during the construction phase. This can result in the process of competitive release, in which species preyed upon by these predators become available to other predators. Often it is smaller species with faster rates of reproduction that will replace existing species. This could have secondary effects elsewhere, if the numbers of predators increase outside of the area of development (Gill and Kimber 2005).

5. The decommissioning of wind turbines would also have significant ecological effects, as the new habitat and accompanying species are removed. Habitat heterogeneity and the abundance of species would be reduced.

H. Structures (formerly § 850.7.6)

1. Organisms may either collide with or avoid the wind turbine structures underwater. While little information is available regarding this topic, the greatest impacts are likely to be within enclosed waters or where the devices form a barrier to movement (Gill 2005); thus collision and avoidance are not likely to be major impacts of the proposed wind turbines in the Ocean SAMP area.

I. Reef effect (formerly § 850.7.7)

1. As noted above in§ 8.4.3(D), wind turbine structures may serve as both artificial reefs, in providing surfaces for non-mobile species to grow on and shelter for small fish, and as fish aggregating devices, which are used to enhance catches by attracting fish (Wilhelmsson *et al*. 2006).

2. After the wind turbines are in place, a change in the type and abundance of benthic species can be expected, which will change food availability for

higher trophic levels. Because the placement of wind turbines may increase habitat for benthic species, the structures may have the effect of increasing local food availability, which may bring some species into the area. This may increase use of the area by immigrant fauna. More adaptable species will probably dominate the area under these new ecological conditions. The change in prey size, type, and abundance in the vicinity of the structures may also affect predators. Predators moving into the area may result in prey depletion (Gill 2005).

3. Oil and gas platforms have been found to harbor large numbers of larval and juvenile fish, and wind turbine support structure can be expected to have a similar effect. Because the structures extend throughout the water column, juvenile or larval fish are more likely to encounter them than other habitat types found only on the bottom, and may be more likely to settle there. There may also be less predation on small fish in midwater habitats, so they can safely hide in the structure at a variety of depths (Love *et al*. 2003). Fish can take advantage of the shelter provided by the structures while being exposed to stronger currents created by the structures, which generate more plankton for plankton-eating fish (Wilhelmsson *et al*. 2006). While colonization of the new structures will begin shortly after construction, it will usually take several years for the colonization to be completed, because not all species will colonize the area at once (DONG Energy *et al*. 2006) and there will be a succession of species and a likely increase in species using the newly formed community hence increasing diversity.

4. Wind turbines may also provide refuge from predation for juveniles of a number of mobile species, which is critical in promoting growth and survival until they reach maturity. Similarly, the structures may also provide refuge for both large and small fish and other species from fishing pressure. In the UK, where fishing is currently not permitted around the structures, they are being promoted as protected areas, and may eventually contribute to stock replenishment for some species. These structures have not yet been in the water long enough to see these effects; however, many of the juvenile fish found around the turbines are small Gadoid species such as cod. Additionally, if there is an absence of trawling and dredging between the wind farms, it may result in increases in benthic fauna (DONG Energy *et al*. 2006; Kaiser *et al*. 2000). Even if fishing is permitted, most fishermen are unlikely to fish immediately next to the turbines because of the possibility of having gear tangled in the structures (see § 8.4.8 of this Part). In oil and gas platforms, fish that remain within the jacketed structures may be less vulnerable to fishing pressure than others (Love *et al*. 2003). In addition to fish, these structures may also provide important habitat for lobsters and crabs. Young, newly-settled individuals of these species typically seek out refuge to avoid predation, including hiding among stones and cobbles, or burying in sediments. Wind turbines and scour protection may provide suitable

hiding places for these individuals, and may enhance the lobster fishery in cases where habitat is a limiting factor (Linley *et al*. 2007).

5. A number of studies of decommissioned oil platforms have indicated fish are attracted by the structures (Ehrich *et al*. 2006). A study conducted on oil and gas platforms off the Californian coast found that the platforms tended to have higher abundances of large, commercially targeted fish than did natural reefs. This result may have been because of low fishing activity around the platforms, creating de facto marine protected areas. Generally, the platforms also had higher numbers of young-of-the-year rockfish than other areas, including natural reefs (Love and Schroeder 2006). One study noted the tendency of large, recreationally targeted species such as tunas and mackerel to associate with fish aggregating devices, and predicted wind turbines might have the same effect (Fayram and de Risi 2007). A study of decommissioned oil rigs in the North Sea off Norway found aggregations of cod, mackerel, and other species around the structures (Soldal *et al*. 2002).

6. The observed effect of other wind turbines has found some species are attracted to wind farms. A study of wind farms in Danish waters found the increased habitat heterogeneity from turbine foundations resulted in an increase of species from adjacent hard surfaces, leading to a local increase in biomass of 50 to 150 times, most of which served as available food for fish and seabirds (DONG Energy *et al*. 2006). Monitoring of the Horns Rev wind farm in Denmark found a 300% increase in the number of sand eels around the wind turbines between 2002 and 2004, and an eight-fold increase in the availability of food for fish in the area, but not a statistically significant difference in the number of fish (DONG Energy and Vattenfall 2006). Another study found an increased number of cod in the area surrounding wind turbines at the Vindeby Offshore Wind Farm in Denmark (Bioconsult A/S 2002). Some studies have not found an increase in fish around structures; this may be because the studies were conducted during the early stages of colonization (DONG Energy *et al*. 2006).

7. One question to be determined about wind turbines is whether they actually increase fish populations by providing habitat, or simply attract fish from elsewhere, concentrating them in the area of the structure. If individual fish are being attracted to the site, but populations are not increasing, this may have impacts on adjacent habitats where the fish would ordinarily be found (Gill 2005). If the structures serve only to aggregate fish and not to produce additional biomass, there is a risk of harvesting pressure around the structures leading to overexploitation of certain stocks by concentrating the fish and leaving them more vulnerable to harvesting (Whitmarsh *et al*. 2008).

8. Love and Schroeder (2006) found that in some instances, the fish found at the platforms were producing significant amounts of larvae that may have

been increasing populations around the platforms and elsewhere. They also found that while some of the fish present around oil and gas platforms were adults of species that had likely migrated from elsewhere, the majority of individuals for many species were small juveniles that had likely been brought to the platforms as plankton and settled there (Love *et al*. 2003). Love and Schroeder (2006) also found that juvenile fish living around oil and gas platforms had lower predation rates than fish living on natural reefs, because of a low density of predators in the mid- and upper waters around the platforms, and that there appeared to be no difference in growth rates between fish living on platforms or on natural reefs.

J. Decommissioning effects (formerly § 850.7.8)

1. As discussed above, wind turbine structures may serve as artificial reefs, providing habitat for a number of invertebrate and fish species, especially juvenile fish. As such, the eventual decommissioning of the turbines could have negative environmental impacts by reducing or removing this habitat. While this issue has not yet been dealt with for offshore wind energy projects, the debate over how to best decommission oil and gas platforms has been ongoing in California and the Gulf of Mexico. For oil and gas platforms, it is estimated that the life of a decommissioned platform left in place will be from 100 to more than 300 years (Love *et al*. 2003). A large-scale wind farm will occupy more seabed space than individual oil and gas rigs, and thus the area of the ocean floor affected by both construction and decommissioning will be larger than for oil and gas rigs. The decommissioning of the wind turbines and the resulting effects on fish and fisheries should be considered.

8.4.8 Commercial and Recreational Fishing (formerly § 850.8)

A. Offshore renewable energy may affect commercial and recreational fisheries activity in many different ways. Some of the potential effects on fishermen from the placement of a wind farm in the Ocean SAMP area may include changing the distribution and/or abundance of fish populations, increasing stocks of certain fish through reef effects; limiting fishermen's access to traditional fishing grounds; gear or vessel damage; and other changes to fishing activities. These general types of effects are discussed below, though specific effects are dependent on site-specific conditions such as location, type and scale of project, and other factors. The potential site-specific effects of an offshore renewable energy project in the Ocean SAMP area will undergo in-depth evaluation as part of the permitting process (see Section 820.4 and Chapter 10, Existing Statutes, Regulations and Policies).

B. Effects on fish populations (formerly § 850.8.1)

1. Some fish species, especially rare or overfished species, could be negatively affected by the presence of wind farms if the wind farms result

in a localized concentration of fishing effort and an increased harvest if the species are attracted to the structures. Alternatively, the increased habitat for some species created by the structures may result in increased populations of commercially important species (see § 8.4.7(I) of this Part), leading to economic gains for commercial fishermen targeting these species (BMT Cordah Limited 2003), and increased opportunities for recreational anglers, who are likely to focus their efforts around the wind turbines.

2. There is also the potential for secondary effects on fish populations if fishermen are displaced from the wind farm area, and as a result concentrate their efforts elsewhere on vulnerable populations or habitats (BMT Cordah Limited 2003). Likewise, if the wind turbines serve as fish aggregating devices, attracting and concentrating fish from elsewhere in the Ocean SAMP area, and attracting more commercial and recreational fishing activity to the area to take advantage of the aggregation, it could have the undesired outcome of leaving fish species more vulnerable to overharvesting from more concentrated fishing effort (Whitmarsh *et al*. 2008).

3. Fish populations could be affected by some or a combination of the factors listed in § 8.4.7 of this Part, such as noise or electromagnetic fields, which could potentially have effects at the population levels if activities such as spawning or feeding are affected. Some fish populations could also be affected by a change in benthic habitat as some areas of the seafloor are converted to hard structures. The cumulative effects of the factors mentioned above may also need to be considered. For more on the ways in which wind farms may affect fish, see § 8.4.7 of this Part.

C. Effects on fish catch (formerly § 850.8.2)

1. Negative impacts to fish catches may be greatest during the construction phase, when the noise generated by construction activities may drive some mobile species out of the immediate area.

2. Engås *et al*. (1996) found the average catch rates for cod to decrease by about 50% both in the immediate vicinity of and at a distance from air gun activity. Haddock catches also decreased by similar percentages. Five days after the air gun was used, fish catches had not increased. However, as noted above, air guns are unlikely to be used in the pre-construction siting process.

3. Positive impacts to fish catch may occur during the operational phase as a result of reef effects if there is a resulting increase in or aggregation of biomass around the turbine structures. If there is an increase in fish in the vicinity of the turbines, this could benefit fishermen, particularly

recreational and commercial rod and reel fishermen, who may be most easily able to target these fish.

4. Westerberg (1994, 2000, as reported in Thomsen *et al*. 2006) found that catches of cod decreased within 100m [328 ft] of a wind turbine while it was operating, likely because of the noise generated by the turbine itself. The study also found higher catches within 100m [328 ft] of the turbines than in the surrounding areas when the turbines were stopped, likely because of the reef effect (for more on the reef effect and fisheries, see § 8.4.7(I) of this Part). However, in a separate study, Wahlberg and Westerberg (2005) estimated that the levels of noise produced by operating turbines (1.5 MW) were only likely to cause avoidance responses by fish closer than 4 m [13 ft] to the turbines and only at high wind speeds (13 m/s [29.1 mph]). They also noted that fish may habituate to the noise created by the wind turbines and disregard the sound. The potential effect of operational noise on fish may vary between projects, as operational noise will varies depending on the turbine size, model, foundation type and speed of rotation (see § 8.4.5(H) of this Part).

5. In a study by Vella *et al*. (2001), the catch per unit effort (CPUE) of cod (*Gadus morhua*) and shorthorn sculpin (*Myoxocephalus scorpius*) was greater within 200 m [656 ft] of a wind turbine than between 200 – 400 m [656-1,312 ft] of a turbine, regardless of whether the turbine was operational or not. The study did find that CPUE was lower in the vicinity of the turbine while the turbine was operational, but still higher than in the area 200 – 400 m from the turbine. This indicates that the turbine may be increasing catch because it is acting as a fish aggregating device (Rodmell and Johnson 2005).

D. Access to fishing grounds (formerly § 850.8.3)

1. Offshore renewable energy facilities may have an adverse impact on commercial and recreational fishermen's access to traditional fishing grounds. The degree of impact varies significantly by facility design, stage of the development process, location in the offshore environment, and type of fishing activity, and may be either temporary or long-term. Fishermen may be displaced from traditional fishing grounds by the structures themselves, regulatory decisions that limit access around the structures or through the facility, or other factors.

2. Fishing access around existing offshore renewable energy facilities in Belgium, Germany, the Netherlands, and the United Kingdom is subject to restrictions imposed by those countries' respective governments. In Belgium, Germany, and the Netherlands, a 500-meter Safety Zone is established around the entire wind farm, and fishing is prohibited within this area. In the United Kingdom, a 500-meter [0.3 mi] Safety Zone is established around each individual turbine only during the construction

period. During operation, a 50-meter [164 ft] Safety Zone is established around each individual turbine. These restrictions are primarily instituted for safety reasons and are similar to those applied to offshore oil and gas rigs in these same countries (except for Belgium, where there are no rigs).

3. In the Ocean SAMP area and other U.S. waters, access around individual turbines or through wind farms is the jurisdiction of the U.S. Coast Guard, in partnership with the U.S. Army Corps of Engineers (in state waters) and the U.S. Bureau of Ocean Energy Management, Regulation and Enforcement (in federal waters). At the time of this writing, there is no formal policy in place that would universally limit fishing or navigational access around and through offshore wind farms in U.S. waters. In addition, as a point of reference, it should be noted that safety zones are not universally established at Gulf of Mexico offshore oil and gas platforms. Those few platform specific safety zones that are in place are designed to address site- and activity-specific safety issues and typically allow recreational activities, including recreational fishing (LeBlanc, pers. comm.).

4. Fishing activity will be affected differently through different stages of the development process. Fishing vessels may be required or may choose to avoid the area during the construction process to avoid conflict with construction activities and vessels. During the operation phase, fishermen may be required or may choose to avoid the turbines because of the potential risk to their vessels or fishing gear from collision with a turbine, snagging gear, or other safety concerns.

5. The potential impacts of offshore renewable energy on fisheries activity varies by gear type. The PEIS (MMS 2007a) indicates that bottom trawling has the greatest potential for conflict with offshore facilities because of the potential for snagging bottom gear on cables and debris. It further indicates that surface longlining may encounter water-sheet use conflicts with renewable energy facility construction and service vessels.

6. If certain gear or vessel types are restricted from the wind farms, either for safety and navigational reasons, or because those fishermen choose to fish elsewhere because of the difficulty of navigating amongst the turbines, this may actually benefit competing gear types fishing for the same species within the wind farms. The presence of a wind farm may significantly alter the patterns of fishing within the area (North Western and North Wales Sea Fisheries Committee n.d.).

7. A loss of fishing grounds from the placement of a wind farm could cause vessels to have to travel further to fishing grounds (BMT Cordah Limited 2003), increasing fuel costs and potentially risks to safety. This could have a disproportionate impact on smaller fishing vessels, to which the risks of venturing further to sea will be greater.

8. Some fishermen have expressed the concern that marine insurance companies might increase their insurance premiums or prohibit insured fishing vessels from operating within the vicinity of offshore wind farms (e.g. Ichthys Marine 2009). However, it should be noted that at the time of this writing, Sunderland Marine does not currently impose restrictions or higher premiums on their members, nor have they heard of other insurance companies issuing such demands (McBurnie, pers. comm.). Sunderland Marine is the world's largest insurer of fishing vessels, and insures The Point Club, a fishing vessel insurance and safety club that insures many of the fishing vessels operating out of Point Judith and Newport (Nixon, pers. comm.).

E. Gear/vessel damage (formerly § 850.8.4)

1. Wind farms may present a navigational hazard for fishing and other vessels, and there is some risk of collision with turbines, or with service vessels. Power cables and bottom fishing gear present mutual possibilities for damage, and may endanger the safety of fishing vessels. Burying cables between the turbines, as well as from the wind farm to shore, will mitigate some of this problem. However, even if cables are buried, there is a potential for them to become uncovered through sea bed movement, putting a trawled net and perhaps the fishing vessel in danger of hang ups (Rodmell and Johnson 2005). Rodmell and Johnson (2005) note that single vessel trawling within and around the wind turbines may be possible if cables are sufficiently buried or protected, but that pair trawling may not be practical, and scallop dredging may not be compatible with wind farms.

2. Long lining and gill nets may be feasible in the vicinity of wind turbines, although their lengths may need to be limited depending on the spacing of the turbines. Purse seining within the wind farms is likely to be difficult, although may be possible on a small scale. The use of lobster and fish pots in the vicinity of the wind turbines should be mostly undisturbed. Even if fishing activity is permitted within the wind farms, fishing vessels may prefer to avoid navigating within and through wind farms (Rodmell and Johnson 2005).

F. Changes to fishing activity (formerly § 850.8.5)

1. The presence of wind farms may impede access to fishing grounds for some fishermen; even if fishing within the turbines is not restricted, some fishermen may choose to avoid the wind farms for safety or insurance reasons, and may have to travel further to fish, making it harder or more costly to retain the same level of catch. The greatest impacts may be to smaller vessels, which may be more limited in their ability to fish elsewhere. This may also result in increased competition for space in other areas (Rodmell and Johnson 2005). Those vessels most likely to have to avoid the wind farm areas will be those with towed or static nets

(Mackinson *et al*. 2006), which in the Ocean SAMP waters includes primarily trawlers and scallop dredges. As many trawlers are targeting groundfish, already a vulnerable fishery due to declining catches and increasing regulations, groundfishing vessels may be the most vulnerable to possible increased costs or reduced earnings from displacement.

2. Fishermen interviewed in the UK were concerned that if they were displaced from their usual fishing grounds, they would have to spend time searching for new fishing grounds, and that if there were insufficient resources in the new fishing grounds to support them, they would inevitably suffer from a reduction in catch. If the fishermen are displaced, they may also suffer a reduction in catch because of the time required to search for and develop the specialized local knowledge of their new fishing grounds they have held at their previous grounds. Fishermen relocated to another area may suffer reduced earnings because they are competing with vessels already fishing in the area, or, in the case that a larger vessel is displaced and seeks out new fishing grounds, it may in turn displace smaller vessels fishing already fishing in the new area (Mackinson *et al*. 2006).

3. Fishermen in the UK were concerned about impacts on the availability and cost of insurance for fishing vessels navigating around wind farms, even if fishing within wind farms is legal (Mackinson *et al*. 2006).

4. If the wind turbine support structures serve as artificial reefs or fish aggregating devices, they could have positive economic benefits for some commercial fishermen through increased catch rates. A study of artificial reefs off Portugal found that fishing around the artificial reefs resulted in substantially higher revenues, and that the value per unit of effort was also greater, because the fish were more concentrated (Whitmarsh *et al*. 2008). These benefits would likely only accrue to fishermen able to fish in the vicinity of the structures, although if the reef effects of the turbine support structures serve to increase fish biomass overall, this could benefit all fishermen in terms of spillover to adjacent habitats and thereby increased catches. There is also a danger that the economic benefits from fish aggregation and the resulting increase in catch efficiency around the turbines could lead to overexploitation of stocks and decrease catches elsewhere, negating any positive benefits to be had (Whitmarsh *et al*. 2008).

5. Any reef effect would also have positive benefits for recreational anglers, who would likely be drawn to the area and may have more opportunities for fishing. This could have secondary economic effects by increasing recreational fishing activity and thus expenditures in the Ocean SAMP area.

6. Fishing incomes may be supplemented or enhanced by offshore aquaculture activities that may be based around the wind turbines. For more on this potential future use, see Chapter 9, Other Future Uses.

8.4.9 Cultural and Historic Resources (formerly § 850.9)

A. The potential effects of offshore renewable energy on cultural and historic resources may include physical impacts on existing offshore submerged archaeological resources such as shipwrecks or pre-contact settlements on the ocean floor, as well as visual impacts when the development is proposed within the viewshed of onshore land-based sites designated as historically significant.

