9.0 MONITORING AND MITIGATION

This section provides information on monitoring and mitigation applicable to the proposed action. If the proposed action were selected, MMS would require that these items be incorporated into an Environmental Management System (EMS), as a condition of its authorization. Since neither MMS nor any other federal or state agency has past experience evaluating how projects such as the proposed action will interact with the marine environment, MMS requested and the applicant agreed to prepare and implement an EMS tailored to the proposed action. The EMS would remain in effect throughout the life of the project, from construction through decommissioning, and would allow for an adaptive management approach in dealing with the environmental impacts arising throughout this timeframe. The EMS would set forth the monitoring efforts the applicant would undertake during construction, operation and maintenance, and decommissioning. In addition, the EMS would contain mitigation measures for unavoidable adverse impacts that the MMS requires as a result of its consultation process with Native Americans and agencies, as well as the environmental review process occurring under NEPA. Additional mitigation measures may be implemented by the applicant as a condition of other permits and approvals that it receives. The discussion below focuses first on an overview of the EMS, then lessons learned from existing offshore wind energy projects, followed by draft monitoring and mitigation associated with the major categories of resources: physical, biological, socioeconomic and land use, and transportation and navigation, and finishing with a presentation of mitigation derived from state environmental review and permitting processes that have already been completed.

9.1 OVERVIEW OF PROPOSED ENVIRONMENTAL MANAGEMENT SYSTEM

One widely recognized international EMS is the International Organization of Standards ISO 14001, used to systematically identify, manage, control, and monitor environmental impacts. An EMS is a system that sets up a structure for continuous improvement in the area of managing and minimizing potential environmental impacts. As a continuous improvement process, an EMS is expected to be reviewed and updated periodically to reflect changing circumstances with respect to environmental policies, construction, operation and decommissioning technologies, actual environmental impacts and their effects, and the effectiveness and viability of mitigation and monitoring programs.

An EMS requires:

1. considering policies and regulations applicable to an action;
2. planning how to undertake the action in compliance with the applicable regulations;
3. implementing the action according to a plan;
4. monitoring and measuring the effects of the action;
5. reviewing the effectiveness of the plan with respect to applicable requirements;
6. where warranted, revising plans to reflect the reality of what is occurring during the implementation of the action; and
7. documenting the applicant's environmental policy, key responsibilities, and procedures to carry out and report the results of numbers 1 - 6 above.

The applicant has agreed to implement an EMS for the project. The applicant would develop an EMS that focuses on three key commitments: complying with environmental legislation, preventing impacts to local resources, and continually striving to improve environmental performance. There are a number of resources within the proposed action location that would be impacted during construction, operation and maintenance, and decommissioning. The EMS would be designed to address each activity within each

phase, and identify the approximate severity of the impacts to each resource associated with that activity. The applicant would use the EMS as a tool in ensuring that it meets its post-decision mitigation and monitoring obligations. Mitigation and monitoring commitments made in a ROD may be incorporated into the EMS, and carried through the system. The ROD states what the decision is, identifies the alternatives considered, including the environmentally preferred alternative, and discusses mitigation plans, including any enforcement and monitoring commitments (40 C.F.R. § 1505.2, [2005]).

MMS has identified four categories of impacts to define the magnitude of effects of an action: negligible, minor, moderate, and major. Negligible impacts are non-measurable or nonexistent impacts to the resource, and therefore no mitigation steps are needed to be discussed. Minor impacts are those that could be avoided with proper mitigation; if impacts occur, the affected resource would recover completely without any mitigation once the impacting agent is eliminated. Moderate impacts include impacts to the affected resource which are unavoidable; either the viability of the affected resource is not threatened (although some impacts may be irreversible) or the affected resources would recover completely if proper mitigation is applied during the life of the proposed action or proper remedial action is taken once the impacting agent is eliminated. Major impacts are those impacts to the affected resource which are unavoidable; the viability of the affected resource may be threatened and the affected resource would not fully recover even if proper mitigation is applied during the life of the proposed action or remedial action is taken once the impacting agent is eliminated.

As commitments and mitigation measures established in the ROD are implemented, tracked and monitored through the EMS, the applicant would document the implementation, tracking and monitoring of commitments and mitigation measures. This documentation can facilitate their internal training, internal auditing, identification of appropriate corrective actions and communication with interested parties. The documentation should be effective and sufficient to provide MMS with details of how well the applicant conforms to its plan, information on compliance with legal standards and requirements, permits, and authorizations, results of internal audits and reviews, and details of deficiencies and corrective and preventative actions.

In the EMS documentation, each of the three phases would be presented in its own part, and each major division of activity would be presented in its own section. Component activities of the major divisions would then be presented in subsections. The resources that may be impacted by each component activity would be listed under their respective subsections. Each resource would be carefully considered; potential impacts to the affected resources would be discussed in detail for each component activity. The EMS would document the applicant's process to incorporate the concept of adaptive management, in that, if unexpected impacts arise, they would be evaluated and addressed as needed.

The EMS documentation would be structured to address the three phases of the proposed action:

1. Construction would include installation of the cable system on shore, installation of the foundation monopiles, erection of the WTGs, installation of the cables in the seabed, and installation of scour protection. Construction activities are expected to have the most substantial impacts per unit time on local resources.
2. Operation and maintenance would include the actual existence of the facilities, and activities such as periodic boat traffic from maintenance vessels. This phase is expected to have the least impact per unit time on potentially affected resources.
3. Decommissioning would include activities involved with deconstructing the WTGs and infrastructure. The impacts are generally similar to, but less intense than, those of the construction phase; consequently, most of the activities and resource impacts refer back to the construction part of the document.

9.2 LESSONS LEARNED FROM EUROPEAN WIND FARMS

In order to identify possible lessons learned from other offshore wind energy projects, MMS reviewed the monitoring results from a recent study on two demonstration wind farms in Denmark (Horns Rev and Nysted), which have been the subject of research and monitoring programs to examine the potential environmental impacts of offshore wind farm projects. Horns Rev, constructed during the summer of 2002, is sited 8.7 to 12.4 miles (14 to 20 km) off the coast of Denmark in the North Sea, and consists of 80 turbines totaling 160 MW. Nysted was constructed between 2002 and 2003 approximately 6.2 miles (10 km) offshore in the Baltic Sea, and incorporates 72 wind turbines placed in 8 rows of 9 turbines each, with a total installed capacity of 165.5 MW. The monitoring data at both sites consist of 3 years of baseline monitoring, monitoring during construction, and 3 years of monitoring during operation.

