4.0 Environmental Consequences of the Proposed Action and Alternatives

Potential impacts on environmental resources may be long-term or short-term; negligible, minor, moderate, or major; adverse or beneficial; direct or indirect; or significant. As used in this analysis, these characteristics are defined below.

Long-Term or Short-Term

These characteristics are determined on a case-by-case basis and do not refer to a rigid time period. In general, long-term impacts would occur either continually or periodically throughout the life of the proposed Port Ambrose Deepwater Port (Port Ambrose Project, Port or Project) (e.g., operational air emissions), or the impacts of an activity would last for years after an activity occurred. Short-term impacts are those that would occur only during a specific phase of the proposed Project, such as during construction or installation activities. Because construction of proposed Project components would occur over a 20-month period spread out between two calendar years, actual construction-related impacts could last up to nine months; these were considered short-term because the impacts would end at the time, or shortly after, construction activities ceased. The duration of most short-term impacts would be only a few hours or days (USCG and MARAD 2006a-c).

Negligible, Minor, Moderate, or Major

These relative terms are used to characterize the magnitude of an impact. Negligible impacts are generally those that might be perceptible, but are at the lower level of detection. A minor impact is slight, but detectable. Moderate impacts are those that are more perceptible, typically are more amenable to quantification or measurement, and may approach major or significant thresholds. Major or significant impacts are those that, in their context and due to their intensity (severity), have the potential to meet the thresholds for significance set forth in Council on Environmental Quality (CEQ) regulations.[1] Such impacts warrant heightened attention and examination for potential means for mitigation in order to fulfill the policies set forth in the National Environmental Policy Act (NEPA). Implementation of the mitigation measures identified in this draft Environmental Impact Statement (EIS) would reduce the magnitude of any impact initially identified as major/significant to minor (USCG and MARAD 2006a-c).

Adverse or Beneficial

An adverse impact would cause unfavorable or undesirable outcomes on the natural or human environment. A beneficial impact would cause positive outcomes on the natural or human environment. A single act might result in adverse impacts on one environmental resource and beneficial impacts on another resource. For example, sediment disturbance could expose benthic invertebrates to predation, which would adversely impact the benthic community, but would result in a beneficial impact on fish by increasing prey availability (USCG and MARAD 2006a-c).

Direct or Indirect

Direct impacts can be identified and assessed with more certainty than indirect impacts because they occur at the same time and the same place as the proposed Project. Direct impacts can be short-term or long-term. Indirect impacts are more difficult to identify and assess because they occur in the near and distant future and involve dynamic variables. Indirect impacts would not occur if it were not for the proposed Project (USCG and MARAD 2006a-b).

Significance

Significant impacts are those that, in their context and due to their intensity (severity), meet the thresholds for significance set forth in CEQ regulations.[2] This draft EIS meets the agencies' requirements to prepare a detailed statement on major federal actions significantly impacting the quality of the human environment.[3]

[1] 40 Code of Federal Regulations (CFR) 1508.27
[2] 40 CFR 1508.27
[3] 42 United States Code (U.S.C.) 102.2(c)

4.1 Water Resources

4.1.1 Introduction

This section addresses potential impacts on water resources associated with the proposed Project and alternatives, including the No Action Alternative. As discussed in Section 3.1, the proposed Project would be located in the New York Bight. Potentially affected water resources in the Region of Influence (ROI) include the marine waters of the nearshore and offshore portions of the New York Bight. Alteration of the ecosystem's water characteristics potentially could impact the overall habitat. Only marine surface water resources are discussed in this section, as there would be no notable impacts on onshore surface water features or groundwater resources.

Construction, operation, and decommissioning of the proposed Project would have no significant impact on the physical oceanography within the ROI. Impact that does occur would be minor and localized. The following sections identify the activities that would affect one or more of the water quality components (salinity, temperature, dissolved oxygen (DO), turbidity, trace elements and human-related discharges) as defined in Section 3.1. These characteristics are determined on a case-by-case basis and do not refer to a rigid time period. In general, long-term impacts would occur either continually or periodically throughout the life of the proposed Port Ambrose Project.

4.1.2 Physical Oceanography

4.1.2.1 Impacts of Construction

Marine currents potentially could be affected by installation of the proposed Port and Mainline construction operations and would cause turbulence and eddies in the downcurrent shadow of these operations. The flow changes and disruptions would extend a short distance downcurrent before returning to ambient conditions. Therefore, impacts on physical oceanographic conditions (currents, tides and wave patterns) associated with the presence of these structures would be anticipated to be short-term and negligible, as the ROI covers a minor area within the context of the larger New York Bight oceanographic environment. The use of dynamic positioning (DP) vessels would have no turbidity-related water quality impacts associated with vessel positioning; however, minor eddies and increased flow velocities are expected that would extend short distances downgradient of the construction operations.

Placement of fixed structures on the seafloor pipeline end manifolds (PLEMs), PLEM anchors (if required), submerged turret loading buoy (STL Buoy) landing pads, buoy anchors, and anchor chains result in direct, minor, highly localized changes in seafloor bathymetry.

4.1.2.2 Impacts of Operation

Localized, negligible impacts on the physical oceanography would result from changes in flow and velocities due to the presence of the proposed Port facilities blocking and re-directing flow. No modeling has been conducted for these impacts, but it is expected that currents should return to ambient conditions immediately downcurrent from the current disrupter.

4.1.2.3 Impacts of Decommissioning

Highly localized short-term, minor direct impacts on the physical oceanography associated with decommissioning would be similar to those associated with construction, but because they happen over a much smaller area (the proposed Mainline would be abandoned in-place, to be consistent with current federal policies to minimize adverse impacts; see Bureau of Ocean Energy Management's (BOEM's) Notice to Lessees No. 2010-G05), the extent of the impacts would be less. The recovery of the STL Buoys, PLEMs, flexible risers, and controls would result in localized turbidity and minor temporary changes in current and wave action from disturbances on the seafloor and decommissioning vessels.

4.1.3 Water Quality

4.1.3.1 Impacts of Construction

Discharge from construction support vessels would include deck runoff and engine cooling water. All gray water and sanitary wastewater disposal would operate according to the International Convention for the Prevention of Pollution from Ships (MARPOL) and U.S. Coast Guard (USCG) requirements. Marine vessels would be well maintained and comply with USCG requirements, and therefore would result in negligible impacts on water quality, especially given the limited time frame of construction operations. Water use during construction is identified in Table 4.1-1.

Routine Discharges

Construction support vessels would be required to fabricate, lower, and backfill the proposed Mainline and pipeline laterals, install the proposed Port structures, and generally support the construction efforts in the ROI. Routine discharges from these marine vessels would include deck runoff and engine cooling water. All gray water and sanitary wastewater would be stored onboard for appropriate disposal. All discharges from the marine vessels would comply with USCG requirements and the requirements highlighted in Table 1.4-1. The use of well-maintained vessels designed and operated in compliance with the applicable regulatory requirements is expected to ensure that routine discharges from marine vessels would result in short-term, negligible impacts on water quality in the ROI, especially given the limited time frame of construction.

Accidental Releases of Fuel, Oil, and Other Chemicals

Construction support vessels would have varying quantities of fuel, other oil (hydraulic oil, lubricating oil, greases, etc.), and other chemicals stored and/or in use in support of construction. Accidental releases are unlikely, but could have potentially adverse direct impacts on local water quality.

Construction support vessels would comply with the applicable USCG requirements that have been developed to minimize the potential for an accidental release or spill and provide for rapid response should one occur. Vessels would be required to have approved spill response plans that identify specific measures to avoid or minimize potential impacts of a spill. Vessels also would be required to maintain spill kits as outlined in its spill plan.

If a release of oil were to occur, it would be expected to result in a sheen on the water surface and elevated concentration of hydrocarbons in the upper water column. Minor releases likely would dissipate rapidly with negligible impact. In order to verify this potential impact, Liberty Natural Gas, LLC (Applicant or Liberty) used National Oceanic and Atmospheric Administration's (NOAA) Automated Data Inquiry for Oil Spills (ADIOS) oil weathering model to assess the fate of such a release of diesel oil in the proposed Project area. Based on the NOAA ADIOS model, predicted dissipation of a maximum spill of 2,500 barrels (105,000 gallons) is rapid. Using a 10-knot wind, oil concentrations of 0.5 percent occurred within 44 hours, and reached less than 0.05 percent within 58 hours. Modeling a 20-knot wind, 0.5 percent concentrations were reached within 11 hours, and less than 0.05 percent oil was reached within 11 hours. Surface currents were assumed to be wind-driven and in the same direction as ambient winds (towards the north-northwest).

If a more significant release were to occur from construction vessels, actions would be taken to control and clean up the spill and minimize the impact. Based on the quantity of petroleum products and chemicals present on the various construction vessels that are anticipated to be used, the design of the vessels in accordance with applicable USCG requirements, and the availability of spill response plans and equipment, it is anticipated that the potential for water quality impacts from an accidental petroleum product spill would be short-term and minor.

Table 4.1-1. Construction Vessel Seawater Intake and Discharge

Activity	Location	Vessel Type	Typical Operation and Duration	Total SW Intake (gpm)	Total SW Disch. (gpm)	CW Intake/ Disch. (gpm)	Total Operation (hrs)	Total SW Intake (MMgal)	Total SW Disch. (MMgal)	Total CW Intake/ Disch. (MMgal)
Hot Tap Installation (intake/ discharge based on 2 tugs)	Transco Pipeline	Work barge (anchored) / Tug	24/7 for 36 days	1,765	1,761	1,761	864	91.5	91.3	91.3
Pipeline Installation Pipe Haul Spread (intake/discharge based on 3 tugs)	Mainline route and Port	DP Pipelay Vessel	24/7 for 45 days	8,827	8,805	8,805	1080	572.0	570.6	570.6
		Tug boat escorting barge		2,644	2,642	2,642	1080	171.3	171.2	171.2
Pipeline Lowering and Backfilling	Mainline route	DP Plow Vessel	24/7 for 90 days	4,411	4,403	4,403	2160	571.7	570.6	570.6
Hot Tap Tie-in	Transco Pipeline	DP Dive Support Vessel (DSV)	24/7 for 46 days	1,325	1,321	1,321	1104	87.8	87.5	87.6
Collocated Y Install and Tie-in	Port									
PLEM to Lateral Tie-ins	Port									
Crew Boat	Mainline route and Port	Crew Boat	12/7 for 6 months	441	440	440	2160	57.1	57.1	57.1
DP DWP Installations	Port	Heavy Lift Vessel	24/7 for 26 days	4	0	0	624	0.2	0.0	0.0
	Port	DP DSV	24/7 for 58 days	1,325	1,321	1,321	1392	110.7	110.3	110.3
Flood, Hydrostatic Test, Dewater (intake/discharge for tugs based on 2 tugs)	Port	Work barge (anchored) / Tug	24/7 for 45 days	1,765	1,761	1,761	1080	114.4	114.1	114.1
	Transco Pipeline	DP DSV	24/7 for 45 days	1,325	1,321	1,321	1080	85.9	85.6	85.6
Total Construction Vessel Seawater Intake and Discharge								**1,862.6**	**1,858.2**	**1,858.2**

Notes:
SW = seawater
CW = cooling water
gpm = gallons per minute
MMgal = million gallons

Hydrostatic Test Water Discharges

Hydrostatic test water discharges in the proposed Project area would be performed in accordance with an individual National Pollutant Discharge Elimination System (NPDES) wastewater discharge permit that would be issued by U.S. Environmental Protection Agency (USEPA) Region 2. The estimated discharge would be 3.5 million gallons. A detailed water use for hydrostatic testing is presented in Table 4.1-2.

Table 4.1-2. Hydrostatic Testing Seawater Intake and Discharge

Pipeline Segment	Intake/ Discharge Location	Total SW Intake (gals)	Total SW Discharge (gals)
Flood subsea tie-in: 30-inch header, 16-inch hot- taps and 26-inch tie-in spools.	Transco Pipeline at SSTI	4,400	0
Flood Laterals and Mainline: 24.64 miles, 26-inch diameter x 0.52- inch	Port at CYA	3,300,000	0
Flood, Test and Dewater Buoy 1 Riser: 794-feet 14-inch diameter	Port at STL Buoy #1	6,350	6,350
Flood, Test and Dewater Buoy 2 Riser: 794-feet 14-inch diameter	Port at STL Buoy #2	6,350	6,350
Flood collocated "Y" assembly 26-inch diameter tie-in spools	Port at CYA	5,000	0
Hydrostatic pressure test of Mainline and Laterals: Assume 5 percent of pipeline volume is required as the additional volume needed to pressurize system.	Port at PLEMs	165,000	0
Dewater and Dry Mainline and Laterals: Vent pressurized water from hydrostatic test and dewater pipeline	Port at PLEMs	0	3,474,400
Total Hydrostatic Test Water Intake and Discharge		**3,487,100**	**3,487,100**

Discharge water at the PLEMs would be tested for the biocide tetrakis (hydroxymethyl) phosphonium sulfate (THPS) concentration, collected in a mixing tank, dosed with an appropriate concentration of hydrogen peroxide, and discharged below the water surface using a diffuser. Hydrostatic test water discharges, therefore, would occur over a limited time frame and with appropriate pre-discharge treatment (neutralization with hydrogen peroxide); such discharges are expected to result in localized, short-term, and minor direct impacts on water quality.

If an accidental spill or discharge of un-neutralized hydrostatic test water occur, potential impacts on water quality and the marine environment would be greater, but should remain localized and short-term because THPS naturally degrades to an ecologically inert compound (Zhoa et al. 2008).

Turbidity

Short-term and adverse direct impacts on water quality and other biologic processes could result from increased turbidity during construction when sediments transported by currents resettles. The proposed Mainline and pipeline laterals would be installed using a dynamic positioning pipelay vessel (DPPV). The DPPV would maneuver along the predetermined route without the use of anchors and associated connecting wire cables.

Installation along the portion of the route that crosses existing cables would be installed using hand-jetting equipped divers. Once the pipe has been lowered to the target depth, the trench would be backfilled with material from the temporary spoil piles.

Surface sediment samples collected as part of the marine survey by AECOM (2014) indicated that sediments within the ROI consisted of 97 percent sand or sand/gravel.

It is expected that a majority of the proposed Mainline would be installed in plowed trenches to a target depth of 4 feet, and then backfilled using plowing equipment similar to that used for installation. In addition, the U.S. Army Corps of Engineers (USACE) would require burial of the proposed Mainline to a depth of 10 feet in the area of the proposed Mainline (milepost [MP] 17.0 to MP 21). Should a USACE permit be issued for the proposed Project, all disturbed areas would be required to be returned to pre-construction conditions immediately upon completion of construction. These installation activities would create a temporary spoils pile of sandy material near the trench that would then be used as backfill Disturbed areas would not be left over time or allowed to return to pre-disturbance conditions by natural processes and currents. It is expected that the areas of the trench that would be excavated to 10 feet would create more turbidity at greater distances from the trench because more material would be disturbed and the deeper trench would require excavation using a jet sled, pushing sediment plumes higher into the water column because more sediment would be disturbed (Appendix I).

Hydrodynamic modeling of the sediment dispersion and deposition due to trenching was performed incorporating local oceanographic and environmental conditions. Since state waters consist of 25 percent fines, and federal waters of only 5 percent fines, these areas were analyzed separately, because grain size influences the characteristics and behavior of sediment plumes. The model also took into consideration the added burial depth required within the Ambrose anchorage area, between MP 17.0 and MP 20.1.

In state waters, the predicted extent of the sediment plume was up to 10,500 feet, at a 25 milligrams per liter (mg/L) suspended solid concentration, in areas of both plowing and jetting. Plumes of high suspended solid concentration (i.e., 100 mg/L) averaged 385 to 919 feet. The maximum area of a 0.2-inch deposition was estimated as 2,541 feet. In federal waters, sediment plumes and deposition were generally lower, due to the smaller proportion of fine-size particles. The maximum plume size was estimated as 7,800 feet, with a concentration of 25 mg/L, in the area of jet sled activities. On average, sediment plumes with high suspended solid concentrations (i.e., 100 mg/L) were predicted to extend 315 to 1,016 feet. The maximum area of 0.2-inch sediment deposition in federal waters was predicted as 2,485 feet. Maximum values are predicted to occur in isolated areas, while mean values are more representative of a more typical outcome. Therefore, based on mean values, elevated concentrations of suspended solids (in excess of 50 mg/L) are likely to occur within 1,400 feet of the proposed Mainline in state waters and within 700 feet in federal waters.

Heavy deposition (0.8 inch or greater) is likely to occur within 190 feet of the proposed Mainline in state waters and within 110 feet in federal waters. Therefore, dispersion and sedimentation impacts on benthic resources would be focused around the proposed Mainline during construction activities. Turbidity and sedimentation would also result from the anchor chain sweep, but these impacts are discussed in terms of normal operation.

Salinity, DO, Trace Elements, Nutrients

The construction of the proposed Project is expected to have localized, short-term and minor direct impact on the overall water quality in the ROI. Based on the volumes of discharge from construction and support vessels, the impact on salinity would be negligible in relation to the surrounding ocean water volumes.

DO could be potentially impacted directly at the discharge point of the vessel, but these would be minor as they would be highly localized. Cooled water discharge would also have a minor effect to the DO concentrations, as equalization between warm and cold water would occur with rapid plume dispersion.

Anthropogenic/naturally occurring trace elements and nutrients could potentially be disturbed and re-suspended into the water column during construction activities. Based on historical uses along the proposed Mainline and within the proposed Port area, it is unlikely that these constituents would be

present in significant quantities. Based on sediment dispersion and deposition modeling related to trenching activities (Hodge 2014), re-entrainment of sediment into the water column would be limited in quantity and of short duration.

4.1.3.2 Impact of Operation

Once the liquefied natural gas (LNG) regasification vessels (LNGRVs) have been fully commissioned, no discharges are anticipated from LNGRVs during natural gas offloading at the proposed Port facilities. Table 4.1-3 indicates the water use for commissioning. The estimated volume of withdrawal/discharge (open-loop) for the 45 days of commissioning is 5,700 gallons per minute (gpm) with an estimated change in temperature of 10 degrees based on CORMIX modeling (Appendix H). The modeling also indicates that the buoyant thermal plume associated with the plume is minor in extent and magnitude.

Routine Discharges

Sufficient storage would be provided so that there would be no sanitary (black water) or hoteling (gray water) discharges when the LNGRV is at the proposed Port facilities.

As described in Section 2.1.5.1, an LNGRV connected to a STL Buoy in regasification mode would use seawater from its ballast water tanks as a source of cooling water in a closed-loop mode. Water would be recycled to and from the ballast water tanks, so there would be no discharge of cooling water at the proposed Port facilities. There would be ballast water withdrawal during regasification to replace the weight of the LNG that has been re-gasified and offloaded from the vessel at the rate of approximately 1,338 gpm to balance the 400 million standard cubic feet per day (MMscf/d) regasification sendout rate. However, there would be no discharge at the proposed Port facilities. This ballast water would be discharged to balance the loading of LNG.

Table 4.1-4 indicates water use averaged out over a 365-day period and, therefore, would be considered conservative, as there would be times during the year when the LNGRV would not be in the proposed Port.

Discharges could occur during specific unique events, such as the commissioning of the proposed Port facilities and/or during the commissioning of a new LNGRV at the proposed Port facilities. The reason this may occur during commissioning is because of the extended length of time an LNGRV would be in port, because during this time ballast water temperatures may rise above cooling water temperature requirements. For the purpose of this evaluation, it is assumed that commissioning of the proposed Port facilities would be performed simultaneously with the commissioning of a new LNGRV. In this process, a new LNGRV would arrive at one of the STL Buoys, retrieve and connect to the STL Buoy, install an emergency shut-down valve, test the STL Buoy and vessel equipment and controls (test valves, pipeline integrity, etc.), test the safety systems, and perform regasification skid performance testing. The LNGRV then would disconnect from the first STL Buoy, move to the second STL Buoy, and generally repeat the exercise, followed by the emissions performance testing.

Due to the limited operation of the regasification system, recirculation of ballast water may be needed to meet vessel cooling water requirements. If recirculation of ballast water is determined not to be adequate, seawater would be used to supply the LNGRV's central freshwater coolers, dump condenser, and freshwater generators during the commissioning period (a time frame of up to 45 days). This process like all other discharges for the proposed Project would be regulated through an NPDES permit.

It is estimated that the average cooling water intake/discharge rate for an LNGRV could approach 8.2 million gallons per day (mgd) during this period. Based on CORMIX modeling, the estimated temperature difference between cooling water intake and discharge is anticipated to be in the range of approximately 9 to 14°F (5 to 8°C), with a maximum difference of 18°F (10°C). The cooling water would discharge through a pipe anticipated to be approximately 2.3 feet in diameter at a depth of 38 feet and would be oriented vertically downward. The primary water quality impact associated with this limited duration, cooling water discharge would be the potential thermal impact from the heated discharge.

Table 4.1-3. Potential LNGRV Commissioning Seawater Intake and Discharge

Activity	Location	Vessel Type	Typical Operation and Duration	Total SW Intake (gpm)	Total SW Disch. (gpm)	CW Intake/ Disch. (gpm)	Total Operation (hrs)	Total SW Intake (MMgal)	Total SW Disch. (MMgal)	Total CW Intake/ Disch. (MMgal)	Approx. Timing
Commissioning of LNGRV and STL Buoys	Port at STL Buoys	LNGRV	Intermittent activity over a 45-day period	7,038	5,700	5,700	1080 (max.)	456.01	369.4	369.4	mid-Oct to early-Dec 2017

Notes:
1. Approximate timing based on construction schedule presented in the September 2012 DWP application (amended September 2014).
2. Seawater (SW) intake includes assumed ballast water intake rate of 1,338 gpm and cooling water (CW) intake rate of 5,700 gpm.
3. Total seawater intake and discharge volumes represent maximum volumes based on continuous operation over 45 day period. LNGRV/STL Buoy commissioning related testing would be implemented intermittently during the commissioning period. Actual seawater intake/discharge volumes should be substantially less than these maximum volumes.

Table 4.1-4. LNGRV Operations Seawater Intake and Discharge

Activity	Location	Vessel Type	Typical Operation and Duration	Total SW Intake (gpm)	Total SW Disch. (gpm)	CW Intake/ Disch. (gpm)	Total Annual Operation (hrs)	Total SW Intake (MMgal)	Total SW Disch. (MMgal)	Total CW Intake/ Disch. (MMgal)	Approx. Timing
LNGRV ballast water intake	Port at STL Buoys	LNGRV	24/7 (45 trips per year)	1,338	0	0	8,760	703.5	0	0	Begins Dec 2017

Notes:
1. Approximate timing based on construction schedule presented in the September 2012 DWP application (amended September 2014).
2. Total seawater (SW) intake and discharge volumes assumes LNGRV operation 24 hours per day and 365 days per year and do not account for periods when there is not an LNGRV at Port. Therefore, these volume estimates should be considered conservative maximum volumes.
CW = cooling water

Operation of the proposed Project is expected to result in short-term, minor adverse thermal water quality impacts. The CORMIX model prepared by the Applicant (Appendix H) indicates the thermal plume associated with LNGRV commissioning for cooling water discharges is expected to be minimal in both areal extent and magnitude. The model indicates that this prediction is applicable across the range of seasonal water column conditions when the water column is both completely mixed and stratified, as well as across the possible range of anticipated current velocities.

In three of the four discharge scenarios evaluated, at the point where the plume's excess temperature is predicted to drop below 1.8°F above ambient, the centerline of the rising conical plume is predicted to be located 34 to 42 feet beneath the water surface, and the volume of water exposed to temperatures of 1.8°F greater than ambient is estimated to be between approximately 1,500 and 2,700 ft^3. In the fourth model run where the plume is predicted to mix with the surface layer prior to dropping below the 1.8°F criterion (summer, stratified conditions) with an ambient current of 0.19 knots. The resultant surface plume is anticipated to meet the criterion within approximately 30 feet downcurrent of the discharge point. The surface plume is predicted to have a surface area of approximately 716 ft^2 and a thickness in the range of approximately 5 to 8 feet. The volume of water exposed to temperatures of 1.8°F greater than ambient is predicted to be approximately 7,500 ft^3. In the four scenarios evaluated, the estimated plume travel time from the point of discharge to the compliance point is predicted to be less than two minutes.

Compliance with the USEPA's 1.8°F excess temperature criterion is predicted to occur within less than 90 feet of the point of discharge, which is well within the typical 328-foot regulatory mixing zone. The plume centerline temperature is predicted to drop from 18°F greater than ambient at the point of discharge to less than 1.8°F greater than ambient within approximately 30 to 90 feet downcurrent of the point of discharge.

An operation support vessel would be required to support the operations efforts. Routine discharges from these marine vessels would include deck runoff and engine cooling water. All gray water and sanitary wastewater would be stored onboard for appropriate disposal. All discharges from the marine vessels would comply with USCG requirements and the requirements highlighted in Table 1.4-1. The use of well-maintained vessels designed and operated in compliance with the applicable regulatory requirements is expected to ensure that routine discharges from marine vessels would result in negligible impacts on water quality, especially given the limited time frame LNGRVs and the support vessel would be in the area.

Accidental Releases of Fuel, Oil, and Other Chemicals

The LNGRVs and the support vessel would have varying quantities of fuel, other oil (e.g., hydraulic oil, lubricating oil, greases, etc.), and other chemicals (e.g., aqueous urea, mercaptan, etc.) stored and/or in use in support of facility operations. Accidental releases of these various substances to the waters surrounding the proposed Project could cause potentially direct, adverse impacts on local water quality.

The potential for a release of natural gas from the proposed Mainline is remote. Automatic shut off valves will activate to limit the amount of gas release. If there were a subsea release of natural gas, the gas would rise to the water surface rapidly and dissipate. Water quality impacts from such a release would be negligible.

The LNGRV engines would be fueled primarily by natural gas, but would be capable of running on marine diesel oil at low engine loads. Other marine support vessels typically would run on fuel oil. All vessels operating at the proposed Project would comply with the applicable USCG and MARPOL requirements. If a release of oil were to occur, it would be expected to result in a sheen on the water surface and elevated concentration of hydrocarbons in the upper water column. Minor releases likely would dissipate rapidly with negligible impact. Major releases of fuel would be handled in accordance with the Applicant's Spill Response Plan.

LNG Spills

Short-term, minor, direct adverse impacts on water quality could occur in the unlikely event of an LNG spill. All LNGRVs are designed with features to minimize the potential for LNG spills (see Section 2.1). However, if an LNG spill were to occur, potential impacts would include exposure to low-temperature LNG at the water surface, possibly resulting in rapidly dropping water temperatures near the surface. These impacts would likely occur in the immediate vicinity of the spill location; the time frame of the impact is limited (see Section 5). Since LNG would boil off as natural gas at the surface, depth and pressure required for gas to dissolve (Artemov et al. 2005) in surface waters would not be sufficient and gas vapors would disperse. In addition, the time frame for these impacts would be limited, and adverse toxic impacts would be expected to be minor after the LNG boiled off and the vapors dispersed.

The potential for a release of natural gas from the proposed Mainline and pipeline laterals is remote. The proposed Mainline and pipeline laterals would be buried or covered before proposed Port operations commence, making damage to the pipeline resulting in leaks less likely. Other than the unlikely event of a pipe leak or rupture, operation of the proposed Mainline and pipeline laterals are not expected to create environmental disturbances. While Patin (1999) suggests that increased dissolved gas levels in the water column during the sudden release of natural gas (methane) into the marine environment may raise to toxic levels; however, further study is needed. Dissolution of natural gas into the marine environment is known to occur naturally from seeps and from methane hydrates and contributes to higher methane concentrations in some regions of the earth's marine environment. These are typically more gradual releases of methane, occurring over an extended period of time, with finer bubble sizes ranging from 0.04 to 0.4 inches and typically at significantly greater depths (greater than 295 feet), pressures and lower temperatures than those along the proposed Mainline and pipeline laterals. Smaller bubble sizes and greater depths and pressures contribute to more gas being dissolved and less gas (calculated at approximately 18 percent at approximately 295 feet) reaching the surface for atmospheric dispersion (Artemov et al. 2005). In general, whether a release is sudden or extended, physics dictate that any methane would gradually dissolve into the water column during the lifetime of the bubble as described by Fick's law, taking into account Henry's law constants, partial pressure and concentrations of dissolved gases (Artemov et al. 2005). Once a gas bubble reaches the surface, it would rise (being lighter than air) and be dispersed by air currents. Neither methane seeps nor gas hydrates are found in the vicinity of the proposed Port or Mainline; therefore, background levels of methane are anticipated to be low and representative of waters in the New York Bight. If a subsea release of natural gas occurs, the limited quantity of gas released would rise to the water surface rapidly and would dissipate. Natural gas is non-toxic to the atmospheric environment. Any localized increase of natural gas concentration in the water column would be short-term, minor, and would dissipate with time and distance.

Planned and Unplanned Maintenance and Repair

Depending on the severity of the maintenance or repair, vessels would be similar to those used during construction as described in Section 4.1.3.1. As with construction, gray water and sanitary wastewater disposal during operation would conform to the MARPOL and USCG requirements. Marine vessels would be well maintained and comply with USCG requirements, and therefore would result in negligible impacts on water quality, especially given the limited time frame of decommissioning operations. Water use during construction is identified in Table 4.1-1. Additional impacts on water quality characteristics (salinity, temperature, DO, turbidity, trace elements and human-related discharges) would be expected to be minimal as described in Section 4.1.3.1. Periodic maintenance, inspection and repair activities would require small vessels (less than 300 gross tons) to be mobilized to the site. Appropriate notifications to the USCG and affected mariners would be made as described in the Applicant's Operations Manual.

Major repairs would be performed by construction-type vessels using a mitigation program similar to that employed during construction. A plan would be followed to mitigate impacts on water quality in the ROI.

The proposed Project traffic represents only a very small increase in overall vessel traffic in the New York Bight area and would have negligible impact to water quality in the ROI.

Turbidity

Operation of the proposed Project is expected to result in short-term, minor water quality impacts from increased turbidity during operation. Currently, the STL Buoys would be secured to the seafloor by a set of eight anchor chains and wire cables extending in a radial distance of up to 3,138 feet to corresponding suction anchors. Final design would account for prevailing current and wind, and wire cable length may be shorter than described here. If necessary, driven piles could be used as an alternative to the suction anchors in the unlikely event geotechnical conditions preclude use of suction anchors. When in operation, the STL Buoy would be raised and lowered from the seafloor. There would be limited lateral movement of the cables. This movement would cause a minor turbidity plume along with the flexible riser connecting the STL Buoy and the PLEM. This limited duration disturbance and the sandy nature of the bottom sediment would result in a minor turbidity plume with limited water quality impacts. The movements of the anchor chains and wire ropes caused by wave, wind and currents for the proposed STL Buoys may make contact with the seabed and create a minor turbidity impact. The current design of the mooring system (APL 2012) is similar to the mooring system design of the Northeast Gateway system. Analysis of total suspended solids (TSS) concentration and sediment transport distance was conducted for the Northeast Gateway system (NEG 2010). The estimated TSS concentration and horizontal distance of sediment transport calculated for the Northeast Gateway Project did not indicate a significant turbidity impact above those normally created during storms.

Salinity, DO, Trace Elements, Nutrients

The operation of the proposed Project would have localized, minor direct impacts on the overall water quality in the proposed Project area. Based on the volumes and type of discharge from operations and the support vessel, the impact on salinity would be negligible in relation to the surrounding ocean water volumes.

Direct impacts on DO could potentially occur at the discharge point of the vessel, but these would be minor as they would be highly localized. Cooled water discharge would also have a minor impact on the DO concentrations, as equalization between warm and cold water would occur with rapid plume dispersion.

Anthropogenic/naturally occurring trace elements and nutrients could potentially be disturbed and re-suspended into the water column from currents and other movements of the mooring system, as well as potentially from water discharge activities. Based on historical uses within the proposed Port area, it is unlikely that these constituents would be present in significant quantities. Based on sediment dispersion and deposition modeling related to mooring system movement (NEG 2010), re-entrainment of sediment into the water column would be limited in quantity and of short duration.

It should be noted that the sediment type identified in the Northeast Gateway Project is finer grained, which would remain in suspension longer; therefore, this analysis should be considered conservative for the proposed Project.

4.1.3.3 Impacts of Decommissioning

Marine vessels would be well-maintained and comply with USCG requirements, and therefore would result in negligible impacts on water quality, especially given the limited time frame of decommissioning. Water quality impacts from the marine vessels used during decommissioning would have routine vessel discharges and the same potential for accidental releases, but because this activity would occur in the proposed Port area only, the extent of the impacts would be over a much smaller area than that associated with original construction. Water use by marine vessels for decommissioning, as estimated by the Applicant, are presented in Table 4.1-5 and show a lesser impact than that for construction.

Table 4.1-5. Decommissioning Seawater Intake and Discharge

Activity	Location	Vessel Type	Typical Operation and Duration	Total SW Intake (gpm)	Total SW Disch. (gpm)	CW Intake/ Disch. (gpm)	Total Operation (hrs)	Total SW Intake (MMgal)	Total SW Disch. (MMgal)	Total CW Intake/ Disch. (MMgal)	Approx. Timing
Hot Tap/PLEM Riser Areas	Transco Pipeline & Port	DP Dive Support Vessel (DSV)	24/7 for 40 days	1,325	1,321	1,321	960	76.3	76.1	76.1	End of Project Life
		2000 HP Tug	24/7 for 40 days	883	881	881	960	50.8	50.7	50.7	End of Project Life
Buoy Removal	Port	Heavy Lift Vessel	24/7 for 30 days	4	0	0	720	0.2	0	0	End of Project Life
Flood and Abandon Mainline and Laterals	Port	--	--	--	--	--	--	3.3	0	0	End of Project Life
Total Decommissioning Vessel Seawater Intake and Discharge								**130.6**	**126.8**	**126.8**	**--**

Notes:
1. Approximate timing based on construction schedule presented in the September 2012 DWP application (amended September 2014).
2. Total seawater (SW) intake rate estimated as cooling water (CW) intake rate plus estimated potable water and miscellaneous service water demand.
3. Heavy Lift Vessel (HLV) assumed to have closed cycle cooling and no CW intake/discharge.

Routine Discharges

Decommissioning support vessels would be required to fabricate, lower, and backfill the proposed Mainline and pipeline laterals, install the port structures, and generally support the operations efforts. Routine discharges from these marine vessels would include deck runoff and engine cooling water. All gray water and sanitary wastewater would be stored onboard for appropriate disposal. All discharges from the marine vessels would comply with USCG requirements and the requirements highlighted in Table 1.4-1. The use of well-maintained vessels designed and operated in compliance with the applicable regulatory requirements is expected to ensure that routine discharges from marine vessels would result in negligible impacts on water quality, especially given the limited time frame operation vessels would be in the area.

Decommissioning activities would result in localized, short-term, minor impacts on water quality and the aquatic environment, which would eventually return to ambient conditions.

4.1.4 Impacts of Alternatives

The proposed Project location is a significantly shorter distance (18.83 nautical miles) requiring significantly less trenching and Mainline installation than would be required for the alternative sites in Study Area A (89.46 nautical miles), B (38.55 nautical miles), C-2 (21.5 nautical miles) and D (46.45 nautical miles). Alternative A is 79 percent greater in length than the proposed Mainline, while Alternative B, C-2 and D are 52, 13 and 57 percent greater in length, respectively, than the proposed Project.

Construction methods for each alternative would be similar; therefore, impacts on water quality at each location would be similar. The shorter distance for installation of the proposed Mainline, as compared to the distance required for these alternatives, would result in a proportional reduction in sediment disturbance and local turbidity of 79, 52, 13 and 57 percent, respectively, for each alternative.

The shorter length of installation would also result in a shorter construction time and therefore, a proportional reduction in the potential for accidental spills over time similar to the above percentages. Operational and decommissioning impacts on water quality would likely not be materially different between the identified alternatives. Therefore, as travel times would be proportionally reduced based on the above percentages, the proposed Project would have the least impact.

Because impact piling was assessed to have the highest potential for sound generation (over the widest area) associated with the proposed Project, the decision was made that the anchors would be installed using suction anchors. If necessary, driven piles could be used as an alternative to the suction anchors in the unlikely event geotechnical conditions preclude use of suction anchors. Several different anchor alternatives have been considered for the proposed Project, including suction anchors, driven piles, fluke anchors, gravity-based anchors, and grouted pile anchors. The amount of water use and discharge would be mostly dependent upon the specific number of vessels that are needed for each alternative. Water use and discharges would likely be less for the fluke and driven pile alternatives than the gravity-based anchor installation. The suction anchor method creates its own issue as to water “intake and discharge,” as seawater would be pumped out of the caisson in order to create the negative pressure needed. Because the seawater would be untreated, no impacts on water quality would occur. Support vessel impacts on water use and discharge from suction anchors would be no different than with fluke and driven pile alternatives. During installation, all alternatives of anchoring would have short-term turbidity and sedimentation impacts owing to various methods used to set the anchors at or below the sea bottom surface. These impacts would only occur throughout the duration of installation. The risk of potential impacts must also be balanced against the effectiveness and reliability of the anchoring system.

The impacts on sediments from the deepwater port design alternatives are potentially greater. The gravity-based structure (GBS), the platform-based unit, and the artificial island generally would result in a greater

disturbance of sediments due to the larger footprint on the seafloor. The floating storage and regasification unit (FSRU), HiLoad, and the STL Buoy system each would result in a smaller sea bottom footprint and less sediment disturbance during construction. However, during operation these alternatives may result in increased long-term turbidity due to anchor cable sweep. Since these two alternatives have distinct advantages directly related to water quality and sediments, the proposed Project design was selected based on a combination of other factors, including environmental, operational, technical, and economic advantages.

For the proposed Project design, the sediment disturbance and turbidity related to the operation phase (anchor cable sweep) would be highly localized and would not result in significant impacts on existing sandy sediments or to water quality degradation based on turbidity. Based on this finding, the proposed Project design was selected as resulting in insignificant impacts on water quality and sediments.

Alternatives for vaporization of the LNG prior to it entering the proposed Mainline and pipeline laterals are open-loop vaporization and closed-loop vaporization, and neither would have an impact on sediments. Open-loop vaporization would require substantial water intake (between 13,944 and 27,932 gpm), the potential use of biocides, and the discharge of colder than ambient temperature water. Closed-loop vaporization requires no intake or discharge from water near the proposed Project area. Therefore, closed-loop vaporization is the most environmentally preferable method.

Under the No Action Alternative, no facilities would be built, and there would be no potential for impacts on water resources. Depending on the characteristics of the alternative measures used to address the areas' energy needs, the region could experience impacts on water resources that are greater than, less than or similar to those that would be associated with the proposed Project.

4.1.5 Mitigations and Monitoring

Impacts on water resources have been adequately mitigated by the Applicant through design modifications and implementation of mitigation measures recommended by federal and state agencies. In addition to the measures proposed by the Applicant to limit impacts, the USCG would request that the Applicant include the following measures in the mitigation and monitoring plan, should a license be granted:

- The proposed Project would limit potential impacts on water resources by using closed-loop shell-and-tube vaporization (STV) methods instead of open rack vaporization (ORV) open-loop technology to vaporize the natural gas.
- The Applicant agrees that quarterly water quality monitoring should be required to demonstrate that impacts are consistent with (or less than) those presented in this draft EIS.
- Monitor seafloor bathymetry annually to identify any areas of erosion.
- Prior to construction, sample sediments to determine they are not contaminated and establish background turbidity values.

4.2 Biological Resources

4.2.1 Introduction

This section addresses potential impacts on biological resources associated with the proposed Project and alternatives, including the No Action Alternative. The biological resources potentially affected by the proposed Project are described in Section 3.2 and include benthic resources, plankton, fisheries, non-endangered marine mammals, and coastal and marine birds. As discussed in Section 3.2.3, and in accordance with Section 7(c)(1) of the Endangered Species Act (ESA) and Section 102 of NEPA, this draft EIS would serve as the Biological Assessment (BA) for the Proposed Action.

Construction of the proposed Project would result in short-term, minor, adverse impacts on biological resources from routine discharges, increased vessel traffic, noise, lighting, marine debris, bottom sediment disturbance, hydrostatic testing, and inadvertent spills. Short-term, potentially moderate to potentially major, adverse impacts on non-threatened and non-endangered marine mammals during construction would result from marine noise from the proposed Mainline installation and STL Buoy anchoring. Operation of the proposed Project would result in long-term, minor to moderate, adverse impacts on biological resources from increased vessel traffic, noise, lighting, marine debris, routine discharges, LNG spills, inadvertent spills, bottom sediment disturbance, marine facilities and proposed Mainline presence, and seawater intake (impingement and entrainment). Decommissioning of the proposed Project would result in short-term, minor, adverse impacts on biological resources from routine discharges, increased vessel traffic, noise, lighting, marine debris, inadvertent spills, and bottom sediment disturbance. Such impacts would be similar to those described for construction.

Construction, operation, and decommissioning of the proposed Project would have no significant impact on the commercial, recreational, ecological, or scientific importance of any biological resource, nor is it expected to cause any measurable change in population size or distribution for any species in the ROI. Impact that does occur would be minor to moderate and localized. The following sections identify the activities that would affect one or more biological resources (benthic resources, plankton, fisheries, non-endangered marine mammals, and coastal and marine birds) as defined in Section 3.2. The activities are presented for the construction, operation, and decommissioning phases of the proposed Project.

4.2.2 Benthic Resources

During construction, operation, and decommissioning, potential impacts on benthic resources would result from bottom sediment disturbance activities. Turbidity would temporarily increase during these activities and would adversely impact benthic communities. While in-place, the footprint of the proposed Project (e.g., PLEMs, STL Buoy landing pads, mooring piles) would not be suitable habitat for benthic organisms; this habitat loss would persist throughout the duration of operation. A permanent loss of benthic habitat would also occur with the installation of mooring piles, even after decommissioning, in the event that suction anchors cannot be removed.

4.2.2.1 Impacts of Construction

Construction of the proposed Project would disturb approximately 250 acres of seafloor. The impacts would be the result of the proposed Mainline and pipeline lateral installation (by jet plow), mooring piles, STL Buoy landing pads, and PLEMs. Impacts on benthic organisms during construction of the proposed Project could include direct crushing or the localized removal, turnover, and disruption of the sediment in the immediate vicinity of the proposed Project. Generally, these impacts would be short- to long-term and moderate with benthic organisms recolonizing the area or new benthic communities moving in shortly after construction.

Recolonization of benthic organisms can be affected by many physical and biological factors. The texture of the disturbed sediment is one factor that can impact recolonization. If a change in sediment texture occurs, a change in the benthic community could occur. Additionally, overturned, deeper sediments may be hypoxic, resulting in longer periods of recolonization.

Given the dynamic nature of sediment processes in the ROI, the trenching and backfilling would be expected to create only temporary and localized alterations to the seafloor habitat. The benthic community associated with the fine and coarse sand seafloor would be expected to rapidly recover following construction (Brooks et al. 2006). Typically, following this type of disturbance, a diverse benthic infaunal community would be recolonized from organisms associated with substrate adjacent to disturbed areas within a matter of one to three years (Byrnes et al. 2004; Lundquist et al. 2010).

The construction of the PLEMs would result in the permanent removal of 3.0 acres of seafloor for the two STL Buoys and anchor chain arrays that would be anchored to the seafloor. This removal of seafloor would persist throughout the life of the proposed Project. Soft-bottom habitat would be permanently displaced by the STL Buoy landing pad, PLEMs, flexible riser and tether systems, and movement of the anchor chain and wire mooring lines. Each PLEM would permanently displace a 33-foot by 33-foot (1,089 square feet [ft^2]) area. In addition, eight suction anchors, approximately 26 feet in diameter and 30 feet in length, would be used to secure each STL Buoy. If necessary, driven piles could be used as an alternative to the suction anchors in the unlikely event geotechnical conditions preclude use of suction anchors. Should driven piles be used to anchor STL Buoy anchor chains to the seafloor, the mooring pile guide frame deployed for each pile would temporarily disturb a 50-foot by 50-foot (2,500 ft^2) area. For the utility crossing for the Neptune Regional Transmission System Power Cable (Neptune Cable) burial, a 4-foot depth for the proposed Mainline may not be possible. In such cases, 24 inches of burial depth in compacted rock would be required[4] and would be achieved using 18 inches of concrete matting overlaying 6 inches of 1 inch minus sand bag at the crossing location for a radial distance of 3 feet around the center of the utility crossing location. As the proposed Mainline rises from a 4-foot burial depth to the utility crossing, 6-inch thick concrete matting would be used. Total area of concrete matting would be approximately 0.1 acre. All concrete matting would be buried to a 3-foot depth along the outside edge to mitigate the hazard of anchor strikes or snags from ocean shipping or due to snagging of bottom fishing trawling gear. The permanent conversion of soft bottom habitat to hard substrate from PLEM and STL Buoy and pipeline armoring during construction, impacts from these activities would have localized, long-term and moderate impacts on benthic species.

Models of sediment transport were developed specifically for construction activities associated with the proposed Project (Appendix I). These models considered construction activities, such as plowing, hand jetting, and excavation, that would disturb sediment. Incorporating local oceanographic and environmental conditions, the models predicted the extent of sediment plumes and deposition. Since state waters consist of 25 percent fines, and federal waters of only 5 percent fines, these areas were analyzed separately, because grain size influences the characteristics and behavior of sediment plumes. Additionally, within the Ambrose anchorage area that overlaps the proposed Mainline from approximately MP 17.0 to MP 20.1, the trench must be excavated to about 10 feet, as opposed to the maximum 7 feet deep required along the rest of the proposed Mainline. Therefore, the sediment dispersion and deposition model was modified to include this section, since Liberty is proposing to use a jet sled to achieve the added 3 feet of burial depth (Appendix I). The additional jet-sledding activities is expected to last 8 days during mid-July 2016, and backfilling is expected to take 21 days between August and September 2016. In state waters, the predicted extent of a sediment plume was up to 10,452 feet, which was for a plume with 25 mg/L suspended solid concentration from hand jetting. Averaging all excavation methods, however, would produce a "typical" 25 mg/L plume of about 2,739 feet in state waters. Plumes of high suspended solid concentration (i.e., 100 mg/L) averaged 385 feet (by hand jet) to 919 feet (by jet sled). The maximum area of a 0.2-inch deposition was estimated as 2,541 feet. For federal waters, sediment plumes and deposition were generally lower, due to the smaller proportion of fine-size particles. The maximum plume size in federal waters was estimated as 7,715 feet, with a concentration of 25 mg/L, associated with jet sled activities. A "typical" plume of 25 mg/L would be about 1,241 feet in federal waters, when all excavated methods are averaged. On average, sediment plumes with high suspended solid concentrations (i.e., 100 mg/L) were predicted to extend an average of 315 feet (by hand jet) to 1,016 feet (backfill by tremie). The maximum area of 0.2-inch sediment deposition in federal waters was predicted as 2,485 feet. Maximum values are predicted to occur in isolated areas, while mean values are more representative of a more typical outcome. Therefore, based on mean values, elevated concentrations of suspended solids (in excess of 50 mg/L) are likely to occur within about 1,400 feet of

[4] Required by the Office of Pipeline Safety, Department of Transportation and published in 49 CFR 192.327 and 49 CFR 195.248.

the proposed Mainline in state waters and within about 700 feet in federal waters. Heavy deposition (of 0.8 inch or greater) is estimated to occur within 190 feet of the proposed Mainline in state waters and within 110 feet in federal waters. Therefore, dispersion and sedimentation impacts on benthic resources would be focused around the proposed Mainline during construction activities. Turbidity and sedimentation would also result from the anchor chain sweep, but these impacts are discussed in terms of normal operation.

Impacts from trenching and backfilling would be localized and short-term due to the rapid and efficient nature of the construction methods used. No significant disturbances from construction or installation would be expected to extend beyond the permanent footprint of the proposed Port facilities and the area encompassing the cable sweep of the STL Buoy anchor chains.

4.2.2.2 Impacts of Operation

Permanent impacts from operation of the proposed Project would be limited to the movement of the mooring lines and anchor chain sweep and the approximately 3.0 acres of seafloor required for the PLEMs, STL Buoy landing pads and anchoring system.

LNGRVs calling on the proposed Project would be connected to the STL Buoy system, so they would not create direct impacts on the seafloor. However, as the LNGRVs drift with the prevailing winds and currents, tension on the STL Buoy mooring system would cause the anchor chains to sweep along the seafloor, scouring the bottom and creating small, localized turbidity plumes. Any benthic organisms in the area affected by the anchor chain sweep would experience direct mortality. These impacts would persist for the duration of proposed Port operation. However, these impacts would be minor because the area of impact would be relatively small compared to similar habitat throughout the ROI.

The impacts of an anchor chain sweep and resulting turbidity and sediment dispersal were modeled for the proposed Calypso LNG Deepwater Port Project (USCG 2008). This model was used as a predictor for the current proposed Port Ambrose Deepwater Port Project, since the proposed Projects and environmental conditions are similar. Both proposed Projects stipulated eight or nine anchor chains to moor an STL Buoy, though total chain length is less for the proposed Port Ambrose Project. Also, bottom sediment is predominantly sands in the ROI of both proposed Projects, though the proposed Port Ambrose Project has less fines (silts and clays). Current velocities just above the sediment have been measured as 0.20 to 0.26 feet per second (ft/sec) for the proposed Port Ambrose Project, which is less than the median current velocity of 0.43 ft/sec measured for the proposed Calypso Project. Turbidity models for the Calypso Project may then be interpreted for the proposed Port Ambrose Project. For the proposed Calypso Project, anchor chain impacts could create suspended sediment concentrations 1 feet above the seafloor that range from 63 to 115 mg/L. If 15 mg/L defines the edge of the sediment plume, the maximum size would range from 558 to 807 feet, with a much smaller average plume. Since the proposed Port Ambrose Project has less anchor chain, a greater proportion of sand-size particles, and lower current velocities, the extent of the sediment plume is expected to be less than that predicted for the Calypso Project.

Another turbidity model conducted for the proposed Northeast Gateway STL buoy mooring system was also considered for applicability and relevance to the current proposed Project (ASA 2005). This model estimated the erosion and turbidity associated with a 100-year storm event; however, the conditions of the proposed Northeast Gateway Project are quite different than the proposed Port Ambrose Project. The Northeast Gateway Project proposed over 23,000 feet of anchor chain and was in an area dominated by fine particles; therefore, estimated TSS concentrations (686 mg/L) and sediment transport (7,527 feet) would be greater in extent than for the proposed Port Ambrose Project.

The hard structure associated with the anchors would provide beneficial impacts by allowing for the colonization of benthic organisms. Colonization of the proposed Port facility structures could result in an

artificial reef-type environment that would support development of pelagic fish communities. Since fishing activities would be prohibited within the Safety Zone, many marine species, especially those that are structure-oriented, may find refuge from commercial and recreational fishing pressure. Impacts beyond the permanent footprint of the proposed Port facilities would be short-term and minor.

4.2.2.3 Impacts of Decommissioning

Decommissioning activities would produce similar benthic impacts as previously described for construction activities. Decommissioning activities would result in similar localized, temporary disturbance of sediments and potential turbidity increases where installed mooring components would be removed from the bottom.

During the recovery of Port facility structures, short-term minor impacts resulting from increased turbidity and displacement could occur. Anchor piles would be backed out by pumping seawater into the pile and recovering it for onshore recycling/disposal. Alternatively, the pile could be cut below the mudline should conditions warrant. While this would decrease the extent and duration of turbidity impacts, it would also result in the permanent removal of benthic habitat created by the pile. Additionally, if fish had used the piles or structures as an artificial reef, the decommissioning may also remove fish habitat and refuge. Therefore, decommissioning of anchor piles would have a long-term, moderate impacts on benthic habitat. The proposed Mainline would be abandoned in-place; therefore, impacts of decommissioning would not be expected.

4.2.3 Plankton

Plankton include free-floating organisms, either plant or animal, with limited to no mobility. These organisms constitute an important part of the food web; therefore, disruptions to phytoplankton, diatom, zooplankton, or ichthyoplankton may affect higher trophic levels. Construction, operation, and decommissioning may result in entrainment of plankton or localized environmental changes to habitat (e.g., turbidity plumes or temperature increases).

4.2.3.1 Impacts of Construction

Turbidity

Short-term, minor, adverse impacts on plankton would occur as a result of turbidity increases associated with the construction of the proposed Project facilities. Indirect impacts would occur because increases in turbidity would cause a reduction in the depth of light penetration, and would have the potential to negatively impact phytoplankton productivity (Berry et al. 2003). Turbidity impacts on marine zooplankton and ichthyoplankton could include reduced vertical migrations, reduced feeding, direct mortality and toxicity, and physiological impairment (Berry et al. 2003; Byrnes et al. 2003). Laboratory tests indicated that mysids exposed to 230 mg/L of natural sediment and copepods exposed to 1,020 mg/L of natural sediment for 28 days experienced 40 percent and 60 to 80 percent mortality, respectively (Berry et al. 2003). Impacts on zooplankton from turbidity are expected to be restricted to the lower portion of the water column (Byrnes et al. 2003).

Impacts on zooplankton are designated as minor because the impacts are expected to be short-term or localized (in the immediate vicinity of the disturbed area and restricted to the lower portion of the water column). Turbidity associated with the installation of the proposed Port facilities would occur in the water column during the excavation of the connection with the existing Transco pipeline on a short-term basis. Therefore, adverse impacts on phytoplankton, diatoms, zooplankton, and ichthyoplankton would be minor.

As presented in more detail in Section 4.2.2.1, turbidity impacts resulting from construction activities are expected to be greatest within a focused area around the proposed Mainline. Suspended solid concentrations of 50 mg/L or greater are likely to be found within 1,400 feet of the proposed Mainline in

state waters and within 700 feet in federal waters. Substantial sedimentation of 0.8 inch or greater is expected to occur within 190 feet of the proposed Mainline in state waters and within 110 feet in federal waters. In general, turbidity impacts on plankton would be restricted to these areas.

Entrainment

Short-term, minor, adverse impacts on ichthyoplankton would result from construction activities. The location of the buoys offshore minimizes ichthyoplankton impacts, since the area has lower densities of fish eggs and larvae. Most fish eggs range from 400 to 450 microns; therefore, these entrainment estimates, based on data collected with 333-micron mesh, should sufficiently represent typical egg densities. Construction activities, including the lowering of the proposed Mainline an additional 3.0 feet within the Ambrose anchorage area, from MP 17.0 to MP 20.1, are estimated to result in the greatest entrainment mortality. During the construction phase of the proposed Project, estimated entrainment is 44,027,806 eggs and 4,075,044 larval fish (Appendix J), plus 5,175,331 eggs and 596,555 larval fish during the added 3-foot burial in the Ambrose anchorage area (Appendix J). This equates to a loss of 24,138 age-1 fish, plus 2,834 age-1 fish from the additional 3.0 feet of pipeline lowering, which is an increase of 11.8 percent (Appendix J). Combined with losses during operation, maintenance, and decommissioning (discussed in the following two sections), the total loss corresponds to 3,482 pounds of fishery yield worth $2,392; far less than 1 percent of annual commercial and recreational harvest.

For zooplankton, at least 21 species of copepod inhabit the New York Bight. The copepod abundance in the inner New York Bight (i.e., up to 66 feet deep) can range from 1,000 to 90,000 individuals per cubic meter and from 200 to 8,000 individuals per cubic meter in the outer New York Bight, based on the season and including all species of copepod (USFWS 1997). One-time limited duration activities, including hydrostatic testing, deepwater port commissioning, and other construction activities, would remove an estimated total of 1.4 to 57.6 billion copepods, depending on the season (see Table 4.3-2), from the outer New York Bight. Using nearshore copepod densities of all species combined, the one-time limited duration construction activities in the inner New York Bight would remove an estimated total of 2.8 to 248.2 billion copepods (see Table 4.3-3). In particular, the removal of copepods, a popular prey item for many marine species, may impact the food web by causing cascading impacts up and down the food chain (USCG and MARAD 2006a). Copepods are the dominant member of zooplankton and a major food source for fish, whales, seabirds, and other crustaceans. They also comprise the largest animal biomass in the ocean environment and contribute a large amount of the secondary productivity in the ocean environment. It has been estimated that large cetaceans would consume about 4 percent of their body weight per day (Seageant 1969). Large whales can ingest up to 461 million copepods per day, totaling approximately 14 billion copepods per month (Durbin et al. 2002). These animals have been found in groups of up to 30 individuals (Watkins and Schevill 1976). If every individual in a group ingests roughly the same amount of copepods (461 million/day), a group of 30 right whales would ingest over 13.8 billion copepods per area per day.

The efficiency of energy transfer between tropic levels is 10 percent (i.e., consumers gain approximately 10 percent of the weight of the prey consumed). Assuming an average weight of 2.0×10^{-6} ounces per copepod (Hicks 1985), proposed Project construction would impact the food web by removing approximately 350 to 31,025 pounds of copepod biomass per year using offshore copepod densities, or 175 to 7,200 pounds of copepod biomass per year using nearshore copepod densities. Moreover, this biomass would not be completely lost to the marine food web. Dead biomass would still be available to detritivores.

The USEPA's Section 316(b) of the Clean Water Act (CWA) would subject LNG facilities to impingement and/or entrainment control requirements on a case-by-case basis using the best professional judgment. A majority of the existing facilities do not fit the criteria under the Phase III scope of the rule (50 mgd; 25 percent used for cooling purposes). It is known that LNG facilities could withdraw more than 50 mgd and use more than 25 percent of water for cooling purposes; however, there has not been a

standard technology identified for offshore facilities. Technologies may be applicable for some facilities, but this is determined case-by-case and would be subject to the best professional judgment.

Construction Support Vessel Intake and Discharges

Short-term, minor, adverse impacts on phytoplankton would result from intake and discharge from construction support vessels. Water use during construction is identified in Table 4.1-1. An irreversible impact from entrainment of organisms within the approximately 1,862.6 million gallons of surface seawater used by construction vessels would result in direct impacts on phytoplankton communities. However, impacts would be short-term and limited to the construction period.

Hydrostatic Testing Intake and Discharge

Short-term, minor, adverse impacts on phytoplankton would result from hydrostatic testing intake and discharges during construction. A one-time irreversible impact from entrainment of organisms within the approximately 3.5 million gallons of surface seawater used during flushing and hydrostatic testing of the proposed Mainline would result in direct impacts on phytoplankton communities. Although the seawater would be screened to prevent fish from being swept into the proposed Mainline, and filtered to remove sediment during filling of the proposed Mainline, phytoplankton would be entrained. A low-toxicity biocide and corrosive inhibitor would be used to inhibit biofouling and corrosion. Discharge water at the PLEMs would be tested for the concentration of the biocide THPS, collected in a mixing tank, dosed with an appropriate concentration of hydrogen peroxide, and discharged below the water surface using a diffuser. Hydrostatic test water discharges, therefore, would occur over a limited time frame and, with appropriate pre-discharge treatment (neutralization with hydrogen peroxide), such discharges are expected to result in localized, short duration, and minor impacts on water quality. As required, the Applicant would obtain an NPDES permit to discharge hydrostatic test water into the New York Bight.

LNGRV Commissioning

Short-term, minor, adverse impacts on phytoplankton would result from water intake and discharge from initial LNGRV commissioning. Once the LNGRVs have been fully commissioned, no discharges are anticipated from LNGRVs during natural gas offloading at the proposed Port facilities. It is estimated that the average cooling water intake/discharge rate for an LNGRV could approach 8.2 mgd during initial LNGRV commissioning. Based on CORMIX modeling, the estimated temperature difference between cooling water intake and discharge is anticipated to be in the range of approximately 9 to 14°F (5 to 8°C), with a maximum difference of 18°F (10°C). Compliance with the USEPA's 1.8°F excess temperature criterion is predicted to occur within less than 90 feet of the point of discharge, which is well within the typical 328-foot regulatory mixing zone. The plume centerline temperature is predicted to drop from 18°F greater than ambient at the point of discharge to less than 1.8°F greater than ambient within approximately 30 to 90 feet downcurrent of the point of discharge. Therefore, water temperature changes would be within a confined area, so adverse impacts on plankton would be short-term and minor.

Routine Discharges

The routine vessel discharges during construction discussed in Section 4.1 would not result in adverse impacts on planktonic species. Routine discharges from these marine vessels would include deck runoff and engine cooling water. All gray water and sanitary wastewater would be stored onboard for appropriate disposal. All discharges from the marine vessels would comply with USCG requirements and the requirements highlighted in Table 1.4-1.

Accidental Releases of Fuel, Oil, and Other Chemicals

Accidental releases of substances, such as fuel, oil, and other chemicals stored and/or in use in support of construction, could degrade water quality with potential adverse short-term impacts on planktonic species. In the case of an emergency, a Spill Response Plan would be followed to handle any accidental spills so

that they would be small and not enter the ocean. Models suggest that a spill of up to 84 gallons would rapidly dissipate, with the actual rate dependent upon environmental conditions. A model was developed using NOAA's ADIOS to predict the dissipation rate of the maximum most probable discharge of 2,500 barrels (105,000 gallons) of fuel oil. Dissipation was rapid; the amount of time it took to reach concentrations of less than 0.05 percent varied between 0.5 and 2.5 days, depending on ambient wind. Concentrations of less than 0.5 percent occurred within 44 hours with 10 knot winds and within 11 hours with 20 knot winds. A thermal discharge plume may cause temperature stress in planktonic organisms, though it is not likely to be detrimental.

Lighting

Negligible impacts on plankton are expected to occur as a result of lighting associated with the proposed Project construction. While phytoplankton, zooplankton, and some ichthyoplankton respond to light cues, any potential for altered responses resulting from lighting used during construction would be negligible relative to the planktonic populations in the ROI and the greater New York Bight.

4.2.3.2 Impacts of Operation

Turbidity

Short-term, minor, adverse impacts on plankton would occur as a result of turbidity increases associated with the proposed Project operation in the same manner as described in Section 4.2.3.1. Routine operation activities with potential to impact turbidity are limited to the movement and possible minor bottom scouring associated with anchor chains, wire, and umbilical systems. As previously discussed, the total area of seafloor expected to be directly impacted by such movement is 1.4 acres per buoy and any resulting turbidity is not expected to extend beyond the approximate 3,138-foot radial footprint of the buoy mooring legs. However, indirect impacts may extend beyond this footprint.

As previously detailed (see Section 4.2.2.2), anchor chain sweep impacts are estimated to be less than those modeled for the proposed Calypso LNG Deepwater Port Project (USCG 2008). Due to shorter anchor chain length, a smaller proportion of fine-size sediment, and lower current velocities, anchor chain sweep impacts for the proposed Port Ambrose Project are expected to be lower than those predicted for the proposed Calypso Project. Therefore, suspended sediment concentrations are expected to be less than a maximum predicted value of 63 to 115 mg/L, and maximum plume size would be expected to be less than 558 to 807 feet. Maximum values reflect isolated and extreme conditions; typical TSS concentration and sediment plume size would be less. Therefore, only plankton within this restricted area may be affected by turbidity during normal operation and impacts would be expected to be localized and minor.