B. Research and documentation of the effects of offshore renewable energy on cultural and historic resources have been compiled for projects in Europe, and during review for the Cape Wind project proposal in the United States (MMS 2010). In anticipation of future offshore renewable energy development within the U.S., BOEM has identified potential impacts and enhancements of such development on cultural and visual resources in the PEIS (MMS 2007a). From Europe, the Collaborative Offshore Wind Research Into the Environment (COWRIE) released, "Guidance for Assessment of Cumulative Impacts on the Historic Environment from Offshore Renewable Energy", that identifies both synergistic and cumulative impacts on cultural and historic resources (COWRIE 2007).

C. The term "Area of Potential Effect" (APE) is defined under the federal National Historic Preservation Act (36 C.F.R. §§ 800.1 through 800.16) as the areas within which a project may directly or indirectly alter the character or use of historic properties. For offshore development proposals, BOEM defines an APE for direct impacts to include both offshore submerged areas and onshore land-based sites where physical disturbance would be required for construction, operation, maintenance, and decommissioning. The APE for submerged areas includes footprints of proposed structures to be secured on the ocean floor and related work area as well as all related bottom-disturbing activities, including, but not limited to, barges, anchorages, appurtenances, and cable routes where ocean sediments and sub-bottom may be disturbed. (MMS 2010). For onshore sites, the APE would include any soil disturbance required for cables or connections to onshore electric transmission cable systems, or visual impacts specifically related to National Historic Landmarks, and other properties listed or eligible for listing on the National Register of Historic Places, including Traditional Cultural Properties (MMS 2010).

D. The construction of offshore renewable energy facilities may result in direct disturbance of offshore submerged archaeological resources, including shipwreck sites and potential settlements that may have existed on what is now the ocean floor. The maps presented in Section 420.4 illustrate a paleo-geographic landscape reconstruction that suggests much of the area that is now Block Island and Rhode Island Sound was dry land over 12,500 years Before

Present (yBP), and that human settlement in these areas was possible. Any disturbance of the bottom could potentially affect any cultural resources present, including early settlement sites; the level of impact may depend on the number and importance of cultural resources in that location, and any seabed disturbance that has occurred previously in the location (MMS 2007a). BOEM requires if any unanticipated cultural resources are encountered during a project, all activities within the area must be stopped and BOEM be consulted (MMS 2007a).

E. For offshore development proposals, an Area of Potential Effect (APE) for indirect impacts is defined to include the area within which the final project as well as the various phases of construction will be notably visible. Visual impacts to the setting, character and other aspects of onshore land-based sites may result from the final project as well as the various phases of construction in an offshore renewable energy project. If turbines were visible from shore, this would represent a change in the viewshed and an alteration of the aesthetics of the visual setting of areas where the structures were visible. For onshore land-based sites, the overall perception of visual impacts of offshore developments is subjective and opinions vary about whether visual impacts for a given project are positive, negative, or neutral (MMS 2007a). In advance of the construction phase, a meteorological tower will likely be installed in the project area to collect data to assess the wind resources. The visual impact of the tower will depend on its distance and thus visibility from shore. During the construction, operation and decommissioning phases, there will be increased vessel traffic in the project area, which will alter the visual characteristics of this area in that many of the construction and maintenance vessels, including a variety of ships and crane/jack-up barges, may be larger in size than other vessels traditionally in use within the project area (MMS 2009a). The FAA will likely require aircraft warning lights on the turbines for air safety purposes; these will be single red lights that flash at night on the nacelles of the peripheral turbines. Whether these lights are visible from land, and thus have an effect on land-based viewing, will depend on whether the turbines themselves are visible from land (MMS 2009a).

F. Section 106 of the National Historic Preservation Act, however, requires that a given project’s visual effect on historic resources be evaluated for National Historic Landmarks and other properties listed or eligible for listing on the National Register of Historic Places, including Traditional Cultural Properties (MMS 2010). If there is a potential visual effect, it must be evaluated to determine what effect, if any, it would have on significant historic resources. A project may be found to have: no effect; no adverse effect if the visual impact is limited and insignificant; or an adverse effect. Adverse effects are defined by the Criteria of Adverse Effect in the Section 106 procedures of the National Historic Preservation Act [36 C.F.R. § 800.5(a)(1)], which state, “An adverse effect is found when an undertaking may alter, directly or indirectly, any of the characteristics of a historic property for inclusion in the National Register in a manner that would diminish the integrity of the property’s location, design, setting, materials, workmanship, feeling, or association.” Examples of adverse effects relevant to the development of offshore renewable energy are listed as including, but not limited to, the following [36 C.F.R. § 800.5(a)(2)]: "Alteration of a property…; Change of the character of the property's use or of physical features within the property's setting that contribute to its historic significance…; Introduction of visual, atmospheric or audible elements that diminish the integrity of the property's significant historic features." Adverse effects from visual impacts may be further evaluated in the case of National Historic Landmarks to determine if they are indirect impacts or direct impacts, which diminish the core significance of the National Historic Landmark (Advisory Council on Historic Preservation, 2010).

G. The magnitude of the visual impacts will depend on site- and project-specific factors, including: distance of the proposed wind facility from shore; size of the facility (i.e., number of wind turbines); size (particularly height) of the wind turbines; surface treatment (primarily color) of wind turbines and electrical service platforms (ESPs); number and type of viewers (e.g., residents, tourists, workers); viewer location (onshore vs. offshore); viewer attitudes toward alternative energy and wind power; visual quality and sensitivity of the landscape/seascape; existing level of development and activities in the wind facility area and nearby onshore areas (i.e., scenic integrity and visual absorption capability); presence of sensitive visual and cultural resources; weather conditions; lighting conditions; and presence and arrangements of aviation and navigation lights on the wind turbines (MMS 2007a).

H. Factors that influence the perception an evaluation of visual impacts include: viewer distance; view duration; visibility factors; seasonal and lighting conditions; landscape/seascape setting; number of viewers; and viewer activity, sensitivity, and cultural factors (MMS 2007a).

8.4.10 Recreation and Tourism (formerly § 850.10)

A. The potential effects of offshore renewable energy on recreational and tourism activities are not well understood given the relatively recent occurrence of offshore renewable energy. The PEIS indicated that offshore renewable energy installations might have visual impacts on marine recreational users and coastal tourists, though this depends on the location and visibility of the structures, as well as the preferences of the individual (MMS 2007a). Visual impacts may be caused by the offshore structures themselves, as well as the sights of support vessels, construction equipment, and helicopters traveling to and from offshore facilities, which may impact cruise ship tourists, coastal tourists, beach users, and recreational boaters. Such impacts could result in the reduction of tourism or recreational activity within sight of the project area (Lilley *et al*. 2009). BOEM cites no evidence of such impacts in other locations with offshore renewable facilities and indicates that such impacts, if any, are expected to be minor (MMS 2007a).

B. Alternatively, the PEIS also indicates that offshore renewable energy structures may enhance marine recreational and tourism activities by becoming an attraction that recreational boaters, charter boat clients, cruise ship passengers, and other visitors may want to visit (MMS 2007a). A 2007 University of Delaware study found that 65.8% of surveyed out-of-state tourists were likely to visit a beach in order to see a wind farm offshore, and 44.5% were likely to pay to take a boat tour of an offshore wind facility (Lilley *et al*. 2009). Anecdotal data provided by a 2006 British Wind Energy Association study indicates several instances in which tourism increased at UK destinations adjacent to offshore wind farms, or where surveyed tourists indicated that the wind farm had no effect on their likelihood to visit the site (British Wind Energy Association 2006). Visitor centers have been developed at some of these sites to facilitate tourists' experience (British Wind Energy Association 2006).

C. Noise associated with on-site marine construction, or traffic noise from support vessels and helicopters traveling to and from the offshore facility, may have a potential impact on coastal tourists and marine recreational users. Such impacts could result in the reduction of tourism or recreational activity within the affected area. In the PEIS, BOEM cites no evidence of such impacts in other locations with offshore renewable facilities and indicates that such impacts, if any, are expected to be minor (MMS 2007a).

D. The construction and operation of offshore renewable energy facilities may result in short- or long-term displacement of marine recreational users, particularly recreational boaters. The construction phase may result in temporary closures of the offshore project area and/or adjacent shoreline areas during activities such as driving piles or installing transmission cables. Though less likely, the operation phase may also result in the long-term displacement of recreational users from all or part of the project area. Such temporary or long-term closures could alter recreational activities and use patterns within the Ocean SAMP area by lengthening transit times between destinations, displacing fishing activities conducted by income-generating charter boat operations, or displacing large-scale sailboat races that rely on the use of the project area. Such a displacement could also cause individual users or entire events to relocate, resulting in increased recreational activity in other in-state or out-of-state locations (MMS 2007a; Royal Yachting Association and the Cruising Association 2004). In the PEIS, BOEM indicates that such impacts, if any, are expected to be minor (MMS 2007a). It should also be noted that enforcing access restrictions around an offshore renewable energy facility may be very difficult given the offshore location.

E. The construction and operation of offshore renewable energy facilities may impact navigation and marine safety for recreational boaters in and around the project area. Alternatively, offshore facilities may provide enhancements to navigation and marine safety by providing mariners access to offshore weather data. Such impacts, enhancements, and mitigation measures are discussed at length in § 8.4.11 of this Part which deals with potential affects to marine transportation, navigation, and infrastructure.

F. Some of the recreational uses discussed in Chapter 6, Recreation and Tourism rely on the presence and visibility of marine and avian species including fish, whales, sharks, and birds. Offshore renewable energy facilities may have some impacts on these species and/or the habitats on which they rely. Alternatively, offshore renewable energy support structures may add to habitat complexity and increase biodiversity within the immediate area, attracting more fish, birds, whales and sharks, thereby improving recreational activities that rely on these species. See §§ 8.4.3, 8.4.4, 8.4.5 and 8.4.7 of this Part for more information on the potential affects offshore renewable energy development may pose to these resources.

G. If offshore renewable energy development results in a reduction in marine recreation and tourism in the Ocean SAMP area, Rhode Island-based businesses that serve these industries may lose some business. Alternatively, marine trades and coastal tourism businesses may benefit from offshore renewable energy in response to the potential growth of marine and coastal tourism activities such as wind farm boat trips (OSPAR 2004) (see above). In addition the construction and operation of an offshore facility may require additional shore-based infrastructure or services that may boost the marine trades sector.

8.4.11 Marine Transportation, Navigation and Infrastructure (formerly § 850.11)

A. Offshore renewable energy may have some effects on marine transportation, navigation activities and other infrastructure in the Ocean SAMP area. The degree to which offshore renewable energy structures may affect marine transportation, navigation and infrastructure varies in large part on the specific siting of a project. Careful consideration when planning the location of an offshore renewable energy facility, as well as the use of appropriate mitigation strategies, can minimize any potential negative impacts (MMS 2007a).

B. In addition to the potential effects identified in European research, the PEIS and the Cape Wind FEIS, the U.S. Coast Guard has issued a Navigation and Vessel Inspection Circular (U.S. Coast Guard NAVIC 02-07) to provide guidance on the information and factors the Coast Guard will consider, which include navigational safety and security, when reviewing a permit application for an offshore renewable energy installation in the navigable waters of the United States (U.S. Coast Guard 2007).

C. Offshore renewable energy facilities may affect navigational safety in a project area by increasing the risk of collision, limiting visibility, or limiting a vessel's ability to maneuver (MMS 2007a; U.S. Coast Guard 2007; BWEA 2007; U.K. Maritime and Coast Guard Agency 2008). However, collision risk was found to be low, especially when facilities are sited appropriately (e.g. MMS 2007a). Risks that have been identified include vessels colliding with offshore renewable structures themselves; with other vessels; or with ice that has formed on or around the structures during winter months. Moreover, visibility may be impaired surrounding an offshore renewable energy facility, as structures may block or hinder a mariner's view of other vessels, nearby land masses, or other navigational features (U.S. Coast Guard 2007; United Kingdom Maritime and Coast Guard Agency 2008). Obstructed visibility could potentially put a vessel at risk of collision or running aground. However, mitigation measures have been identified that can lower this potential risk to acceptable levels. For instance, mariners have been advised to follow required standard operating procedures, where applicable, as outlined in the International Regulations for Preventing Collisions at Sea (COLREGS) for limited visibility conditions. Adherence with these standard regulations can mitigate hazards to navigation caused by impaired visibility within an offshore renewable energy facility (U.S. Coast Guard 2009; U.K. Maritime and Coast Guard Agency 2008). Offshore renewable energy structures may also limit the ability of some larger vessels to maneuver to avoid collision, as these vessels usually require greater stopping distances and have wider turning radii (U.S. Coast Guard 2007; U.S. Coast Guard 2009). The PEIS notes that such impacts can be mitigated to acceptable levels by siting offshore renewable energy facilities so that they do not interfere with designated fairways or shipping lanes, and using appropriate signage and/or lighting to warn passing vessels (MMS 2007a; U.S. Coast Guard 2009). In addition, the U.S. Coast Guard considers all of these navigational safety issues when evaluating a permit application for an offshore renewable energy structure (U.S. Coast Guard 2007).

D. Whereas offshore renewable energy facilities may potentially displace marine transportation, military, or navigation uses, appropriate siting away from shipping lanes, military usage areas, or other intensively-used areas can minimize or eliminate any potential displacement of these uses (MMS 2007a). Vessels that cannot safely operate or navigate within an offshore renewable energy facility may be excluded from areas that were previously used, and therefore would need to alter travel routes in the vicinity of such projects (United Kingdom Maritime and Coastguard Agency 2008; U.S. Coast Guard 2007). Route alterations may potentially extend vessel travel times. The PEIS (MMS 2007a) notes that such impacts can be mitigated to acceptable levels by siting offshore renewable energy facilities away from designated fairways or shipping lanes. In addition, BOEM (MMS 2007a) expects that the military impacts of offshore wind farms will be negligible provided that development is coordinated with the U.S. Department of Defense and all appropriate military agencies.

E. Offshore renewable energy structures may affect the physical characteristics of a waterway, which include localized currents and sediment deposition and erosion (United Kingdom Maritime and Coastguard Agency 2008) though can be minimized to acceptable levels through proper siting and mitigation methods (U.S. Coast Guard 2007; MMS 2007a). Currents that are altered in direction and/or speed within or around an offshore renewable energy facility, may affect how vessels navigate through an area. In addition, structures that attach to the seafloor or extend through the water column may affect the surrounding water depth by altering sediment movement or deposition (MMS 2007a; U.S. Coast Guard 2007; United Kingdom Maritime and Coastguard Agency 2008). Consequently, if shoaling occurs, vessel navigation may be impacted within or around an offshore renewable energy facility. These effects may be most pronounced in predominantly shallow areas, or areas composed of highly mobile substrate (i.e. sands) with strong waves or currents. Mitigation measures may include installing scour-protection devices and monitoring sediment transport processes (United Kingdom Maritime and Coastguard Agency 2008; U.S. Coast Guard 2007; MMS 2007a). For more information on scour and the potential effects to coastal processes and physical oceanography see § 8.4.2 of this Part.

F. Due to the large size of some offshore renewable structures, offshore renewable energy installations may interfere with the use of radar by ships or shore-based facilities within the area. However, interference may be negligible to minor when properly mitigated (MMS 2007a; U.S. Coast Guard 2007; Technology Service Corporation 2008; Howard and Brown 2004; U.S. Department of Defense 2006). Studies have shown that ship and land-based radar systems may have some difficulty in detecting marine targets within an offshore renewable energy facility as the result of the distortion or degradation of radar signals by the installed structures (U.S. Coast Guard 2009; Technology Service Corporation 2008; MMS 2007a; U.S. Department of Defense 2006, BWEA 2007). Research conducted to assess the potential radar impacts of the proposed Cape Wind project in Nantucket Sound found that the facility would only pose adverse impacts in accurately detecting targets within and immediately behind the wind farm, as the installed structures may produce false targets or mask real targets (U.S. Coast Guard 2009; Technology Service Corporation 2008; United Kingdom Maritime and Coastguard Agency 2008). In other words, vessels navigating near but outside a wind farm may not be able to clearly identify, by radar, another vessel operating within the wind farm due to radar clutter. However, radar impacts observed within the wind farm can be mitigated to acceptable levels through greater attention by radar operators in distinguishing between real and false targets (U.S. Coast Guard 2009). No adverse impacts were found to occur between vessels operating completely outside, but within the vicinity of, the wind farm (U.S. Coast Guard 2009; Technology Service Corporation 2008). Because the severity of impacts to radar varies widely depending on site-specific characterizations, the U.S. Coast Guard considers impacts on navigation radar when reviewing a permit application (U.S. Coast Guard 2007).

G. Weather radar located near offshore renewable energy installations may also be adversely impacted by offshore renewable energy structures; impacts may include misidentification of thunderstorm features, false radar estimates of precipitation accumulation, and incorrect storm cell identification and tracking (MMS 2007a).

H. The installation of offshore renewable energy facilities may cause either minimal impacts or possible enhancements to navigation and communication tools and systems, including global positioning systems, magnetic compasses, cellular phone communications, very-high frequency (VHF) communications, ultra-high frequency (UHF) and other microwave systems, and automatic identification systems (AIS) (MMS 2007a, United Kingdom Maritime and Coastguard Agency 2008). The PEIS (MMS 2007a) indicates that any impacts are likely to be negligible to minor, and cites a number of studies in which no negative impacts were found. For example, Brown and Howard (2004) found no impact of wind farms on GPS accuracy and also noted that magnetic compasses, AIS, and VHF communications (ship-to-ship and ship-to-shore) were not affected within the wind farm installation. The U.S. Coast Guard requires permit applicants to conduct research on the potential impacts of an offshore renewable energy installation on navigation and communication systems prior to construction (U.S. Coast Guard 2007).

I. Search and rescue operations by agencies such as the U.S. Coast Guard, may be positively and/or negatively affected by offshore renewable energy installations (U.S. Coast Guard 2007; LeBlanc 2009). For example, installations may prolong the response time of search and rescue missions in cases where longer routes around the facility are required. Alternatively, offshore renewable energy structures may provide refuge to distressed mariners stranded or disabled within the vicinity of the facility (U.S. Coast Guard 2007). When evaluating an offshore renewable energy permit, the U.S. Coast Guard will examine if an offshore renewable energy facility will prolong an agency's response time during a rescue mission (LeBlanc 2009). Previous research conducted to analyze the effects of offshore wind farms on search and rescue operations, involving helicopters, showed that radio communications and VHF homing systems worked satisfactorily, as did thermal imaging of vessels, turbines, and personnel within the wind facility (Brown 2005).

J. Operational offshore renewable energy facilities may provide enhancements to navigation and marine safety by providing mariners with access to in-situ offshore weather, wave and current data. This information may increase navigational safety by informing mariners of current offshore conditions, or providing a recent history of offshore conditions to aid in search and rescue operations within the area.

K. During the construction of an offshore renewable energy facility, vessel traffic may temporarily increase in a project area (MMS 2007a). Transits and operations of vessels involved in the transport of equipment and materials, facility construction, or the laying of submarine cables may temporarily increase (MMS 2007a). As a result, port facilities may also experience increased activity (MMS 2007a). Increased vessel activity may continue, albeit to a lesser extent, through the operation of the offshore renewable energy facility, as maintenance vessels will be required to service the installed structures. The presence of these vessels may increase the demand for port services, and enhance the economic activity associated with port facilities and marine industries.

L. Siting of offshore renewable energy facilities near pre-existing submarine cables may impact the security and accessibility of these cables. Such impacts can be mitigated to acceptable levels by considering pre-existing cables when siting offshore renewable energy facilities. Cable ships require a minimum distance from an offshore structure in order to safely access a submarine cable for repair or replacement (International Cable Protection Committee 2007). Offshore renewable energy installations whose location does not allow for safe access to existing submarine cables by the appropriate vessels may negatively impact the operation, performance, and longevity of this infrastructure (International Cable Protection Committee 2007). In addition, laying new submarine cables associated with an offshore renewable energy facility may require crossing existing cables in the area.