The environmental monitoring program focused primarily on the effects of construction and operation of the offshore wind farms on the infauna, epifauna, and vegetation of the benthic community; on fish, marine mammals and birds; and on peoples' attitudes towards offshore wind farms locally and nationally. Overall, the results from the Danish wind farms suggest that with proper siting and placement of turbines, offshore wind farms can be engineered and operated without significant damage to the marine environment and vulnerable species. In general, the monitoring results show that the wind farms seem to pose a low risk to birds, mammals, and fish. The studies stress that appropriate siting is an essential precondition for ensuring limited impact on nature and the environment, and that careful spatial planning is necessary to avoid damaging cumulative impacts. Important differences between the two sites were observed in the results of some studies, suggesting that environmental impacts are likely to vary by location even with careful site planning. Therefore, it is difficult to generalize the results of this monitoring program to potential environmental impacts at other offshore wind sites including the proposed action.

Research on the benthic communities at Horns Rev and Nysted focused on the effects of the introduction of hard foundation structures. Changes observed include increased abundance and biomass in the benthic community at the turbine sites associated with increased habitat heterogeneity and structural complexity, and a change in community composition. This may have a positive environmental impact if the increased biomass provides additional food resources for fish and birds. There was no clear evidence of impacts associated with changes in the hydrodynamic regime on the surrounding native benthic communities, seabed sediment structure, or established fouling communities. Many of these results are dependent on the particular benthic community and substrate types present, the level of natural scouring action, the salinity, and the species in the water column available for colonization. However, the rapid colonization and long-term establishment of a hard-surface community on turbine foundations was similar to what is observed on other artificial reefs, and may be representative of what would occur in other locations, including the proposed action.

Potential long-term impacts of offshore wind farms on fish may likewise be associated with the creation of artificial reefs and the establishment of the new hard-surface benthic communities at wind turbine sites. It was expected that fish would be attracted to these areas at the Danish wind farms, resulting in a positive effect on fish abundance and diversity, since artificial reefs may provide additional food, shelter, spawning areas, and a refuge from fishing activities that occur outside the wind farm area. To date, no effect has been observed on fish species composition, distribution and abundance at the Danish wind farm sites; however, it has been suggested that because it can take years for the full reef community to become established, sufficient time may not yet have passed to observe long-term effects on fish distribution or abundance.

The study at Nysted also looked for effects on fish and fish behavior that might be caused by the EMFs created by submarine cables during the operation phase of the wind farm. The Nysted study was

not conclusive on this point, but suggests that there is no strong effect. There was some evidence of either avoidance or attraction to the magnetic fields depending on the fish species. The data, however, did not rule out the possibility that physical conditions, not EMFs, along the cables might have caused the observations. Only one species, flounder, showed a correlation between the inferred strength of the EMF and increased avoidance of the cable. It may be invalid, however, to assume that other species do not feel an effect of the EMFs; a weakness of this study was that the EMFs around the cables were not measured directly, and the strength of the fields was inferred from turbine output only, which may not be sensitive enough to produce a correlation.

Construction activity did seem to have an effect on marine mammal behavior and abundance. Other than a reaction to pile-driving and ramming activities, construction and operation of the wind farms had no noticeable effect on seals. Decreases in porpoise abundance were found at both sites during construction, only a slight decrease at Horns Rev, and a much stronger decrease at Nysted, with clear effects from the pile driving and ramming activities. At Horns Rev, there was no observed effect of wind farm operation, while at Nysted; the decrease in porpoises observed during construction has persisted during the first 2 years of operation, with indications of a slow recovery. The conclusions in these studies are that most effects of the wind farms on mammals are temporary and related to construction noise, but the reasons behind the slow recovery at Nysted are unclear.

Radar, infra-red video monitoring, and visual observations confirmed that at the Danish offshore wind farms most of the more numerous species of birds showed avoidance of wind farm areas, although responses were highly species specific. Birds tended to avoid the vicinity of the turbines and move along the periphery of the wind farm. Slightly extended migration distances for seasonal migrations are unlikely to have negative consequences for any species. The energetic costs of avoidance behavior could be much higher for wind farms located near nesting sites, which the Danish projects are not, if the avoidance interferes with daily foraging trips, affecting breeding success.

Post-construction studies showed an almost complete absence of loons and scoters within the Horns Rev wind farm, and reductions in long-tailed duck densities within the Nysted wind farm. This suggests displacement of these birds from feeding areas, probably due to avoidance of the turbines rather than a decrease in food resources. A few species such as cormorants and gulls may have increased their use of the wind farm areas, mostly as resting ground.

Low collision rates of migrating birds with turbines were predicted by computer simulation. Comparing model predictions for common eider to observed levels from one of the turbines using an infra-red monitoring system, collision rates for this species' migration through the Danish wind farm areas appear to be very low. It should be noted, however, that the assessments from this study were primarily focused on waterbird behavior and collision, and potential effects on other kinds of migrating birds were not addressed. This study also made no attempt to quantify the effects of weather conditions, such as areas with fog, on potential collision rates.

The final study conducted on Nysted and Horns Rev looked at the attitudes of neighboring local populations and the national population towards offshore wind farms. Results suggested the national population was favorably inclined to offshore wind farms, with this sentiment represented in the local Horns Rev population. The Nysted population was more critical of offshore wind farms, suggesting there may be substantial differences in local attitudes. Results of the study clearly showed that people expressed a willingness to pay for future wind farms to be located at distances from the shore where their visual impact is reduced. Willingness to pay to place wind farms completely out of sight was limited, but the local population at Nysted had a higher willingness to pay for this than Horns Rev or the national population.