Entrainment

Long-term, minor, adverse impacts on ichthyoplankton would result from construction activities. Lower densities of fish eggs and larvae in the ROI minimizes entrainment effects. During operation and maintenance of the proposed Project, estimated entrainment is 40,070,732 eggs and 5,986,906 larval fish (Appendix J). This equates to a loss of 24,106 age-1 fish. The total loss of ichthyoplankton throughout the life of the proposed Project equates to 3,270 pounds of fishery yield, valued at $2,262; far less than 1 percent of annual commercial and recreational harvest.

For zooplankton, at least 21 species of copepod inhabit the New York Bight. The copepod abundance in the inner New York Bight (i.e., up to 66 feet deep) can range from 1,000 to 90,000 individuals per cubic meter and from 200 to 8,000 individuals per cubic meter in the outer New York Bight, based on the season and including all species of copepod (USFWS 1997). Peak activity at the proposed Port would occur in the winter (a time of low copepod abundance) and in the summer (a time of high copepod abundance), affecting 0.88 to 35.36 billion copepods, respectively, over the course of a year (see Table 4.3-2). In particular, the removal of copepods, a popular prey item for many marine species, may impact the food web by causing cascading impacts up and down the food chain (USCG and MARAD

2006a). Copepods are the dominant member of zooplankton and a major food source for fish, whales, seabirds, and other crustaceans. They also comprise the largest animal biomass in the ocean environment and contribute a large amount of the secondary productivity in the ocean environment. It has been estimated that large cetaceans would consume about 4 percent of their body weight per day (Seageant 1969). Large whales can ingest up to 461 million copepods per day, totaling approximately 14 billion copepods per month (Durbin et al. 2002). These animals have been found in groups of up to 30 individuals (Watkins and Schevill 1976). If every individual in a group ingests roughly the same amount of copepods (461 million/day), a group of 30 right whales would ingest over 13.8 billion copepods per area per day.

The efficiency of energy transfer between tropic levels is 10 percent (i.e., consumers gain approximately 10 percent of the weight of the prey consumed). Assuming an average weight of 2.0×10^{-6} ounces per copepod (Hicks 1985), the proposed Project would impact the food web by removing approximately 110 to 4,420 pounds of copepod biomass per year. Moreover, this biomass would not be completely lost to the marine food web. Dead biomass would still be available to detritivores.

LNGRV Ballast Water Intake

Long-term, minor, adverse impacts on phytoplankton would result from impingement and entrainment from LNGRV ballast water intake over the life of the proposed Project. When an LNGRV is connected to an STL Buoy in regasification mode, seawater from its ballast water tanks would be used as a source of cooling water. Water would be recycled to and from the ballast water tanks, thus there would be no discharge of cooling water at the proposed Port facilities. It is estimated that while connected to the STL Buoy, the LNGRV would withdraw approximately 1.93 mgd at the annual natural gas sendout rate of 400 MMscf/d, at intake velocities less than 0.5 ft/sec. Minor impacts on plankton via entrainment would occur as a result of water intakes associated with the support vessel used during the proposed Project operation due to the comparatively small sizes of those vessels and the volume of cooling water used.

Routine Discharges

The routine vessel discharges during the proposed Project operation to the ROI would not degrade water quality, as discussed in Section 4.1, and therefore would not result in adverse impacts on planktonic species. Routine discharges would include deck runoff from the LNGRV and support vessel and engine cooling water from the support vessel. All gray water and sanitary wastewater would be stored onboard for appropriate disposal. All discharges from the marine vessels would comply with USCG requirements and the requirements highlighted in Table 1.4-1.

Accidental Releases of Fuel, Oil, and Other Chemicals

Accidental releases of fuel, oil, and other chemicals stored and/or in use in support of construction could degrade water quality with potential localized, short-term negative impact on planktonic species. A Spill Response Plan would be set in-place to handle emergency situations to ensure that any accidental spills would be small and contained, not entering the sea. Impacts would be expected to be similar to those associated with an accidental spill during construction, as discussed in Section 4.2.3.1. Models suggest that a spill of up to 84 gallons would rapidly dissipate, with wind stress and abiotic factors affecting the actual rate of dispersion. Based on a NOAA ADIOS model, predicted dissipation of a maximum spill of 2,500 barrels (105,000 gallons) is rapid. Using a 10-knot wind, oil concentrations of 0.5 percent occurred within 44 hours, and reached less than 0.05 percent within 58 hours. Modeling a 20-knot wind, 0.5 percent concentrations were reached within 11 hours, and less than 0.05 percent oil was reached within 11 hours.

LNG Spills

Short-term, minor, direct adverse impacts on plankton could occur in the unlikely event of an LNG spill. All LNGRVs are designed with features to minimize the potential for LNG spills (see Section 2.1).

However, if an LNG spill were to occur, potential impacts would include exposure to low-temperature LNG at the water surface, possibly resulting in frostbite or death and asphyxiation by natural gas vapors above the surface of the water. These impacts would likely occur in the immediate vicinity of the spill location; the time frame of the impact is limited (see Section 5). Since LNG would boil off as natural gas at the surface, depth and pressure required for gas to dissolve (Artemov et al. 2005) in surface waters would not be sufficient and gas vapors would disperse. In addition, the time frame for these impacts would be limited, and adverse toxic impacts would be expected to be minor after the LNG boiled off and the vapors dispersed.

The potential for a release of natural gas from the proposed Mainline and pipeline laterals are remote. If there were a subsea release of natural gas, the gas would rise to the water surface rapidly and dissipate. In general, whether a release is sudden or extended, physics dictate that any methane would gradually dissolve into the water column during the lifetime of the bubble as described by Fick's law, taking into account Henry's law constants, partial pressure and concentrations of dissolved gases (Artemov et al. 2005). Once a gas bubble reaches the surface, it would rise (being lighter than air) and be dispersed by air currents. Plankton impacts from such a release would be short-term and minor.

Planned and Unplanned Maintenance and Repair

Short-term, minor, adverse impacts on phytoplankton would result from intake and discharge from support vessels during maintenance and repair. Depending on the severity of the maintenance or repair, vessels would be similar to those used during construction as described in Section 4.2.3.1. Water use during construction is identified in Table 4.1-1. An irreversible impact from entrainment of organisms within surface seawater used by construction vessels during maintenance and repair events would result in direct impacts on phytoplankton communities. However, impacts would be short-term and limited to the associated maintenance and repair period.

It is anticipated that planned maintenance activities would occur on a regular basis either annually or biennially; whereas repair activities, either planned or unplanned, would occur on a less frequent basis. Planned maintenance activities are typically short in duration (several days or less) and would include attaching/detaching and/or cleaning the buoy pick-up line to the STL Buoy, performing surveys and inspections with a remotely operated vehicle (ROV), and cleaning or replacing parts (e.g. bulbs, batteries, etc.) on the floating navigation (i.e., marker) buoys. Inspections and surveys would also be conducted after a significant storm event.

Repairs can be either minor or major. Minor repairs are typically shorter in duration and could include replacing faulty pressure transducers, or repairing a stuck valve. These kinds of repairs would require one diver support vessel with three or four anchors to hold its position. Minor repairs could take from a few days to several weeks depending on the nature of the problem.

Major repairs, on the other hand, are longer in duration and typically require large construction vessels similar to those used to install the proposed Mainline and set the buoy and anchoring system. These vessels would typically mobilize from local ports, Canada, or the Gulf of Mexico. Major repairs typically require upfront planning, equipment procurement, and mobilization of vessels and possibly saturation divers. Examples of major repairs are damage to the riser or umbilical line and their possible replacement, damage to the proposed Mainline system and manifolds, or anchor chain replacement. These types of repairs could take up to two to four weeks.

Lighting

Negligible impacts on plankton are expected to occur as a result of lighting associated with the proposed Project's operation, as described in Section 4.2.3.1. The proposed Port would require operational lighting for 24-hour operations with illuminated deck lights for LNGRVs and require navigational beacons; however, once the LNGRV has successfully docked, the lighted buoys would be taken onboard and

turned off. Lights would be downshielded to illuminate the deck only and would not intentionally illuminate the surrounding waters. While phytoplankton, zooplankton, and some ichthyoplankton respond to light cues, any potential for altered responses resulting from lighting used during operation would be negligible relative to the planktonic populations in the ROI and the greater New York Bight.

4.2.3.3 Impacts of Decommissioning

Turbidity

Short-term, minor, adverse impacts on plankton would occur as a result of turbidity increases associated with the proposed Project decommissioning in the same manner as described in Section 4.2.3.1. The proposed Mainline and pipeline laterals would be abandoned in-place to be consistent with current federal policies to minimize adverse impacts, and the benthic habitat that has re-established itself on the seafloor above the buried proposed Mainline would not be disturbed. Only the removal of the STL Buoy systems would require disturbing the benthic habitat below those structures, exposing plankton to short-term and minor increased turbidity in the water column. Once these systems are removed, that benthic habitat once again would become available for rapid recolonization by sessile and infaunal benthic organisms. The process of capping and flushing of the ends of the proposed Mainline could also result in short-term, localized, and minor impacts on plankton in the ROI. Since the proposed Mainline itself would be abandoned in-place, no turbidity would be generated along its route.

Entrainment

Short-term, minor, adverse impacts on ichthyoplankton would result from decommissioning the proposed Project. Lower densities of fish eggs and larvae in the area around the buoys would minimize entrainment of ichthyoplankton. During decommissioning activities, estimated entrainment is 2,573,528 eggs and 296,648 larval fish (Appendix J). This equates to a loss of 1,411 age-1 fish. The total entrainment loss of ichthyoplankton throughout the life of the proposed Project equates to 3,270 pounds of fishery yield, valued at $2,262; far less than 1 percent of annual commercial and recreational harvest. Entrainment losses of ichthyoplankton during decommissioning would be short-term, resulting in minor impacts.

For zooplankton, at least 21 species of copepod inhabit the New York Bight. The copepod abundance in the inner New York Bight (i.e., up to 66 feet deep) can range from 1,000 to 90,000 individuals per cubic meter and from 200 to 8,000 individuals per cubic meter in the outer New York Bight, based on the season and including all species of copepod (USFWS 1997). One-time limited duration activities for deepwater port decommissioning would remove an estimated total of 0.1 to 3.96 billion copepods, depending on the season (see Table 4.3-2), from the outer New York Bight. In particular, the removal of copepods, a popular prey item for many marine species, may impact the food web by causing cascading impacts up and down the food chain (USCG and MARAD 2006a). Copepods are the dominant member of zooplankton and a major food source for fish, whales, seabirds, and other crustaceans. They also comprise the largest animal biomass in the ocean environment and contribute a large amount of the secondary productivity in the ocean environment. It has been estimated that large cetaceans would consume about 4 percent of their body weight per day (Seageant 1969). Large whales can ingest up to 461 million copepods per day, totaling approximately 14 billion copepods per month (Durbin et al. 2002). These animals have been found in groups of up to 30 individuals (Watkins and Schevill 1976). If every individual in a group ingests roughly the same amount of copepods (461 million/day), a group of 30 right whales would ingest over 13.8 billion copepods per area per day.

The efficiency of energy transfer between tropic levels is 10 percent (i.e., consumers gain approximately 10 percent of the weight of the prey consumed). Assuming an average weight of 2.0×10^{-6} ounces per copepod (Hicks 1985), proposed Project decommissioning would impact the food web by removing approximately 12.4 to 495 pounds of copepod biomass per year. Moreover, this biomass would not be completely lost to the marine food web. Dead biomass would still be available to detritivores.

Vessel Intake and Discharge

Short-term, minor, adverse impacts on phytoplankton would result from intake and discharge from vessels used during decommissioning. Decommissioning activities would occur in the proposed Port area only; therefore, the extent of the impacts would be over a much smaller area than that associated with the original construction. Section 4.2.3.1 discusses additional issues of construction impacts that may be similar to decommissioning impacts.

Routine Discharges

As discussed in Section 4.1, the routine vessel discharges during proposed Project operation would not result in adverse impacts on planktonic species. Routine discharges from these marine vessels would include deck runoff and engine cooling water. All gray water and sanitary wastewater would be stored onboard for appropriate disposal. All discharges from the marine vessels would comply with USCG requirements and the requirements highlighted in Table 1.4-1.

Accidental Releases of Fuel, Oil, and Other Chemicals

Accidental releases of fuel, oil, and other chemicals stored and/or in use in support of proposed Project decommissioning could degrade water quality with potential adverse short-term impacts on planktonic species. A Spill Response Plan would be set in-place to handle emergency situations to ensure that any accidental spills would be small and contained, not entering the sea. Impacts would be expected to be similar to those associated with an accidental spill during construction, as discussed in Section 4.2.3.1.

Lighting

Negligible impacts on plankton (as described in Section 4.2.3.1) are expected to occur as a result of lighting associated with the proposed Project decommissioning. While phytoplankton, zooplankton, and some ichthyoplankton respond to light cues, any potential for altered responses resulting from lighting used during construction would be negligible relative to the planktonic populations in the ROI and the greater New York Bight.

4.2.4 Fisheries Resources

Over 100 marine species use the marine waters of the New York Bight, most of which live in the coastal area. Since a variety of species are found in the ROI, impacts of construction, operation, and decommissioning would vary by species and habitat. For consistency with other biological resources, the following sections present impacts on fisheries resources from the activities during three distinct phases of the proposed Project. For a complete impact analysis organized by ecological guild, as defined in Section 3.2.3, refer to Appendix F. Effects to feeding ecology, and associated trophic guilds, are integrated in this section. Most species may experience little to no effect, while others may experience sub-lethal to lethal effects. Effects to ichthyoplankton are discussed in Section 4.2.3; this section pertains to juvenile and adult fish. Large, mobile individuals would likely be able to avoid most effects associated with the proposed Project, while early lifestages and small individuals (both invertebrates and vertebrates) may be more susceptible to effects, since they are more limited to a given area. Overall, a relatively small proportion of fish may be affected, which would have a negligible impact on entire populations.

4.2.4.1 Impacts of Construction

Benthic Habitat

Impacts on benthic resources and habitat are discussed in Section 4.2.2. Short-term, negligible, adverse impacts on demersal fish would occur as a result of seafloor disturbance during proposed Project construction. The plowed installation and burial of the proposed Mainline and pipeline laterals would result in a short-term disturbance of approximately 219 acres of seafloor along the length of the proposed Mainline route. Direct and indirect impacts on marine fish would include disturbance to benthic habitats

and localized increases in turbidity (discussed further in the Turbidity section below). The extent of adverse impacts on fish populations would be limited to those individuals in the immediate area of the proposed Mainline route during construction. Benthic disturbance is likely to result in decreased abundance or quality of prey items for crab-eaters, amphipod/shrimp eaters, and benthivores. If a fish is within, or approaches, the proposed Project area during construction, it would likely move away from the activity. Any fish that are displaced during construction would be expected to return following construction.

Turbidity

Short-term, minor, adverse impacts on fish would occur from turbidity associated with construction of the proposed Project. Activities that resuspend sediments have the potential to negatively impact early lifestages of demersal fish species (USEPA 1976; Colby and Hoss 2004). Turbidity-related impacts may include reductions in growth and feeding rates, and the clogging of respiratory structures. Impacts on demersal fish species from excess suspended sediments from the proposed construction activities have the potential to result in four types of effects: (1) no effect; (2) behavioral effects (e.g., alarm reaction or avoidance response); (3) sub-lethal effects (e.g., reduction in feeding rate or feeding success); and (4) lethal effects (e.g., direct mortality from increased predation or significant degradation of habitat) (Newcombe and Jensen 1996). The severity of impacts is typically associated with both the concentration of suspended sediments and the duration of exposure. The feeding behavior of fish that depend the most heavily on benthic resources (i.e., crab-eaters, amphipod/shrimp eaters, and benthivores) are the most likely to be temporarily impacted. If turbidity increases throughout the water column, though, all trophic guilds would be affected. The results from previous sediment transport modeling analyses of similar seafloor sediment composition showed that turbidity would not exceed 100 mg/L immediately at the jet-plow trench and would decrease to 10 mg/L or less within an hour, and would be confined to an area within 160 feet of the jet-plow trench. Those TSS levels expected during construction are unlikely to cause either lethal or sub-lethal effects to fish (Wilber and Clarke 2001). At most, demersal fish in the immediate area of impact may experience some temporary physiological stress; however, it is more likely that the other concurrent construction activities would elicit a temporary avoidance response and cause the fish to leave the area (Newcombe and Jensen 1996).

As presented in more detail in Section 4.2.2.1, turbidity impacts resulting from construction activities are expected to be focused around the proposed Mainline. Suspended solid concentrations of 50 mg/L or greater are likely to be found within 1,400 feet of the proposed Mainline in state waters and within 700 feet in federal waters. Substantial sedimentation of 0.8 inch or greater is expected to occur within 190 feet of the proposed Mainline in state waters and within 110 feet in federal waters. Most fish species are mobile enough to escape unfavorable turbidity, but demersal species and lifestages may experience greater impacts.

American sand lance, winter flounder, scallop, and longfin squid have egg stages that are demersal, but many other offshore species (hake, redfish, pollock, lobster, scallop, and surfclam) have larval stages that settle onto the bottom and are thus susceptible to turbidity-related impacts. Overall turbidity increases would be short-term and localized, with displaced fish expected to return shortly after construction ceased.

Construction Support Vessel Intake and Discharges

Based on habitat usage, the marine fish most likely to be affected by intakes at 20 and 32 feet below the surface are bay anchovies, summer flounder, red hake, king mackerel, and Spanish mackerel. There would be no impacts due to impingement of marine fish resources during construction activities, because the proposed Project intake velocities would be less than 0.5 ft/sec in keeping with best technology available standards set forth in Section 316(b) regulations under the CWA. These velocities are sufficiently low enough to allow juvenile and adult fish to escape impingement. Short-term, minor,

adverse impacts on ichthyoplankton would result from intake and discharge from construction support vessels. Water use during construction is identified in Table 4.1-1. Ichthyoplankton communities would be directly and irreversibly impacted by entrainment, as discussed in Section 4.2.3. However, impacts would be short-term and limited to the construction period.

Hydrostatic Testing Intake and Discharge

Fish most likely to be affected by intake would be the same as those described above. Short-term, minor, adverse impacts on ichthyoplankton would result from hydrostatic testing intake and discharges during construction (see Section 4.2.3.1 for impacts of construction on ichthyoplankton). Juvenile and adult fish might have a risk of impingement, but the use of screens, coupled with a low intake velocity, would mitigate this risk. Hydrostatic testing discharge might briefly and locally degrade water quality, with minor impacts on marine fish.

LNGRV Commissioning

Short-term, minor, adverse impacts on marine fish species would result from water discharge from initial LNGRV commissioning due to thermal plumes. Once the LNGRVs have been fully commissioned, no discharges are anticipated from LNGRVs during natural gas offloading at the proposed Port facilities. It is estimated that the average cooling water intake/discharge rate for a LNGRV could approach 8.2 mgd during this period. Based on CORMIX modeling, the estimated temperature difference between cooling water intake and discharge is anticipated to be in the range of approximately 9°F to 14°F (5°C to 8°C), with a maximum difference of 18°F (10°C). Compliance with the USEPA's 1.8°F excess temperature criterion is predicted to occur within less than 90 feet of the point of discharge, which is well within the typical 328-foot regulatory mixing zone. The plume centerline temperature is predicted to drop from 18°F greater than ambient at the point of discharge to less than 1.8°F greater than ambient within approximately 30 to 90 feet downcurrent of the point of discharge. Most marine fish are adept swimmers and would be capable of escaping an unfavorable thermal plume. Additionally, the plume would be small and dissipate rapidly, impacting very few individuals.

Routine Discharges

As discussed in Section 4.1, routine vessel discharges during the proposed Project construction would not result in adverse impacts on fish species. Routine discharges from these marine vessels would include deck runoff and engine cooling water. All gray water and sanitary wastewater would be stored onboard for appropriate disposal. All discharges from the marine vessels would comply with USCG requirements and the requirements highlighted in Table 1.4-1. Juvenile and adult fish have sufficient mobility to evacuate or avoid unfavorable conditions. Therefore, routine discharges would have a negligible impact on fish populations.

Accidental Releases of Fuel, Oil, and Other Chemicals

Accidental releases of fuel, oil, and other chemicals stored and/or in use in support of construction could degrade water quality with potential adverse short-term impacts on fish species. In the case of an emergency, a Spill Response Plan would be followed to handle any accidental spills so that they would be small and not enter the ocean. Models suggest that a spill of up to 84 gallons would rapidly dissipate, with wind stress and abiotic factors affecting the actual rate of dispersion. Based on a NOAA ADIOS model, predicted dissipation of a maximum spill of 2,500 barrels (105,000 gallons) is rapid. Using a 10-knot wind, oil concentrations of 0.5 percent occurred within 44 hours, and reached less than 0.05 percent within 58 hours. Modeling a 20-knot wind, 0.5 percent concentrations were reached within 11 hours, and less than 0.05 percent oil was reached within 11 hours.

Noise

Short-term, minor, adverse impacts on fish would result from noise generated during the proposed Project construction. Potential impacts of continuous sounds on marine fish include temporary threshold shifts (TTS), physiological stress response, and behavioral response (e.g., startle, alarm, avoidance), physiological damage to hearing structures, or in more severe instances, hemorrhaging in the body cavity (permanent threshold shift or PTS). Chronic sub-lethal effects to physiology and behavior can also be detrimental, with the possibility of decreased survival or reproductive failure, resulting in low population abundance. Section 4.11 discusses the effects of noise on fisheries resources in more detail.

Sound sources of underwater construction noise associated with the proposed Project include impact pile driving (from anchor pile installation, if in the unlikely event geotechnical conditions preclude use of suction anchors), proposed Mainline and pipeline lateral installation, and construction vessel transit. A more detailed discussion of underwater noise resulting from each of these construction activities associated with the proposed Project is provided in Section 4.11, but the loudest noises are associated with pile driving.

The sensitivity of marine fish species to sound is highly variable and largely unknown, and there is broad variability in hearing capabilities within single fish groups, yet NOAA has conservatively established interim noise exposure criteria for pile-driving impacts on marine fish at 180 decibel (dB) re 1 microPascal (µPa) peak. Noise impacts on marine fish resources depend on loudness, the specific acoustic frequency pattern at a given location, the distance from the sound source, and a fish's particular hearing sensitivity (MMS 2000a). Current data suggest that most species of fish detect sounds from 50 to 1,000 hertz (Hz), with few fish hearing sounds above 4 kilohertz (kHz) (Popper 2008). It is believed that most fish have their best hearing sensitivity from 100 to 400 Hz (Popper 2003). Additionally, some clupeids (shad in the subfamily Alosinae) possess ultrasonic hearing (i.e., able to detect sounds above 100,000 Hz) (Astrup 1999).

Hearing capabilities of fish have been studied in less than 0.01 percent of fish species (NRC 2003). Ramcharitar et al. (2006) investigated the hearing sensitivity of weakfish (*Cynoscion regalis*), which were found to detect frequencies up to 2 kHz. The sciaenid with the greatest hearing sensitivity discovered thus far is the silver perch (*Bairdiella chrysoura*), which has responded to sounds up to 4 kHz (Ramcharitar et al. 2004). Atlantic cod (*Gadus morhua*) may also be able to detect high-frequency sounds of up to 38 kHz at 185 to 200 dB relative to re 1 µPa (Astrup and Mohl 1993). Experiments on several species of the Clupeidae (i.e., herrings, shads, and menhadens) have obtained responses to frequencies between 40 kHz and 180 kHz (Astrup 1999). Mann et al. (1998) reported that the American shad can detect sounds from 0.1 to 180 kHz. This shad species has relatively high thresholds (about 145 dB re 1 µPa) (Mann et al. 1997). Likewise, other Alosid herring, including alewife (*Alosa pseudoharengus*) and blueback herring (*Alosa aestivalis*), have upper hearing thresholds in the range of 100 to 120 kHz. In contrast, the Clupeidae bay anchovy (*Anchoa mitchilli*) and Spanish sardine (*Sardinella aurita*) did not respond to frequencies over 4 kHz (Gregory and Clabburn 2003; Mann et al. 2001). Fish use sound to communicate aggression, reproduction, and defense, thus disruptions to their ability to hear or produce noises may impact inter- and intra-specific interactions. The effect of noise on feeding behavior and predator defense would apply to all six trophic guilds. Further detail regarding effects of construction on fish communication is provided in Section 4.11.2.2.

Invertebrates, especially cephalopods, may also be impacted by underwater noise, though these effects are not well understood (Mooney et al. 2012). Packard et al. (1990) found that squid, octopus, and cuttlefish can detect stimuli from 1 to 100 Hz, but it is believed that the animals use statocysts (hair cells) to detect acceleration in the water around them, but it remains unclear whether they can detect the pressure of a sound field (Packard et al. 1990; Wilson et al. 2007; Hu et al. 2009). Since the hearing capacity of cephalopods is still undetermined, it is difficult to assess the effects of acoustic stress on these invertebrates. Noise associated with the construction of the proposed Project, especially pile driving if

warranted, would be temporary. Coupled with the well-developed swimming ability of cephalopods, these animals would not be expected to be negatively impacted by noise.

While impacts from pile-driving activities would be possible during construction in the unlikely event geotechnical conditions preclude use of suction anchors, the impact potential from pile driving along with associated vessel noise would be short-term and minor. It is probable that most adult fish would leave the construction area temporarily because of in-water disturbances, and the distance between the fish and the noise source would increase, thereby minimizing the chance of injury. Individuals that are temporarily displaced by pile driving or vessel noise without injury would be expected to return immediately following construction. Since the probability of hearing impact decreases as sounds attenuate with distance from a source (MMS 2002), impacts on fish as a result of proposed Project construction noise would be indirect, short-term, and minor.

Because impact piling was assessed to have the highest potential for sound generation (over the widest area) associated with the proposed Project, the Applicant's preferred mooring design is the use of suction anchors. All sound sources from the construction phase of the proposed Project are considered to have a minor impact on species of fish. Because the behavioral response of fish to a perceived marine sound depends on a range of factors, including: (1) sound pressure level (SPL); (2) frequency, duration, and novelty of the sound; (3) the physical and behavioral state of the animal at the time of perception; and (4) the ambient acoustic features of the environment (Hildebrand 2004), it is more difficult to predict behavioral shifts due to anthropogenic sounds. The radiation of sound to marine waters during construction of the proposed Project would likely be within the immediate vicinity of the proposed Project, and effects would be expected to be temporary, hence "harassment" (TTS) for all species is expected to be minor. Although species abundance varies by season in the ROI, the likelihood of "harm" (PTS) or "harassment" (TTS) from the proposed Project to individuals or species due to underwater sound would be unlikely because of the transient and seasonal nature of the species moving through the ROI and the ability of animals to move away from sound sources.

Vessel Traffic

Short-term, negligible, adverse impacts on marine fish would occur as a result of construction vessel traffic during proposed Project construction. Construction of the proposed Project would result in a slight increase in vessel traffic. The proposed Port facilities would be located adjacent to the approach to the Ambrose Channel, already one of the busiest shipping channels on the U.S. Atlantic Coast. Therefore, this slight increase in vessel traffic would be negligible in comparison to existing vessel traffic in the area.

While fish behavior in the vicinity of a vessel is quite variable (e.g., avoidance, attraction, school compression, etc.), vessels do not normally collide with adult or juvenile fish, most of which can detect and avoid them (Jørgensen et al. 2004), reducing the potential for vessel strikes. Early lifestages of most fish could be displaced by vessels and not struck in the same manner as adults of larger species. However, a vessel's propeller movement or propeller wash could entrain early lifestages. The low-frequency sounds of large vessels or accelerating small vessels caused avoidance responses among herring (Chapman and Hawkins 1973), but avoidance ended within 10 seconds after the vessel departed.

Vessel strikes do pose threats to a limited number of large, slow-moving fish at the surface (Kappel 2005), although this is not considered a major threat to most marine fish expected to occur within the ROI. Sturgeon, particularly Atlantic sturgeon, are vulnerable to ship strikes (Brown and Murphy 2010). Whale sharks (*Rhincodon typus*), basking sharks (*Cetorhinus maximus*), ocean sunfish (*Mola* species), and manta rays (*Manta birostris*) have also been struck by vessels (NMFS 2010c; Rowat et al. 2007; Stevens 2007). Vessel strikes may occur for a limited number of fish at the surface; however, the slight increase in vessel traffic during construction would not substantially increase the strike risk from existing vessel traffic in the area.

Ingestion of Marine Debris

Short-term, negligible, adverse impacts on marine fish would result from the accidental release of marine debris (e.g., ropes, plastic, etc.) during construction. Marine debris of a size that can be swallowed by a fish could be eaten either at the surface, in the water column, or at the seafloor; therefore, all six trophic guilds may be impacted. Open-ocean planktivores and piscivores are most likely to ingest materials in the water column, though. Coastal bottom-dwelling predators and estuarine bottom-dwelling predators, such as crab-eaters and benthivores, could ingest materials from the seafloor. The potential for fish to encounter and ingest marine debris depends on their feeding group, size, and geographic range. While no aspect of the proposed action includes the intentional "dumping" of debris in the marine environment, it is possible that during routine construction activities some construction-related debris could end up as marine debris. Existing regulations prohibit the disposal of plastic, dunnage, lining, floating packing materials, and all other trash within 12 miles of the coast. Further, as a standard operating procedure (SOP), all vessels associated with the proposed Project would be prohibited from dumping trash of any kind. Solid waste management training would be provided that emphasizes the importance of minimizing impacts on marine mammals, sea turtles, and migratory birds. This combination of proposed Project policy and existing regulations would ensure that any marine debris accidentally expended within the proposed Project area would be negligible.

Entanglement

Negligible impacts on marine fish would occur from entanglements in anchor lines, tethers, or other materials during construction. Unlike typical fishing nets and lines, the equipment used during construction would not be designed for trapping or entanglement purposes. It may be possible that an item capable of entangling a fish (rope, plastic, etc.) could inadvertently fall into the water from the deck of a construction vessel. Most fish entanglement observations involve abandoned or discarded nets, lines, and other materials that form loops or incorporate rings (Derraik 2002; Keller et al. 2010; Laist 1987; Macfadyen et al. 2009). A 25-year dataset assembled by the Ocean Conservancy reported that fishing line, rope, and fishing nets accounted for 68 percent of fish entanglements, with the remainder due to encounters with various items such as bottles, cans, and plastic bags (Ocean Conservancy 2010).

Fish entanglement occurs most frequently at or just below the surface or in the water column where objects are suspended. A smaller number involve objects on the seafloor, particularly abandoned fishing gear designed to catch bottom fish or invertebrates (Ocean Conservancy 2010). More fish species are entangled in coastal waters and the continental shelf than elsewhere in the marine environment because of higher concentrations of human activity (e.g., fishing, sources of entangling debris), higher fish abundances, and greater species diversity (Helfman et al. 2009; Macfadyen et al. 2009).

STL tethers and anchor lines securing the derrick/lay barge would be large in diameter, knotless, nonfloating, and taut, and would only be deployed for a short period of time. These materials would be too large to entangle a fish. In addition, anchor lines would be separated by hundreds of feet as they radiated away from the vessel and would not be laterally connected to other lines, thereby avoiding the creation of a "web effect."

Lighting

Short-term, minor, adverse impacts on marine fish would result from lighting used during construction. Lighting used during construction would primarily be limited to the vessels (navigation lights, spotlights, decklights, etc.) used to illuminate the work area both on the vessel and on the water. Lights would be downshielded to illuminate the deck only and would not intentionally illuminate the surrounding waters. Certain types of lighting are known to attract some marine organisms, including fish. Artificial light can temporarily influence feeding patterns in isolated areas where small baitfish are attracted to lighting, which draws in larger predatory species that feed on those prey species. Precautions would be made to

minimize the amount of lighting needed directly on the water surface, as appropriate, while maintaining a safe work area.

Alteration to Prey Species Abundance and Distribution

Benthic fauna serve as a food source for fish in several trophic guilds (in particular, crab-eaters, amphipod/shrimp eaters, and benthivores); therefore, indirect adverse impacts on benthic communities during construction could cause individual fish to avoid feeding in the area for a short period and move into adjacent areas. The benthic community associated with the seafloor would be expected to rapidly recover following disturbance (Brooks et al. 2006). Typically, following this type of disturbance, a diverse benthic infaunal community would be recolonized from organisms associated with substrate adjacent to disturbed areas within a matter of one to three years (Byrnes et al. 2004; Lundquist et al. 2010), resulting in long-term moderate, but isolated, impacts on the benthic prey species abundance and distribution. However, the isolated areas of impact would not result in population-level effects to the benthic community, and thus fish populations, of the New York Bight.

4.2.4.2 Impacts of Operation

Benthic Habitat

Impacts on benthic resources and habitat are discussed in Section 4.2.2. Long-term, negligible, adverse impacts on demersal fish would occur as a result of seafloor disturbance from anchor chain sweep during proposed Project operation in the same manner as described in Section 4.2.4.1. The anchor cables and flexible risers would disturb the seafloor as they sweep along the bottom substrate during routine operations. The continual disturbance of these soft substrates would result in the loss of food and habitat resources for fish that utilize soft substrates. However, this area represents a negligible proportion of the available acreage of soft sediments in the New York Bight. The hard structure associated with the anchors would provide beneficial impacts by allowing for the colonization of benthic organisms, which would serve as a food resource for fish, as well as provide a structure for fish to congregate around. Anchor chains can provide some limited structure for fish to congregate near. However, it is anticipated that suction and driven piles would have minor beneficial impacts on fish during operation.

Turbidity

Long-term, negligible, adverse impacts on fish would occur as a result of turbidity increases associated with the proposed Project operation, in the same manner as described in Section 4.2.4.1. Routine operation activities with potential to impact turbidity are limited to the movement and possible minor bottom scouring associated with anchor chains, wire, and umbilical systems. As previously discussed, the total area of seafloor expected to be directly impacted by such movement is 1.4 acres per buoy and any resulting turbidity is expected to be greatest within the approximate 3,138-foot radius footprint of the buoy mooring legs.

As previously detailed (see Section 4.2.2.2), anchor chain sweep impacts are estimated to be less than those modeled for the proposed Calypso LNG Deepwater Port Project (USCG 2008), because of shorter anchor chain length, a smaller proportion of fine-size sediment, and lower current velocities. Suspended sediment concentrations are expected to be less than a maximum predicted value of 63 to 115 mg/L, and maximum plume size would be expected to be less than 558 to 807 feet. Maximum values reflect isolated and extreme conditions; typical TSS concentration and sediment plume size would be less. During routine operation, fish would likely avoid areas of increased turbidity, resulting in negligible impacts, though they would last throughout the life of the proposed Project.

LNGRV Ballast Water Intake

No impact on fish species would result from impingement from LNGRV ballast water intake over the life of the proposed Project. Entrainment impacts on ichthyoplankton are discussed in Section 4.2.3. When an

LNGRV is connected to an STL Buoy in regasification mode, seawater from its ballast water tanks would be used as a source of cooling water. Water would be recycled to and from the ballast water tanks, thus there would be no discharge of cooling water at the proposed Port facilities. It is estimated that while connected to the STL Buoy, the LNGRV would withdraw approximately 1.93 mgd at the annual natural gas sendout rate of 400 MMscf/d, at intake velocities less than 0.5 ft/sec. Due to this low velocity, marine fish would be capable of swimming away, avoiding impingement. Negligible impacts on fish via impingement would occur as a result of water intakes associated with the support vessel used during proposed Project operation due to the comparatively small sizes of those vessels and the volume of cooling water used.

Routine Discharges

Routine discharges would not result in adverse impacts on fish or ichthyoplankton. Routine discharges would include deck runoff from the LNGRV and support vessel and engine cooling water from the support vessel. All gray water and sanitary wastewater would be stored on-board for appropriate disposal. All discharges from the marine vessels would comply with USCG requirements and the requirements highlighted in Table 1.4-1. Juvenile and adult fish have sufficient mobility to evacuate or avoid unfavorable conditions. Therefore, routine discharges would have a negligible impact on fish populations.

Accidental Releases of Fuel, Oil, and Other Chemicals

As presented in Section 4.2.4.1 (the impacts of construction on fisheries resources), the accidental release of materials is highly unlikely, although possible short-term, direct, and adverse impacts would result. In the most extreme case, acute mortality could result. Water quality could be affected in the spill area, but spills would likely dissipate. In the case of a spill, however, a Spill Response Plan would be followed to stop or minimize any foreign substances from entering the ocean.

LNG Spills

Short-term, minor, direct adverse impacts on fisheries resources could occur in the unlikely event of an LNG spill. All LNGRVs are designed with features to minimize the potential for LNG spills (see Section 2.1). However, if an LNG spill were to occur, potential impacts would include exposure to low-temperature LNG at the water surface, possibly resulting in frostbite or death and asphyxiation by natural gas vapors above the surface of the water. These impacts would likely occur in the immediate vicinity of the spill location; the time frame of the impact is limited (see Section 5). Since LNG would boil off as natural gas at the surface, depth and pressure required for gas to dissolve (Artemov et al. 2005) in surface waters would not be sufficient and gas vapors would disperse. In addition, the time frame for these impacts would be limited, and adverse toxic impacts would be expected to be minor after the LNG boiled off and the vapors dispersed.

The potential for a release of natural gas from the proposed Mainline and pipeline laterals is remote. The proposed Mainline and pipeline laterals would be buried or covered before proposed Port operations commence, making damage to the pipeline resulting in leaks less likely. Other than the unlikely event of a pipe leak or rupture, operation of the proposed Mainline and pipeline laterals are not expected to create environmental disturbances. While Patin (1999) suggests that for fish species an adverse pattern (impaired movement, cell damage and other anomalies) indicative of toxicity resulted from the sudden release of natural gas (methane) into the marine environment, avoidance effects were observed when concentrations of dissolved gas ranged from 0.1 to 0.5 mg/L. Fry of species in laboratory studies showed avoidance behavior in the presence of 0.02 to 0.05 mg/L of gas. Increased temperatures and decreased oxygen saturation appeared to increase the susceptibility of fish to these impacts (Patin 1999). However, while chronic exposure of fish to the presence of natural gas in the water environment may suggest a relatively low resistance for behavior response and fish mortality, additional study is lacking.

In addition, dissolution of natural gas into the marine environment also occurs naturally from seeps and from methane hydrates and contributes to higher methane concentrations in some regions of the earth's marine environment. These are typically more gradual releases of methane, occurring over an extended period of time, with finer bubble sizes ranging from 0.04 to 0.4 inches and typically at significantly greater depths (greater than 295 feet), pressures and lower temperatures than those along the proposed Mainline and pipeline laterals. Smaller bubble sizes and greater depths and pressures contribute to more gas being dissolved and less gas (calculated at approximately 18 percent at approximately 295 feet) reaching the surface for atmospheric dispersion (Artemov et al. 2005). Studies specifically relating to toxicity impacts on indigenous fish in these likely elevated gas environments were not readily available.

In general, whether a release is sudden or extended, physics dictate that any methane would gradually dissolve into the water column during the lifetime of the bubble as described by Fick's law, taking into account Henry's law constants, partial pressure and concentrations of dissolved gases (Artemov et al. 2005). Once a gas bubble reaches the surface, it would rise (being lighter than air) and be dispersed by air currents. Neither methane seeps nor gas hydrates are found in the vicinity of the proposed Port or Mainline; therefore, background levels of methane are anticipated to be low and representative of waters in the New York Bight. If a subsea release of natural gas occurs, the limited quantity of gas released would rise to the water surface rapidly and would dissipate. Natural gas is non-toxic to the atmospheric environment. Any localized increase of natural gas concentration in the water column would be short-term, minor, would dissipate with time and distance, and would likely be avoided by fish.

Planned and Unplanned Maintenance and Repair

Short-term, minor, adverse impacts on fish would result from intake and discharge from support vessels during planned and unplanned maintenance and repair. Depending on the severity of the maintenance or repair, vessels would be similar to those used during construction as described in Section 4.2.4.1. Water use during construction is identified in Table 4.1-1. Maintenance vessels would also use screens and low-intake velocities (i.e., 0.5 ft/sec), thus water intake would have negligible impingement risk for marine fish. Discharges may cause temperature stress for marine fish, but impacts would likely be short-term and minor. The extent and duration of planned and unplanned maintenance and repair impacts would likely change on a case-by-case basis.

Repairs can be either minor or major. Minor repairs are typically shorter in duration and could include replacing faulty pressure transducers, or repairing a stuck valve. These kinds of repairs would require one diver support vessel with three or four anchors to hold its position. Minor repairs could take from a few days to several weeks depending on the nature of the problem.

Major repairs, on the other hand, are longer in duration and typically require large construction vessels similar to those used to install the proposed Mainline and set the buoy and anchoring system. These vessels would typically mobilize from local ports, Canada, or the Gulf of Mexico. Major repairs typically require upfront planning, equipment procurement, and mobilization of vessels and possibly saturation divers. Examples of major repairs are damage to the riser or umbilical line and their possible replacement, damage to the proposed Mainline system and manifolds, or anchor chain replacement. These types of repairs could take up to two to four weeks.

Noise

Long-term, minor, adverse impacts on fish would result from noise generated during proposed Project operation. Support vessel and LNGRV noise is the primary noise producing factor during operations. A more detailed discussion of underwater noise resulting from operation activities associated with the proposed Project is provided in Section 4.11. Since pile driving, if required, would be considered worst-case and be limited to construction activities only in the unlikely event geotechnical conditions preclude use of suction anchors, the potential for noise impacts during operations is substantially reduced and limited to noise associated with LNGRV transiting and regasification and the support vessel. Underwater

noise is anticipated to be produced by the LNGRVs during the approach, mooring, maneuvering on the buoy and regasification procedures. A standby support vessel would also be located in close proximity to the LNGRVs during mooring and regasification. The highest energy source of underwater sound during the operation phase would be from vessel transits near the proposed Port and from mooring activities. Vessel sounds during operations would result from propeller cavitation and propulsion, in addition to flow noise from water dragging across the hull and bubbles breaking in the wake. The dominant sound source from vessels would be propeller cavitation with noise intensity dependent upon size and speed of the vessel. Noise impacts from LNGRVs would be expected to be comparable to those generated by common and existing vessel traffic in the New York Bight.

All operational sound sources are considered to have minor consequences to species of fish relative to "harm" criteria (PTS). The radiation of sound to marine waters during operations is expected to be temporary, hence "harassment" (TTS) for all species is considered minor. Although species abundance varies by season and species in the ROI, the likelihood of "harm" (PTS) or "harassment" (TTS) from the proposed Project to individuals or species due to underwater sound is unlikely because of the transient and seasonal nature of the species moving through the ROI, and the ability of animals to move away from sound sources.

Vessel Traffic

Long-term, negligible, adverse impacts on marine fish would occur as a result of LNGRV and support vessel traffic during proposed Project operation. The proposed Port facilities would be located adjacent to the approach to the Ambrose Channel, already one of the busiest shipping channels on the U.S. Atlantic Coast. Therefore, this slight increase in vessel traffic would be negligible in comparison to existing vessel traffic in the area. Fish behavior in the vicinity of transiting vessels and the risk for vessel strike would be expected to be similar to that described in Section 4.2.4.1. Vessel traffic during operation is limited to the LNGRV and support vessel.

Ingestion of Marine Debris

Long-term, negligible, adverse on marine fish would result from the accidental release of marine debris (e.g., ropes, plastic, etc.) during operation. Marine debris of a size that can be swallowed by a fish could be eaten either at the surface, in the water column, or at the seafloor; therefore, all six trophic guilds may be impacted. Though open-ocean planktivores and piscivores are most likely to ingest materials in the water column. Coastal bottom-dwelling predators and estuarine bottom-dwelling predators, such as crab-eaters and benthivores, could ingest materials from the seafloor. The potential for fish to encounter and ingest marine debris depends on their feeding group, size, and geographic range. As a SOP, all vessels associated with the proposed Project would be prohibited from dumping trash of any kind. Solid waste management training would be provided that emphasizes the importance of minimizing impacts on marine mammals, sea turtles, and migratory birds. This combination of proposed Project policy and existing regulations would ensure that any marine debris accidentally expended within the proposed Project area would be negligible as described in Section 4.2.4.1.

Entanglement

Long-term, negligible, adverse impacts on marine fish would result from entanglement during operation due to the large size of materials and remote chance that items capable of entangling a fish might be inadvertently discharged into the water. Impacts are expected to be similar to those described in Section 4.2.4.1. STL Buoy and anchor chains would be large in diameter, knotless, nonfloating, and taut. These materials would be too large to entangle a fish. In addition, anchor lines would be separated by hundreds of feet as they radiated away from the STL Buoy and would not be laterally connected to other lines, thereby avoiding the creation of a "web effect."

Lighting

Long-term, minor, adverse direct and indirect impacts on marine fish would result from lighting used by the LNGRV and support vessel during operation, as described in Section 4.2.4.1. Lighting used during construction would primarily be limited to the vessels (navigation lights, spotlights, decklights, etc.) used to illuminate the work area both on the vessel and on the water. Lights would be downshielded to illuminate the deck only and would not intentionally illuminate the surrounding waters. Certain types of lighting are known to attract some marine organisms, including fish. Artificial light can temporarily influence feeding patterns in isolated areas where small baitfish are attracted to lighting, which draws in larger predatory species that feed on those prey species. Precautions would be made to minimize the amount of lighting needed directly on the water surface, as appropriate, while maintaining a safe work area. The lighting used on the proposed Project vessels may result in temporary and isolated fish attraction, but would not result in population-level impacts on the fish resources in the proposed Project area.

Alteration to Prey Species Abundance and Distribution

Long-term, moderate, but isolated, impacts on the benthic prey species abundance and distribution would occur during operation, potentially affecting the primary benthic-dependent trophic guilds (i.e., crab-eaters, amphipod/shrimp eaters, and benthivores). Approximately 3.0 acres of seafloor would be occupied by proposed Port facilities or swept by the anchor chain and wire. This habitat area would be removed from access by organisms that otherwise would feed or live there. However, this acreage is inconsequential when compared to the habitat generally available in the New York Bight. The isolated areas of impact would not result in population-level effects to the benthic community, and thus the dependent fish species of the New York Bight as described in Section 4.2.4.1.

4.2.4.3 Impacts of Decommissioning

Benthic Habitat

Impacts on benthic resources and habitat are discussed in Section 4.2.2. Short-term, minor, adverse impacts on fish would occur from decommissioning the proposed Project. As described in Section 4.2.4.1, decommissioning activities would produce similar benthic impacts as previously described for construction activities. Decommissioning activities would result in similar localized, temporary disturbance of sediments and potential turbidity increases where installed mooring components would be removed from the bottom.

During the recovery of Port facility structures, short-term impacts resulting from increased turbidity and displacement could occur. Anchor piles would be cut below the mudline and abandoned in-place upon decommissioning, resulting in a permanent removal of these structures as benthic habitat.

Turbidity

Short-term, minor, adverse impacts on fish would occur as a result of turbidity increases associated with proposed Project decommissioning, in the same manner as described in Section 4.2.4.1. The proposed Mainline and pipeline laterals would be abandoned in-place to be consistent with current federal policies to minimize adverse impacts, and the benthic habitat that has re-established itself on the seafloor above the buried proposed Mainline would not be disturbed. Only the removal of the STL Buoy systems would require disturbing the benthic habitat below those structures, exposing fish to short-term and minor increased turbidity in the water column. Therefore, feeding behavior of all six trophic guilds may be temporarily impacted. Once these systems are removed, that benthic habitat once again would become available for rapid recolonization by sessile and infaunal benthic organisms and benthic fish species. The process of capping and flushing of the ends of the proposed Mainline could also result in short-term, localized, and minor impacts on fish in the proposed Project area. Since the proposed Mainline itself would be abandoned in-place, no turbidity would be generated along its route.

Vessel Intake and Discharge

Short-term, minor, adverse impacts on fisheries resources would result from intake and discharge from vessels used during decommissioning. Decommissioning activities would occur in the proposed Port area only; therefore, the extent of the impacts would be over a much smaller area than that associated with original construction. Section 4.2.4.1 discusses additional issues that may arise during decommissioning that are similar to construction impacts.

Routine Discharges

As discussed in Section 4.1, the routine vessel discharges during proposed Project decommissioning would not result in adverse impacts on fish species. Routine discharges from these marine vessels would include deck runoff and engine cooling water similar to construction. All gray water and sanitary wastewater would be stored onboard for appropriate disposal. All discharges from the marine vessels would comply with USCG requirements and the requirements highlighted in Table 1.4-1. Section 4.2.4.1 discusses additional issues that may arise during decommissioning that are similar to construction impacts.

Accidental Releases of Fuel, Oil, and Other Chemicals

Accidental releases of fuel, oil, and other chemicals stored and/or in use in support of proposed Project decommissioning could degrade water quality with potential adverse short-term impacts on fish species. Section 4.2.4.1 discusses additional issues that may arise during decommissioning that are similar to construction impacts.

Noise

Short-term, minor, adverse impacts on fish would result from noise during proposed Project decommissioning. Service vessel noise is the primary noise-producing factor during decommissioning. A more detailed discussion of underwater noise resulting from decommissioning activities associated with the proposed Project is provided in Section 4.11. Potential impacts of continuous sounds on marine fish include TTS, physiological stress and behavioral responses (e.g., startle, alarm, avoidance), physiological damage to hearing structures, or in more severe instances, hemorrhaging in the body cavity (PTS). Chronic sub-lethal effects to physiology and behavior can also be detrimental, with the possibility of decreased survival or reproductive failure, resulting in low population abundance. Since pile driving is limited to construction activities only in the unlikely event geotechnical conditions preclude use of suction anchors, the potential for noise impacts during decommissioning is substantially reduced and limited to noise associated with the support vessels, with similar impacts as described in Section 4.2.4.1.

Vessel Traffic

Short-term, negligible, adverse impacts on marine fish would occur as a result of vessel traffic during proposed Project decommissioning. Vessel traffic during decommissioning is limited to service vessels. The proposed Port facilities would be located adjacent to the approach to the Ambrose Channel, already one of the busiest shipping channels on the U.S. Atlantic Coast. Therefore, similar to construction, this slight increase in vessel traffic would be negligible in comparison to existing vessel traffic in the area. Fish behavior in the vicinity of transiting vessels and the risk for vessel strike would be expected to be similar to that in the same manner as described in Section 4.2.4.1.

Ingestion of Marine Debris

Short-term, negligible, adverse impacts on marine fish would result from the accidental release of marine debris (e.g., ropes, plastic, etc.) during operation. Marine debris of a size that can be swallowed by a fish could be eaten either at the surface, in the water column, or at the seafloor; therefore, all six trophic guilds may be impacted. Though open-ocean planktivores and piscivores are most likely to ingest materials in the water column. Coastal bottom-dwelling predators and estuarine bottom-dwelling predators, such as

crab-eaters and benthivores, could ingest materials from the seafloor. The potential for fish to encounter and ingest marine debris depends on their feeding group, size, and geographic range. As a SOP, all vessels associated with the proposed Project would be prohibited from dumping trash of any kind. Solid waste management training would be provided that emphasizes the importance of minimizing impacts on marine mammals, sea turtles, and migratory birds. This combination of proposed Project policy and existing regulations would ensure that any marine debris accidentally expended within the proposed Project area would be negligible, as described in Section 4.2.4.1.

Entanglement

Short-term, negligible, adverse impacts on marine fish would result from entanglement during operation due to the large size of materials and the remote chance that items capable of entangling a fish might be inadvertently discharged into the water. Unlike typical fishing nets and lines, the equipment used during decommissioning would not be designed for trapping or entanglement purposes. It may be possible that an item capable of entangling a fish (rope, plastic, etc.) could inadvertently fall into the water from the deck of a service vessel. STL tethers and anchor lines securing the derrick/lay barge would be large in diameter, knotless, nonfloating, and taut, and would only be deployed for a short period of time. These materials would be too large to entangle a fish. In addition, anchor lines would be separated by hundreds of feet as they radiated away from the vessel and would not be laterally connected to other lines, thereby avoiding the creation of a “web effect.” Impacts would be expected to be similar to those described for construction in Section 4.2.4.1.

Lighting

Short-term, minor, adverse impacts on marine fish would result from lighting used by support vessels during decommissioning, as described in Section 4.2.4.1. Lighting used during decommissioning would primarily be limited to the vessels (navigation lights, spotlights, decklights, etc.) used to illuminate the work area both on the vessel and on the water. Lights would be downshielded to illuminate the deck only and would not intentionally illuminate the surrounding waters. Certain types of lighting are known to attract some marine organisms, including fish. Artificial light can temporarily influence feeding patterns in isolated areas where small baitfish are attracted to lighting, which draws in larger predatory species that feed on those prey species. Precautions would be made to minimize the amount of lighting needed directly on the water surface, as appropriate, while maintaining a safe work area. The lighting used on the proposed Project vessels may result in temporary and isolated fish attraction, but would not result in population-level impacts on the fish resources in the proposed Project area.

Alteration to Prey Species Abundance and Distribution

Long-term, moderate, but isolated, adverse impacts on the benthic prey species abundance and distribution would occur during operation. Benthic fauna serve as a food source for fish in several trophic guilds (in particular, crab-eaters, amphipod/shrimp eaters, and benthivores); therefore, indirect adverse impacts on benthic communities during decommissioning could cause individual fish to avoid feeding in the area for a short period and move into adjacent areas. The benthic community associated with the seafloor would be expected to rapidly recover following disturbance from decommissioning (Brooks et al. 2006). Typically, following this type of disturbance, a diverse benthic infaunal community would be recolonized from organisms associated with substrate adjacent to disturbed areas within a matter of one to three years (Byrnes et al. 2004; Lundquist et al. 2010), resulting in long-term, moderate, but isolated, impacts on the benthic prey species abundance and distribution. However, the isolated areas of impact would not result in population-level effects to the benthic community, or to the dependent fish species of the New York Bight, as described in Section 4.2.4.1.

4.2.5 Non-Endangered Marine Mammals

The impact of the proposed Project on non-endangered marine mammals would vary depending on species and habitat usage. Only seven non-endangered marine mammal species are likely to occur in the ROI (see Section 3.2.4.1 for descriptions). Marine mammals are extremely mobile, likely avoiding physical, chemical, or biological disturbances. Therefore, most proposed Project-related activities would be avoided altogether.

4.2.5.1 Impacts of Construction

Turbidity

Short-term, minor, adverse impacts on non-endangered marine mammals would occur from turbidity associated with construction of the proposed Project. Plowing and jetting activities would displace bottom sediments and result in temporary water column and seafloor disturbances, as described in Section 4.2.2.1, which have the potential to impact marine mammals. While disturbed sediments would be suspended into the lower portion of the water column directly above the seafloor and cause a turbidity plume, bottom currents in the area typically are slow (less than 0.2 knots), and the coarse, sandy sediments should settle rapidly before any marine mammal would likely encounter it. Turbidity impacts resulting from construction activities are expected to be greatest within a focused area around the proposed Mainline (Section 4.2.2.1). Suspended solid concentrations of 50 mg/L or greater are likely to be found within 1,400 feet of the proposed Mainline in state waters and within 700 feet in federal waters. Substantial sedimentation of 0.8 inch or greater is expected to occur within 190 feet of the proposed Mainline in state waters and within 110 feet in federal waters. The likelihood of a marine mammal encountering a turbidity plume substantial enough to impact the animal would be very low. If one of these animals approaches the impacted area during construction, the animal would likely move away from the activity. Any marine mammals displaced during construction would be expected to return following construction.

Construction Support Vessel Intake and Discharges

Construction vessel intake and discharges, as discussed in Section 4.1, would not result in adverse impacts on non-endangered marine mammals. There would be no impacts due to impingement of marine fish resources (potential prey items) during construction activities because proposed Project intake velocities would be less than 0.5 ft/sec in keeping with best technology available standards set forth in Section 316(b) regulations under the CWA. These velocities are sufficiently low enough to allow juvenile and adult fish to escape impingement and would not impact non-endangered marine mammals.

Hydrostatic Testing Intake and Discharge

Hydrostatic testing intake and discharge discussed in Section 4.1 would not result in adverse impacts on non-endangered marine mammals.

LNGRV Commissioning

Short-term, minor, impacts on non-endangered marine mammals would result from water intake and discharge from initial LNGRV commissioning. Once the LNGRVs have been fully commissioned, no discharges are anticipated from LNGRVs during natural gas offloading at the proposed Port facilities. It is estimated that the average cooling water intake/discharge rate for an LNGRV could approach 8.2 mgd during this period. Based on CORMIX modeling, the estimated temperature difference between cooling water intake and discharge is anticipated to be in the range of approximately 9°F to 14°F (5°C to 8°C), with a maximum difference of 18°F (10°C). Compliance with the USEPA's 1.8°F excess temperature criterion is predicted to occur within less than 90 feet of the point of discharge, which is well within the typical 328-foot regulatory mixing zone. The plume centerline temperature is predicted to drop from 18°F greater than ambient at the point of discharge to less than 1.8°F greater than ambient within approximately 30 to 90 feet downcurrent of the point of discharge. A thermal plume from water discharge

may cause stress for local marine mammals; however, they would not likely be adversely affected, because the plume would be relatively small and would rapidly disperse.

Routine Discharges

Routine discharges would not result in adverse impacts on non-endangered marine mammals. Routine discharges from construction vessels would include deck runoff and engine cooling water. All gray water and sanitary wastewater would be stored onboard for appropriate disposal. All discharges from the marine vessels would comply with USCG requirements and the requirements highlighted in Table 1.4-1. Since only a small area would be impacted, discharges would dissipate, and marine mammals could avoid unfavorable conditions.

Accidental Releases of Fuel, Oil, and Other Chemicals

Accidental releases of fuel, oil, and other chemicals stored and/or in use in support of construction could degrade water quality with potential adverse short-term impacts on non-endangered marine mammals. In the case of an emergency, a Spill Response Plan would be followed to handle any accidental spills so that they would be small and not enter the ocean. Models suggest that a spill of up to 84 gallons would rapidly dissipate, with wind stress and abiotic factors affecting the actual rate of dispersion. Using NOAA's ADIOS model, dissipation rates of the maximum most probable discharge of 2,500 barrels (105,000 gallons) of fuel oil were predicted. The amount of time it took to reach concentrations of less than 0.05 percent varied between 0.5 and 2.5 days, depending on ambient wind. Concentrations of less than 0.5 percent occurred within 44 hours with 10-knot winds and within 11 hours with 20-knot winds. Therefore, an accidental spill would be expected to affect non-endangered marine mammals for an extended period of time.

Noise

Short-term, moderate, adverse impacts on non-endangered marine mammals would result from noise generated during proposed Project construction. Impulsive and continuous sound sources of underwater construction noise associated with the proposed Project include impact pile driving (from anchor pile installation, if in the unlikely event geotechnical conditions preclude use of suction anchors), and proposed Mainline and pipeline lateral installation, and support vessels. A more detailed discussion of underwater noise resulting from each of these construction activities associated with the proposed Project is provided in Section 4.11.

There are many natural and anthropogenic sound sources in the ocean, some of which have the potential to elicit a response from marine mammals, depending on the sound level, as well as the animal's hearing capabilities. In general, baleen whales and pinnipeds are more sensitive to low- and mid-frequency sounds (0 to 60 kHz), while dolphins and other toothed whales tend to be more sensitive to high-frequency sounds (up to 150 kHz and higher). National Oceanic and Atmospheric Administration, National Marine Fisheries Service (NOAA Fisheries) has established the following criteria for determining acoustic impacts on marine mammals: 180 dB re 1 μPa at 1 meter for Level A harassment; 160 dB re 1 μPa at 1 meter for Level B harassment (impulse noises); and 120 dB re 1 μPa at 1 meter for Level B harassment (continuous noises).

NOAA Fisheries released a draft document entitled *Draft Guidance for Assessing the Effects of Anthropogenic Sound on Marine Mammals* (NOAA Fisheries 2013c). The Draft Guidance was closed to public comment on March 14, 2014, and is anticipated to be finalized and released formally sometime this year. When finalized, the Draft Guidance is intended to be used as a tool to assess impacts of anthropogenic sound on marine fauna under the jurisdiction of NOAA Fisheries. It provides objective noise levels for which individual marine mammals are predicted to experience change in their hearing sensitivity, and is intended to be used by NOAA Fisheries and other relevant stakeholders when seeking to determine the impact of activities on marine mammals from underwater noise generation. In the Draft Guidance, NOAA Fisheries equates the onset of PTS with "harm" as defined in the ESA, and with "Level

A Harassment" as defined in the Marine Mammal Protection Act (MMPA). As such, PTS is considered equivalent to these two types of takes. NOAA Fisheries equates TTS as "harassment" as defined under the ESA and "Level B Harassment" as defined in the MMPA. It is worth noting that NOAA Fisheries also considers behavioral changes to constitute "harassment" and "Level B Harassment"; however, objective criteria for assessing behavioral change in marine mammals have not yet been finalized.

For comparison, Table 4.2-1 provides context for where these sounds fall within the spectrum of typical underwater sounds.

Table 4.2-1. Noise Levels of Common Marine Sound Sources

Source	Source Level (dB re 1 µPa at 1 meter)
Icebreaker Ship	193 a/
Large Tanker	186 a/
Seismic Air Gun Array (32 guns)	259 (peak) a/
Dolphin Whistles	125–173 a/
Dolphin Clicks	194–219 b/
Humpback Whale Song	144–174 c/
Snapping Shrimp	183–189 d/
Sperm Whale Click	236 e/
Lightning Strike	260 f/
Seafloor Volcanic Eruption	255 g/

a/ Richardson et al. 1995
b/ Rasmussen et al. 2002
c/ Payne and Payne 1985; Thompson et al. 1979
d/ Au and Banks 1998
e/ Levenson 1974; Watkins 1980
f/ Hill 1985
g/ Northrop 1974

Species of cetaceans and pinnipeds were assigned to functional hearing groups based on their hearing characteristics by Southall et al. (2007). Each functional hearing group has been assigned an M-weighting function to account for the fact that marine mammals do not hear equally well at all frequencies within their functional hearing range. M-weighting functions de-emphasize frequencies that are near the lower and upper frequency end of the estimated hearing range, where noise levels have to be higher to result in the same auditory effect (Southall et al. 2007). The M-weighting functions are similar in intent to the C-weighting function that is commonly used when assessing the impact of high-amplitude sounds on humans. NOAA's Draft Guidance suggests revision to the M-weighting functions and functional hearing groups to account for new research findings; both expanding the upper hearing range of low frequency (LF) cetaceans, and splitting pinnipeds into two families. Table 4.2-2 presents the estimated auditory bandwidth and species applicable to the associated functional hearing group.