8.4.12 Cumulative Impacts (formerly § 850.12)

A. Table 8.20 in § 8.4.12(A)(1) of this Part summarizes of all the potential effects of offshore renewable energy development on existing resources and uses identified in this section. The range and severity of effects will vary depending on the project. Project specific effects will be thoroughly examined as part of a project's NEPA review. In order to assess what the net effect might be from any of these effects related to offshore renewable energy, numerous factors will need to be taken into account, including the duration, frequency, and/or intensity of the effect. Furthermore, most effects are still not fully understood and will require further monitoring (see § 8.5 of this Part for monitoring requirements for offshore renewable energy in the Ocean SAMP area).

1. Table 8.20. Summary of potential effects of offshore renewable energy development during each stage of development.

Area	Pre-construction Siting	Construction	Operation	Decommissioning
Alteration of waves and currents	N/A	N/A	Changes in current velocity and direction; changes in wave heights; Changes in larval distribution; Scour (local and global)	N/A
Water Column Density Stratification	N/A	N/A	Reduced spatial extent of stratification; Shorter seasonal duration of stratification	N/A
Alteration of Benthic Habitat	N/A	Redistribution of sediments; Smothering of benthic organisms; smothering of eggs and larvae; damage to benthic habitat from cable sweep; Loss of habitat; disturbance to shellfish beds or hard	Introduction of hard substrate; Loss of seabed area	Loss of habitat; Redistribution of sediments; Smothering of benthic organisms; smothering of eggs and larvae;

		bottom habitats from cable laying		
Water quality	Accidental spillage of contaminants or debris	Accidental spillage of contaminants or debris	Accidental release of contaminants	Accidental spillage of contaminants or debris
Turbidity	N/A	Affect primary production; secondary effects on prey species; potential smothering of eggs and larvae	N/A	Affect primary production; secondary effects on prey species; potential smothering of eggs and larvae
Noise effects – marine mammals	Avoidance; sound masking; stress	Masking of sounds; displacement; temporary/permanent hearing threshold shifts; stress; injury; mortality	Avoidance; sound masking; stress	Avoidance; sound masking; stress
Noise effects - fish	Avoidance; sound masking; stress.	Masking of sounds; displacement; temporary/permanent hearing threshold shifts; stress; injury; mortality; decreased catch rates.	Avoidance; sound masking; stress.	Avoidance; sound masking; stress.

Noise effects – sea turtles	Avoidance	Avoidance	Probably none	Avoidance
EMF	N/A	N/A	Avoidance or attraction by sensitive species, resulting in changes to feeding or migratory behavior.	N/A
Reef effects	N/A	N/A	Increased colonization for invertebrates; increased fish habitat; shelter for juvenile species; increased predators; possibility of invasive species; increased fish catch; attraction for sea turtles.	Loss of reef effects.
Vessel traffic	Increased risk of collision with marine mammals; Increased noise causing avoidance by fish and marine mammals.	Increased risk of collision with marine mammals; Increased noise causing avoidance by fish and marine mammals; Increased risk of collision with sea turtles.	Increased risk of collision with marine mammals; Increased noise causing avoidance by fish and marine mammals.	Increased risk of collision with marine mammals; Increased noise causing avoidance by fish and marine mammals.

Effects to birds	N/A	Displacement; disturbance.	Displacement; disturbance; avoidance; collision with turbines.	Displacement; disturbance.
Visual effects	Increased vessel traffic.	Increased vessel traffic, including heavy construction equipment.	Presence of wind turbines.	Increased vessel traffic, including heavy construction equipment.

B. In addition to the effects caused by any one renewable energy project within the Ocean SAMP area, the cumulative impact of past, present, and future uses on the Ocean SAMP area must be considered. The Ocean SAMP area is not pristine – activities in the offshore waters have been taking place for hundreds of years – but neither is it heavily industrialized. The ecosystem and its resources, as well as those who use the Ocean SAMP area, are currently being directly or indirectly affected by activities taking place inside of and beyond the Ocean SAMP area. When considering the effects of a wind energy project on the marine environment, the cumulative effects of existing activities such as fishing, marine transportation, and recreation will need to be considered alongside the proposed project, as should the effects of multiple renewable energy or other development projects on this area. Particularly important will be the cumulative effects of global climate change along with other current and future activities. The total cumulative effects cannot be fully understood and cannot be predicted with certainty, but nonetheless the potential for cumulative effects should be taken into account. A cumulative impact analysis of a proposed project would be required under 40 C.F.R. § 1508.7 of NEPA regulations.

C. While not all offshore renewable energy projects will have the same effects on the natural resources or existing uses of the Ocean SAMP area, identifying all potential effects aids in determining the most appropriate siting for any future projects. Through the Ocean SAMP process existing uses and resources have been identified and described, adding to the current understanding of the area. Moreover, the policies and standards outlined in the Ocean SAMP document provide protection and consideration to important areas, resources and uses of the area. In the end, the findings and policies of the Ocean SAMP will help to manage and address cumulative impacts of potential offshore renewable energy development, or any future development within the waters of the Ocean SAMP boundary.

8.5 General Policies and Regulatory Standards (formerly § 860)

8.5.1 General Policies (formerly § 860.1)

A. The Council supports offshore development in the Ocean SAMP area that is consistent with the Ocean SAMP goals which are to:

1. Foster a properly functioning ecosystem that can be both ecologically effective and economically beneficial;

2. Promote and enhance existing uses; and

3. Encourage marine-based economic development that considers the aspirations of local communities and is consistent and complementary to the state's overall economic development needs and goals.

B. The Council supports the policy of increasing renewable energy production in Rhode Island. The Council also recognizes:

1. Offshore wind energy currently represents the greatest potential for utility-scale renewable energy generation in Rhode Island;

2. Offshore renewable energy development is a means of mitigating the potential effects of global climate change;

3. Offshore renewable energy development will diversify Rhode Island's energy portfolio;

4. Offshore renewable energy development will aid in meeting the goals set forth in Rhode Island's Renewable Energy Standard; and

5. Marine renewable energy has the potential to assist in the redevelopment of urban waterfronts and ports.

C. The Council's support of offshore renewable energy development shall not be construed to endorse or justify any particular developer or particular offshore renewable energy proposal.

D. The policies and standards contained herein supersede §§ 00-1.3.1(C) and 00-1.3.1(H) of this Chapter (Rhode Island Coastal Resources Management Program (RICRMP)) only for the jurisdictional area of the Ocean SAMP. Dredging and dredge disposal activities remain governed by § 00-1.3.1(I) of this Chapter.

E. The Council may require the applicant to fund a program to mitigate the potential impacts of a proposed offshore development to natural resources and existing human uses. The mitigation program may be used to support restoration projects, additional monitoring, preservation, or research activities on the impacted resource or site.

F. To the greatest extent possible, offshore development structures and projects shall be made available to researchers for the investigation into the effects of large-scale installations on the marine environment, and to the extent practicable, educators for the purposes of educating the public.

G. The Council shall work in coordination with the U.S. Department of the Interior Bureau of Ocean Energy Management, Regulation and Enforcement to develop a seamless process for review and design approval of offshore wind energy facilities that is consistent across state and federal waters.

H. The Council shall work together with the U.S. Coast Guard, the U.S. Navy, the U.S. Army Corps of Engineers, NOAA, fishermen's organizations, marine pilots, recreational boating organizations, and other marine safety organizations to promote safe navigation, fishing, and recreational boating activity around and through offshore structures and developments, and along cable routes, during the construction, operation and decommissioning phases of such projects. The Council will promote and support the education of all mariners regarding safe navigation around offshore structures and developments, and along cable routes.

I. Discussions with the U.S. Coast Guard, the U.S. Department of Interior Bureau of Ocean Energy Management, Regulation, and Enforcement, and the U.S. Army Corps of Engineers have indicated that no vessel access restrictions are planned for the waters around and through offshore structures and developments, or along cable routes, except for those necessary for navigational safety. Commercial and recreational fishing and boating access around and through offshore structures and developments and along cable routes is a critical means of mitigating the potential adverse impacts of offshore structures on commercial and recreational fisheries and recreational boating. The Council endorses this approach and shall work to ensure that the waters surrounding offshore structures, developments, and cable routes remain open to commercial and recreational fishing, marine transportation, and recreational boating, except for navigational safety restrictions. The Council requests that federal agencies notify the Council as soon as is practicable of any federal action that may affect vessel access around and through offshore structures and developments and along cable routes. The Council will continue to monitor changes to navigational activities around and through offshore developments and along cable routes. Any changes affecting existing navigational activities may be subject to CZMA federal consistency review if the federal agency determines its activity will have reasonably foreseeable effects on the uses or resources of Rhode Island's coastal zone.

J. To coordinate the review process for offshore wind energy developments, the Council shall adopt consistent information requirements similar to the requirements of the U.S. Department of the Interior's Bureau of Ocean Energy Management, Regulation and Enforcement for offshore wind energy. All documentation required at the time of application shall be similar with the requirements followed by the U.S. Department of the Interior Bureau of Ocean Energy Management, Regulation and Enforcement when issuing renewable energy leases on the Outer Continental Shelf. For further details on these regulations see 30 C.F.R. §§ 285 et seq. The Council shall continue to monitor the federal review process and information requirements for any changes and will make adjustments to the Ocean SAMP policies accordingly.

K. To the maximum extent practicable, the Council shall coordinate with the appropriate federal and state agencies to establish project specific requirements that shall be followed by the applicant during the pre-construction, construction, operation and decommissioning phases of an offshore development. To the maximum extent practicable, the Council shall work in coordination with a Joint Agency Working Group when establishing pre-construction survey and data requirements, monitoring requirements, protocols and mitigation measures for a proposed offshore development. State members of the Joint Agency Working Group shall coordinate with the Habitat Advisory Board and the Fishermen's

Advisory Board and shall seek input from these Boards before establishing project specific requirements that shall be followed by the applicant for an offshore development. And, to the maximum extent practical, and consistent with the federal agency and tribal members' authorities, federal members of the Joint Agency Working Group, are strongly encouraged to coordinate with the Habitat Advisory Board and the Fishermen's Advisory Board. The Joint Agency Working Group shall comprise those state and federal agencies that have a regulatory responsibility related to the proposed project, as well as the Narragansett Indian Tribal Historic Preservation Office. The agency composition of this working group may differ depending on the proposed project, but will generally include the lead federal agency with primary jurisdiction over the proposed project and the CRMC. The pre-construction survey requirements outlined in § 8.5.2(F) of this Part may be reduced for small- scale offshore developments as specified by the Joint Agency Working Group.

L. The following are industry goals that projects should strive for. These are not required standards at this time but are targets project proponents should try to meet where possible to alleviate potential adverse impacts:

1. A goal for the wind farm applicant and operator is to have operational noise from wind turbines average less than or equal to 100 dB re 1 μPa2 in any 1/3 octave band at a range of 100 meters at full power production;

2. The applicant and manufacturer should endeavor to minimize the radiated airborne noise from the wind turbines; and

3. A monitoring system including acoustical, optical and other sensors should be established near these facilities to quantify the effects.

8.5.2 Regulatory Standards (formerly § 860.2)

A. The federal offshore renewable energy leasing process, and subsequent regulation of renewable energy projects located in federal waters, will remain under the jurisdiction of BOEM in consultation and coordination with relevant federal agencies and affected state, local, and tribal officials, as per BOEM's statutory authority at 43 U.S.C. § 1337(p) and the regulations found at 30 C.F.R. § 285.

B. Overall regulatory standards (formerly 860.2.1)

1. All offshore developments regardless of size, including energy projects, which are proposed for or located within state waters of the Ocean SAMP area, are subject to the policies and standards outlined in §§ 11.9 and 11.10 of this Subchapter (except, as noted above, § 11.9 of this Subchapter policies shall not be used for CRMC concurrence or objection for CZMA Federal Consistency reviews). For the purposes of the Ocean SAMP, offshore developments are defined as:

a. Large-scale projects, such as:

(1) offshore wind facilities (5 or more turbines within 2 km of each other, or 18 MW power generation);

(2) wave generation devices (2 or more devices, or 18 MW power generation);

(3) instream tidal or ocean current devices (2 or more devices, or 18 MW power generation); and

(4) offshore LNG platforms (1 or more);

(5) Artificial reefs (1/2 acre footprint and at least 4 feet high), except for projects of a public nature whose primary purpose is habitat enhancement; and

(6) outer continental shelf (OCS) exploration, development, and production plans

b. Small-scale projects, defined as any projects that are smaller than the above thresholds;

c. Underwater cables;

d. Mining and extraction of minerals, including sand and gravel;

e. Aquaculture projects of any size, as defined in § 00-1.3.1(K) of this Chapter and subject to the regulations of § 00-1.3.1(K) of this Chapter;

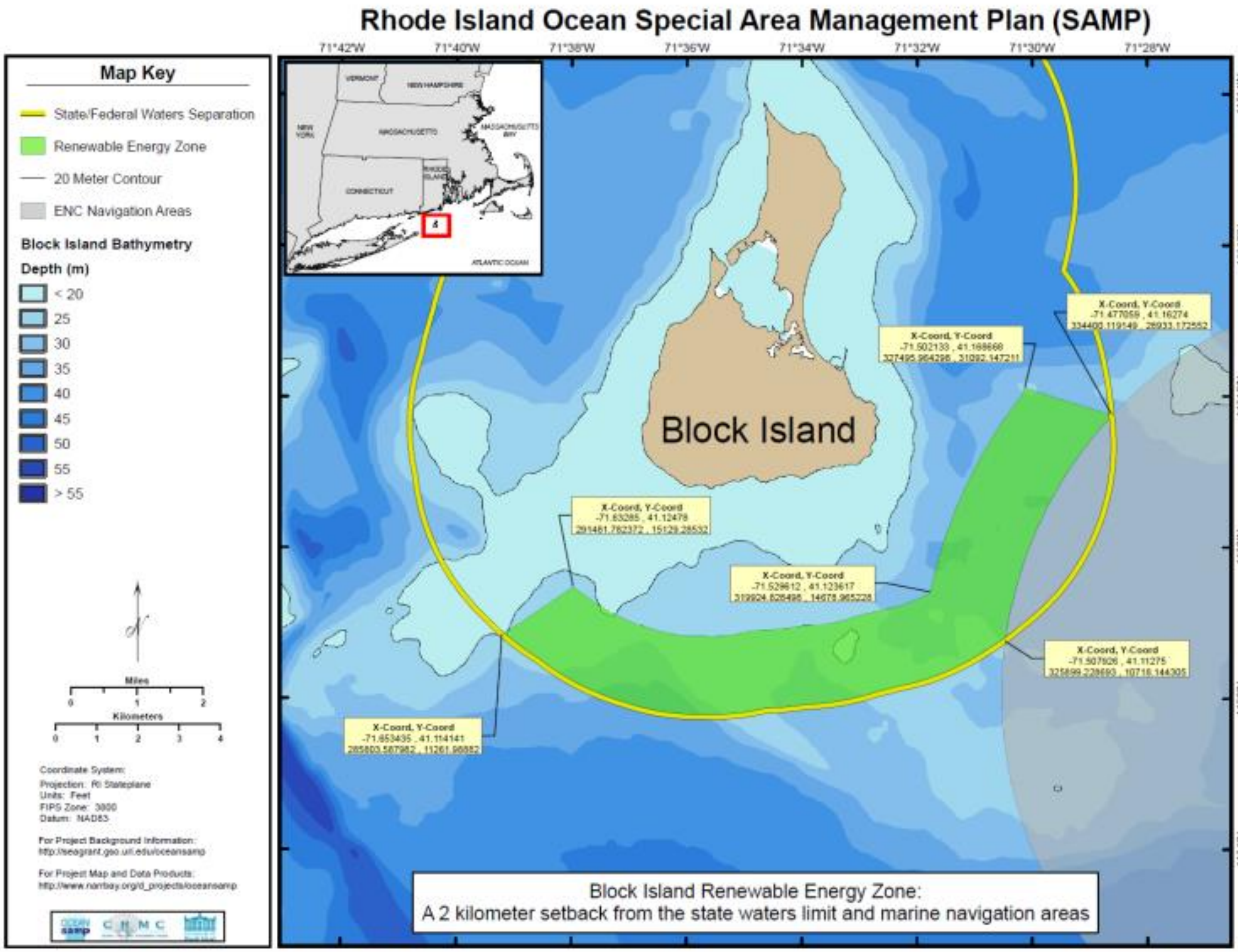
f. Dredging, as defined in § 00-1.3.1(I) of this Chapter and subject to the regulations of § 00-1.3.1(I) of this Chapter; or

g. Other development as defined in the Part 1 of this Chapter (RICRMP) which is located in tidal waters from the mouth of Narragansett Bay seaward, between 500 feet offshore and the 3-nautical mile, state water boundary.

2. In assessing the natural resources and existing human uses present in state waters of the Ocean SAMP area, the Council finds that the most suitable area for offshore renewable energy development in the state waters of the Ocean SAMP area is the renewable energy zone depicted in Figure 8.47 in § 8.5.2(B)(2)(a) of this Part. The Council designates this area as Type 4E waters. In Subchapter 00 Part 1 of this Chapter (Rhode Island Coastal Resources Management Program – Red Book) these waters were previously designated as Type 4 (or multipurpose) but are hereby modified to show that this is the preferred site for large scale

renewable energy projects in state waters. The Council may approve offshore renewable energy development elsewhere in the Ocean SAMP area, within state waters, where it is determined to have no significant adverse impact on the natural resources or human uses of the Ocean SAMP area. Large-scale offshore developments shall avoid areas designated as Areas of Particular Concern consistent with §8.5.2(C) of this Part. No large-scale offshore renewable energy development shall be allowed in Areas Designated for Preservation consistent with § 8.5.2(D) of this Part.

a. Figure 8.47: Renewable Energy Zone



3. Offshore Developments shall not have a significant adverse impact on the natural resources or existing human uses of the Rhode Island coastal zone, as described in the Ocean SAMP. In making the evaluation of the effect on human uses, the Council will determine, for example, if there is an overall net benefit to the Rhode Island marine economic sector from the development of the project or if there is an overall net loss. Where the Council determines that impacts on the natural resources or human uses of the Rhode Island coastal zone through the pre-construction, construction, operation, or decommissioning phases of a project constitute significant adverse effects not previously evaluated, the Council shall, through its permitting and enforcement authorities in state waters and through any subsequent CZMA federal consistency reviews, require that the applicant modify the proposal to avoid and/or mitigate the impacts or the Council shall deny the proposal.

4. Any assent holder of an approved offshore development shall:

   a. Design the project and conduct all activities in a manner that ensures safety and shall not cause undue harm or damage to natural resources, including their physical, chemical, and biological components to the extent practicable; and take measures to prevent unauthorized discharge of pollutants including marine trash and debris into the offshore environment.

   b. Submit requests, applications, plans, notices, modifications, and supplemental information to the Council as required;

   c. Follow up, in writing, any oral request or notification made by the Council, within 3 business days;

   d. Comply with the terms, conditions, and provisions of all reports and notices submitted to the Council, and of all plans, revisions, and other Council approvals, as provided in§ 8.5.2(F) of this Part;

   e. Make all applicable payments on time;

   f. Conduct all activities authorized by the permit in a manner consistent with the provisions of this document, the Rhode Island Coastal Resources Management Program, and all relevant federal and state statutes, regulations and policies;

   g. Compile, retain, and make available to the Council within the time specified by the Council any information related to the site assessment, design, and operations of a project; and

   h. Respond to requests from the Council in a timeframe specified by the Council.