Conclusions reached from the Danish offshore wind farms, therefore, showed generally minimal environmental impacts over the long term at these sites, but enough differences between sites to recommend caution in generalizing too much from these limited studies. New benthic habitats were colonized fairly rapidly, without strong observed effects on the surrounding soft bottom communities. The effects of the offshore wind farms were neutral with regard to fish density, species composition and abundance, showing neither positive nor negative effects. Results from the study on the potential effects of EMFs were inconclusive. Marine mammals, in general, were affected during construction temporarily, but their use of wind farm areas recovered during the operation phase, with the exception of the porpoises at Nysted, which exhibited long-term avoidance of the area. Bird studies showed general avoidance of wind farm areas for migration in most species, as well as avoidance by some species that otherwise use the area as a feeding ground. Collision rates with turbines for a large diving duck, the common eider, during migration, were predicted and observed to be very low.

9.3 PHYSICAL RESOURCES MITIGATION

9.3.1 Noise

Proposed mitigation specific to noise includes performing all construction activities associated with the onshore cable installation during normal daytime work hours only. In addition, noise barrier walls are proposed and would be constructed at the edge of the HDD pit to shield nearby residences at 32 and 49 New Hampshire Avenue.

Mitigation measures to reduce underwater noise impacts include but are not limited to the use of underwater sound monitoring to confirm pile driving noise levels and the use of soft start pile driving.

During operation, potential operational sound effects would be minimized to the extent practicable by site selection offshore and through the selection of state-of-the-art, very low noise wind turbines.

9.3.2 Water Quality

MMS requires a draft O&M Plan that details standard operating and maintenance protocols to ensure proper operation of offshore facilities. The draft O&M Plan specifies operating guidelines, maintenance schedules, and materials approved for maintenance activities. The maintenance program would include preventive and emergency maintenance functions including shore-based predictive maintenance analysis of the WTGs and ESP. The O&M Plan would be incorporated into the EMS. The applicant would be responsible for developing and implementing an OSRP and a stormwater pollution prevention plan (SWPPP) covering all phases of the proposed action.

OSRP

The OSRP would be prepared in accordance with the DOI's MMS regulations at 30 CFR 254, "Oil Spill Response Requirements for Facilities Located Seaward of the Coastline." These regulations require owners/operators of oil handling, storage, or transportation facilities located seaward of the coastline to submit a spill response plan to MMS for approval prior to facility operation.

In the event of a release of oil to the ocean, the applicant's employees, its contractors, and its responders would refer to the OSRP to ensure that the appropriate spill response actions are taken in a timely manner to minimize impacts to sensitive receptors and the environment.

Emergency Response Plan

The applicant has prepared an Emergency Response Plan that would be incorporated into the EMS. The purpose of this ERP is to describe procedures to be followed by the applicant's personnel in

responding to emergencies, including those involving releases of hazardous substances (see Section 5.2.2.1), fires, medical emergencies, severe weather, etc. Impacts to humans and the environment would be reduced through application of this plan. This facility would be subject to MMS and Occupational Safety and Health Administration (OSHA) regulations with respect to emergency response.

9.3.3 Electro Magnetic Fields

The proposed action design incorporates economically viable and prudent measures to reduce EMF. The use of three-conductor cables – rather than a flat arrangement of single conductor cables in separate trenches – minimizes the spacing between phases, which in turn, reduces the magnetic flux density. The cable is proposed to be buried at a depth of 6 ft (1.8 m) to reduce the magnetic flux density on the sea floor. Since all of the proposed transmission cables contain grounded metallic shields, no or minimal electric fields should exist beyond the cable itself.

As a result of designing the proposed action to: (1) effectively prevent the creation of electric fields; (2) employ viable, economic and environmentally safe measures to reduce magnetic flux densities; and (3) comply with established guidelines or standards for EMF, no additional mitigation has been proposed at this time.

9.4 BIOLOGICAL RESOURCES MITIGATION

9.4.1 Coastal and Intertidal Vegetation

The applicant has proposed to avoid or minimize direct impacts to coastal and intertidal vegetation through the avoidance of seagrass beds along the electric transmission cable, and installation of the onshore transmission line across the intertidal zone using HDD methods.

9.4.2 Avifauna

The applicant has included anti-perching devices into the ESP and WTG design. In addition, as part of the state permitting process, the applicant has committed to a number of other avian impact mitigation measures, as presented in Section 9.7.

9.4.3 Subtidal Offshore Resources

The applicant has proposed the use of midline buoys on anchor cables to reduce the amount of area that would be impacted by anchor cable sweep; and use of a cofferdam when constructing the HDD to minimize the dispersal of disturbed sediments and any released drilling fluid. A drilling fluid fracture or overburden breakout monitoring program would be part of the overall HHD operation in Lewis Bay. This monitoring program would serve to minimize the potential for significant impacts associated with a drilling fluid breakout in Lewis Bay.

9.4.4 Marine Mammals

Specific to marine mammals, the applicant has proposed to adopt *NOAA Fisheries Regional Viewing Guidelines-Northeast Region* (NMFS and NOS, 2006), as well as several other measures which are relevant to marine mammals due to their protection under the Marine Mammal Protection Act, and are discussed below under Threatened & Endangered Species. Ultimately, the applicant would be required to abide by any measures required by NOAA Fisheries under the terms of its review and approval process under the ESA and the MMPA.

9.4.5 Fish and Fisheries

Measures proposed by the applicant to minimize or avoid potential impacts to the commercial fishing industry include: no restrictions on fishing activities within the turbine array during operations; marking the WTGs with USCG-approved lighting to ensure safe vessel operation; and burying the inner-array cables and two submarine cable circuits to a minimum of 6 ft (1.8 m) below the seabed to avoid the potential for conflicts with fishing vessels and gear operation.

9.4.6 Essential Fish Habitat

At this time, the applicant has proposed pre- and post-construction documentation and monitoring of the eelgrass bed, a productive habitat designated as EFH, and if it is determined that eelgrass has been lost, replanting would occur. The post-construction monitoring plan would be developed to document potential indirect impacts from cable embedment and subsequent habitat recovery. Should the habitat not recover naturally, the disturbance would be mitigated by replanting. Additionally, an eelgrass survey would be performed for two consecutive years following construction to document the change in density. Ongoing consultation with resource agencies could result in modifications to this Plan.