Table 4.2-2. Marine Mammal Functional Hearing Groups from NOAA Draft Guidance
(NOAA Fisheries 2013c)

Functional Hearing Group	Estimated Auditory Bandwidth	Relevant Species
Low Frequency (LF) Cetaceans	7 Hz to 20 kHz	Baleen Whales
Mid Frequency (MF) Cetaceans	150 Hz to 160 kHz	Dolphins
High Frequency (HF) Cetaceans	200 Hz to 180 kHz	Harbor Porpoise
Phocid Pinnipeds	75 to 100 kHz	Seals

NOAA's Draft Guidance is anticipated to form the applicable criteria for assessing underwater noise impacts on marine mammals. The Guidance proposes dual criteria, utilizing both peak sound pressure in dB (dB_{peak}) and cumulative sound exposure level ($_c$SEL) metrics, with assessment to be based upon whichever criterion is exceeded first. Both M-weighted and unweighted SEL criteria are provided; however, NOAA Fisheries notes that the unweighted SEL criteria are likely to result in an overly conservative assessment, as they do not take into account the hearing sensitivity of the receiver functional hearing group. Table 4.2-3 outlines the criteria from the Draft Guidance.

Table 4.2-3. Applicable Underwater Noise Criteria for Cetaceans from NOAA Draft Guidance (NOAA Fisheries 2013c)

Functional Hearing Group	PTS Onset (Level A Harassment)		TTS Onset (Level B Harassment)	
	Impulsive	Non-impulsive	Impulsive	Non-impulsive
Low Frequency (LF) Cetaceans	230 dB_{peak} 187 db(M) $_c$SEL	230 dB_{peak} 198 db(M) $_c$SEL	224 dB_{peak} 172 db(M) $_c$SEL	224 dB_{peak} 178 db(M) $_c$SEL
Mid Frequency (MF) Cetaceans	230 dB_{peak} 187 db(M) $_c$SEL	230 dB_{peak} 198 db(M) $_c$SEL	224 dB_{peak} 172 db(M) $_c$SEL	224 dB_{peak} 178 db(M) $_c$SEL
High Frequency (HF) Cetaceans	201 dB_{peak} 161 db(M) $_c$SEL	201 dB_{peak} 180 db(M) $_c$SEL	195 dB_{peak} 146 db(M) $_c$SEL	195 dB_{peak} 160 db(M) $_c$SEL
Phocid Pinnipeds	235 dB_{peak} 192 db(M) $_c$SEL	235 dB_{peak} 197 db(M) $_c$SEL	229 dB_{peak} 177 db(M) $_c$SEL	229 dB_{peak} 183 db(M) $_c$SEL

Broadband noise source levels for the construction vessels would be approximately 170 to 180 dB re 1 μPa at 1 meter; within the hearing range of the non-endangered marine mammals. Vessel noise would be continuous, but would vary spatially depending on if the support vessel is in transit or moored at the proposed Port facilities. In general, baleen whale reactions to transient vessel noise include changes in swimming direction and speed, blow rate, and the frequency and kinds of vocalizations (Richardson et al. 1995). Baleen whales occasionally approach stationary or slow-moving boats but more commonly, avoid them. Avoidance is strongest when boats approach directly or when vessel noise changes abruptly. Long-term reactions of baleen whales to vessels vary, but some species tend to show habituation to frequent boat traffic. Over a 25-year observational study, minke whale reactions changed from frequent positive interaction to a general lack of interest; humpback whale reactions changed from being predominantly negative to being often positive; and finback reactions changed from being mostly negative to being mostly uninterested. During the same study, right whale reactions to vessels varied, but over the 25-year observation period, right whales consistently showed either uninterested or negative reactions to vessels, with no habituation or change over time (Watkins 1986).

Continuous noise created by construction vessels could create masking effects among marine mammals. Masking occurs when underwater noise interferes with an animal's ability to hear biologically relevant sounds. Ambient noise levels in the proposed Project area and surrounding waters are elevated and variable due to existing levels of shipping, fishing, and recreational vessel traffic. As a result, temporary increases due to construction vessel traffic would have a minimal contribution to the existing ambient noise. In addition, the transient nature and short-term duration of construction vessel noise would reduce the potential for masking to occur (LGL and Jasco 2005).

In general, marine mammal exposure to construction vessel noise would only occur for a finite period of time and would not be expected to have long-term population-level impacts on marine mammals. Under the MMPA, the potential for temporary acoustic exposures from construction activities would be expected to be within the non-injurious behavioral effects zone (Level B harassment) for marine mammals (USCG 2006a,b; FERC 2006). Because impact piling was assessed to have the highest potential for sound

generation (over the widest area) associated with the proposed Project, the Applicant's preferred mooring design is the use of suction anchors. All sound sources from the construction phase of the proposed Project are considered to have a minor impact on species of marine mammals, sea turtles, and fish. Because the behavioral response of marine mammals, sea turtles, and fish to a perceived marine sound depends on a range of factors, including: (1) the SPL; (2) frequency, duration, and novelty of the sound; (3) the physical and behavioral state of the animal at the time of perception; and (4) the ambient acoustic features of the environment (Hildebrand 2004), it is more difficult to predict behavioral shifts due to anthropogenic sounds. The radiation of sound to marine waters during the construction phase of the proposed Project would be within the immediate vicinity of the proposed Project, and effects are expected to be temporary, hence "harassment" (TTS) for all species is expected to be minor. Although species abundance varies by season in the ROI, the likelihood of "harm" (PTS) or "harassment" (TTS) from the proposed Project to individuals or species due to underwater sound is unlikely because of the transient and seasonal nature of the species moving through the ROI, and the ability of animals to move away from sound sources.

Vessel Traffic

Short-term, minor, adverse impacts on non-endangered marine mammals would occur as a result of support vessel traffic during proposed Project construction. Each of the marine mammal species potentially occurring in the ROI would be susceptible to vessel strike during construction of the proposed Project. Impacts from vessel collisions take two forms, propeller wounds and blunt trauma, and can cause injury or mortality to the individual involved (Laist et al. 2001). If struck, serious injury or mortality to the animal would result. Sub-lethal injury would range from minor to serious impacts, potentially leading to decreased feeding and reproductive success. Any marine mammal strike would be considered a "take" under the MMPA. While it is known that an increase in vessel traffic increases the risk of collision, the proportional probability of that risk associated with construction vessels cannot be quantified, particularly when vessel traffic is already high.

The Large Whale Vessel Strike Database (Strike Database) has documented 292 incidents of large whale/vessel collisions from 1975 to 2002, involving 11 species of whales. Of those incidents, 48 resulted in injury and 198 were fatal. The vessels involved in collisions included recreational vessels, freighters, tankers, cruise ships, and navy vessels, among others (Jensen and Silber 2004). The majority of serious injuries and mortalities are a result of impact with large vessels (greater than 262 ft long), although smaller vessels have caused some of these impacts (Laist et al. 2001). Small vessels might cause fewer collisions because they generally operate in clear weather and are relatively maneuverable, whereas larger vessels are less likely to detect nearby whales to be able to avoid collisions (Laist et al. 2001).

Where vessel speed was known (58 incidents), the Strike Database reported speeds ranging from 2 to 51 knots; most collisions occurred when vessels were traveling at speeds of 13 to 15 knots (Jensen and Silber 2004). A more recent study, which evaluated the effects of impact speed on whales, determined that a vessel traveling at 10.5 knots had a 50-percent chance of causing serious injury or mortality to the affected individual. This probability increased to 75 percent for vessels traveling at 14 knots, and exceeded 90 percent for vessels traveling at 17 knots (Pace and Silber 2005).

The Strike Database documented 28 confirmed vessel strikes of large whales off the coasts of New York and New Jersey, including two right whales, three humpback whales, two sperm whales, four minke whale, and one unknown species. Only one of the strikes, involving a humpback whale, did not result in mortality of the individual. It is likely that the numbers reported in the Strike Database are underestimates of the number of whales struck because it is unlikely that every incident was noticed and reported (Jensen and Silber 2004).

Installation of offshore components is scheduled to begin in early 2016 and take approximately nine months to complete. Installation activities would be completed during late fourth quarter 2016. Activity

performed, locations of activity, typical vessel example, operation and duration, and size by construction vessel type are given in Table 4.2-4. It is estimated that the majority of vessel traffic would be within the proposed Project area, with large vessel movement and speed contingent upon the task performed and duration (e.g., proposed Mainline installation). These vessels would most likely mobilize and demobilize once. Crew boats, on the other hand, would operate and transit the site more frequently, depending on duty.

Large vessels are only likely to mobilize/demobilize to the construction site once, whereas smaller vessels may transit the proposed Project area multiple times. Therefore, large vessels used for construction would only be a concern for a short duration. Additionally, a Marine Mammal and Sea Turtle Vessel Strike Avoidance Plan has been prepared to decrease risk of collisions (Appendix K). The mitigation measures detailed in Section 4.2.8 would be taken to avoid collisions.

Ingestion of Marine Debris

Short-term, negligible, adverse impacts on non-endangered marine mammals would result from the accidental release of marine debris (e.g., ropes, plastic, etc.) during construction. Ingestion of marine debris has been documented for bowhead and minke whales (Laist 1997), including plastic sheeting and polyethylene bags (Laist 1997). It is possible that mysticetes may ingest items found on the surface or within the water column, but with the exception of the humpback whale, it is not likely that mysticetes would encounter items found on the seafloor. Both sperm whales and beaked whales are known to incidentally ingest foreign objects while foraging; however, this does not always result in negative consequences to the animal's health (Laist 1997; Walker and Coe 1990). Existing regulations prohibit the disposal of plastic, dunnage, lining, floating packing materials, and all other trash within 12 miles of the coast. Further, as a SOP, all vessels associated with the proposed Project would be prohibited from dumping trash of any kind. Solid waste management training would be provided that emphasizes the importance of minimizing impacts on marine mammals, sea turtles, and migratory birds. This combination of proposed Project policy and existing regulations would ensure that any marine debris accidentally expended within the proposed Project area would be negligible.

Table 4.2-4. Construction Vessel Information

Activity	From MP	To MP	Vessel Type	"Typical" Vessel	Typical Operation and Duration	Length (m)	Breadth (m)	Draft (m)
Pipeline Installation	0	21.67	DP Pipelay Vessel	Allseas ***Lorelay***	24/7 45 days	182.5	25.8	8.1
Pipeline Lowering and Backfilling	0	21.67	DP Plow Vessel	CTC ***Volantis***	24/7 90 days	106.6	22.0	7.3
Hot Tap Tie-in	21.67		DP Dive Support Vessel (DSV)	Cal Dive ***Kestrel***	24/7 37 days	100.0	25.0	5.3
Collocated Y Install & Tie-in	0.0							
PLEM to Lateral Tie-ins	0.0							
Pipe Haul	0	21.67	Tug boat escorting barge	2000 hp tug (200 class barge)	24/7 45 days	30	8.6	8.1
Crew Boat	0	21.67	Crew Boat	Coastal Crewboats ***MW South Fork***	12/7 6 months	24.4	6.1	8.1
DP DWP Installations	Buoy 1 / Buoy 2		Heavy Lift Vessel	Jumbo ***Javelin***	24/7 26 days	144.2	26.7	7.5

Activity	From MP	To MP	Vessel Type	"Typical" Vessel	Typical Operation and Duration	Length (m)	Breadth (m)	Draft (m)
	Buoy 1 / Buoy 2		DP DSV	Cal Dive ***Kestrel***	24/7 58 days	100.0	25.0	5.3
Hot Tap Installation	0.0		Work barge (anchored) / Anchor Handling Tug support	Lewek ***Martin***	24/7 13 days	64.8	16.0	5.0
Hot Tap Cargo Barge	0.0		Tug boat escorting barge	2000 hp tug (200 class barge)	24/7 13 days	30	8.6	3.5
Flood, Hydrotest, Dewater	0.0		Work barge (anchored) / Anchor Handling Tug support	Lewek ***Martin***	24/7 45 days	64.8	16.0	5.0
	21.67		DP DSV	Cal Dive ***Kestrel***	24/7 45 days	100.0	25.0	5.3
Supplemental Lowering and Backfill Operations								
Supplemental Lowering (Jet Sled)	17	20.1	DP Jet Vessel	Cal Dive ***Kestrel***	24/7 for 8 days	100.0	25.0	5.3
Survey Boat	17	20.1	Survey Boat	Coastal Crewboats ***MW South Fork***	24/7 for 8 days	24.4	6.1	8.1
Jet Sled	17	20.1	Deployed from DP Jet Vessel		24/7 for 8 days			
Supplemental Backfill (Tremie)	17	20.1	DP Jet Vessel	Cal Dive ***Kestrel***	24/7 for 21 days	100.0	25.0	5.3
Hopper Haul Spread (assumes 4 tugs)	17	20.1	Tug boat escorting barge	2000 hp tugs (200 class barge)	24/7 for 21 days	30.0	8.6	8.1
Survey Boat	17	20.1	Survey Boat	Coastal Crewboats ***MW South Fork***	24/7 for 21 days	24.4	6.1	8.1

Entanglement

Short-term, minor, adverse impacts on non-endangered marine mammals would result from entanglement in anchor lines, tethers, or other materials during construction. Entanglement of marine mammals within derelict fishing gear, ropes, lines, or other marine debris has received much attention in recent decades and is an important threat to marine mammals. A 25-year dataset assembled by the Ocean Conservancy reported that fishing line, rope, and fishing nets accounted for most entanglements, with the remainder due to encounters with various items such as bottles, cans, and plastic bags (Ocean Conservancy 2010).

Construction barges and other vessels would use fixed anchoring methods, and the associated anchor cables could pose a risk of entanglement to marine mammals. Other lines and hoses would be associated with the jetting equipment at jetting locations. Marine mammals could be entangled by anchors, anchor lines, or buoy lines deployed during construction, but the potential for such an event would be low. Anchor lines securing the derrick/lay barge would be large in diameter, knotless, non-floating, and taut, and would only be deployed for a short period of time. In addition, anchor lines would be separated by

hundreds of feet as they radiated away from the vessel and would not be laterally connected to other lines, thereby avoiding the creation of a "web effect." With adherence to best management practices for detection of marine mammals in the area, the potential for entanglement associated with construction activities can be minimized. Combined, these factors would decrease the potential for marine mammal entanglement and impacts would be short-term and minor.

Lighting

Short-term, minor, adverse impacts on non-endangered marine mammals would result from lighting used during construction. Certain types of lighting are known to attract some marine organisms, including marine mammals. Artificial light could potentially confuse marine mammals approaching the proposed Project area where lighting is used during construction activities. Lighting used during construction would primarily be limited to the vessels (navigation lights, spotlights, decklights, etc.) used to illuminate the work area both on the vessel and on the water. Lights would be downshielded to illuminate the deck only and would not intentionally illuminate the surrounding waters. The Applicant has committed to minimize the amount of lighting needed directly on the water surface, while still providing a safe work area.

Marine mammals may be attracted to the lighting used during proposed Project construction, operations, or decommissioning. However, the nature of the other associated stressors covered in this section associated with the construction activities (i.e., noise, seafloor disturbance, etc.) would likely cause animals to move away from those activities, rather than be attracted to the proposed Project area, because of the lighting, resulting in minor and temporary impacts during construction.

Alteration to Prey Species Abundance and Distribution

Negligible, adverse impacts on marine mammals are expected to occur as a result of alteration to prey species abundance and distribution associated with the proposed Project during construction. The abundance and distribution of marine mammal prey species may be impacted during construction by turbidity, sedimentation, and noise, as well as entrainment during water withdrawals, as described above. The displacement of some prey species, like fish, may actually attract marine mammals away from the proposed Project construction. Since potential impacts on marine mammal prey species would be short-term and confined to the general vicinity of the construction activities, adverse impacts on marine mammals would be negligible.

Air Emissions

Negligible adverse impacts on non-endangered marine mammals are expected as a result of air emissions from support vessels during construction, not from regasification activities. Air emissions are expected to be similar to that of other vessels transiting the approach to Ambrose Channel in the proposed Project area. Components that have the potential to leak, such as connectors, valves, and flanges, are situated in a confined space that would include gas leakage detectors to alert workers of any issues immediately. Additionally, SOPs would be enacted to reduce the potential for fugitive emissions. Construction activities would contribute a very minor portion of total air emissions in the New York Bight, and emissions would be temporary.

4.2.5.2 Impacts of Operation

Benthic Habitat

Impacts on benthic resources and habitat are discussed in Section 4.2.2. Long-term, negligible, adverse impacts on non-endangered marine mammals would occur as a result of seafloor disturbance from anchor chain sweep during proposed Project operation, in the same manner as described in Section 4.2.5.1. The anchor cables and flexible risers would disturb the seafloor as they sweep along the bottom substrate during routine operations. The continual disturbance of these soft substrates would result in the loss of

food and habitat resources for marine mammals that utilize soft substrates. However, this area represents a negligible proportion of the available acreage of soft sediments in the New York Bight.

Turbidity

Long-term, negligible, adverse impacts on non-endangered marine mammals would occur as a result of turbidity increases associated with proposed Project operation, in the same manner as described in Section 4.2.5.1. Routine operation activities with potential to impact turbidity are limited to the movement and possible minor bottom scouring associated with anchor chains, wire, and umbilical systems. As previously discussed, the total area of seafloor expected to be impacted by such movement is 1.4 acres per buoy and any resulting turbidity is expected to be highest within the approximate 3,138-foot radial footprint of the buoy mooring legs.

Due to shorter anchor chain length, a smaller proportion of fine-size sediment, and lower current velocities, anchor chain sweep impacts for the proposed Project are expected to be lower than those predicted for the proposed Calypso Project (USCG 2008). Therefore, suspended sediment concentrations would be less than a maximum predicted value of 63 to 115 mg/L, and maximum plume size would be expected to be less than 558 to 807 feet. Maximum values reflect isolated and extreme conditions; typical TSS concentration and sediment plume size would be less. Turbidity resulting from anchor chain sweep would persist throughout the life of the proposed Project.

LNGRV Ballast Water Intake

Negligible, long-term, direct impacts on non-endangered marine mammals are expected to occur as a result of potential prey removal associated with the proposed Project ballast water intake during operation. When an LNGRV is connected to an STL Buoy in regasification mode, seawater from its ballast water tanks would be used as a source of cooling water. Water would be recycled to and from the ballast water tanks, thus there would be no discharge of cooling water at the Port facilities. It is estimated that while connected to the STL Buoy, the LNGRV would withdraw approximately 1.93 mgd at the annual natural gas sendout rate of 400 MMscf/d, at intake velocities less than 0.5 ft/sec.

At least 21 species of copepod inhabit the New York Bight. The copepod abundance in the inner New York Bight (i.e., up to 66 feet deep) can range from 1,000 to 90,000 individuals per cubic meter and from 200 to 8,000 individuals per cubic meter in the outer New York Bight, based on the season and including all species of copepod, not just those that have been identified as the preferred prey of whales (USFWS 1997). Peak activity at the proposed Port would occur in the winter (a time of low copepod abundance) and in the summer (a time of high copepod abundance), affecting 0.88 to 35.36 billion copepods, respectively, over the course of a year (Table 4.3-2).

In particular, the removal of copepods, a popular prey item for many large ESA-listed whales, may affect a few species. It has been estimated that large cetaceans would consume about 4 percent of their body weight per day (Seageant 1969). Large whales can ingest up to 461 million copepods per day, totaling approximately 14 billion copepods per month (Durbin et al. 2002). While ballast water intake would have minimal to moderate impact on the amount of food available for whales to forage, the dominant foragers of copepods, namely the humpback whale and North Atlantic right whale, feed further north and are not likely to depend on copepods in the ROI as a major part of their diets. Since potential impacts on prey species would be confined to the general vicinity of the proposed Port, it is not expected to adversely impact ESA-listed marine mammals.

Routine Discharges

As discussed in Section 4.1, the routine vessel discharges during proposed Project operation would not result in adverse impacts on non-endangered marine mammals. Routine discharges would include deck runoff from the LNGRV and support vessel and engine cooling water from the support vessel. All gray water and sanitary wastewater would be stored onboard for appropriate disposal. All discharges from the

marine vessels would comply with USCG requirements and the requirements highlighted in Table 1.4-1. Since only a small area would be impacted, discharges would dissipate, and marine mammals could avoid unfavorable conditions.

Accidental Releases of Fuel, Oil, and Other Chemicals

Accidental releases of fuel, oil, and other chemicals stored and/or in use in support of proposed Project operation could degrade water quality with potential adverse short-term impacts on non-endangered marine mammals within the proposed Project area. Risks associated with construction (Section 4.2.5.1) would be similar, albeit less during operation. An accidental release of a substance is expected to dissipate, even with an extreme spill reaching concentrations of less than 0.05 percent in less than 2.5 days (see Section 4.2.5.1 for more detail).

LNG Spills

Short-term, minor, direct, adverse impacts on non-endangered marine mammals could occur in the unlikely event of an LNG spill. All LNGRVs are designed with features to minimize the potential for LNG spills (see Section 2.1). However, if an LNG spill were to occur, potential impacts would include exposure to low-temperature LNG at the water surface, possibly resulting in frostbite or death and asphyxiation by natural gas vapors above the surface of the water. These impacts would likely occur in the immediate vicinity of the spill location; the time frame of the impact is limited (see Section 5). Since LNG would boil off as natural gas at the surface, depth and pressure required for gas to dissolve (Artemov et al. 2005) in surface waters would not be sufficient and gas vapors would disperse. In addition, the time frame for these impacts would be limited, and adverse toxic impacts would be expected to be minor after the LNG boiled off and the vapors dispersed.

The potential for a release of natural gas from the proposed Mainline and pipeline laterals are remote. If there were a subsea release of natural gas, the gas would rise to the water surface rapidly and dissipate. In general, whether a release is sudden or extended, physics dictate that any methane would gradually dissolve into the water column during the lifetime of the bubble as described by Fick's law, taking into account Henry's law constants, partial pressure and concentrations of dissolved gases (Artemov et al. 2005). Once a gas bubble reaches the surface, it would rise (being lighter than air) and be dispersed by air currents. Non-endangered marine mammal impacts from such a release would be short-term and minor.

Noise

Long-term, moderate, adverse impacts on non-endangered marine mammals would occur as a result of noise associated with proposed Project operation. Support vessel and LNGRV noise is the primary noise producing factor during operations. All construction sound sources would be considered to have minor consequences to species of marine mammals relative to harm criteria (PTS). The radiation of sound to marine waters during operations is expected to be temporary, hence “harassment” (TTS) for all species would be considered minor. Although species abundance varies by season and species in the ROI, the likelihood of “harm” (PTS) or “harassment” (TTS) from the proposed Project to individuals or species due to underwater sound would be unlikely because of the transient and seasonal nature of the species moving through the ROI, and the ability of animals to move away from sound sources. Noise levels predicted for LNGRV transit and mooring activities show the TTS criterion to be exceeded for high frequency (HF) cetaceans (harbor porpoises) within 38 kilometers (km) of the source, and PTS threshold to be exceeded for HF cetaceans within 270 meters. In particular, the 38 km distance seems fairly large; however, both the TTS and PTS threshold distances are for 24 hours of continuous exposure. Therefore, the likelihood of the LNGRV transit causing TTS or PTS in harbor porpoises is expected to be rare. The overall risk level to harbor porpoises for LNGRV transit and mooring is low for PTS and TTS occurrence. A more detailed discussion of underwater noise resulting from operation activities associated with the proposed Project is provided in Section 4.11. The Port of New York and New Jersey is among the busiest ports in the United States, receiving over 4,500 large vessels and 240 cruise vessels each year.

Even at a maximum of 45 LNGRVs per year, this would only contribute less than 2 percent of the total traffic; therefore, vessel noise would not be a significant noise source. Since pile driving is limited to construction activities only in the unlikely event geotechnical conditions preclude use of suction anchors, the potential for noise impacts during operations is substantially reduced and limited to continuous noise associated with the support vessel, with similar impacts as described in Section 4.2.5.1.

Planned and Unplanned Maintenance and Repair

Planned and unplanned maintenance and repair sound effects may have short-term, minor, adverse impacts on marine mammals. It is anticipated that planned maintenance activities would occur on a regular basis either annually or biennially; whereas repair activities, either planned or unplanned, would occur on a less frequent basis. Planned maintenance activities are typically short in duration (several days or less) and would include attaching/detaching and/or cleaning the buoy pick-up line to the STL Buoy, performing surveys and inspections with a ROV, and cleaning or replacing parts (e.g., bulbs, batteries, etc.) on the floating navigation (i.e., marker) buoys. Inspections and surveys would also be conducted after a significant storm event. Minor repairs would not be expected to increase noise levels by any significant amount. The primary source of noise during maintenance and repairs is vessel noise.

According to the Bureau of Ocean Energy Management (BOEM), underwater noise from small vessels ranges from 145 to 170 dB at 1 meter. According to the USCG, underwater noise associated with vessels with an engine between 1,200 horsepower (hp) and 6,140 hp ranges from 92 to 112 dB at 1 meter (see Section 4.11.2.1). Non-continuous noise associated with small vessel movement and positioning would be below the zone of injury as given in the MMPA for Level A and Level B harassment; therefore, impact on marine mammals from planned maintenance would be minimized. At a maximum, every 7 years an intelligent pig would be run down the proposed Mainline and pipeline laterals to assess the condition of the proposed Mainline system. This particular activity would require several large construction-type vessels and several weeks to complete. According to BOEM, noise associated with larger vessels can range from 169 to 198 dB at 1 meter (MMS 2004b; Richardson et al. 1995).

Repairs can be either minor or major. Minor repairs are typically shorter in duration and could include replacing faulty pressure transducers, or repairing a stuck valve. These kinds of repairs would require one diver support vessel with three or four anchors to hold its position. Minor repairs could take from a few days to several weeks depending on the nature of the problem.

Major repairs, on the other hand, are longer in duration and typically require large construction vessels similar to those used to install the proposed Mainline and set the buoy and anchoring system. These vessels would typically mobilize from local ports, Canada, or the Gulf of Mexico. Major repairs typically require upfront planning, equipment procurement, and mobilization of vessels and possibly saturation divers. Examples of major repairs are damage to the riser or umbilical line and their possible replacement, damage to the proposed Mainline system and manifolds, or anchor chain replacement. These types of repairs could take up to two to four weeks. To provide a worst-case scenario, it was assumed that the noise generated by maintenance and repair activities would be similar to that generated during the construction of the facilities (LGL and JASCO 2005). The results of the Neptune LNG noise modeling for the proposed Mainline route indicates that the 120-dB contour during proposed Mainline repair activities would extend out 3.5 to 4.1 nautical miles encompassing an area from 35 to 44 nautical square miles. These modeling results are also expected to be a representative worst-case scenario of maintenance and repair activities for the proposed Project. This worst-case scenario is anticipated to occur no more than once per five-year period, lasting no more than 28 days. These underwater sound levels could cause some species to temporarily disperse from or avoid repair areas, but they are expected to return shortly after the completion of repairs.

Short-term, minor, adverse impacts on non-endangered marine mammals would occur as a result of support vessel traffic during proposed Project maintenance and repair. Vessel traffic would be similar to

construction as described in Section 4.2.5.1. It is estimated that the majority of vessel traffic would be within the proposed Project area, with large vessel movement and speed contingent upon the task performed and duration (e.g., proposed Mainline installation). These vessels would most likely mobilize and demobilize once. Crew boats, on the other hand, would operate and transit the site more frequently, depending on duty.

Vessel Traffic

Long-term, minor, adverse impacts on non-endangered marine mammals would occur as a result of vessel traffic during proposed Project operation, in the same manner as described in Section 4.2.5.1. As previously discussed, increases in vessel traffic or vessel speeds could increase the potential for collisions with marine mammals, thereby increasing the occurrence of serious injuries or mortality. The strike of any marine mammal would be considered a "take" and would require issuance of an incidental take authorization under Section 101(a)(5) of the MMPA. Vessel traffic during operation is limited to the LNGRV and support vessel. On a year-round continuous basis, the proposed Port would receive a maximum of 45 LNGRVs per year that would enter the Port via the Hudson Canyon to Ambrose Traffic Lane and exit the Ambrose to Nantucket Traffic Lane.

Short-term, minor, adverse impacts on non-endangered marine mammals would occur as a result of support vessel traffic during proposed Project maintenance and repair. As previously discussed, increases in vessel traffic or vessel speeds could increase the potential for collisions with marine mammals, thereby increasing the occurrence of serious injuries or mortality. The strike of any marine mammal would be considered a "take" and would require issuance of an incidental take authorization under Section 101(a)(5) of the MMPA. LNGRVs can be categorized as a Category A - Ocean-Going Deep Draft Commercial Vessel with a length overall between 765 and 985 feet. It has been estimated that there are approximately 2,650 deep arrivals and departures to/from the harbor (Det Norske Veritas 2010). In addition, one to five Category A vessels use the Ambrose to Nantucket Outbound Traffic Lane (located to the east of the proposed Port) on a daily basis and 0.5 to one vessel use the Hudson Canyon to Ambrose Inbound Traffic Lane on a daily basis. Overall, the addition of 45 LNGRV trips annually would account for a 1.7 percent increase in total Category A vessel traffic for the Port of New York and New Jersey, between a 2.5 and 12.3 percent increase in the Ambrose to Nantucket Outbound Traffic Lane, and an increase between 12.3 and 24.6 percent in the Hudson Canyon to Ambrose Inbound Traffic Lane. In addition, the LNGRVs must slow to 3 knots within the proposed Project Safety Zone surrounding each buoy. Since vessel speed is proportional to marine mammal collisions, this speed would increase both the ability of a marine mammal to avoid the vessel and the ability of the vessel to identify and avoid a marine mammal.

Prior to arrival at the proposed Port, LNGRVs would travel at faster speeds. At these traveling speeds, the potential for vessel/marine mammal interaction would increase, decreasing the ability of both parties to identify and avoid the other. In addition, as previously discussed, a marine mammal that is struck by a vessel at a speed of 17 knots is more than 90 percent likely to experience mortality. Support vessels would comply with speed restrictions, further reducing collision risk.

Any increase in vessel traffic would increase the potential for collisions between ships and marine mammals; however, the non-threatened and non-endangered marine mammals that occur in the ROI, such as dolphins, porpoises, and pinnipeds, are quick, agile, and generally capable of avoiding vessel impact. In addition, various species of smaller cetaceans are often seen riding the bow waves of passing vessels. Mitigation measures also would be implemented (detailed in Section 4.2.8) to minimize the impacts of vessel strike on marine mammals, as discussed for construction.

Ingestion of Marine Debris

Long-term, negligible, adverse impacts on non-endangered marine mammals would result from the accidental release of marine debris (e.g., ropes, plastic, etc.) during operation, as described in

Section 4.2.5.1. It is possible that mysticetes may ingest items found on the surface or within the water column, but with the exception of the humpback whale, it is not likely that mysticetes would encounter items found on the seafloor. Both sperm whales and beaked whales are known to incidentally ingest foreign objects while foraging; however, this does not always result in negative consequences to the animal's health (Laist 1997; Walker and Coe 1990). Existing regulations prohibit the disposal of plastic, dunnage, lining, floating packing materials, and all other trash within 12 miles of the coast. Further, as a SOP, all vessels associated with the proposed Project would be prohibited from dumping trash of any kind. Solid waste management training would be provided that emphasizes the importance of minimizing impacts on marine mammals, sea turtles, and migratory birds. This combination of proposed Project policy and existing regulations would ensure that any marine debris accidentally expended within the proposed Project area would be negligible.

Entanglement

Long-term, negligible, adverse impacts on non-endangered marine mammals would result from entanglement during operation. The design of the STL Buoy system includes anchor lines and recovery lines throughout the water column. The chains and cables used for the anchor lines resemble rigid "structures" because of their weight and relative immobility. The weight of the chain and cable combination would also increase the anchor line tautness, and thereby minimize the threat of entanglement during operations. Therefore, although it is possible that a mammal might swim into one of the chains, it is not likely that the chain would wrap around and entangle the animal. Non-endangered marine mammals would be unlikely to become entangled in these lines because of the large size of the lines (the anchor chain, anchor cable, and retrieval line would be approximately 18 inches, 6 inches, and 4 inches in diameter, respectively).

Lighting

Long-term, minor, adverse direct and indirect impacts on non-endangered marine mammals would result from lighting used by the LNGRV and support vessel during operation. Lighting used during construction would primarily be limited to the vessels (navigation lights, spotlights, decklights, etc.) used to illuminate the work area both on the vessel and on the water. Lights would be downshielded to illuminate the deck only and would not intentionally illuminate the surrounding waters. Certain types of lighting are known to attract some marine organisms, including marine mammals. Artificial light can temporarily influence feeding patterns in isolated areas where small baitfish are attracted to lighting, which draws in larger predatory species that feed on those prey species. Precautions would be made to minimize the amount of lighting needed directly on the water surface, as appropriate, while maintaining a safe work area.

Marine mammals may be attracted to the lighting used during proposed Project construction, operations, or decommissioning. However, the nature of the other associated stressors covered in this section associated with the operational activities (i.e., noise, seafloor disturbance, etc.) would likely cause animals to move away from those activities, rather than be attracted to the proposed Project area because of the lighting.

Alteration to Prey Species Abundance and Distribution

Long-term, negligible, adverse impacts on marine mammals would be expected to occur as a result of alteration to prey species abundance and distribution associated with the proposed Project during operation. Impacts on benthic prey species abundance and distribution would occur during operation, potentially affecting the primary benthic-dependent trophic guilds (i.e., crab-eaters, amphipod/shrimp eaters, and benthivores). Approximately 3.0 acres of seafloor would be occupied by proposed Port facilities or swept by the anchor chain and wire. This habitat area would be removed from access by organisms that otherwise would feed or live there. However, this acreage is inconsequential when compared to the habitat generally available in the New York Bight.

Air Emissions

Long-term, negligible, adverse impacts on non-endangered marine mammals would be expected as a result of air emissions from LNGRVs and the support vessel during operation. Air emissions are expected to be similar to that of other vessels transiting the approach to Ambrose Channel in the proposed Project area. Components that have the potential to leak, such as connectors, valves, and flanges, are situated in a confined space that would include gas leakage detectors to alert workers of any issues immediately. Additionally, SOPs would be enacted to reduce the potential for fugitive emissions. Operational activities would contribute a very minimal portion of total air emissions in the New York Bight.

4.2.5.3 Impacts of Decommissioning

Benthic Habitat

Impacts on benthic resources and habitat are discussed in Section 4.2.2. Short-term, minor, adverse impacts on non-endangered marine mammals would occur from decommissioning the proposed Project. As described in Section 4.2.5.1, decommissioning activities would produce similar seafloor habitat impacts as previously described for construction activities. Decommissioning activities would result in similar localized, short-term, minor disturbance of sediments and potential turbidity increases where installed mooring components would be removed from the bottom.

Turbidity

Short-term, minor, adverse impacts on non-endangered marine mammals would occur as a result of turbidity increases associated with proposed Project decommissioning, in the same manner as described in Section 4.2.5.1. The proposed Mainline and pipeline laterals would be abandoned in-place to be consistent with current federal policies to minimize adverse impacts, and the benthic habitat that has re-established itself on the seafloor above the buried proposed Mainline would not be disturbed. Only the removal of the STL Buoy systems would require disturbing the benthic habitat below those structures, exposing marine mammals to short-term and minor increased turbidity in the water column. Once these systems are removed, that benthic habitat once again would become available for rapid recolonization by sessile and infaunal benthic organisms. The process of capping and flushing of the ends of the proposed Mainline could also result in short-term, localized, and minor impacts on marine mammals in the proposed Project area. Since the proposed Mainline itself would be abandoned in-place, no turbidity would be generated along its route.

Vessel Intake and Discharge

Support vessel intake and discharge for decommissioning, as discussed in Section 4.1, would be similar to construction vessel intakes and discharges and not result in adverse impacts on non-endangered marine mammals. There would be no impacts due to impingement of marine fish resources (potential prey items) during decommissioning activities because proposed Project intake velocities would be less than 0.5 ft/sec in keeping with best technology available standards set forth in Section 316(b) regulations under the CWA. These velocities are sufficiently low enough to allow juvenile and adult fish to escape impingement and would not impact non-endangered marine mammals.

Routine Discharges

As discussed in Section 4.1, the routine vessel discharges during proposed Project operation would not result in adverse impacts on non-endangered marine mammal species in the ROI. Routine discharges from decommissioning vessels would include deck runoff and engine cooling water similar to construction. All gray water and sanitary wastewater would be stored onboard for appropriate disposal. All discharges from the marine vessels would comply with USCG requirements and the requirements highlighted in Table 1.4-1. Section 4.2.5.1 discusses issues that may arise during construction, which would be similar to those involved with decommissioning the proposed Port.

Accidental Releases of Fuel, Oil, and Other Chemicals

Accidental releases of fuel, oil, and other chemicals stored and/or in use in support of proposed Project decommissioning could degrade water quality with potential adverse, short-term impacts on marine mammal species in the proposed Project area. Dissipation rates have been predicted to be rapid. Section 4.2.5.1 discusses additional issues that may arise during decommissioning that are similar to construction impacts.

Noise

Short-term, minor, adverse impacts on non-endangered marine mammals would occur as a result of noise associated with decommissioning. A more detailed discussion of underwater noise resulting from decommissioning activities associated with the proposed Project is provided in Section 4.11. Since pile driving is limited to construction activities only in the unlikely event geotechnical conditions preclude use of suction anchors, the potential for noise impacts during operations is substantially reduced and limited to noise associated with the support vessel, with similar impacts as described in Section 4.2.5.1. In general, marine mammal exposure to support vessel noise would only occur for a finite period of time and would not be expected to have long-term population-level impacts on marine mammals. Under the MMPA, the potential for temporary acoustic exposures from construction activities would be expected to be within the non-injurious behavioral effects zone (Level B harassment) for marine mammals (USCG 2006a,b; FERC 2006). All sound sources from the decommissioning phase of the proposed Project are considered to have a minor impact on species of marine mammals. Because the behavioral response of marine mammals to a perceived marine sound depends on a range of factors, including: (1) the SPL; (2) frequency, duration, and novelty of the sound; (3) the physical and behavioral state of the animal at the time of perception; and (4) the ambient acoustic features of the environment (Hildebrand 2004), it is more difficult to predict behavioral shifts due to anthropogenic sounds. The radiation of sound to marine waters during the construction phase of the proposed Project would be within the immediate vicinity of the proposed Project, and effects would be expected to be temporary, hence “harassment” (TTS) for all species is expected to be minor. Although species abundance varies by season in the ROI, the likelihood of “harm” (PTS) or “harassment” (TTS) from the proposed Project to individuals or species due to underwater sound is unlikely because of the transient and seasonal nature of the species moving through the ROI, and the ability of animals to move away from sound sources.

Vessel Traffic

Short-term, minor, adverse impacts on non-endangered marine mammals would occur as a result of vessel traffic during proposed Project decommissioning in the same manner as described in Section 4.2.5.1. Vessel traffic during decommissioning is limited to vessels similar to those described for construction. It is estimated that the majority of vessel traffic would be within the proposed Project area, with large vessel movement and speed contingent upon the task performed and duration (e.g., proposed Mainline installation). These vessels would most likely mobilize and demobilize once. Crew boats, on the other hand, would operate and transit the site more frequently, depending on duty.

Large vessels are only likely to mobilize/demobilize to the construction site once, whereas smaller vessels may transit the proposed Project area multiple times. Therefore, large vessels used for construction would only be a concern for a short duration. Additionally, a Marine Mammal and Sea Turtle Vessel Strike Avoidance Plan has been prepared to decrease risk of collisions (Appendix K). The mitigation measures detailed in Section 4.2.8 would be taken to avoid collisions.

Ingestion of Marine Debris

Short-term, negligible, adverse impacts on non-endangered marine mammals would result from the accidental release of marine debris (e.g., ropes, plastic, etc.) during decommissioning, as described in Section 4.2.5.1. Existing regulations prohibit the disposal of plastic, dunnage, lining, floating packing

materials, and all other trash within 12 miles of the coast. Further, as a SOP, all vessels associated with the proposed Project would be prohibited from dumping trash of any kind. Solid waste management training would be provided that emphasizes the importance of minimizing impacts on marine mammals, sea turtles, and migratory birds. This combination of proposed Project policy and existing regulations would ensure that any marine debris accidentally expended within the proposed Project area would be negligible.

Entanglement

Short-term, minor, adverse impacts on non-endangered marine mammals would result from entanglement during decommissioning. Entanglement of marine mammals within derelict fishing gear, ropes, lines, or other marine debris has received much attention in recent decades and is an important threat to marine mammals. A 25-year dataset assembled by the Ocean Conservancy reported that fishing line, rope, and fishing nets accounted for most entanglements, with the remainder due to encounters with various items such as bottles, cans, and plastic bags (Ocean Conservancy 2010).

Barges and other vessels would use fixed anchoring methods, and the associated anchor cables could pose a risk of entanglement to marine mammals. Marine mammals could be entangled by anchors, anchor lines, or buoy lines deployed during decommissioning, but the potential for such an event would be low. Anchor lines securing the barges would be large in diameter, knotless, non-floating, and taut, and would only be deployed for a short period of time. In addition, anchor lines would be separated by hundreds of feet as they radiated away from the vessel and would not be laterally connected to other lines, thereby avoiding the creation of a “web effect.” With adherence to best management practices for detection of marine mammals in the area, the potential for entanglement associated with construction activities would be minimized. Combined, these factors would decrease the potential for marine mammal entanglement and impacts would be short-term and minor.

Lighting

Short-term, minor, adverse impacts on non-endangered marine mammals would result from lighting used by support vessels during decommissioning, as described in Section 4.2.5.1. Certain types of lighting are known to attract some marine organisms, including marine mammals. Artificial light could potentially confuse marine mammals approaching the proposed Project area where lighting is used during decommissioning. Lighting used during decommissioning would primarily be limited to the vessels (navigation lights, spotlights, decklights, etc.) used to illuminate the work area both on the vessel and on the water. Lights would be downshielded to illuminate the deck only and would not intentionally illuminate the surrounding waters. The Applicant has committed to minimize the amount of lighting needed directly on the water surface, while still providing a safe work area.

Marine mammals may be attracted to the lighting used during proposed Project construction, operations, or decommissioning. However, the nature of the other associated stressors covered in this section associated with the construction activities (i.e., noise, seafloor disturbance, etc.) would likely cause animals to move away from those activities, rather than be attracted to the proposed Project area because of the lighting, resulting in minor and temporary impacts during decommissioning.

Alteration to Prey Species Abundance and Distribution

Negligible impacts on marine mammals are expected to occur as a result of alteration to prey species abundance and distribution associated with the proposed Project during decommissioning. The abundance and distribution of marine mammal prey species may be impacted during decommissioning by turbidity, sedimentation, and noise, as well as entrainment during water withdrawals. Such water withdrawals are expected to be similar to those described for construction (Section 4.2.5.2). The displacement of some prey species, like fish, may actually attract marine mammals away from the proposed Project decommissioning. Since potential impacts on marine mammal prey species would be short-term and

confined to the general vicinity of the decommissioning activities, it is not expected to adversely impact marine mammals.

Air Emissions

Negligible impacts on non-endangered marine mammals are expected as a result of air emissions from support vessels during decommissioning, as described in Section 4.2.5.1. Air emissions are expected to be similar to that of other vessels transiting the approach to Ambrose Channel in the proposed Project area. Components that have the potential to leak, such as connectors, valves, and flanges, are situated in a confined space that would include gas leakage detectors to alert workers of any issues immediately. Additionally, SOPs would be enacted to reduce the potential for fugitive emissions. Decommissioning activities would contribute a very minimal portion of total air emissions in the New York Bight, and emissions would be short-term.

4.2.6 Coastal and Marine Birds

Birds forage in a variety of habitats such as coastal wetlands, estuaries, kelp beds, lagoons, and in the intertidal zone, as well as nearshore in shallower waters, and on the open ocean where they catch prey near or at the surface. Many species forage in large groups on shoaling fish, or concentrations of molluscs attached to the seafloor. Water temperatures, currents, upwellings, wind direction, and ocean floor topography can all influence when and where seabirds forage (Elphick 2007; Fauchald et al. 2002; Spear and Ainley 1997). Oceanic fronts (gradients in current speed, temperature, salinity, density, and enhanced circulation) attract seabirds due to increased foraging opportunities.

The assemblage of avifauna in the marine environment is dynamic and seasonal, and therefore impacts are difficult to assess, and may vary by time of year. Construction of the proposed Project has the potential to affect avian species within the ROI as a result of direct habitat loss or change (direct effects) or through temporary displacement or disturbance during the construction and operation phase of the proposed Project. Specifically, potential impacts during construction, operation, and decommissioning on non-threatened and non-endangered coastal and marine birds may include changes to benthic foraging habitat, increases in water turbidity, changes to ambient noise levels, increased vessel traffic, changes to ambient lighting, vessel discharge and spills, ingestion of marine debris, and entanglement.

4.2.6.1 Impacts of Construction

Benthic Habitat

Negligible impacts on coastal and marine birds would be expected as a result of benthic habitat disturbance during construction. Impacts on benthic resources and habitat are discussed in Section 4.2.2. Seafloor impacts are discussed in Section 4.2.2.1. Birds occurring in the ROI primarily occupy the airspace above the proposed Project, the water surface, or in the upper portions of the water column during foraging. Few seabird species forage on or near the seafloor. Grebes, loons, and some sea duck species are capable of diving to the seafloor during feeding; however, these birds typically dive only to approximately 90 feet. The amount of subsea habitat that would be altered as a result of the proposed Project represents only a very small proportion of the subsea habitat available in similar water depths along the New York Bight. Further, the water depths in the proposed Project area are at the limit of the diving depth for most sea ducks and would likely be marginal foraging habitat (Goudie et al. 2000; Robertson and Savard 2002; Bordage and Savard 2011). The proposed Project is unlikely to have adverse impacts on birds as a result of alterations to seafloor habitat because the proposed Project area is generally too deep for benthic foraging birds and limited to a small footprint on the seafloor, and impacts on seafloor habitat would be short-term (i.e., the benthic environment would revert to pre-installation conditions).

Turbidity

Short-term, minor impacts on coastal and marine birds would be expected as a result of increased turbidity during construction. Turbidity has the potential to impact birds foraging in the water column by reducing visibility, which could potentially affect underwater movement or prey capture. Turbidity may be increased during jet plowing. Jet plowing is unlikely to adversely affect avifauna because of the high sand content of the sediments and the slow speed of the plow (approximately 1.9 inches per second). The action of jet plowing would minimally increase the turbidity, but the increased turbidity would be localized in nature and only be conducted for a short-term during the construction phase of the proposed Project.

Noise

Short-term, moderate impacts on coastal and marine birds would be expected as a result of noise during construction. Increases in ambient sound levels may cause disturbance to birds resulting in avoidance behavior from proposed Mainline and pipeline lateral installation, and construction vessel transit. A detailed discussion of underwater noise resulting from each of these construction activities associated with the proposed Project is provided in Section 4.11. Potential impacts of noise during the installation of the proposed Project on avifauna in the area may include temporary displacement or short-term disruption of normal behavior patterns (Drewitt and Langston 2006).

In the offshore environment, a limited amount of validated research on displacement effects of noise on seabirds and other avian species using the marine environment makes predicting the level of impact from proposed Project construction and operation difficult (Stewart et al. 2005). Researchers have documented a range of bird behavioral responses to noise, including no response, alert behavior, startle response, flying or swimming away, diving into the water, and increased vocalizations (National Park Service 1994; Larkin et al. 1996; Pytte et al. 2003; Plumpton 2006). While they are difficult to measure in the field, some of these behavioral responses are likely accompanied by physiological responses, such as increased heart rate or stress.

European studies suggest that disturbance and avoidance impacts may occur up to 2.2 nautical miles from offshore construction sites (BOWind 2008). However, avoidance behavior as a result of construction activities is typically short in duration, and is highly unlikely to result in reduced population fitness or individual injury or mortality (BOWind 2008).

Vessel Traffic

Short-term, negligible impacts on coastal and marine birds would be expected from increased vessel traffic during proposed Project construction. Construction of the proposed Project would result in a slight increase in vessel traffic in the ROI. Vessel traffic associated with offshore construction would not result in a substantial increase in vessel traffic above current levels and would be similar in nature to other commercial vessel and recreational traffic currently occurring in the proposed Project area. Large vessels would only likely be mobilized/demobilized to the construction site once, whereas smaller vessels may transit the ROI multiple times. During the day, birds are able to detect and avoid vessels, which reduces the probability that vessel strikes would impact seabird populations. Depending on the lighting scheme of the vessel, the potential of a night collision is possible. Therefore, disturbance or displacement associated with increased vessel movement is unlikely. However, to ensure safety during nighttime operations, all construction support vessels would be lit and marked in accordance with USCG requirements. As discussed further in the following sections, research has demonstrated that steady burning lights can attract birds (Gehring et al. 2009). For this reason, downshielded lights (aka hooded lights) would be used, where possible, on construction vessels.

Routine Discharges

Routine discharges are unlikely to adversely affect coastal and marine birds. The ROI is not expected to contain habitat that concentrates avian activity, which could result in displacement or direct harm to avifauna. If a small area of the ROI was impacted by routine discharge, it is unlikely that birds would be displaced or precluded from important foraging, resting, or migrating habitat. The discharges would dissipate, and avifaunae could easily avoid unfavorable conditions. Routine discharge would not be of a magnitude that would be likely to cause harm to birds.

Accidental releases of fuel, oil, and other chemicals

Short-term, negligible, adverse direct impacts on coastal and marine birds would be expected from accidental releases of fuel, oil, and other chemicals. Oil spills pose a risk to seabirds through direct contamination and destruction of nesting, roosting, and foraging habitats (USEPA 1999). Most petroleum products that would be carried on the construction vessels would be light, remaining on the surface of the water and evaporating in the event of a spill. These spills would not be expected to adversely affect coastal and marine birds in the area. Heavier petroleum products that create a sheen and remain on the water's surface could affect marine birds landing on or diving through the water's surface for food. Birds coated with petroleum products could become limited in their flying abilities and therefore impact their ability to avoid predators, detect food, breathe, and reproduce. The overall adverse impact from an inadvertent spill on coastal and marine birds would be short-term and negligible.

Ingestion of Marine Debris

Short-term, negligible, direct impacts on coastal and marine birds would be expected from marine debris. Marine debris (any solid, manufactured material that is disposed of or abandoned into the marine environment) could be lost from any vessel involved in construction of the proposed Project. Ingestion of plastic marine debris due to pollution is a known stressor for seabirds (North American Bird Conservation Initiative 2009; Onley and Scofield 2007; Waugh et al. 2012; Weimerskirch 2004). Plastic marine debris can lead to blockage within the digestive system, internal damage, or accumulation of toxins present in the debris. Ingestion of accidentally released marine debris could result in harm to some birds; however, the impact of releasing potentially small amounts of marine debris into the environment is unlikely to have long-term, adverse impacts on coastal and marine birds. Impacts on coastal and marine birds would be mitigated through adherence to existing statutes that regulate marine debris. Further, as a SOP, all vessels associated with the proposed Project would be prohibited from dumping trash of any kind. Solid waste management training would be provided that emphasizes the importance of minimizing impacts on marine mammals, sea turtles, and migratory birds. This combination of proposed Project policy and existing regulations would ensure that any marine debris accidentally expended within the proposed Project area would be negligible.

Entanglement

Birds are known to become entangled in artificial materials at sea (North American Bird Conservation Initiative 2009; Onley and Scofield 2007; Waugh et al. 2012; Weimerskirch 2004). However, adverse impacts on birds from the proposed Project are unlikely because anchor lines securing the derrick/lay barge would be large in diameter, knotless, non-floating, and taut, and would only be deployed for a short period of time, and are thus unlikely to entangle avifauna. Furthermore, the proposed construction activities are not unique to the New York Bight; birds in the region interact with vessels and moorings routinely and are likely habituated to the presence of marine vessels. Construction activities are unlikely to elicit individual curiosity, which could result in adverse interactions.

Lighting

Short-term, minor direct impacts on coastal and marine birds would be expected from artificial lighting associated with construction. Artificial lighting associated with vessels and offshore oil and gas platforms

in offshore environments are known to attract both marine birds and terrestrial species and in some cases have caused some fatalities, particularly during poor weather conditions (Merkel and Johansen 2011). Lights on construction vessels could attract birds or bats migrating/moving at night through the area. Solid white lighting, which many construction vessels contain, appears more problematic for birds, especially nocturnal migrants, than other types of lights (Poot et al. 2008; Gehring et al. 2009).

Lighting used during construction would be limited to the vessels (navigation lights, spotlights, decklights, etc.) and be used to illuminate the work areas both on the vessel and on the water's surface. Precautions would be made to minimize the amount of lighting needed directly on the water surface, as appropriate, without compromising the quality or safety of the work area. However, the proposed Project is located adjacent to the approach to the Ambrose Channel, one of the busiest shipping channels on the U.S. Atlantic Coast (Figure 3.7.1) and has various elements of artificial lighting.

Marine Protected Areas

There are no marine protected areas (MPAs) within the proposed Project area as shown in Figure 3.2-1. The only MPA located in the ROI is the Gateway National Recreation Area (GNRA). Proposed Project impacts on biological resources are expected to be isolated within the immediate area of the proposed Project, as discussed for each in the above sections. Therefore, no adverse impacts would be expected on the resources that the GNRA is designed to protect.

4.2.6.2 Impacts of Operation

Benthic Habitat

Impacts on benthic resources and habitat are discussed in Section 4.2.6.1. As stated in Section 4.2.6.1, birds occurring in the ROI primarily occupy the airspace above the proposed Project, the water surface, or in the upper portions of the water column during foraging. Few seabird species forage on or near the seafloor. Grebes, loons, and some sea duck species are capable of diving to the seafloor during feeding; however, these birds typically dive only to approximately 90 feet. No additional seafloor habitat would be altered during proposed Project operation. Further the water depths in the proposed Project area are at the limit of the diving depth for sea ducks and would be considered marginal foraging habitat (Goudie et al. 2000; Robertson and Savard 2002; Bordage and Savard 2011). The proposed Project is unlikely to have adverse impacts on birds during operation as a result of alterations to seafloor habitat, because the proposed Project area is generally too deep for benthic foraging birds.

Turbidity

Long-term, minor impacts on coastal and marine birds would be expected as a result of increased turbidity during operation. Turbidity has the potential to impact birds foraging in the water column by reducing visibility, which could potentially affect underwater movement or prey capture. Potential turbidity resulting from anchor chain sweep would likely be localized, and intermittent throughout the proposed Project life. In addition, water depths in the proposed Project area are at the limit of the diving depth for most sea ducks and would be considered marginal foraging habitat (Goudie et al. 2000, Robertson and Savard 2002, Bordage and Savard 2011).

Noise

Long-term, minor, adverse impacts on coastal and marine birds could occur as a result of increased airborne noise levels generated during operation. Such impacts could displace birds from the area. Bird species with coastal distribution would not be affected by noise during operation, as it is unlikely that noise generated by operation would reach coastal areas.

Vessel Traffic

As stated in Section 4.2.6.1, the vessel traffic associated with operation would result in a negligible increase in vessel traffic above current levels and would be similar in nature to other commercial vessel and recreational traffic currently occurring in the proposed Project area. The impacts of vessel movements would be expected to be short-term, temporary, and localized with disturbances of individual birds in the vicinity expected. Therefore, disturbance or displacement associated with increased vessel movement is unlikely. However, to ensure safety during nighttime operations, all vessels would be lit in a manner to minimize impacts on birds (downshielding), but marked in accordance with USCG requirements.

Routine Discharges

As discussed in Section 4.1, the routine vessel discharges during proposed Project operation would be unlikely to result in adverse impacts on non-endangered coastal and marine birds. Routine discharges would include deck runoff from the LNGRV and support vessel and engine cooling water from the support vessel. All gray water and sanitary wastewater would be stored onboard for appropriate disposal. All discharges from the marine vessels would comply with USCG requirements and the requirements highlighted in Table 1.4-1. If a small area of the ROI was impacted by routine discharge, it is unlikely that birds would be displaced or precluded from important foraging, resting, or migrating habitat. The discharges would dissipate, and avifaunae could easily avoid unfavorable conditions. Routine discharge would not be of a magnitude that would be likely to cause harm to birds.

Accidental releases of fuel, oil, and other chemicals

Short-term, negligible, adverse direct impacts on coastal and marine birds would be expected from accidental releases of fuel, oil, and other chemicals. Oil spills pose a risk to seabirds through direct contamination and destruction of nesting, roosting, and foraging habitats (USEPA 1999). Most petroleum products that would be carried on the LNGRV and support vessel would be light, remaining on the surface of the water and evaporating in the event of a spill. These spills would not be expected to adversely affect coastal and marine birds in the area. Heavier petroleum products that create a sheen and remain on the water's surface could affect marine birds landing on or diving through the water's surface for food. Birds coated with petroleum products could become limited in their flying abilities and therefore impact their ability to avoid predators, detect food, breathe, and reproduce.

LNG Spills

Short-term, minor, direct adverse impacts on coastal and marine birds could occur in the unlikely event of an LNG spill. All LNGRVs are designed with features to minimize the potential for LNG spills (see Section 2.1). However, if an LNG spill were to occur, potential impacts would include exposure to low-temperature LNG at the water surface, possibly resulting in frostbite or death and asphyxiation by natural gas vapors above the surface of the water. These impacts would likely occur in the immediate vicinity of the spill location; the time frame of the impact is limited (see Section 5). Since LNG would boil off as natural gas at the surface, depth and pressure required for gas to dissolve (Artemov et al. 2005) in surface waters would not be sufficient and gas vapors would disperse. In addition, the time frame for these impacts would be limited, and adverse toxic impacts would be expected to be minor after the LNG boiled off and the vapors dispersed.

The potential for a release of natural gas from the proposed Mainline and pipeline laterals are remote. If there were a subsea release of natural gas, the gas would rise to the water surface rapidly and dissipate. In general, whether a release is sudden or extended, physics dictate that any methane would gradually dissolve into the water column during the lifetime of the bubble as described by Fick's law, taking into account Henry's law constants, partial pressure and concentrations of dissolved gases (Artemov et al. 2005). Once a gas bubble reaches the surface, it would rise (being lighter than air) and be dispersed by air currents. Coastal and marine bird impacts from such a release would be short-term and minor.

Ingestion of Marine Debris

Short-term, minor, adverse impacts on coastal and marine birds would be expected from accidental release of marine debris during construction. Marine debris (any solid, manufactured material that is disposed of or abandoned into the marine environment) could be lost from any vessel involved in operation of the proposed Project. Ingestion of plastic marine debris due to pollution is a known stressor for seabirds (North American Bird Conservation Initiative 2009; Onley and Scofield 2007; Waugh et al. 2012; Weimerskirch 2004). Plastic marine debris can lead to blockage within the digestive system, internal damage, or accumulation of toxins present in the debris. Ingestion of accidentally released marine debris could result in harm to some birds; however, the impact of releasing potentially small amounts of marine debris into the environment is unlikely to have long-term, adverse impacts on coastal and marine birds. Impacts on coastal and marine birds would be mitigated through adherence to existing statutes that regulate marine debris. Further, as a SOP, all vessels associated with the proposed Project would be prohibited from dumping trash of any kind. Solid waste management training would be provided that emphasizes the importance of minimizing impacts on marine mammals, sea turtles, and migratory birds. This combination of proposed Project policy and existing regulations would ensure that any marine debris accidentally expended within the proposed Project area would be short-term and minor.

Entanglement

As stated in Section 4.2.6.1, birds are known to become entangled in artificial materials at sea (North American Bird Conservation Initiative 2009; Onley and Scofield 2007; Waugh et al. 2012; Weimerskirch 2004). The design of the STL Buoy system includes anchor lines and recovery lines throughout the water column. Birds diving for prey items would unlikely become entangled in these lines because of the large size of the lines (the anchor chain, anchor cable, and retrieval line would be approximately 18 inches, 6 inches, and 4 inches in diameter, respectively). Therefore, anchor and recovery lines necessary for the proposed Project would result in long-term, minor, adverse impacts on coastal and marine birds.

Lighting

Short-term, minor direct impacts on coastal and marine birds would be expected from artificial lighting associated with operation. Artificial lighting associated with vessels and offshore oil and gas platforms in offshore environments are known to attract both marine birds and terrestrial species and in some cases have caused some fatalities, particularly during poor weather conditions (Merkel and Johansen 2011). Lights on LNGRVs and the support vessel could attract birds or bats migrating/moving at night through the area. Solid white lighting, which many construction vessels contain, appears more problematic for birds, especially nocturnal migrants, than other types of lights (Poot et al. 2008; Gehring et al. 2009).

Lighting used during operation would be limited to the vessels (navigation lights, spotlights, decklights, etc.) and be used to illuminate the work areas both on the vessel and on the water's surface. Precautions would be made to minimize the amount of lighting needed directly on the water surface, as appropriate, without compromising the quality or safety of the work area. However, the proposed Project is located adjacent to the approach to the Ambrose Channel, one of the busiest shipping channels on the U.S. Atlantic Coast (Figure 3.7.1) and has various elements of artificial lighting.

Marine Protected Areas

There are no MPAs within the proposed Project area as shown in Figure 3.2-1. The only MPA located in the ROI is the GNRA. Proposed Project impacts on biological resources are expected to be isolated within the immediate area of the proposed Project, as discussed for each in the above sections. Therefore, no adverse impacts would be expected on the resources that the GNRA is designed to protect.

4.2.6.3 Impacts of Decommissioning

Impacts on coastal and marine birds would not be materially different than those previously described for construction. Short-term, minor, adverse impacts, similar to the construction impacts described in Section 4.2.6.1, would be expected from decommissioning activities.

4.2.7 Impacts of Alternatives

Port sites in Study Areas B, C, and D contain similar existing biological resources; they are located in roughly the same depth (100 feet) with sandy substrate. The Port site in Study Area C is located approximately 18.9 nautical miles from the Transco interconnect, while an alternative location in Study Area D would be approximately 50 miles from the interconnect. The site in Study Area B would require crossing of a fishing ground referred to as the “Mud Hole,” thus it could result in potentially greater impacts on fishery resources. The site in Study Area D is also within a designated fishing ground, known locally as the “Yankee Spot,” thus it could result in potentially greater impacts on fishery resources.

The Mainline route analysis evaluation considered two Mainline routes from the Preferred Port location (Mainline Route C-1 and Mainline Route C-2; see Figure 2.2-1). Mainline routes from Study Area A were eliminated due to inadequate water depth and distance from shore, which would have resulted in additional visual impacts. Mainline routes from Study Area B were eliminated because these routes would require crossing a popular fishing ground referred to as the “Mud Hole” and would be immediately adjacent to a designated pilot transfer area and a disposal area. Mainline routes from Study Area D were eliminated because these routes would require crossing at least one Traffic Separation Scheme (TSS) by LNGRVs calling on the Port, as well as a popular fishing ground known as the “Yankee Spot.” Additionally, a Mainline route in Study Area D would be nearly twice as long as Mainline routes from Study Area C, which would result in greater seabed impacts, increased turbidity and associated water quality impacts.