5. Any large-scale offshore development, as defined in § 8.3(G) of this Part, shall require a meeting between the Fisherman's Advisory Board (FAB), the applicant, and the Council staff to discuss potential fishery-related impacts, such as, but not limited to, project location, construction schedules, alternative locations, project minimization and identification of high fishing activity or habitat edges. For any state permit process for a Large-Scale Offshore Development this meeting shall occur prior to submission of the state permit application. The Council cannot require a pre-application meeting for federal permit applications, but the Council strongly encourages applicants for any large-scale offshore development, as defined in § 8.3(G) of this Part and § 11.3(F) of this Subchapter, in federal waters to meet with the HAB and the Council staff prior to the submission of a federal application, lease, license, or authorization. However, for federal permit applicants, a meeting with the HAB shall be necessary data and information required for federal consistency reviews for purposes of starting the CZMA 6-month review period for federal license or permit activities under 15 C.F.R. Part 930, Subpart D, and OCS Plans under 15 C.F.R. Part 930, Subpart E, pursuant to 15 C.F.R. § 930.58(a)(2). Any necessary data and information shall be provided before the 6-month CZMA review period begins for a proposed project.

6. The Council shall prohibit any other uses or activities that would result in significant long-term negative impacts Rhode Island's commercial or recreational fisheries. Long-term impacts are defined as those that affect more than one or two seasons.

7. The Council shall require that the potential adverse impacts of offshore developments and other uses on commercial or recreational fisheries be evaluated, considered, and mitigated as described in § 8.5.2(B)(8) of this Part.

8. For the purposes of §§ 5.3.1 and 5.3.2 of this Subchapter, mitigation is defined as a process to make whole those fisheries user groups that are adversely affected by proposals to be undertaken or undertaken projects in the Ocean SAMP area. Mitigation measures shall be consistent with the purposes of duly adopted fisheries management plans, programs, strategies and regulations of the agencies and regulatory bodies with jurisdiction over fisheries in the SAMP area, including but not limited to those set forth in § 5.3.1(B) of this Subchapter. Mitigation shall not be designed or implemented in a manner that substantially diminishes the effectiveness of duly adopted fisheries management programs. Mitigation measures may include, but are not limited to, compensation, effort reduction, habitat preservation, restoration and construction, marketing, and infrastructure improvements. Where there are potential impacts associated with proposed projects, the need for mitigation shall be presumed. Negotiation of mitigation agreements shall be a necessary condition of any approval or permit of a project by the Council. Mitigation

shall be negotiated between the Council staff, the FAB, the project developer, and approved by the Council. The reasonable costs associated with the negotiation, which may include data collection and analysis, technical and financial analysis, and legal costs, shall be borne by the applicant. The applicant shall establish and maintain either an escrow account to cover said costs of this negotiation or such other mechanism as set forth in the permit or approval condition pertaining to mitigation. This policy shall apply to all large-scale offshore developments, underwater cables, and other projects as determined by the Council.

9. The Council recognizes that moraine edges, as illustrated in Figure 8.49 in § 8.5.2(C)(6) of this Part, are important to commercial and recreational fishermen. In addition to these mapped areas, the FAB may identify other edge areas that are important to fisheries within a proposed project location. The Council shall consider the potential adverse impacts of future activities or projects on these areas to Rhode Island's commercial and recreational fisheries. Where it is determined that there is a significant adverse impact, the Council will modify or deny activities that would impact these areas. In addition, the Council will require assent holders for offshore developments to employ micro-siting techniques in order to minimize the potential impacts of such projects on these edge areas.

10. The finfish, shellfish, and crustacean species that are targeted by commercial and recreational fishermen rely on appropriate habitat at all stages of their life cycles. While all fish habitat is important, spawning and nursery areas are especially important in providing shelter for these species during the most vulnerable stages of their life cycles. The Council shall protect sensitive habitat areas where they have been identified through the site assessment plan or construction and operation plan review processes for offshore developments as described in § 8.5.2(F) of this Part.

11. Any large-scale offshore development, as defined in § 8.3(G) of this Part, shall require a meeting between the HAB, the applicant, and the Council staff to discuss potential marine resource and habitat-related issues such as, but not limited to, impacts to marine resource and habitats during construction and operation, project location, construction schedules, alternative locations, project minimization, measures to mitigate the potential impacts of proposed projects on habitats and marine resources, and the identification of important marine resource and habitat areas. For any state permit process for a large-scale offshore development, this meeting shall occur prior to submission of the state permit application. The Council cannot require a pre-application meeting for federal permit applications, but the Council strongly encourages applicants for any large-scale offshore development, as defined in § 8.3(G) of this Part, in federal waters to meet with the HAB and the Council staff prior to the submission of a federal application, lease, license, or authorization. However, for

federal permit applicants, a meeting with the HAB shall be necessary data and information required for federal consistency reviews for purposes of starting the CZMA 6-month review period for federal license or permit activities under 15 C.F.R. Part 930, Subpart D, and OCS Plans under 15 C.F.R. Part 930, Subpart E, pursuant to 15 C.F.R. § 930.58(a)(2). Any necessary data and information shall be provided before the 6-month CZMA review period begins for a proposed project.

12. The potential impacts of a proposed project on cultural and historic resources will be evaluated in accordance with the National Historic Preservation Act and Antiquities Act, and the Rhode Island Historical Preservation Act and Antiquities Act as applicable. Depending on the project and the lead federal agency, the projects that may impact marine historical or archaeological resources identified through the joint agency review process shall require a marine archaeology assessment that documents actual or potential impacts the completed project will have on submerged cultural and historic resources.

13. Guidelines for Marine Archaeology Assessment in the Ocean SAMP Area can be obtained through the RIHPHC in their document, "Performance Standards and Guidelines for Archaeological Projects: Standards for Archaeological Survey" (RIHPHC 2007), or the lead federal agency responsible for reviewing the proposed development.

14. The potential non-physical impacts of a proposed project on cultural and historic resources shall be evaluated in accordance with 36 C.F.R. § 800.5, Assessment of Adverse Effects, (v) Introduction of visual, atmospheric, or audible elements that diminish the integrity of the property's significant historic features. Depending on the project and the lead federal agency, the Ocean SAMP Interagency Working Group may require that a project undergo a visual impact assessment that evaluates the visual impact a completed project will have on onshore cultural and historic resources.

15. A visual impact assessment may require the development of detailed visual simulations illustrating the completed project's visual relationship to onshore properties that are designated National Historic Landmarks, listed on the National Register of Historic Places, or determined to be eligible for listing on the National Register of Historic Places. Assessment of impacts to specific views from selected properties of interest may be required by relevant state and federal agencies to properly evaluate the impacts and determination of adverse effect of the project on onshore cultural or historical resources.

16. A visual impact assessment may require description and images illustrating the potential impacts of the proposed project.

17. Guidelines for Landscape and Visual Impact Assessment in the Ocean SAMP Area can be obtained through the lead federal agency responsible for reviewing the proposed development.

C. Areas of particular concern (formerly § 860.2.2)

1. Areas of particular concern (APCs) have been designated in state waters through the Ocean SAMP process with the goal of protecting areas that have high conservation value, cultural and historic value, or human use value from large-scale offshore development. These areas may be limited in their use by a particular regulatory agency (e.g., shipping lanes), or have inherent risk associated with them (e.g., unexploded ordnance locations), or have inherent natural value or value assigned by human interest (e.g., glacial moraines, historic shipwreck sites). Areas of particular concern have been designated by reviewing habitat data, cultural and historic features data, and human use data that has been developed and analyzed through the Ocean SAMP process. Currently designated areas of particular concern are based on current knowledge and available datasets; additional areas of particular concern may be identified by the Council in the future as new datasets are made available. Areas of particular concern may be elevated to areas designated for preservation in the future if future studies show that areas of particular concern cannot risk even low levels of large-scale offshore development within these areas. Areas of particular concern include:

   a. Areas with unique or fragile physical features, or important natural habitats;

   b. Areas of high natural productivity;

   c. Areas with features of historical significance or cultural value;

   d. Areas of substantial recreational value;

   e. Areas important for navigation, transportation, military and other human uses; and

   f. Areas of high fishing activity.

2. The Council has designated the areas listed below in § 8.5.2(C)(3) of this Part in state waters as areas of particular concern. All large-scale, small-scale, or other offshore development, or any portion of a proposed project, shall be presumptively excluded from APCs. This exclusion is rebuttable if the applicant can demonstrate by clear and convincing evidence that there are no practicable alternatives that are less damaging in areas outside of the APC, or that the proposed project will not result in a significant alteration to the values and resources of the APC. When evaluating a project proposal, the Council shall not consider cost as a factor when

determining whether practicable alternatives exist. Applicants which successfully demonstrate that the presumptive exclusion does not apply to a proposed project because there are no practicable alternatives that are less damaging in areas outside of the APC must also demonstrate that all feasible efforts have been made to avoid damage to APC resources and values and that there will be no significant alteration of the APC resources or values. Applicants successfully demonstrating that the presumptive exclusion does not apply because the proposed project will not result in a significant alteration to the values and resources of the APC must also demonstrate that all feasible efforts have been made to avoid damage to the APC resources and values. The Council may require a successful applicant to provide a mitigation plan that protects the ecosystem. The Council will permit underwater cables, only in certain categories of Areas of Particular Concern, as determined by the Council in coordination with the Joint Agency Working Group. The maps listed below in § 8.5.2(C) of this Part depicting areas of particular concern may be superseded by more detailed, site-specific maps created with finer resolution data.

3. Areas of particular concern that have been identified in the Ocean SAMP area in state waters are described as follows:

   a. Historic shipwrecks, archeological or historical sites and their buffers as described in § 4.3 of this Subchapter, are areas of particular concern. For the latest list of these sites and their locations please refer to the Rhode Island State Historic Preservation and Heritage Commission.

   b. Offshore dive sites within the Ocean SAMP area, as shown in Figure 8.48 in § 8.5.2(C)(5) of this Part are designated areas of particular concern. The Council recognizes that offshore dive sites, most of which are shipwrecks, are valuable recreational and cultural ocean assets and are important to sustaining Rhode Island's recreation and tourism economy.

   c. Glacial moraines are important habitat areas for a diversity of fish and other marine plants and animals because of their relative structural permanence and structural complexity. Glacial moraines create a unique bottom topography that allows for habitat diversity and complexity, which allows for species diversity in these areas and creates environments that exhibit some of the highest biodiversity within the entire Ocean SAMP area. The Council also recognizes that because glacial moraines contain valuable habitats for fish and other marine life, they are also important to commercial and recreational fishermen. Accordingly, the Council shall designate glacial moraines as identified in Figures 8.49 and 8.50 in §§ 8.5.2(C)(6) and (7) of this Part as areas of particular concern.

d. Navigation, Military, and Infrastructure areas including: designated shipping lanes, precautionary areas, recommended vessel routes, ferry routes, dredge disposal sites, military testing areas, unexploded ordnance, pilot boarding areas, anchorages, and a coastal buffer of 1 km as depicted in Figure 8.51 in § 8.5.2(C)(8) of this Part are designated as Areas of Particular Concern. The Council recognizes the importance of these areas to marine transportation, navigation and other activities in the Ocean SAMP area.

e. Areas of high fishing activity as identified during the pre-application process by the Fishermen's Advisory Board, as defined in § 11.3(E) of this Subchapter, may be designated by the Council as areas of particular concern.

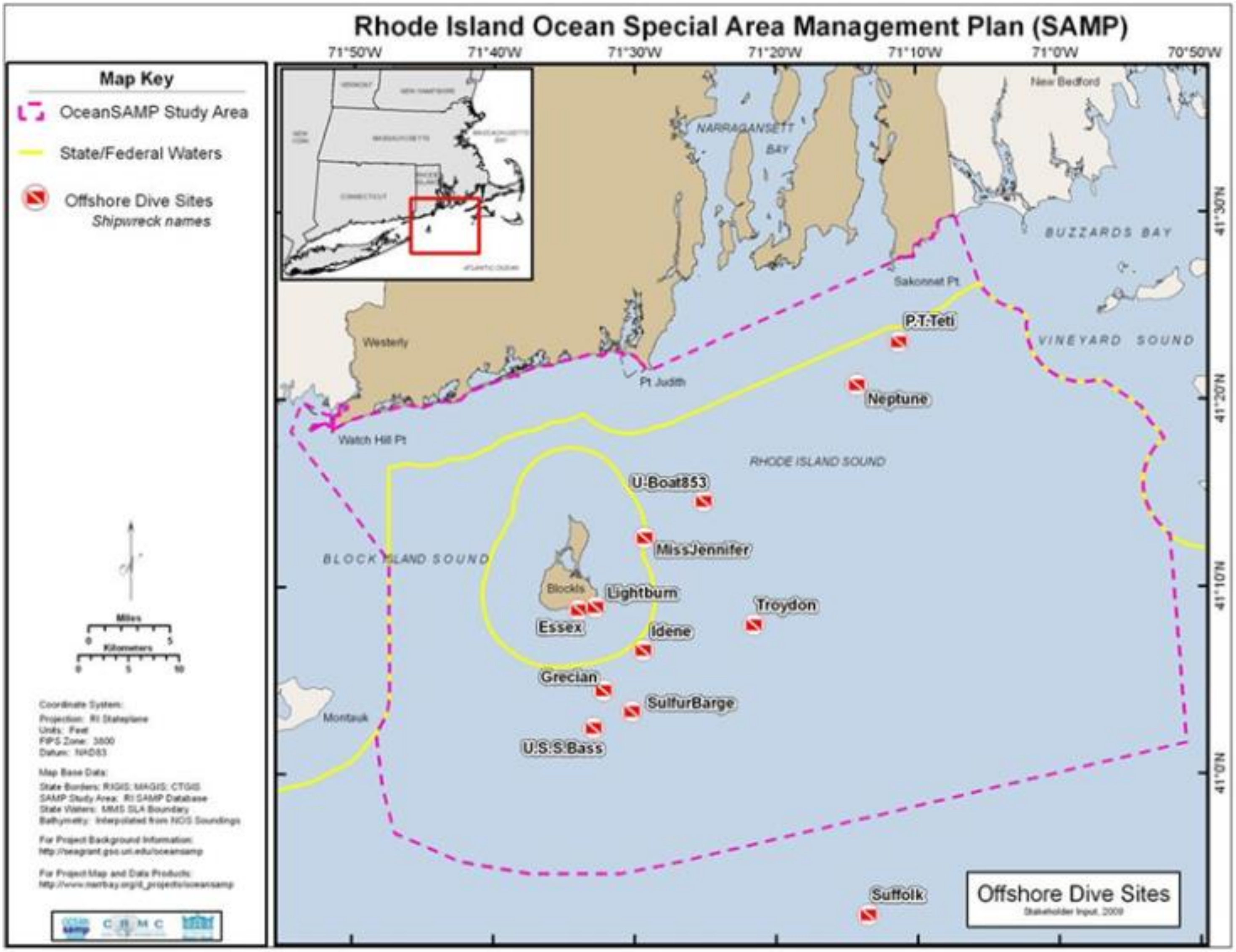
f. Several heavily-used recreational boating and sailboat racing areas, as shown in Figure 8.52 in § 8.5.2(C)(9) of this Part, are designated as areas of particular concern. The Council recognizes that organized recreational boating and sailboat racing activities are concentrated in these particular areas, which are therefore important to sustaining Rhode Island's recreation and tourism economy.

g. Naval Fleet Submarine Transit Lane, as described in Chapter 7, Marine Transportation, Navigation, and Infrastructure section 720.7, are designated as areas of particular concern.

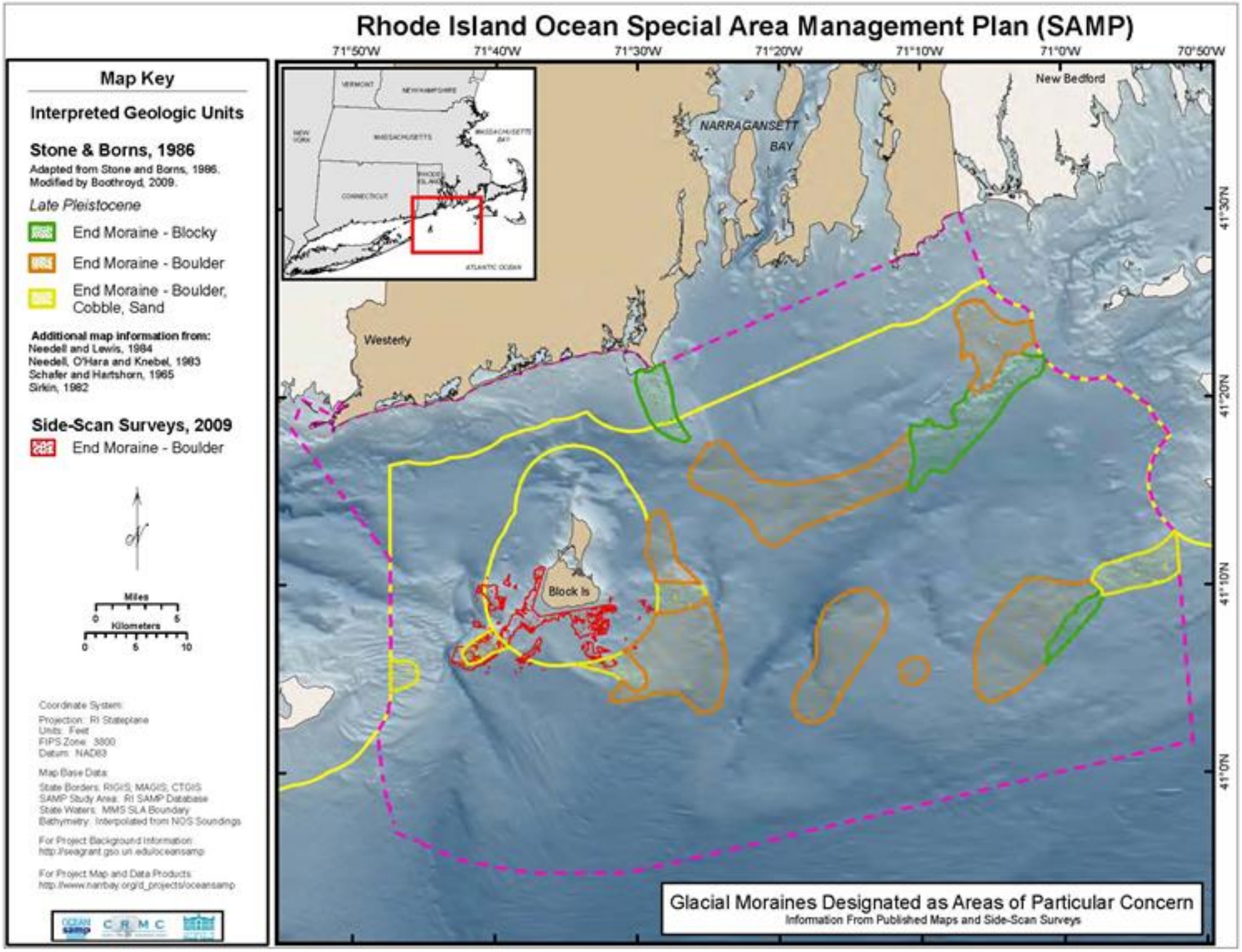
h. Other areas of particular concern may be identified during the pre-application review by state and federal agencies as areas of importance.

4. Developers proposing projects for within the renewable energy zone as described in § 8.5.2(C) of this Part shall adhere to the requirements outlined in § 8.5.2(C)(2) of this Part regarding areas of particular concern in state waters, including any areas of particular concern that overlap the renewable energy zone (see Figure 8.53 in § 8.5.2(C)(10)) of this Part.