9.4.7 Threatened & Endangered Species

Specific mitigation measures to minimize the potential for vessel collisions, vessel harassment and acoustic disturbance to MMPA and ESA/MESA protected marine species include requiring vessels to follow *NOAA Fisheries Regional Viewing Guidelines-Northeast Region* (NMFS and NOS, 2006) while in transit to and from the site of the proposed action so as to minimize harassment or harm of any individuals that may be in the area. NOAA Fisheries consultations under the ESA Section 7 are ongoing, and the ultimate decision on the adequacies of these measures or the need for additional measures are dependent on concluding the consultation process. These NOAA Fisheries regional viewing guidelines are explained below.

Measures to Avoid Collision

When in sight of whales:

2 miles to 1 mile (3.2 to 1.6 km) away:

- Reduce speed to 13 knots (6.7 m/s)
- Post a dedicated lookout to assist the vessel operator in monitoring the location of all marine mammals
- Avoid sudden changes in speed and direction
- Aircraft should maintain a minimum altitude of 1,000 ft (305 m) over water

1 mile to ½ mile (1.6 to 0.8 km) away:

- Reduce speed to 10 knots (5.1 m/s)

½ mile (0.8 km) or less:

- Reduce speed to 7 knots (3.6 m/s)
- Maneuver to avoid head-on approach

Close Approach Procedure:

600 ft (183 m) or closer:

- Parallel the course and speed of moving whales up to the designated speed limit within that distance
- Do not attempt a head-on approach to whales
- Approach and leave stationary whales at no more than idle or "no wake" speed, not to exceed 7 knots (3.6 m/s)
- Do not intentionally drift down on whales
- Vessels in multi-vessel approaches should maintain communication with each other (via VHF channels 9, 13, or 16 for hailing) to coordinate viewing
- Take into account the presence of obstacles (vessels, structures, fishing gear, or the shoreline). All vessels in close approach must stay to the side or behind the whales so they do not box in the whales or cut off their path

Standby Zone

300 ft to 600 ft (91 to 183 m) away:

- Two vessel limit within the 300 to 600 ft Stand-By Zone at any one time

Close Approach Zone

100 ft to 300 ft (30.5 to 191 m) away:

- One vessel limit
- Other vessels stand off (up to two vessels in Stand-By Zone – others outside 600 ft [183 m])
- If more than one vessel is within 600 ft (183 m), the vessel within 300 ft (91.4 m) should limit its time to 15 minutes in close approach to whales

No Intentional Approach within 100 ft (30.5 m)

- Do not approach within 100 ft of whales. If whales approach within 100 ft of your vessel, put engines in neutral and do not re-engage propulsion until whales are observed clear of harm's way from your vessel

Departure Procedure

- All vessels should leave the whales following the same speed and distance procedures described above
- In order for vessels to be clear of whales before dark, vessels should cease whale watching and begin their return to port 15 minutes before sunset

Right Whale Sighting

- All sightings of a right whale should be called in to the NMFS Sighting Advisory System: 978-585-8473 (pager)

Entangled Whale

- Any sighting of an entangled whale should be reported. Vessels should stand-by and keep the whale in sight until help arrives (an estimated 45 minutes or more) or arrange for another vessel to maintain contact with the whale
- Disentanglement HOTLINE (weekdays): 800-900-3622 or Disentanglement pager: 508-307-5300 or NMFS Stranding & Entanglement HOTLINE: 978-281-9351 or USCG on VHF CH-16

Entangled Right Whale

- Maintain 500 yards. To report or get authorization to approach, call: Disentanglement Hotline (weekdays): 800-900-3622 or Disentanglement pager: 508-307-5300 or NMFS Stranding & Entanglement Hotline: 978-281-9351

Dead Whale

- Any sighting of a dead whale should be reported to the NMFS Stranding & Entanglement Hotline: 978-281-9351

Potential Violations

Any activity that appears to be an intentional or negligent action leading to a collision or harassment incident should be reported to the NOAA Enforcement HOTLINE: 800-853-1964.

In addition, vessel operators would follow guidelines implemented for the Gulf of Mexico oil and gas lease industry for vessel strike avoidance (MMS, 2003). These guidelines are summarized below:

(1) Vessel operators and crews should maintain a vigilant watch for marine mammals and sea turtles and slow down or stop their vessel to avoid striking protected species.

(2) When whales are sighted, maintain a distance of 295 ft (89.9 m) or greater from the whale.

(3) When sea turtles or small cetaceans are sighted, attempt to maintain a distance of 148 ft (45.1 m) or greater whenever possible.

(4) When cetaceans are sighted while a vessel is underway, attempt to remain parallel to the animal's course. Avoid excessive speed or abrupt changes in direction until the cetacean has left the area.

(5) Reduce vessel speed to 10 knots (5.1 m/s) or less when pods or large assemblages of cetaceans are observed near an underway vessel. Cetaceans at the surface may indicate the presence of submerged animals near the vessel.

(6) Whales may surface in unpredictable locations or approach slowly moving vessels. When you sight animals in the vessel's path or in close proximity to a moving vessel, reduce speed and shift the engine to neutral. Do not engage the engines until the animals are clear of the area.

Vessel operators and crew would be required to undergo training to ensure they are familiar with NOAA regional viewing guidelines and MMS guidelines for vessel strike avoidance to minimize encounters and interactions with marine mammals and sea turtles. These training requirements would be written to contractor agreements/contracts. Additional federal mitigation requirements may be added as

well through the federal ESA Section 7 consultation process, the MMPA authorization process for marine mammals, and/or by the MMS through any permits issued.

Measures to Reduce Likelihood of Acoustic Harassment

Mitigation of noise impacts would occur through utilization of the following measures:

Underwater Sound Monitoring

Underwater sound monitoring is proposed by the applicant during the installation of the first three monopiles. The monitoring would be conducted in order to confirm that actual pile driving noise levels do not exceed the levels utilized for conducting the analysis presented.

NMFS Approved Observer

The applicant has proposed to utilize a marine mammal observer to insure that no marine mammals, sea turtles or other protected species are within the 1,640 ft (500 m) safety radius during pile driving. If protected marine species are observed within the 1,640 ft (500 m) Safety Zone by the NMFS approved observer, the observer would ensure that work ceases until the animal is clear of the work area and safety zone.