Because impact piling was assessed to have the highest potential for sound generation (over the widest area) associated with the proposed Project, the decision was made that the anchors would be installed at the proposed Project using suction anchors. If necessary, driven piles could be used as an alternative to the suction anchors in the unlikely event geotechnical conditions preclude use of suction anchors. Several different anchor alternatives have been considered for the proposed Project, including suction anchors, driven piles, fluke anchors, gravity-based anchors, and grouted pile anchors. It is anticipated that driven piles would have the smallest footprint. Installation of a gravity-based anchor system would generally result in a greater disturbance of the sea bottom and more overall loss of benthic habitat than other types of anchors. The fluke anchor system would likely have the next greatest impact due to "setting" the anchor by pulling it into the seafloor. The driven pile and grouted pile anchor designs present a relatively smaller seafloor footprint and, therefore, would potentially result in significantly less of an effect to benthic habitat. During installation, all alternatives of anchoring would have short-term turbidity and sedimentation impacts owing to various methods used to set the anchors at or below the sea bottom surface. Gravity-based anchor structures would result in a direct loss of existing fish habitat in a significant area (each approximately 2,500 ft^2). Other anchor designs present smaller environmental footprints and, therefore, would potentially result in significantly less of an effect on benthic habitat. Suction anchors, by virtue of pumping out the water from inside the caisson, would have an impact on the zooplankton within that water column, which the other alternatives avoid. On the other hand, gravity-based anchor system structures would provide a significant amount of hard substrate at different depths as it protrudes above the seafloor. This would likely result in an artificial reef sustaining development of new biotic communities that have a potential to support significant marine populations. Such gravity-based anchor reefs would be unavailable to commercial and recreational fishermen; therefore, would not result in any direct positive economic impact. As discussed further in Section 4.11, pile driving generates the highest underwater noise levels during construction, which is required when using driven piles. Other alternative anchoring systems are installed using different methods, which would likely generate

underwater noise but likely to a lesser extent. These impacts would only occur throughout the duration of installation and the risk of these potential impacts must also be balanced against the effectiveness and reliability of the anchoring system.

The impacts on biological resources from the deepwater port alternatives are varied. The GBS, the platform-based unit, and the artificial island generally would result in a greater disturbance of sediments due to the larger footprint on the sea bottom, as well as permanent conversion of soft bottom habitats to hard structure. The FSRU, HiLoad, and the STL Buoy alternatives each would result in a smaller sea bottom footprint and less sediment disturbance during construction. However, the HiLoad design requires deeper water depth resulting in the need for a longer pipeline with more bottom disturbance. In addition, during operation these alternatives could result in increased long-term turbidity due to anchor cable sweep. Impacts on biological resources from increased vessel activity, water use, noise and light would likely be similar for all alternative designs.

Based on the selection of the proposed Project design, there are two alternatives for vaporization of the LNG prior to it entering the proposed Mainline. The alternatives are open-loop vaporization and closed-loop vaporization, and neither would have an impact on benthic environments. Open-loop vaporization would require substantial water intake (between 13,944 and 27,932 gpm), the potential use of biocides, and the discharge of colder than ambient temperature water, which would adversely impact fisheries resources due to impingement and entrainment. Seawater intake would not be required by any of the closed-loop vaporization alternatives; thus, eliminating impacts on ichthyoplankton and fisheries that would be caused by an open-loop vaporization system.

4.2.8 Mitigations and Monitoring

SOPs allow for maintaining safety during proposed Project construction, operation, and decommissioning. The Applicant has developed mitigation measures for those proposed Project activities that have the potential to impact the environment (see Table 4.2-5). Unlike SOPs, mitigation measures are modifications to the Proposed Action that are specifically implemented to reduce a potential environmental impact on a particular resource. Everyone working on the proposed Project would undergo environmental training, including solid waste management training; this training would address ways to minimize impacts on marine species. Together, the procedures and measures outlined below would ensure that impacts on marine resources would be avoided or minimized by the Applicant during proposed Project construction, operation, and decommissioning.

Table 4.2-5. Mitigation Measures Followed to Minimize or Eliminate Impacts on Biological Resources

Mitigation Measures	
Avoidance of Sensitive Habitats	Mainline route selected based on avoiding or minimizing disturbance to sensitive biological resources (e.g., hard bottom areas, biogenic reefs, designated fishing areas, and submerged aquatic vegetation).
	Mainline and two lateral pipelines connecting to the two PLEMs would be installed utilizing DP vessels; stationary anchored vessels would be used only for installation of the SSTI.
Impingement and Entrainment	To minimize the risk of entrainment of plankton, ballast water would be recirculated for all vessel cooling needs, thus eliminating any cooling water intake.
	Intake velocity for ballast water and hydrostatic testing water would be less than 0.5 ft/sec to eliminate risk of impingement.
Noise	See mitigations in Section 4.11.

Mitigation Measures	
Turbidity and Seafloor Disturbance	To minimize seafloor disturbance, DP vessels would be used for all construction activities, except for anchored vessels installing the SSTI and hot-tap.
	Most of the Mainline and pipeline laterals (99 percent of length) would be trenched using plow technology; jetting would be used only when needed to deepen a trench or near other utilities.
	Return of seabed to pre-construction conditions immediately upon construction completion.
Water Quality	Biocide used in hydrostatic testing would be neutralized using hydrogen peroxide prior to discharge to minimize toxicity and no discharges would be made from the LNGRVs during cargo offloading operations at the proposed Port.
Ballast Water	All project vessels would comply with a ballast water management plan and vessels bound for the proposed Port would conduct a mid-ocean ballast water exchange; there would be no discharge of ballast water at the proposed Port.
Lighting	A lighting plan would be developed in consultation with the U.S. Fish and Wildlife Service (USFWS) to minimize adverse impacts on wildlife during construction, operation and decommissioning of the proposed Port.
	During construction, lighting for navigation and safe operations would be used when vessels are stationary where applicable. Lights would be well-shielded and directed downwards. Lights would not intentionally illuminate surrounding waters.
	During project operation, lighting would be kept to a minimum; lights would be downshielded to illuminate the deck only; lights would not intentionally illuminate surrounding waters and would be turned off when not being used.
Vessel Strikes	Marine Mammal and Sea Turtle Vessel Strike Avoidance Plan has been prepared to decrease collision risk. Vessels would adhere to all appropriate speed restrictions, on site and in transit, and would always remain in navigation channels.
Environmental Training and Plans	All personnel working on the Project would attend environmental training to emphasize the importance of minimizing impacts on marine resources including: • Marine pollution prevention (avoidance and spills handling); • Marine mammal and sea turtle identification and avoidance (see Appendix K); • Injured/dead protected species reporting; • Solid waste and recyclables handling; • Licenses, approvals, permit conditions; and • Communications protocols.

4.3 Threatened and Endangered Marine Mammals, Sea Turtles, Fish, and Birds

4.3.1 Introduction

This section discusses the impacts of the construction, operation, and decommissioning of the proposed Project on protected (i.e., threatened or endangered) marine species including marine mammals, sea turtles, fish and birds. Due to the range of activities associated with the proposed Project, some impacts are short-term, while others are long-term. Most impacts are negligible, but others, such as noise and vessel traffic, may have long-term effects to different ESA-listed species.

Construction of the proposed Project would result in short-term, minor, adverse impacts on threatened and endangered marine species from routine discharges, increased vessel traffic, noise, lighting, marine debris, bottom sediment disturbance, entanglement, and inadvertent spills. Short-term, potentially moderate to potentially major, adverse impacts on threatened and endangered marine mammals during

construction would result from marine noise from proposed Mainline installation and STL Buoy anchoring. Operation of the proposed Project would result in long-term, minor to moderate, adverse impacts on threatened and endangered marine species from increased vessel traffic, noise, lighting, marine debris, routine discharges, LNG spills, inadvertent spills, bottom sediment disturbance, and proposed Project facilities and Mainline presence. Although a permanent impact on approximately 3.2 acres of seafloor would be expected in the area of the proposed Port facilities due to buoy placement, impacts beyond the permanent footprint of the proposed Project would be anticipated to be short-term and minor. Short-term, minor, adverse impacts on biological resources during decommissioning would result from routine discharges, increased vessel traffic, noise, lighting, marine debris, inadvertent spills, and bottom sediment disturbance. Such impacts would be similar to those described for construction.

The following sections identify the activities that may affect, but not likely to adversely affect (Table 4.3-1) one or more threatened and endangered marine species (marine mammals, sea turtles, fish and birds) as defined in Section 3.3. The activities are presented for the construction, operation, and decommissioning phases of the proposed Project.

4.3.2 Marine Mammals

ESA-listed marine mammals would not experience long-term or permanent impacts from the construction, operation, and decommissioning of the proposed Project (Table 4.3-1). Of the six whales that may occur in the New York Bight, only the fin and humpback whale are somewhat likely to transit the ROI. Although some of the proposed Project-related activities may affect threatened or endangered marine mammals, the effects are expected to be temporary and short-term. Therefore, even if these animals do not vacate or avoid the disturbance, they are not expected to experience long-term negative effects.

4.3.2.1 Impacts of Construction

Benthic Habitat

Impacts on benthic resources and habitat are discussed in Section 4.2.2. Short-term, minor, adverse impacts on ESA-listed marine mammals would occur as a result of seafloor disturbance during proposed Project construction. The impacts on seafloor habitat would be primarily from the installation of the proposed Mainline and pipeline laterals, as well as the PLEMs and STL Buoys. Seafloor acreage impacts are discussed in more detail in Section 4.2.5.1. Impacts from construction would be localized and short-term due to the rapid and efficient nature of the construction methods used. No significant disturbances from construction/installation would be expected to extend beyond the permanent footprint of the proposed Port facilities and the area encompassing the cable sweep of the STL Buoy anchor chains. Although a permanent impact of approximately 3.2 acres would be expected, impacts beyond the permanent footprint of the proposed Port facilities would be short-term and minor.

The impacts of alteration to seafloor habitat previously described for non-endangered marine mammals (Section 4.2.5) also apply to ESA-listed marine mammals. The likelihood of an ESA-listed marine mammal entering this area during construction is very low. If one of these animals approaches the impacted area during construction, the animal would likely move away from the activity. Any ESA-listed marine mammals that are displaced during construction of the proposed Project area are expected to return following construction. Alterations to seafloor habitats associated with trenching, backfilling, and jetting activities may affect, but not likely to adversely affect ESA-listed marine mammals.

Turbidity

Short-term, minor, adverse impacts on ESA-listed marine mammals would occur as a result of seafloor disturbance during proposed Project construction. Plowing and jetting activities would displace bottom sediments and result in temporary water column and seafloor disturbances, as described in Section 4.2.5.1, which have the potential to impact ESA-listed marine mammals.

Table 4.3-1. Impact Assessment Summary for Federal Threatened and Endangered Species

Common Name	Scientific Name	Occurrence in New York Bight	ESA and MMPA Status	Impact Assessment	Impacts of Alternatives
Marine Mammals					
Blue whale	*Balaenopera musculus*	Unlikely, prefers deeper waters	Endangered	May affect, but not likely to adversely affect	May affect, but not likely to adversely affect
Fin whale	*Balaenoptera physalus*	Abundant, Year-Round	Endangered	May affect, but not likely to adversely affect	May affect, but not likely to adversely affect
Humpback whale	*Megaptera novaeangilae*	Common, Seasonal	Endangered	May affect, but not likely to adversely affect	May affect, but not likely to adversely affect
North Atlantic right whale	*Eubalaena glacialis*	Rare, Seasonal	Endangered	May affect, but not likely to adversely affect	May affect, but not likely to adversely affect
Sei whale	*Balaenoptera borealis*	Rare, Seasonal	Endangered	May affect, but not likely to adversely affect	May affect, but not likely to adversely affect
Sperm whale	*Physeter macrocephalus*	Unlikely, prefers deeper waters	Endangered	May affect, but not likely to adversely affect	May affect, but not likely to adversely affect
Sea Turtles					
Kemp's ridley turtle	*Lepidochelys kempii*	Abundant, Seasonal	Endangered	May affect, but not likely to adversely affect	May affect, but not likely to adversely affect
Loggerhead turtle	*Caretta*	Abundant, Seasonal	Threatened	May affect, but not likely to adversely affect	May affect, but not likely to adversely affect
Green turtle	*Chelonia mydas*	Common, Seasonal	Endangered	May affect, but not likely to adversely affect	May affect, but not likely to adversely affect
Leatherback turtle	*Dermochelys coriacea*	Abundant, Seasonal	Endangered	May affect, but not likely to adversely affect	May affect, but not likely to adversely affect
Marine Fish					
Atlantic sturgeon	*Acipencer oxyrinchus*	Seasonal	Endangered	May affect, but not likely to adversely affect	May affect, but not likely to adversely affect
Coastal and Marine Birds					
Roseate tern	*Sterna dougallii*	Patchy along coast, Seasonal	Endangered	May affect, but not likely to adversely affect	May affect, but not likely to adversely affect
Piping plover	*Charadrius melodus*	Isolated/rare along coast, Seasonal	Threatened	May affect, but not likely to adversely affect	May affect, but not likely to adversely affect

The impacts of turbidity previously described for non-endangered marine mammals also apply to ESA-listed marine mammals. While disturbed sediments would be suspended into the lower portion of the water column directly above the seafloor and cause a turbidity plume, bottom currents in the area typically are slow (less than 0.2 knots), and the coarse, sandy sediments should settle rapidly before any ESA-listed marine mammal would likely encounter it. Suspended solid concentrations of 50 mg/L or greater are likely to be found within 1,400 feet of the proposed Mainline in state waters and within 700 feet in federal waters (see Section 4.2.2.1 for further discussion). Substantial sedimentation of 0.8 inch or greater is expected to occur within 190 feet of the proposed Mainline in state waters and within 110 feet in federal waters.

The likelihood of an ESA-listed marine mammal encountering a turbidity plume substantial enough to impact the animal is very low. If one of these animals approaches the impacted area during construction, the animal would likely move away from the activity. Any threatened and endangered marine mammals that are displaced during construction of the proposed Project area are expected to return following construction. The short-term and localized increase in turbidity associated with construction activities may affect, but not likely to adversely affect ESA-listed marine mammals.

Routine Discharges

Routine discharges would not result in adverse impacts on ESA-listed marine mammals. Routine discharges from construction vessels would include deck runoff and engine cooling water. All gray water and sanitary wastewater would be stored onboard for appropriate disposal. All discharges from the marine vessels would comply with USCG requirements and the requirements highlighted in Table 1.4-1. Since only a small area would be impacted, discharges would dissipate, and marine mammals could avoid unfavorable conditions. Impacts related to alteration of prey species abundance and distribution from construction vessel intake and discharge are discussed later in this section.

Hydrostatic Testing Intake and Discharge

Hydrostatic testing intake and discharge discussed in Section 4.1 would not result in adverse impacts on ESA-listed marine mammals. Impacts related to alteration of prey species abundance and distribution from hydrostatic testing intake and discharge are discussed later in this section.

Accidental Releases of Fuel, Oil, and Other Chemicals

Accidental releases of fuel, oil, and other chemicals stored could degrade water quality with potential adverse, short-term impacts on ESA-listed marine mammals. In the case of an emergency, a Spill Response Plan would be followed to handle any accidental spills so that they would be small and not enter the ocean. Models suggest that a spill of up to 84 gallons would rapidly dissipate, with wind stress and abiotic factors affecting the actual rate of dispersion. NOAA's ADIOS modeling system predicted rapid dissipation rates of the maximum most probable discharge of 2,500 barrels (105,000 gallons) of fuel oil. The time it took to reach concentrations of less than 0.05 percent varied between 0.5 and 2.5 days, depending on ambient wind. Concentrations of less than 0.5 percent occurred within 44 hours with 10-knot winds and within 11 hours with 20-knot winds. The short-term and localized potential for accidental release of fuel, oil and other chemicals associated with construction activities may affect, but not likely to adversely affect ESA-listed marine mammals.

LNGRV Commissioning

Short-term, minor impacts on ESA-listed marine mammals from water intake and discharge may result from initial LNGRV commissioning. Once the LNGRVs have been fully commissioned, no discharges are anticipated from LNGRVs during natural gas offloading at the proposed Port facilities. It is estimated that the average cooling water intake/discharge rate for an LNGRV could approach 8.2 mgd during this period. Based on CORMIX modeling, the estimated temperature difference between cooling water intake and discharge is anticipated to be in the range of approximately 9°F to 14°F (5°C to 8°C), with a

maximum difference of 18°F (10°C). Compliance with the USEPA's 1.8°F excess temperature criterion is predicted to occur within less than 90 feet of the point of discharge, which is well within the typical 328-foot regulatory mixing zone. The plume centerline temperature is predicted to drop from 18°F greater than ambient at the point of discharge to less than 1.8°F greater than ambient within approximately 30 to 90 feet downcurrent of the point of discharge. A thermal plume from water discharge may cause stress for local marine mammals; however, they would not likely be adversely affected, because the plume would be relatively small and would dissipate. The short-term, minor impacts associated with LNGRV commissioning may affect, but not likely to adversely affect ESA-listed marine mammals.

Noise

Short-term, moderate, adverse impacts on ESA-listed marine mammals would result from noise generated during proposed Project construction. Sound sources of underwater construction noise associated with the proposed Project include impact pile driving (from anchor pile installation, if in the unlikely event geotechnical conditions preclude use of suction anchors), proposed Mainline and pipeline lateral installation, and support vessels. A more detailed discussion of underwater noise resulting from each of these construction activities associated with the proposed Project is provided in Section 4.11.

The hearing capabilities and criteria for acoustic impacts discussed in previous sections for non-endangered marine mammals (discussed in Section 4.2.5) also apply to ESA-listed marine mammals.

Continuous noise created by construction vessels could create masking effects among ESA-listed marine mammals in the same manner as for non-endangered marine species. Masking occurs when underwater noise interferes with an animal's ability to hear biologically relevant sounds. Ambient noise levels in the proposed Project area and surrounding waters are elevated and variable due to current levels of shipping, fishing, and recreational vessel traffic. As a result, temporary increases due to construction vessel traffic would have a minimal contribution to that ambient noise. In addition, the transient nature and short-term duration of construction vessel noise would reduce the potential for masking to occur (LGL and Jasco 2005).

Pile-driving activities and other sound sources generated during construction would impact different species in different ways and to different degrees. In general, construction-related noise would be moderate and short-term; therefore, it may affect, but not likely to adversely affect ESA-listed marine mammals. Because impact piling was assessed to have the highest potential for sound generation (over the widest area) associated with the proposed Project, the Applicant's preferred mooring design is the use of suction anchors. All sound sources from the construction phase of the proposed Project would be considered to have a minor impact on endangered marine mammals. Because the behavioral response of marine mammals to a perceived marine sound depends on a range of factors, including: (1) the SPL; (2) frequency, duration, and novelty of the sound; (3) the physical and behavioral state of the animal at the time of perception; and (4) the ambient acoustic features of the environment (Hildebrand 2004), it is more difficult to predict behavioral shifts due to anthropogenic sounds. The radiation of sound to marine waters during proposed Project construction would be within the immediate vicinity of the proposed Project, and effects are expected to be temporary, hence "harassment" (TTS) for all species is expected to be minor. Although species abundance varies by season in the ROI, the likelihood of "harm" (PTS) or "harassment" (TTS) from the proposed Project to individuals or species due to underwater sound would be unlikely because of the transient and seasonal nature of the species moving through the ROI, and the ability of animals to move away from sound sources.

The short-term and moderate increase in noise associated with construction activities may affect, but not likely to adversely affect ESA-listed marine mammals.

Vessel Traffic

Short-term, minor, adverse impacts on ESA-listed marine mammals would occur as a result of support vessel traffic during proposed Project construction and would impact ESA-listed marine mammals in the same manner as for non-endangered marine species (as presented in Section 4.2.5 and Table 4.2-2). Each of the federally listed marine mammal species potentially occurring in the ROI would be susceptible to vessel strike during construction of the proposed Project, as there are recorded incidents of each of these species being involved in a vessel collision. Impacts from vessel collisions take two forms, propeller wounds and blunt trauma, and can cause injury or mortality to the individual involved. Sub-lethal injury could range from minor to serious impacts, potentially leading to decreased feeding and reproductive success. If struck, serious injury or mortality to the animal would result. Any marine mammal strike would be considered a "take" under the MMPA. If a threatened or endangered marine mammal were to be struck, it would also be considered a "take" under the ESA the MMPA and would require issuance of an incidental take authorization under Section 101(a)(5) of the MMPA. While it is known that an increase in vessel traffic increases the risk of collision, the probability of that risk cannot be quantified.

The Large Whale Vessel Strike Database (Strike Database) has documented 292 incidents of large whale/vessel collisions from 1975 to 2002, involving 11 species of whales. Of those incidents, 48 resulted in injury and 198 were fatal. The vessels involved in collisions included recreational vessels, freighters, tankers, cruise ships, and navy vessels, among others (Jensen and Silber 2004). The majority of serious injuries and mortalities are a result of impact with large vessels (greater than 262 ft long), although smaller vessels have caused some of these impacts (Laist et al. 2001). Small vessels might cause fewer collisions because they generally operate in clear weather and are relatively maneuverable, whereas larger vessels are less likely to detect nearby whales to be able to avoid collisions (Laist et al. 2001).

Where vessel speed was known (58 incidents), the Strike Database reported speeds ranging from 2 to 51 knots; most collisions occurred when vessels were traveling at speeds of 13 to 15 knots (Jensen and Silber 2004). A more recent study, which evaluated the effects of impact speed on whales, determined that a vessel traveling at 10.5 knots had a 50-percent chance of causing serious injury or mortality to the affected individual. This probability increased to 75 percent for vessels traveling at 14 knots, and exceeded 90 percent for vessels traveling at 17 knots (Pace and Silber 2005).

The Strike Database documented 28 confirmed vessel strikes of large whales off the coasts of New York and New Jersey, including two right whales, three humpback whales, two sperm whales, four minke whale, and one unknown species. Only one of the strikes, involving a humpback whale, did not result in mortality of the individual. It is likely that the numbers reported in the Strike Database are underestimates of the number of whales struck because it is unlikely that every incident was noticed and reported (Jensen and Silber 2004).

Construction of the proposed Project would require various construction vessels (see Table 4.2-4). These vessels would range from 80 to 599 feet and large vessel movement and speed would be contingent upon task performed and duration (e.g. proposed Mainline installation). These vessels would most likely mobilize and demobilize once. Crew boats, on the other hand, would operate and transit the site more frequently, depending on duty.

Among the species listed as threatened or endangered in the proposed Project area, the North Atlantic right whale is the only endangered species for which recent population modeling exercises by NOAA indicate that the loss of a single individual could have a negative effect to the survival of the species. The death of even one individual is above the acceptable limit and, should it occur, would be considered a long-term and major adverse impact. While an increase in vessel traffic increases the risk of collision, the proportional probability of that risk associated with construction vessels cannot be quantified, particularly when vessel traffic is already high. Large vessels would only likely mobilize/demobilize to the

construction site once, whereas smaller vessels may transit the proposed Project area multiple times. Therefore, the risk of strike from a large vessel has a smaller likelihood.

The North Atlantic right whale is particularly susceptible to vessel strikes. Because the proposed Project area partially overlaps the Mid-Atlantic seasonal management area (SMA) for this protected marine mammal, vessels 65 feet or longer must maintain speeds less than 10 knots within this area from 1 November to 30 April to reduce collision risk. Therefore, vessels 65 feet or longer would comply with speed restrictions set in-place. A Marine Mammal and Sea Turtle Vessel Strike Avoidance Plan has been prepared to decrease risk of collisions, which would inform all crew to guidelines to protect marine species from collisions (Appendix K). Section 4.2.8 details the measures that would be taken by the Applicant to reduce the potential for vessel collisions with any marine animal. The short-term and minor increase in vessel traffic associated with construction activities may affect, but not likely to adversely affect ESA-listed marine mammals.

Ingestion of Marine Debris

Short-term, negligible, adverse impacts on ESA-listed marine mammals would result from the accidental release of marine debris (e.g., ropes, plastic, etc.) during construction. Ingestion of marine debris has been documented for bowhead and minke whales (Laist 1997), including plastic sheeting and polyethylene bags (Laist 1997). It is possible that mysticetes may ingest items found on the surface or within the water column, but with the exception of the humpback whale, it is not likely that mysticetes would encounter items found on the seafloor. Both sperm whales and beaked whales are known to incidentally ingest foreign objects while foraging; however, this does not always result in negative consequences to the animal's health (Laist 1997; Walker and Coe 1990). Existing regulations prohibit the disposal of plastic, dunnage, lining, floating packing materials, and all other trash within 12 miles of the coast. Further, as a SOP, all vessels associated with the proposed Project would be prohibited from dumping trash of any kind. Solid waste management training would be provided that emphasizes the importance of minimizing impacts on marine mammals, sea turtles, and migratory birds. This combination of proposed Project policy and existing regulations would ensure that any marine debris accidentally expended within the proposed Project area would be negligible. The short-term and negligible potential for accidental release of marine debris associated with construction activities may affect, but not likely to adversely affect ESA-listed marine mammals.

Entanglement

Short-term, minor, adverse impacts on ESA-listed marine mammals would result from entanglement in anchor lines, tethers, or other materials during construction. Entanglement of ESA-listed marine mammals within derelict fishing gear, ropes, lines, or other marine debris has received much attention in recent decades and is an important threat to marine mammals. A 25-year dataset assembled by the Ocean Conservancy reported that fishing line, rope, and fishing nets accounted for most entanglements, with the remainder due to encounters with various items such as bottles, cans, and plastic bags (Ocean Conservancy 2010). Potential impacts of entanglement for marine mammals are sometimes fatal. However, since animals are capable of freeing themselves of entanglement, scarring may be a better indicator of fisheries interaction than entanglement records. In an analysis of the scarification of right whales, 338 of 447 (75.6 percent) right whales examined during 1980 to 2002 were scarred at least once by fishing gear (Knowlton et al. 2005). NOAA Fisheries records from 1990 through 2007 have confirmed 46 right whale entanglements within weirs, gillnets, and trailing line and buoys.

Construction barges and other vessels would use fixed anchoring methods, and the associated anchor cables could pose a risk of entanglement to marine mammals. Other lines and hoses would be associated with the jetting equipment at jetting locations. Marine mammals could be entangled by anchors, anchor lines, or buoy lines deployed during construction, but the potential for such an event would be low. Anchor lines securing the derrick/lay barge would be large in diameter, knotless, non-floating, and taut,

and would only be deployed for a short period of time. In addition, anchor lines would be separated by hundreds of feet as they radiated away from the vessel and would not be laterally connected to other lines, thereby avoiding the creation of a "web effect." With adherence to best management practices for detection of ESA-listed marine mammals in the area, the potential for entanglement associated with construction activities can be minimized. Combined, these factors would decrease the potential for ESA-listed marine mammal entanglement and impacts would be short-term and minor, and may affect, but not likely to adversely affect ESA-listed marine mammals.

Lighting

Short-term, minor, adverse impacts on ESA-listed marine mammals would result from lighting used during construction. Certain types of lighting are known to attract ESA-listed marine mammals. Artificial light can confuse adult turtles making their way to nesting habitat, or turtle hatchlings moving toward the water, possibly resulting in an increased risk of mortality (NMFS 2010d).

Lighting used during construction would primarily be limited to the vessels (navigation lights, spotlights, decklights, etc.) used to illuminate the work area both on the vessel and on the water. Precautions would be made to minimize the amount of lighting needed directly on the water surface, as appropriate, without compromising the quality or safety of the work area.

ESA-listed marine mammals may be attracted to the lighting used during proposed Project construction. However, the nature of the other associated stressors covered in this section associated with the construction activities (i.e., noise, seafloor disturbance, etc.) would likely cause animals to move away from those activities, rather than be attracted to the proposed Project area because of the lighting, resulting in minor and temporary impacts during construction.

The additional lighting associated with construction vessels may affect, but not likely to adversely affect ESA-listed marine mammals.

Alteration to Prey Species Abundance and Distribution

Negligible impacts on ESA-listed marine mammals would be expected to occur as a result of alteration to prey species abundance and distribution associated with the proposed Project during construction in the same manner as for non-endangered marine species. The abundance and distribution of prey species may be impacted during construction by turbidity, sedimentation, and noise, as well as entrainment during water withdrawals during construction, as described in Section 4.2.3.

In particular, the removal of copepods, a popular prey item for many large ESA-listed whales, may affect a few species. It has been estimated that large cetaceans would consume about 4 percent of their body weight per day (Seageant 1969). Large whales can ingest up to 461 million copepods per day, totaling approximately 14 billion copepods per month (Durbin et al. 2002). Peak activity at the proposed Port would occur in the winter (a time of low copepod abundance) and in the summer (a time of high copepod abundance), affecting 0.88 to 35.36 billion copepods, respectively, over the course of a year.

At least 21 species of copepod inhabit the New York Bight. The copepod abundance in the inner New York Bight (i.e., up to 66 feet deep) can range from 1,000 to 90,000 individuals per cubic meter and from 200 to 8,000 individuals per cubic meter in the outer New York Bight, based on the season and including all species of copepod, not just those that have been identified as the preferred prey of whales (USFWS 1997). One-time limited duration activities, including hydrostatic testing, deepwater port commissioning, and other construction, operation, and decommissioning activities, would remove an estimated total of 1.4 to 57.6 billion copepods, depending on the season (Table 4.3-2), from the outer New York Bight. Using nearshore copepod densities of all species combined, the one-time limited duration construction activities in the inner New York Bight would remove an estimated total of 2.8 to 248.2 billion copepods (Table 4.3-3). One-time limited duration activities would have minimal to moderate impact on the amount of food available for whales to forage; however, the dominant foragers of copepods, namely the

humpback whale and North Atlantic right whale, feed further north and are not likely to depend on copepods in the ROI as a major part of their diets. Since potential impacts on prey species would be short-term and confined to the general vicinity of the construction activities, impacts on prey species may affect, but not likely to adversely affect ESA-listed marine mammals.

Table 4.3-2. Summary of Proposed Port Ambrose Project Estimated Seawater Intake Volumes with Calculated Copepod Intake for Outer New York Bight Densities (200 – 8,000/m^3) throughout Project Life

Activity	Total Seawater Intake (MMgal)	Total Seawater Intake (MMm^3)	Total Copepod Intake 1 (MM copepods)	Total Copepod Intake 2 (MM copepods)	Approximate Timing
One-time Limited Duration Activities					
Construction Vessels	1,396.91	5.29	1,058	42,306	December 2016 to November 2017
Hydrostatic Testing	3.49	0.01	3	106	August to October 2016
Deepwater Port Commissioning	369.4	1.40	280	11,186	October to December 2017
Decommissioning	130.66	0.49	99	3,957	End of Project Life
Total One-time Limited Duration Activities	**2,628.83**	**9.95**	**1,440**	**57,555**	
Periodic "As-needed" Activities					
Maintenance and Repair (intake/discharge over 30 days)	42.94	0.16	33	1,300	As needed (assume at 5-year intervals)
Emergency Scenario (intake/discharge over 30 days)	42.94	0.16	33	1,300	As needed (assume at 5-year intervals)
Total Periodic "As-needed" Activities	**85.88**	**0.32**	**66**	**2,600**	
Annual Operations					
Port Operations - LNGRV and Support Vessel (total intake/discharge over a year)	1,167.40	4.42	884	35,356	Beginning in December 2017 (CW intake/discharge from support vessel only)

Notes:
1. Approximate timing based on construction occurring one year later than the schedule presented in the September 2012 Deepwater Port application.
2. Total Copepod Intake 1 based on an estimated 200 individuals per cubic meter in outer New York Bight (USFWS 1997).
3. Total Copepod Intake 2 based on an estimated 8,000 individuals per cubic meter in outer New York Bight (USFWS 1997).

Table 4.3-3. Summary of Proposed Port Ambrose Project Estimated Seawater Intake Volumes with Calculated Copepod Intake for Inner New York Bight Densities (1,000 – 90,000/m^3) throughout Project Life

Activity	Total Seawater Intake (MMgal)	Total Seawater Intake (MMm^3)	Total Copepod Intake A (MM copepods)	Total Copepod Intake B (MM copepods)	Approximate Timing
One-time Limited Duration Activities					
Construction Vessels	465.64	1.76	1,763	158,648	December 2016 to November 2017
Supplemental Lowering and Backfilling	262.76	0.99	995	89,527	July to September 2017
Total One-time Limited Duration Activities	**782.40**	**2.76**	**2,758**	**248,175**	
Periodic "As-needed" Activities					
Maintenance and Repair (intake/discharge over 30 days)	14.31	0.05	55	4,877	As needed (assume at 5-year intervals)
Emergency Scenario (intake/discharge over 30 days)	14.31	0.05	55	4,877	As needed (assume at 5-year intervals)
Total Periodic "As-needed" Activities	**28.62**	**0.10**	**110**	**9,754**	

Notes:
1. Approximate timing based on construction occurring one year later than the schedule presented in the September 2012 Deepwater Port application.
2. Total Copepod Intake A based on an estimated 1,000 individuals per cubic meter in inner New York Bight (USFWS 1997).
3. Total Copepod Intake B based on an estimated 90,000 individuals per cubic meter in inner New York Bight (USFWS 1997).

Air Emissions

Negligible impacts on ESA-listed marine mammals are expected as a result of air emissions from support vessels during construction rather than the regasification process. Parts like connectors, valves, and flanges that may leak would be monitored in a small space by gas leakage detectors so that workers are notified of any issues immediately. Additionally, SOPs would be enacted to reduce the potential for fugitive emissions. Air emissions are expected to be similar to that of other vessels transiting the approach to Ambrose Channel in the ROI. Construction activities would contribute a very minimal portion of total air emissions in the New York Bight, and emissions would be short-term. The negligible impacts expected from increased air emissions associated with construction activities may affect, but not likely to adversely affect ESA-listed marine mammals.

4.3.2.2 Impacts of Operation

Benthic Habitat

Impacts on benthic resources and habitat are discussed in Section 4.2.2. Long-term, negligible, adverse impacts on ESA-listed marine mammals would occur as a result of seafloor disturbance from anchor chain sweep during proposed Project operation in the same manner as described in Section 4.2. Therefore, alterations of seafloor habitats associated with operations may affect, but not likely to adversely affect ESA-listed marine mammals.

Turbidity

Long-term, minor, adverse impacts on ESA-listed marine mammals would occur as a result of turbidity increases associated with proposed Project operation in the same manner as on non-listed marine

mammals, as described in Section 4.2.5. Routine operation activities with potential to impact turbidity are limited to the movement and possible minor bottom scouring associated with anchor chains, wire, and umbilical systems. As previously discussed, the total area of seafloor expected to be impacted by such movement is 1.4 acres per buoy and any resulting turbidity is expected to be greatest within the approximate 3,138-foot radial footprint of the buoy mooring legs.

As previously detailed (see Section 4.2.2.2), anchor chain sweep impacts are estimated to be less than those modeled for the proposed Calypso LNG Deepwater Port Project (USCG 2008), because of shorter anchor chain length, a smaller proportion of fine-size sediment, and lower current velocities. Suspended sediment concentrations are expected to be less than a maximum predicted value of 63 to 115 mg/L, and maximum plume size would be expected to be less than 558 to 807 feet. Maximum values reflect isolated and extreme conditions; typical TSS concentration and sediment plume size would be less. Turbidity associated with proposed Port operations may affect, but not likely to adversely affect ESA-listed marine mammals.

LNGRV Ballast Water Intake

Negligible, long-term, direct impacts on ESA-listed marine mammals are expected to occur as a result of potential prey removal associated with the proposed Project ballast water intake during operation. When an LNGRV is connected to an STL Buoy in regasification mode, seawater from its ballast water tanks would be used as a source of cooling water. Water would be recycled to and from the ballast water tanks, thus there would be no discharge of cooling water at the proposed Port facilities. It is estimated that while connected to the STL Buoy, the LNGRV would withdraw approximately 1.93 mgd at the annual natural gas sendout rate of 400 MMscf/d, at intake velocities less than 0.5 ft/sec.

At least 21 species of copepod inhabit the New York Bight. The copepod abundance in the inner New York Bight (i.e., up to 66 feet deep) can range from 1,000 to 90,000 individuals per cubic meter and from 200 to 8,000 individuals per cubic meter in the outer New York Bight, based on the season and including all species of copepod, not just those that have been identified as the preferred prey of whales (USFWS 1997). Peak activity at the proposed Port would occur in the winter (a time of low copepod abundance) and in the summer (a time of high copepod abundance), affecting 0.88 to 35.36 billion copepods, respectively, over the course of a year (Table 4.3-2). In particular, the removal of copepods, a popular prey item for many large ESA-listed whales, may affect a few species. It has been estimated that large cetaceans would consume about 4 percent of their body weight per day (Seageant 1969). Large whales can ingest up to 461 million copepods per day, totaling approximately 14 billion copepods per month (Durbin et al. 2002). These animals have been found in groups of up to 30 individuals (Watkins and Schevill 1976). If every individual in a group ingests roughly the same amount of copepods (461 million/day), a group of 30 right whales would ingest over 13.8 billion copepods per area per day.

Humpback whales are a migratory species that forage from the Gulf of Maine to the Scotian Shelf from April to December and migrate to southern waters during the winter (Robbins 2011). Humpback whale foraging areas are well north of the ROI. The North Atlantic right whale is also a migratory species travelling the U.S. East Coast and Canada seasonally (Pendleton et al. 2009). During the late winter through early summer, right whales can be found foraging in the critical habitat areas of Cape Cod Bay to the Great South Channel (between Nantucket Shoals and Georges Bank, southeast of Cape Cod) (Pendleton et al. 2012). While ballast water intake would have minimal to moderate impact on the amount of food available for whales to forage, the dominant foragers of copepods, namely the humpback whale and North Atlantic right whale, feed further north and are not likely to depend on copepods in the ROI as a major part of their diets. Since potential impacts on prey species would be confined to the general vicinity of the proposed Port, it would not likely adversely affect ESA-listed marine mammals.

The impacts associated with LNGRV ballast water intake associated with operational vessels may affect, but not likely to adversely affect ESA-listed marine mammals.

Routine Discharges

As discussed in Section 4.1, the routine vessel discharges during proposed Project operation would not result in adverse impacts on ESA-listed marine mammals. Routine discharges would include deck runoff from the LNGRV and support vessel, and engine cooling water from the support vessel. All gray water and sanitary wastewater would be stored onboard for appropriate disposal. All discharges from the marine vessels would comply with USCG requirements and the requirements highlighted in Table 1.4-1. Since only a small area would be impacted, discharges would dissipate, and ESA-listed marine mammals could avoid unfavorable conditions. Routine discharge associated with operation activities may affect, but not likely to adversely affect ESA-listed marine mammals.

Accidental Releases of Fuel, Oil, and Other Chemicals

Accidental releases of fuel, oil, and other chemicals stored and/or in use in support of proposed Project operation could degrade water quality with potential adverse short-term impacts on ESA-listed marine mammals within the ROI. Risks associated with construction (Section 4.3.2.1) would be similar, albeit less during operation. An accidental release of a substance would be expected to dissipate, even with an extreme spill reaching concentrations of less than 0.05 percent in less than 2.5 days (see Section 4.3.2.1 for more detail). In the event of an accidental spill, workers would follow the Spill Response Plan to prevent or mitigate foreign substances from entering the ocean. Therefore, a spill may affect, but not likely to adversely affect, ESA-listed marine mammals.

LNG Spills

Short-term, minor, direct, adverse impacts on ESA-listed marine mammals could occur in the unlikely event of an LNG spill. All LNGRVs are designed with features to minimize the potential for LNG spills (see Section 2.1). However, if an LNG spill were to occur, potential impacts would include exposure to low-temperature LNG at the water surface, possibly resulting in frostbite or death and asphyxiation by natural gas vapors above the surface of the water. These impacts would likely occur in the immediate vicinity of the spill location; the time frame of the impact is limited (see Section 5). Since LNG would boil off as natural gas at the surface, depth and pressure required for gas to dissolve (Artemov et al. 2005) in surface waters would not be sufficient and gas vapors would disperse. In addition, the time frame for these impacts would be limited, and adverse toxic impacts would be expected to be minor after the LNG boiled off and the vapors dispersed.

The potential for a release of natural gas from the proposed Mainline and pipeline laterals are remote. If there were a subsea release of natural gas, the gas would rise to the water surface rapidly and dissipate. In general, whether a release is sudden or extended, physics dictate that any methane would gradually dissolve into the water column during the lifetime of the bubble as described by Fick's law, taking into account Henry's law constants, partial pressure and concentrations of dissolved gases (Artemov et al. 2005). Once a gas bubble reaches the surface, it would rise (being lighter than air) and be dispersed by air currents. ESA-listed marine mammal impacts from such a release would be short-term and minor. Therefore, the potential for LNG spill or release of natural gas associated with operation activities may affect, but not likely to adversely affect ESA-listed marine mammals.

Noise

Long-term, moderate, adverse impacts on ESA-listed marine mammals could occur as a result of noise generated during operations. Support vessel and LNGRV noise is the primary noise-producing factor during operations. All construction sound sources would be considered to have minor consequences to species of marine mammals relative to “harm” criteria (PTS). The radiation of sound to marine waters during operations is expected to be temporary, hence “harassment” (TTS) for all species would be considered minor. Although species abundance varies by season and species in the ROI, the likelihood of “harm” (PTS) or “harassment” (TTS) from the proposed Project to individuals or species due to

underwater sound would be unlikely because of the transient and seasonal nature of the species moving through the ROI, and the ability of animals to move away from sound sources. Noise levels predicted for LNGRV transit and mooring activities show the TTS criterion to be exceeded for HF cetaceans (harbor porpoises) within 38 km of the source, and PTS threshold to be exceeded for HF cetaceans within 270 meters. In particular, the 38-km distance seems fairly large; however, both the TTS and PTS threshold distances are for 24 hours of continuous exposure. Therefore, the likelihood of the LNGRV transit causing TTS or PTS in harbor porpoises would be rare. The overall risk level to harbor porpoises for LNGRV transit and mooring is low for PTS and TTS occurrence. A more detailed discussion of underwater noise resulting from operation activities associated with the proposed Project is provided in Section 4.11. The Port of New York and New Jersey is among the busiest ports in the United States, receiving over 4,500 large vessels and 240 cruise vessels each year. Even at a maximum of 45 LNGRVs per year, this would only contribute less than 2 percent of the total traffic; therefore, vessel noise would not be a significant noise source. Since pile driving is limited to construction activities only in the unlikely event geotechnical conditions preclude use of suction anchors, the potential for noise impacts during operations is substantially reduced and limited to continuous noise associated with the support vessel, with similar impacts as described in Section 4.2.5.1.

Continuous noise created by the noise sources associated with proposed Port operations could create masking effects among marine mammals, in the same manner as described in Section 4.2.5.1. The noise associated with proposed Port operations activities may affect, but not likely to adversely affect ESA-listed marine mammals. Under the MMPA, the potential acoustic exposures from proposed Port operations activities would be within the non-injurious behavioral effects zone (Level B harassment) for marine mammals (USCG 2006a, 2006b; FERC 2006). Therefore, increased noise associated with operation activities may affect, but not likely to adversely affect ESA-listed marine mammals.

Planned and Unplanned Maintenance and Repair

Planned and unplanned maintenance and repair sound effects may have short-term, minor, adverse impacts on ESA-listed marine mammals. It is anticipated that planned maintenance activities would occur on a regular basis either annually or biennially; whereas repair activities, either planned or unplanned, would occur on a less frequent basis. Planned maintenance activities are typically short in duration (several days or less) and would include attaching/detaching and/or cleaning the buoy pick-up line to the STL Buoy, performing surveys and inspections with a ROV, and cleaning or replacing parts (e.g., bulbs, batteries, etc.) on the floating navigation (i.e., marker) buoys. Inspections and surveys would also be conducted after a significant storm event. Minor repairs would not be expected to increase noise levels by any significant amount. The primary source of noise during maintenance and repairs is vessel noise.

According to BOEM, underwater noise from small vessels ranges from 145 to 170 dB at 1 meter. According to the USCG, underwater noise associated with vessels with an engine between 1,200 hp and 6,140 hp ranges from 92 to 112 dB at 1 meter (see Section 4.11.2.1). Non-continuous noise associated with small vessel movement and positioning would be below the zone of injury as given in the MMPA for Level A and Level B harassment; therefore, impact on ESA-listed marine mammals from planned maintenance would be minimized. At a maximum, every 7 10 years an intelligent pig would be run down the proposed Mainline and pipeline laterals to assess the condition of the proposed Mainline system. This particular activity would require several large construction-type vessels and several weeks to complete. According to BOEM, noise associated with larger vessels can range from 169 to 198 dB at 1 meter (MMS 2004b; Richardson et al. 1995).

Repairs can be either minor or major. Minor repairs are typically shorter in duration and could include replacing faulty pressure transducers, or repairing a stuck valve. These kinds of repairs would require one diver support vessel with three or four anchors to hold its position. Minor repairs could take from a few days to several weeks depending on the nature of the problem.

Major repairs, on the other hand, are longer in duration and typically require large construction vessels similar to those used to install the proposed Mainline and set the buoy and anchoring system. These vessels would typically mobilize from local ports, Canada, or the Gulf of Mexico. Major repairs typically require upfront planning, equipment procurement, and mobilization of vessels and possibly saturation divers. Examples of major repairs are damage to the riser or umbilical line and their possible replacement, damage to the proposed Mainline system and manifolds, or anchor chain replacement. These types of repairs could take up to two to four weeks. To provide a worst-case scenario, it was assumed that the noise generated by maintenance and repair activities would be similar to that generated during the construction of the facilities (LGL and JASCO 2005). The results of the Neptune LNG noise modeling for the proposed Mainline route indicates that the 120-dB contour during proposed Mainline repair activities would extend out 3.5 to 4.1 nautical miles encompassing an area from 35 to 44 nautical square miles. These modeling results are also expected to be a representative worst-case scenario of maintenance and repair activities for the proposed Project. This worst-case scenario is anticipated to occur no more than once per five-year period, lasting no more than 28 days or 672 hours. These underwater sound levels could cause some species to temporarily disperse from or avoid repair areas, but they are expected to return shortly after the completion of repairs.

Short-term, minor, adverse impacts on ESA-listed marine mammals would occur as a result of support vessel traffic during proposed Project maintenance and repair. Vessel traffic would be similar to construction as described in Section 4.3.2.1. It is estimated that the majority of vessel traffic would be within the proposed Project area, with large vessel movement and speed contingent upon the task performed and duration (e.g., proposed Mainline installation). These vessels would most likely mobilize and demobilize once. Crew boats, on the other hand, would operate and transit the site more frequently, depending on duty.

Large vessels are only likely to mobilize/demobilize to the construction site once, whereas smaller vessels may transit the proposed Project area multiple times. Therefore, large vessels used for construction would only be a concern for a short duration. Additionally, a Marine Mammal and Sea Turtle Vessel Strike Avoidance Plan has been prepared to decrease risk of collisions (Appendix K). The mitigation measures detailed in Section 4.2.8 would be taken to avoid collisions.

Impacts resulting from planned and unplanned maintenance and repair may affect, but not likely to adversely affect ESA-listed marine mammals.

Vessel Traffic

Long-term, minor, adverse impacts on ESA-listed marine mammals could occur as a result of increased vessel traffic during routine proposed Port operations. As previously discussed, increases in vessel traffic or vessel speeds could increase the potential for collisions with marine mammals, thereby increasing the occurrence of serious injuries or mortality. The strike of any marine mammals would be considered a take under the MMPA. The strike of any threatened or endangered marine mammals also would be considered a take under the ESA. The expected increase in vessel traffic during proposed Port operations would be 45 LNGRVs per year, plus routine number of support vessel transits. Compared to the annual number of deep draft vessels already transiting the approach to the Ambrose Channel (800 vessels), where the proposed Project is located, the minor increase in vessel traffic would be expected to result in only a small increased risk of vessel strikes to ESA-listed marine mammals. In addition, the LNGRVs must slow to 3 knots within the proposed Project Safety Zone surrounding each buoy. Since vessel speed is proportional to marine mammal collisions, this speed would increase both the ability of a marine mammal to avoid the vessel and the ability of the vessel to identify and avoid a marine mammal.

Prior to arrival at the proposed Port, LNGRVs would travel at faster speeds. At these traveling speeds, the potential for vessel/marine mammal interaction would increase, decreasing the ability of both parties to identify and avoid the other. In addition, as previously discussed, a marine mammal that is struck by a

vessel at a speed of 17 knots is more than 90 percent likely to experience mortality. Support vessels would comply with speed restrictions, further reducing collision risk.

The North Atlantic right whale is particularly susceptible to vessel strikes. Because the proposed Project area partially overlaps a SMA for this protected marine mammal, vessels 65 feet or longer must maintain speeds less than 10 knots within this area from 1 November to 30 April to reduce collision risk. Therefore, vessels 65 feet or longer would comply with speed restrictions set in-place. A Marine Mammal and Sea Turtle Vessel Strike Avoidance Plan has been prepared to decrease risk of collisions; this would inform all crew to guidelines to protect marine species from collisions (Appendix K). The mitigation measures detailed in Section 4.2.8 would be taken to avoid collisions.

The minor increase in vessel traffic may affect, but not likely to adversely affect ESA-listed marine mammals.

Ingestion of Marine Debris

Long-term, negligible, adverse impacts on ESA-listed marine mammals would result from the accidental release of marine debris (e.g., ropes, plastic, etc.) during operation, as described for construction in Section 4.3.2.1. It is possible that mysticetes may ingest items found on the surface or within the water column, but with the exception of the humpback whale, it is not likely that mysticetes would encounter items found on the seafloor. Both sperm whales and beaked whales are known to incidentally ingest foreign objects while foraging; however, this does not always result in negative consequences to the animal's health (Laist 1997; Walker and Coe 1990). Existing regulations prohibit the disposal of plastic, dunnage, lining, floating packing materials, and all other trash within 12 miles of the coast. Further, as a SOP, all vessels associated with the proposed Project would be prohibited from dumping trash of any kind. Solid waste management training would be provided that emphasizes the importance of minimizing impacts on marine mammals, sea turtles, and migratory birds. This combination of proposed Project policy and existing regulations would ensure that any marine debris accidentally expended within the proposed Project area would be negligible. Therefore, the potential accidental release of marine debris associated with operation activities may affect, but not likely to adversely affect ESA-listed marine mammals.

Entanglement

Long-term, negligible, adverse impacts on federally listed marine mammals could occur due to the increased risk of entanglement within anchor lines, chains, messenger lines, recovery line, bridle, or the floating buoy during routine proposed Port operations. The chains and cables used for the anchor lines resemble rigid "structures" because of their weight and relative immobility. The weight of the chain and cable combination would also increase the anchor line tautness, and thereby minimize the threat of entanglement during operations. Therefore, although it is possible that a mammal might swim into one of the chains, it is not likely that the chain would wrap around and entangle the animal. Marine mammals would be unlikely to become entangled in these lines because of the large size of the lines (the anchor chain, anchor cable, and retrieval line would be approximately 18 inches, 6 inches, and 4 inches in diameter, respectively). The other structures and accessories are not prone to become wrapped around an object, thereby minimizing the possibility of an animal becoming entangled within. They would be separated by several hundred feet as they extended out from the buoys, and would not be horizontally linked. Therefore, the potential for entanglement and subsequent direct impacts on ESA-listed marine mammals would be low. The amount, size, and type of anchor lines or other materials in the water column during operations may affect, but not likely to adversely affect ESA-listed marine mammals.

Lighting

Long-term, minor, adverse impacts on ESA-listed marine mammals would result from lighting used by the support vessel during operation, similar to the effects to non-endangered marine mammals, as

described in Section 4.2.5. Certain types of lighting are known to attract some marine organisms, including marine mammals.

Lighting used during operations would be limited to the vessels (navigation lights, spotlights, decklights, etc.) used to illuminate the work area both on the vessel and on the water. The buoys would also be lighted. Precautions would be made to minimize the amount of lighting needed directly on the water surface, as appropriate, without compromising the quality or safety of the work area. Such measures to be implemented during operations include downshielding the deck lights to illuminate only the deck and not the surrounding water surface. This is an important measure to minimize any attraction of ESA-listed marine mammals to the lights. Also, since the vessel would be stationary during these lighted operations, there is no risk for collision of an ESA-listed marine mammal.

The additional lighting associated with operational vessels may affect, but not likely to adversely affect ESA-listed marine mammals.

Alteration to Prey Species Abundance and Distribution

Long-term, negligible, adverse impacts on ESA-listed marine mammals would be expected to occur as a result of alteration to prey species abundance and distribution associated with the proposed Project during operation. Refer to LNGRV Ballast Water Intake detailed above for additional information on the potential for prey removal during proposed Port operations.

The potential prey removal associated with operational vessels may affect, but not likely to adversely affect ESA-listed marine mammals.

Air Emissions

Negligible impacts on ESA-listed marine mammals would be expected as a result of air emissions from LNGRVs or the support vessel during operation, similar to non-endangered marine mammals, as described in Section 4.2.5.

Air emissions associated with operational vessels may affect, but not likely to adversely affect ESA-listed marine mammals.

4.3.2.3 Impacts of Decommissioning

Benthic Habitat

Impacts on benthic resources and habitat are discussed in Section 4.2.2. Short-term, minor, adverse impacts on ESA-listed marine mammals would occur from decommissioning the proposed Project. As described in Section 4.3.2.1, decommissioning activities would produce similar water column impacts as previously described for construction activities. Decommissioning activities would result in similar localized, temporary disturbance of sediments and potential turbidity increases where installed mooring components would be removed from the bottom.

During the recovery of suction anchors, short-term, minor, direct impacts could include increased turbidity and fish displacement. Suction anchors used to secure the mooring lines would be inspected and backed out by pumping seawater into the pile and recovering it for onshore recycling/disposal. Alternatively, the pile could be cut below the mudline should conditions warrant. Driven piles would be abandoned in-place upon decommissioning, resulting in a permanent removal of these structures as benthic habitat.

Any ESA-listed marine mammals that are displaced during decommissioning of the proposed Port area would be expected to return following completed activities. Alterations to seafloor habitats associated with decommissioning activities may affect, but not likely to adversely affect ESA-listed marine mammals.

Turbidity

Short-term, minor, adverse impacts on ESA-listed marine mammals would occur as a result of turbidity increases associated with proposed Project decommissioning in the same manner as described for non-endangered marine mammals in Section 4.2.5. The proposed Mainline and pipeline laterals would be abandoned in-place to be consistent with current federal policies to minimize adverse impacts, and the benthic habitat that has re-established itself on the seafloor above the buried proposed Mainline would not be disturbed. Only the removal of the STL Buoy systems would require disturbing the benthic habitat below those structures, exposing ESA-listed marine mammals to short-term and minor increased turbidity in the water column. Once these systems are removed, that benthic habitat once again would become available for rapid recolonization by sessile and infaunal benthic organisms. The process of capping and flushing of the ends of the proposed Mainline could also result in short-term, localized, and minor impacts on ESA-listed marine mammals in the proposed ROI. Since the proposed Mainline itself would be abandoned in-place, no turbidity would be generated along its route. The temporary and highly localized increase in turbidity associated with decommissioning activities would have no effect to ESA-listed marine mammals.

Routine Discharges

As discussed in Section 4.1, the routine vessel discharges during proposed Project operation would not result in adverse impacts on ESA-listed marine mammal species in the ROI. Routine discharges from decommissioning vessels would include deck runoff and engine cooling water similar to construction. All gray water and sanitary wastewater would be stored onboard for appropriate disposal. All discharges from the marine vessels would comply with USCG requirements and the requirements highlighted in Table 1.4-1. Routine discharges during decommissioning activities would have similar impacts as those for construction; these impacts are discussed in Section 4.3.2.1. Therefore, routine discharge associated with decommissioning activities may affect, but not likely to adversely affect ESA-listed marine mammals.

Accidental Releases of Fuel, Oil, and Other Chemicals

Accidental releases of fuel, oil, and other chemicals stored and/or in use in support of proposed Project decommissioning could degrade water quality with potential adverse short-term impacts on ESA-listed marine mammals in the proposed Project area. Dissipation rates have been predicted to be rapid. A spill during decommissioning activities would have similar impacts as a spill during construction; these impacts are discussed in Section 4.3.2.1. Accidental release of fuel, oil and other chemicals associated with decommissioning activities may affect, but not likely to adversely affect ESA-listed marine mammals.

Noise

Short-term, minor, adverse impacts could occur on ESA-listed marine mammals during proposed Project decommissioning. Service vessel noise is the primary noise-producing factor during decommissioning. A more detailed discussion of underwater noise resulting from decommissioning activities associated with the proposed Project is provided in Section 4.11. Since pile driving is limited to construction activities only in the unlikely event geotechnical conditions preclude use of suction anchors, the potential for noise impacts during decommissioning is substantially reduced and limited to noise associated with the support vessels, with similar impacts as described in Section 4.2.5.3 for marine mammals.

The noise generated during decommissioning activities would be primarily from vessels and would be expected to be at similar levels as during construction activities. Noise impacts during decommissioning would be limited to the immediate proposed Project area, where the vessels would be located. Decommissioning would not require any pile driving, pipe laying, trenching, or backfilling. Therefore, the noise associated with those activities would be absent and the overall noise generated during decommissioning would be substantially less than during construction.

In general, ESA-listed marine mammal exposure to support vessel noise would only occur for a finite period of time and would not be expected to have long-term, population-level impacts on marine mammals. Under the MMPA, the potential for temporary acoustic exposures from construction activities would be expected to be within the non-injurious behavioral effects zone (Level B harassment) for marine mammals (USCG 2006a,b; FERC 2006). All sound sources from the decommissioning phase of the proposed Project are considered to have a minor impact on species of marine mammals. Because the behavioral response of marine mammals to a perceived marine sound depends on a range of factors, including: (1) the SPL; (2) frequency, duration, and novelty of the sound; (3) the physical and behavioral state of the animal at the time of perception; and (4) the ambient acoustic features of the environment (Hildebrand 2004), it is more difficult to predict behavioral shifts due to anthropogenic sounds. The radiation of sound to marine waters during the construction phase of the proposed Project would be within the immediate vicinity of the proposed Project and effects are expected to be temporary, hence "harassment" (TTS) for all species would be minor. Although species abundance varies by season in the ROI, the likelihood of "harm" (PTS) or "harassment" (TTS) from the proposed Project to individuals or species due to underwater sound would be unlikely because of the transient and seasonal nature of the species moving through the ROI, and the ability of animals to move away from sound sources.

Increased noise associated with decommissioning activities may affect, but not likely to adversely affect ESA-listed marine mammals.

Vessel Traffic

Short-term, minor, adverse impacts on ESA-listed marine mammals would occur as a result of vessel traffic during proposed Project decommissioning in the same manner as for non-endangered marine mammals, as described in Section 4.2.5. It is estimated that the majority of vessel traffic would be within the proposed Project area, with large vessel movement and speed contingent upon the task performed and duration (e.g., proposed Mainline installation). These vessels would most likely mobilize and demobilize once. Crew boats, on the other hand, would operate and transit the site more frequently, depending on duty.

Large vessels are only likely to mobilize/demobilize to the construction site once, whereas smaller vessels may transit the proposed Project area multiple times. Therefore, large vessels used for construction would only be a concern for a short duration. Additionally, a Marine Mammal and Sea Turtle Vessel Strike Avoidance Plan has been prepared to decrease risk of collisions (Appendix K). The mitigation measures detailed in Section 4.2.8 would be taken to avoid collisions.

Therefore, the risk of vessel strikes would be similar to (or less than) the risk associated with construction activities. The minor increase in vessel traffic may affect, but not likely to adversely affect ESA-listed marine mammals.

Ingestion of Marine Debris

Short-term, negligible, adverse impacts on ESA-listed marine mammals would result from the accidental release of marine debris (e.g., ropes, plastic, etc.) during decommissioning, similar to non-endangered marine mammals, as described in Section 4.2.5.3. Existing regulations prohibit the disposal of plastic, dunnage, lining, floating packing materials, and all other trash within 12 miles of the coast. Further, as a SOP, all vessels associated with the proposed Project would be prohibited from dumping trash of any kind. Solid waste management training would be provided that emphasizes the importance of minimizing impacts on marine mammals, sea turtles, and migratory birds. This combination of proposed Project policy and existing regulations would ensure that any marine debris accidentally expended within the proposed Project area would be negligible. Therefore, the potential for accidental release of marine debris associated with decommissioning activities may affect, but not likely to affect ESA-listed marine mammals.

Entanglement

Short-term, minor, adverse impacts on ESA-listed marine mammals would result from entanglement during decommissioning, as described in Section 4.2.5.3. Entanglement of marine mammals within derelict fishing gear, ropes, lines, or other marine debris has received much attention in recent decades and is an important threat to marine mammals. A 25-year dataset assembled by the Ocean Conservancy reported that fishing line, rope, and fishing nets accounted for most entanglements, with the remainder due to encounters with various items such as bottles, cans, and plastic bags (Ocean Conservancy 2010).

Barges and other vessels would use fixed anchoring methods, and the associated anchor cables could pose a risk of entanglement to marine mammals. Marine mammals could be entangled by anchors, anchor lines, or buoy lines deployed during decommissioning, but the potential for such an event would be low. Anchor lines securing barges would be large in diameter, knotless, non-floating, and taut, and would only be deployed for a short period of time. In addition, anchor lines would be separated by hundreds of feet as they radiated away from the vessel and would not be laterally connected to other lines, thereby avoiding the creation of a "web effect." With adherence to best management practices for detection of marine mammals in the area, the potential for entanglement associated with construction activities would be minimized. Combined, these factors would decrease the potential for marine mammal entanglement and impacts would be short-term and minor, and may affect, but not likely to adversely affect ESA-listed marine mammals.

Lighting

Short-term, minor, adverse impacts on ESA-listed marine mammals would result from lighting used by support vessels during decommissioning, as described for construction in Section 4.2.5.1. Artificial light could potentially confuse marine mammals approaching the proposed Project area where lighting is used during decommissioning. Lighting used during decommissioning would primarily be limited to the vessels (navigation lights, spotlights, decklights, etc.) used to illuminate the work area both on the vessel and on the water. Lights would be downshielded to illuminate the deck only and would not intentionally illuminate the surrounding waters. The Applicant has committed to minimize the amount of lighting needed directly on the water surface, while still providing a safe work area.

Marine mammals may be attracted to the lighting used during proposed Project construction, operations, or decommissioning. However, the nature of the other associated stressors covered in this section associated with the construction activities (i.e., noise, seafloor disturbance, etc.) would likely cause animals to move away from those activities, rather than be attracted to the proposed Project area because of the lighting, resulting in minor and temporary impacts during decommissioning. The level at which ESA-listed marine mammals would be attracted to this type of lighting is expected to be minimal, as discussed for construction impacts.

The additional lighting associated with construction vessels during decommissioning may affect, but not likely to adversely affect ESA-listed marine mammals.

Alteration to Prey Species Abundance and Distribution

Short-term, negligible, adverse impacts on ESA-listed marine mammals would be expected to occur as a result of alteration to prey species abundance and distribution associated with the proposed Project during decommissioning by turbidity, sedimentation, and noise, as well as entrainment during water withdrawals. Such water withdrawals would be expected to be similar to those described for construction (Section 4.2.5.2). The displacement of some prey species, like fish, may actually attract marine mammals away from the proposed Project decommissioning. Since potential impacts on marine mammal prey species would be short-term and confined to the general vicinity of the decommissioning activities, alteration of prey species abundance and distribution may affect, but not likely to adversely affect ESA-listed marine mammals.