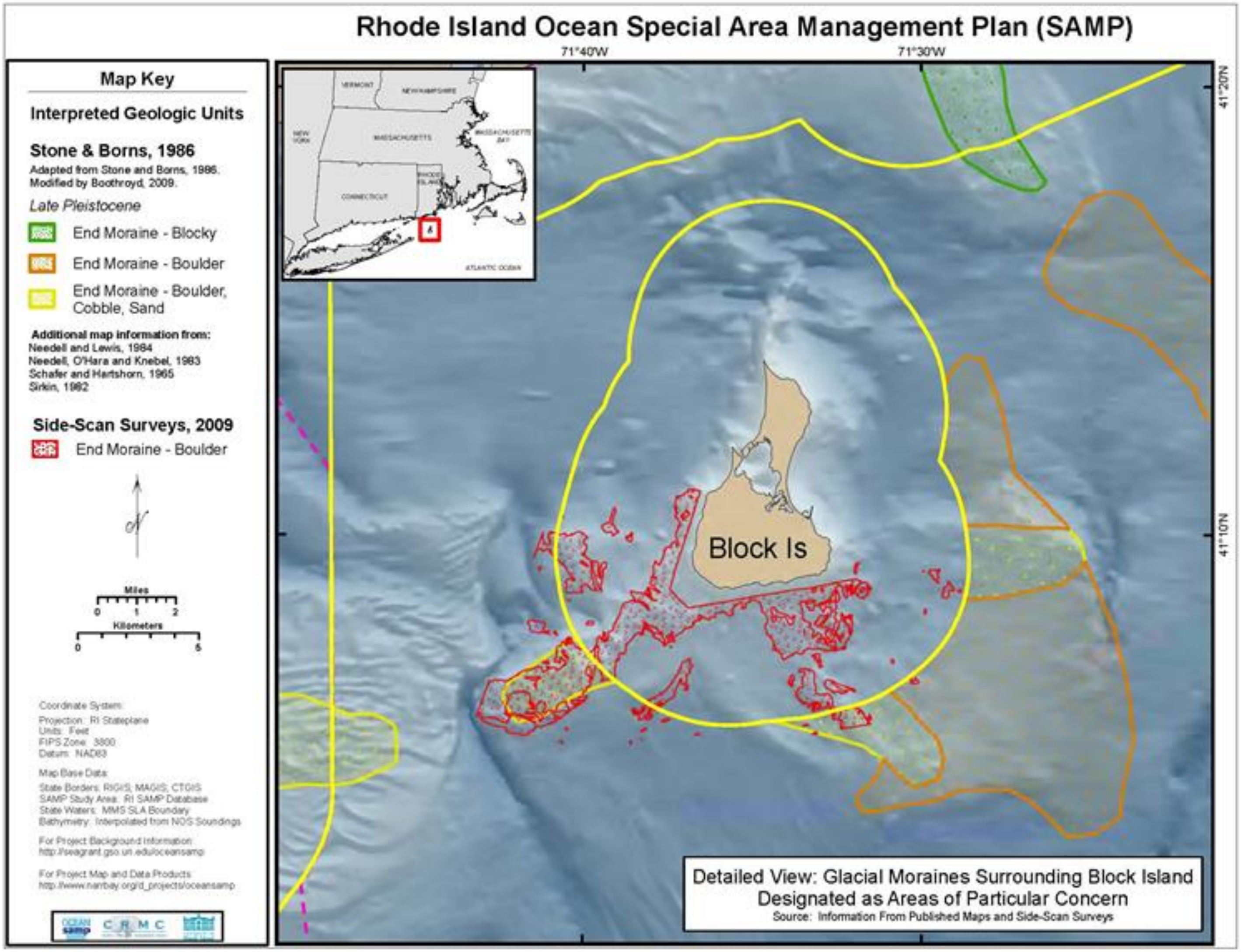
5. Figure 8.48: Offshore dive sites designated as Areas of Particular Concern in state waters.



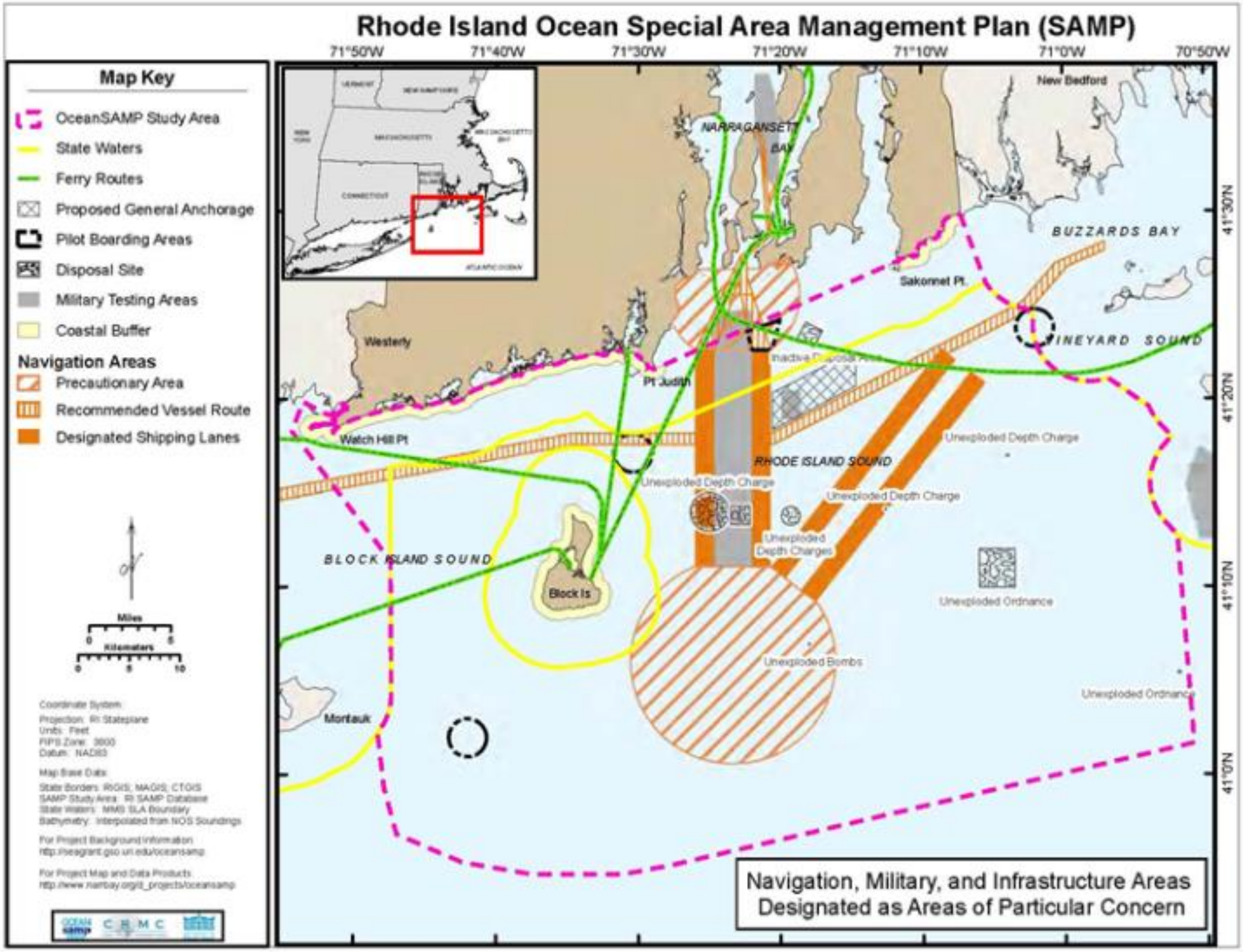
6. Figure 8.49: Glacial moraines designated as Areas of Particular Concern in state waters.



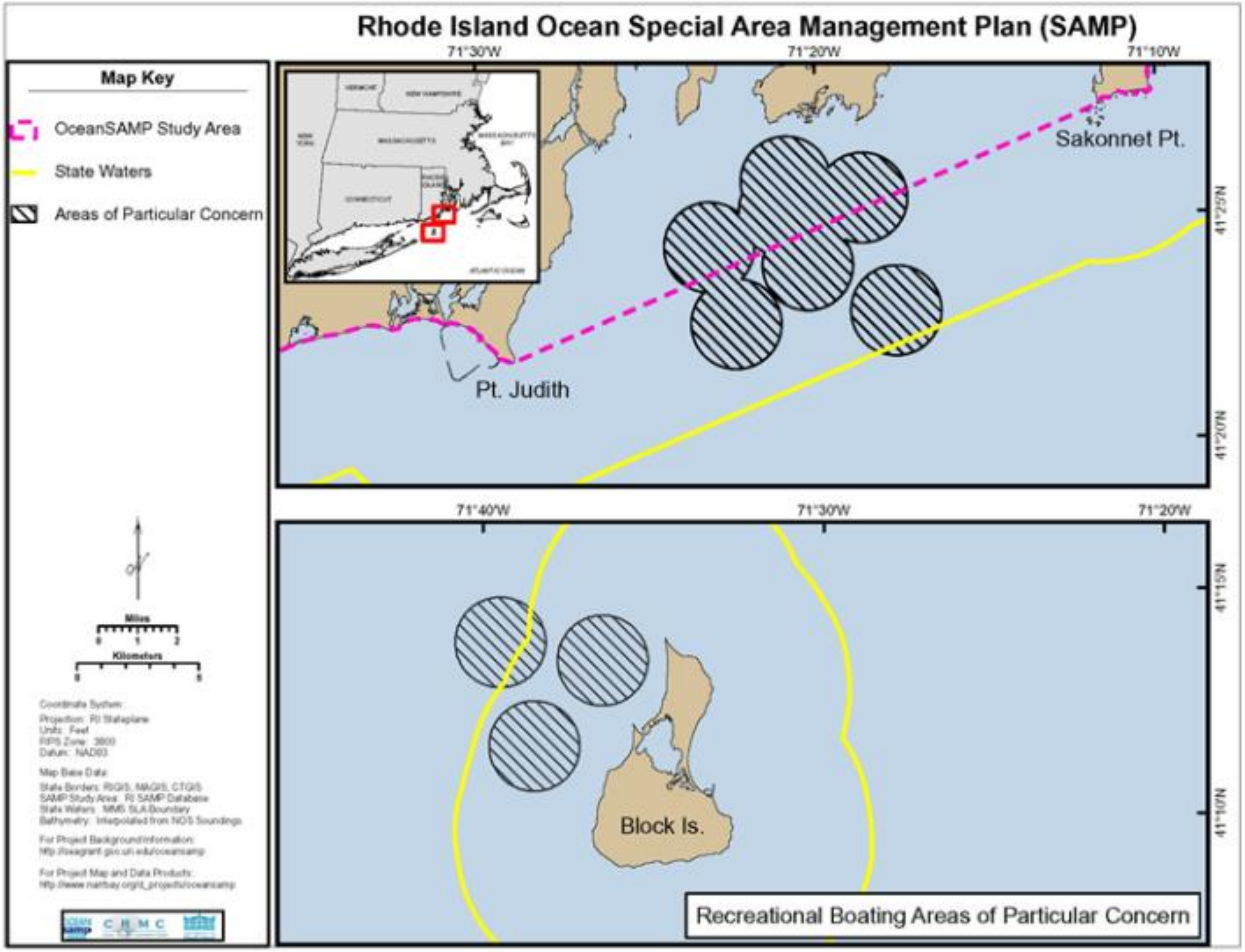
7. Figure 8.50: Detailed view: Glacial moraines surrounding Block Island designated as Areas of Particular Concern in state waters



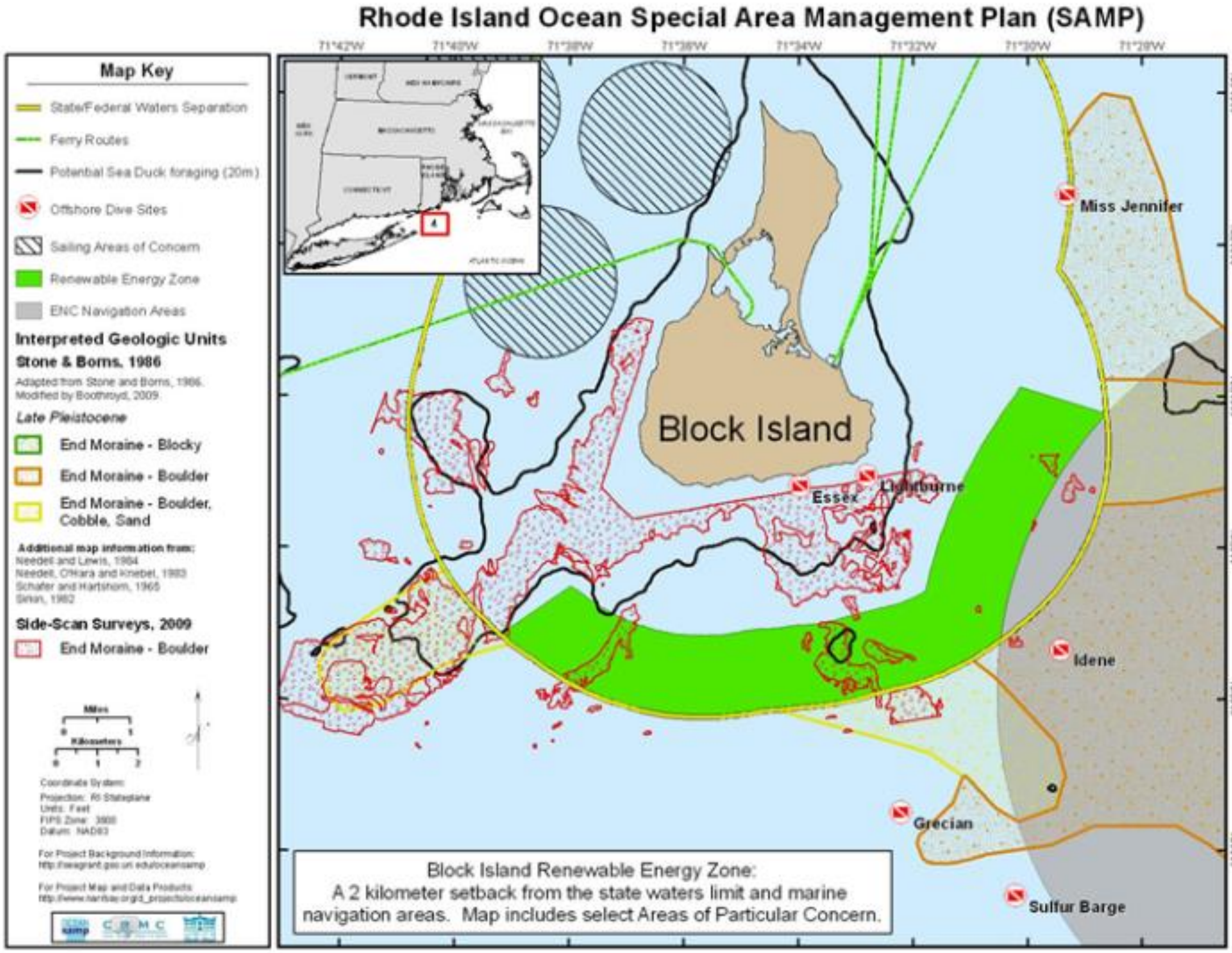
8. Figure 8.51: Navigation, military, and infrastructure areas designated as Areas of Particular Concern in state waters



9. Figure 8.52: Recreational boating areas designated as Areas of Particular Concern in state waters



10. Figure 8.53: Areas of particular concern overlapping the renewable energy zone in state waters

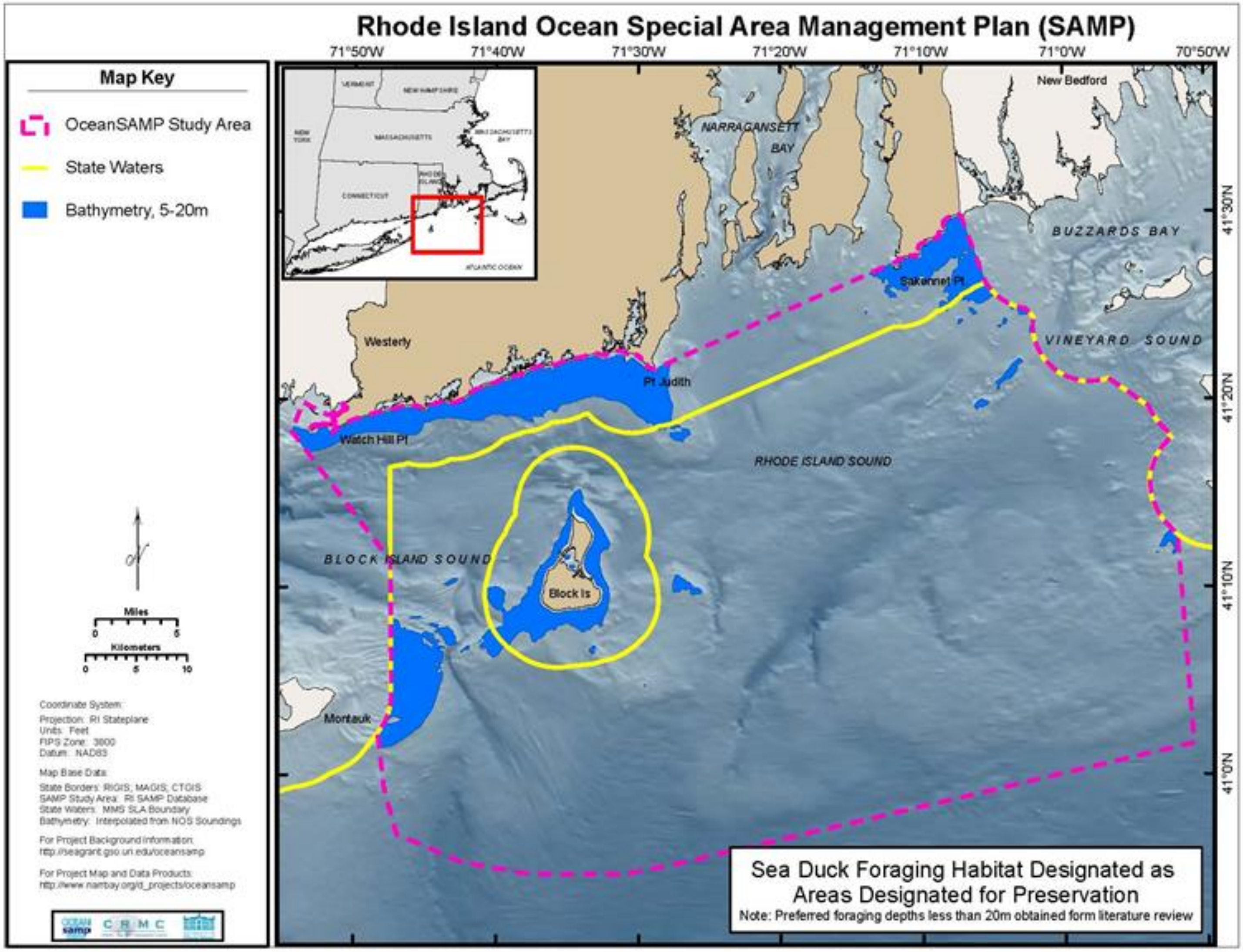


D. Prohibitions and areas designated for preservation (formerly § 860.2.3)

1. Areas designated for preservation are designated in the Ocean SAMP area in state waters for the purpose of preserving them for their ecological value. Areas designated for preservation were identified by reviewing habitat and other ecological data and findings that have resulted from the Ocean SAMP process. Areas designated for preservation are afforded additional protection than areas of particular concern (see § 8.5.2(C) of this Part because of scientific evidence indicating that large-scale offshore development in these areas may result in significant habitat loss. The areas listed in § 8.5.2(D) of this Part are designated as areas designated for preservation. The Council shall prohibit any large-scale offshore development, mining and extraction of minerals, or other development that has been found to be in conflict with the intent and purpose of an area designated for preservation. Underwater cables are exempt from this prohibition. Areas designated for preservation include:

   a. Ocean SAMP sea duck foraging habitat in water depths less than or equal to 20 meters [65.6 feet] (as shown in Figure 8.54 in § 8.5.2(D) of this Part) is designated as an area designated for preservation due to their ecological value and the significant role these foraging habitats play to avian species, and existing evidence suggesting the potential for permanent habitat loss as a result of offshore wind energy development. The current research regarding sea duck foraging areas indicates that this habitat is depth limited and generally contained within the 20 meter depth contour. It is likely there are discreet areas within this region that are prime feeding areas, however at present there is no long-term data set that would allow this determination. Thus, the entire area within the 20 meter contour is being protected as an area designated for preservation until further research allows the Council and other agencies to make a more refined determination.