Soft Start Pile Driving

The applicant has proposed to utilize a "soft-start" of pile driving equipment in order to allow any marine life not visible from the surface to move away from the monopiles.

9.5 SOCIOECONOMICS AND LAND USE MITIGATION

9.5.1 Cultural Resources

The following is a summary of the applicant's proposed mitigation for potential impacts to Historic/Archaeological Resources:

- All submerged potentially archaeologically sensitive areas identified during marine archaeological investigations have been avoided by redesign of the proposed action, including relocation of eight WTGs and associated cable arrays.
- The interpreted limits of three submerged potential historic resources on the seafloor within the offshore site of the proposed action would be extended by a 100 ft (30 m) perimeter that would constitute a no-activity buffer zone. The no-activity zones would be demarcated on plans provided to contractors and detailed in construction specifications; compliance would be overseen by an environmental inspector.
- In addition, Procedures Guiding the Unanticipated Discovery of Cultural Resources and Human Remains would be provided to construction contractors, outlining measures to be taken in the event that previously unidentified submerged and upland historic/archaeological resources are discovered during construction. Compliance with the procedures, which would be overseen by an environmental inspector, would ensure that potential resources are identified and assessed in accordance with applicable regulations and in consultation with the appropriate agencies.

The consultation process under Section 106 of the NHPA is ongoing and while the applicant has provided these measures, the final determination of adequate mitigation remains pending, until the consultation process is concluded.

9.5.2 Visual

The applicant proposes the following mitigation for impacts to the visual setting of the proposed action area: eliminating daytime lighting and reducing nighttime lighting on the WTGs; and changing the color of the WTGs from white to off-white to reduce contrast with the landscape. Because some of these measures could affect safety of air traffic and vessel traffic, which fall under the jurisdiction of the FAA and USCG, respectively, adoption of these design elements is only preliminary, and would ultimately depend upon approval or a determination of adequacy by the FAA and USCG.

9.6 TRANSPORTATION AND NAVIGATION MITIGATION

9.6.1 Onshore Transportation

The applicant has proposed the following mitigation specific to overland transportation arteries: installation of the onshore cable system would occur outside of the height of the summer tourist season to minimize any vehicular disruption; trenchless technologies would be used at major intersections and railroad crossings in order keep traffic disruptions to a minimum.

The applicant has proposed to develop a Construction Traffic Management Plan to be prepared in consultation with local and state officials to ensure that safe access is maintained for vehicular traffic during onshore cable system installation, once the final route has been determined. This plan would typically include the following mitigation measures:

- Construction zone signage;
- Police officer details to provide traffic control in work zones;
- Areas to maintain ingress to and egress from off-street facilities;
- Temporary pavement marking, barriers or other means, as may be required, to ensure safe traffic flow;
- Notice of construction schedules and locations to minimize local inconvenience;
- Coordination with the Town Department of Public Works for any roadway construction projects to minimize multiple construction periods in the same areas; and
- Maintenance of safe pedestrian flow through construction zones.

9.6.2 Port Facilities

The applicant has proposed mitigation measures specific to navigation including the notification of registered fishermen regarding the timeframe and location of construction activities in advance of mobilization; and daily broadcasted updates providing information on marine channel 16 to provide current information on construction activities as well as information for following days; the lighting of monopoles and construction vessels; and the spacing and placement of monopoles to allow for safe navigation. Since jurisdiction over navigation and port safety as well as rules and regulations for navigation of vessels in U.S. waters lies with the USCG, ultimate decisions about the adequacy of these measures, the ability to implement them, or the requirement for different procedures or design features lies with the USCG, not MMS. MMS is continuing to consult with the USCG as part of the NEPA process, and would incorporate any Terms & Conditions (introduced below) into its lease agreement with the applicant.

Other mitigation proposed with respect to navigation is as follows:

- The applicant would have its work vessels that are working in the area assist vessels in distress within the proposed action area upon receiving a request for assistance from the vessel or the USCG.
- The applicant would work with the USCG to develop information that could be provided to mariners to educate them regarding the potential effects of the WTGs on marine radar.

USCG Terms and Conditions (see Appendix E)

The USCG has provided Terms and Conditions requiring that the design and construction of the proposed action shall not impede navigation and that the applicant shall ensure that maritime navigation safety is maintained. The Terms and Conditions require the WTGs and ESP to be marked with private aids to navigation such as clearly visible, unique, alpha-numeric identification characters, in accordance with guidelines set by the International Association of Marine Aids to Navigation and Lighthouse Authorities (IALA); and safety lines, mooring attachments and access ladders must be placed on each WTG and a plan for placement and design must be approved by the USCG. The Terms and Conditions also require the applicant to submit a research analysis before the start of construction, concerning whether or not the WTGs as designed would interfere with marine communication or navigation systems or produce any adverse impacts to navigational safety. In addition, the applicant is required under the Terms and Conditions to provide status reports to the USCG monthly throughout the construction activities, including information regarding the current status, any changes to the construction schedule, a description of any complaints received during construction, and copies of any correspondence between the applicant and federal, state, and local agencies. The full Terms and Conditions are provided in Appendix E.

9.6.3 Communications: Electromagnetic Fields, Signals and Beacons

The applicant proposes the following mitigation to minimize impacts to communications: construction crews would be required to avoid the frequencies listed in Table 5.3.4-1. VHF radios used for construction should be tested for output to ensure that they are not inadvertently tuned to any of these frequencies, and to ensure that they have no spurious emission within +/-50 KHz.

As a precaution, watercraft would be advised by the applicant or its contractors to respect a two-wavelength distance from the cranes at the lowest frequency of interest, which would be approximately 4,000 ft (1,219.5 m) on 500 KHz.

9.7 STATE MITIGATION

In addition to the mitigation discussed above, the applicant has committed to mitigation as part of the MEPA process to address concerns of regulatory agencies and to minimize impacts on the environment. This mitigation is included in the MEPA FEIR Certificate (Refer to the Certificate on the Final EIR in Appendix E) but the commitments are presented below using the language of the FEIR Certificate (as denoted by the italicized text). This State mitigation is independent of any MMS mitigation proposed or to be proposed.

9.7.1 MEPA FEIR Certificate Compensatory Mitigation

The proponent has voluntarily offered compensatory mitigation as part of the MEPA process. Details are presented below.