Air Emissions

Negligible impacts on ESA-listed marine mammals would be expected as a result of air emissions from support vessels during decommissioning, as described in Section 4.2.5.1. Air emissions would be expected to be similar to that of other vessels transiting the approach to Ambrose Channel in the proposed Project area. Components that have the potential to leak, such as connectors, valves, and flanges, are situated in a confined space that would include gas leakage detectors to alert workers of any issues immediately. Additionally, SOPs would be enacted to reduce the potential for fugitive emissions. Decommissioning activities would contribute a very minimal portion of total air emissions in the New York Bight, and emissions would be short-term. Therefore, the negligible air emissions associated with decommissioning activities may affect, but not likely to adversely affect ESA-listed marine mammals.

4.3.3 Sea Turtles

Four sea turtles occur in the New York Bight, but their presence is seasonal (Table 4.3-1). Therefore, these species would only be susceptible to proposed Project-related impacts during the warmer months. Although sea turtles are slow-moving compared to other fish or marine mammal species, their capacity to travel long distances would allow them to leave the ROI, if necessary. Potential adverse impacts associated with the proposed Project would be temporary, minor, and highly localized.

4.3.3.1 Impacts of Construction

Benthic Habitat

Impacts on benthic resources and habitat are discussed in Section 4.2.2. Short-term, minor, adverse impacts on ESA-listed sea turtles would occur as a result of seafloor disturbance during proposed Project construction, as described in Section 4.3.2.1. Impacts on sea turtles would be similar to those for ESA-listed marine mammals, namely habitat loss associated with proposed Mainline installation and anchoring, as discussed in Section 4.2.5.1. Similar to ESA-listed marine mammals, ESA-listed sea turtles have a low likelihood of entering this area during construction. If a sea turtle approaches the ROI during construction, it would likely move away from the activity. Any sea turtle that would be displaced during construction of the proposed Project would be expected to return following construction. Alterations to seafloor habitats associated with trenching, backfilling, and jetting activities may affect, but not likely to adversely affect ESA-listed sea turtles.

Turbidity

Short-term, minor, adverse impacts on ESA-listed sea turtles would occur as a result of seafloor disturbance during proposed Project construction in the same manner as discussed in Section 4.3.2.1 for marine mammals. Plowing and jetting activities would displace bottom sediments and result in temporary water column and seafloor disturbances, as described in Section 4.2.5.1, which have the potential to impact ESA-listed sea turtles. Impacts on sea turtles would be similar to those for ESA-listed marine mammals via habitat loss associated with proposed Mainline installation and anchoring, as discussed in Section 4.2.5.1. While disturbed sediments would be suspended into the lower portion of the water column directly above the seafloor and cause a turbidity plume, bottom currents in the area typically are slow (less than 0.2 knots), and the coarse, sandy sediments would settle rapidly before any ESA-listed sea turtle would likely encounter it.

As presented in more detail in Section 4.2.2.1, turbidity impacts resulting from construction activities are expected to be greatest within a focused area around the proposed Mainline. Suspended solid concentrations of 50 mg/L or greater are likely to be found within 1,400 feet of the proposed Mainline in state waters and within 700 feet in federal waters. Substantial sedimentation of 0.8 inch or greater is expected to occur within 190 feet of the proposed Mainline in state waters and within 110 feet in federal waters. Sea turtles would likely move away from areas of increased turbidity associated with construction activities.

The likelihood of an ESA-listed sea turtle encountering a turbidity plume substantial enough to impact the animal is very low. If one of these animals approaches the impacted area during construction, the sea turtle would likely move away from the activity. Any threatened and endangered sea turtles that are displaced during construction of the proposed Project area would be expected to return following construction. The short-term and localized increase in turbidity associated with construction activities may affect, but not likely to adversely affect ESA-listed sea turtles.

Routine Discharges

Routine discharges would not result in adverse impacts on ESA-listed sea turtles. Routine discharges from construction vessels would include deck runoff and engine cooling water. All gray water and sanitary wastewater would be stored onboard for appropriate disposal. All discharges from the marine vessels would comply with USCG requirements and the requirements highlighted in Table 1.4-1. Since only a small area would be impacted, discharges would dissipate, and sea turtles could avoid unfavorable conditions. Impacts related to alteration of prey species abundance and distribution from construction vessel intake and discharge are discussed later in this section. Routine discharges associated with construction activities may affect, but not likely to adversely affect ESA-listed sea turtles.

Hydrostatic Testing Intake and Discharge

A short-term, negligible adverse impact would be incurred by sea turtles through hydrostatic testing/pigging of the pipelines. A total of 3.5 million gallons of near-surface water would be used to conduct hydrostatic testing during construction. Although planktonic stages of sea turtle prey would be entrained in the water, the loss would not constitute a population-level impact. In addition, the proposed Project is not located near breeding beaches or hatchling habitat, therefore, impacts to hatchling sea turtles are not expected. Neither the intake nor the discharge of the hydrostatic test water would directly affect sea turtles at any life stage. Although a spill of hydrostatic test water would release low-oxygen water into the water column, the adverse impacts would be negligible and short term. Therefore, hydrostatic testing intake and discharge may affect, but not likely to adversely affect ESA-listed sea turtles.

Accidental Releases of Fuel, Oil, and Other Chemicals

Accidental releases of fuel, oil, and other chemicals stored and/or in use in support of construction could degrade water quality with potential adverse short-term impacts on ESA-listed sea turtles. In the case of an emergency, a Spill Response Plan would be followed to handle any accidental spills so that they would be small and not enter the ocean. Models suggest that a spill of up to 84 gallons would rapidly dissipate, with wind stress and abiotic factors affecting the actual rate of dispersion. A model predicted dissipation rates of the maximum most probable discharge of 2,500 barrels (105,000 gallons) of fuel oil with 10 and 20 knot winds. Dissipation was rapid; the amount of time it took to reach concentrations of less than 0.05 percent varied between 0.5 and 2.5 days, depending on ambient wind. Concentrations of less than 0.5 percent occurred within 44 hours with 10-knot winds and within 11 hours with 20-knot winds. Therefore, accidental releases of fuel, oil, and other chemicals associated with construction activities may affect, but not likely to adversely affect ESA-listed sea turtles.

LNGRV Commissioning

Short-term, minor, impacts on ESA-listed sea turtles may result from water intake and discharge from initial LNGRV commissioning. Once the LNGRVs have been fully commissioned, no discharges would be anticipated from LNGRVs during natural gas offloading at the proposed Port facilities. It is estimated that the average cooling water intake/discharge rate for a LNGRV could approach 8.2 mgd during this period. Although planktonic stages of sea turtle prey would be entrained in the water, the loss would not constitute a population-level impact. In addition, the proposed Project is not located near breeding beaches or hatchling habitat, therefore, impacts to hatchling sea turtles are not expected. Intake of the

cooling water would not directly affect sea turtles at any life stage. Although planktonic stages of sea turtle prey would be entrained in the water, the loss would not constitute a population-level impact. In addition, the proposed Project is not located near breeding beaches or hatchling habitat, therefore, impacts to hatchling sea turtles are not expected. Intake of the cooling water would not directly affect sea turtles at any life stage. Based on CORMIX modeling, the estimated temperature difference between cooling water intake and discharge is anticipated to be in the range of approximately 9°F to 14°F (5°C to 8°C), with a maximum difference of 18°F (10°C). Compliance with the USEPA's 1.8°F excess temperature criterion is predicted to occur within less than 90 feet of the point of discharge, which is well within the typical 328-foot regulatory mixing zone. The plume centerline temperature is predicted to drop from 18°F greater than ambient at the point of discharge to less than 1.8°F greater than ambient within approximately 30 to 90 feet downcurrent of the point of discharge. A thermal plume from water discharge may cause stress for local sea turtles; however, they would not likely be adversely affected, because the plume would be relatively small and would disperse. The short-term and minor impacts associated with LNGRV commissioning may affect, but not likely to adversely affect ESA-listed sea turtles.

Noise

Short-term, moderate, adverse impacts on ESA-listed sea turtles would result from noise generated during proposed Project construction in the same manner as described in Section 4.3.2.1. Sound sources of underwater construction noise associated with the proposed Project include impact pile driving (from anchor pile installation, if in the unlikely event geotechnical conditions preclude use of suction anchors), proposed Mainline and pipeline lateral installation, and support vessels. A more detailed discussion of underwater noise resulting from each of these construction activities associated with the proposed Project is provided in Section 4.11.

Few studies have evaluated the hearing of sea turtles, and those tested by auditory brainstem response exhibit relatively high auditory thresholds. Various studies indicate that sea turtles may be low-frequency (0 to 500 Hz) hearing specialists with thresholds at 400 Hz ranging from 121 to 131 dB re 1 at μPa at 1 meter (ONR 2005; Bartol and Ketten 2006). However, the electrophysiological audiometric techniques used in these studies measure small electrical voltages produced by neural activity when the auditory system is stimulated by sound, but did not actually measure behavioral responses to sounds (hearing). Despite the lack of data, noise generated during construction could result in potential impacts on sea turtles. As a result, noise created during proposed Project construction could result in physical auditory impacts, such as temporary threshold shifts or masking, as well as behavioral disruptions, such as disorientation or the alteration of foraging activities.

Continuous noise created by construction vessels could create masking effects among ESA-listed sea turtles in the same manner as for non-endangered marine species. Masking occurs when underwater noise interferes with an animal's ability to hear biologically relevant sounds. Ambient noise levels in the proposed Project area and surrounding waters are elevated and variable due to existing levels of shipping, fishing, and recreational vessel traffic. As a result, short-term increases due to construction vessel traffic would have a minimal contribution to that ambient noise. In addition, the transient nature and short-term duration of construction vessel noise would reduce the potential for masking to occur (LGL and Jasco 2005).

The noise associated with proposed Port operations activities may affect, but not likely to adversely affect ESA-listed sea turtles. Because impact piling was assessed to have the highest potential for sound generation (over the widest area) associated with the proposed Project, the Applicant's preferred mooring design is the use of suction anchors. All sound sources from proposed Project construction would be considered to have a minor impact on species of turtles. Because the behavioral response of sea turtles to a perceived marine sound depends on a range of factors, including: (1) the SPL; (2) frequency, duration, and novelty of the sound; (3) the physical and behavioral state of the animal at the time of perception; and (4) the ambient acoustic features of the environment (Hildebrand 2004), it is more difficult to predict

behavioral shifts due to anthropogenic sounds. The radiation of sound to marine waters during proposed Project construction would be within the immediate vicinity of the proposed Project, and effects would be expected to be temporary, hence "harassment" (TTS) for all species is expected to be minor. Although species abundance varies by season in the ROI, the likelihood of "harm" (PTS) or "harassment" (TTS) from the proposed Project to individuals or species due to underwater sound would be unlikely because of the transient and seasonal nature of the species moving through the ROI, and the ability of animals to move away from sound sources. The short-term and moderate increase in noise associated with construction activities may affect, but not likely to adversely affect ESA-listed sea turtles.

Vessel Traffic

Short-term, minor, adverse impacts on ESA-listed sea turtles would occur as a result of support vessel traffic during proposed Project construction and would impact ESA-listed sea turtles in the same manner as for non-endangered marine species. If struck, serious injury or mortality to the animal would result. If a threatened or endangered sea turtle were to be struck, it would be considered a "take" under the ESA. While an increase in vessel traffic increases the risk of collision, the proportional probability of that risk associated with construction vessels cannot be quantified, particularly when vessel traffic is already high. Large vessels are only likely to mobilize/demobilize to the construction site once, whereas smaller vessels may transit the proposed Project area multiple times. Therefore, the risk of strike from a large vessel has a smaller likelihood.

Sea turtles could be struck by a support vessel, but they would likely be able to avoid a strike by diving away from these slow-moving vessels in the proposed Project area. A Marine Mammal and Sea Turtle Vessel Strike Avoidance Plan has been prepared (Appendix K); this would inform all crew to guidelines to protect marine species from collisions. The minor increase in vessel traffic during construction may affect, but not likely to adversely affect ESA-listed sea turtles.

Ingestion of Marine Debris

Short-term, minor, adverse impacts on ESA-listed sea turtles would result from the accidental release of marine debris (e.g., ropes, plastic, etc.) during construction in the same manner as for other non-endangered marine species. Sea turtles ingesting marine debris are susceptible to blockage in the digestive system, internal damage, or an accumulation of toxins that may be present in the debris. Ingestion of marine debris is an important threat to the recovery of ESA-listed sea turtles, with varying degrees of severity based on species morphology and feeding behavior (NOAA 2013a; Lazar and Gracan 2011; Macedo et al. 2011). Sea turtles can mistake debris for prey; one study found 37 percent of dead leatherback turtles to have ingested various types of plastic (Mrosovsky et al. 2009). Plastic ingestion was identified as the cause of death in 9 percent of these cases. Existing regulations prohibit the disposal of plastic, dunnage, lining, floating packing materials, and all other trash within 12 miles of the coast. Further, as a SOP, all vessels associated with the proposed Project would be prohibited from dumping trash of any kind. Solid waste management training would be provided that emphasizes the importance of minimizing impacts on marine mammals, sea turtles, and migratory birds. This combination of proposed Project policy and existing regulations would ensure that any marine debris accidentally expended within the proposed Project area would be minor. The potential accidental release of marine debris associated with construction activities may affect, but not likely to adversely affect ESA-listed sea turtles.

Entanglement

Short-term, minor, adverse impacts on ESA-listed sea turtles would result from entanglement in anchor lines, tethers, or other materials during construction in the same manner as for non-endangered marine species. ESA-listed sea turtles could be entangled by anchors, anchor lines, or buoy lines deployed during construction, but the potential for such an event would be low in the same manner as described for non-endangered species. Marine debris can also be a problem for sea turtles through entanglement (Lazar and Gracan 2011; Macedo et al. 2011). Various types of marine debris, including derelict fishing gear and

cargo nets, can entangle and drown turtles in all lifestages. Hawksbill sea turtles are particularly susceptible to entanglement in gill nets or drift nets because of their preference for nearshore areas (NMFS and USFWS 1993).

Construction barges and other vessels would use fixed anchoring methods, and the associated anchor cables could pose a risk of entanglement to sea turtles. Other lines and hoses would be associated with the jetting equipment at jetting locations. Sea turtles could be entangled by anchors, anchor lines, or buoy lines deployed during construction, but the potential for such an event would be low. Anchor lines securing the derrick/lay barge would be large in diameter, knotless, non-floating, and taut, and would only be deployed for a short period of time. In addition, anchor lines would be separated by hundreds of feet as they radiated away from the vessel and would not be laterally connected to other lines, thereby avoiding the creation of a "web effect." With adherence to best management practices for detection of ESA-listed sea turtles in the area, the potential for entanglement associated with construction activities would be minimized. Combined, these factors would decrease the potential for ESA-listed sea turtle entanglement and impacts would be short-term and minor.

The minor amount of anchor lines or other materials in the water column during construction may affect, but not likely to adversely affect ESA-listed sea turtles.

Lighting

Short-term, minor, adverse impacts on ESA-listed sea turtles would result from lighting used during construction. Certain types of lighting are known to attract ESA-listed sea turtles. Artificial light can confuse adult turtles making their way to nesting habitat, or turtle hatchlings moving toward the water, possibly resulting in an increased risk of mortality (NMFS 2010d).

Lighting used during construction would primarily be limited to the vessels (navigation lights, spotlights, decklights, etc.) used to illuminate the work area both on the vessel and on the water. Precautions would be made to minimize the amount of lighting needed directly on the water surface, as appropriate, without compromising the quality or safety of the work area.

ESA-listed sea turtles may be attracted to the lighting used during proposed Project construction. However, the nature of the other associated stressors covered in this section associated with the construction activities (i.e., noise, seafloor disturbance, etc.) would likely cause animals to move away from those activities, rather than be attracted to the proposed Project area because of the lighting, resulting in minor and temporary impacts during construction.

The additional lighting associated with construction vessels may affect, but not likely to adversely affect ESA-listed sea turtles.

Alteration to Prey Species Abundance and Distribution

Negligible impacts on ESA-listed sea turtles are expected to occur as a result of alteration to prey species abundance and distribution associated with the proposed Project during construction in the same manner as for non-endangered marine species. The abundance and distribution of prey species may be impacted during construction by turbidity, sedimentation, and noise, as well as entrainment during water withdrawals during construction, as described above. Since potential impacts on prey species would be temporary and confined to the general vicinity of the construction activities, it would not be expected to adversely impact ESA-listed sea turtles.

Air Emissions

Negligible impacts on ESA-listed sea turtles would be expected as a result of air emissions from support vessels during construction rather than the regasification process. Parts such as connectors, valves, and flanges that may leak would be monitored in a small space by gas leakage detectors so that workers are

notified of any issues immediately. Additionally, SOPs would be enacted to reduce the potential for fugitive emissions. Air emissions would be expected to be similar to that of other vessels transiting the approach to the Ambrose Channel in the proposed Project area. Construction activities would contribute a very minimal portion of total air emissions in the New York Bight, and emissions would be short-term. Therefore, air emission impacts associated with construction activities may affect, but not likely to adversely affect ESA-listed sea turtles.

4.3.3.2 Impacts of Operation

Benthic Habitat

Impacts on benthic resources and habitat are discussed in Section 4.2.2. Long-term, negligible, adverse impacts on ESA-listed sea turtles would occur as a result of seafloor disturbance from anchor chain sweep during proposed Project operation in the same manner as described in Section 4.2.2. Therefore, alterations of seafloor habitats associated with operations may affect, but not likely to adversely affect ESA-listed sea turtles.

Turbidity

Long-term, minor, adverse impacts on ESA-listed sea turtles would occur as a result of turbidity increases associated with proposed Project operation in the same manner as described for other non-endangered marine organisms. Routine operation activities with potential to impact turbidity are limited to the movement and possible minor bottom scouring associated with anchor chains, wire, and umbilical systems. As previously discussed, the total area of seafloor expected to be impacted by such movement is 1.4 acres per buoy and any resulting turbidity would not be expected to extend beyond the approximate 3,138-foot radial footprint of the buoy mooring legs. Due to shorter anchor chain length, a smaller proportion of fine-size sediment, and lower current velocities, anchor chain sweep impacts for the proposed Project would be expected to be lower than those predicted for the proposed Calypso Project. Therefore, suspended sediment concentrations would be expected to be less than a maximum predicted value of 63 to 115 mg/L, and maximum plume size would be expected to be less than 558 to 807 feet. Maximum values reflect isolated and extreme conditions; typical TSS concentration and sediment plume size would be less. Turbidity associated with proposed Port operations may affect, but not likely to adversely affect ESA-listed sea turtles.

LNGRV Ballast Water Intake

LNGRV ballast water intake discussed in Section 4.1 would not result in adverse impacts on ESA-listed sea turtles. Although planktonic stages of sea turtle prey would be entrained in the water, the loss would not constitute a population-level impact. In addition, the proposed Project is not located near breeding beaches or hatchling habitat, therefore, impacts to hatchling sea turtles are not expected. Intake of the ballast water would not directly affect sea turtles at any life stage.

Routine Discharges

As discussed in Section 4.1, the routine vessel discharges during proposed Project operation would not result in adverse impacts on ESA-listed sea turtles, but could degrade water quality with potential adverse short-term impacts on ESA-listed sea turtles within the ROI. Routine discharges would include deck runoff from the LNGRV and support vessel and engine cooling water from the support vessel. All gray water and sanitary wastewater would be stored onboard for appropriate disposal. All discharges from the marine vessels would comply with USCG requirements and the requirements highlighted in Table 1.4-1. Since only a small area would be impacted, discharges would dissipate, and ESA-listed sea turtles could avoid unfavorable conditions. Additional potential stressors are discussed in the impacts of construction under Section 4.2.5.1. Therefore, routine discharges associated with operations may affect, but not likely to adversely affect ESA-listed sea turtles.

Accidental Releases of Fuel, Oil, and Other Chemicals

Accidental releases of fuel, oil, and other chemicals stored and/or in use in support of proposed Project operation could degrade water quality with potential adverse short-term impacts on ESA-listed sea turtles within the proposed Project area. Risks associated with construction (Section 4.3.3.1) would be similar, albeit less during operation. An accidental release of a substance would be expected to dissipate, even with an extreme spill reaching concentrations of less than 0.05 percent, in less than 2.5 days (see Section 4.3.3.1 for more detail). In the event of an accidental spill, workers would follow the Spill Response Plan to prevent or mitigate foreign substances from entering the ocean. Therefore, a spill may affect, but not likely to adversely affect ESA-listed sea turtles.

LNG Spills

Short-term minor, direct adverse impacts on ESA-listed sea turtles could occur in the unlikely event of an LNG spill. All LNGRVs are designed with features to minimize the potential for LNG spills (see Section 2.1). However, if an LNG spill were to occur, potential impacts would include exposure to low-temperature LNG at the water surface, possibly resulting in frostbite or death and asphyxiation by natural gas vapors above the surface of the water. These impacts would likely occur in the immediate vicinity of the spill location; the time frame of the impact is limited (see Section 5). Since LNG would boil off as natural gas at the surface, depth and pressure required for gas to dissolve (Artemov et al. 2005) in surface waters would not be sufficient and gas vapors would disperse. In addition, the time frame for these impacts would be limited, and adverse toxic impacts would be expected to be minor after the LNG boiled off and the vapors dispersed.

The potential for a release of natural gas from the proposed Mainline and pipeline laterals are remote. If there were a subsea release of natural gas, the gas would rise to the water surface rapidly and dissipate. In general, whether a release is sudden or extended, physics dictate that any methane would gradually dissolve into the water column during the lifetime of the bubble as described by Fick's law, taking into account Henry's law constants, partial pressure and concentrations of dissolved gases (Artemov et al. 2005). Once a gas bubble reaches the surface, it would rise (being lighter than air) and be dispersed by air currents. ESA-listed marine turtle impacts from such a release would be short-term and minor. Therefore, the potential for an LNG spill or release of natural gas associated with operation activities may affect, but not likely to adversely affect ESA-listed sea turtles.

Noise

Long-term, moderate, adverse impacts on ESA-listed sea turtles could occur as a result of noise generated during operations. The noise associated with the operation of the proposed Project includes the following sound sources: LNGRV transits, support vessel transits, and maneuvering with thrusters associated with mooring approach. The Port of New York and New Jersey receives over 4,500 large vessels and 240 cruise vessels each year, making it the busiest port on the East Coast. Even at a maximum of 45 LNGRVs per year, this would only contribute less than 2 percent to the total traffic; therefore, vessel noise would not be a significant noise source. The sensitivities of non-listed species to noise have already been discussed in Section 4.2.4.1; these hearing effects apply equally to ESA-listed sea turtles during proposed Port operations as well.

The noise associated with proposed Port operations activities may affect, but not likely to adversely affect ESA-listed sea turtles.

Planned and Unplanned Maintenance and Repair

Planned and unplanned maintenance and repair sound effects may have short-term, minor, adverse impacts on ESA-listed marine mammals. It is anticipated that planned maintenance activities would occur on a regular basis either annually or biennially; whereas repair activities, either planned or unplanned, would occur on a less frequent basis. Planned maintenance activities are typically short in duration

(several days or less) and would include attaching/detaching and/or cleaning the buoy pick-up line to the STL Buoy, performing surveys and inspections with a ROV, and cleaning or replacing parts (e.g. bulbs, batteries, etc.) on the floating navigation (i.e., marker) buoys. Inspections and surveys would also be conducted after a significant storm event. Minor repairs would not be expected to increase noise levels by any significant amount. The primary source of noise during maintenance and repairs is vessel noise.

According to BOEM, underwater noise from small vessels ranges from 145 to 170 dB at 1 meter. According to the USCG, underwater noise associated with vessels with an engine between 1,200 hp and 6,140 hp ranges from 92 to 112 dB at 1 meter (see Section 4.11.2.1). At a maximum, every 7 10 years an intelligent pig would be run down the proposed Mainline and pipeline laterals to assess the condition of the proposed Mainline system. This particular activity would require several large construction-type vessels and several weeks to complete. According to BOEM, noise associated with larger vessels can range from 169 to 198 dB at 1 meter (MMS 2004b; Richardson et al. 1995).

Repairs can be either minor or major. Minor repairs are typically shorter in duration and could include replacing faulty pressure transducers, or repairing a stuck valve. These kinds of repairs would require one diver support vessel with three or four anchors to hold its position. Minor repairs could take from a few days to several weeks depending on the nature of the problem.

Major repairs, on the other hand, are longer in duration and typically require large construction vessels similar to those used to install the proposed Mainline and set the buoy and anchoring system. These vessels would typically mobilize from local ports, Canada, or the Gulf of Mexico. Major repairs typically require upfront planning, equipment procurement, and mobilization of vessels and possibly saturation divers. Examples of major repairs are damage to the riser or umbilical line and their possible replacement, damage to the proposed Mainline system and manifolds, or anchor chain replacement. These types of repairs could take up to two to four weeks. To provide a worst-case scenario, it was assumed that the noise generated by maintenance and repair activities would be similar to that generated during the construction of the facilities (LGL and JASCO 2005). The results of the Neptune LNG noise modeling for the proposed Mainline route indicates that the 120-dB contour during proposed Mainline repair activities would extend out 3.5 to 4.1 nautical miles encompassing an area from 35 to 44 nautical square miles. These modeling results are also expected to be a representative worst-case scenario of maintenance and repair activities for the proposed Project. This worst-case scenario is anticipated to occur no more than once per five-year period, lasting no more than 28 days or 672 hours. These underwater sound levels could cause some species to temporarily disperse from or avoid repair areas, but they are expected to return shortly after the completion of repairs.

Short-term, minor, adverse impacts on ESA-listed sea turtles would occur as a result of support vessel traffic during proposed Project maintenance and repair. Vessel traffic would be similar to construction as described in Section 4.3.3.1. It is estimated that the majority of vessel traffic would be within the proposed Project area, with large vessel movement and speed contingent upon the task performed and duration (e.g., proposed Mainline installation). These vessels would most likely mobilize and demobilize once. Crew boats, on the other hand, would operate and transit the site more frequently, depending on duty.

Large vessels are only likely to mobilize/demobilize to the construction site once, whereas smaller vessels may transit the proposed Project area multiple times. Therefore, large vessels used for construction would only be a concern for a short duration. Additionally, a Marine Mammal and Sea Turtle Vessel Strike Avoidance Plan has been prepared to decrease risk of collisions (Appendix K). The mitigation measures detailed in Section 4.2.8 would be taken to avoid collisions.

Impacts resulting from planned and unplanned maintenance and repair may affect, but not likely to adversely affect ESA-listed sea turtles.

Vessel Traffic

Long-term, minor, adverse impacts on ESA-listed sea turtles could occur as a result of increased vessel traffic during routine proposed Port operations. Increased vessel traffic during operations could increase the potential for collisions with ESA-listed sea turtles in the same manner as described for non-endangered marine mammals discussed in Section 4.2.5.1. The expected increase in vessel traffic during proposed Port operations would be 45 LNGRVs per year, plus routine number of support vessel transits. Compared to the annual number of deep draft vessels already transiting the approach to the Ambrose Channel (800 vessels), where the proposed Project is located, the minor increase in vessel traffic is expected to result in only a small increased risk of vessel strikes to ESA-listed sea turtles. In addition, the LNGRVs must slow to 3 knots within the proposed Project Safety Zone surrounding each buoy. Since vessel speed is proportional to marine mammal collisions, this speed would be protective of sea turtles during operations. Large vessels are only likely to mobilize/demobilize to the construction site once, whereas smaller vessels may transit the proposed Project area multiple times. Therefore, during normal operations, large vessels used for construction would not be a concern.

A Marine Mammal and Sea Turtle Vessel Strike Avoidance Plan has been prepared to decrease risk of collisions (Appendix K); this would inform all crew to guidelines to protect marine species from collisions. The mitigation measures detailed in Section 4.2.8 would be taken to avoid collisions.

The minor increase in vessel traffic may affect, but not likely to adversely affect ESA-listed sea turtles.

Ingestion of Marine Debris

Long-term, negligible, adverse impacts on ESA-listed sea turtles would result from the accidental release of marine debris (e.g., ropes, plastic, etc.) during operation, as described for other non-endangered species in Section 4.2. Sea turtles ingesting marine debris are susceptible to blockage in the digestive system, internal damage, or an accumulation of toxins that may be present in the debris. Ingestion of marine debris is an important threat to the recovery of ESA-listed sea turtles, with varying degrees of severity based on species morphology and feeding behavior (NOAA 2013a; Lazar and Gracan 2011; Macedo et al. 2011). Sea turtles can mistake debris for prey; one study found 37 percent of dead leatherback turtles to have ingested various types of plastic (Mrosovsky et al. 2009). Plastic ingestion was identified as the cause of death in 9 percent of these cases. Therefore, the potential accidental release of marine debris associated with operation activities may affect, but not likely to adversely affect ESA-listed sea turtles.

Entanglement

Long-term, negligible, adverse impacts on ESA-listed sea turtles could occur due to the increased risk of entanglement within anchor lines, chains, messenger lines, recovery line, bridle, or the floating buoy during routine proposed Port operations. The chains and cables used for the anchor lines resemble rigid “structures” because of their weight and relative immobility. The weight of the chain and cable combination would also increase the anchor line tautness, and thereby minimize the threat of entanglement during operations. Therefore, although it is possible that a sea turtle might swim into one of the chains, it is not likely that the chain would wrap around and entangle the animal. Sea turtles would be unlikely to become entangled in these lines because of the large size of the lines (the anchor chain, anchor cable, and retrieval line would be approximately 18 inches, 6 inches, and 4 inches in diameter, respectively). Other structures and accessories are not prone to become wrapped around an object, thereby minimizing the possibility of an animal becoming entangled. They would be separated by several hundred feet as they extended out from the buoys, and would not be horizontally linked. Therefore, the potential for entanglement and subsequent direct impacts on for ESA-listed sea turtles is low.

The amount, size, and type of anchor lines or other materials in the water column during operations may affect, but not likely to adversely affect ESA-listed sea turtles.

Lighting

Long-term, minor, adverse impacts on ESA-listed sea turtles would result from lighting used by the support vessel during operation, as described for non-endangered marine species in Section 4.2. Certain types of lighting are known to attract some marine organisms, including sea turtles. Artificial light can confuse adult turtles making their way to nesting habitat, or turtle hatchlings moving toward the water, possibly resulting in an increased risk of mortality (NMFS 2010d).

Lighting used during operations would be limited to the vessels (navigation lights, spotlights, decklights, etc.) used to illuminate the work area both on the vessel and on the water. The buoys would also be lighted. Precautions would be made to minimize the amount of lighting needed directly on the water surface, as appropriate, without compromising the quality or safety of the work area. Such measures to be implemented during operations include downshielding the deck lights to illuminate only the deck and not the surrounding water surface. This is an important measure to minimize any attraction of ESA-listed sea turtles to the lights. Also, since the vessel would be stationary during these lighted operations, there is no risk for collision of an ESA-listed sea turtle.

The additional lighting associated with operational vessels may affect, but not likely to adversely affect ESA-listed sea turtles.

Alteration to Prey Species Abundance and Distribution

Long-term, negligible, adverse impacts on ESA-listed sea turtles are expected to occur as a result of alteration to prey species abundance and distribution associated with the proposed Project during operation, as described for non-endangered marine species in Section 4.2.

The potential prey removal associated with operational vessels may affect, but not likely to adversely affect ESA-listed sea turtles.

Air Emissions

Negligible impacts on ESA-listed sea turtles are expected as a result of air emissions from LNGRVs or the support vessel during operation, as described for non-endangered marine species in Section 4.2.

Air emissions associated with operational vessels may affect, but not likely to adversely affect ESA-listed sea turtles.

4.3.3.3 Impacts of Decommissioning

Benthic Habitat

Impacts on benthic resources and habitat are discussed in Section 4.2.2. Short-term, minor, adverse impacts on ESA-listed sea turtles would occur from decommissioning the proposed Project. As described in Section 4.3.1, decommissioning activities would produce similar water column impacts as previously described for construction activities. Decommissioning activities would result in similar localized, temporary disturbance of sediments and potential turbidity increases where installed mooring components would be removed from the bottom.

During the recovery of suction anchors, short-term, minor direct impacts could include increased turbidity and fish displacement. Suction anchors used to secure the mooring lines would be inspected and backed out by pumping seawater into the pile and recovering it for onshore recycling/disposal. Alternatively, the pile could be cut below the mudline should conditions warrant. Driven piles would be abandoned in-place upon decommissioning, resulting in a permanent removal of these structures as benthic habitat.

Any ESA-listed sea turtles that are displaced during decommissioning of the proposed Port area are expected to return following construction. Alterations to seafloor habitats associated with decommissioning activities may affect, but not likely to adversely affect ESA-listed sea turtles.

Turbidity

Short-term, minor, adverse impacts on ESA-listed sea turtles would occur as a result of turbidity increases associated with proposed Project decommissioning in the same manner as described for non-endangered marine species in Section 4.2. The proposed Mainline and pipeline laterals would be abandoned in-place to be consistent with current federal policies to minimize adverse impacts, and the benthic habitat that has re-established itself on the seafloor above the buried proposed Mainline would not be disturbed. Only the removal of the STL Buoy systems would require disturbing the benthic habitat below those structures, exposing ESA-listed sea turtles to short-term and minor increased turbidity in the water column. Once these systems are removed, that benthic habitat once again would become available for rapid recolonization by sessile and infaunal benthic organisms. The process of capping and flushing of the ends of the proposed Mainline could also result in short-term, localized, and minor impacts on ESA-listed sea turtles in the proposed Project area. Since the proposed Mainline itself would be abandoned in-place, no turbidity would be generated along its route. The temporary and highly localized increase in turbidity associated with decommissioning activities may affect, but not likely to adversely affect ESA-listed sea turtles.

Routine Discharges

As discussed in Section 4.1, the routine vessel discharges during proposed Project operation would not result in adverse impacts on ESA-listed sea turtles in the proposed Project area. Routine discharges from decommissioning vessels would include deck runoff and engine cooling water similar to construction. All gray water and sanitary wastewater would be stored onboard for appropriate disposal. All discharges from the marine vessels would comply with USCG requirements and the requirements highlighted in Table 1.4-1. Routine discharges during decommissioning activities would have similar impacts as those for construction; these impacts are discussed in Section 4.3.2.1.

Accidental Releases of Fuel, Oil, and Other Chemicals

Accidental releases of fuel, oil, and other chemicals stored and/or in use in support of proposed Project decommissioning could degrade water quality with potential adverse short-term impacts on ESA-listed sea turtles in the proposed Project area. Dissipation rates have been predicted to be rapid. A spill during decommissioning activities would have similar impacts as a spill during construction; these impacts are discussed in Section 4.3.3.1.

Noise

Short-term, minor, adverse impacts could affect ESA-listed sea turtles during proposed Project decommissioning. Service vessel noise is the primary noise-producing factor during decommissioning. A more detailed discussion of underwater noise resulting from decommissioning activities associated with the proposed Project is provided in Section 4.11. Since pile driving is limited to construction activities only in the unlikely event geotechnical conditions preclude use of suction anchors, the potential for noise impacts during operations is substantially reduced and limited to noise associated with the support vessel, with similar impacts as described for non-endangered marine species in Section 4.2.

The noise generated during decommissioning activities would be primarily from vessels and would be expected to be at similar levels as during construction activities. Noise impacts during decommissioning would be limited to the immediate proposed Project area, where the vessels would be located. Decommissioning would not require any pile driving, pipe laying, trenching, or backfilling. Therefore, the noise associated with those activities would be absent and the overall noise generated during decommissioning would be substantially less than during construction.

In general, ESA-listed sea turtle exposure to support vessel noise would only occur for a finite period of time and would not be expected to have long-term population-level impacts. All sound sources from the decommissioning phase of the proposed Project are considered to have a minor impact on species of sea

turtles. Because the behavioral response of sea turtles to a perceived marine sound depends on a range of factors, including: (1) the SPL; (2) frequency, duration, and novelty of the sound; (3) the physical and behavioral state of the animal at the time of perception; and (4) the ambient acoustic features of the environment (Hildebrand 2004), it is more difficult to predict behavioral shifts due to anthropogenic sounds. The radiation of sound to marine waters during the construction phase of the proposed Project would be within the immediate vicinity of the proposed Project and effects would be expected to be temporary, hence "harassment" (TTS) for all species is expected to be minor. Although species abundance varies by season in the ROI, the likelihood of "harm" (PTS) or "harassment" (TTS) from the proposed Project to individuals or species due to underwater sound is unlikely because of the transient and seasonal nature of the species moving through the ROI, and the ability of animals to move away from sound sources.

The temporary and localized increase in ambient noise associated with decommissioning activities may affect, but not likely to adversely affect ESA-listed sea turtles.

Vessel Traffic

Short-term, minor, adverse impacts on ESA-listed sea turtles would occur as a result of vessel traffic during proposed Project decommissioning in the same manner as described for non-endangered marine species in Section 4.2. It is estimated that the majority of vessel traffic would be within the proposed Project area, with large vessel movement and speed contingent upon the task performed and duration (e.g., proposed Mainline installation). These vessels would most likely mobilize and demobilize once. Crew boats, on the other hand, would operate and transit the site more frequently, depending on duty.

Large vessels are only likely to mobilize/demobilize to the construction site once, whereas smaller vessels may transit the proposed Project area multiple times. Therefore, large vessels used for construction would only be a concern for a short duration. Additionally, a Marine Mammal and Sea Turtle Vessel Strike Avoidance Plan has been prepared to decrease risk of collisions (Appendix K). The mitigation measures detailed in Section 4.2.8 would be taken to avoid collisions.

Vessel traffic during decommissioning is limited to support vessels. Decommissioning activities would require an increase in vessel traffic similar to that associated with construction, but of lesser intensity. Therefore, the risk of vessel strikes would be similar (or less than) to the risk associated with construction activities. The minor increase in vessel traffic may affect, but not likely to adversely affect ESA-listed sea turtles.

Water Quality

As discussed above for turbidity, water quality impacts associated with decommissioning would result in short-term, minor impacts on ESA-listed sea turtles. The routine vessel discharges during decommissioning discussed in Section 4.1 would not result in adverse impacts on ESA-listed sea turtles, but could degrade water quality. Decommissioning activities may also discharge water, causing a temporary increase in ocean temperature that may affect, but not likely to adversely affect ESA-listed sea turtles.

Ingestion of Marine Debris

Short-term, negligible, adverse impacts on ESA-listed sea turtles would result from the accidental release of marine debris (e.g., ropes, plastic, etc.) during decommissioning, similar to effects of construction, as described in Section 4.3.3.1. Sea turtles ingesting marine debris are susceptible to blockage in the digestive system, internal damage, or an accumulation of toxins that may be present in the debris. Existing regulations prohibit the disposal of plastic, dunnage, lining, floating packing materials, and all other trash within 12 miles of the coast. Further, as a SOP, all vessels associated with the proposed Project would be prohibited from dumping trash of any kind. Solid waste management training would be provided that emphasizes the importance of minimizing impacts on marine mammals, sea turtles, and

migratory birds. This combination of proposed Project policy and existing regulations would ensure that any marine debris accidentally expended within the proposed Project area would be negligible. Therefore, the potential accidental release of marine debris associated with decommissioning activities may affect, but not likely to adversely affect ESA-listed sea turtles.

Entanglement

Short-term, minor, adverse impacts on ESA-listed sea turtles would result from entanglement during decommissioning, as described in Section 4.3.3.1. Entanglement in derelict fishing gear, ropes, lines, or other marine debris has received much attention in recent decades and is an important threat to sea turtles. A 25-year dataset assembled by the Ocean Conservancy reported that fishing line, rope, and fishing nets accounted for most entanglements, with the remainder due to encounters with various items such as bottles, cans, and plastic bags (Ocean Conservancy 2010).

Barges and other vessels would use fixed anchoring methods, and the associated anchor cables could pose a risk of entanglement to ESA-listed sea turtles. Sea turtles could be entangled by anchors, anchor lines, or buoy lines deployed during decommissioning, but the potential for such an event would be low. Anchor lines securing barges would be large in diameter, knotless, non-floating, and taut, and would only be deployed for a short period of time. In addition, anchor lines would be separated by hundreds of feet as they radiated away from the vessel and would not be laterally connected to other lines, thereby avoiding the creation of a “web effect.” With adherence to best management practices for detection of sea turtles in the area, the potential for entanglement associated with construction activities would be minimized. Combined, these factors would decrease the potential for sea turtle entanglement and impacts would be short-term and minor, and may affect, but not likely to adversely affect ESA-listed sea turtles.

Lighting

Short-term, minor, adverse impacts on ESA-listed sea turtles would result from lighting used by support vessels during decommissioning, as described for construction in Section 4.3.3.1. Artificial light could potentially confuse sea turtles approaching the proposed Project area where lighting is used during decommissioning. Lighting used during decommissioning would primarily be limited to the vessels (navigation lights, spotlights, decklights, etc.) used to illuminate the work area both on the vessel and on the water. Lights would be downshielded to illuminate the deck only and would not intentionally illuminate the surrounding waters. The Applicant has committed to minimize the amount of lighting needed directly on the water surface, while still providing a safe work area.

Sea turtles may be attracted to the lighting used during proposed Project construction, operations, or decommissioning. However, the nature of the other associated stressors covered in this section associated with the construction activities (i.e., noise, seafloor disturbance, etc.) would likely cause animals to move away from those activities, rather than be attracted to the proposed Project area because of the lighting, resulting in minor and temporary impacts during decommissioning. The level at which ESA-listed sea turtles would be attracted to this type of lighting is expected to be minimal, as discussed for construction impacts.

The additional lighting associated with construction vessels may affect, but not likely to adversely affect ESA-listed sea turtles.

Alteration to Prey Species Abundance and Distribution

Short-term, negligible, adverse impacts on ESA-listed sea turtles would be expected to occur as a result of alteration to prey species abundance and distribution associated with the proposed Project during decommissioning by turbidity, sedimentation, and noise, as well as entrainment during water withdrawals. Such water withdrawals would be expected to be similar to those described for construction (Section 4.3.3.1). The displacement of some prey species, like fish, may actually attract sea turtles away from the proposed Project decommissioning. Since potential impacts on sea turtle prey species would be

temporary and confined to the general vicinity of the decommissioning activities may affect, but not likely to adversely affect ESA-listed marine mammals.

Air Emissions

Negligible impacts on ESA-listed sea turtles would be expected as a result of air emissions from support vessels during decommissioning, similar in scope to impacts during construction, as described in Section 4.3.3.1. Air emissions would be expected to be similar to that of other vessels transiting the approach to Ambrose Channel in the proposed Project area. Components that have the potential to leak, such as connectors, valves, and flanges, are situated in a confined space that would include gas leakage detectors to alert workers of any issues immediately. Additionally, SOPs would be enacted to reduce the potential for fugitive emissions. Decommissioning activities would contribute a very minimal portion of total air emissions in the New York Bight, and emissions would be short-term. Therefore, negligible air emissions associated with decommissioning activities may affect, but not likely to adversely affect ESA-listed marine mammals.

4.3.4 Fish

The Atlantic sturgeon is the only ESA-listed species within the ROI (Table 4.3-1). Proposed Project-related impacts on this fish species would be similar to impacts on other fish species, as discussed in Section 4.2.4. The injury criteria for fish often comes from piling driving information derived from California Department of Transportation's Fisheries Habitat Working Group (FHWG 2008). This guidance document reports 206 dB_{peak} re 1 μPa as peak level and 187 dB re 1 μPa $_{c}$SEL for fish over 2 grams. Because data on hearing capabilities exist for perhaps only 100 of the 29,000 or more extant species of fish (Popper et al. 2006), any extrapolation of hearing capabilities between different species is speculative (ICF Jones & Stokes 2009).

Driven piles would only be required in the unlikely event geotechnical conditions preclude the use of suction anchors. The FHWG criteria does not address behavioral effects of noise on fish, as little is known regarding the threshold levels for such effects. As a conservative measure, NOAA Fisheries and USFWS generally have used SPL 150 dB re 1 μPa as the threshold for behavioral effects to ESA-listed fish species (salmon and bull trout) for most biological opinions evaluating pile driving, citing that sound pressure levels in excess of SPL 150 dB re 1 μPa can cause temporary behavioral changes (startle and stress) that could decrease a fish's ability to avoid predators (ICF Jones & Stokes 2009).

Specifically, Atlantic sturgeon use particle motion to detect sounds around them (Lovella et al. 2005). Since Atlantic sturgeon have swim bladders, they may be more vulnerable to acoustic stress, because pile driving can rapidly expand and contract the swim bladder, as well as rupture capillaries (Caltrans 2001). The gradual increase in activities (and noise; see Section 4.11.6) would allow Atlantic sturgeon to vacate the area, thus avoiding the risk of injury or mortality. This avoidance response would also preclude any interactions between other equipment and Atlantic sturgeon. The benthic footprint of the proposed Project would permanently alter an area that might be used for foraging by the Atlantic sturgeon; however, the footprint is extremely small relative to the surrounding habitat. Long-term, minor, adverse impacts on the Atlantic sturgeon would be expected to occur as a result of construction, operation, and decommissioning of the proposed Project. However, the isolated nature of impacts would not result in population-level impacts. Therefore, impacts expected to occur as a result of construction, operation, and decommissioning of the proposed Project and may affect, but not likely to adversely affect Atlantic sturgeon.

4.3.5 Coastal and Marine Birds

Proposed Project-related impacts on threatened and endangered coastal and marine birds would be similar to those experienced by other, non-listed coastal and marine birds, as discussed in Section 4.2.6. Long-term, minor, adverse impacts on ESA-listed birds would be expected to occur as a result of construction, operation, and decommissioning of the proposed Project (Table 4.3-1). However, since the areas of

impact would be isolated, they would not result in population-level impacts. Therefore, impacts expected to occur as a result of construction, operation, and decommissioning of the proposed Project may affect, but not likely to adversely affect coastal and marine birds.

4.3.6 Impacts of Alternatives

The impacts of the proposed Port site on ESA-listed marine mammals, sea turtles, fish, and birds compared to those located in Study Areas B and D would be similar in scope to the impacts on all biological resources, as discussed in Section 4.2.7.1; however, the duration and extent of impacts would be greater for a port site located in Study Area D, as this would require a Mainline route nearly twice as long. Though the sites are similar, the sites in Study Areas B and D are situated on and/or adjacent to an active fishing ground and could have greater impacts on fisheries resources.

Mainline routes C-1 and C-2 would have similar impacts on threatened and endangered marine mammals, sea turtles, fish, and birds as the Mainline routes are in the same general vicinity.

Because impact piling was assessed to have the highest potential for sound generation (over the widest area) associated with the proposed Project, the decision was made that the anchors would be installed at the proposed Project using suction anchors. If necessary, driven piles could be used as an alternative to the suction anchors in the unlikely event geotechnical conditions preclude use of suction anchors. Several different anchor alternatives have been considered for the proposed Project, including suction anchors, driven piles, fluke anchors, gravity-based anchors, and grouted pile anchors. It is anticipated that driven piles would have the smallest footprint. Installation of a gravity-based anchor system would generally result in a greater disturbance of the sea bottom and more overall loss of benthic habitat than other types of anchors. The fluke anchor system would likely have the next greatest impact due to "setting" the anchor by pulling it into the seafloor. The driven pile and grouted pile anchor designs present a relatively smaller seafloor footprint and, therefore, would potentially result in significantly less of an effect to benthic habitat. During installation, all alternatives of anchoring would have short-term turbidity and sedimentation impacts owing to various methods used to set the anchors at or below the sea bottom surface. Gravity-based anchor structures would result in a direct loss of existing fish habitat in a significant area (each approximately 2,500 ft^2). Other anchor designs present smaller environmental footprints and, therefore, would potentially result in significantly less of an effect on benthic habitat. Suction anchors, by virtue of pumping out the water from inside the caisson, would have an impact on the zooplankton within that water column, which the other alternatives avoid. On the other hand, gravity-based anchor system structures would provide a significant amount of hard substrate at different depths as it protrudes above the seafloor. This would likely result in an artificial reef sustaining development of new biotic communities that have a potential to support significant marine populations. Such gravity-based anchor reefs would be unavailable to commercial and recreational fishermen; therefore, would not result in any direct positive economic impact. As discussed further in Section 4.11, pile driving generates the highest underwater noise levels during construction, which is required when using driven piles. Other alternatives are installed using different methods, which would likely generate underwater noise, but likely to a lesser extent. These impacts would only occur throughout the duration of installation and the risk of these potential impacts must also be balanced against the effectiveness and reliability of the anchoring system.

The impacts on ESA-listed marine mammals, sea turtles, fish, and birds from the deepwater port alternatives are varied. The GBS, the platform-based unit, and the artificial island generally would result in a greater disturbance of sediments due to the larger footprint on the sea bottom, as well as permanent conversion of soft bottom habitats to hard structure. The FSRU, HiLoad, and the STL Buoy alternatives each would result in a smaller sea bottom footprint and less sediment disturbance during construction. However, the HiLoad design requires deeper water depth resulting in the need for a longer pipeline with more bottom disturbance and the potential for increased duration of construction vessel activity. In addition, during operation these alternatives could result in increased long-term turbidity due to anchor

cable sweep. Impacts on biological resources from increased vessel activity, water use, noise and light would likely be similar for all alternative designs.

Based on the selection of the proposed Project design, there are two alternatives for vaporization of the LNG prior to it entering the proposed Mainline. The alternatives are open-loop vaporization and closed-loop vaporization, and neither would have an impact on benthic environments. Open-loop vaporization would require substantial water intake (between 13,944 and 27,932 gpm), the potential use of biocides, and the discharge of colder than ambient temperature water which would adversely impact local prey resources due to impingement and entrainment. Seawater intake would not be required by the any of the closed-loop vaporization alternatives; thus, eliminating impacts on prey species that would be caused by an open-loop vaporization system.

The No Action Alternative would prevent any construction, operation, and decommissioning of the proposed Project. This would result in no impacts on any species or associated habitat.

4.3.7 Mitigations and Monitoring

The mitigation measures for ESA-listed marine species would follow those outlined in Section 4.2.8, as well as additional measures. Vessel interactions with protected species are of particular concern. In order to minimize and prevent collisions with protected species, a Marine Mammal and Sea Turtle Vessel Strike Avoidance Plan has been developed (Appendix K). Compliance with this plan would ensure the greatest reduction in collision risk. In addition to the slower speeds used upon approach to the proposed Port, vessels 65 feet or longer would also adhere to any speed restrictions in-place. For example, from 1 November to 30 April, vessels 65 feet or longer within the SMA and within 20 nautical miles of major ports must maintain speeds below 10 knots.

4.4 Essential Fish Habitat

4.4.1 Introduction

This section addresses potential impacts on essential fish habitat (EFH) associated with the proposed Project and alternatives, including the No Action Alternative. As discussed in Section 3.4, the proposed Project would be located in the New York Bight. Potentially affected EFH in the ROI include the marine waters benthic environment of the nearshore and offshore portions of the New York Bight. An analysis of impacts on EFH is included in Appendix E. Construction, operation, and decommissioning of the proposed Project would have no significant impact on a number of designated EFH species. However, direct, temporary impacts from these activities are expected via displacement from the water column to designated EFH species. In addition, direct and temporary to long-term impacts from construction, operation, and decommissioning have the potential to exist from the displacement of benthic habitat.

Construction, operation, and decommissioning of the proposed Project would have no significant impact on EFH within the ROI. Impact that does occur would be highly localized, direct impacts within the footprint of the proposed Project ranging from temporary to long-term on the habitat and associated prey species for the duration of activities. However, since the ROI represents only a very small portion of this type of available offshore benthic and water column EFH in the New York Bight, only a commensurately small portion of available EFH would be potentially exposed to adverse impacts. The following sections identify the activities that would affect one or more EFH species as defined in Section 3.4. The activities are presented for the construction, operation, and decommissioning phases of the proposed Project.

4.4.2 EFH Assessment Methods

In order to determine the degree and duration of potential impacts of the proposed Project on species with designated EFH, it was necessary to determine the overlap of each species' life history stages, habitat preference, and prey resources within the proposed Project area. Details of this process are provided in

Appendix E. EFH-designated species and life history stages in the proposed Project area were identified based on a list in the NOAA Guide to EFH Designations in the northeastern United States (NOAA/NMFS/NERO 2013) for the 10-minute by 10-minute area of latitude and longitude bounded on the north, west, south, and east as follows: 40° 30′ N latitude, 74° W longitude, 40° 20′ N latitude, and 73° 50′ W longitude. EFH designations for coastal finfish and shellfish species in this area were also based on information compiled by NOAA Fisheries and the Fishery Management Councils, located on the EFH Mapper Tool (NOAA/NMFS/NERO 2013), and the EFH source documents contained within each of the EFH text descriptions. This data is compiled from the NOAA Fisheries bottom trawl and Marine Resources Monitoring, Assessment, and Prediction (MARMAP) surveys (NOAA/NMFS/NERO 2013) and is used by regional Fishery Management Councils to designate EFH in Fishery Management Plans (FMPs). A total of 23 bony fish, 10 sharks, two skates, one mollusk, and two bivalve shellfish are currently designated as EFH species in this area. Each EFH-designated species and the corresponding designated lifestages are presented in Table 3.4-1.

4.4.3 Impacts of Construction, Operation, and Decommissioning

The overall potential adverse impacts on EFH-designated species and EFH in the ROI would be highly localized within the proposed Project area, relatively minor (in comparison to the overall available EFH area), and short-term. These impacts are detailed in Appendix E and summarized in Tables 4.4-1 and 4.4-2. Most EFH-designated species feed on motile epifaunal organisms or on small forage fish and would not be adversely affected. For any benthic-feeding EFH species, the impact of trenching on local forage habitat area would be short-term, lasting only until the trenched area is re-colonized by new benthic organisms. This process would be expected to take less than a year. While the trenching would be expected to have long-term adverse impacts on the benthic infauna occupying the sediment to be dredged within the proposed Project area, the indirect effects of the loss of those prey resources for EFH species would not adversely affect those EFH species. Therefore, additional mitigation measures are not necessary.

No adverse impact would be expected on the following EFH species: Atlantic mackerel, Atlantic salmon, bluefin tuna, haddock, monkfish (eggs and larvae), shortfin mako shark, skipjack tuna, or witch flounder. Direct, short-term, minor impacts would be expected via displacement from the water column to the following EFH species: Atlantic butterfish, Atlantic herring, basking shark, blue shark, bluefish, cobia, dusky shark, king mackerel, longfin squid, sandbar shark, sand tiger shark, spiny dogfish, Spanish mackerel, tiger shark, and white shark. The potential does exist for direct, long-term, moderate impacts on the benthic habitat to the following EFH species: Atlantic surfclam and ocean quahog. Direct, short-term minor impacts are expected from displacement from the benthic habitat for the following EFH species: Atlantic cod, black sea bass, little skate, monkfish (adults), ocean pout, pollock, red hake, scup, summer flounder, whiting/silver hake, windowpane flounder, winter flounder, winter skate, and yellowtail flounder.

4.4.4 Mitigations and Monitoring

Minimizing impacts on EFH is discussed in Appendix E. The greatest mitigation measure taken to protect EFH is the selection of the proposed Mainline location. The proposed Mainline route avoids sensitive habitat, such as oyster reefs, hardbottom habitat, and submerged aquatic vegetation, that are important areas of biodiversity. Instead, the proposed Mainline would be sited in an area dominated by sand, which is a dynamic and resilient environment, with the benthic community capable of recovering to pre-disturbance condition. Additional measures, such as water intake reduction, impingement screens, and minimizing noise and lighting, would reduce local impacts on EFH. Impacts on EFH species would not be expected to be different from those described for fisheries resources detailed in Section 4.2.4. Therefore, mitigation measures would be the same as those detailed in Section 4.2.8.

Table 4.4-1. Direct and Indirect Effects of the Proposed Project on Benthic Essential Fish Habitat (EFH) of Federally Managed Species

Duration of Impact on Benthic EFH	Context of Impact	EFH Species Impacted	Remarks (Lifestages Affected)
Direct Impact – Mortality and Displacement			
Long-Term	Mortality from trenching and displacement from the benthic habitat	Atlantic surfclam	Juveniles and adults have EFH listed within the waters of the proposed Project area. Mortality of specimens within trenching zone expected, but long-term recovery would occur through repopulation from surrounding source populations once trenching is completed. Adverse Effects to Benthic Infauna Removed by Dredge
		ocean quahog	Juveniles and adults have EFH listed within the waters of the proposed Project area. Potential exists for mortality of specimens within trenching zone to occur. However, long-term recovery would occur through repopulation from surrounding source populations once trenching is completed. Adverse Effects to Benthic Infauna Removed by Dredge.
Direct and Indirect Impact – Displacement and Prey Loss			
Temporary	Displacement from the benthic habitat and loss of benthic prey from trenching	Atlantic cod	Adults have EFH within the waters of the Project area; they would be expected to return once the trenching event is completed, but feeding opportunities would be temporarily limited in the Project area due to loss of prey resources.
		black sea bass	Juveniles and adults have EFH within the waters of the Project area; they would be expected to return once the trenching event is completed, but feeding opportunities would be temporarily limited in the Project area due to loss of prey resources.
		little skate	Juveniles and adults have EFH within the waters of the Project area; they would be expected to return once the trenching event is completed, but feeding opportunities would be temporarily limited in the Project area due to loss of prey resources.
		monkfish	Eggs, larvae, and adults have EFH within the Project area. Adults have EFH designated in Project area; would likely avoid trenching activities, returning upon completion. Adults may also lose prey resources.
		ocean pout	Eggs, larvae, and adults have EFH within the Project area; only adults are likely to be displaced temporarily until dredge activities finished. Eggs and larvae are often associated with hardbottom habitat, especially those with crevices, which is not characteristic of the sandy bottom in the Project area. Prey resources may also be diminished during this time.
		pollock	Juveniles have EFH designated in the Project area, which may be displaced temporarily during dredge activities. They may also experience lower prey availability.
		red hake	Only eggs, larvae, and juveniles have EFH within the waters of the Project area. Juveniles would be expected to return once the trenching event is completed, but feeding opportunities would be temporarily limited in the Project area due to loss of prey resources. Eggs and larvae are found in surface waters and would not be impacted by trenching.
		scup	Juveniles and adults have EFH within the waters of the Project area; they would be expected to return once the trenching event is completed, but feeding opportunities would be temporarily limited in the Project area due to loss of prey resources.
		summer flounder	Larval, juvenile, and adult lifestages have EFH within the waters of the Project area; they would be expected to return once the trenching event is completed, but feeding opportunities would be temporarily limited in the Project area due to loss of prey resources. Larvae would not be expected to be impacted, since they primarily occur in surface waters.
		whiting/silver hake	Egg, larval, and juvenile lifestages have EFH within the waters of the Project area. Juveniles would be expected to return once the trenching event is completed, but feeding opportunities would be temporarily limited in the Project area due to loss of prey resources. Eggs and larvae are found in surface waters and would not be impacted by trenching.
		windowpane flounder	All lifestages have EFH within the waters of the Project area. Juveniles and adults would be expected to return once the trenching event is completed, but feeding opportunities would be temporarily limited in the Project area due to loss of prey resources. Eggs are found in surface waters and larvae in pelagic waters and would not be impacted by trenching.
		winter flounder	All lifestages have EFH within the waters of the Project area. Juveniles and adults would be expected to return once the trenching event is completed, but feeding opportunities would be temporarily limited in the Project area due to loss of prey resources. Eggs and larvae are demersal, but primarily occur in water < 6 meters deep February – June. Some of these eggs and larvae could be directly impacted by the dredge. However, since most winter flounder spawning occurs well outside of the Project area, no population-level impacts are expected.
		winter skate	Juveniles and adults have EFH within the waters of the Project area; they would be expected to return once the trenching event is completed, but feeding opportunities would be temporarily limited in the Project area due to loss of prey resources.
		yellowtail flounder	All lifestages have EFH within the waters of the Project area. Juveniles and adults would be expected to return once the trenching event is completed, but feeding opportunities would be temporarily limited in the Project area due to loss of prey resources. Eggs and larvae are found in offshore pelagic waters and would not be impacted by trenching.

Table 4.4-2. Direct and Indirect Effects of the Proposed Project on Water Column EFH of Federally Managed Species

Duration of Impact on Water Column EFH	Context of Impact	EFH Species Impacted	Remarks (Lifestages Affected)
No Impact			
--	--	Atlantic mackerel	All lifestages have EFH within the waters of the Project area, but occur near the surface, away from the trenching.
		Atlantic salmon	Transient, extralimital pelagic species. These fish are not expected to be impacted.
		bluefin tuna	Juveniles and adults have EFH listed within the waters of the proposed Project area, but occur near the surface, away from the trenching. Highly mobile epipelagic species, they would avoid areas of trenching.
		haddock	EFH has only been designated for larval haddock, which only occur in surface waters and would thus be away from dredge activities.
		monkfish	Epipelagic eggs and larvae have EFH listed within the proposed Project area, but occur at the surface, away from the trenching.
		shortfin mako	All lifestages have EFH limited to depths greater than 82 feet. While those depths occur in the Project area, because of trenching, the ambient depths surrounding the Project area are approximately 45 feet. The 25-meter isobath is well offshore from the Project area.
		skipjack tuna	Adults have EFH listed within the waters of the proposed Project area, but occur near the surface, away from the trenching. Highly mobile epipelagic species, would avoid areas of trenching.
		witch flounder	Only larvae have EFH within the Project area. Spawning occurs in depths between 330 to 525 feet, therefore larvae would not be found in the Project area.
Direct Impact - Displacement			
Temporary	Displacement from the water column	Atlantic butterfish	All lifestages have EFH designated in the Project area; these pelagic fish are expected to evacuate during dredge activities and return following completion.
		Atlantic sea herring	Only juveniles and adults have EFH within the Project area; they would be expected to avoid the area during a trenching event, but return once the event is completed.
		basking shark	Adults have EFH listed within the Project area but are efficient, albeit slow, swimmers, expected to avoid dredge activity and return after Project completion.
		blue shark	All lifestages of this wide-ranging species have EFH designated in the Project area; highly mobile, the blue shark is expected to avoid the area during trenching and return upon completion.
		bluefish	All lifestages are pelagic and have EFH within the waters of the Project area; they would be expected to return once the trenching event is completed.
		cobia	All lifestages have EFH within the waters of the Project area; they would be expected to return once the trenching event is completed.
		common thresher shark	All lifestages have EFH within the waters of the Project area; they would be expected to return once the trenching event is completed.
		dusky shark	The neonate and juvenile stages of dusky shark have EFH within the waters of the Project area; they would be expected to return once the trenching event is completed.
		king mackerel	All lifestages have EFH within the waters of the Project area; they would be expected to return once the trenching event is completed.
		longfin squid	Both juveniles and adults (pre-recruits and recruits) of longfin squid are pelagic and have EFH within the waters of the Project area; they would be expected to return once the trenching event is completed.
		sandbar shark	Neonate, juvenile and adult stages of sandbar shark have EFH within the waters of the Project area; they would be expected to return once the trenching event is completed.
		sand tiger shark	Only the neonate larval stage of sand tiger shark has EFH within the waters of the Project area; they would be expected to return once the trenching event is completed.
		spiny dogfish	Only juveniles have EFH within the Project area; they would be expected to avoid the area during a trenching event, but return once the event is completed.
		Spanish mackerel	All life stages have EFH within the waters of the Project area; they would be expected to return once the trenching event is completed.
		tiger shark	The neonate and juvenile stages of tiger shark have EFH within the waters of the Project area; they would be expected to return once the trenching event is completed.
		white shark	Juvenile white sharks have had EFH designated in the Project area; they are expected to avoid the area during trenching and return once the event is finished.