(1) Figure 8.54: Sea duck foraging habitat designated as areas designated for preservation in state waters



2. The mining and extraction of minerals, including sand and gravel, from tidal waters and salt ponds is prohibited. This prohibition does not apply to dredging for navigation purposes, channel maintenance, habitat restoration, or beach replenishment for public purposes.

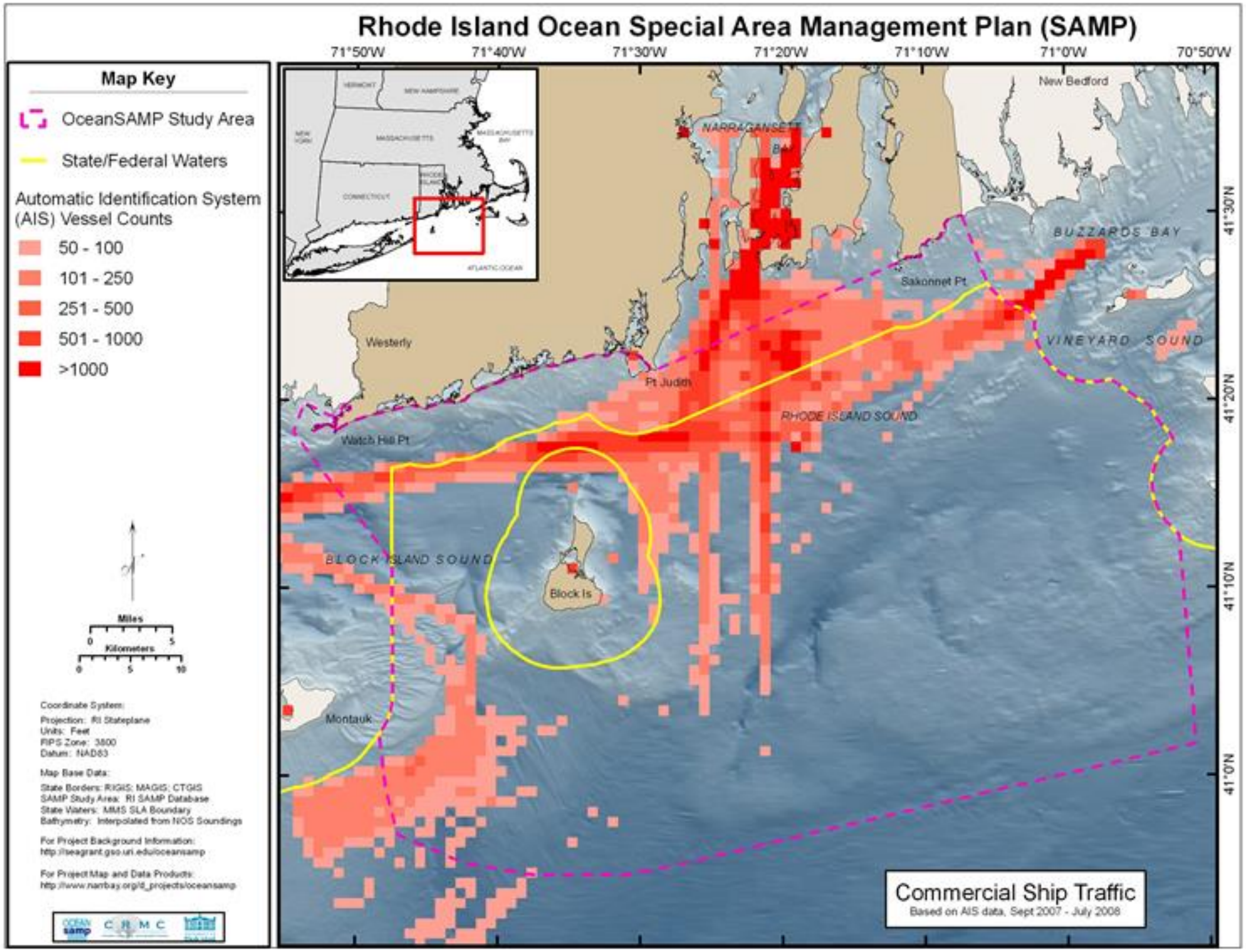
3. The Council shall prohibit any offshore development in areas identified as critical habitat under the Endangered Species Act.

4. Dredged material disposal, as defined in § 00-1.3.1(I) of this Chapter and subject to the regulations of § 00-1.3.1(I) of this Chapter, is further limited in the Ocean SAMP area by the prohibition of dredged material disposal in the following areas of particular concern as defined in § 8.5.2(C) of this Part: historic shipwrecks, archaeological, or historic sites; offshore dive sites; navigation, military, and infrastructure areas; and moraines. Beneficial reuse may be allowed in areas designated for preservation, whereas all other dredged material disposal is prohibited in those areas. All disposal of dredged material will be conducted in accordance with the U.S. EPA and U.S. Army Corps of Engineers' manual, Evaluation of Dredged Material Proposed for Ocean Disposal.

E. Other Areas (formerly § 860.2.4)

1. Large-scale projects or other development which is found to be a hazard to commercial navigation shall avoid areas of high intensity commercial marine traffic in state waters. Avoidance shall be the primary goal of these areas. Areas of high intensity commercial marine traffic are defined as having 50 or more vessel counts within a 1 km by 1 km grid, as in Figure 8.55 in § 8.5.2(E) of this Part.

a. Figure 8.55: Areas of high intensity commercial ship traffic in state waters



F. Application requirements (formerly § 860.2.5)

1. For the purposes of this document, the phrase "'necessary data and information'" shall refer to the necessary data and information required for federal consistency reviews for purposes of starting the Coastal Zone Management Act (CZMA) 6-month review period for federal license or permit activities under 15 C.F.R. Part 930, Subpart D, and OCS Plans under 15 C.F.R. Part 930, Subpart E, pursuant to 15 C.F.R. § 930.58(a)(2). Any necessary data and information shall be provided before the 6-month CZMA review period begins for a proposed project. It should be noted that other federal and state agencies may require other types of data or information as part of their review processes.

2. For the purposes of this document, the following terms shall be defined as:

    a. A site assessment plan (SAP) is defined as a pre-application plan that describes the activities and studies the applicant plans to perform for the characterization of the project site.

    b. A construction and operations plan (COP) is defined as a plan that describes the applicant's construction, operations, and conceptual decommissioning plans for a proposed facility, including the applicant's project easement area.

    c. A certified verification agent (CVA) is defined as an independent third-party agent that shall use good engineering judgment and practices in conducting an independent assessment of the design, fabrication and installation of the facility. The CVA shall have licensed and qualified Professional Engineers on staff.

3. Prior to construction, the following sections shall be considered necessary data and information and shall be required by the Council:

    a. Site assessment plan – A SAP is a pre-application plan that describes the activities and studies (e.g., installation of meteorological towers, meteorological buoys) the applicant plans to perform for the characterization of the project site. Within the renewable energy zone, if an applicant applies within 2 years of CRMC's adoption of the Ocean Special Area Management Plan they may elect to combine the SAP and construction and operation plan (COP) phase, but only within the renewable energy zone and only for 2 years after the adoption date. If an applicant elects to combine these two phases all requirements shall still be met. The SAP shall describe how the applicant shall conduct the resource assessment (e.g., meteorological and oceanographic data collection) or technology testing activities. The applicant shall receive the approval of the SAP by the Council. For projects within Type 4E waters (depicted in Figure 8.47 in § 1.5.2(B) of this Part), pre-construction data requirements may incorporate data generated by the Ocean SAMP provided the data was collected within 2 years of the date of application, or where the Ocean SAMP data is determined to be current enough to meet the requirements of the Council in coordination with the Joint Agency Working Group. The applicant shall reference information and data discussed in the Ocean SAMP (including appendices and technical reports) in their SAP.

(1) The applicant's SAP shall include data from:

(AA) Physical characterization surveys (e.g., geological and geophysical surveys or hazards surveys); and

(BB) Baseline environmental surveys (e.g., biological or archaeological surveys).

(2) The SAP shall demonstrate that the applicant has planned and is prepared to conduct the proposed site assessment activities in a manner that conforms to the applicant's responsibilities listed above in § 8.5.2(B)(5) and:

(AA) Conforms to all applicable laws, regulations;

(BB) Is safe;

(CC) Does not unreasonably interfere with other existing uses of the state waters,

(DD) Does not cause undue harm or damage to natural resources; life (including human and wildlife);the marine, coastal, or human environment; or sites, structures, or direct harm to objects of historical or archaeological significance;

(EE) Uses best available and safest technology;

(FF) Uses best management practices; and

(GG) Uses properly trained personnel.

(3) The applicant shall also demonstrate that the site assessment activities shall collect the necessary data and information required for the applicant's COP, as described below in § 8.5.2(F)(3)(b) of this Part.

(4) The applicant's SAP shall include the information described in Table 8.21 in § 8.5.2(F) of this Part, as applicable.

(AA) Table 8.21: Contents of a site assessment plan (SAP)

Project information:	**Including:**
(1) Contact information	The name, address, e-mail address, and phone number of an authorized representative.
(2) The site assessment or technology testing concept.	A discussion of the objectives; description of the proposed activities, including the technology to be used; and proposed schedule from start to completion.
(4) Stipulations and compliance.	A description of the measures the applicant took, or shall take, to satisfy the conditions of any permit stipulations related to the applicant's proposed activities.
(5) A location.	The surface location and water depth for all proposed and existing structures, facilities, and appurtenances located both offshore and onshore.
(6) General structural and project design, fabrication, and installation.	Information for each type of facility associated with the applicant's project.
(7) Deployment activities.	A description of the safety, prevention, and environmental protection features or measures that the applicant will use.

(8) The applicant's proposed measures for avoiding, minimizing, reducing, eliminating, and monitoring environmental impacts.	A description of the measures the applicant shall take to avoid or minimize adverse effects and any potential incidental take, before the applicant conducts activities on the project site, and how the applicant shall mitigate environmental impacts from proposed activities, including a description of the measures to be used.
(9) Reference information.	Any document or published source that the applicant cites as part of the plan. The applicant shall reference information and data discussed in the Ocean SAMP (including appendices and technical reports), other plans referenced in the Ocean SAMP, other plans previously submitted by the applicant or that are otherwise readily available to the Council.
(10) Decommissioning and site clearance procedures.	A discussion of methodologies.
(11) Air quality information.	Information required for the Clean Air Act (42 U.S.C. § 7409) and implementing regulations
(12) A listing of all Federal, State, and local authorizations or approvals required to conduct site assessment activities on the project site.	A statement indicating whether such authorization or approval has been applied for or obtained.
(13) A list of agencies or persons with whom the applicant has communicated, or will communicate, regarding potential impacts associated with the proposed activities.	Contact information and issues discussed.

(14) Financial assurance information.	Statements attesting that the activities and facilities proposed in the applicant's SAP are or shall be covered by an appropriate performance bond or other Council approved security.
(15) Other information.	Additional information as requested by the Council in coordination with the Joint Agency Working Group.

(5) The applicant's SAP shall provide the results of geophysical and geological surveys, hazards surveys, archaeological surveys (as required by the Council in coordination with the Joint Agency Working Group), and biological surveys outlined in Table 8.22 in § 8.5.2(F) of this Part (with the supporting data) in the applicant's SAP:

(AA) Table 8.22: Necessary data and information to be provided in the Site Assessment Plan.

Information.	**Report contents.**	**Including.**
(1) Geotechnical	Reports from the geotechnical survey with supporting data.	A description of all relevant seabed and engineering information to allow for the design of the foundation of that facility. The applicant shall provide information to depths below which the underlying conditions shall not influence the integrity or performance of the structure. This could include a series of sampling locations (borings and *in situ* tests) as well as laboratory testing of soil samples.
(2) Shallow hazards	The results from the shallow hazards survey with supporting data, if required.	A description of information sufficient to determine the presence of the following features and their likely effects on the proposed facility, including: (i) Shallow faults;

		(ii) Gas seeps or shallow gas; (iii) Slump blocks or slump sediments; (iv) Hydrates; and (v) Ice scour of seabed sediments.
(3) Archaeological resources	The results from the archaeological survey with supporting data, if required.	(i) A description of the results and data from the archaeological survey; (ii) A description of the historic and prehistoric archaeological resources, as required by the National Historic Preservation Act and Antiquities Act (16 U.S.C. § 470 et. seq.), as amended, the Rhode Island Historical Preservation Act and Antiquities Act and §§ 00-1.2.3 and 00-1.3.5 of this Chapter, as applicable; (iii) For more information on the archeological surveys and assessments required see § 4.3 of this Subchapter.
(4) Geological survey	The results from the geological survey with supporting data.	A report that describes the results of a geological survey that includes descriptions of: (i) Seismic activity at the proposed site; (ii) Fault zones; (iii) The possibility and effects of seabed subsidence; and (iv) The extent and geometry of faulting attenuation effects of geologic conditions near the site.
(5) Biological survey	The results from the biological survey with supporting data.	A description of the results of a biological survey, including descriptions of the presence of live bottoms; hard bottoms; topographic features; and surveys of other marine resources such as

		fish populations (including migratory populations) not targeted by commercial or recreational fishing, marine mammals, sea turtles, and sea birds.
(6) Fish and Fisheries Survey	The results from the fish and fisheries survey with supporting data.	A report that describes the results of: (i) A biological assessment of commercially and recreationally targeted species. This assessment shall assess the relative abundance, distribution, and different life stages of these species at all four seasons of the year. This assessment shall comprise a series of surveys, employing survey equipment and methods that are appropriate for sampling finfish, shellfish, and crustacean species at the project's proposed location. This assessment may include evaluation of survey data collected through an existing survey program, if data are available for the proposed site. (ii) An assessment of commercial and recreational fisheries effort, landings, and landings value. Assessment shall focus on the proposed project area and alternatives across all four seasons of the year must. Assessment may use existing fisheries monitoring data but shall be supplemented by interviews with commercial and recreational fishermen. (iii) For more information on these assessments see § 8.5.2(J) of this Part.

(6) The applicant shall submit a SAP that describes those resources, conditions, and activities listed in Table 8.23 in § 8.5.2(F) of this Part that could be affected by the applicant's proposed activities, or that could affect the activities proposed in the applicant's SAP, including but not limited to:

(AA) Table 8.23: Resource data and uses that shall be described in the Site Assessment Plan.

Type of information	**Including:**
(1) Hazard information	Meteorology, oceanography, sediment transport, geology, and shallow geological or manmade hazards.
(2) Water quality	Turbidity and total suspended solids from construction.
(3) Biological resources	Benthic communities, marine mammals, sea turtles, coastal and marine birds, fish and shellfish (not targeted by commercial or recreational fishing), plankton, seagrasses, and plant life.
(4) Threatened or endangered species	As required by the Endangered Species Act (ESA) of 1973 (16. U.S.C. § 1531 et. seq.).
(5) Sensitive biological resources or habitats	Essential fish habitat, refuges, preserves, Areas of Particular Concern, Areas Designated for Preservation, sanctuaries, rookeries, hard bottom habitat, and calving grounds; barrier islands, beaches, dunes, and wetlands.
(6) Archaeological and visual resources	As required by the National Historic Preservation Act and Antiquities Act (16 U.S.C. § 470 et. seq.), as amended, the Rhode Island Historical Preservation Act and Antiquities Act

	and §§ 00-1.2.3 and 00-1.3.5 of this Chapter, as applicable.
(7) Social and economic resources	Employment, existing offshore and coastal infrastructure (including major sources of supplies, services, energy, and water), land use, subsistence resources and harvest practices, recreation, minority and lower income groups, and view shed.
(8) Fisheries resources and uses	Commercially and recreationally targeted species, recreational and commercial fishing (including fishing seasons, location, and type), commercial and recreational fishing activities, effort, landings, and landings value.
(8) Coastal and marine uses	Military activities, vessel traffic, and energy and non-energy mineral exploration or development.

(7) The Council shall review the applicant's SAP in conjunction with the Joint Agency Working Group to determine if it contains the information necessary to conduct technical and environmental reviews and shall notify the applicant if the SAP lacks any necessary information.

(8) As appropriate, the Council shall coordinate and consult with relevant Federal and State agencies, and affected Indian tribes.

(9) Any large-scale offshore development, as defined above in § 8.3(G) of this Part, shall require a pre-application meeting between the FAB, the applicant, and the Council staff to discuss potential fishery-related impacts, such as, but not limited to, project location, construction schedules, alternative locations, and project minimization. During the pre-application meeting for a large-scale offshore development, the FAB can also

identify areas of high fishing activity or habitat edges to be considered during the review process.

(10) During the review process, the Council may request additional information if it is determined that the information provided is not sufficient to complete the review and approval process.

(11) Once the SAP is approved by the Council the applicant may begin conducting the activities approved in the SAP.

(12) Reporting requirements of the applicant under an approved SAP:

(AA) Following the approval of a SAP, the applicant shall notify the Council in writing within 30 days of completing installation activities of any temporary measuring devices approved by the Council.

(BB) The applicant shall prepare and submit to the Council a report semi-annually. The first report shall be due 6 months after work on the SAP begins; subsequent reports shall be submitted every 6 month thereafter until the SAP period is complete. The report shall summarize the applicant's site assessment activities and the results of those activities.

(CC) The Council reserves the right to require additional environmental and technical studies, if it is found there is a critical area lacking or missing information.

(13) The applicant shall seek the Council's approval before conducting any activities not described in the approved SAP, describing in detail the type of activities the applicant proposes to conduct and the rationale for these activities. The Council shall determine whether the activities proposed are authorized by the applicant's existing SAP or require a revision to the applicant's SAP. The Council may request additional information from the applicant, if necessary, to make this determination.

(14) The Council shall periodically review the activities conducted under an approved SAP. The frequency and extent of the review shall be based on the significance of any changes in available information and on onshore or

offshore conditions affecting, or affected by, the activities conducted under the applicant's SAP. If the review indicates that the SAP should be revised to meet the requirements of this part, the Council shall require the applicant to submit the needed revisions.

(15) The applicant may keep approved facilities (such as meteorological towers) installed during the SAP period in place during the time that the Council reviews the applicant's COP for approval. Note: Structures in state waters shall require separate authorizations outside the SAP process.

(16) The applicant is not required to initiate the decommissioning process for facilities that are authorized to remain in place under the applicant's approved COP. If, following the technical and environmental review of the applicant's submitted COP, the Council determines that such facilities may not remain in place the applicant shall initiate the decommissioning process.

(17) The Executive Director on behalf of the Council will be responsible for reviewing and approving study designs conducted as part of the necessary data and information contained in the SAP. The Executive Director shall seek the advice of the FAB and HAB in setting out the study designs to be completed in the SAP. The Executive Director shall also brief the Ocean SAMP Subcommittee on each study design as it is being considered. Any applicant that initiated, conducted and/or completed site assessment studies or surveying activities prior to the adoption of the policies set forth in the SAMP, shall demonstrate that the studies were done in accordance with federal protocols for such studies or in the alternative, to the Council's satisfaction that the completed studies were conducted with approval from the Executive Director and in accordance with §§ 11.10.5(A), 11.10.5(C)(2), 11.10.5(C)(3) and 11.10.5(C)(4) of this Subchapter.

b. Construction and operations plan (COP) - The COP describes the applicant's construction, operations, and conceptual decommissioning plans for the proposed facility, including the applicant's project easement area.