9.7.1.1 Bird Island

The proponent would provide $780,000 towards the restoration of Bird Island, off the town of Marion in Buzzards Bay, with funds to be managed by the Department of Fish and Game, Natural Heritage and Endangered Species Program.

At 1.5 acres in size, Bird Island supports an average of 750 pairs of Roseate Terns, and is the second or third largest Roseate Tern colony in North America, supporting an average of 22 percent of the North American population. It is also the third largest Common Tern colony in Massachusetts, and supports an average of 1,900 pairs of Common Terns. Bird Island is conservation land owned by the Town of Marion and managed by the Harbormaster and Conservation Commission.

While Bird Island provides prime nesting habitat, the island is subject to significant and accelerating erosion. As a result, former Common Tern nesting areas adjacent to the seawall have turned into salt marsh, which is unsuitable for nesting. Common Terns have moved into interior nesting areas, forcing Roseate Terns out. The objective of the local, state, and federal partnership that is managing the restoration is to restore tern nesting habitat and protect the historic lighthouse by rebuilding the revetment to reduce erosion, fill eroded areas, and revegetate appropriate areas to provide suitable nesting habitat. Based on consultation with the Natural Heritage and Endangered Species Program, the enhancement of tern nesting habitat on Bird Island would directly benefit the same tern population that is subject to potential impacts from the WTG array. The project has a total cost of $3.775 million, the balance of which would be borne by the US Army Corps of Engineers, who is also providing planning, design, and construction services. If the proposed restoration project does not go forward, for whatever reason, the proponent shall coordinate with EOEA and state agencies and develop an alternative vehicle of equal value for mitigating avian impacts.

9.7.1.2 Natural Resource Preservation, Marine Habitat Restoration, and Coastal Recreation Enhancement Projects

The proponent would provide $4.22 million in annual payments prorated over the life of the project towards natural resource preservation, marine habitat restoration, and coastal recreation enhancement projects in the area of Cape Cod, Nantucket, and Martha's Vineyard, with funds to be managed by the Coastal Zone Management Office, in consultation with state agencies and the Cape Cod Commission.

9.7.2 Other Environmental Mitigation Proposed Under the MEPA FEIR Certificate

Other mitigation the applicant would be committed to under the MEPA FEIR certificate is as follows:

Air Quality

- The power produced would reduce demand on fossil-fuel fired facilities and reduce air emissions from these facilities. The project would also reduce the need to construct additional fossil fuel-fired electric generation facilities as energy demand increases, facilitating the Commonwealth's and the region's air quality goals.

Avian

- The proponent has committed to working with MMS to design and implement postconstruction monitoring which would be guided by an EMS currently under

development as required by MMS. The EMS would be subject to adaptive management as the results of the monitoring are evaluated. The EMS would include the involvement of a technical advisory group.

Marine Resources

- Vessels transporting construction materials to the project site in Nantucket Sound would travel at slow speeds, usually at 10 knots or below.
- Potential vessel impacts (collisions and harassment) to marine mammals and sea turtles would be minimized by requiring that project vessels follow National Oceanic & Atmospheric Administration (NOAA) Fisheries Regional Viewing Guidelines - Northeast Region (NMFS and NOS, 2006) while in transit to and from the site so as not to disturb any individuals that may be in the area.
- The use of state-of-the-art hydraulic jet plow technology for cable installation to minimize sediment transport and suspended sediments.
- The use of monopile foundations for the WTGs.
- Implementing post-construction monitoring to document habitat disturbance and recovery.
- Potential impacts to marine mammals and sea turtles associated with underwater sound levels created by pile driving would be minimized by conducting a "soft-start" to each piling event.
- Underwater sound monitoring would be performed during initial monopile construction (the first three monopiles).
- A NMFS approved observer would be posted on-site during all pile driving activities to monitor the area during construction. If protected marine species are observed within the 500 m (1,640 ft) Safety Zone by the NMFS approved observer, the observer would ensure that work would cease until the animal is clear of the work area and safety zone.

Fisheries

- Utilization of a state-of-the-art hydraulic jet plow for cable installation, monopile foundations for WTG towers, HDD installation at the nearshore area, and post-construction monitoring to document habitat disturbance and recovery.
- The pile driving hammer and jet plow technology that would be used to install the monopile foundations and the submarine cables, respectively, were selected specifically for their ability to keep sediment disturbance to a minimum.
- The proponent has agreed to work with commercial/recreational fishing agencies and interests to ensure that the construction and operation of the project would minimize potential impacts to commercial and recreational fishing interests.
- Measures proposed to minimize or avoid potential impacts to the commercial fishing industry include: no restrictions on fishing activities within the site; marking the WTGs with USCG-approved lighting to ensure safe vessel operation; and burying the inner-array cables and two submarine cable circuits to a minimum of 6 ft (1.8 m) below the seabed to avoid the potential for conflicts with fishing vessels and gear operation.

- Notification of fishermen well in advance of mobilization as to the location and timeframe of project construction activities, as well as a daily broadcast on VHS marine channel 16 as to the construction activities for that and upcoming days.
- Cable burial depth would be inspected periodically during project operation to ensure adequate coverage is maintained so as not to interfere with fishing gear/activity or with the safe operation of the cable.
- To protect sensitive fish species such as winter flounder, the proponent has committed to avoid in-water construction in Lewis Bay between January 1 and May 1 of any year. No submarine installation or cofferdam/HDD installation would occur during this timeframe.

Benthic and Shellfish

- Utilizing state-of-the-art hydraulic jet plow for cable installation in order to minimize seabed disturbance and sediment dispersion during cable embedment.
- Utilizing monopile foundations for WTG towers which minimize the seabed footprint and sediment disturbance while also minimizing opportunities for benthic organism colonization or fish habitat creation.
- Post construction monitoring to document habitat disturbance and recovery.
- The use of mid-line buoys on anchor lines in order to minimize the impacts from anchor line sweep.
- The duration and sequencing of construction has been designed to minimize the period of disturbance.
- Impacts to benthos and benthic habitat in Lewis Bay within 200 ft (61 m) of shore would be minimized by using HDD methodology to transition the submarine cable system to the shore.
- The proponent has committed to working with the Town Shellfish Constable to appropriately avoid or minimize impacts to designated shellfish areas from installation of the submarine cable. The proponent would provide the Town of Yarmouth with funds to mitigate for the direct area of impact within the Town's designated recreational shellfish bed in accordance with the Town's mitigation policies.