4.5 Geological Resources

This section identifies how the geologic conditions within the ROI may affect or be affected by construction and/or operation of the proposed Project and alternatives, including the No Action Alternative. Protection of unique geological features, minimization of sediment erosion, and the location of facilities in relation to mineral resources and potential geologic hazards, such as seismicity and sinkholes, were considered when evaluating the potential geological impacts of the proposed Project. Generally, impacts on geological resources or impacts caused by geologic hazards can be avoided or minimized through proper siting, foundation, and structural engineering design; erosion control measures; and construction, operation, and decommissioning techniques.

This evaluation does not address soil resources, because soil resources are located only onshore and no new development of onshore facilities has been proposed. This evaluation focuses on the geologic features (bathymetry, mineral resources, geologic hazards, paleontological resources, and sediments) defined in Section 3.5 in the offshore environment. The activities are presented for the construction, operation, and decommissioning phases of the proposed Project.

4.5.1 Introduction

Geological resources generally would not be affected by the proposed Project. Some localized and short-term disturbance of seafloor sediments would be expected during construction and decommissioning, and long-term disturbance during operations.

Impacts on sensitive seafloor geology would be avoided by physically siting the proposed Project on soft bottom sediments with no mineral leases, paleontological resources, or evidence of geologic hazards (e.g., sinkholes, steep slopes, and hard bottom). It should be noted that the proposed Mainline crosses the New York Bight Fault Zone, but this fault has not been active for at least 1.8 million years.

Seafloor disturbance would be minimized and avoided along the proposed Mainline and pipeline laterals by installing them with a jet plow, minimizing sediment disturbance during standard operations, and abandoning the proposed Mainline and pipeline laterals in-place during decommissioning to be consistent with current federal policies to minimize adverse impacts. While sediment disturbance within the footprint of the anchor chains would occur throughout the life of the proposed Project, the only substrate disturbed would be soft bottom; no disturbance would be expected along the proposed Mainline or pipeline laterals through the operational life of the proposed Project.

Construction, operation, and decommissioning of the proposed Project would not be expected to impact any mineral or paleontological resources, increase the risk associated with any geological hazards (landslides, seismicity, and liquefaction), or alter sediment composition or structure. The Applicant would conduct geotechnical borehole sampling and testing prior to construction in order to verify the sediment conditions and ensure that no potential hazards would be located at an anchor location or would alter the performance of an anchor.

4.5.2 Impacts of Construction

Construction activities would affect up to 250 acres on the seafloor. The bottom sediment disturbance from the placement of the proposed Project components would result in adverse negligible, short-term impacts on bathymetry and sediments in the proposed Project area. Prior to installation of any of the proposed Project components, the Applicant would perform surveys to ensure that no previously unidentified unique geologic features, as well as no previously unidentified debris or other hazards (e.g., shipwrecks or third-party facilities), were located within the construction work areas. Following completion of the pre-installation surveys, long baseline arrays would be laid out on the seafloor to precisely locate the positions of the construction vessels during installation and ensure proper placement

of proposed Project components on the seafloor. Table 4.5-1 indicates the installation and backfill method for the proposed Project components.

Table 4.5-1. Proposed Pipeline Trenching and Backfilling Methods

Starting MP	to MP	Method	Backfill Method	Length of Pipeline
0.00	16.97	post-lay plow with diver hand jetting at locations where pipeline crosses existing cable a/	backfill plow	16.97 miles (14.8 nautical miles)
16.97	20.08	post-lay plow and additional jet sled pipeline lowering	imported material utilizing a DP vessel outfitted with tremie equipment to place the material in the trench	3.11 miles (2.7 nautical miles)
20.08	21.67	post-lay plow with diver hand jetting at locations where pipeline crosses existing cable a/	backfill plow	1.59 miles (1.4 nautical miles)
Lateral 1		post-lay plow	backfill plow	0.88 miles (0.76 nautical miles)
Lateral 2		post-lay plow	backfill plow	1.77 miles (1.54 nautical miles)
Utilities		submersible pump air lift, supplemented by diver hand jetting	protective structure and concrete mats	n/a
Hot-tap connectors		submersible pump air lift, supplemented by diver hand jetting	protective structure and concrete mats	n/a
Subsea Tie-in (SSTI) MP 21.67		submersible pump air lift, supplemented by diver hand jetting	protective structure and concrete mats	n/a
Collocated Y Assembly (CYA) MP 0.0		submersible pump air lift, supplemented by diver hand jetting	protective structure and concrete mats	n/a

a/ Post-lay plow: the five relic cables crossing the planned pipeline route would be lowered to an appropriate depth below the seabed before the commencement of the pipeline installation program. This would allow the pipeline to be installed and the post-lay plow to pass over the relic cable without physical contact.

Bottom Sediment Disturbance

Construction activities (installation of the proposed Project components) would result in minor short-term alterations of seafloor bathymetry and in bottom sediment disturbance. Potential impacts on water quality and biological resources associated with bottom sediment disturbance are discussed in Sections 4.1 and 4.2, respectively.

Bathymetry

Installation of the proposed Project components would cause minor, short-term changes of the seafloor topography (bathymetry). These would be confined to the construction zone and nearby areas, where disturbed sediments would resettle to the bottom. Should a USACE permit be issued for the proposed Project, all disturbed areas would be required to be returned to pre-construction conditions immediately upon completion of construction. Disturbed areas would not be left over time or allowed to return to pre-disturbance conditions by natural processes and currents. Because sediment disturbance would be localized, temporary, and reversible, the impacts on bathymetry during construction would be negligible.

Sediments

Installation of the proposed Project components would affect up to 250 acres of sediment on the seafloor. These would be confined to the construction zone and nearby areas, where disturbed sediments would resettle to the bottom. After construction, it is anticipated that currents would level any deposited sediment and return the disturbed area to approximately pre-construction conditions. Because sediment disturbance would be localized, temporary, and reversible, the short-term adverse impacts on sediments during construction would be negligible.

4.5.3 Impacts of Operation

During operations, the anchor chains sweeping the seafloor caused by raising and lowering the STL Buoys would result in bottom sediment disturbance and would impact bathymetry and sediments in the proposed Port facilities area, resulting in an adverse minor, long-term impact.

Bottom Sediment Disturbance

Under typical operations, the STL Buoy would not be raised and lowered because the LNGRV would remain moored at the STL Buoy except to avoid severe storms (i.e., hurricanes). One of the STL Buoys would be raised and lowered an average of approximately once per week (based on 45 trips to and from the proposed Project annually).

Bathymetry

The effects of the anchor chains sweeping the seafloor would include leveling of the bathymetry throughout the operational life of the proposed Project. The placement of the fixed structures would cause localized changes of the bathymetry within the 2-acre footprint of the structures for the duration of the proposed Project. Given the expanse of soft bottom sediments in the proposed Project area, the highly localized proposed Project disturbance, and active sediment transport that is occurring in the area (see Section 3.5), the long-term adverse impacts on bathymetry during operations would be negligible.

Sediments

The movements of the anchor chains and wire ropes caused by wave, wind and currents for the STL Buoys may make contact with the seabed and create a minor turbidity impact. Impacted sediments would be transported vertically into the water column and then currents would transport the sediments horizontally until they settle back to the seabed. Review of the current design of the mooring system (APL 2012) indicates that the system is similar to the mooring system design of the Northeast Gateway system. (A geotechnical survey would be conducted and final design of the mooring system would be prepared using data from that survey.) Analysis of TSS concentration and sediment transport distance was conducted for the Northeast Gateway system (NEG 2010). The estimated TSS concentration and horizontal distance of sediment transport calculated for the Northeast Gateway Project did not indicate a significant turbidity impact above those normally created during storms.

It should be noted that the sediment type identified in the Northeast Gateway Project is fine-grained, which would remain in suspension longer; therefore, this analysis should be considered conservative for the proposed Port Ambrose Project.

The placement of the fixed structures would cause localized changes in the sedimentation patterns on the seafloor for the duration of the proposed Project. In addition, the seafloor currents could cause minor scouring adjacent to the components on the seafloor. Given the expanse of relatively soft bottom sediments in the proposed Project area, the highly localized proposed Project disturbance, and active sediment movement that is occurring in the area (see Section 3.5), the long-term adverse impacts on sediments during operations would be minor.

4.5.4 Impacts of Decommissioning

Decommissioning of the proposed Project, as described in Section 2.1.17, would result in impacts on bathymetry and sediments that would be similar to those described for construction (adverse negligible, short-term impacts). Several proposed Project components would be abandoned in-place to be consistent with current federal policies to minimize adverse impacts, including the proposed Mainline, pipeline laterals, and the anchors, the ends of which would either be buried below the seafloor or covered with protective concrete mats. Suction anchors used to secure the mooring lines would be inspected and backed out by pumping seawater into the pile and recovering it for onshore recycling/disposal. Alternatively, the pile could be cut below the mudline should conditions warrant. Driven piles would be abandoned in-place upon decommissioning, resulting in a permanent impact as there would be a permanent removal of benthic habitat. Because the proposed Project would be in an area of sediment reworking (see Section 3.5), any scars related to construction, operation, or decommissioning would be expected to return to pre-construction conditions following decommissioning. Seafloor sediments would recover naturally following decommissioning.

4.5.5 Impacts of Alternatives

The impacts of the proposed Port site on geological resources compared to those located in Study Areas B and D would be similar in scope. Mainline routes C-1 and C-2 would have similar impacts on geological resources as the routes are in the same general vicinity.

Because impact piling was assessed to have the highest potential for sound generation (over the widest area) associated with the proposed Project, the decision was made that the anchors would be installed at the proposed Project using suction anchors. If necessary, driven piles could be used as an alternative to the suction anchors in the unlikely event geotechnical conditions preclude use of suction anchors. Several different anchor alternatives have been considered for the proposed Project, including suction anchors, driven anchors, fluke anchors, gravity-based anchors, and grouted pile anchors. It is anticipated that driven piles would have the smallest footprint. Installation of a gravity-based anchor system would generally result in a greater disturbance of the sea bottom and more overall loss of benthic habitat than other types of anchors. The fluke anchor system would likely have the next greatest impact due to "setting" the anchor by pulling it into the seafloor. The driven pile and grouted pile anchor designs present a relatively smaller seafloor footprint and, therefore, would potentially result in significantly less of an effect to benthic habitat. These impacts would only occur throughout the duration of installation and the risk of these potential impacts must also be balanced against the effectiveness and reliability of the anchoring system. Under the above alternatives the impacts would be minor and short-term.

The impacts on geologic resources from the deepwater port alternatives are varied. The GBS, the platform-based unit, and the artificial island generally would result in a greater disturbance of sediments due to the larger footprint on the sea bottom. The FSRU, HiLoad, and the STL Buoy alternatives each would result in a smaller sea bottom footprint and less sediment disturbance during construction. However, during operation these alternatives could result in increased long-term minor impacts on bottom sediment due to anchor cable sweep.

Based on the selection of the proposed Project design, there are two alternatives for vaporization of the LNG prior to it entering the proposed Mainline system. The alternatives are open-loop vaporization and closed-loop vaporization, and neither would have an impact on geological resources.

Under the No Action Alternative, no facilities would be built, and there would be no potential for impacts on geological resources. Depending on the characteristics of the alternative measures used to address the areas' energy needs, the region could experience impacts on geological resources that are greater than, less than or similar to those that would be associated with the proposed Project.

4.5.6 Mitigations and Monitoring

Impacts on geological resources would be adequately mitigated by the Applicant through design modifications and implementation of mitigation measures recommended by federal and state agencies; therefore, the USCG does not request additional mitigation measures to be implemented. However, the USCG would consult with BOEM, and based on recommendations provided by BOEM, the USCG would consider these recommendations.

4.6 Cultural Resources

4.6.1 Introduction

This section addresses potential impacts on cultural resources associated with the proposed Project and alternatives, including the No Action Alternative. As discussed in Section 3.6.1, the area of potential effect (APE) for archaeology includes all marine locations that would undergo disturbance due to proposed Project construction, operation, and decommissioning.

In letters dated August 30, 2013, the USCG initiated consultation with the New York State Historic Preservation Office (NYSHPO) and the New Jersey Historic Preservation Office (NJHPO). NYSHPO responded by letter dated December 13, 2013, that it had no information regarding any potential significant historic properties within the APE of the proposed Project within New York State waters and that there is limited potential for such resources to occur. Further, in response to a letter dated May 12, 2014, concerning the potential for impacts to historic properties from additional burial of the proposed Mainline within the Ambrose anchorage area, the NYSHPO stated in a letter dated May 19, 2014, that the proposed Project would have no effect on historic properties within the APE. NJHPO responded in a letter dated September 24, 2013, by noting that studies related to historic architecture, archaeology, and underwater archaeology may be necessary to assess proposed Project effects under Section 106.

Construction of the proposed Project has the potential to impact submerged cultural resources in the APE; however, studies completed within the proposed Port facilities and in state waters concluded that there are not likely to be any potentially significant cultural resources in these areas. Additional analysis is required to determine the significance of potential cultural resources identified during review of remote sensing data collected within the portion of the APE in federal waters. Operation of the proposed Project would have no direct or indirect impacts on cultural resources since no new areas of seafloor would be impacted by operational activities. Decommissioning of the proposed Project would not be expected to result in impacts on submerged cultural resources provided that anchor handling plans and avoidance plans are implemented to avoid all high probability targets, shipwrecks, and paleochannels.

4.6.2 Impacts of Construction

There is potential to impact submerged cultural resources in the APE as a result of the proposed Project. Archaeological survey reports for the proposed Project and the alternatives have been reviewed by the Maritime Administration (MARAD), NYSHPO, and NJHPO. Magnetic anomalies, side-scan sonar targets, and subbottom profiler images have been identified that reveal the locations of both submerged cultural resources and areas with high potential to contain submerged cultural resources.

Archaeological review of geophysical data collected within the proposed Port facilities area did not reveal the presence of potential cultural resources. None of the recorded anomalies possessed characteristics indicative of potentially significant cultural resources (RCG&A 2012b).

In state waters, 12 targets were recorded as a result of remote sensing data collection. Of these, three targets were recommended as potential cultural resources that should be avoided. Follow-up ROV investigation indicated that these three targets all represent miscellaneous debris and not a historic

shipwreck (RCG&A 2012a). There would be no impacts on potentially significant shipwrecks within the APE in state waters.

The Mainline is proposed within the Inner Long Island Platform, a distinct region characterized by sediment starvation, little sediment cover, and heavy reworking of bottom sediments. Vibracore samples collected in the APE within state waters subjected to sedimentological and geochronological data analyses indicated the presence of two paleochannels with potential to contain submerged archaeological resources. However, the depth range of proposed Project impacts has been determined to be contained within the depth range where the sediments have been extensively reworked with little potential to contain preserved cultural materials (RCG&A 2012b).

Analysis and review of remote sensing data collected within the portion of the APE in federal waters revealed 13 targets recommended as potential cultural resources. A formal evaluation of these targets was recommended (RCG&A 2012c). If the areas of these target locations cannot be avoided by the proposed Project, then additional assessment would be required to determine if these are cultural resources that meet the criteria to be eligible to the National Register of Historic Places (NRHP).

Review of chirp seismic data with the APE in federal waters indicated three paleochannels that have potential to contain submerged archaeological sites. This portion of the APE is also located within the Long Island Platform that has undergone heavy reworking of bottom sediments (RCG&A 2012b). The placement of deep pilings are not expected to result in significant impacts on drowned terrestrial prehistoric archaeological sites.

4.6.3 Impacts of Operation

There would be no direct or indirect impacts on cultural resources from the operation of the proposed Project since no new areas of seafloor would be impacted by operational activities.

4.6.4 Impacts of Decommissioning

No impacts on submerged cultural resources would be expected as a result of the decommissioning of the proposed Project, provided that anchor handling plans and avoidance plans are implemented to avoid all high probability targets, shipwrecks, and paleochannels.

4.6.5 Impacts of Alternatives

Analyses and review of side scan imagery and magnetometer data indicated one target that may represent a significant submerged cultural resource within the APE for Mainline Route C-1 (RCG&A 2012b). If avoidance is not possible, further investigations should be designed and implemented in consultation with MARAD, NYSHPO, and BOEM to determine if the target represents a cultural resource that may be eligible to the NRHP. If the resource that may be affected by the proposed Project proves to be eligible to the NRHP, an appropriate treatment plan would be developed and implemented prior to construction.

Analyses and review of magnetometer data indicated a single target that may represent a significant submerged cultural resource within the APE for Mainline Route C-2 (RCG&A 2012b). No side scan sonar or subbottom profiler contacts were recorded that could be associated with this one magnetic anomaly. The amplitude and duration of this anomaly suggest that it might represent a buried cultural resource (RCG&A 2012b). If the proposed Project would not avoid this target, then further investigations should be designed and implemented in consultation with MARAD, NYSHPO, NJHPO, and BOEM.

Because impact piling was assessed to have the highest potential for sound generation (over the widest area) associated with the proposed Project, the decision was made that the anchors would be installed at the proposed Project using suction anchors. If necessary, driven piles could be used as an alternative to the suction anchors in the unlikely event geotechnical conditions preclude use of suction anchors. Several different anchor alternatives have been considered for the proposed Project, including suction anchors,

driven piles, fluke anchors, gravity-based anchors, and grouted pile anchors. It is anticipated that driven piles would have the smallest footprint. Installation of a gravity-based anchor system would generally result in a greater disturbance of the sea bottom and more overall loss of benthic habitat than other types of anchors, which could impact cultural resources. The fluke anchor system would likely have the next greatest impact due to "setting" the anchor by pulling it into the seafloor. The driven pile and grouted pile anchor designs present a relatively smaller seafloor footprint and, therefore, would potentially result in significantly less of an effect to cultural resources. These impacts would only occur throughout the duration of installation, and the risk of these potential impacts must also be balanced against the effectiveness and reliability of the anchoring system.

The probability for encountering known cultural resources from the alternative deepwater port designs would be similar to that predicted for the proposed Project's design since they would be in the same location. No known cultural resources, including historic shipwrecks, have been identified.

Based on the selection of the proposed Project design, there are two alternatives for vaporization of the LNG prior to it entering the proposed Mainline system. The alternatives are open-loop vaporization and closed-loop vaporization, and neither would have an impact on cultural resources.

4.6.6 Mitigations and Monitoring

If the proposed Project cannot avoid targets identified in federal waters as potentially significant cultural resources, then further investigations would be required to determine if these targets represent potential historic properties. If the targets are identified as historic properties, an appropriate treatment plan would need to be developed and implemented prior to construction.

Liberty has developed a draft Unanticipated Discoveries Plan for the proposed Project (Appendix L). This plan should be reviewed by MARAD, NYSHPO, NJHPO, and BOEM. All proposed Project construction, operation, and decommissioning personnel should be familiar with the plan and the steps that Liberty has agreed to follow in the event of the discovery of a significant cultural resource, including human remains.

4.7 Ocean Uses, Land Uses, Recreation, and Visual Resources

4.7.1 Introduction

This section addresses potential impacts on ocean uses, land uses, recreation, and visual resources associated with the proposed Project and alternatives, including the No Action Alternative. As discussed in Section 3.7, the high population and population density of New York City result in more intensive use of the surrounding open waters for commerce and recreation, additional development pressure on open and under-utilized land, and a stronger focus on protecting recreational and visual resources.

Construction of the proposed Project would result in short-term, localized, and minor impacts on ocean uses, recreation, and visual resources. Construction of the proposed Project would have no significant impact on land uses as the proposed onshore sites have a history of extensive industrial use. Operation of the proposed Project would result in minor and localized impacts due to enforcement of the Safety Zone, No Anchoring Areas (NAAs), and the Area to be Avoided (ATBA). Decommissioning of the proposed Project would result in similar impacts on those expected during construction; however, impacts would be of a lesser extent in both duration and significance.

4.7.2 Ocean Uses

4.7.2.1 Impacts of Construction

Impacts on ocean uses in and near the proposed Project area would primarily occur as a result of seafloor and sediment disturbance and increased vessel traffic. However, the impacts would be concentrated during the short-term construction period, localized to the area immediately surrounding proposed Project

activities, and minor given consideration to the existing traffic levels and patterns in the proposed Project area.

Commercial Shipping

Short-term, minor, adverse impacts on commercial shipping would result from proposed Project construction activities. Commercial and recreational vessels would be excluded from the construction area during the construction phase of the proposed Project. Construction of the proposed Project facilities would increase vessel traffic within the proposed Project area, but not significantly over the current number of vessels operating in the New York Bight. Existing vessel traffic patterns would be temporarily affected from installation of the proposed Mainline, which would cross through the Ambrose to Nantucket Traffic Lane and the Hudson Canyon to Ambrose Traffic Lane. Construction vessels would generally operate at slow speeds relative to other vessel traffic in the proposed Project area. Potential impacts resulting from installation of the proposed Mainline and construction vessel transits through the Traffic Separation Schemes (TSSs) are expected to be effectively avoided by maintaining safe navigation practices.

The Port of New York and New Jersey

Short-term, minor, adverse impacts on the Port of New York and New Jersey would result from proposed Project construction activities. Impacts on the Port of New York and New Jersey would be indirect impacts on navigation of commercial vessels transiting to and departing as described in Section 4.7.2.1. The Port of New York and New Jersey would not experience direct impacts from construction of the proposed Project.

Cruise Ships and Passenger Ferries

Cruise ships using the Nantucket to Ambrose/Ambrose to Nantucket Traffic Lanes may experience short-term and minor impacts from increased vessel traffic in the proposed Project area during construction of the proposed Project as described in Section 4.7.2.1. However, this increase in vessel traffic would not represent a significant increase over the current number of vessels operating in the New York Bight.

Commercial Fishing

Construction of the proposed Project facilities would result in short-term, minor, adverse impacts on commercial fishing from increased vessel traffic in the ROI and displacement of fishing activities in the proposed Project area. Impacts on EFH, as described in Section 4.4, could also affect commercial fisheries.

Military Use

Liberty has been involved in consultations with the USCG regarding construction of the proposed Project.

Offshore Sand Borrow and Disposal Areas

The proposed Project would not be located near offshore sand borrow and disposal areas. The proposed Mainline is located 0.6 nautical mile southwest of the closest sand borrow area (Figure 3.7-1). Construction of the proposed Project would not impact offshore sand borrow areas due to their distance from the proposed Project facilities. Federal legislation now prohibits dumping, and the offshore disposal areas have been closed.

Submerged Infrastructure

The proposed Mainline would cross five out-of-service submarine cables and the Neptune high voltage direct current (HVDC) transmission cable that connects Sayreville, New Jersey to Nassau County, New York (Figure 3.7-1). Liberty has designed the crossings of the proposed Mainline to avoid impacts on the

cables as described in Section 2.1.15. Crossing agreements would be negotiated with cable owner-operators prior to construction.

Artificial Reefs

Atlantic Beach Reef, located approximately 0.6 nautical mile west of the proposed Mainline, and Fishing Line Reef, located approximately 2.0 nautical miles east of the proposed Mainline, could potentially be affected during construction (Figure 3.7-1). Any impacts would be a result of sediment transport from construction activities and would be short-term and minor. Impacts on other artificial reefs, including Hempstead Town Reef, are unlikely due to their distance from the proposed Project.

4.7.2.2 Impacts of Operation

Commercial Shipping

Long-term, minor, adverse impacts on commercial shipping would result from proposed Project operation due to exclusion from certain areas associated with the proposed Project Safety Zone, NAAs, and the ATBA (Figure 3.7-1). Other vessels would be precluded from transiting through the Safety Zone. Outside of these areas, the proposed Project would not impact offshore transportation when not in use. To deliver LNG to the proposed Project, the LNGRV would travel through open waters at a speed of approximately 20 knots via the inbound Hudson Canyon to the Ambrose Traffic Lane and would approach the STL Buoys at approximately 3 knots within the Safety Zone surrounding the buoys. The LNGRVs would depart via the outbound Ambrose to Nantucket Traffic Lane. Potential impacts on the use of the TSS by commercial shipping traffic are expected to be effectively avoided by maintaining safe navigation practices and not interfering with existing vessel traffic patterns. The STL Buoys are expected to receive 45 deliveries of LNG each year.

The Port of New York and New Jersey

Long-term, minor, adverse impacts on the Port of New York and New Jersey would result from proposed Project operation. Impacts on the Port of New York and New Jersey would be indirect impacts on navigation of commercial vessels transiting to and departing, as described in Section 4.7.2.1. The Port of New York and New Jersey would not experience direct impacts from operation of the proposed Project.

Cruise Ships and Passenger Ferries

The ferry routes used by the Staten Island Ferry, Circle Line Downtown, Circle Line Sightseeing Cruises, Trust for Governors Island, Liberty Landing Ferry, New York Waterway, New York Water Taxi, Seaport Liberty Cruises, Seastreak, and Statue Cruises are located within the New York Harbor and along the coastline and would not cross through the ROI. The ferry routes do not cross through the proposed Project area; however, the ferry operators may experience short-term and minor impacts from the support vessel transiting from shore to the proposed Project area. However, this increase in vessel traffic would not represent a significant increase over the current number of vessels operating in the coastal waters of New York and New Jersey.

Commercial Fishing

Operation of the proposed Mainline and pipeline laterals would not impact commercial fishing activities because they would be buried below the seafloor, effectively preventing damage to the fishing gear and to the pipelines. Operation of the STL Buoys would affect commercial fishing through enforcement of the NAAs surrounding the proposed Port facilities. However, this displacement of commercial fishing activities is anticipated to have a minor effect to commercial fishermen because of the relatively small area of the proposed Port in comparison to other fishable areas, and because fishing activity is relatively low within the proposed Project area (see Figure 3.8-1). Long-term, minor, adverse impacts on commercial fishing would result from proposed Project operation.

Military Use

Liberty has been involved in consultations with the USCG regarding operation of the proposed Project.

Offshore Sand Borrow and Disposal Areas

Operation of the proposed Project would not impact offshore sand borrow areas due to their distance from the proposed Project facilities.

Submerged Infrastructure

The proposed Project would be designed and constructed such that there would be no impacts on submarine cables and the Neptune HVDC transmission cable during operation.

Artificial Reefs

Atlantic Beach Reef is located approximately 0.6 nautical mile west of the proposed Mainline and the Fishing Line Reef is located approximately 2.0 nautical miles east of the proposed Mainline (Figure 3.7-1). No impacts would be anticipated during operation of the proposed Project.

Renewable Energy Projects

BOEM (2012) published a study titled *Identification of Outer Continental Shelf Renewable Energy Space-Use Conflicts and Analysis of Potential Mitigation Measures* to identify potential space-use conflicts between Outer Continental Shelf (OCS) renewable energy development and other uses of the ocean environments and to recommend measures that BOEM can implement to promote avoidance or mitigation of such conflicts. The study concludes that submarine gas pipelines are potential issues for offshore renewable energy because the pipelines can suffer damage from construction, maintenance, and repair activities. These issues could result in potential impacts, including costly rerouting of the pipe and pollution if a pipeline were damaged by renewable energy project activity.

The study also found that the proposed Project facilities can result in the long-term, moderate, direct impacts due to exclusion or restriction of exploitation or exploration activities for renewable energy projects. Potential impacts related to these issues include increased risk of vessel collision, accidents that could cause oil pollution, and displacement of productive renewable energy generation.

4.7.2.3 Impacts of Decommissioning

Commercial Shipping

Short-term, minor, adverse impacts on commercial shipping would result from proposed Project decommissioning activities. Decommissioning of the offshore components of the proposed Project would involve abandoning or removing the proposed Port facilities and abandoning the proposed Mainline and pipeline laterals in-place to be consistent with current federal policies to minimize adverse impacts. This would cause a temporary increase in vessel traffic; however, the increase would be less than during construction. Vessels used to support decommissioning activities would generally operate at slow speeds relative to other vessel traffic in the proposed Project area, and impacts would be expected to be effectively avoided by maintaining safe navigation practices.

The Port of New York and New Jersey

Short-term, minor, adverse impacts to the Port of New York and New Jersey would result from proposed Project decommissioning activities. The Port of New York and New Jersey would not experience direct impacts from decommissioning of the proposed Project.

Cruise Ships and Passenger Ferries

Decommissioning of the offshore components of the proposed Project would cause a similar but less intensive increase in vessel traffic in the proposed Project area. This short-term and minor vessel increase would not impact cruise ships and passenger ferries.

Commercial Fishing

The short-term and minor increase in vessel traffic in the proposed Project area would cause negligible displacement of fishing activities in the proposed Project area.

Military Use

Liberty would engage in consultations with the USCG regarding decommissioning of the proposed Project.

Offshore Sand Borrow and Disposal Areas

Decommissioning of the proposed Project would not impact offshore sand borrow areas due to their distance from the proposed Project facilities.

Submerged Infrastructure

To be consistent with current federal policies to minimize adverse impacts, decommissioning of the proposed Project would involve abandoning the proposed Mainline and pipeline laterals in-place. This would remove the potential for impacts on the submarine cables and the Neptune HVDC transmission cable.

Artificial Reefs

No impacts are anticipated during decommissioning of the proposed Project.

4.7.3 Land Uses

The onshore activities associated with the proposed Project are minimal and limited to construction-related activities, operation of an office facility, storage and loading of supplies, and mooring of a support vessel at a leased boat slip.

4.7.3.1 Impacts of Construction

Onshore facilities to support construction activities include:

- Pipe staging and concrete weight coating (CWC) facility for fabrication and construction of the proposed Port;
- Shore-based office and warehouse space for construction; and
- Support vessel staging area for construction and operation.

As discussed in Section 2.2.1.5, Liberty is currently reviewing two potential locations for the pipe staging and CWC facilities at Quonset Point in North Kingstown, Rhode Island and Port of Coeymans in Coeymans, New York to meet the site selection criteria. No significant modifications of either site are anticipated to accommodate construction activities; therefore, impacts would be expected to be short-term and minor. Any required upgrades, such as site reinforcement or foundations, would occur on previously disturbed lands.

Quonset Point has been used as a pipe staging and CWC coating facility to support previous offshore pipeline installations, including the Northeast Gateway Deepwater Port Project and the Hubline Pipeline, and has access to Narragansett Bay to accommodate the marine transportation needs of construction activities. Use of this site for the proposed Project is consistent with approved development plans and existing land use for the property and adjacent properties.

The Port of Coeymans has access to the Hudson River and has six potential sites for the required construction activities. All these sites have been heavily mined, filled, and graded due to the property's extensive industrial history. Use of this site for the proposed Project is consistent with the existing industrial uses of the property and adjacent properties, including its open space and barge access for a large prefabrication project for the Willis Avenue Bridge.

Liberty would select existing third-party manufacturing facilities that have sufficient workforces and infrastructure to manufacture the facility components. By selecting appropriate third-party manufacturers, Liberty would avoid potential land use impacts, including increased development and traffic.

4.7.3.2 Impacts of Operation

Onshore facilities to support operation include:

- Shore-based office and warehouse space for operation; and
- Support vessel staging area for operation.

The shore-based office and warehouse space would be leased near the proposed Project area to support operation. The sites would have existing facilities to serve as a construction warehouse and waterfront dock space that meet Project-specific criteria of water depth, crane capacity, and proximity to the worksite. Liberty is considering existing facilities in industrial waterfront locations with similar uses in New York City, Staten Island, and Long Island. No specific locations have been identified at this time. No construction of new facilities would be needed to support proposed Port operations. The use of existing facilities with comparable uses would mitigate land use impacts during operation.

4.7.3.3 Impacts of Decommissioning

Onshore support locations for decommissioning activities would be selected prior to decommissioning of the proposed Project based on factors such as size, proximity to the proposed Project, dock space, water depth, existing land use, and local and regional capabilities. Sites to support decommissioning activities cannot be considered at this time because the potential locations may change during the proposed Project lifespan.

4.7.4 Recreation

The New York and New Jersey coasts are popular destinations for recreational boating and fishing, whale watching and sea life tours, scuba diving, and shoreline activities. Most of these activities occur along the coastline and within 3.0 nautical miles from shore. Overall impacts on recreational resources would be largely avoided due to the location of the proposed Project facilities in relation to the locations that recreational activities occur.

4.7.4.1 Impacts of Construction

Recreational Boating and Fishing

Recreational boating and fishing typically occur in state waters within 3.0 nautical miles of the coastline. Recreational fishing is known to occur in the proposed Project area (NYDOS 2013); however, a relatively small amount of recreational boating and fishing occurs in areas greater than 3.0 nautical miles from the shoreline (NOAA Fisheries 2013b). Shore-side facilities would likely be located in existing industrial and working waterfront areas that are not compatible with recreational resources and facilities. Therefore, short-term, minor, adverse impacts on recreational boating and fishing would result from proposed Project construction activities.

Whale Watching and Sea Life Tours

American Princess Cruises is the only whale watching company that has the potential to cross through the proposed Project area due to its location based out of South Street Seaport in Manhattan (American

Princess Cruises 2013). The proposed Project area is also known to be used for other types of wildlife viewing (NYDOS 2013). These whale watching and sea life tours may experience short-term, minor impacts from increased vessel traffic in the proposed Project area during construction of the proposed Project. Potential impacts resulting from installation of the proposed Mainline and construction vessel transits through the TSS would be expected to be effectively avoided by maintaining safe navigation practices.

Scuba Diving

As discussed in Section 4.7.2.3, the Atlantic Beach Reef and Fishing Line Reef may experience short-term, minor impacts during construction of the proposed Mainline. Potential impacts on shipwrecks are discussed further in Section 4.6.

Shoreline Activities

Physical use of shoreline recreational activities would not be directly affected during construction of the proposed Project. Any impacts would be indirect and minor as a result of visual impacts as described in Section 4.7.5.

4.7.4.2 Impacts of Operation

Recreational Boating and Fishing

Recreational fishing is known to occur in the proposed Project area (NYDOS 2013); however, recreational boating and fishing does not typically occur greater than 3.0 nautical miles from the coastline (NOAA Fisheries 2013b). Impacts on recreational boating and fishing would be avoided during operation due to the distance of the proposed Project from the coastline and the character of existing vessel traffic in the proposed Project area. Therefore, long-term, negligible, adverse impacts on recreational boating and fishing would result from proposed Project operation.

Whale Watching and Sea Life Tours

Operation of the proposed Project would not affect whale watching and sea life tours as tour boat operators would be expected to have the ability to safely navigate around the Safety Zone, NAAs, and the ATBA. Therefore, long-term, negligible, adverse impacts on whale watching and sea life tours would result from proposed Project operation.

Scuba Diving

Operation of the proposed Project would not affect scuba diving because of the distance of dive sites from the proposed Project facilities.

Shoreline Activities

Physical use of shoreline recreational activities would not be directly affected during operation of the proposed Project. Any impacts would be indirect and negligible as a result of visual impacts as described in Section 4.7.5.

4.7.4.3 Impacts of Decommissioning

Recreational Boating and Fishing

Impacts on recreational fishing and boating would be avoided during decommissioning of the proposed Project components because a relatively small amount of recreational boating and fishing occurs in areas greater than 3.0 nautical miles from the shoreline and shoreside facilities would be located in existing industrial and working waterfront areas that are not compatible with recreational activities. Therefore, short-term, minor, adverse impacts on recreational boating and fishing would result from proposed Project decommissioning activities.

Whale Watching and Sea Life Tours

Similar to construction, decommissioning of the offshore components of the proposed Project would cause a minor increase in vessel traffic in the proposed Project area and would not impact whale watching and sea life tours. These whale watching and sea life tours may experience short-term and minor impacts from increased vessel traffic in the proposed Project area during decommissioning activities.

Scuba Diving

No impacts are anticipated during decommissioning of the proposed Project.

Shoreline Activities

Physical use of shoreline recreational activities would not be directly affected during decommissioning of the proposed Project. Any impacts would be indirect and negligible as a result of visual impacts as described in Section 4.7.5.

4.7.5 Visual Resources

Impacts on visual quality depend on the existing visual landscape and viewer groups. Due to the distance for the proposed Project facilities from shore, visibility of proposed Project facilities would be limited to immediate shore points and offshore viewer groups and an existing visual landscape of open ocean with vessels ranging from small non-motorized recreational vessels to large oceangoing vessels. Visual impacts during construction, operation, and decommissioning of the proposed Project would be avoided due to the existing visual character of the proposed Project area.

4.7.5.1 Impacts of Construction

The proposed Mainline would be approximately 1.9 nautical miles from the closest point of land at Atlantic Beach, New York, and the STL Buoy systems would be approximately 16.1 nautical miles from the closest point of land located at Jones Beach, New York. During construction of the proposed Project, vessels supporting construction of the proposed Project would be visible from some locations along the coast of Long Island in the context of the existing oceangoing traffic in the New York Bight and the Ambrose to Nantucket/Hudson Canyon to Ambrose Traffic Lanes. Any impacts would be indirect and negligible as a result of visual impacts.

4.7.5.2 Impacts of Operation

The proposed Mainline and pipeline laterals would not be visible during operation of the proposed Project, because they would be buried below the seafloor and the two STL Buoys would be lowered to a landing pad on the seafloor when not in use. The only visible component of the proposed Project would be the LNGRVs when they deliver LNG at the STL Buoys. Visibility of the LNGRVs would be limited to 21.7 nautical miles because, beyond this distance, the visible components of the proposed Project would fall below the optical horizon line when viewed from ground level. Meteorological conditions in the proposed Project area limit views to less than 10 nautical miles, approximately 48 percent of the year and approximately 60 percent during summer months. The LNGRVs would be at least 16.1 nautical miles from the coastline while offloading LNG and would be difficult to distinguish along the horizon, or, when visible on clear days, would appear as small, two-dimensional rectilinear forms on the horizon. Visual simulations are available in Appendix G as part of the Visual Impact Assessment prepared by Saratoga Associates (Saratoga Associates 2012). The LNGRVs would be visible only from locations on the coastline; public views from points further than the immediate shoreline are mostly screened by dunes, coastal vegetation and the built environment. Any impacts would be indirect and negligible as a result of visual impacts.

Open views of the LNGRVs would be available to the mariners who are on water near the proposed Project. However, oceangoing and commercial vessels are common in the open waters of the New York

Bight and mariners are accustomed to their presence. Additionally, the LNGRVs would be beyond the existing oceangoing ship traffic using the Nantucket to Ambrose/Ambrose to Nantucket Traffic Lanes.

4.7.5.3 Impacts of Decommissioning

Similar to construction, decommissioning of the offshore components of the proposed Project would cause a similar but less intensive increase in vessel traffic in the proposed Project area. Any impacts would be indirect and negligible as a result of visual impacts.

4.7.6 Impacts of Alternatives

4.7.6.1 Ocean Use

As discussed in Section 2.2.13, Study Areas C and D have potential conflicts with existing ocean uses. Study Area C is located within a potential wind farm area and Study Area D is located within a Restricted/Prohibited Airspace (Military Operations) area. The proposed Port locations in Study Areas B and D would have similar impacts on commercial shipping, cruise ship and passenger ferry transits, submerged infrastructure, and artificial reefs as the proposed Mainline route. The Port locations in Study Areas B and D would require a Mainline route that would cross either the fishing ground known as the "Mud Hole" (Study Area B) or the fishing ground known as the "Yankee Spot" (Study Area D). Study Area D would require crossing at least one TSS by LNGRVs calling on the Port.

Mainline routes C-1 and C-2 would have similar impacts because they both cross the Nantucket to Ambrose/Ambrose to Nantucket Traffic Lanes and the separation zone. Crossing of the traffic lane would result in short-term impacts during construction of the proposed Project from increased vessel traffic within the TSS, but not significantly over the current number of vessels operating in the New York Bight. Potential impacts on the use of the TSS would be expected to be effectively avoided by maintaining safe navigation practices. Liberty would take the necessary precautions to mitigate any potential impacts through measures described in Section 4.7.7.

Because impact piling was assessed to have the highest potential for sound generation (over the widest area) associated with the proposed Project, the decision was made that the anchors would be installed at the proposed Project using suction anchors. If necessary, driven piles could be used as an alternative to the suction anchors in the unlikely event geotechnical conditions preclude use of suction anchors. Several different anchor alternatives have been considered for the proposed Project, including suction anchors, driven piles, fluke anchors, gravity-based anchors, and grouted pile anchors. Since all vessel activities unrelated to the proposed Port would be prohibited within the Safety Zone, impacts on ocean uses would not be materially different between proposed anchoring alternatives; however, installation of the gravity-based anchor would result in greater impacts on ocean uses, recreation, and visual resources due to the increased number of required vessel transits during construction.

4.7.6.2 Land Use

Onshore facilities proposed as part of this proposed Project, including the pipe staging and CWC facility, shore-based office and warehouse space for construction and operation, and support vessel staging area, would be evaluated after Liberty identifies the preferred and alternative locations for these facilities. Impacts on land use would be minimized by selecting locations that are capable of supporting the construction and operation activities with the appropriate size, location, accessibility, infrastructure, and availability.

4.7.6.3 Recreation Resources

As discussed in Section 4.7.6.1, the alternative Port locations in Study Areas B and D would have greater direct impacts on recreational resources than the proposed Project location because of their proximity to popular fishing grounds. With the exception of these sport fishing areas, the proposed and alternative

Project locations would have comparable impacts on other recreational activities, including whale watching and sea life tours, scuba diving, and shoreline activities.

The site in Study Area D would be located approximately 12.2 nautical miles from the coastline of Long Island, while the proposed Port site in Study Area C would be located approximately 16.1 nautical miles from the coastline. By locating the visible components of the proposed Project at the Alternative Project location (Study Area D), the proposed Project would have greater impacts on visual resources and therefore indirect impacts on recreation.

4.7.6.4 Visual Resources

As discussed in Section 4.7.6.3, the alternative Port site in Study Area D would have greater direct impacts on visual resources than the proposed Port site in Study Area C, because it is approximately 4.3 nautical miles closer to the shoreline of New York than the proposed Project location. The proposed Port location in Study Area C is 16.1 nautical miles from the coastline and would have negligible visual impacts, particularly in the context of the existing traffic lanes used by oceangoing and commercial vessels, including 5,529,909 20-foot equivalent units (TEUs) that were loaded and unloaded at the Port of New York and New Jersey in 2012 (PANYNJ 2013b).

To the degree that construction vessels required for installation of the proposed Mainline are visible from the coastline, Mainline routes C-1 and C-2 would have similar impacts on visual resources during construction because they are both located similar distances to the Long Island coastline. The proposed Mainline would not have impacts on visual resources during operation.

4.7.7 Mitigations and Monitoring

4.7.7.1 Ocean Use

The proposed Mainline would cross the Nantucket to Ambrose inward bound lane and the Ambrose to Nantucket outbound lane from MP 4.07 to MP 13.65 for a distance of 8.3 nautical miles, including the traffic separation zone. During construction and decommissioning of the proposed Project, the USCG would issue Local Notices to Mariners (LNMs) to communicate the proposed Project activities with the public and commercial vessel operators on a regular basis. Additionally, Marine Safety Information Broadcasts (MSIBs) would be issued whenever Port-related activities (e.g., construction, marine mammal monitoring or general proposed Port operations) would occur. The proposed Mainline would be buried below the seafloor and would not have impacts during operation of the proposed Project.

Liberty would design cable crossings to avoid impacts on the Neptune HVDC transmission cable that connects Sayreville, New Jersey to Nassau County, New York. If necessary, Liberty would negotiate crossing agreements with cable owner-operators prior to construction.

The Safety Zone, NAAs, and the ATBA, described in Section 2.1.15, would restrict non-Project related vessels. Vessels would be precluded from transiting through the Safety Zone.

4.7.7.2 Land Use

Mitigation measures that may be required for onshore facilities would be evaluated during the NEPA process following selection of their locations. Liberty has indicated that the selected locations would be capable of supporting the construction and operation activities with the appropriate size, location, accessibility, infrastructure, and availability.

4.7.7.3 Recreation Resources

The issuance of LNMs are recommended for construction of the proposed Project and would be available to recreational fishermen and whale watching and sea life tour operators to mitigate potential impacts from increased vessel traffic in the ROI. Additionally, MSIBs would be issued whenever Port-related

activities (e.g., construction, marine mammal monitoring or general proposed Port operations) would occur. Due to the distance of the proposed Project from the New York and New Jersey coastlines and locations of interest for scuba diving, impacts on these recreational resources would not be anticipated during construction and operation of the proposed Project and mitigation measures would not be required.

The Safety Zone, NAAs, and the ATBA, described in Section 2.1.15, would restrict non-Project related vessels. Vessels would be precluded from transiting through the Safety Zone.

4.7.7.4 Visual Resources

Due to the distance of the proposed Project from the New Jersey and New York coastlines and the presence of commercial and oceangoing vessels in the ROI, impacts on visual resources would be negligible during construction, operation, and decommissioning of the proposed Project and mitigation measures would not be required.

4.8 Socioeconomics

4.8.1 Introduction

This section addresses potential impacts on socioeconomics associated with the proposed Project and alternatives, including the No Action Alternative. The socioeconomic resources potentially affected by the proposed Project are discussed in Section 3.8 and include offshore and onshore economic conditions such as commercial and recreational fisheries, marine-based tourism and recreation, marine commerce, OCS resources, populations and demographics, housing, employment and income, and recreation and tourism.

Construction of the proposed Project would result in short-term, localized, adverse, and reversible impacts to offshore economic conditions; however, impacts on onshore economic conditions would be short-term, moderate, and beneficial. Operation of the proposed Project would result in negligible, long-term, adverse impacts on offshore economic conditions; however, impacts on onshore economic conditions would be long-term, minor and beneficial. Decommissioning of the proposed Project would produce similar disturbance impacts as previously described for construction activities with adverse impacts on offshore economics conditions and beneficial impacts on onshore economic conditions.

4.8.2 Offshore Economic Conditions

During construction, operation, and decommissioning, potential impacts on offshore economic conditions would result from seafloor disturbance activities, noise, the exclusion zone, and the Safety Zone, which would temporarily impact commercial and recreational fisheries, marine-based tourism and recreation, marine commerce and shipping, and OCS resources.

4.8.2.1 Impacts of Construction

Construction of the proposed Project would disturb approximately 250 acres of seafloor as discussed in Section 4.2.2.1. Generally, these impacts would be short-term, localized, and minor with marine species returning to the area shortly after construction. No significant disturbances from construction/installation would be expected to extend beyond the permanent footprint of the proposed Port facilities and the area encompassing the cable sweep of the STL Buoy anchor chains.

Commercial Fisheries

Impacts on commercial fishing from the proposed Mainline and Port facilities construction would be short-term, minor, direct, and adverse. Disturbance of the seafloor and creation of noise from proposed Mainline trenching and installation and placement of the STL Buoys would result in short-term displacement of fish, followed by rapid recolonization. Most commercial fish species would avoid the construction areas; however, relocation of species would be reversible.

Liberty does not anticipate being in any one area for more than 60 days as construction progresses along the proposed Mainline route; however, access to certain fishing grounds would be temporarily affected by construction of the proposed Mainline and Port facilities. Commercial and recreational vessels, including those engaged in commercial fishing, would be temporarily excluded from the vicinity of construction activities, potentially resulting in minor space-use conflicts. Adverse impacts would be localized to the immediate surrounding area and would be short-term in nature.

Recreational Fisheries

A majority of recreational fishing is done nearshore, where the installation of the proposed Mainline would have a minimal impact. Impacts on recreational fisheries performed farther offshore would be similar to impacts on commercial fisheries. Impacts include short-term displacement of fish due to seafloor and noise disturbance in the work area during construction. Recreational fishing opportunities are not concentrated in the vicinity of the proposed Project, and as construction activities would progress along the proposed Mainline route, any impacts would be localized, short-term, and minor.

Marine-Based Tourism and Recreation

Increased vessel traffic traversing to and from the proposed Project during construction would result in short-term, minor, direct, and adverse impacts on marine-based tourism and recreation, including boating, scuba diving, and wildlife watching.

Limited access to the Atlantic Beach Reef, located approximately 0.6 nautical mile west of the proposed Mainline route, and the Fishing Line Reef, located approximately 2.0 nautical miles east of the proposed Mainline, would result in short-term, minor, direct, and adverse impacts on scuba divers who dive at these artificial reefs. This may result in increased use of other dive sites during the construction of the proposed Mainline and Port facilities.

Short-term, minor, direct, and adverse impacts on wildlife watching operations also would result from short-term exclusion from the work area, as well as the displacement of certain species. Based on the nine-month construction timeline, there is a potential conflict with the principal wildlife watching seasons for whales and seals. However, with adequate notification of the location and status of construction activities, wildlife watching vessel operators would be able to transit around the construction areas and would experience only minor and short-term delays.

Aesthetic impacts on cruises ships, nearshore hotels, and other marine-based tourism and recreation due to construction would be short-term and minor (see Section 4.7.5). Increased demand for hotel rooms by construction workers is not expected due to the housing of all workers on construction vessels and barges. Cruise ships and visitors at nearshore hotels and other marine-based tourism and recreation areas would view ordinary ship traffic to and from the proposed Project and New York and New Jersey during construction (see Section 4.9.3).

Marine Commerce and Shipping

Impacts on marine commerce and shipping would be short-term, minor, direct, and adverse. Proposed Mainline and Port facilities construction within the outbound Ambrose to Nantucket Shipping Lane and the inbound Nantucket to Ambrose Shipping Lane would result in other vessel traffic avoiding the construction spread; however, the shipping lanes would not be entirely blocked or closed to traffic at any point during construction. See Section 4.9.3 for further information on impacts on commercial shipping traffic and existing shipping lanes in the proposed Project area.

OCS Resources

The proposed Project would be located on the OCS in currently unleased blocks. Although the proposed Mainline runs parallel to a sand borrow area from MP 16.5 to MP 19.3, approximately 0.6 nautical mile

from the proposed Mainline, construction of the proposed Project would not impact the current use of source dredge material within the New York Bight.

The proposed Project would be located within some of the lease blocks that have been identified as an area of interest for the Long Island–New York City Offshore Wind Collaborative. In September 2011, the collaborative submitted a lease application with the BOEM for a proposed wind farm area, 127 square miles in size.

Additional impacts on potential impacts on OCS mineral resources are discussed in Section 4.5.

4.8.2.2 Impacts of Operation

Operation activities would be limited to movement of the mooring lines and anchor chain sweep and the approximately 3.2 acres of seafloor required for the PLEMs, STL Buoy landing pads and anchoring system. Long-term, negligible, adverse impacts on fisheries would occur as a result of turbidity increases associated with operation of the proposed Project as described in Section 4.8.2.1.

LNGRVs calling on the proposed Project would be connected to the STL Buoy system and therefore would not create direct impacts on the seafloor. However, as the LNGRVs drift with the prevailing winds and currents, tension on the STL Buoy mooring system would cause the anchor chains to sweep along the seafloor, scouring the bottom and creating small, localized turbidity plumes. Fish in the area affected by the anchor chain sweep would likely temporarily leave this area.

The area in the vicinity of the proposed Mainline route would be available for transit and fishing, outside of the Safety Zone, NAAs, and the ATBA during operation. Therefore, operational activities along the proposed Mainline would not impact offshore economic conditions.

Maintenance and repair activities, including planned and unplanned activities, would have similar impacts as those expected during construction of the proposed Project as described in Section 4.8.2.1. Minor repairs are typically shorter in duration and could include replacing faulty pressure transducers, or repairing a stuck valve. These kinds of repairs would require one diver support vessel with three or four anchors to hold its position. Minor repairs could take from a few days to several weeks depending on the nature of the problem. Major repairs, on the other hand, are longer in duration and typically require large construction vessels similar to those used to install the proposed Mainline and set the buoy and anchoring system. These vessels would typically mobilize from local ports, Canada, or the Gulf of Mexico. Major repairs typically require upfront planning, equipment procurement, and mobilization of vessels and possibly saturation divers. Examples of major repairs are damage to the riser or umbilical line and their possible replacement, damage to the proposed Mainline system and manifolds, or anchor chain replacement. These types of repairs could take up to two to four weeks. Impacts from maintenance and repair activities would be short-term, localized and limited to the associated maintenance and repair period.

Commercial Fisheries

Operational impacts on commercial fishing would be long-term, minor, direct, and adverse. The Safety Zone, NAAs, and the ATBA, described in Section 2.1.15, would restrict non-Project related vessels, including commercial fishing operations. Impacts due to turbidity increases, noise, and direct loses from ballast water intake also would be long-term, minor, direct, and adverse. Ballast water taken as the LNGRVs unload the LNG into the proposed Mainline system would be re-circulated for use in cooling the LNGRVs' engines and for other cooling and auxiliary purposes. Cooling water discharges could occur during the commissioning period and would be discharged through an outlet pipe located on the bottom of the LNGRV. (See Sections 4.1.2 and 4.2.3 for a discussion of the impact of water intake and discharge on fisheries resources, and Section 4.11 for a discussion of acoustic impacts.) No major reduction in populations of the commercial and recreationally important species available to the fishing industries is

anticipated. Therefore, secondary economic impacts, such as reduced employment in fishing or fishing-related industries, are also not anticipated.

Long-term, minor, indirect, beneficial impacts on fisheries would occur from induced conservation associated with excluded fishing in the Safety Zone. As discussed in Section 3.8.1.1, the number of commercial fishing trips that occur in Blocks 44 and 45 is a small percentage of the total number of commercial fishing trips that occur in Area 612.

The area in the vicinity of the proposed Mainline route would be available for transit and fishing, outside of the Safety Zone, NAAs, and the ATBA during operation. Therefore, operational activities along the proposed Mainline would not impact commercial fishing.

Recreational Fisheries

Impacts on recreational fishing due to operation of the proposed Project would be similar to those for commercial fishing and are related to exclusion of vessels due to the Safety Zone, NAAs, and the ATBA, which could limit access to certain fishing grounds. Impacts on recreational fishing would be long-term and minimal. Furthermore, recreational fishers are unlikely to fish in close proximity to the proposed Port site due to the lack of relief or structure on the ocean bottom in this area.

Marine-Based Tourism and Recreation

Impacts on marine-based tourism and recreation during operation of the proposed Project would be similar to those for commercial fishing (long-term, minor, direct, and adverse) and are related to exclusion of vessels due to the Safety Zone, NAAs, and the ATBA. There would be no impacts along the proposed Mainline during operation.

Marine Commerce and Shipping

Impacts on marine commerce and shipping during operation of the proposed Project would be similar to those for commercial fishing (long-term, minor, direct, and adverse) and are related to exclusion of vessels due to the Safety Zone, NAAs, and the ATBA. Outside of the exclusion zone and Safety Zone, there would be no impacts along the proposed Mainline during operation.

OCS Resources

The proposed Project would be located on the OCS in currently unleased blocks. Although the proposed Mainline runs parallel to a sand borrow area from MP 16.5 to MP 19.3, approximately 0.6 nautical mile from the proposed Mainline, operation and maintenance of the proposed Project would not impact the current use of source dredge material within the New York Bight.

The proposed Project would be located within some of the lease blocks that have been identified as an area of interest for the Long Island–New York City Offshore Wind Collaborative. In September 2011, the collaborative submitted a lease application with the BOEM for a proposed wind farm area, 127 square miles in size.

Additional impacts on potential impacts on OCS mineral resources are discussed in Section 4.5.

4.8.2.3 Impacts of Decommissioning

Decommissioning activities would produce similar disturbance impacts as previously described for construction activities in Section 4.2.4.3, but to a lesser degree, because the proposed Mainline and pipeline laterals would be abandoned in-place to be consistent with current federal policies to minimize adverse impacts. Decommissioning activities would result in similar localized, temporary disturbance of sediments and potential turbidity increases where installed mooring components would be removed from the bottom and during recovery of proposed Port facility structures. Anchor piles would be backed out by pumping seawater into the pile and recovering it for onshore recycling/disposal. Alternatively, the pile

could be cut below the mudline should conditions warrant, resulting in a long-term impact as there would be a permanent removal of benthic habitat.

Short-term, minor, adverse impacts on offshore economic resources would result from intake and discharge from vessels used during decommissioning, as well as from noise generated by decommissioning activities. Decommissioning activities would occur in the proposed Port area only; therefore, the extent of the impacts would be over a much smaller area than that associated with original construction. A more detailed discussion of underwater noise associated with decommissioning of the proposed Project is provided in Section 4.11.

Short-term, minor, adverse impacts on offshore economic resources would result from increased vessel traffic and exclusion of vessels due to the Safety Zone, NAAs, and the ATBA. These impacts would be similar to those described for activities associated with construction of the proposed Project, as described in Section 4.8.2.1, but to a lesser extent due to the limited area and duration of impact.

As discussed in Section 4.1, the routine vessel discharges during proposed Project operation would not result in direct adverse impacts on fish species, but could degrade water quality with potential indirect adverse short-term impacts on fish species.

Commercial Fisheries

Short-term, minor, adverse impacts on commercial fisheries would occur from decommissioning of the proposed Project. As described in Section 4.8.2.1, decommissioning activities would produce similar disturbance of sediments, turbidity increases, noise and vessel traffic as previously described for construction activities. Because the proposed Mainline and pipeline laterals would be abandoned in-place to be consistent with current federal policies to minimize adverse impacts, impacts would be further localized to the area associated with the removal of the STL Buoy systems. Most commercial fish species would avoid the decommissioning area, but rapid re-colonization would be expected following the completion of activities. Therefore, adverse impacts would be localized, short-term and minor.

Recreational Fisheries

Because a majority of recreational fishing is done nearshore and decommissioning activities would be focused on removal of installed mooring facilities and not the removal of the proposed Mainline or pipeline laterals, impacts on recreational fisheries would be even more minor than those described for commercial fisheries. Impacts include short-term displacement of fish due to seafloor and noise disturbance in the work area during decommissioning. Any impacts would be localized, short-term and minor.

Marine-Based Tourism and Recreation

Short-term, minor, adverse impacts on marine-based tourism and recreation would occur from the decommissioning of the proposed Project. As described in Section 4.8.2.1, decommissioning activities would result in increased vessel traffic and short-term, minor, adverse impacts on wildlife watching as previously described for construction activities. Because the proposed mainline and pipeline laterals would be abandoned in-place to be consistent with current federal policies to minimize adverse impacts, impacts would be further localized to the area associated with the removal of the STL Buoy systems and would not likely extend to the Atlantic Beach Reef and Fishing Line Reef.

Marine Commerce and Shipping

Short-term, minor, adverse impacts on marine commerce and shipping would occur from the decommissioning of the proposed Project. As described in Section 4.8.2.1, decommissioning activities would result in increased vessel traffic and short-term exclusion of vessels due to the Safety Zone, NAAs, and the ATBA. Because the proposed Mainline and pipeline laterals would be abandoned in-place to be

consistent with current federal policies to minimize adverse impacts, impacts would be further localized to the area associated with the removal of the STL Buoy systems. See Section 4.9.3 for further information on impacts on commercial shipping traffic and existing shipping lanes in the ROI.

OCS Resources

The proposed Project would be located on the OCS in currently unleased blocks. Although the proposed Mainline runs parallel to a sand borrow area from MP 16.5 to MP 19.3, approximately 0.6 nautical mile from the proposed Mainline, decommissioning of the proposed Project would not impact the current use of source dredge material within the New York Bight.

The proposed Project would be located within some of the lease blocks that have been identified as an area of interest for the Long Island–New York City Offshore Wind Collaborative. In September 2011, the collaborative submitted a lease application with the BOEM for a proposed wind farm area, 127 square miles in size.

Additional impacts on potential impacts on OCS mineral resources are discussed in Section 4.5.

4.8.3 Onshore Economic Conditions

During construction, operation, and decommissioning, potential impacts on onshore economic conditions would result from purchase of goods and services, increased employment, and generation of income, which would produce short-term, moderate and beneficial impacts.

4.8.3.1 Impacts of Construction

Purchase of goods and services utilized during construction of the proposed Project would produce short-term, moderate, and beneficial impacts. Liberty anticipates that $85.7 million would be spent on regional expenditures for goods and services for construction of the proposed Project. Regional and local materials required for construction of the proposed Project include fuel for construction vessels and barges; equipment and supplies; marine equipment and vessels; and catering services, food, and supplies for personnel living on barges and vessels during construction. Some construction activities would be performed by local entities and with local equipment, including certain aspects of proposed Mainline installation, marine support, and onshore support equipment and services. Liberty would contribute to the regional tax base during construction. Liberty anticipates that local expenditures would be approximately $65.6 million, excluding salary and wages.

Population and Demographics

Impacts on local community services during proposed Project construction would be short-term and negligible. Local community services, such as fire, police, schools, water/electric utilities, and local roadways and traffic would not be impacted by the proposed Project due to the offshore location and small, full-time staff requirements. Impacts on populations and demographics are not anticipated by the proposed Project.

Housing

Impacts on housing during proposed Project construction would be short-term and negligible. Eight non-local workers would require housing for approximately 15 months before, during, and after construction of the proposed Port and Mainline. According to the U.S. Census Bureau, rental vacancy rates of the five-county proposed Project area range from 4.2 percent (Kings County) to 6.0 percent (Suffolk County) (U.S. Census Bureau 2013), which illustrates the availability of temporary housing in the proposed Project area. Therefore, housing these eight workers would not impact the level of temporary housing in the area.

The majority of proposed Mainline and Port installation would be performed by vessels and barges that would house all workers and specialists. Other activities, such as the offshore supply and crew boats, would require approximately 54 workers total, all of whom Liberty anticipates would be local. Therefore, these workers would not require local temporary housing and would not impact temporary housing markets in the area.

Employment and Income

Construction of the proposed Project would result in short-term, moderate, and beneficial impacts on the community. An estimated 685 workers would be required for construction of the proposed Mainline, including supervisors, and skilled and unskilled laborers. These workers would be required to perform further survey activities; perform geotechnical investigations; assembling and lowering the proposed Mainline; plowing; backfilling operations; operate support vessels; and execute dives and dive support activities. The type of jobs includes specialized marine construction personnel, engineers, welders, riggers, galley crew, and tugboat operators. Liberty has agreed to use local labor to the extent possible to support construction of the proposed Project. Liberty anticipates that 65 percent of the workers, approximately 445 personnel, would be needed from the local area to construct the proposed Mainline. Total wages for the 685 workers, 65 percent of whom would be from the local area, is estimated at $24 million. Approximately 55 percent, $13.1 million, would be paid to local construction workers.

In addition to the approximately 685 workers that would be required for installation of the proposed Mainline, an estimated 35 workers would be required at the pipe coating yard and an additional 62 workers would be required for project management, logistics, and specialty services.