(1) The applicant's COP shall describe all planned facilities that the applicant shall construct and use for the applicant's project, including onshore and support facilities and all anticipated project easements.

(2) The applicant's COP shall describe all proposed activities including the applicant's proposed construction activities, commercial operations, and conceptual decommissioning plans for all planned facilities, including onshore and support facilities.

(3) The applicant shall receive the Council's approval of the COP before the applicant can begin any of the approved activities on the applicant's project site, lease or easement.

(4) The COP shall demonstrate that the applicant has planned and is prepared to conduct the proposed activities in a manner that:

(AA) Conforms to all applicable laws, implementing regulations.

(BB) Is safe;

(CC) Does not unreasonably interfere with other uses of state waters;

(DD) Does not cause undue harm or damage to natural resources; life (including human and wildlife); the marine, coastal, or human environment; or direct impact to sites, structures, or objects of historical or archaeological significance;

(EE) Uses best available and safest technology;

(FF) Uses best management practices; and

(GG) Uses properly trained personnel.

(5) The applicant's COP shall include the following project-specific information, as applicable:

(AA) Table 8.24: Contents of the construction and operations plan (COP).

Project information:	**Including:**

(1) Contact information	The name, address, e-mail address, and phone number of an authorized representative.
(2) Designation of operator, if applicable	
(3) The construction and operation concept	A discussion of the objectives, description of the proposed activities, tentative schedule from start to completion, and plans for phased development.
(5) A location	The surface location and water depth for all proposed and existing structures, facilities, and appurtenances located both offshore and onshore, including all anchor/mooring data.
(6) General structural and project design, fabrication, and installation	Information for each type of structure associated with the project and, unless the Council provides otherwise, how the applicant shall use a CVA to review and verify each stage of the project.
(7) All cables and pipelines, including cables on project easements	Location, design and installation methods, testing, maintenance, repair, safety devices, exterior corrosion protection, inspections, and decommissioning. The applicant shall prior to construction also include location of all cable crossings and appropriate clearance from the owners of existing cables.
(8) A description of the deployment activities	Safety, prevention, and environmental protection features or measures that the applicant shall use.
(9) A list of solid and liquid wastes generated.	Disposal methods and locations.
(10) A list of chemical products used (if stored volume exceeds Environmental Protection	A list of chemical products used; the volume stored on location; their treatment, discharge, or disposal methods used; and the name and location of the onshore waste receiving, treatment, and/or disposal facility. A description of how these products would be brought onsite, the number of

Agency (EPA) Reportable Quantities.	transfers that may take place, and the quantity that shall be transferred each time.
(12) Decommissioning and site clearance procedures	A discussion of general concepts and methodologies.
(13) A list of all Federal, State, and local authorizations, approvals, or permits that are required to conduct the proposed activities, including commercial operations	A list of all Federal, State, and local authorizations, approvals, or permits that are required to conduct the proposed activities, including commercial operations. In addition, a statement indicating whether the applicant has applied for or obtained such authorizations, approvals, or permits.
(14) The applicant's proposed measures for avoiding, minimizing, reducing, eliminating, and monitoring environmental impacts	A description of the measures the applicant shall take to avoid or minimize adverse effects and any potential incidental take before conducting activities on the project site, and how the applicant shall minimize environmental impacts from proposed activities, including a description of the measures.
(15) Information the applicant incorporates by reference	A list of the documents referenced and the actual document if requested.
(16) A list of agencies and persons with whom the applicant has communicated, or with whom the applicant shall communicate, regarding potential impacts associated with the proposed activities	Contact information, issues discussed and the actual document if requested
(17) Reference	Contact information.
(18) Financial assurance	Statements attesting that the activities and facilities proposed in the applicant's COP are or shall be

	covered by an appropriate bond or security, as required by § 8.5.2(H) of this Part.
(19) CVA nominations	CVA nominations for reports required.
(20) Construction schedule	A reasonable schedule of construction activity showing significant milestones leading to the commencement of commercial operations.
(21) Air quality information	Information required for the Clean Air Act (42 U.S.C. § 7409) and implementing regulations.
(22) Other information	Additional information as required by the Council.

(6) The applicant's COP shall include the following information and surveys for the proposed site(s) of the applicant's facility or facilities:

(AA) Table 8.25: Necessary data and information to be provided in the construction and operations plan (COP).

Information:	**Report contents:**	**Including:**
(1) Shallow hazards	The results of the shallow hazards survey with supporting data, if required.	Information sufficient to determine the presence of the following features and their likely effects on the proposed facility, including: (i) Shallow faults; (ii) Gas seeps or shallow gas; (iii) Slump blocks or slump sediments; (iv) Hydrates; or (v) Ice scour of seabed sediments.

(2) Geological survey relevant to the siting and design of the facility	The results of the geological survey with supporting data.	Assessment of: (i) Seismic activity at the proposed site; (ii) Fault zones; (iii) The possibility and effects of seabed subsidence; and (iv) The extent and geometry of faulting attenuation effects of geologic conditions near the site.
(3) Biological Survey	The results of the biological survey with supporting data.	A description of the results of biological surveys used to determine the presence of live bottoms, hard bottoms, and topographic features, and surveys of other marine resources such as fish populations (including migratory populations) not targeted by commercial or recreational fishing, marine mammals, sea turtles, and sea birds.
(4) Fish and Fisheries Survey	The results from the fish and fisheries survey with supporting data.	A report that describes the results of: (i) A biological assessment of commercially and recreationally targeted species. This assessment shall assess the relative abundance, distribution, and different life stages of these species at all four seasons of the year. This assessment shall comprise a series of surveys, employing survey equipment and methods that are appropriate for sampling finfish, shellfish, and crustacean species at the project's proposed location. This assessment may include evaluation of survey data collected through an

		existing survey program, if data are available for the proposed site. (ii) An assessment of commercial and recreational fisheries effort, landings, and landings value. Assessment shall focus on the proposed project area and alternatives across all four seasons of the year must. Assessment may use existing fisheries monitoring data but shall be supplemented by interviews with commercial and recreational fishermen. (iii) For more information on these assessments see § 8.5.2(J) of this Part.
(5) Geotechnical survey	The results of any sediment testing program with supporting data, the various field and laboratory tests employed, and the applicability of these methods as they pertain to the quality of the samples, the type of sediment, and the anticipated design application. The applicant shall explain how the engineering properties of each sediment stratum affect the design of the facility. In the explanation, the applicant shall describe the uncertainties inherent in the overall testing program, and the	(i) The results of a testing program used to investigate the stratigraphic and engineering properties of the sediment that may affect the foundations or anchoring systems of the proposed facility. (ii) The results of adequate *in situ* testing, boring, and sampling at each foundation location, to examine all important sediment and rock strata to determine its strength classification, deformation properties, and dynamic characteristics. A minimum of one boring shall be taken per turbine planned, and the boring shall be taken within 50 feet of the final location of the turbine.

	reliability and applicability of each method.	(iii) The results of a minimum of one deep boring (with soil sampling and testing) at each edge of the project area and within the project area as needed to determine the vertical and lateral variation in seabed conditions and to provide the relevant geotechnical data required for design.
(6) Archaeological and visual resources, if required	The results of the archaeological resource survey with supporting data.	A description of the historic and prehistoric archaeological resources, as required by the National Historic Preservation Act and Antiquities Act (16 U.S.C. § 470 et. seq.), as amended, the Rhode Island Historical Preservation Act and Antiquities Act and §§ 00-1.2.3 and 00-1.3.5 of this Chapter, as applicable.
(7) Overall site investigation.	An overall site investigation report for the proposed facility that integrates the findings of the shallow hazards surveys and geologic surveys, and, if required, the subsurface surveys with supporting data.	An analysis of the potential for: (i) Scouring of the seabed; (ii) Hydraulic instability; (iii) The occurrence of sand waves; (iv) Instability of slopes at the facility location; (v) Liquefaction, or possible reduction of sediment strength due to increased pore pressures; (vi) Cyclic loading; (vii) Lateral loading;

		(viii) Dynamic loading; (ix) Settlements and displacements; (x) Plastic deformation and formation collapse mechanisms; and (xi) Sediment reactions on the facility foundations or anchoring systems.

(7) The applicant's COP shall describe those resources, conditions, and activities listed in Table 8.26 that could be affected by the applicant's proposed activities, or that could affect the activities proposed in the applicant's COP, including:

(AA) Table 8.26: Resources, conditions and activities that shall be described in the construction and operations plan (COP).

Type of Information:	**Including:**
(1) Hazard information and sea level rise	Meteorology, oceanography, sediment transport, geology, and shallow geological or manmade hazards. Provide an analysis of historic and project (medium and high) rates of sea level rise and shall at minimum assess the risks for each alternative on public safety and environmental impacts resulting from the project (see § 3.3.2 of this Subchapter for more information).
(2) Water quality and circulation	Turbidity and total suspended solids from construction. Modeling of circulation and stratification to ensure that water flow patterns and velocities are not altered in ways that would lead to major ecosystem change.

(3) Biological resources	Benthic communities, marine mammals, sea turtles, coastal and marine birds, fish and shellfish not targeted by commercial or recreational fishing, plankton, seagrasses, and plant life.
(4) Threatened or endangered species	As defined by the ESA (16 U.S.C. § 1531 et. seq.)
(5) Sensitive biological resources or habitats	Essential fish habitat, refuges, preserves, Areas of Particular Concern, sanctuaries, rookeries, hard bottom habitat, barrier islands, beaches, dunes, and wetlands.
(6) Fisheries resources and uses	Commercially and recreationally targeted species, recreational and commercial fishing (including fishing seasons, location, and type), commercial and recreational fishing activities, effort, landings, and landings value.
(6) Archaeological resources	As required by the NHPA (16 U.S.C. § 470 et. seq.), as amended.
(7) Social and economic resources	As determined by the Council in coordination with the Joint Agency Working Group.
(8) Coastal and marine uses	Military activities, vessel traffic, and energy and non-energy mineral exploration or development.

(8) The applicant shall submit an oil spill response plan per the Oil Pollution Act of 1990, 33 U.S.C. § 2701 *et seq*.

(9) The applicant shall submit the applicant's Safety Management System, the contents of which are described below:

(AA) How the applicant plans to ensure the safety of personnel or anyone on or near the facility;

(BB) Remote monitoring, control and shut down capabilities;

(CC) Emergency response procedures;

(DD) Fire suppression equipment (if needed);

(EE) How and when the safety management system shall be implemented and tested; and

(FF) How the applicant shall ensure personnel who operate the facility are properly trained.

(10) The Council shall review the applicant’s COP and the information provided to determine if it contains all the required information necessary to conduct the project’s technical and environmental reviews. The Council shall notify the applicant if the applicant’s COP lacks any necessary information.

(11) As appropriate, the Council shall coordinate and consult with relevant Federal, State, and local agencies, the FAB and affected Indian tribes.

(12) During the review process, the Council may request additional information if it is determined that the information provided is not sufficient to complete the review and approval process. If the applicant fails to provide the requested information, the Council may disapprove the applicant’s COP.

(13) Upon completion of the technical and environmental reviews and other reviews required, the Council may approve, disapprove, or approve with modifications the applicant’s COP.

(14) In the applicant’s COP, the applicant may request development of the project area in phases. In support of the applicant’s request, the applicant shall provide details as to what portions of the site shall be initially developed for commercial operations and what portions of the site shall be reserved for subsequent phased development.

(15) If the application and COP is approved, prior to construction the applicant shall submit to the Council for approval the documents listed below:

(AA) Facility design report- The applicant's facility design report provides specific details of the design of any facilities, including cables and pipelines, that are outlined in the applicant's approved SAP or COP. The applicant's facility design report shall demonstrate that the applicant's design conforms to the applicant's responsibilities listed in § 8.5.2(B) of this Part. The applicant shall include the following items in the applicant's facility design report:

(i) Table 8.27: Contents of the facility design report.

Required documents:	**Required contents:**	**Other requirements:**
(1) Cover letter	(i) Proposed facility designations; (ii)The type of facility	The applicant shall submit 4 paper copies and 1 electronic copy.
(2) Location	(i) Latitude and longitude coordinates, Universal Mercator grid-system coordinates, state plane coordinates in the Lambert or Transverse Mercator Projection System; (ii) These coordinates shall be based on the NAD (North American Datum) 83 datum plane coordinate system; and (iii) The location of any proposed project easement.	The applicant's plat shall be drawn to a scale of 1 inch equals 100 feet and include the coordinates of the project site, and boundary lines. The applicant shall submit 4 paper copy and 1 electronic copy.
(3) Front, side, and plan view drawings	(i) Facility dimensions and orientation; (ii) Elevations relative to Mean Lower Low Water; and	The applicant's drawing sizes shall not exceed 11" x 17". The applicant shall submit 4 paper copies and 1 electronic copy.

	(iii) Pile sizes and penetration.	
(4) Complete set of structural drawings	The approved for construction fabrication drawings should be submitted, including, e.g., (i) Cathodic protection systems; (ii) Jacket design; (iii) Pile foundations; (iv) Mooring and tethering systems; (v) Foundations and anchoring systems; and (vi) Associated cable and pipeline designs.	The applicant's drawing sizes shall not exceed 11" x 17". The applicant shall submit 4 paper copies and 1 electronic copy.
(5) Summary of environmental data used for design	A summary of the environmental data used in the design or analysis of the facility. Examples of relevant data include information on: (i) Extreme weather; (ii) Seafloor conditions; and (iii) Waves, wind, currents, tides, temperature, sea level rise projections, snow and ice effects, marine growth, and water depth.	The applicant shall submit 4 paper copies and 1 electronic copy. If the applicant submitted these data as part of the SAP or COP, the applicant may reference the plan.
(6) Summary of the engineering design data	(i) Loading information (e.g., live, dead, environmental); (ii) Structural information (e.g., design-life; material types; cathode protection systems;	The applicant shall submit 4 paper copies and 1 electronic copy.

	design criteria; fatigue life; jacket design; deck design; production component design; foundation pilings and templates, and mooring or tethering systems; fabrication or installation guidelines); (iii) Location of foundation boreholes and foundation piles; and (iv) Foundation information (e.g., soil stability, design criteria).	
(7) A complete set of design calculations	Self-explanatory.	The applicant shall submit 4 paper copies and 1 electronic copy.
(8) Project-specific studies used in the facility design or installation	All studies pertinent to facility design or installation, (e.g., oceanographic and soil reports)	The applicant shall submit 4 paper copies and 1 electronic copy.
(9) Description of the loads imposed on the facility	(i) Loads imposed by jacket; (ii) Turbines; (iii) Transition pieces; (iv) Foundations, foundation pilings and templates, and anchoring systems; and (v) Mooring or tethering systems.	The applicant shall submit 4 paper copies and 1 electronic copy.
(10) Geotechnical report	A list of all data from borings and recommended design parameters.	The applicant shall submit 4 paper copies and 1 electronic copy.

(ii) For any floating facility, the applicant's design shall meet the requirements of the U.S. Coast Guard for structural integrity and stability (e.g., verification of center of gravity). The design shall also consider: foundations, foundation pilings and templates, and anchoring systems; and mooring or tethering systems.

(iii) The applicant is required to use a certified verified agent (CVA). The facility design report shall include two paper copies of the following certification statement: ''The design of this structure has been certified by a Council approved CVA to be in accordance with accepted engineering practices and the approved SAP, or COP as appropriate. The certified design and as-built plans and specifications shall be on file at (given location).''

(BB) Fabrication and installation report. The applicant's fabrication and installation report shall describe how the applicant's facilities shall be fabricated and installed in accordance with the design criteria identified in the facility design report; the applicant's approved SAP or COP; and generally accepted industry standards and practices. The applicant's fabrication and installation report shall demonstrate how the applicant's facilities shall be fabricated and installed in a manner that conforms to the applicant's responsibilities listed in§ 8.5.2(B)(5) of this Part. The applicant shall include the following items in the applicant's fabrication and installation report:

(i) Table 8.28: Contents of the fabrication and installation report.

Required documents:	**Required contents:**	**Other requirements:**
(1) Cover letter	(i) Proposed facility designation; (ii) Area, name, and block number; and	The applicant shall submit 4 paper copies and 1 electronic copy.

	(iii) The type of facility	
(2) Schedule	Fabrication and installation.	The applicant shall submit 4 paper copies and 1 electronic copy.
(3) Fabrication information	The industry standards the applicant shall use to ensure the facilities are fabricated to the design criteria identified in the Facility Design Report.	The applicant shall submit 4 paper copies and 1 electronic copy.
(4) Installation process information	Details associated with the deployment activities, equipment, and materials, including offshore and onshore equipment and support, and anchoring and mooring permits.	The applicant shall submit 4 paper copies and 1 electronic copy.
(5) Federal, State, and local permits (e.g., EPA, Army Corps of Engineers)	Either 1 copy of the permit or information on the status of the application.	The applicant shall submit 4 paper copies and 1 electronic copy.
(6) Environmental information	(i) Water discharge; (ii) Waste disposal; (iii) Vessel information; and (iv) Onshore waste receiving treatment or disposal facilities.	The applicant shall submit 4 paper copies and 1 electronic copy. If the applicant submitted these data as part of the SAP or COP, the applicant may reference the plan.
(7) Project easement	Design of any cables, pipelines, or facilities. Information on burial methods and vessels.	The applicant shall submit 4 paper copies and 1 electronic copy.

(ii) A CVA report shall include the following: a fabrication and installation report which shall include four paper copies of the following certification statement: ‘‘The fabrication and installation of this structure has been certified by a Council approved CVA to be in accordance with accepted engineering practices and the approved SAP or COP as appropriate.”

(16) Based on the Council’s environmental and technical reviews, if approved, the Council may specify terms and conditions to be incorporated into any approval the Council may issue. The applicant shall submit a certification of compliance annually (or another frequency as determined by the Council) with certain terms and conditions which may include:

(AA) Summary reports that show compliance with the terms and conditions which require certification; and

(BB) A statement identifying and describing any mitigation measures and monitoring methods, and their effectiveness. If the applicant identified measures that were not effective, then the applicant shall make recommendations for new mitigation measures or monitoring methods.

(17) After the applicant’s COP, facility design report, and fabrication and installation report is approved, and the Council has issued a permit and lease for the project site, construction shall begin by the date given in the construction schedule included as a part of the approved COP, unless the Council approves a deviation from the applicant’s schedule.

(18) The applicant shall seek approval from the Council in writing before conducting any activities not described in the applicant’s approved COP. The application shall describe in detail the type of activities the applicant proposes to conduct. The Council shall determine whether the activities the applicant proposes are authorized by the applicant’s existing COP or require a revision to the applicant’s COP. The Council may request additional information from the applicant, if necessary, to make this determination.

(19) The Council shall periodically review the activities conducted under an approved COP. The frequency and extent of the review shall be based on the significance of any changes in available information, and on onshore or offshore conditions affecting, or affected by, the activities conducted under the applicant's COP. If the review indicates that the COP should be revised, the Council may require the applicant to submit the needed revisions.

(20) The applicant shall notify the Council, within five (5) business days, any time the applicant ceases commercial operations, without an approved suspension, under the applicant's approved COP. If the applicant ceases commercial operations for an indefinite period which extends longer than 6 months, the Council may cancel the applicant's lease, and the applicant shall initiate the decommissioning process.

(21) The applicant shall notify the Council in writing of the following events, within the time periods provided:

(AA) Not later than 10 days after commencing activities associated with the placement of facilities on the lease area under a fabrication and installation report;

(BB) Not later than 10 days after completion of construction and installation activities under a fabrication and installation report; and

(CC) At least 7 days before commencing commercial operations.

(22) The applicant may commence commercial operations within 30 days after the CVA has submitted to the Council the final fabrication and installation report.

(23) The applicant shall submit a project modification and repair report to the Council, demonstrating that all major repairs and modifications to a project conform to accepted engineering practices.

(AA) A major repair is a corrective action involving structural members affecting the structural integrity of a portion of or all the facility.