Aquatic Vegetation

- The proponent would not anchor vessels or perform cable installation work in the area near Egg Island where eelgrass beds are located.
- A dive survey would be conducted to confirm the limits of the eelgrass bed near Egg Island (verifying the limits of submerged aquatic vegetation [SAV] previously surveyed in July 2003) prior to the commencement of cable installation in the same calendar year preceding construction, and divers would also be used to confirm correct placement of work vessel anchors.
- If during installation of the submarine cable the eelgrass beds are disturbed, the proponent has committed to replanting eelgrass.

- Pre and post-construction monitoring of the eelgrass bed would be performed and if it is determined that eelgrass has been lost as a result of project activities, replanting would occur.
- The proponent has committed to aerially photograph the entrance to Lewis Bay in the month of July immediately prior to jet-plowing, under conditions conducive to documenting the extent of eelgrass beds, to use the photographs in finalizing the exact location of jet-plowing, and to provide such photographs to the Energy Facilities Siting Board.
- The proponent would denote the edge of the eelgrass bed at the water surface with buoys near Egg Island. In addition, the proponent would implement a No Wake Zone for its construction vessels at a distance of 200 ft (61 m) from the edge of the eelgrass bed.
- An eelgrass survey win be performed for the two consecutive years following construction to document the change in density which would be coordinated with the appropriate state and federal agencies.

Visual

- The proponent has removed daytime FAA lighting on the WTGs, formerly proposed in the DEIR.
- Potential nighttime visual impacts have been lessened by the reduction in FAA nighttime lighting (from the originally proposed 260 lights down to 57).
- Revisions to the layout have narrowed the breadth of the visual impact as seen from certain areas around the Sound.
- The WTGs would be an off-white color, to reduce contrast with the sea and sky.
- The upland transmission route would be located entirely below ground within paved roads and existing utility ROWs to avoid visual impacts and impacts to potential unidentified archaeological resources.
- If MMS determines there would be an adverse effect (due to visual impacts) MMS would direct a formal consultation process under the requirements of the NHPA, to develop measures to help mitigate these impacts on historic properties.
- The proponent and MMS would continue to consult with MHC, the Wampanoag Tribe of Gay Head Aquinnah (WTGHA) and other consulting parties to address and resolve issues concerning potential visual effects of the project on historic properties.

Historical/Archaeological

- All submerged potentially archaeologically sensitive areas identified during marine archaeological investigations have been avoided, including relocation of eight WTGs and associated cable arrays.
- The interpreted limits of three submerged potential historic resources on the seafloor within the site would be extended by a 100 ft (30.5 m) perimeter that would constitute a no-activity buffer zone. Compliance would be overseen by an environmental inspector.
- In addition, Procedures Guiding the Unanticipated Discovery of Cultural Resources and Human Remains would be provided to construction contractors, outlining

measures to be taken in the event that previously unidentified submerged and upland historic/archaeological resources are discovered during Project construction. Compliance with the procedures would be overseen by an environmental inspector.

- The proponent has reduced lighting on the WTGs and revised the layout such that the breadth of visual impact of the array as seen from certain areas is reduced. If the MMS determines that the offshore above water components of the project would result in adverse effects to certain onshore aboveground historic properties due to visual impacts, then the MMS would direct a formal consultation process under the National Historic Preservation Act (NHPA) to develop mitigation measures that would be detailed in a Programmatic Agreement.

Noise

- The proponent has selected state-of-the-art, very low noise wind turbines.
- Construction noise impacts would be temporary, unavoidable, and are primarily associated with the laying of the Onshore Transmission Line from the transition vault at the shore of Lewis Bay along existing roadways to the Barnstable Switching Station using standard roadway construction equipment. Noise mitigation for this onshore activity would consist of scheduling activities during normal working hours and ensuring that all equipment has properly functioning noise mufflers.
- Onshore construction activities (which include the HDD at the landfall), would be temporary, lasting 4 to 6 weeks, and would be audible to persons near the cable corridor. Sound levels would be similar to roadway construction equipment. Noise barrier walls would be constructed at the edge of the HDD pit to shield nearby residences at 32 and 49 New Hampshire Avenue.

Land Alteration

- Scour mats and or rock armoring (rip-rap) would be placed at the foundation of each WTG and each support pile of the ESP to minimize sediment scour.
- The use of state-of-the-art hydraulic jet plow for offshore cable embedment that minimizes sediment disturbance.
- Restoration of the dredged cofferdam area using originally dredged material supplemented with imported clean sandy backfill material if necessary to restore preconstruction contours.

Wetlands/Drainage

- The proposed submarine and onshore transmission cable route would be designed to fully comply with all applicable local, state and federal wetland performance standards.
- Direct wetland impacts would be minimized through the use of hydraulic jet plowing, HDD, and installation of the upland transmission line within existing paved roadways or disturbed electric ROWs.
- The proponent has committed to coordinate with the Yarmouth and Barnstable Conservation Commissions, the DEP, and Natural Heritage Endangered Species Program (NHESP) to prevent impacts to state-listed species as part of the project.

- The project would use best management practices for sedimentation and erosion control and stormwater management.
- A pre-construction survey would be perfon11ed to document the occurrence of state-listed rare species along the NSTAR Electric ROW route. If a state-listed species is located within the proposed transmission line route, a Conservation Permit under Massachusetts Endangered Species Act (MESA) would be obtained and efforts would be made to eliminate, minimize, or mitigate for any potential impacts.
- Post-construction monitoring would document habitat disturbance and recovery.
- The upland transmission line system has been sited below grade within existing roadways and maintained ROW.
- Sediment and erosion controls would be installed prior to construction, and would be inspected and maintained throughout the construction activities.
- A Dewatering Plan would be prepared to address the procedures for handling of any water encountered during excavation.
- The transmission line would not contain any fluids, petroleums, oils, or lubricants.
- The project would not result in any direct discharge of untreated stormwater into wetlands and waterbodies. Once installed, the paved areas would be restored to preconstruction conditions and the NSTAR Electric ROW would be restored to pre-construction contours and revegetated using a suitable upland seed mixture. The existing stormwater collections and management systems for these roadways would remain intact.