A portion of construction activities would require specialized marine crews to operate certain vessels. Liberty has proposed the use of a DPPV for pipelay and pipeline lowering and backfilling, which would be operated by a specialized crew that operates the vessel and a nucleus of senior construction crew members that manage the pipelay operations. A specialized marine crew would be mobilized from Europe to operate a custom plow that would be designed specifically for the proposed Project. Two specialized DP vessels would be mobilized to install the STL Buoys, both of which would require specialized marine and construction crews. These specialized crews would remain on the construction vessel in federal waters. Local or regional contracts would complement these basic teams and provide offshore and onshore support services.

A project management office would be established to manage the construction phase of the proposed Project for a 15-month period, including the approximate nine months during construction and several months prior to and after construction is complete. A total of 97 workers would be required for onshore support, of which 52 could be local. Onshore support positions include logistics staff, inspection staff, specialty services, and support at the fabrication and pipe coating yards and pipe loadout pier. The total wages for onshore workers supporting the offshore construction of the proposed Project would be approximately $18.1 million; local staff wages would be approximately $7.1 million.

Recreation and Tourism

Impacts on recreation and tourism during proposed Project construction would be short-term and negligible. Onshore recreation and tourism would not be impacted by construction of the proposed Project due to the distance from the shore to the proposed Project location. Impacts related to construction activities are limited to viewshed alterations, which are discussed in Section 4.7.5.

4.8.3.2 Impacts of Operation

During operation, there would be long-term, minor, and beneficial impacts due to the lease of certain onshore facilities, including office space, a pier for the dedicated support vessel, and a warehouse. The office lease and additional shore-based office supplies are anticipated to cost $340,000 annually. This lease would be required for the duration of the proposed Project's lifetime. A long-term charter agreement

for the dedicated support vessel, which would provide Class I firefighting capability and support for emergency evacuation of personnel, would have an estimated annual cost of $4.0 million for the vessel charter with crew and fuel. An additional cost of $300,000 is anticipated for the urea and mercaptan, which would be delivered to the LNGRVs at the proposed Port facilities via the dedicated support vessel.

Additional non-labor costs include regulatory fees, yearly inspections, planned maintenance, and insurance, estimated at $1.25 million. An additional $100,000 annually has been included in Liberty's annual operating cost estimate to account for miscellaneous expenses.

Finally, the proposed Project would provide a source of tax revenues for New York State (ICF International 2012).

Overall, these expenditures would result in long-term, minor, and beneficial impacts during the operation of the proposed Project.

Population and Demographics

Impacts on local community services during proposed Project operation would be long-term and negligible. Due to the small number of staff required during operation of the proposed Project, there would be no impacts on populations and demographics.

Housing

Impacts on housing during proposed Project operation would be long-term and negligible. Due to the small number of staff required during operation of the proposed Project and the rental vacancy rates provided in Table 3.8-8 in Section 3.8.2.2, there would be no impacts on housing due to operation of the proposed Project.

Employment and Income

Operation of the proposed Project would result in long-term, minor, and beneficial impacts on the community. Project organization and operation consists of five management personnel who would be located onshore.

Operation of the proposed Project would result in purchase of goods and services from existing local businesses, which would generate long-term, moderate, and beneficial impacts on the community. Examples of these goods and services include leasing of an onshore office space, a pier for the dedicated support vessel, a warehouse for logistics and administration, and a staging area; and purchase of equipment and supplies required for planned maintenance.

Recreation and Tourism

Impacts on recreation and tourism during proposed Project operation would be long-term and negligible. Onshore recreation and tourism would not be impacted by operation of the proposed Project due to the distance from the shore to the proposed Project location. Impacts related to construction activities are limited to viewshed alterations, which are discussed in Section 4.7.5.

Planned and Unplanned Maintenance and Repair

Maintenance and repair activities, including planned and unplanned activities, would have similar impacts as those expected during construction of the proposed Project. There would be short-term, minor, and beneficial impacts due to the employment of additional staff, rental of equipment, and purchase of materials for maintenance and repair.

4.8.3.3 Impacts of Decommissioning

Onshore impacts from decommissioning of the proposed Project would be short-term, minor, and beneficial. Impacts would be similar to those expected during construction of the proposed Project, but to

a lesser extent, as the number of workers and amount of equipment and services that would be purchased would be more limited.

Population and Demographics

Impacts on populations and demographics would not be anticipated with decommissioning of the proposed Project.

Housing

Impacts on housing would not be anticipated with decommissioning of the proposed Project.

Employment and Income

Decommissioning of the proposed Project would result in short-term, minor, and beneficial impacts on the community due to employment of workers required on marine vessels and purchase of goods and services in the proposed Project area. Since decommissioning of the proposed Project requires significantly less effort than construction, the impact on employment and income would be expected to be similar, but to a much smaller degree than those associated with construction of the proposed Project.

Recreation and Tourism

Impacts on onshore recreation and tourism would not be anticipated with decommissioning of the proposed Project.

4.8.4 Impacts of Alternatives

A detailed analysis of the Project alternatives is provided in Section 2.2 of this draft EIS; only those factors relating to socioeconomic resources will be covered in this section.

4.8.4.1 Commercial Fisheries

A Mainline route to Study Area B would require crossing of a popular commercial fishing ground referred to as the “Mud Hole”. A Mainline route to Study Area D would be nearly twice as long and would require crossing of a designated fishing ground known locally as the “Yankee Spot.” Therefore, impacts on commercial fisheries could be increased if either of these Port locations were selected.

Mainline routes C-1 and C-2 would have similar impacts on commercial fisheries because they are located in the same general vicinity. Mainline Route C-2 is approximately 2.6 nautical miles longer than Mainline Route C-1, which could result in additional seabed impacts. Mainline Route C-2 is also located closer to the Cholera Bank designated fishing grounds.

Because impact piling was assessed to have the highest potential for sound generation (over the widest area) associated with the proposed Project, the decision was made that the anchors would be installed at the Project using suction anchors. If necessary, driven piles could be used as an alternative to the suction anchors in the unlikely event geotechnical conditions preclude use of suction anchors. Several different anchor alternatives have been considered for the proposed Project, including suction anchors, driven piles, fluke anchors, gravity-based anchors, and grouted pile anchors. It is anticipated that driven piles would have the smallest footprint. Installation of a gravity-based anchor system would generally result in a greater disturbance of the sea bottom and more overall loss of benthic habitat than other types of anchors, which could impact commercial fisheries. The fluke anchor system would likely have the next greatest impact due to "setting" the anchor by pulling it into the seafloor. The driven pile and grouted pile anchor designs present a relatively smaller seafloor footprint and, therefore, would potentially result in significantly less of an effect to commercial fisheries. These impacts would only occur throughout the duration of installation, and the risk of these potential impacts must also be balanced against the effectiveness and reliability of the anchoring system.

4.8.4.2 Recreational Fisheries

Impacts of alternatives on recreational fisheries are similar to impacts of alternatives on commercial fisheries discussed in Section 4.8.4.1.

4.8.4.3 Marine-Based Tourism and Recreation

As stated in Section 4.8.4.1, Mainline routes C-1 and C-2 are located in the same general vicinity; therefore, both Mainline routes would likely have similar impacts on marine-based tourism and recreation opportunities, such as sailing and power boating; however Mainline routes to Study Areas B and D would result in greater impacts to marine-based tourism and recreation related to fishing.

4.8.4.4 Marine Commerce and Shipping

Impacts of construction on marine commerce and shipping are similar for Mainline Route C-1 and Mainline Route C-2 as they are located in the same general vicinity. The Port location in Study Area D would result in impacts exclusively to the Nantucket to Ambrose Shipping Lane, whereas the Port location in Study Area C would result in impacts on the Ambrose to Nantucket Shipping Lane. The proposed Port location in Study Area D would require the LNGRVs to cross the incoming vessel traffic lane when departing the proposed Port facilities, whereas the proposed Port location in Study Area C would not require LNGRVs to cross the vessel traffic lane. Both locations avoid Precautionary and Anchorage Areas.

4.8.4.5 OCS Resources

Mainline Routes C-1 would be located within some of the OCS lease blocks that have been identified as an area of interest for the Long Island–New York City Offshore Wind Collaborative.

4.8.4.6 Onshore Economic Conditions

Mainline routes C-1 and C-2 are located in the same general vicinity; therefore, both Mainline routes are expected to have similar economic benefits in terms of the purchase of goods and services during construction and generation of employment and income in the local community.

4.8.5 Mitigations and Monitoring

4.8.5.1 Offshore Economic Conditions

Mitigation measures that would be implemented to reduce the risk of impingement and entrainment of fish during water intake during commissioning and operation of the proposed Project, and minimize turbidity and seafloor disturbance during construction of the proposed Project, are discussed in Section 4.2.8.

As discussed in Section 4.7.7.1, Liberty would issue LNMs to the USCG to communicate proposed Project activities with the public and commercial vessel operators on a regular basis. Additionally, MSIBs would be issued whenever Port-related activities (e.g., construction, marine mammal monitoring or general proposed Port operations) would occur. Issuance of LNMs, which would be available to the public, would mitigate potential impacts from increased vessel traffic on commercial and recreational fisheries, marine-based tourism and recreation, marine commerce and shipping, and OCS resources. The proposed Mainline would be buried below the seafloor and would not have impacts during the operation of the proposed Project; however, the Safety Zone, NAAs, and the ATBA around the STL Buoys would preclude vessels from transiting through the Safety Zone and the ATBA and from fishing or anchoring in the NAAs.

Although the proposed Project is located within lease blocks that have been identified as an area of interest for the Long Island–New York City Offshore Wind Collaborative, careful siting would avoid potential impacts.

4.8.5.2 Onshore Economic Conditions

As impacts on population and demographics, housing, and recreation and tourism are not expected from the construction and operation of the proposed Project, mitigation measures are not required. Impacts on employment and income would be short-term, moderate, and beneficial; therefore, mitigation measures are also not required.

4.9 Transportation

4.9.1 Introduction

This section addresses potential impacts on transportation associated with the proposed Project and alternatives, including the No Action Alternative. As discussed in Section 3.10, the New York and New Jersey region has the greatest population of any region in the United States and has the regional transportation network to support its transit needs. The region is also home to the Port of New York and New Jersey, which is the largest port on the East Coast and the third largest port in the United States.

Construction and decommissioning of the proposed Project would result in minor, short-term disturbances to both the regional transportation network and navigation through the open waters off the coasts of New York and New Jersey. No long-term impacts are anticipated to occur to onshore or offshore transportation during operation and maintenance of the proposed Project.

4.9.2 Onshore Transportation

The onshore regional transportation network in New York City and northern New Jersey experiences high levels of traffic volume and is managed by the Port Authority of New York and New Jersey (PANYNJ). Potential impacts on onshore transportation would be concentrated to material delivery and workforce trips during construction and, to a lesser degree, decommissioning. Impacts during operation of the proposed Project would be minor and negligible due to the offshore nature of the proposed Project and associated operational activities.

4.9.2.1 Impacts of Construction

Impacts to onshore transportation during construction would be short-term and minor. Construction of the proposed Project would result in a slight increase in traffic resulting from the local workforce travelling to the onshore facilities (see Section 3.8 for more information on the required local workforce). The increase in traffic from the local workforce would likely be negligible in the context of the levels of traffic experienced by the existing transportation network in Long Island, New York City and northern New Jersey, as long as the onshore facilities are in locations with the appropriate size, location, accessibility, infrastructure, and availability.

Existing third-party facilities selected by Liberty would manufacture the facility components. Large project components and equipment would likely be brought to the proposed Project site via barges from ports outside of the local area. In the event that large project components and equipment are trucked to the Port of New York and New Jersey via the local transportation system, the activity would be overseen by the PANYNJ, if necessary, and minor, short-term impacts and disruptions to normal traffic may occur. Overall, the local transportation network has sufficient capacity to accommodate the anticipated vehicle traffic associated by the proposed Project construction, as movements of industrial and construction equipment are a regular occurrence in the PANYNJ transportation network.

4.9.2.2 Impacts of Operation

The onshore transportation network would not experience impacts during operation of the proposed Project. Delivery vehicles serving supply vessels and local workforce travelling to the shore-based office and warehouse space required for operation and maintenance of the proposed Project would likely be the

only onshore vehicle traffic associated with the proposed Project. The number of vehicle trips required for operation and maintenance of the proposed Project would be short-term and negligible in the context of the levels of traffic experienced by the existing transportation network in Long Island, New York City and northern New Jersey.

4.9.2.3 Impacts of Decommissioning

Decommissioning of the proposed Project would have similar but less intensive impacts as that of construction.

4.9.3 Offshore Transportation

Offshore transportation in and around the proposed Project area consists of commercial and recreational boating traffic, commercial shipping traffic, and a TSS. Proposed Project activities would increase vessel traffic in the New York Bight throughout the proposed Project lifespan. However, this increase would be minor in the context of existing vessel traffic. Potential impacts resulting from increased vessel traffic are expected to be effectively avoided by maintaining safe navigation practices established through the 1972 International Rules of the Road (72 COLREGS).

4.9.3.1 Impacts of Construction

Impacts on offshore transportation from proposed Project construction would be short-term, minor and adverse. Commercial and recreational vessels would be excluded from the construction area during the construction phase of the proposed Project. Construction of the proposed Project would increase vessel traffic within the ROI, but not significantly over the current number of vessels operating in the ROI. Vessels involved with construction of the proposed Project, which would include derrick barges, support tugs, diver-support vessels, supply vessels, and crew/survey vessels, would generally operate at slow speeds relative to other vessel traffic in the proposed Project area. Potential impacts resulting from installation of the proposed Mainline and construction vessel transits through the TSSs are expected to be effectively avoided by maintaining safe navigation practices established through the 1972 International Rules of the Road (72 COLREGS).

4.9.3.2 Impacts of Operation

Impacts on offshore transportation from proposed Project operation would be short-term, minor and adverse. Operational impacts on offshore transportation would be long-term, minor, direct, and adverse. The Safety Zone, NAAs, and the ATBA, described in Section 2.1.15, would restrict non-Project related vessels. During operation, vessels would be precluded from transiting through the Safety Zone. Surrounding these areas, the proposed Project would not impact offshore transportation. To deliver LNG to the proposed Project, the LNGRV would travel through open waters at a speed of approximately 20 knots via the inbound Hudson Canyon to the Ambrose Traffic Lane and would approach the STL Buoys at approximately 3 knots within the Safety Zone surrounding the buoys. The LNGRVs would depart via the outbound Ambrose to Nantucket Traffic Lane. Potential impacts on the use of the TSS are expected to be effectively avoided by maintaining safe navigation practices and not interfering with existing vessel traffic patterns. The STL Buoys are expected to receive 45 deliveries of LNG each year. Maintenance and repair activities would require the deployment of a diver-support vessel for minor repairs or vessels similar to those used for construction for major repairs. Planned and unplanned maintenance and repair activities would cause a short-term and negligible increase of vessel traffic in the ROI, similar to traffic described for construction.

4.9.3.3 Impacts of Decommissioning

Decommissioning of the offshore components of the proposed Project would involve abandoning or removing the proposed Port facilities and abandoning the proposed Mainline and pipeline laterals in-place

to be consistent with current federal policies to minimize adverse impacts, and would have similar but less intensive impacts as that of construction.

4.9.4 Impacts of Alternatives

If Liberty chooses appropriate locations for the onshore facilities that are capable of supporting the construction and operation activities with the appropriate size, location, accessibility, infrastructure, and availability, transportation impacts would likely be negligible in the context of the levels of traffic experienced by the existing transportation network in Long Island, New York City and northern New Jersey and the regulations enforced by the PANYNJ. Selection of an alternative for the proposed offshore Project components would not influence onshore traffic.

The Port locations in Study Areas B, C, and D would have similar impacts on commercial and recreational boating, commercial shipping, and existing traffic lanes and navigation. Neither Project alternative would be located in a traffic lane or a location that directly impacts offshore navigation.

Mainline routes C-1 and C-2 would have similar impacts because they both cross the Nantucket to Ambrose/Ambrose to Nantucket Traffic Lanes and the separation zone. Crossing of the traffic lane would result in short-term, minor impacts during construction of the proposed Project from increased vessel traffic within the TSS, but not significantly over the current number of vessels operating in the New York Bight. Potential impacts on the use of the TSS are expected to be effectively avoided by maintaining safe navigation practices and avoiding interference with existing vessel traffic patterns. Liberty should take the necessary precautions to mitigate any potential impacts through measures described in Section 4.7.7.

Because impact piling was assessed to have the highest potential for sound generation (over the widest area) associated with the proposed Project, the decision was made that the anchors would be installed using suction anchors. If necessary, driven piles could be used as an alternative to the suction anchors in the unlikely event geotechnical conditions preclude use of suction anchors. Several different anchor alternatives have been considered for the proposed Project, including suction anchors, driven piles, fluke anchors, gravity-based anchors, and grouted pile anchors. Since all vessel activities unrelated to the proposed Port would be prohibited within the Safety Zone, impacts on ocean uses would not be materially different between proposed anchoring alternatives; however, installation of the gravity-based anchor would result in greater impacts to transportation due to the increased number of required vessel transits during construction.

4.9.5 Mitigations and Monitoring

4.9.5.1 Onshore Transportation

In the event that large project components and equipment are trucked to the proposed onshore Project facilities via the local transportation system, Liberty would consult with the PANYNJ to determine applicable regulations regarding restrictions on hazardous materials, vehicle lengths, widths, heights, and weights and acquire the appropriate permits.

4.9.5.2 Offshore Transportation

The proposed Mainline would cross the Nantucket to Ambrose inward bound lane and the Ambrose to Nantucket outbound lane from MP 4.07 to MP 13.65 for a distance of 8.3 nautical miles, including the traffic separation zone. During construction of the proposed Project, the USCG would issue LNMs to communicate proposed Project activities with the public and commercial vessel operators on a regular basis. Additionally, MSIBs would be issued whenever Port-related activities (e.g., construction, marine mammal monitoring or general proposed Port operations) would occur. The proposed Mainline would be buried below the seafloor and would not have impacts during operation of the proposed Project.

The Safety Zone, NAAs, and the ATBA, described in Section 2.1.15, would restrict non-Project related vessels. Vessels would be precluded from transiting through the Safety Zone.

Liberty would also continue outreach efforts with harbor pilots, commercial shipping organizations, ferry operators, yacht clubs, charter boat and fishermen organizations and recreational boaters to promote communications on the activities associated with construction and operation of the proposed Project.

4.10 Air Quality

4.10.1 Introduction

This section addresses potential impacts on air quality associated with the proposed Project and alternatives, including the No Action Alternative. As discussed in Section 3.11, permitting of deepwater ports under the Deepwater Port Act (DWPA) presumes air quality standards attainment status equivalent to adjacent onshore areas.

Construction of the proposed Project would produce air emissions from engines associated with marine vessels, compressor generators, and cranes, as well as other construction activities including welding. Operation of the proposed Project would produce air emissions from two primary sources, two marine boilers and two dual-fuel generator engines. Combustion sources and storage tanks would also result in air emissions from the LNGRV during operation of the proposed Project. Decommissioning of the proposed Project would result in comparable emissions to those described for the construction process. Construction, operation, and decommissioning of the proposed Project would not cause or contribute to an exceedance of ambient air quality standards.

4.10.2 Impacts of Construction

Construction activities would produce air emissions, predominantly combustion emissions from engines associated with marine vessels, compressors, generators, and cranes. Impacts associated with the proposed Project construction would be expected to be short-term, negligible, and adverse. Other construction activities such as welding would generate minor emissions, but these would be insignificant relative to the combustion emissions. Fugitive particulate matter emissions typically associated with construction projects would not occur since the proposed Project does not have an onshore component and the proposed Mainline would be installed in the seabed.

Construction-related offshore equipment that would generate air emissions include the following:

- Geotechnical coring vessel – including rig, deck crane, generator and compressor engines;
- DP pipelaying vessel – including winch, gantry boom/hoist, deck crane, coating station, generator and compressor engines;
- Pipehaul tug – including main drive and auxiliary generator engines;
- Plowing operations – including gantry boom/hoist, deck crane, anchor and plough winch, generator and compressor engines;
- DP dive support vessel (DSV) operations – including main, generator, and compressor engines;
- Heavy lift vessel – including crane, thruster and propulsion engines;
- Barges and associated tugs – including main drive and auxiliary generator engines; and
- Survey and miscellaneous activity vessels – including main drive and auxiliary generator engines.

Air quality impacts from proposed Port construction are also being evaluated as part of USCG/MARAD's General Conformity Determination. Further details of the conformity analysis are provided in Section 4.10.6.

4.10.2.1 Construction Emissions

Construction emission estimates were based on the expected number of each type of vessel, engines per vessel, duration of use (days and hours/day), load factor (percent of maximum rated capacity) and published emission factors. Construction of the proposed Project would be expected to take 11 months, February through December of 2016. Included as part of construction emissions are emissions from a geotechnical coring vessel, which is scheduled to operate in the spring of 2015. Therefore, construction emissions would be spread over two calendar years. Emissions were estimated for the entirety of the construction period, as well as the maximum amount in any calendar year.

For an individual engine, emissions estimates are based on the engine horsepower, load factor, emission factor, and duration of operation. The durations, horsepower, and load factors provided in the detailed tables in this subsection and the greenhouse gas (GHG) emissions subsection are part of the construction plan and use emissions factors for ocean-going vessels (which are the pipelay vessel and the heavy lift vessel) or for harbor craft (which are all of the other vessels) in “Current Methodologies in Preparing Mobile Source Port-Related Emission Inventories” (ICF 2009).

Annex VI of the MARPOL Protocol, as codified in 40 CFR 1043, limits the sulfur content of fuel to 0.10 percent beginning in calendar year 2016 in Emission Control Areas. Since the proposed Project would be located in the North America Emission Control Area, this sulfur content in marine diesel oil is used as the basis for the upper limit of sulfur dioxide (SO_2) emissions from all vessels.

The 2010 Multi-Facility Emissions Inventory for the Port of New York and New Jersey "2010 Multi-Facility Emissions Inventory” (PANYNJ 2012) provides total 2010 emissions from harbor craft and ocean-going vessel port calls. This document was used to help identify the emission factor category from the ICF International (ICF) document of each proposed Project vessel engine. Category 1 harbor vessel emission factors were used for all engines except the DP pipelay vessel, the plowing vessel, and the heavy lift vessel main engines. Category 2 emission factors were used for the dynamic positioning of the pipelay vessel and the heavy lift vessel main engines. Category 3 emission factors were used for the plowing vessel.

To calculate emissions from construction, the rating of each engine was multiplied by its emission factor, load factor, and total operating time. Emissions from these construction sources are summarized in Table 4.10-1. Detailed emission calculations for criteria pollutant emissions are provided in Table 4.10-2. As shown in the tables, total nitrogen oxide (NO_x) emissions during the construction period would be approximately 480 tons with up to 473 tons occurring within one calendar year. As discussed in Section 4.10.6 on general conformity, a portion of these emissions could require offsets to demonstrate general conformity.

Table 4.10-1. Construction Emissions Summary

Construction Task	NO_X	VOC	CO	SO_2	PM_{10}	$PM_{2.5}$
Geotechnical Coring Vessel	7.55	0.30	5.55		0.34	0.33
Dynamic Positioning Pipelay Vessel	121.86	6.12	64.03		8.72	8.46
Pipehaul Tug	31.67	1.26	23.28		1.45	1.41
Plowing Operations	69.18	2.64	11.90		1.28	1.18
Dive Support Vessel (DSV) and Dynamic Positioning (DP) DSV	73.14	2.90	53.77		3.27	3.17
150-foot Survey Vessel	10.68	0.42	7.85		0.51	0.49
Local Fishing Vessels for support, patrol	21.36	0.85	15.71		1.02	0.99
Dewater/Dry/Precommission Spread	15.31	0.61	11.26		0.69	0.67
Pipeline Installation Totals	**350.75**	**15.10**	**193.35**		**17.28**	**16.70**

Construction Task	NO_X	VOC	CO	SO_2	PM_{10}	$PM_{2.5}$
Hopper Tug	15.96	0.63	11.74		0.72	0.70
DP Jet, Tremmie Vessel, and Survey Vessel	46.29	1.84	34.03		2.05	1.99
Supplemental Lowering and Backfill Totals	**62.25**	**2.47**	**45.77**		**2.77**	**2.69**
Heavy Lift Vessel	40.32	1.72	27.19		2.10	2.04
Assist Installation Vessel/Dive Support Vessel	26.51	1.05	19.49		1.18	1.14
Deepwater Port Installation Totals	**66.83**	**2.77**	**46.68**		**3.28**	**3.18**
Project Total Construction	**480**	**20.3**	**286**	**30.82**	**23.3**	**22.6**
Maximum Calendar Year Emissions a/	473	20.1	281	30.36	23.0	22.2
Ozone Precursor Totals	480	20.3	---	---	---	---
Ozone Significant Emission Rate Threshold	100	50	---	---	---	---
$PM_{2.5}$ Total	480	---	---	31	---	23
$PM_{2.5}$ Significant Emission Rate Threshold	100	---	---	100	---	100
a/ Maximum emissions occur during 2016.						

4.10.3 Impacts of Operation

Emissions generated from proposed Project operations were evaluated based on data provided by Liberty in their Deepwater Port Application and with data contained in their March 2014 Air Permit Application as supplemented on September 12, 2014. Impacts associated with the proposed Project operation would be expected to be long-term, minor and adverse. Based on the Air Permit Application, the USEPA would prepare a permit that details the applicable monitoring, recordkeeping and reporting requirements sufficient to ensure that the requirements of the permit are enforceable. The USEPA would issue a draft permit with all supporting documentation for public review and comment prior to issuance of the final permit.

4.10.3.1 Operation Emissions

LNGRVs would contain two primary sources of air pollutant emissions, two marine boilers to supply heat for regasification of the LNG and two dual-fuel generator engines to supply electrical power to run the LNGRV's internal ship systems and associated LNG regasification equipment. In addition to these sources, a gas combustion unit (GCU) would combust any excess boil-off gas (BOG) while the LNGRV is moored at the proposed Port facilities. Regasified LNG and BOG are both natural gas fuels produced by different processes. The proposed Mainline would not contain any sources of air pollutant emissions during operation.

The only air emission sources on the LNGRV other than the combustion sources would be storage tanks for marine fuel oil, waste oil, overflow, and sludge. Volatile organic compound (VOC) emissions would occur from these tanks when they are being filled (working losses) and during variations in ambient temperatures (breathing losses). The quantity of working and breathing loss storage tank emissions depends largely upon tank throughput and storage material vapor pressure. Since the material throughput to these tanks while at the proposed Port would be virtually zero and the material vapor pressures very low (0.0074 pounds per square inch absolute for distillate fuel oils), VOC emissions from these tanks would be insignificant and are not further accounted for in this document.

The only other emission source associated with the proposed Project operation would be a support vessel, which would operate at the proposed Port and would travel to and from the mainland.

Stationary Source Descriptions

Each LNGRV would be equipped with two Mitsubishi Model MHI MAC-100BF marine boilers, each rated at 321 million British thermal units per hour (MMBtu/hr) while firing natural gas, used for regasification. While at the proposed Port facilities, NO_x emissions from the boilers would be controlled through the use of low-NOx burners and selective catalytic reduction (SCR). Emissions of other pollutants would be limited through firing of LNG and BOG and good combustion practices. The boilers are assumed to operate continuously.

Two Wärtsilä Model 12V50DF generator engines, each rated at 11.0 megawatt hours while firing BOG and LNG, would be used to generate power for regasification, dynamic positioning, propulsion motors, and hoteling. While at the proposed Port facilities, NO_x and emissions from the boilers would be controlled through the use of SCR. Emissions of other pollutants would be limited through firing of LNG and BOG and good combustion practices. The boilers are assumed to operate continuously.

During regasification, a Snecma GCU rated at 208 MMBtu/hr would be used to combust any excess BOG. During regasification, the boilers and engines would be fired with BOG. Excess BOG may be generated for short periods of time during initial arrival at the proposed Port facilities and during periods of no or low gas sendout. LNGRV operations would be managed such that GCU operation would not be required during normal regasification periods but only during LNGRV arrival, no sendout periods, and system upsets.

Stationary Source Emissions

Operation of the boilers, engines, and GCU predominantly result in combustion pollutant emissions, including NO_x, SO_2, carbon monoxide (CO), total suspended particulates (TSP), particulate matter with an aerodynamic diameter less than or equal to 10 microns (PM_{10}), particulate matter with an aerodynamic diameter less than or equal to 2.5 microns ($PM_{2.5}$), ozone (O_3) and VOCs. Additionally, operation of the SCR would result in ammonia (NH_3) emissions due to the injection of a small amount of excess NH_3 to optimize removal of NO_x emissions from the boiler and engines. GHG emissions would also occur and these are addressed in Section 4.10.7. Emissions of other pollutants would also occur, including hazardous air pollutants (HAPs), sulfuric acid mist (H_2SO_4) and lead (Pb), but these emissions would be insignificant as their emissions are extremely low for combustion of LNG and BOG.

Each LNGRV would have three regasification units, each with a capacity of 250 MMscf/d, yielding a total sendout capacity of 750 MMscf/d. However, the peak sendout capacity would be limited by the receiving interconnection pipeline to 660 MMscf/d with the average sendout rate predicted to be 400 MMscf/d.

The two boilers can achieve the peak regasification rate of 660 MMscf/d while operating at 77 percent of their rated capacity. For the predicted average sendout rate of 400 MMscf/d, the boilers would each operate at 47 percent of their rated capacity. Criteria pollutant emissions from the boilers are based upon vendor specified guaranteed emission rates and the guaranteed NO_x emission rate from the SCR vendor.

The two generator engines can achieve the peak regasification rate of 660 MMscf/d while operating at 70 percent of their rated capacity. For the predicted average sendout rate of 400 MMscf/d, one engine would operate at 34 percent load and a second engine at 68 percent load. Criteria pollutant emissions from the engines are based upon vendor specified guaranteed emission rates and the guaranteed NO_x and CO emission rates from the SCR and oxidation catalyst vendors, respectively.

Estimated annual potential emissions are based upon continuous year-round steady state operation of the boilers and engines at the average annual sendout rate. During typical operation of the LNGRVs, the boilers and engines would be in operation prior to docking at the proposed Port facilities and therefore any increase in emissions due to startup and shutdown are not anticipated. Startup and shutdown

emissions may result due to malfunction or as a result of a boiler or engine being shut down during a period of low sendout rates.

In the event of a startup while at the proposed Port facilities, boiler startup would transition to normal operation at 15 percent operating load. Due to the reduced fuel throughput, boiler emissions during a startup period are less than during normal operation, with the exception of NO_x if the SCR is not up to temperature at the time of startup. The engines are started cold on marine diesel oil and switch to LNG or BOG after approximately 10 minutes. It is predicted that any increase in emissions due to startup of the engines on marine diesel oil would be offset by the period of engine shutdown. Due to the associated downtime as a result of a malfunction or shutdown, no increase in annual potential emissions is expected as a result of startup and shutdown of the boilers and engines.

For the purposes of establishing annual potential emissions for the proposed Project, it is presumed that the GCU would not operate during normal operation, including low sendout periods. Operation of the GCU is included in the air quality impact analysis as discussed in Section 4.10.3.2.

Table 4.10-2. Detailed Construction Emissions (Criteria Pollutants)

Task	Equipment Type	Duration (days)	Op. Time (hr/day)	Qty. Vessels	Engines per vessel	Engine Rating (hp)	Load Factor	Exhaust Emission Factors a/					Project Emission Rate b/				
								NOx (g/hp-hr)	VOC (g/hp-hr)	CO (g/hp-hr)	PM_{10} (g/hp-hr)	$PM_{2.5}$ (g/hp-hr)	NOx (tons)	VOC (tons)	CO (tons)	PM_{10} |(tons)	$PM_{2.5}$ (tons)
Pipeline Installation																	
Geotechnical Coring Vessel																	
	Coring Operation	*3/20/2015*	*thru*	*5/9/2015*													
	Generators	51 days	8	1	3	800	100%	5.0708	0.2013	3.7285	0.2237	0.2170	5.47	0.22	4.02	0.24	0.23
	Air Compressor	51 days	12	1	2	180	100%	5.0708	0.2013	3.7285	0.2237	0.2170	1.23	0.05	0.91	0.05	0.05
	Rig	51 days	12	1	2	80	70%	5.0708	0.2013	3.7285	0.2983	0.2893	0.38	0.02	0.28	0.02	0.02
	Crane	51 days	12	1	2	335	20%	5.0708	0.2013	3.7285	0.2237	0.2170	0.46	0.02	0.34	0.02	0.02
													7.55	**0.30**	**5.55**	**0.34**	**0.33**
DP Pipelay Vessel		*03/27/16*	*thru*	*05/13/16*													
	Barge Generators	48 days	12	1	2	1400	0%	5.0708	0.2013	3.7285	0.2237	0.2170	0.00	0.00	0.00	0.00	0.00
	Weld Generators	48 days	16	1	3	550	0%	5.0708	0.2013	3.7285	0.2237	0.2170	0.00	0.00	0.00	0.00	0.00
	Lorelay	48 days	24	1	1	24490	50%	7.3079	0.3728	3.7285	0.5369	0.5208	113.63	5.80	57.98	8.35	8.10
	Anchor winches	48 days	12	1	0	600	50%	5.0708	0.2013	3.7285	0.2237	0.2170	0.00	0.00	0.00	0.00	0.00
	Gantry boom engine	48 days	8	1	0	335	20%	5.0708	0.2013	3.7285	0.2237	0.2170	0.00	0.00	0.00	0.00	0.00
	Gantry hoist engine	48 days	8	1	0	520	20%	5.0708	0.2013	3.7285	0.2237	0.2170	0.00	0.00	0.00	0.00	0.00
	Gantry Swing Engines	48 days	8	1	0	335	20%	5.0708	0.2013	3.7285	0.2237	0.2170	0.00	0.00	0.00	0.00	0.00
	Gantry generator	48 days	8	1	0	260	10%	5.0708	0.2013	3.7285	0.2237	0.2170	0.00	0.00	0.00	0.00	0.00
	Deck Cranes	48 days	12	1	1	335	20%	5.0708	0.2013	3.7285	0.2237	0.2170	0.22	0.01	0.16	0.01	0.01
	Air Compressor	48 days	12	1	2	180	80%	5.0708	0.2013	3.7285	0.2237	0.2170	0.93	0.04	0.68	0.04	0.04
	Line-up Station	48 days	18	1	0	120	90%	5.0708	0.2013	3.7285	0.2237	0.2170	0.00	0.00	0.00	0.00	0.00
	UT Station	48 days	18	1	0	60	80%	5.0708	0.2013	3.7285	0.2983	0.2893	0.00	0.00	0.00	0.00	0.00
	Coating Station	48 days	18	1	0	60	80%	5.0708	0.2013	3.7285	0.2983	0.2893	0.00	0.00	0.00	0.00	0.00
	3600 HP AHT Main engines	48 days	18	2	0	1200	75%	5.0708	0.2013	3.7285	0.2237	0.2170	0.00	0.00	0.00	0.00	0.00
	AHT Generator	48 days	12	2	0	120	70%	5.0708	0.2013	3.7285	0.2237	0.2170	0.00	0.00	0.00	0.00	0.00
	AHT Winch Engine	48 days	8	2	0	120	80%	5.0708	0.2013	3.7285	0.2237	0.2170	0.00	0.00	0.00	0.00	0.00
	135' crew boat main engines	48 days	8	1	4	600	40%	5.0708	0.2013	3.7285	0.2237	0.2170	2.06	0.08	1.52	0.09	0.09
	crew boat generator	48 days	12	1	2	80	70%	5.0708	0.2013	3.7285	0.2983	0.2893	0.36	0.01	0.27	0.02	0.02
	Supply Vessel Main Engines	48 days	12	1	2	1125	50%	5.0708	0.2013	3.7285	0.2237	0.2170	3.62	0.14	2.66	0.16	0.16
	Supply Vessel Generator	48 days	12	1	3	180	60%	5.0708	0.2013	3.7285	0.2237	0.2170	1.04	0.04	0.77	0.05	0.04
													121.86	**6.12**	**64.03**	**8.72**	**8.46**
Pipehaul Tug		03/12/16	thru	05/16/16													
	2400 HP Tug Main Engines	66 days	24	5	2	900	35%	5.0708	0.2013	3.7285	0.2237	0.2170	27.89	1.11	20.51	1.23	1.19
	Tug Generator	66 days	24	5	2	80	50%	5.0708	0.2013	3.7285	0.2983	0.2893	3.54	0.14	2.60	0.21	0.20
	Tug Winch	66 days	2	5	1	80	80%	5.0708	0.2013	3.7285	0.2983	0.2893	0.24	0.01	0.17	0.01	0.01
													31.67	**1.26**	**23.28**	**1.45**	**1.41**

Task	Equipment Type	Duration (days)	Op. Time (hr/day)	Qty. Vessels	Engines per vessel	Engine Rating (hp)	Load Factor	Exhaust Emission Factors a/					Project Emission Rate b/				
								NOx (g/hp-hr)	VOC (g/hp-hr)	CO (g/hp-hr)	PM_{10} (g/hp-hr)	$PM_{2.5}$ (g/hp-hr)	NOx (tons)	VOC (tons)	CO (tons)	PM_{10} |(tons)	$PM_{2.5}$ (tons)
Plowing Operations		*05/13/16*	*thru*	*08/05/16*													
	Barge Generators	58 days	12	1	2	1400	0%	5.0708	0.2013	3.7285	0.2237	0.2170	0.00	0.00	0.00	0.00	0.00
	Maersk Assister - Propulsion Bollard Pull	58 days	24	1	1	6487	61%	9.8432	0.3728	0.8203	0.1417	0.1268	59.77	2.26	4.98	0.86	0.77
	Maersk Assister - Rauma 3-drum waterfall 400 mt cap	58 days	24	1	1	1800	0%	5.0708	0.2013	3.7285	0.2237	0.2170	0.00	0.00	0.00	0.00	0.00
	Anchor winches	58 days	12	1	0	600	50%	5.0708	0.2013	3.7285	0.2237	0.2170	0.00	0.00	0.00	0.00	0.00
	Gantry boom engine	58 days	8	1	0	335	20%	5.0708	0.2013	3.7285	0.2237	0.2170	0.00	0.00	0.00	0.00	0.00
	Gantry hoist engine	58 days	8	1	0	520	20%	5.0708	0.2013	3.7285	0.2237	0.2170	0.00	0.00	0.00	0.00	0.00
	Gantry Swing Engines	58 days	8	1	0	335	20%	5.0708	0.2013	3.7285	0.2237	0.2170	0.00	0.00	0.00	0.00	0.00
	Gantry generator	58 days	8	1	0	260	10%	5.0708	0.2013	3.7285	0.2237	0.2170	0.00	0.00	0.00	0.00	0.00
	Deck Crane	58 days	12	1	0	180	61%	5.0708	0.2013	3.7285	0.2237	0.2170	0.00	0.00	0.00	0.00	0.00
	Plough Winch	58 days	8	2	0	120	80%	5.0708	0.2013	3.7285	0.2237	0.2170	0.00	0.00	0.00	0.00	0.00
	Air Compressor	58 days	12	1	2	180	61%	5.0708	0.2013	3.7285	0.2237	0.2170	0.85	0.03	0.63	0.04	0.04
	3600 HP AHT Main engines	58 days	18	2	0	1200	75%	5.0708	0.2013	3.7285	0.2237	0.2170	0.00	0.00	0.00	0.00	0.00
	AHT Generator	58 days	12	2	0	120	70%	5.0708	0.2013	3.7285	0.2237	0.2170	0.00	0.00	0.00	0.00	0.00
	AHT Winch Engine	58 days	8	2	0	120	80%	5.0708	0.2013	3.7285	0.2237	0.2170	0.00	0.00	0.00	0.00	0.00
	135' crew boat main engines	58 days	8	1	4	600	40%	5.0708	0.2013	3.7285	0.2237	0.2170	2.49	0.10	1.83	0.11	0.11
	Crew boat generator	58 days	12	1	2	80	70%	5.0708	0.2013	3.7285	0.2983	0.2893	0.44	0.02	0.32	0.03	0.02
	Supply Vessel Main Engines	58 days	12	1	2	1,125	50%	5.0708	0.2013	3.7285	0.2237	0.2170	4.38	0.17	3.22	0.19	0.19
	Supply Vessel Generator	58 days	12	1	3	180	60%	5.0708	0.2013	3.7285	0.2237	0.2170	1.26	0.05	0.93	0.06	0.05
													69.18	**2.64**	**11.90**	**1.28**	**1.18**
DPDSV	*Pre-lay investigations*	*03/08/16*	*thru*	*03/23/16*													
	Install crossings	*03/12/16*	*thru*	*04/12/16*													
	Lower plow transitions	*08/13/16*	*thru*	*09/06/16*													
	Tie-in collocated Y assembly	*08/03/16*	*thru*	*08/13/16*													
	System hydrotest, dewater and dry	*09/09/16*	*thru*	*10/13/16*													
	Purge and pack Mainline, laterals and PLEMS	*10/13/16*	*thru*	*10/24/16*													
	Air Compressor	129 days	24	1	2	180	35%	5.0708	0.2013	3.7285	0.2237	0.2170	2.18	0.09	1.60	0.10	0.09
	Dive compressors	129 days	24	1	2	80	35%	5.0708	0.2013	3.7285	0.2983	0.2893	0.97	0.04	0.71	0.06	0.06
	Crane	129 days	24	1	2	335	35%	5.0708	0.2013	3.7285	0.2237	0.2170	4.06	0.16	2.98	0.18	0.17
	Diving equipment	129 days	24	1	1	250	35%	5.0708	0.2013	3.7285	0.2237	0.2170	1.51	0.06	1.11	0.07	0.06
	Main Engines	129 days	24	1	2	3000	35%	5.0708	0.2013	3.7285	0.2237	0.2170	36.34	1.44	26.72	1.60	1.56
	Generator	129 days	24	1	3	250	35%	5.0708	0.2013	3.7285	0.2237	0.2170	4.54	0.18	3.34	0.20	0.19
	Bow Thruster	129 days	24	1	0	950	70%	5.0708	0.2013	3.7285	0.2237	0.2170	0.00	0.00	0.00	0.00	0.00
	Stern Thruster	129 days	24	1	0	950	70%	5.0708	0.2013	3.7285	0.2237	0.2170	0.00	0.00	0.00	0.00	0.00
													49.61	**1.97**	**36.47**	**2.20**	**2.14**

Task	Equipment Type	Duration (days)	Op. Time (hr/day)	Qty. Vessels	Engines per vessel	Engine Rating (hp)	Load Factor	Exhaust Emission Factors a/					Project Emission Rate b/				
								NOx (g/hp-hr)	VOC (g/hp-hr)	CO (g/hp-hr)	PM_{10} (g/hp-hr)	$PM_{2.5}$ (g/hp-hr)	NOx (tons)	VOC (tons)	CO (tons)	PM_{10} |(tons)	$PM_{2.5}$ (tons)
Dive Support Vessel																	
	Install hot taps and SSTI	*02/05/16*		*thru*	*03/13/16*												
	System Hydrotest, Dewater and Dry	*09/09/16*		*thru*	*10/13/16*												
	Purge and pack Mainline, laterals and PLEMS	*10/13/16*		*thru*	*10/24/16*												
	Commissioning support	*10/24/16*		*thru*	*12/03/16*												
	Generators	123 days	24	1	3	800	35%	5.0708	0.2013	3.7285	0.2237	0.2170	13.86	0.55	10.19	0.61	0.59
	Air Compressor	123 days	24	1	2	180	35%	5.0708	0.2013	3.7285	0.2237	0.2170	2.08	0.08	1.53	0.09	0.09
	Dive compressors	123 days	24	1	2	80	35%	5.0708	0.2013	3.7285	0.2983	0.2893	0.92	0.04	0.68	0.05	0.05
	Crane	123 days	24	1	2	335	20%	5.0708	0.2013	3.7285	0.2237	0.2170	2.21	0.09	1.63	0.10	0.09
	Tug Main Engines	123 days	24	1	2	300	35%	5.0708	0.2013	3.7285	0.2237	0.2170	3.47	0.14	2.55	0.15	0.15
	Tug Generator	123 days	24	1	2	60	50%	5.0708	0.2013	3.7285	0.2983	0.2893	0.99	0.04	0.73	0.06	0.06
													23.53	**0.93**	**17.30**	**1.07**	**1.03**
150' Survey Vessel		*03/01/16*		*thru*	*10/31/16*												
	Main Engines	245 days	24	1	2	350	35%	5.0708	0.2013	3.7285	0.2237	0.2170	8.05	0.32	5.92	0.36	0.34
	Generators	245 days	24	1	2	80	50%	5.0708	0.2013	3.7285	0.2983	0.2893	2.63	0.10	1.93	0.15	0.15
													10.68	**0.42**	**7.85**	**0.51**	**0.49**
Local Fishing Vessels for support, patrol and liaison		*03/01/16*		*thru*	*10/31/16*												
	Main Engines	245 days	24	2	2	350	35%	5.0708	0.2013	3.7285	0.2237	0.2170	16.10	0.64	11.84	0.71	0.69
	Generators	245 days	24	2	2	80	50%	5.0708	0.2013	3.7285	0.2983	0.2893	5.26	0.21	3.87	0.31	0.30
													21.36	**0.85**	**15.71**	**1.02**	**0.99**
Dewater/Dry/Precommission Spread		*09/09/16*		*thru*	*12/03/16*												
	Air compressors	86 days	24	1	6	240	50%	5.0708	0.2013	3.7285	0.2237	0.2170	8.31	0.33	6.11	0.37	0.36
	Pumps	86 days	24	1	4	240	50%	5.0708	0.2013	3.7285	0.2237	0.2170	5.54	0.22	4.07	0.24	0.24
	Light plant	86 days	24	2	1	60	50%	5.0708	0.2013	3.7285	0.2983	0.2893	0.69	0.03	0.51	0.04	0.04
	Crane	86 days	24	1	1	335	20%	5.0708	0.2013	3.7285	0.2237	0.2170	0.77	0.03	0.57	0.03	0.03
													15.31	**0.61**	**11.26**	**0.69**	**0.67**
Supplemental Lowering and Imported Backfill Operation																	
Hopper Tug		*08/15/16*		*thru*	*09/05/16*												
	2400 HP Tug Main Engines	22 days	24	4	2	900	70%	5.0708	0.2013	3.7285	0.2237	0.2170	14.87	0.59	10.94	0.66	0.64
	Tug Generator	22 days	24	4	2	80	50%	5.0708	0.2013	3.7285	0.2983	0.2893	0.94	0.04	0.69	0.06	0.05
	Tug Winch	22 days	24	4	1	80	15%	5.0708	0.2013	3.7285	0.2983	0.2893	0.14	0.01	0.10	0.01	0.01
													15.96	**0.63**	**11.74**	**0.72**	**0.70**
DP Jet/Tremie Vessel		07/18/16 thru 09/05/16 14 days at port converting to Tremie															
	Jet Barge Generator	36 days	24	1	1	425	70%	5.0708	0.2013	3.7285	0.2237	0.2170	1.44	0.06	1.06	0.06	0.06
	Jet Barge sled winch	36 days	8	1	1	240	50%	5.0708	0.2013	3.7285	0.2237	0.2170	0.19	0.01	0.14	0.01	0.01
	Crane	36 days	24	1	1	365	70%	5.0708	0.2013	3.7285	0.2237	0.2170	1.23	0.05	0.91	0.05	0.05
	Jet Barge jetting pumps	36 days	22	1	2	1840	75%	5.0708	0.2013	3.7285	0.2237	0.2170	12.22	0.49	8.98	0.54	0.52
	Jet Barge air compressor	36 days	22	1	1	900	75%	5.0708	0.2013	3.7285	0.2237	0.2170	2.99	0.12	2.20	0.13	0.13

Task	Equipment Type	Duration (days)	Op. Time (hr/day)	Qty. Vessels	Engines per vessel	Engine Rating (hp)	Load Factor	Exhaust Emission Factors a/					Project Emission Rate b/				
								NOx (g/hp-hr)	VOC (g/hp-hr)	CO (g/hp-hr)	PM_{10} (g/hp-hr)	$PM_{2.5}$ (g/hp-hr)	NOx (tons)	VOC (tons)	CO (tons)	PM_{10} |(tons)	$PM_{2.5}$ (tons)
	Dive compressors	36 days	12	1	2	80	70%	5.0708	0.2013	3.7285	0.2983	0.2893	0.27	0.01	0.20	0.02	0.02
	Port Bow Thruster	36 days	24	1	1	1950	70%	5.0708	0.2013	3.7285	0.2237	0.2170	6.59	0.26	4.85	0.29	0.28
	Stbd Thruster	36 days	24	1	1	1950	70%	5.0708	0.2013	3.7285	0.2237	0.2170	6.59	0.26	4.85	0.29	0.28
	Port Stern Thruster	36 days	24	1	1	1950	70%	5.0708	0.2013	3.7285	0.2237	0.2170	6.59	0.26	4.85	0.29	0.28
	Stbd Stern Thruster	36 days	24	1	1	1950	70%	5.0708	0.2013	3.7285	0.2237	0.2170	6.59	0.26	4.85	0.29	0.28
													44.71	**1.78**	**32.87**	**1.98**	**1.92**
110' Survey Vessel		8/15/16	thru	09/05/16													
	Main Engines	22 days	24	1	2	350	65%	5.0708	0.2013	3.7285	0.2237	0.2170	1.34	0.05	0.99	0.06	0.06
	Generators	22 days	24	1	2	80	50%	5.0708	0.2013	3.7285	0.2983	0.2893	0.24	0.01	0.17	0.01	0.01
													1.58	**0.06**	**1.16**	**0.07**	**0.07**
DWP Installation per APL Schedule																	
Heavy Lift Vessel (HLV)																	
HLV Transit to field and preparation		*06/12/16*	*thru*	*06/14/16*													
	Main Engines	3 days	24	1	2	11760	80%	7.3079	0.3728	3.7285	0.5369	0.5208	10.91	0.56	5.57	0.80	0.78
	shaft generators	3 days	12	1	2	5000	80%	5.0708	0.2013	3.7285	0.2237	0.2170	1.61	0.06	1.18	0.07	0.07
HLV Installation Activities		*06/15/16*	*thru*	*07/08/16*													
	Azimuth Thruster forward	24 days	24	1	1	2280	75%	5.0708	0.2013	3.7285	0.2237	0.2170	5.51	0.22	4.05	0.24	0.24
	Bow Thruster	24 days	24	1	2	1950	75%	5.0708	0.2013	3.7285	0.2237	0.2170	9.42	0.37	6.92	0.42	0.40
	Shaft generators	24 days	12	1	2	5000	80%	5.0708	0.2013	3.7285	0.2237	0.2170	12.88	0.51	9.47	0.57	0.55
													40.32	**1.72**	**27.19**	**2.10**	**2.04**
Assist Installation Vessel/Dive Support Vessel (DSV																	
DSV Transit to field and preparation		*07/04/16*	*thru*	*07/06/16*													
	Main Engines	3 days	8	1	2	3000	70%	5.0708	0.2013	3.7285	0.2237	0.2170	0.56	0.02	0.41	0.02	0.02
	Generator	3 days	16	1	3	250	70%	5.0708	0.2013	3.7285	0.2237	0.2170	0.14	0.01	0.10	0.01	0.01
DSV Installation Activities		*07/06/16*	*thru*	*08/29/16*													
	Air Compressor	55 days	12	1	2	180	80%	5.0708	0.2013	3.7285	0.2237	0.2170	1.06	0.04	0.78	0.05	0.05
	Dive compressors	55 days	12	1	2	80	70%	5.0708	0.2013	3.7285	0.2983	0.2893	0.41	0.02	0.30	0.02	0.02
	Crane	55 days	12	1	2	335	20%	5.0708	0.2013	3.7285	0.2237	0.2170	0.49	0.02	0.36	0.02	0.02
	Diving equipment	55 days	24	1	1	250	60%	5.0708	0.2013	3.7285	0.2237	0.2170	1.11	0.04	0.81	0.05	0.05
	Main Engines	55 days	8	1	2	3000	70%	5.0708	0.2013	3.7285	0.2237	0.2170	10.33	0.41	7.60	0.46	0.44
	Generator	55 days	16	1	3	250	70%	5.0708	0.2013	3.7285	0.2237	0.2170	2.58	0.10	1.90	0.11	0.11
	Bow Thruster	55 days	16	1	2	950	70%	5.0708	0.2013	3.7285	0.2237	0.2170	6.54	0.26	4.81	0.29	0.28
	Stern Thruster	55 days	16	1	1	950	70%	5.0708	0.2013	3.7285	0.2237	0.2170	3.27	0.13	2.41	0.14	0.14
													26.51	**1.05**	**19.49**	**1.18**	**1.14**
												Total:	**479.83**	**20.35**	**285.81**	**23.32**	**22.55**

Notes:

(1) Emission factors from 'Current Methodologies in Preparing Mobile Source Port-Related Emission Inventories'

(2) Project Emissions Rate = Engine Rating (hp) x Load Factor x Engines per Vessel x Total Operation (hr/project) x Exhaust Emission Factor (g/hp-hr) / 453.6 grams/lb / 2000 lb/ton

Provided in Table 4.10-3 are the total potential emissions from the stationary source aspects of the LNGRVs at the proposed Port detailing emissions from boilers, engines, and GCUs.

Table 4.10-3. Proposed Project Potential Stationary Source Criteria Pollutant Emissions

Pollutant	Average Hourly Emission Rates (lb/hr)Aggregate per LNGRV - Total			Annual Potential to Emit (tpy)			Project Annual Potential to Emit (tpy)
	Boilers	Engines	GCU	LNGRV Boilers	LNGRV Engines	LNGRV GCU	
CO	4.26	12.60	1.40	18.7	55.2	6.1	80.0
NO_x (with SCR)	3.41	5.40	0.93	14.9	23.7	4.1	42.7
Pb	1.36E-04	4.54E-05	2.8E-06	5.98E-04	1.99E-04	1.23E-05	8.09E-04
$TSP/PM_{10}/PM_{2.5}$	2.07	2.13	0.05	9.1	9.3	0.2	18.6
SO_2	0.16	0.08	0.00	0.7	0.4	0.0	1.1
VOCs	1.42	3.69	0.35	6.2	16.2	1.5	23.9
Annual Operation (hours/year)				**8,760**	**8.760**	**540**	

Notes:
1. Potential to emit (PTE) associated with regasification at 400 MMscf/d natural gas sendout and an annual capacity factor of 100 percent for regasification equipment.
2. The GCU only operates at low and no sendout and the annual average hourly emission rate is based on the average of the two respective operational emission rates.
3. Aggregate per LNGRV refers to the total for the source type operation on an LNGRV. Engine emissions are the maximum of operation with or without dynamic positioning.
4. At the time of LNGRV arrival, two boilers and two engines would be in operation and therefore do not contribute additional startup emissions to the PTE. If startup of a boiler or engine is necessary, the increase in emissions attributable to startup/shutdown are anticipated to be offset by the absence of emissions during the period of non-operation.

Mobile Source Emissions

NO_x, VOC, and $PM_{2.5}$ emissions have been quantified for the LNGRVs while in transit to and from the proposed Port and from the support vessel. LNGRV mobile source emissions are based on 45 port visits per year. Arrivals assume 1.1 hours in transit to the proposed Port (based on travel from 25 miles from shore to the proposed Port) and assume 2 hours at port. Departures assume 1 hour of maneuvering at the proposed Port and 2.7 hours in transit between the proposed Port and 25 miles from shore.

Support vessel emissions have been broken out for the vessel while idling at the proposed Port or at the harbor, while operating in transit to and from the Port, and while patrolling at the Port. The support vessel is assumed to operate at idle for 4,258 hours per year at the Port or at the harbor, at patrol speed for 4,380 hours per year at the Port, and for 122 hours per year at transit to or from the Port.

Based on the above assumptions, operational emissions of these key pollutants from all vessel activities are summarized under General Conformity in Section 4.10.6.1.

Table 4.10-4 compares the potential operational emissions versus the applicable non-attainment new source review (NNSR) and Prevention of Significant Deterioration (PSD) major source thresholds. Based on emission estimates shown in the table, the proposed Project is not subject to PSD review for criteria pollutants, or for GHG. (While potential GHG emissions, expressed as carbon dioxide equivalents (CO_2e), exceed the PSD major source threshold, the U.S. Supreme Court ruled on June 23, 2014 that a project is not subject to PSD for any pollutant if GHG is the only pollutant that exceeds a PSD major source threshold. See *Utility Air Regulatory Group v. EPA* [No. 12-1146].)

Table 4.10-4. Operational PTE vs. PSD/NNSR Applicability Thresholds

Pollutant	Operational PTE (tpy)	PSD Applicability		NNSR Applicability	
		Threshold (tpy)	Applicability (Yes/No)	Threshold (tpy)	Applicability (Yes/No)
CO	80.0	100 (boilers)/ 250 (Project)	No	n/a	n/a
NO_x	42.7	100 (boilers)/ 250 (Project)	No	25	Yes
Pb	0.0	100 (boilers)/ 250 (Project)	No	n/a	n/a
TSP	18.6	100 (boilers)/ 250 (Project)	No	n/a	n/a
PM_{10}	18.6	100 (boilers)/ 250 (Project)	No	n/a	n/a
$PM_{2.5}$	18.6	100 (boilers)/ 250 (Project)	No	n/a	n/a
SO_2	1.1	100 (boilers)/ 250 (Project)	No	n/a	n/a
VOCs	23.9	n/a	n/a	25	No
Note: n/a = not applicable					

4.10.3.2 Operational Air Quality Impacts

An air quality dispersion modeling analysis was performed to achieve the following:

- Demonstrate compliance with PSD increments;
- Demonstrate compliance with National Ambient Air Quality Standards (NAAQS)/New York Ambient Air Quality Standards (NYAAQS);
- Satisfy the NEPA requirement to assess cumulative impacts; and
- Demonstrate that no adverse Class I area impacts are experienced (e.g., at Brigantine Wilderness Area, the only proximate Class I area).

Several air quality dispersion models were used to predict ambient impacts from operation of the proposed Project. To assess Class II area impacts, AERMOD was used to predict near field impacts (within 10.8 nautical miles of the two STL Buoys) and to evaluate various operating loads of the boilers and engines. Since the proposed Project's distance to shore of 13 nautical miles is greater than this 10.8 nautical mile radius, all AERMOD receptors were overwater. The Offshore and Coastal Dispersion (OCD) model was used to predict impacts at overwater and coastline receptors. The OCD model accounts for the thermal internal boundary layer that develops at the coastline, which impacts dispersion.

Modeling of impacts for comparison to significant impact levels (SILs), significant monitoring concentrations, and allowable PSD increments was performed for only operational emissions, as construction emissions are not subject to PSD review. For modeling applicable PSD increments, only the regasification portion of the engine emissions were modeled along with the stack parameters associated with the operating engine load. Modeling of cumulative impacts was performed for all LNGRV emissions, including those attributable to regasification, hoteling, and dynamic positioning, for comparison to the NAAQS/NYAAQS.

The following operating scenarios were evaluated using AERMOD:

- Peak sendout (660 MMscf/d each) for short-term (1-hour to 24-hour averaging periods) and total impacts;
- Average sendout (400 MMscf/d) for short-term (1-hour to 24-hour averaging periods) and total impacts;

- Average sendout (400 MMscf/d) for long-term (annual) impacts (with average emission rates for boilers and engines, including the GCU for total impacts modeling);
- Low sendout (64.5 MMscf/d) for short-term (1-hour to 24-hour averaging periods) including GCU for total impacts only; and
- No sendout (with engines and GCU operating) for short-term (1-hour to 24-hour averaging periods) impacts only.

The various sendout scenarios were modeled for both regasification-only emissions impacts and total emissions impacts as follows:

Regasification-only emissions impacts (for PSD SILs and increment comparison)

- Regasification boiler(s); and
- Engine(s) with proportion of emissions associated with regasification electrical demand and stack parameters associated with total engine load (regasification and hoteling) without dynamic positioning.

Total emissions impacts (for NAAQS comparison)

- Regasification boiler(s) – same as for regasification-only emissions impacts;
- Engine(s) with total emissions and stack parameters associated with total engine load with DP (regasification, hoteling and DP); and
- GCU for annual impacts and low sendout and no sendout scenarios.

Table 4.10-5 summarizes predicted AERMOD impacts for operation of a single LNGRV.

For each modeled single LNGRV scenario, if the maximum predicted regasification-only emissions impact was below 50 percent of the applicable SIL, then modeling of two LNGRVs was not conducted as the predicted impact for two LNGRVs can be no more than double the impact for a single LNGRV. Similarly, modeling of two LNGRVs in different operating scenarios cannot result in a maximum predicted impact that is greater than the simple sum of the maximum predicted impact attributable to an LNGRV in each operating mode without consideration of the impact receptor locations, which do not coincide. Therefore, if the simple sum of maximum, single LNGRV-predicted impacts for LNGRVs operating in different modes is less than a SIL, predicted impacts cannot exceed a SIL. Based on this concept, impacts were predicted for single LNGRVs in the various regasification-only operating scenarios described above and were summed to determine which combinations warrant concurrent modeling of two LNGRVs.

Table 4.10-5. Maximum AERMOD Predicted Impacts (μg/m^3) a/

Pollutant	Averaging Period	Maximum Sendout b/	Average Sendout b/	Low Sendout c/	Short-term Impact d/	Long-term Impact e/	Significant Impact Level f/
CO	1-hour	12.69	16.58	7.67	16.58	n/a	2000
	8-hour	9.30	13.81	6.45	13.81	n/a	500
NO_2 g/	1-hour Max (Tier 1)	9.39	8.11	3.03	9.39	n/a	n/a
	1-hr H5yrAvg (Tier 1)	9.13	8.02	2.84	9.13	n/a	7.5
	1-hour Max (Tier 2)	7.51	6.49	2.42	7.51	n/a	n/a
	1-hr H5yrAvg (Tier 2)	7.30	6.41	2.27	7.30	n/a	7.5
	Annual (Tier 2)	n/a	n/a	n/a	n/a	0.20	1
PM_{10}	24-hour Max	2.60	2.64	0.86	2.68	n/a	5

Pollutant	Averaging Period	Maximum Sendout b/	Average Sendout b/	Low Sendout c/	Short-term Impact d/	Long-term Impact e/	Significant Impact Level f/
	Annual	n/a	n/a	n/a	n/a	0.11	1
$PM_{2.5}$	24-hour Max	2.60	2.64	0.86	2.68	n/a	n/a
	24-hr H5yrAvg	2.14	2.13	0.70	2.14	n/a	1.2
	Annual	n/a	n/a	n/a	n/a	0.11	0.3
SO_2	1-hour	0.30	0.24	0.11	0.30	n/a	7.8
	3-hour	0.29	0.23	0.08	0.29	n/a	25
	24-hour	0.17	0.16	0.05	0.18	n/a	5
	Annual	n/a	n/a	n/a	n/a	0.01	1
TSP	24-hour	2.60	2.64	0.86	2.68	n/a	5
	Annual	n/a	n/a	n/a	n/a	0.11	1

Notes:
a/ Unless otherwise noted, maximum predicted impact of years 2002, 2004, 2005, 2006, and 2008.
b/ Maximum sendout impacts are from one LNGRV operating at 660 MMscf/d; average sendout impacts are from one LNGRV operating at 400 MMscf/d.
c/ Low sendout regasification-only impacts are from one LNGRV operating at 64.5 MMscf/d (equivalent to 15 percent boiler load).
d/ Maximum of short-term impacts predicted for maximum sendout, average sendout, low sendout, and no sendout.
e/ Based upon annual average emissions, boiler stack parameters associated with average sendout.
f/ Applies at Class II areas (not Brigantine Class I area). The 1-hour SO_2 SIL value was recommended by the USEPA in an August 23, 2010 memorandum.2
g/ NO_2 impacts presented on this table are based upon the USEPA's Tier 1 procedure (100 percent conversion of NO to NO_2) and Tier 2 procedure (80 percent conversion of NO to NO for 1-hour impacts and 75 percent conversion for annual impacts.) For the purpose of this analysis, the USEPA-recommended interim SIL (7.5 µg/m^3) is used.
n/a = not applicable

The following combinations were evaluated for regasification-only impacts.