(BB) A major modification is an alteration involving structural members affecting the structural integrity of a portion of or all the facility.

(CC) The report must also identify the location of all records pertaining to the major repairs or major modifications.

(DD) The Council may require the applicant to use a CVA for project modifications and repairs.

G. Design, fabrication and installation standards (formerly § 860.2.6)

1. Certified verification agent. The certified verification agent (CVA) shall use good engineering judgment and practices in conducting an independent assessment of the design, fabrication and installation of the facility. The CVA shall certify in the facility design report to the Council that the facility is designed to withstand the environmental and functional load conditions appropriate for the intended service life at the proposed location. The CVA is paid for by the applicant, but is approved and reports to the Council.

a. The applicant shall use a CVA to review and certify the facility design report, the fabrication and installation report, and the project modifications and repairs report. The applicant shall use a CVA to:

(1) Ensure that the applicant's facilities are designed, fabricated, and installed in conformance with accepted engineering practices and the facility design report and fabrication and installation report;

(2) Ensure that repairs and major modifications are completed in conformance with accepted engineering practices; and

(3) Provide the Council immediate reports of all incidents that affect the design, fabrication, and installation of the project and its components.

b. Nominating a CVA for Council approval. The applicant shall nominate a CVA for the Council approval. The applicant shall specify whether the nomination is for the facility design report, fabrication and installation report, modification and repair report, or for any combination of these.

(1) For each CVA that the applicant nominates, the applicant shall submit to the Council a list of documents

they shall forward to the CVA and a qualification statement that includes the following:

(AA) Previous experience in third-party verification or experience in the design, fabrication, installation, or major modification of offshore energy facilities;

(BB) Technical capabilities of the individual or the primary staff for the specific project;

(CC) Size and type of organization or corporation;

(DD) In-house availability of, or access to, appropriate technology (including computer programs, hardware, and testing materials and equipment);

(EE) Ability to perform the CVA functions for the specific project considering current commitments;

(FF) Previous experience with the Council requirements and procedures, if any; and

(GG) The level of work to be performed by the CVA.

c. Individuals or organizations acting as CVAs shall not function in any capacity that shall create a conflict of interest, or the appearance of a conflict of interest.

d. The verification shall be conducted by or under the direct supervision of registered professional engineers.

e. The Council shall approve or disapprove the applicant's CVA prior to construction.

f. The applicant shall nominate a new CVA for the Council approval if the previously approved CVA:

(1) Is no longer able to serve in a CVA capacity for the project; or

(2) No longer meets the requirements for a CVA set forth in this subpart.

g. The CVA shall conduct an independent assessment of all proposed:

(1) Planning criteria;

(2) Operational requirements;

(3) Environmental loading data;

(4) Load determinations;

(5) Stress analyses;

(6) Material designations;

(7) Soil and foundation conditions;

(8) Safety factors; and

(9) Other pertinent parameters of the proposed design.

h. For any floating facility, the CVA shall ensure that any requirements of the U.S. Coast Guard for structural integrity and stability (e.g., verification of center of gravity), have been met. The CVA shall also consider:

(1) Foundations;

(2) Foundation pilings and templates, and

(3) Anchoring systems.

i. The CVA shall do all of the following:

(1) Use good engineering judgment and practice in conducting an independent assessment of the fabrication and installation activities;

(2) Monitor the fabrication and installation of the facility;

(3) Make periodic onsite inspections while fabrication is in progress and verify the items required by § 8.5.2(G)(1)(k) of this Part;

(4) Make periodic onsite inspections while installation is in progress and satisfy the requirements of § 8.5.2(G)(1)(l) of this Part; and

(5) Certify in a report that project components are fabricated and installed in accordance with accepted engineering practices; the applicant's approved COP or SAP; and the fabrication and installation report.

(AA) The report shall also identify the location of all records pertaining to fabrication and installation.

(BB) The applicant may commence commercial operations or other approved activities 30 days after the Council receives that certification report, unless the Council notifies the applicant within that time period of its objections to the certification report.

j. The CVA shall monitor the fabrication and installation of the facility to ensure that it has been built and installed according to the facility design report and fabrication and installation report.

(1) If the CVA finds that fabrication and installation procedures have been changed or design specifications have been modified, the CVA shall inform the applicant and the Council.

k. The CVA shall make periodic onsite inspections while fabrication is in progress and shall verify the following items, as appropriate:

(1) Quality control by lessee (or grant holder) and builder;

(2) Fabrication site facilities;

(3) Material quality and identification methods;

(4) Fabrication procedures specified in the Fabrication and Installation Report, and adherence to such procedures;

(5) Welder and welding procedure qualification and identification;

(6) Adherence to structural tolerances specified;

(7) Nondestructive examination requirements and evaluation results of the specified examinations;

(8) Destructive testing requirements and results;

(9) Repair procedures;

(10) Installation of corrosion protection systems and splash-zone protection;

(11) Erection procedures to ensure that overstressing of structural members does not occur;

(12) Alignment procedures;

(13) Dimensional check of the overall structure, including any turrets, turret and- hull interfaces, any mooring line and chain and riser tensioning line segments; and

(14) Status of quality-control records at various stages of fabrication.

l. The CVA shall make periodic onsite inspections while installation is in progress and shall, as appropriate, verify, witness, survey, or check, the installation items required by this section. The CVA shall verify, as appropriate, all of the following:

(1) Load out and initial flotation procedures;

(2) Towing operation procedures to the specified location, and review the towing records;

(3) Launching and uprighting activities;

(4) Submergence activities;

(5) Pile or anchor installations;

(6) Installation of mooring and tethering systems;

(7) Transition pieces, support structures, and component installations; and

(8) Installation at the approved location according to the facility design report and the fabrication and installation report.

m. For a fixed or floating facility, the CVA shall verify that proper procedures were used during the following:

(1) The loadout of the transition pieces and support structures, piles, or structures from each fabrication site; and

(2) The actual installation of the facility or major modification and the related installation activities.

n. For a floating facility, the CVA shall verify that proper procedures were used during the following:

(1) The loadout of the facility;

(2) The installation of foundation pilings and templates, and anchoring systems.

o. The CVA shall conduct an onsite survey of the facility after transportation to the approved location.

p. The CVA shall spot-check the equipment, procedures, and recordkeeping as necessary to determine compliance with the applicable documents incorporated by reference and the regulations under this part.

q. The CVA shall prepare and submit to the applicant and the Council all reports required by this subpart. The CVA shall also submit interim reports to the applicant and the Council, as requested by the Council. The CVA shall submit one electronic copy and four paper copies of each final report to the Council. In each report, the CVA shall:

(1) Give details of how, by whom, and when the CVA activities were conducted;

(2) Describe the CVA's activities during the verification process;

(3) Summarize the CVA's findings; and

(4) Provide any additional comments that the CVA deems necessary.

r. Until the Council releases the applicant's financial assurance under § 1.5.2(F) of this Part, the applicant shall compile, retain, and make available to the Council representatives, all of the following:

(1) The as-built drawings;

(2) The design assumptions and analyses;

(3) A summary of the fabrication and installation examination records;

(4) Results from the required inspections and assessments;

(5) Records of repairs not covered in the inspection report submitted.

s. The applicant shall record and retain the original material test results of all primary structural materials during all stages of construction until the Council releases the applicant's financial assurance under § 8.5.2(H) of this Part. Primary material is material that, should it fail, would lead to a significant reduction in facility safety, structural reliability, or operating capabilities. Items such as steel brackets, deck stiffeners and secondary braces or beams would not generally be considered primary structural members (or materials).

t. The applicant shall provide the Council with the location of these records in the certification statement.

u. The Council may hire its own CVA agent to review the work of the applicants CVA. The applicant shall be responsible for the cost of the Council's CVA. The Council's CVA shall perform those duties as assigned by the Council.

H. Pre-construction standards (formerly § 860.2.7)

1. The Council may issue a permit for a period of up to 50 years to construct and operate an offshore development. A lease shall be issued at the start of the construction phase and payment shall commence at the end of the construction phase. Lease payments shall be due when the project becomes operational. Lease renewal shall be submitted five (5) years before the end of the lease term. Council approval shall be required for any assignment or transfer of the permit or lease. This provision shall not apply to aquaculture permitting. Aquaculture permitting and leasing are governed by the provisions of R.I. Gen. Laws Chapter 20-10 and § 00-1.3.1(K) of this Chapter.

2. Prior to construction, the assent holder shall post a performance bond sufficient to ensure removal of all structures at the end of the lease and restore the site. The Council shall review the bond amount initially and every 3 years thereafter to ensure the amount is sufficient.

3. Prior to construction, the assent holder shall show compliance with all federal and state agency requirements, which may include but are not limited to the requirements of the following agencies: the Rhode Island Coastal Resources Management Council, the Rhode Island Department of Environmental Management, the Rhode Island Energy Facilities Siting Board, the Rhode Island Historical Preservation and Heritage Commission, U.S. Department of the Interior Bureau of Ocean Energy Management, Regulation and Enforcement, Army Corps of Engineers, National Oceanic and Atmospheric Administration, U.S. Fish and Wildlife Service, and the U.S. Environmental Protection Agency.

4. The Council shall consult with the U.S. Coast Guard, the U.S. Navy, marine pilots, the Fishermen's Advisory Board as defined in § 11.3(E) of this Subchapter, fishermen's organizations, and recreational boating organizations when scheduling offshore marine construction or dredging activities. Where it is determined that there is a significant conflict with season-limited commercial or recreational fishing activities, recreational boating activities or scheduled events, or other navigation uses, the Council shall modify or deny activities to minimize conflict with these uses.

5. The Council shall require the assent holder to provide for communication with commercial and recreational fishermen, mariners, and recreational boaters regarding offshore marine construction or dredging activities. Communication shall be facilitated through a project website and shall complement standard U.S. Coast Guard procedures such as Notices to Mariners for notifying mariners of obstructions to navigation.

6. For all large-scale offshore developments, underwater cables, and other development projects as determined by the Council, the assent holder shall designate and fund a third-party fisheries liaison. The fisheries liaison must be knowledgeable about fisheries and shall facilitate direct communication between commercial and recreational fishermen and the project developer. Commercial and recreational fishermen shall have regular contact with and direct access to the fisheries liaison throughout all stages of an offshore development (pre-construction; construction; operation; and decommissioning).

7. Where possible, offshore developments should be designed in a configuration to minimize adverse impacts on other user groups, which include but are not limited to: recreational boaters and fishermen, commercial fishermen, commercial ship operators, or other vessel operators in the project area. Configurations which may minimize adverse impacts on vessel traffic include, but are not limited to, the incorporation of a traffic lane through a development to facilitate safe and direct navigation through, rather than around, an offshore development.

8. Any assent holder of an approved offshore development shall work with the Council when designing the proposed facility to incorporate where possible mooring mechanisms to allow safe public use of the areas surrounding the installed turbine or other structure.

9. The facility shall be designed in a manner that minimizes adverse impacts to navigation. As part of its application package, the project applicant shall submit a navigation risk assessment under the U.S. Coast Guard's Navigation and Vessel Inspection Circular 02-07,

"Guidance on the Coast Guard's Roles and Responsibilities for Offshore Renewable Energy Installations."

10. Applications for projects proposed to be sited in state waters pursuant to the Ocean SAMP shall not have a significant impact on marine transportation, navigation, and existing infrastructure. Where the Council, in consultation with the U.S. Coast Guard, the U.S. Navy, NOAA, the U.S. Bureau of Ocean Energy Management, Regulation and Enforcement, the U.S. Army Corps of Engineers, marine pilots, the R.I. Port Safety and Security Forums, or other entities, as applicable, determines that such an impact on marine transportation, navigation, and existing infrastructure is unacceptable, the Council shall require that the applicant modify the proposal or the Council shall deny the proposal. For the purposes of Chapter 7, Marine Transportation, Navigation and Infrastructure policies and standards §§ 7.3.1 and 7.3.2 of this Subchapter, impacts will be evaluated according to the same criteria used by the U.S. Coast Guard, as follows; these criteria shall not be construed to apply to any other Ocean SAMP chapters or policies:

    a. Negligible: No measurable impacts.

    b. Minor: Adverse impacts to the affected activity could be avoided with proper mitigation; or impacts would not disrupt the normal or routine functions of the affected activity or community; or once the impacting agent is eliminated, the affected activity would return to a condition with no measurable effects from the proposed action without any mitigation.

    c. Moderate: Impacts to the affected activity are unavoidable; and proper mitigation would reduce impacts substantially during the life of the proposed action; or the affected activity would have to adjust somewhat to account for disruptions due to impacts of the proposed action; or once the impacting agent is eliminated, the affected activity would return to a condition with no measurable effects from the proposed action if proper remedial action is taken.

    d. Major: Impacts to the affected activity are unavoidable; proper mitigation would reduce impacts somewhat during the life of the proposed action; the affected activity would experience unavoidable disruptions to a degree beyond what is normally acceptable; and once the impacting agent is eliminated, the affected activity may retain measurable effects of the proposed action indefinitely, even if remedial action is taken.

11. Prior to construction, the Applicant shall provide a letter from the U.S. Coast Guard showing it meets all applicable U.S. Coast Guard standards.

l. Standards for construction activities (formerly § 860.2.8)

1. The Assent holder shall use the best available technology and techniques to minimize impacts to the natural resources and existing human uses in the project area.

2. The Council shall require the use of an environmental inspector to monitor construction activities. The environmental inspector shall be a private, third-party entity that is hired by the Assent holder, but is approved and reports to the Council. The environmental inspector shall possess all appropriate qualifications as determined by the Council. This inspector service may be part of the CVA requirements.

3. Installation techniques for all construction activities should be chosen to minimize sediment disturbance. Jet plowing and horizontal directional drilling in nearshore areas shall be required in the installation of underwater transmission cables. Other technologies may be used provided the applicant can demonstrate they are as effective, or more effective, than these techniques in minimizing sediment disturbance.

4. All construction activities shall comply with the policies and standards outlined in the Rhode Island Coastal Resources Management Program (aka the 'Red Book'; Subchapter 00 Part 1 of this Chapter), as well as the regulations of other relevant state and federal agencies.

5. The applicant shall conduct all activities on the applicant's permit under this part in a manner that conforms with the applicant's responsibilities in § 8.5.2 of this Part, and using:

    a. Trained personnel; and

    b. Technologies, precautions, and techniques that shall not cause undue harm or damage to natural resources, including their physical, atmospheric, chemical and biological components.

6. The Assent holder shall be required to use the best available technology and techniques to mitigate any associated adverse impacts of offshore renewable energy development.

    a. As required, the applicant shall submit to the Council:

(1) Measures designed to avoid or minimize adverse effects and any potential incidental take of endangered or threatened species as well as all marine mammals;

(2) Measures designed to avoid likely adverse modification or destruction of designated critical habitat of such endangered or threatened species; and

(3) The applicant's agreement to monitor for the incidental take of the species and adverse effects on the critical habitat, and provide the results of the monitoring to the Council as required; and

7. If the Assent holder, the Assent holder's subcontractors, or any agent acting on the Assent holder's behalf discovers a potential archaeological resource while conducting construction activities, or any other activity related to the Assent holder's project, the applicant shall:

a. Immediately halt all seafloor disturbing activities within the area of the discovery;

b. Notify the Council of the discovery within 24 hours; and

c. Keep the location of the discovery confidential and not take any action that may adversely affect the archaeological resource until the Council has made an evaluation and instructed the applicant on how to proceed.

(1) The Council may require the Assent holder to conduct additional investigations to determine if the resource is eligible for listing in the National Register of Historic Places under 36 C.F.R. § 60.4. The Council shall do this if:

(AA) The site has been impacted by the Assent holder's project activities; or

(BB) Impacts to the site or to the area of potential effect cannot be avoided.

(2) If the Council incurs costs in protecting the resource, under 16 U.S.C § 470h-2(g) (National Historic Preservation Act), the Council may charge the applicant reasonable costs for carrying out preservation responsibilities.

8. Post construction, the Assent holder shall provide a side scan sonar survey of the entire construction site to verify that there is no post construction debris left at the project site. These side-scan sonar survey results shall be filed with the Council within 90 days of the end of the construction period. The results of this side-scan survey shall be verified by a third-party reviewer, who shall be hired by the Assent holder but who is pre-approved by and reports to the Council.

9. All pile-driving or drilling activities shall comply with any mandatory best management practices established by the Council in coordination with the Joint Agency Working Group and which are incorporated into the RICRMP.

10. The Council may require the Assent holder to hire a CVA to perform periodic inspections of the structure(s) during the life of those structure(s). The CVA shall work for and be responsible to the council.

J. Monitoring requirements (formerly § 860.2.9)

1. The Council in coordination with the Joint Agency Working Group shall determine requirements for monitoring prior to, during, and post construction. Specific monitoring requirements shall be determined on a project-by-project basis and may include but are not limited to the monitoring of:

   a. Coastal processes and physical oceanography

   b. Underwater noise

   c. Benthic ecology

   d. Avian species

   e. Marine mammals

   f. Sea turtles

   g. Fish and fish habitat

   h. Commercial and recreational fishing

   i. Recreation and tourism

   j. Marine transportation, navigation and existing infrastructure

   k. Cultural and historic resources

2. The Council shall require where appropriate that project developers perform systematic observations of recreational boating intensity at

the project area at least three times: pre-construction; during construction; and post-construction. Observations may be made while conducting other field work or aerial surveys and may include either visual surveys or analysis of aerial photography or video photography. The Council shall require where appropriate that observations capture both weekdays and weekends and reflect high-activity periods including the July 4th holiday weekend and the week in June when Block Island Race Week takes place. The quantitative results of such observations, including raw boat counts and average number of vessels per day, will be provided to the Council.

3. The items listed below shall be required for all offshore developments:

   a. A biological assessment of commercially and recreationally targeted species shall be required within the project area for all offshore developments. This assessment shall assess the relative abundance, distribution, and different life stages of these species at all four seasons of the year. This assessment shall comprise a series of surveys, employing survey equipment and methods that are appropriate for sampling finfish, shellfish, and crustacean species at the project's proposed location. Such an assessment shall be performed at least four (4) times: pre-construction (to assess baseline conditions); during construction; and at two different intervals during operation (i.e., 1 year after construction and then post-construction). At each time this assessment must capture all four seasons of the year. This assessment may include evaluation of survey data collected through an existing survey program, if data are available for the proposed site. The Council will not require this assessment for proposed projects within the renewable energy zone that are proposed within 2 years of the adoption of the Ocean SAMP.

   b. An assessment of commercial and recreational fisheries effort, landings, and landings value shall be required for all proposed offshore developments. Assessment shall focus on the proposed project area and alternatives. This assessment shall evaluate commercial and recreational fishing effort, landings, and landings value at three different stages: pre-construction (to assess baseline conditions); during construction; and during operation. At each stage, all four seasons of the year must be evaluated. Assessment may use existing fisheries monitoring data but shall be supplemented by interviews with commercial and recreational fishermen. Assessment shall address whether fishing effort, landings, and landings value has changed in comparison to baseline conditions. The Council will not require this assessment for proposed projects within the renewable energy zone that are proposed within 2 years of the adoption of the Ocean SAMP.

4. The Council in coordination with the Joint Agency Working Group may also require facility and infrastructure monitoring requirements that may include but are not limited to:

   a. Post construction monitoring including regular visual inspection of inner array cables and the primary export cable to ensure proper burial, foundation and substructure inspection.

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TITLE 650 - COASTAL RESOURCES MANAGEMENT COUNCIL

CHAPTER 20 - COASTAL MANAGEMENT PROGRAM

SUBCHAPTER 05 - OCEAN SPECIAL AREA MANAGEMENT PLAN

PART 8 - RICRMP: OCEAN SAMP - CHAPTER 8 - RENEWABLE ENERGY AND OTHER OFFSHORE DEVELOPMENT (650-RICR-20-05-8)

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