Water Quality

- An Oil Spill Response Plan (OSRP), a Stormwater Pollution Prevention Plan (SWPPP), and an Operation & Maintenance (O&M) Plan would be implemented during project construction/decommissioning and operation to prevent potential impacts to water quality from spills and erosion/sedimentation.
- The proponent would work with the Yarmouth Shellfish Constable to mitigate for any short-term impacts to shel1fish productivity and would provide the Town with funds to mitigate for the direct area of impact.
- To minimize the release of bentonite drilling fluid into Lewis Bay during HDD, freshwater would be used as a drilling fluid to the extent practicable prior to the drill bit or the reamer emerging in the pre-excavation pit.
- Scour protection, in the form of scour control mats and/or rock armor, would be installed around monopiles and ESP piles in order to prevent scouring.

Construction

- Use of state-of-the-art low-impact hydraulic jet plow installation for the marine cables.
- Use of HDD cable installation techniques at the landfall to avoid impacts to the intertidal zone and shoreline in Lewis Bay.
- A temporary cofferdam would be used during construction to minimize sediment resuspension at the interface between the HDD conduit and submarine cable system.

- Use of hollow monopile foundations for WTG towers.
- Installation of scour protection mats and/or rock armor to reduce scour potential near the WTGs.
- Post-construction monitoring including regular visual inspection of inner array cable routes in areas of migrating sand waves, to ensure the cables remain properly buried.

Navigation and Transportation

- Direct communication would be established between Air Station Cape Cod Search and Rescue (SAR) personnel and the proponent's operation center (manned 2417) in order to facilitate rapid remote WTG shut down, at the request of the USCG, in the event of bad weather SAR by air.
- The proponent would implement procedures outlined by the USCG to deconflict the areas around ongoing construction activities.
- The proponent has designed the WTG monopiles to withstand the forces of up to six (6) inch (15 cm) thick ice floes impacting the monopile.
- The proponent has committed to initiate manual shutdown of WTG(s) experiencing icing conditions if conditions warrant such a shutdown.
- The proponent would use either Seabed Scour Control Mats or rock armor for scour protection to limit changes to bottom contours in the vicinity of the WTGs.
- The proponent would provide private aids-to-navigation (ATONs) (lights and sound signals) within the site to assist mariners.
- The proponent would mark each WTG with its alphanumeric designation to serve as a point of reference for mariners.
- The proponent would provide the USCG; other local, state, and federal agencies and commercial sailors with a plan showing the designations of each WTG.
- The proponent has committed to continue coordinating with the USCG and NOAA regarding inclusion of the project site on NOAA nautical charts covering the area.
- The proponent has committed to immediately shutting down all or a portion of the WTGs upon notification from the USCG that SAR aircraft have been ordered to respond to an incident within or immediately adjacent to the project site.
- The proponent would work with the USCG to develop information that could be used to provide mariners to educate them regarding the potential effects of the WTGs on marine radar.
- The submarine cable system would be buried 6 ft below the present sea bottom. Installation of the upland cable system will occur outside of the height of the summer tourist season to minimize any vehicular disruption.
- Trenchless technologies would be used at major intersections and railroad crossings in order keep traffic disruptions to a minimum.
- Impacts to land-based transportation would be limited and temporary in nature. A Construction Traffic Management Plan would be prepared in consultation with local and state officials to ensure that safe access is maintained for vehicular traffic during onshore cable system installation, once the final route has been determined.

Telecommunication

- The potential does exist for interference to vessel mounted radar operating within or in close proximity to the proposed project site. The proponent would work with the USCG to develop information and training opportunities that could be provided to local mariners in order to raise awareness if interference does occur.

9.7.3 Mitigation Required Under the Massachusetts Energy Facility Siting Board Decision

In addition, at the conclusion of the Massachusetts Energy Facility Siting Board proceedings, the applicant was required to provide mitigation measures relative to the electric transmission cable. MMS is not requiring this mitigation at this time, but has provided it to show other measures that the applicant must implement in order to minimize or mitigate impacts on the environment as a result of the state review and permitting process completed to date.

As presented in the EFSB Final Decision, the applicant has agreed to the following measures to protect vegetation:

- The applicant would not anchor vessels or perform cable installation work in the area near Egg Island where eelgrass beds are located.
- A dive survey would be conducted to confirm the limits of the eelgrass bed near Egg Island (verifying the limits of SAV previously surveyed in July 2003) prior to the commencement of cable installation in the same calendar year preceding construction, and divers would also be used to confirm correct placement of work vessel anchors.
- If during installation of the submarine cable the eelgrass beds are disturbed, the applicant has committed to replanting eelgrass.
- The applicant has committed to aerially photograph the entrance to Lewis Bay in the month of July immediately prior to jet-plowing, under conditions conducive to documenting the extent of eelgrass beds, to use the photographs in finalizing the exact location of jet-plowing, and to provide such photographs to the EFSB.

The applicant is committed to the minimization and/or mitigation that was presented in the draft EIR and EFSB record and has since committed to the following additional items.

- The applicant would denote the edge of the eelgrass bed at the water surface with buoys near Egg Island. In addition, the applicant would implement a No Wake Zone for its construction vessels at a distance of 200 ft (61 m) from the edge of the eelgrass bed.
- The scope of work to perform the dive survey at the eelgrass bed within Lewis Bay would be coordinated with the appropriate state and Federal agencies.
- Development of a BACI Plan for Eelgrass
- Pre and post-construction monitoring of the eelgrass bed would be performed; if it is determined that eelgrass has been lost as a result of project activities, replanting would occur. The post-construction monitoring plan would be developed to document potential indirect impacts from cable embedment and subsequent habitat recovery. Habitat recovery would be considered successful, if it is found that SAV

has migrated back to the site of disturbance. Should the habitat not recover naturally, the disturbance would be mitigated by replanting.

An eelgrass survey would be performed, in the same timeframe as the pre-construction surveys, for the 2 consecutive years following construction to document the change in density.