LNGRV Combination	Buoy 1 LNGRV scenario	Buoy 2 LNGRV scenario
• Combination 1	Average sendout (660 MMscf/d)	Low sendout (64.5 MMscf/d)
• Combination 2	Low sendout (64.5 MMscf/d)	Low sendout (64.5 MMscf/d)
• Combination 3	330 MMscf/d sendout (simulated by average sendout of 400 MMscf/d)	330 MMscf/d sendout (simulated by average sendout of 400 MMscf/d)

The following combinations were evaluated for total impacts (not PSD impacts).

LNGRV Combination	Buoy 1 LNGRV scenario	Buoy 2 LNGRV scenario
• Combination 4	Maximum sendout (660 MMscf/d)	No sendout
• Combination 5	Average sendout (400 MMscf/d)	No sendout
• Combination 6	Average sendout (400 MMscf/d)	Low sendout with GCU
• Combination 7	Low sendout with GCU	No sendout
• Combination 8	Low sendout with GCU	Low sendout with GCU
• Combination 9	No sendout	No sendout
• Combination 10	330 MMscf/d sendout (simulated by average sendout of 400 MMscf/d)	330 MMscf/d sendout (simulated by average sendout of 400 MMscf/d)

Modeling was performed using AERMOD for those combinations of two LNGRVs for which the simple sum of maximum predicted impacts exceeded a SIL.

Modeling was performed with OCD for a single LNGRV without downwash (AERMOD was used for downwash). OCD-predicted maximum impacts from a single LNGRV operating at maximum, average, and low sendout rates are summarized in Table 4.10-6 for overwater receptors and Table 4.10-7 for shoreline receptors. The results are compared to the applicable SILs, which are lower than the PSD increments, and therefore, predicted impacts below a SIL would also be less than the allowable increment. The maximum predicted impacts at both overwater and shoreline receptors are all below the promulgated SILs.

Within the overwater receptor grid, AERMOD-predicted impacts are greater than OCD-predicted impacts. Shoreline receptor impacts are less than overwater receptor impacts. Modeling of two LNGRVs was not performed using OCD with overwater receptors because the predicted AERMOD impacts (with downwash) are greater than the OCD impacts (no downwash as modeled). Modeling of two LNGRVs was not performed using OCD with shoreline receptors because the predicted OCD impacts for a single LNGRV indicate that the doubling of impacts to account for combinations of two LNGRVs would not cause an impact that exceeds a SIL at shoreline receptors.

With regard to Class I area impacts, the proposed Project is not a very large source or located within 100 km of a Class I area. To assess Class I area impacts, the Federal Land Manager's Air Quality Related Values Work Group (FLAG) "Q/D" procedure was used as a screening tool to assess the potential for air quality impacts at the closest Class I area to the proposed Project, which is the Brigantine Wilderness area in New Jersey. "Q" is the maximum 24-hour emissions (in tons per year based on continuous operation) of PM_{10}, SO_2, NO_x, and sulfuric acid (H_2SO_4), while "D" is the distance (in kilometers) to the nearest Class I area. Per FLAG guidance, a Q/D less than 10 may not require a Class I air quality-related values impact assessment.

Table 4.10-6. Maximum Overwater OCD Predicted Impacts (µg/m³) a/

Pollutant	Averaging Period	Maximum Sendout b/	Average Sendout b/	Low Sendout c/	Short-term Impact d/	Long-term Impact e/	Significant Impact Level f/
CO	1-hour	5.63	7.28	4.25	7.28	n/a	2000
	8-hour	1.61	2.29	1.64	2.29	n/a	500
NO_2 g/	1-hour Max (Tier 1)	4.17	3.68	1.54	4.17	n/a	7.5
	1-hr H5yrAvg (Tier 1)	n/a	n/a	n/a	n/a	n/a	n/a
	1-hour Max (Tier 2)	3.34	2.94	1.23	3.34	n/a	7.5
	1-hr H5yrAvg (Tier 2)	n/a	n/a	n/a	n/a	n/a	n/a
	Annual (Tier 2)	n/a	n/a	n/a	n/a	0.31	1
PM_{10}	24-hour Max	0.31	0.36	0.21	0.36	n/a	5
	Annual	n/a	n/a	n/a	n/a	0.21	1
$PM_{2.5}$	24-hour Max	0.31	0.36	0.21	0.36	n/a	1.2
	24-hr H5yrAvg	n/a	n/a	n/a	n/a	n/a	n/a
	Annual	n/a	n/a	n/a	n/a	0.21	0.3
SO_2	1-hour	0.14	0.12	0.04	0.14	n/a	7.8
	3-hour	0.10	0.05	0.03	0.07	n/a	25
	24-hour	0.02	0.02	0.01	0.02	n/a	5

Pollutant	Averaging Period	Maximum Sendout b/	Average Sendout b/	Low Sendout c/	Short-term Impact d/	Long-term Impact e/	Significant Impact Level f/
	Annual	n/a	n/a	n/a	n/a	0.01	1
TSP	24-hour	0.31	0.36	0.21	0.36	n/a	5
	Annual	n/a	n/a	n/a	n/a	0.21	1

Notes:
a/ Unless otherwise noted, maximum predicted impact of years 2002, 2004, 2005, 2006, and 2008.
b/ Maximum sendout impacts are from one LNGRV operating at 660 MMscf/d; average sendout impacts are from one LNGRV operating at 400 MMscf/d.
c/ Low sendout regasification-only impacts are from one LNGRV operating at 64.5 MMscf/d (equivalent to 15 percent boiler load).
d/ Maximum of short-term impacts predicted for maximum sendout, average sendout, low sendout, and no sendout.
e/ Based upon annual average emissions, boiler stack parameters associated with average sendout.
f/ Applies at Class II areas (not Brigantine Class I area). The 1-hour SO_2 SIL value is recommended by the USEPA in their August 23, 2010 memorandum titled Guidance Concerning the Implementation of the 1-hour SO_2 NAAQS for the Prevention of Significant Deterioration Program.
g/ NO_2 impacts presented on this table are based upon the USEPA's Tier 1 procedure (100 percent conversion of NO to NO_2) and Tier 2 procedure (80 percent conversion of NO to NO_2 for 1-hour impacts and 75 percent conversion for annual impacts). For the purpose of this analysis, the USEPA-recommended interim SIL (7.5 µg/m^3) is used.
n/a = not applicable

Table 4.10-7. Maximum Shoreline OCD Predicted Impacts (µg/m^3) a/

Pollutant	Averaging Period	Maximum Sendout b/	Average Sendout b/	Low Sendout c/	Short-term Impact d/	Long-term Impact e/	Significant Impact Level f/
CO	1-hour	0.90	1.14	0.41	1.14	n/a	2000
	8-hour	0.37	0.43	0.15	0.43	n/a	500
NO_2 g/	1-hour Max (Tier 1)	0.66	0.54	0.13	0.78	n/a	7.5
	1-hr H5yrAvg (Tier 1)	n/a	n/a	n/a	n/a	n/a	n/a
	1-hour Max (Tier 2)	0.53	0.43	0.10	0.62	n/a	7.5
	1-hr H5yrAvg (Tier 2)	n/a	n/a	n/a	n/a	n/a	n/a
	Annual (Tier 2)	n/a	n/a	n/a	n/a	0.06	1
PM_{10}	24-hour Max	0.07	0.06	0.02	0.07	n/a	5
	Annual	n/a	n/a	n/a	n/a	0.04	1
$PM_{2.5}$	24-hour Max	0.07	0.06	0.02	0.07	n/a	1.2
	24-hr H5yrAvg	n/a	n/a	n/a	n/a	n/a	n/a
	Annual	n/a	n/a	n/a	n/a	0.04	0.3
SO_2	1-hour	0.02	0.02	0.00	0.02	n/a	7.8
	3-hour	0.01	0.01	0.00	0.01	n/a	25
	24-hour	0.00	0.00	0.00	0.00	n/a	5
	Annual	n/a	n/a	n/a	n/a	0.00	1
TSP	24-hour	0.07	0.06	0.02	0.07	n/a	5
	Annual	n/a	n/a	n/a	n/a	0.04	1

Notes:
a/ Unless otherwise noted, maximum predicted impact of years 2002, 2004, 2005, 2006, and 2008.
b/ Maximum sendout impacts are from one LNGRV operating at 660 MMscf/d; average sendout impacts are from one LNGRV operating at 400 MMscf/d.
c/ Low sendout regasification-only impacts are from one LNGRV operating at 64.5 MMscf/d (equivalent to 15 percent boiler load).
d/ Maximum of short-term impacts predicted for maximum sendout, average sendout, low sendout, and no sendout.
e/ Based upon annual average emissions, boiler stack parameters associated with average sendout.
f/ Applies at Class II areas (not Brigantine Class I area). The 1-hour SO_2 SIL value was recommended by the USEPA in an August 23, 2010 memorandum titled Guidance Concerning the Implementation of the 1-hour SO_2 NAAQS for the Prevention of Significant Deterioration Program.
g/ NO_2 impacts presented on this table are based upon the USEPA's Tier 1 procedure (100 percent conversion of NO to NO_2) and Tier 2 procedure (80 percent conversion of NO to NO_2 for 1-hour impacts and 75 percent conversion for annual impacts.) For the purpose of this analysis, the USEPA-recommended interim SIL (7.5 µg/m^3) is used.
n/a = not applicable

The maximum 24-hour operating scenario, including hoteling and dynamic positioning, consists of one LNGRV operating at peak sendout mode with a second LNGRV present in no sendout mode. The maximum emission rates under this scenario are as follows:

LNGRV 1 (peak sendout)

NO_x: 5.785 lb/hr/boiler
PM_{10}: 3.518 lb/hr/boiler
SO_2: 0.278 lb/hr/boiler
NO_x: 7.790 lb/hr/engine
PM_{10}: 2.644 lb/hr/engine
SO_2: 0.078 lb/hr/engine

LNGRV 2 (no sendout)

NO_x: 0 lb/hr/boiler
PM_{10}: 0 lb/hr/boiler
SO_2: 0 lb/hr/boiler
NO_x: 3.192 lb/hr/engine
PM_{10}: 1.334 lb/hr/engine
SO_2: 0.025 lb/hr/engine
NO_x: 33.28 lb/hr/GCU
PM_{10}: 1.664 lb/hr/GCU
SO_2: 0.125 lb/hr/GCU

Emissions of H_2SO_4 would be a small fraction of the SO_2 emissions and would not affect the Q/D analysis. The combined emissions from above are 59.71 lb/hr, which is equivalent to 261.5 tons per year (tpy) at 8,760 hours per year. The Brigantine Wilderness area is located 113 km from the proposed Project and the resulting Q/D is 2.3. This value is well below 10 and therefore a CALPUFF modeling analysis to predict air quality impacts in the nearest Class I area may not be required.

Cumulative impacts were based on this proposed Project and any other reasonably foreseeable project or action in the area with the potential to have significant air impact in the vicinity of the proposed Project location. PSD sources (regasification process sources) were included if proposed Project-only impacts exceed a SIL and pose a threat to the maintenance of a NAAQS. The applicable SILs were not exceeded; therefore, the NEPA impact evaluation includes the modeling of the following sources:

- LNGRVs while moored at the proposed Port (total impacts); and
- LNGRV and support vessel in transit.

No other major stationary sources associated with other offshore projects were identified that have filed permit applications with the USEPA, NYSDEC or NJDEP and could potentially impact the proposed Project area.

Existing ship traffic through New York and New Jersey approaches surrounding the proposed Project are assumed to be counted in the conservative, onshore background monitoring data and therefore were not modeled. Due to recent regulations improving the quality of fuel used in shipping (MARPOL Annex VI), no adjustments for future shipping (when the proposed Project commences operation) are included in the NEPA modeling, as impacts of key pollutants (SO_2, $PM_{2.5}$, NO_x) attributable to shipping are expected to decrease over time.

The emissions associated with in-transit LNGRV operation and with approach and departure maneuvering are not related to regasification and were therefore not part of the stationary source modeling; however, INPUFF modeling of air quality impacts was performed for transit and maneuvering operations. Therefore, engine emissions attributable to the power production needed for two 2,000-kilowatt (kW)

bow thrusters and two 1,200-kW stern thrusters that would help position the LNGRV during approach and departure have been modeled. Regasification boilers were not included in the INPUFF modeling of vessels in transit; however, they would be operating when the LNGRVs arrive at the proposed Port. Therefore, the contribution of vessels in transit to the cumulative impacts were conservatively estimated, as described below.

The NEPA cumulative impact modeling is essentially the proposed Project total impacts presented in the foregoing impact tables plus impacts associated with vessels in transit. Proposed Project total concentrations are the simple sums of predicted impacts plus background. This conservative, simple-sum approach does not account for the spatial and temporal variations of predicted impacts (maximum impacts for each source at different receptors under different meteorological data periods) that would result in lower impacts and includes the overestimates of background concentrations (from an onshore location).

In this analysis, the maximum overwater proposed Project impacts are the maximums as described above. That is, the maximum predicted short-term LNGRV impacts listed on these tables were conservatively determined as follows:

- For CO and SO_2, the short-term impacts are the maximums of the simple sums of two predicted impacts for LNGRVs operating in the various combinations of operating scenarios.
- For NO_2, PM_{10}, and $PM_{2.5}$, the 1-hour and 24-hour impacts, as applicable, are the maximum of predicted impacts determined through AERMOD modeling for the possible combinations of two LNGRVs (for those combinations of operating scenarios for which the simple sum of predicted single-LNGRV impacts exceeded a SIL). The USEPA's Tier 2 approach (80 percent of NO_x converts to NO_2) was used for 1-hour NO_2 impacts.

This approach is conservative and over-predicts the total ambient air concentrations.

Annual LNGRV impacts are based on one LNGRV operating at 400 MMscf/d. The USEPA's Tier 2 approach (75 percent of NO_x converts to NO_2) was used for annual NO_2 impacts.

In summary, this procedure is conservative for the following reasons.

- The simple sum of maximum predicted concentrations described above conservatively assumes that the maximum predicted impacts and background concentrations from each component are concurrent in both time and space. This is very unlikely, especially since the emission points from the LNGRVs at the STL Buoys (weathervaning and in transit) would be shifting in position, and the separation distance between the STL Buoys is well beyond the distance to the maximum impact location for a single LNGRV.
- The maximum impacts listed for two LNGRVs were conservatively calculated, as described above.
- The sum of predicted concentrations includes two LNGRVs at the Buoys and the support vessel in transit.
- The conservative background concentrations are from suburban and urban areas and are not concurrent in time and space with the maximum predicted impacts from the proposed Project. Ambient concentrations in the vicinity of the proposed Port are expected to be significantly lower than the ambient background concentrations measured at the monitors because of the transient nature of sources of air pollutant emissions at sea.
- There are relatively large distances between the proposed Port and the nearest shore; therefore, there are no major onshore sources that would be expected to impact the proposed Project area significantly. Impacts from onshore sources are assumed to be in the background data measured at the onshore monitoring stations.

The cumulative impacts and comparisons to the NAAQS/NYAAQS for overwater receptors are presented in Table 4.10-8. The cumulative impact analysis includes impacts attributable to the proposed Project, vessels in transit, and monitored background concentrations.

As noted above, regasification boilers were not included in the INPUFF modeling of vessels in transit. These boilers would be operating, but not at regasification loads, when the LNGRVs arrive at the proposed Port and when they depart. Regardless of differences in stack parameters, the potential impacts attributable to regasification boilers were conservatively estimated in the simple-sum cumulative impacts by doubling the maximum predicted impacts of an LNGRV in transit.

This comparison of simple-sum impacts plus background to NAAQS/NYAAQS demonstrates that the proposed Project would not cause an exceedance of ambient air quality standards. The highest percentage of the NAAQS/NYAAQS occurs with 24-hour $PM_{2.5}$ and is 92.4 percent of the NAAQS (91 percent of simple sum attributable to the conservative background concentration).

Since maximum predicted impacts from one LNGRV operating at peak sendout are greater than maximum predicted impacts for LNGRVs in transit, the simple-sum cumulative impact method conservatively sums the INPUFF-predicted impact for a single LNGRV operating in the immediate vicinity of the proposed Port (2.5 knot vessel speed) with the maximum AERMOD-predicted impact from two LNGRVs operating at the proposed Port.

A variation of the cumulative impacts analysis is presented in Table 4.10-9 for shoreline receptors. This analysis compares a simple sum of predicted shoreline impacts plus background concentrations to the NAAQS/NYAAQS. Impacts attributable to LNGRVs in transit are doubled, as described above. As expected based on previous discussion of the modeling approach, the maximum concentrations are less than those presented in Table 4.10-8, which presents impacts that are proximate to the proposed Port. This analysis also shows that the proposed Project would not cause or contribute to an exceedance of ambient air quality standards.

4.10.4 Impacts of Decommissioning

Proposed Project decommissioning would result in comparable emissions to those described for the construction process. Impacts associated with proposed Project decommissioning would be expected to be short-term, negligible, and adverse.

During decommissioning, the proposed Mainline and pipeline laterals would be capped and abandoned in-place to be consistent with current federal policies to minimize adverse impacts. Minor air emissions are anticipated for these activities.

4.10.5 Impacts of Alternatives

4.10.5.1 Anchoring Alternative

Other anchoring alternatives offer no benefit to air quality as mobile source emissions would be greater than the proposed Project due to the ship maneuvers and tugs that would be required during operations for these alternatives.

4.10.5.2 Alternate Port Location

The predicted impacts for each alternative location (Study Areas B and D) studied would be similar.

Table 4.10-8. Cumulative Impacts at Overwater Receptors and Comparison to NAAQS/NYAAQS

Pollutant	Averaging Period	Maximum Overwater Project Impacts a/ (µg/m³)	Background Concentration (µg/m³)	LNGRV in Transit b/ (µg/m³)	Support Vessel in Transit b/ (µg/m³)	Total Concentration c/ (µg/m³)	NAAQS / NYAAQS (µg/m³)	Percentage of NAAQS / NYAAQS
CO	1-hour	35.27	4,579	2.22	5.83	4,622	40,000	11.6%
	8-hour	34.16	2,862	1.56	4.08	2,902	10,000	29.0%
NO_2 d/	1-hr H5yrAvg (Tier 2)	20.42	115.9	1.31	11.44	149.1	188	79.3%
	Annual (Tier 2)	0.17	33.8	0.13	1.14	35.2	100	35.2%
PM_{10}	24-hour Max	3.28	73	0.070	0.233	76.6	150	51.1%
	Annual	0.11	30	0.017	0.058	30.2	n/a	n/a
$PM_{2.5}$	24-hr H5yrAvg	2.40	26.3	0.070	0.233	29.0	35	82.9%
	Annual	0.11	10.9	0.017	0.058	11.1	12	92.4%
SO_2	1-hour	1.48	68.9	0.029	0.009	70.4	196	35.9%
	3-hour	0.66	55.0	0.026	0.008	55.7	1,300	4.3%
	24-hour	0.39	26.2	0.012	0.003	26.6	365	7.3%
	Annual	0.01	5.2	0.003	0.001	5.2	80	6.5%

Notes:
a/ Maximum of scenarios modeled (AERMOD or OCD).
b/ Maximum predicted impact for any vessel speed; LNGRV impacts doubled to approximate engines plus boilers because only the engines were modeled. This doubling of the maximum impact at any modeled LNGRV speed is conservative because LNGRV engine emissions are significantly greater than emissions from the boilers, which would operate at low load.
c/ Simple sum of Project impact and background; not concurrent in time or space.
d/ NO_2 impacts based on Tier 2 procedure (80% conversion of NOx to NO_2 for 1-hour impacts and 75% conversion for annual impacts).

NAAQS/NYAAQS = National and New York Ambient Air Quality Standards
H5yrAvg = highest of the 5-year averages (over the receptor grid) of the maximum predicted impacts at each receptor (form of SIL).

Table 4.10-9. Cumulative Impacts at Shoreline Receptors and Comparison to NAAQS/NYAAQS

Pollutant	Averaging Period	Maximum Shoreline Project Impacts a/ (µg/m³)	Background Concentration (µg/m³)	LNGRV in Transit b/ (µg/m³)	Support Vessel in Transit b/ (µg/m³)	Total Concentration c/ (µg/m³)	NAAQS / NYAAQS (µg/m³)	Percentage of NAAQS / NYAAQS
CO	1-hour	4.28	4,579	2.22	5.83	4,591	40,000	11.5%
	8-hour	1.52	2,862	1.56	4.08	2,869	10,000	28.7%
NO_2 d/	1-hr H5yrAvg (Tier 2)	2.16	115.9	1.31	11.44	130.8	188	69.6%
	Annual (Tier 2)	0.10	33.8	0.13	1.14	35.2	100	35.2%
PM_{10}	24-hour Max	0.16	73	0.070	0.233	73.5	150	49.0%
	Annual	0.03	30	0.017	0.058	30.1	n/a	n/a
$PM_{2.5}$	24-hr H5yrAvg	0.16	26.3	0.070	0.233	26.8	35	76.5%
	Annual	0.03	10.9	0.017	0.058	11.0	12	91.7%
SO_2	1-hour	0.04	68.9	0.029	0.009	69.0	196	35.2%
	3-hour	0.04	55.0	0.026	0.008	55.1	1,300	4.2%
	24-hour	0.02	26.2	0.012	0.003	26.2	365	7.2%
	Annual	0.00	5.2	0.003	0.001	5.2	80	6.5%

Notes:
a/ Maximum of scenarios modeled (AERMOD or OCD).
b/ Maximum predicted impact for any vessel speed; LNGRV impacts doubled to approximate engines plus boilers because only the engines were modeled. This doubling of the maximum impact at any modeled LNGRV speed is conservative because LNGRV engine emissions are significantly greater than emissions from the boilers, which would operate at low load.
c/ Simple sum of Project impact and background; not concurrent in time or space.
d/ NO_2 impacts based on Tier 2 procedure (80% conversion of NOx to NO_2 for 1-hour impacts and 75% conversion for annual impacts).

NAAQS/NYAAQS = National and New York Ambient Air Quality Standards
H5yrAvg = highest of the 5-year averages (over the receptor grid) of the maximum predicted impacts at each receptor (form of SIL).

4.10.5.3 Vaporization Alternative

There are two commercially available LNG vaporization alternatives: open-loop and closed-loop. In an open-loop system, seawater would be pumped to the LNG vessel to transfer the heat necessary to vaporize the LNG. At seawater temperatures below 59°F, auxiliary heaters are used to ensure the seawater has sufficient heat for vaporization. Open-loop systems often require an anti-fouling agent to prevent the pipes from becoming plugged. A seawater intake and a wastewater discharge system would be associated with the open-loop system. In a closed-loop system, freshwater would be circulated and heated/reheated with steam produced by gas-fired boilers. There would be no intake or discharge of water in a closed-loop system.

Ambient air systems can also be used, but these systems are better suited for warmer climates; supplemental heating of the air would be required for the proposed Project. These systems also require a much larger area than a water-based system.

For the proposed Project, an open-loop system would use seawater at a rate ranging from 13,944 to 27,932 gpm and as a result, could impact marine biota due to impingement and entrainment of organisms in the seawater intake structures. The discharge and the cooled wastewater would generate a plume of cooled seawater in the vicinity of an outfall that could also impact marine biota. At cooler seawater temperatures, boilers would be required to heat the seawater resulting in additional air emissions during this operating mode.

A closed-loop system would generate more air emissions than an open-loop system due to the additional combustion necessary to heat the freshwater. This additional combustion, however, would allow for combustion of excess BOG that would otherwise be vented to the atmosphere; resulting in an overall reduction in methane emissions, a potent GHG. A closed-loop system would not require seawater and therefore would not impact marine life or water quality.

During fall through the winter months, low seawater temperatures would adversely affect the performance of an open-loop system at the proposed Port and require supplemental heating from auxiliary heaters. As the reduction in air emissions associated with an open-loop system was determined to be small as compared to the increased impact on marine life or water quality, a closed-loop system was selected for the proposed Project.

LNG vaporization would be accomplished via a recirculated water-glycol mixture that would be heated by steam generated by the LNGRV's two auxiliary boilers firing BOG. It is estimated that approximately 2.5 percent of each LNGRV's LNG cargo would be consumed by this process.

4.10.5.4 Construction Schedule Alternative

From an air quality perspective, there is no significant difference between the alternative construction schedules.

4.10.5.5 Alternate Pipeline Routes

The proposed Mainline would be located in the seabed floor with no onshore component and therefore would have no measurable air quality impact.

4.10.6 General Conformity

Section 176(c) of the Clean Air Act (CAA) established requirements to ensure that federal actions or actions approved by federal agencies do not adversely affect a state's ability to achieve and maintain attainment with the NAAQS. Federal agencies are required to review activities involving air emissions for conformity with state, tribal, and federal implementation plans (SIPs, TIPs, and FIPs). Regulations governing General Conformity are promulgated under 40 CFR 93.

The conformity process has three phases, as follows:

- Applicability analysis;
- Conformity determination; and
- Review process (not described herein).

4.10.6.1 Applicability Analysis

Per CAA Section 176(c)(5), conformity provisions are applicable to actions that are located in areas designated as nonattainment and air quality maintenance areas. Furthermore, conformity requirements are triggered if the action results in emissions above a de minimis emission threshold for that nonattainment pollutant. The conformity regulations provide the following steps to assess the applicability of an action to conformity requirements:

1. Would the action occur in a nonattainment or maintenance area;
2. Would one or more of the specific exemptions apply to the action;
3. Would the federal agency include the action on its list of ‘‘presumed to conform’’ actions;
4. Would the total direct and indirect emissions exceed a de minimis level; and/or
5. Would the facility have an emission budget approved by the state or tribe as part of the SIP or TIP. The federal agency would determine if the emissions from the proposed action are within the budget of the SIP or TIP.

If the action would cause emissions of nonattainment pollutants above the de minimis threshold in any nonattainment or maintenance area and the action is not otherwise exempt, ‘‘presumed to conform,’’ or included in the existing emissions budget of the SIP or TIP, the agency must conduct a conformity determination before it takes the action.

Federal actions resulting in emission rates above these thresholds are subject to conformity review with the following exceptions:

- New or modified sources that require a New Source Review permit (PSD and NNSR);
- Routine, recurring transportation of material and personnel;
- Routine ship movements and operation of facilities, mobile assets and equipment;
- Planned maintenance and repair activities; and
- Additional exemptions as specified in 40 CFR 93.153(c), (d), and (e).

The proposed Project would result in emissions during the construction period and then during operation of the proposed Port, not covered by any of the above exceptions, and therefore potentially subject to conformity review. Construction and operating emissions would occur in several distinct nonattainment and maintenance areas, depending on the location selected for the pipe staging and CWC coating area. Emissions must be evaluated against the applicable de minimis thresholds for the specific nonattainment or maintenance area in which they occur. In addition, based on guidance from USEPA Region 2, the geographic areas potentially subject to general conformity are limited to state waters, which extend 3 nautical miles from shore, and to the 500-meter Safety Zone around the proposed Project site. As the proposed Project site is located 13 nautical miles offshore, a significant portion of both construction emissions and operating emissions would occur outside of either state waters or the Safety Zone.

For the majority of emissions from both construction and operation, it is expected that the nearest land would be in Nassau County, which is part of the New York-N. New Jersey-Long Island, NY-NJ-CT marginal ozone nonattainment area and $PM_{2.5}$ maintenance area; and the New York-N. New Jersey-Long Island CO maintenance area. A portion of construction emissions, mainly related to pipehaul tugs transporting material from the staging area to the undersea construction area, would occur in one or more additional designated areas, again, depending on the staging site chosen, and the resulting travel route

taken to the undersea construction area. The two main candidate sites are Coeymans, New York, which would result in construction emissions in the Albany-Schenectady-Troy and Poughkeepsie ozone nonattainment areas; and Quonset Point, Rhode Island, which would result in construction emissions in the Providence, Rhode Island ozone nonattainment area. (A potential third staging site being considered is located in Elizabeth, New Jersey, which would be part of the same New York-N. New Jersey-Long Island, NY-NJ-CT nonattainment and maintenance areas as the Project site.)

Table 4.10-10 lists the separate nonattainment and maintenance areas that could potentially be affected, along with their de minimis thresholds for applicability of general conformity. The actual areas affected will be known once the pipe staging and CWC site is finally chosen.

Table 4.10-10. Potentially Affected Designated Areas and De Minimis Thresholds

Nonattainment and/or Maintenance Area	De minimis thresholds in 40 CFR 93.153 (tpy)					
	Ozone		CO	$PM_{2.5}$		
	VOC	NOx		Direct emissions	SO_2	NOx
New York-N. New Jersey-Long Island, NY-NJ-CT: Marginal ozone nonattainment (2008 8-hour); $PM_{2.5}$ maintenance area	50	100	--	100	100	100
New York-N. New Jersey-Long Island: CO maintenance area	--	--	100	--	--	--
Albany-Schenectady-Troy, NY: Marginal ozone nonattainment (1997 8-hour)	50	100	--	--	--	--
Poughkeepsie, NY: Moderate ozone nonattainment (1997 8-hour)	50	100	--	--	--	--
Providence, RI: Moderate ozone nonattainment (1997 8-hour)	50	100	--	--	--	--

The construction emissions would be subject to conformity requirements if a threshold is exceeded within a calendar year for NOx, VOC, CO and/or $PM_{2.5}$ emissions in one or more designated areas. Table 4.10-11 provides a comparison of maximum potential calendar year construction emissions versus the applicable conformity thresholds for these pollutants. (Note that the construction emission totals presented in this document represent the sum of all emissions occurring within 25 miles offshore, in all potentially affected nonattainment or maintenance areas, and therefore represent a very conservative estimate of the emissions potentially subject to conformity. A separate general conformity analysis would be prepared that includes only those emissions expected to occur within state waters or the proposed Project Safety Zone, and separately totaled for each distinct nonattainment or maintenance area in which they occur.)

Table 4.10-11. Construction Potential to Emit (PTE) vs. Conformity Thresholds (tpy)

Pollutant	Construction PTE	Conformity Threshold	Applicable?
NOx	473	100	TBD
VOC	20.1	50	No
CO	281	100	TBD
$PM_{2.5}$	22.2	100	No

General conformity applicability will be determined during operations. As described above, the proposed Project requires a NNSR permit; thus operational emissions included in this permit are exempt from conformity requirements. Therefore, only proposed Project emissions not included in the air permit (i.e., hoteling emissions, LNGRV maneuvering emissions, and support vessel emissions) will be included in the operational conformity analysis. Worst-case operational emissions potentially subject to conformity are as follows:

- NO_x: 9.62 tpy (stationary LNGRV emissions not in air permit) + 2.47 tpy (LNGRV maneuvering and transit emissions) + 74.66 tpy (support vessel emissions) = 86.75 tpy
- VOC: 4.00 tpy (stationary LNGRV emissions not in air permit) + 1.40 tpy (LNGRV maneuvering and transit emissions) + 2.96 tpy (support vessel emissions) = 8.36 tpy
- CO: To be determined
- $PM_{2.5}$: 3.20 tpy (stationary LNGRV emissions not in air permit) + 0.68 tpy (LNGRV maneuvering and transit emissions) + 3.29 tpy (support vessel emissions) = 7.17 tpy

(As with the construction emission totals, these operational emissions represent all activities expected to occur within 25 miles offshore, although they are all expected to occur within a single nonattainment or maintenance area for each pollutant. A separate general conformity analysis would be prepared that includes only those operational emissions expected to occur within state waters or the proposed Project Safety Zone.)

Table 4.10-12 provides a comparison of potential operational emissions versus the applicable conformity threshold for these three pollutants.

Table 4.10-12. Operation Potential to Emit (PTE) vs. Conformity Thresholds (tpy)

Pollutant	Operational PTE	Conformity Threshold	Applicable?
NOx	87	100	No
VOC	8.4	50	No
CO	TBD	100	TBD
$PM_{2.5}$	7.2	100	No

In summary, the proposed Project could potentially trigger conformity requirements for NO_x and CO emissions during construction, and for CO emissions during operation. However, the separate general conformity analysis is expected to show that a significant portion of these emissions would occur outside the geographic areas potentially subject to general conformity, and that they could potentially remain below all applicable conformity thresholds.

4.10.6.2 Conformity Determination

Once the conformity determination is completed, the reviewing agency must determine that the proposed Project would meet all SIP control requirements and determine that it would not cause a violation or interfere with attainment of the NAAQS. The primary method to ensure that the proposed Project would not interfere with NAAQS attainment is by securing a concomitant reduction in emissions by obtaining offsets of the subject pollutant(s). If required, Liberty would obtain discreet NO_x and/or CO emission offsets to offset any emissions in excess of a conformity threshold. Since construction-related offsets would be discrete tons in a calendar year, separate ozone and non-ozone season offsets would be secured to offset the construction NO_x emissions that would occur during the ozone and non-ozone seasons.

4.10.7 Greenhouse Gases and Climate Change

As described in Section 3.11.4, GHGs are compounds in the atmosphere that inhibit the radiation of heat

back out through the atmosphere resulting in a greenhouse effect that may affect the global climate. GHGs include pollutants resulting from the combustion of fossil fuels as well as fugitive emissions. The vessels used for construction, as well as the LNGRVs during operation, would include combustion units that emit GHGs, primarily CO_2 and to a lesser extent CH_4 and N_2O. Fugitive CH_4 emissions may also occur from fugitive losses of LNG from valves, flanges, and other components of the natural gas handling system (regasification and proposed Mainline). These GHGs have different levels of global warming potential (GWP) that are normalized to CO_2e (carbon dioxide equivalent). For example, one ton of CH_4 has a GWP equal to 25 tons of CO_2 and therefore one ton of CH_4 equates to 25 tons CO_2e. Similarly, one ton of N_2O has a GWP of 298. Although CH_4 and N_2O have greater GWPs than CO_2, proposed Project emissions of these GHGs are dramatically lower than CO_2 and as a result have only a minor impact on total GHG emissions from the proposed Project.

4.10.7.1 Construction

For each type of engine associated with the proposed Project, construction emission estimates were conducted based on the expected number of each type of vessel, engines per vessel, duration of use (days and hours/day), load factor (percent of maximum rated capacity) and published emission factors. Construction of the proposed Project would be expected to take 11 months, February through December of 2016. Included as part of construction emissions are emissions from a geotechnical coring vessel, which is scheduled to operate in the spring of 2015. Therefore, construction emissions would be spread over two calendar years. Emissions were estimated for the entirety of the construction period, as well as the maximum amount in any calendar year.

For an individual engine, emissions estimates are based on the engine horsepower, load factor, emission factor, and duration of operation. The durations, horsepower, and load factors provided in the calculation spreadsheet are part of the construction plan and use CO_2 emissions factors for ocean-going vessels (which are the pipelay vessel and the heavy lift vessel) or for harbor craft (which are all of the other vessels) in "Current Methodologies in Preparing Mobile Source Port-Related Emission Inventories" (ICF 2009). CH_4 and N_2O emission factors were from 40 CFR 98, Subpart C, converted using 32 percent efficiency of the engines.

Total GHG emissions from these construction sources, expressed as CO_2e emissions, are 41,845 tons. Of this total, 41,076 tons are projected to occur in calendar year 2016.

Short-term, negligible, adverse impacts would result from increased vessel and equipment use associated with proposed Project construction activities. GHG emissions during the construction period are provided in Table 4.10-13.

4.10.7.2 Operation

LNGRV stationary source GHG emissions from proposed Project operations have also been estimated by Liberty. A summary of operational emissions by emission source is provided in Table 4.10-14.

As shown in Table 4.10-13, total GHG emissions, expressed as CO_2e, would be 199,578 tons per year. To put some perspective on these operational GHG emissions, annual GHG emissions from a typical passenger car have been estimated by USEPA at 4.7 metric tons of CO_2e per year (EPA-420-F-14-040 May 2014, *Greenhouse Gas Emissions from a Typical Passenger Vehicle*). Therefore, the proposed Project's operational GHG emissions would be equivalent to 38,516 typical passenger vehicles. According to New York Department of Motor Vehicle statistics[5], in 2013 there were 9,185,181 standard passenger vehicles registered in New York State with 1,808,038 registered in New York City alone. By comparison, the proposed Project would have operational GHG emissions equivalent to approximately

[5] http://dmv.ny.gov/statistic/2013reginforce.pdf

0.42 percent of the passenger vehicles in New York State and 2.1 percent of the passenger vehicles in New York City.

By providing the lowest GHG-producing fossil fuel to the region could ultimately allow for a concurrent reduction in regional GHG emissions from regional utility power plants and other combustion sources that might combust the natural gas rather than higher emitting fossil fuels such as oil.

4.10.7.3 Decommissioning

Similar to impacts from the proposed Port construction, short-term, negligible, adverse impacts would result from increased vessel and equipment use associated with decommissioning activities. Proposed decommissioning actions would burn fossil fuel in various types of engines and equipment and produce CO_2e and N_2O from the fossil fuel combustion.

4.10.8 Mitigations and Monitoring

Fugitive emissions from the proposed Project would be minimized through implementation of SOPs that would include inspection of the STL Buoy connection to the LNGRV's mating cone prior to and during transfer of natural gas, leak detection monitoring, and inspection and maintenance programs.

Natural gas is the lowest emitting fossil fuel and therefore results in lower criteria pollutant and GHG emissions as compared to other fossil fuels. Additionally, measures to improve LNGRV efficiency, such as to minimize GCU operation, would be implemented to minimize emissions.

The following additional measures have been proposed as potential measures for mitigating and/or minimizing impacts to air quality.

- The proposed Project would obtain a pre-construction air permit prior to commencement of construction.
- The proposed Project would also apply for a Title V operating permit, which would specify emissions limitations, monitoring, recordkeeping, and reporting requirements.
- Emissions from marine vessels during construction would be minimized through the operation and maintenance of the marine engines in accordance with recommended manufacturer operation and maintenance procedures.
- The LNGRVs' boilers would be equipped with low NO_x burners to minimize emissions formation of NO_x, and SCR would be employed to further reduce NO_x emissions. Emissions of all other pollutants from the boilers would be minimized through firing of LNG and BOG and good combustion practices.
- The LNGRVs' generator engines would be exhausted to an SCR and oxidation catalyst would be employed to reduce NO_x, CO and VOC emissions. Emissions of all other pollutants from the engines would be minimized through firing of LNG and BOG and good combustion practices.
- Liberty would obtain discreet NO_x emission offsets to offset the construction-related NO_x emissions. Sufficient ozone and non-ozone season offsets would be secured to offset the construction NO_x emissions that would occur during the ozone and non-ozone seasons.
- GHG emissions would be limited through the use of best available control technology (BACT) controls included in the original March 2014 air permit application.

Table 4.10-13. Detailed Construction Emissions (GHGs)

Task	Equipment Type	Duration (days)	Op. Time (hr/day)	Qty. Vessels	Engines per vessel	Engine Rating (hp)	Load Factor	Exhaust Emission Factors a/			Project Emission Rate b/				
								CO_2 (g/hp-hr)	CH_4 (g/hp-hr)	N_2O (g/hp-hr)	CO_2 (tons)	CH_4 (tons)	CH_4 (ton CO_2e)	N_2O (tons)	N_2O (ton CO_2e)
Pipeline Installation															
Geotechnical Coring Vessel															
	Coring Operation	*3/20/2015*	*thru*	*5/9/2015*											
	Generators	51 days	8	1	3	800	100%	514.5329	0.0239	0.0048	555.38	0.03	0.64	0.01	1.53
	Air Compressor	51 days	12	1	2	180	100%	514.5329	0.0239	0.0048	124.96	0.01	0.14	0.00	0.35
	Rig	51 days	12	1	2	80	70%	514.5329	0.0239	0.0048	38.88	0.00	0.05	0.00	0.11
	Crane	51 days	12	1	2	335	20%	514.5329	0.0239	0.0048	46.51	0.00	0.05	0.00	0.13
											765.73	**0.04**	**0.89**	**0.01**	**2.12**
DP Pipelay Vessel	*03/27/16*	*thru*	*05/13/16*												
	Barge Generators	48 days	12	1	2	1400	0%	514.5329	0.0239	0.0048	0.00	0.00	0.00	0.00	0.00
	Weld Generators	48 days	16	1	3	550	0%	514.5329	0.0239	0.0048	0.00	0.00	0.00	0.00	0.00
	Lorelay	48 days	15	1	1	24490	50%	514.5329	0.0239	0.0048	8,000.63	0.37	9.27	0.07	22.11
	Anchor winches	48 days	12	1	0	600	50%	514.5329	0.0239	0.0048	0.00	0.00	0.00	0.00	0.00
	Gantry boom engine	48 days	8	1	0	335	20%	514.5329	0.0239	0.0048	0.00	0.00	0.00	0.00	0.00
	Gantry hoist engine	48 days	8	1	0	520	20%	514.5329	0.0239	0.0048	0.00	0.00	0.00	0.00	0.00
	Gantry Swing Engines	48 days	8	1	0	335	20%	514.5329	0.0239	0.0048	0.00	0.00	0.00	0.00	0.00
	Gantry generator	48 days	8	1	0	260	10%	514.5329	0.0239	0.0048	0.00	0.00	0.00	0.00	0.00
	Deck Cranes	48 days	12	1	1	335	20%	514.5329	0.0239	0.0048	21.89	0.00	0.03	0.00	0.06
	Air Compressor	48 days	12	1	2	180	80%	514.5329	0.0239	0.0048	94.09	0.00	0.11	0.00	0.26
	Line-up Station	48 days	18	1	0	120	90%	514.5329	0.0239	0.0048	0.00	0.00	0.00	0.00	0.00
	UT Station	48 days	18	1	0	60	80%	514.5329	0.0239	0.0048	0.00	0.00	0.00	0.00	0.00
	Coating Station	48 days	18	1	0	60	80%	514.5329	0.0239	0.0048	0.00	0.00	0.00	0.00	0.00
	3600 HP AHT Main engines	48 days	18	2	0	1200	75%	514.5329	0.0239	0.0048	0.00	0.00	0.00	0.00	0.00
	AHT Generator	48 days	12	2	0	120	70%	514.5329	0.0239	0.0048	0.00	0.00	0.00	0.00	0.00
	AHT Winch Engine	48 days	8	2	0	120	80%	514.5329	0.0239	0.0048	0.00	0.00	0.00	0.00	0.00
	135' crew boat main engines	48 days	8	1	4	600	40%	514.5329	0.0239	0.0048	209.08	0.01	0.24	0.00	0.58
	crew boat generator	48 days	12	1	2	80	70%	514.5329	0.0239	0.0048	36.59	0.00	0.04	0.00	0.10
	Supply Vessel Main Engines	48 days	12	1	2	1125	50%	514.5329	0.0239	0.0048	367.53	0.02	0.43	0.00	1.02
	Supply Vessel Generator	48 days	12	1	3	180	60%	514.5329	0.0239	0.0048	105.85	0.00	0.12	0.00	0.29
											8,835.65	**0.41**	**10.24**	**0.08**	**24.41**
Pipehaul Tug	*03/12/16*	*thru*	*05/16/16*												
	2400 HP Tug Main Engines	66 days	24	5	2	900	35%	514.5329	0.0239	0.0048	2,829.98	0.13	3.28	0.03	7.82
	Tug Generator	66 days	24	5	2	80	50%	514.5329	0.0239	0.0048	359.36	0.02	0.42	0.00	0.99
	Tug Winch	66 days	2	5	1	80	80%	514.5329	0.0239	0.0048	23.96	0.00	0.03	0.00	0.07
											3,213.30	**0.15**	**3.72**	**0.03**	**8.88**

Task	Equipment Type	Duration (days)	Op. Time (hr/day)	Qty. Vessels	Engines per vessel	Engine Rating (hp)	Load Factor	Exhaust Emission Factors a/			Project Emission Rate b/				
								CO_2 (g/hp-hr)	CH_4 (g/hp-hr)	N_2O (g/hp-hr)	CO_2 (tons)	CH_4 (tons)	CH_4 (ton CO_2e)	N_2O (tons)	N_2O (ton CO_2e)
Plowing Operations	*05/13/16*	*thru*	*08/05/16*												
	Barge Generators	58 days	12	1	2	1400	0%	514.5329	0.0239	0.0048	0.00	0.00	0.00	0.00	0.00
	Maersk Assister - Propulsion Bollar	58 days	24	1	1	6487	61%	481.7818	0.0239	0.0048	2,925.28	0.14	3.62	0.03	8.63
	Maersk Assister - Rauma 3-drum w	58 days	24	1	1	1800	0%	514.5329	0.0239	0.0048	0.00	0.00	0.00	0.00	0.00
	Anchor winches	58 days	12	1	0	600	50%	514.5329	0.0239	0.0048	0.00	0.00	0.00	0.00	0.00
	Gantry boom engine	58 days	8	1	0	335	20%	514.5329	0.0239	0.0048	0.00	0.00	0.00	0.00	0.00
	Gantry hoist engine	58 days	8	1	0	520	20%	514.5329	0.0239	0.0048	0.00	0.00	0.00	0.00	0.00
	Gantry Swing Engines	58 days	8	1	0	335	20%	514.5329	0.0239	0.0048	0.00	0.00	0.00	0.00	0.00
	Gantry generator	58 days	8	1	0	260	10%	514.5329	0.0239	0.0048	0.00	0.00	0.00	0.00	0.00
	Deck Crane	58 days	12	1	0	180	61%	514.5329	0.0239	0.0048	0.00	0.00	0.00	0.00	0.00
	Plough Winch	58 days	8	2	0	120	80%	514.5329	0.0239	0.0048	0.00	0.00	0.00	0.00	0.00
	Air Compressor	58 days	12	1	2	180	61%	514.5329	0.0239	0.0048	86.69	0.00	0.10	0.00	0.24
	3600 HP AHT Main engines	58 days	18	2	0	1200	75%	514.5329	0.0239	0.0048	0.00	0.00	0.00	0.00	0.00
	AHT Generator	58 days	12	2	0	120	70%	514.5329	0.0239	0.0048	0.00	0.00	0.00	0.00	0.00
	AHT Winch Engine	58 days	8	2	0	120	80%	514.5329	0.0239	0.0048	0.00	0.00	0.00	0.00	0.00
	135' crew boat main engines	58 days	8	1	4	600	40%	514.5329	0.0239	0.0048	252.64	0.01	0.29	0.00	0.70
	Crew boat generator	58 days	12	1	2	80	70%	514.5329	0.0239	0.0048	44.21	0.00	0.05	0.00	0.12
	Supply Vessel Main Engines	58 days	12	1	2	1,125	50%	514.5329	0.0239	0.0048	444.10	0.02	0.51	0.00	1.23
	Supply Vessel Generator	58 days	12	1	3	180	60%	514.5329	0.0239	0.0048	127.90	0.01	0.15	0.00	0.35
											3,880.82	**0.19**	**4.73**	**0.04**	**11.27**
DPDSV	*Pre-lay investigations*	*03/08/16*	*thru*	*03/23/16*											
	Install crossings	*03/12/16*	*thru*	*04/12/16*											
	Lower plow transitions	*08/13/16*	*thru*	*09/06/16*											
	Tie-in collocated Y assembly	*08/03/16*	*thru*	*08/13/16*											
	System hydrotest, dewater and dry	*09/09/16*	*thru*	*10/13/16*											
Purge and pack Mainline, laterals and PLEMS		*10/13/16*	*thru*	*10/24/16*											
	Air Compressor	129 days	24	1	2	180	35%	514.5329	0.0239	0.0048	221.25	0.01	0.26	0.00	0.61
	Dive compressors	129 days	24	1	2	80	35%	514.5329	0.0239	0.0048	98.33	0.00	0.11	0.00	0.27
	Crane	129 days	24	1	2	335	35%	514.5329	0.0239	0.0048	411.78	0.02	0.48	0.00	1.14
	Diving equipment	129 days	24	1	1	250	35%	514.5329	0.0239	0.0048	153.65	0.01	0.18	0.00	0.42
	Main Engines	129 days	24	1	2	3000	35%	514.5329	0.0239	0.0048	3,687.55	0.17	4.27	0.03	10.19
	Generator	129 days	24	1	3	250	35%	514.5329	0.0239	0.0048	460.94	0.02	0.53	0.00	1.27
	Bow Thruster	129 days	24	1	0	950	70%	514.5329	0.0239	0.0048	0.00	0.00	0.00	0.00	0.00
	Stern Thruster	129 days	24	1	0	950	70%	514.5329	0.0239	0.0048	0.00	0.00	0.00	0.00	0.00
											5,033.50	**0.23**	**5.83**	**0.05**	**13.91**
Dive Support Vessel															
	Install hot taps and SSTI	*02/05/16*	*thru*	*03/12/16*											
	System Hydrotest, Dewater and Dry	*09/09/16*	*thru*	*10/13/16*											
Purge and pack Mainline, laterals and PLEMS		*10/13/16*	*thru*	*10/24/16*											
	Commissioning support	*10/24/16*	*thru*	*12/03/16*											
	Generators	123 days	24	1	3	800	35%	514.5329	0.0239	0.0048	1,406.41	0.07	1.63	0.01	3.89
	Air Compressor	123 days	24	1	2	180	35%	514.5329	0.0239	0.0048	210.96	0.01	0.24	0.00	0.58
	Dive compressors	123 days	24	1	2	80	35%	514.5329	0.0239	0.0048	93.76	0.00	0.11	0.00	0.26
	Crane	123 days	24	1	2	335	20%	514.5329	0.0239	0.0048	224.36	0.01	0.26	0.00	0.62
	Tug Main Engines	123 days	24	1	2	300	35%	514.5329	0.0239	0.0048	351.60	0.02	0.41	0.00	0.97
	Tug Generator	123 days	24	1	2	60	50%	514.5329	0.0239	0.0048	100.46	0.00	0.12	0.00	0.28
											2,387.55	**0.11**	**2.77**	**0.02**	**6.60**

Task	Equipment Type	Duration (days)	Op. Time (hr/day)	Qty. Vessels	Engines per vessel	Engine Rating (hp)	Load Factor	Exhaust Emission Factors a/			Project Emission Rate b/				
								CO_2 (g/hp-hr)	CH_4 (g/hp-hr)	N_2O (g/hp-hr)	CO_2 (tons)	CH_4 (tons)	CH_4 (ton CO_2e)	N_2O (tons)	N_2O (ton CO_2e)
150' Survey Vessel	*03/01/16*	*thru*	*10/31/16*												
	Main Engines	245 days	24	1	2	350	35%	514.5329	0.0239	0.0048	817.07	0.04	0.95	0.01	2.26
	Generators	245 days	24	1	2	80	50%	514.5329	0.0239	0.0048	266.80	0.01	0.31	0.00	0.74
											1,083.87	**0.05**	**1.26**	**0.01**	**2.99**
Local Fishing Vessels for support, patrol	*03/01/16*	*thru*	*10/31/16*												
	Main Engines	245 days	24	2	2	350	35%	514.5329	0.0239	0.0048	1,634.15	0.08	1.89	0.02	4.52
	Generators	245 days	24	2	2	80	50%	514.5329	0.0239	0.0048	533.60	0.02	0.62	0.00	1.47
											2,167.74	**0.10**	**2.51**	**0.02**	**5.99**
Dewater/Dry/Precommission Spread	*09/09/15*	*thru*	*12/03/15*												
	Air compressors	86 days	24	1	6	240	50%	514.5329	0.0239	0.0048	842.87	0.04	0.98	0.01	2.33
	Pumps	86 days	24	1	4	240	50%	514.5329	0.0239	0.0048	561.91	0.03	0.65	0.01	1.55
	Light plant	86 days	24	2	1	60	50%	514.5329	0.0239	0.0048	70.24	0.00	0.08	0.00	0.19
	Crane	86 days	24	1	1	335	20%	514.5329	0.0239	0.0048	78.43	0.00	0.09	0.00	0.22
											1,553.45	**0.07**	**1.80**	**0.01**	**4.29**
Supplemental Lowering and Imported Backfill Operation															
Hopper Tug	08/15/16	thru	09/05/16												
	2400 HP Tug Main Engines	22 days	24	4	2	900	70%	514.5329	0.0239	0.0048	1,509.32	0.07	1.75	0.01	4.17
	Tug Generator	22 days	24	4	2	80	50%	514.5329	0.0239	0.0048	95.83	0.00	0.11	0.00	0.26
	Tug Winch	22 days	24	4	1	80	15%	514.5329	0.0239	0.0048	14.37	0.00	0.02	0.00	0.04
											1,619.53	**0.08**	**1.88**	**0.02**	**4.47**
DP Jet/Tremie Vessel	07/18/16	thru	09/05/16	14 days at port converting to Tremie											
	Jet Barge Generator	36 days	24	1	1	425	70%	514.5329	0.0239	0.0048	145.79	0.01	0.17	0.00	0.40
	Jet Barge sled winch	36 days	8	1	1	240	50%	514.5329	0.0239	0.0048	19.60	0.00	0.02	0.00	0.05
	Crane	36 days	24	1	1	365	70%	514.5329	0.0239	0.0048	125.21	0.01	0.15	0.00	0.35
	Jet Barge jetting pumps	36 days	22	1	2	1840	75%	514.5329	0.0239	0.0048	1,239.80	0.06	1.44	0.01	3.43
	Jet Barge air compressor	36 days	22	1	1	900	75%	514.5329	0.0239	0.0048	303.21	0.01	0.35	0.00	0.84
	Dive compressors	36 days	12	1	2	80	70%	514.5329	0.0239	0.0048	27.44	0.00	0.03	0.00	0.08
	Port Bow Thruster	36 days	24	1	1	1950	70%	514.5329	0.0239	0.0048	668.90	0.03	0.78	0.01	1.85
	Stbd Thruster	36 days	24	1	1	1950	70%	514.5329	0.0239	0.0048	668.90	0.03	0.78	0.01	1.85
	Port Stern Thruster	36 days	24	1	1	1950	70%	514.5329	0.0239	0.0048	668.90	0.03	0.78	0.01	1.85
	Stbd Stern Thruster	36 days	24	1	1	1950	70%	514.5329	0.0239	0.0048	668.90	0.03	0.78	0.01	1.85
											4,536.66	**0.21**	**5.26**	**0.04**	**12.54**
110' Survey Vessel	08/15/16	thru	09/05/16												
	Main Engines	22 days	24	1	2	350	65%	514.5329	0.0239	0.0048	136.26	0.01	0.16	0.00	0.38
	Generators	22 days	24	1	2	80	50%	514.5329	0.0239	0.0048	23.96	0.00	0.03	0.00	0.07
											160.22	**0.01**	**0.19**	**0.00**	**0.44**
DWP Installation per APL Schedule															
Heavy Lift Vessel (HLV)															
HLV Transit to field and preparation	*06/12/16*	*thru*	*06/14/16*												
	Main Engines	3 days	24	1	2	11760	80%	514.5329	0.0239	0.0048	768.38	0.04	0.89	0.01	2.12
	shaft generators	3 days	12	1	2	5000	80%	514.5329	0.0239	0.0048	163.35	0.01	0.19	0.00	0.45

Task	Equipment Type	Duration (days)	Op. Time (hr/day)	Qty. Vessels	Engines per vessel	Engine Rating (hp)	Load Factor	Exhaust Emission Factors a/			Project Emission Rate b/				
								CO_2 (g/hp-hr)	CH_4 (g/hp-hr)	N_2O (g/hp-hr)	CO_2 (tons)	CH_4 (tons)	CH_4 (ton CO_2e)	N_2O (tons)	N_2O (ton CO_2e)
HLV Installation Activities *06/15/16*		*thru*	*07/08/16*												
	Azimuth Thruster forward	24 days	24	1	1	2280	75%	514.5329	0.0239	0.0048	558.65	0.03	0.65	0.01	1.54
	Bow Thruster	24 days	24	1	2	1950	75%	514.5329	0.0239	0.0048	955.58	0.04	1.11	0.01	2.64
	Shaft generators	24 days	12	1	2	5000	80%	514.5329	0.0239	0.0048	1,306.77	0.06	1.51	0.01	3.61
											3,752.72	**0.17**	**4.35**	**0.03**	**10.37**
Assist Installation Vessel/Dive Support Vessel (DSV															
DSV Transit to field and preparation *07/04/16*		*thru*	*07/06/16*												
	Main Engines	3 days	8	1	2	3000	70%	514.5329	0.0239	0.0048	57.17	0.00	0.07	0.00	0.16
	Generator	3 days	16	1	3	250	70%	514.5329	0.0239	0.0048	14.29	0.00	0.02	0.00	0.04
DSV Installation Activities *07/06/16*		*thru*	*08/29/16*												
	Air Compressor	55 days	12	1	2	180	80%	514.5329	0.0239	0.0048	107.81	0.00	0.12	0.00	0.30
	Dive compressors	55 days	12	1	2	80	70%	514.5329	0.0239	0.0048	41.93	0.00	0.05	0.00	0.12
	Crane	55 days	12	1	2	335	20%	514.5329	0.0239	0.0048	50.16	0.00	0.06	0.00	0.14
	Diving equipment	55 days	24	1	1	250	60%	514.5329	0.0239	0.0048	112.30	0.01	0.13	0.00	0.31
	Main Engines	55 days	8	1	2	3000	70%	514.5329	0.0239	0.0048	1,048.14	0.05	1.21	0.01	2.90
	Generator	55 days	16	1	3	250	70%	514.5329	0.0239	0.0048	262.04	0.01	0.30	0.00	0.72
	Bow Thruster	55 days	16	1	2	950	70%	514.5329	0.0239	0.0048	663.82	0.03	0.77	0.01	1.83
	Stern Thruster	55 days	16	1	1	950	70%	514.5329	0.0239	0.0048	331.91	0.02	0.38	0.00	0.92
											2,689.57	**0.12**	**3.12**	**0.02**	**7.43**
										Total:	**41,680.33**	**1.94**	**48.54**	**0.39**	**115.72**
									Total GHG emissions (Short tons CO_2 e):				**41,845**		

Notes:

(1) CO_2 emission factors from 'Current Methodologies in Preparing Mobile Source Port-Related Emission Inventories'

(2) Project Emissions Rate = Engine Rating (hp) x Load Factor x Engines per Vessel x Total Operation (hr/project) x Exhaust Emission Factor (g/hp-hr) / 453.6 grams/lb / 2000 lb/ton
CH4 and N2O emission factors from 40 CFR 98, Subpart C - converted using 32% efficiency of engines
Emissions (tons) of CH4 and N2O converted to equivalent emissions of CO2 (ton CO2e) by multiplying by global warming potentials of 25 and 298, respectively.

Table 4.10-14. Summary of Operational Emissions (GHGs)

Operational GHG Emission Source	Potential GHG Emissions (tpy)
LNGRV Boilers	146,740
LNGRV Engines	49,821
LNGRV GCU	3,016
Total	**199,578**

4.11 Noise

4.11.1 Introduction

This section addresses potential impacts on airborne and underwater noise associated with the proposed Project and alternatives, including the No Action Alternative. Noise-producing activities associated with the proposed Project include buoy installation (i.e., impact pile driving, if in the unlikely event geotechnical conditions preclude use of suction anchors), proposed Mainline installation, construction vessel transit, LNGRV transit, and regasification. In order to predict received sound levels resulting from the noted activities associated with the proposed Project, acoustic propagation modeling was conducted by the Applicant (Appendix M). The acoustic analysis modeled various sound sources associated with the proposed Project and evaluated sound propagation and attenuation to determine the received sound levels within both the airborne and underwater environments. The received airborne noise impacts were evaluated at noise-sensitive areas (NSAs), while the received underwater noise impacts were evaluated with respect to marine mammals, sea turtles, and fish species within proximity to the proposed Project.

Construction of the proposed Project would result in an incremental increase in onshore sound level; however, impacts would be short-term and are not expected to be significant. All sound sources from the construction phase of the proposed Project are considered to have a minor impact on species of marine mammals, turtles, and fish; however, impacts are expected to be short-term and “harassment” (TTS) for all species is expected to be minor. Operation of the proposed Project would result in negligible noise impacts on onshore NSAs due to the distance from shore. Additional trips made by the support vessel would be within existing navigation channels and the noise produced would not exceed that of existing vessel traffic. Construction of the proposed Project would have insignificant impacts on species of marine mammals, turtles, and fish relative to the “harm” criteria (PTS), as the greatest noise impact of underwater sound (use of driven pilings as a mooring anchoring system) has been removed from the proposed Project scope. Decommissioning of the proposed Project would result in similar impacts to those from the construction and operation phases of the proposed Project.

4.11.2 Impacts of Construction

Sources of construction noise associated with the proposed Project include buoy installation (i.e., impact pile driving, if in the unlikely event geotechnical conditions preclude use of suction anchors), proposed Mainline installation, and construction vessel transit. Proposed Project construction would take approximately nine months to complete. Airborne and underwater noise resulting from each of these construction activities associated with the proposed Project are discussed in the following subsections.

4.11.2.1 Airborne Construction Noise Impacts

Airborne construction noise impacts are primarily generated by vessel movements and activity. Vessels are complex sources of airborne radiated noise with many single sources contributing to the overall sound emission, each one with unique characteristics. Different operating modes can be characterized by different sources onboard. For instance, for moving vessels the most dominant sound sources include main propulsion engines and their related exhaust discharges.

Construction noise impacts along the proposed Mainline would vary with activity and distance from shore, but would be short-term and minor at any location as the construction operations move along the proposed Mainline. Airborne noise associated with construction activities that are within hearing distance of onshore receptors would be similar to and consistent with the noise already generated by regional vessel traffic and standard onshore-offshore construction noise.

During construction, operating barges, tugs, and large diesel engine support vessels would be expected to be dominant noise sources. Temporary noise would be produced by diesel powered construction cranes, compressors, generators, welding machines, and other miscellaneous tools. Table 4.11-1 lists the offshore construction equipment and the corresponding sound pressure level that would be expected 3.0 feet and 3.1 miles away, with all equipment operating for a similar project (i.e., Neptune LNG) (USCG 2006a). These sound pressure levels are expected to be generally representative of the proposed Project.

Table 4.11-1. Noise Emission Sources for Vessels Used During Construction – Typical Vessel Class

Equipment Type	Engine Size (hp)	SPL (dBA) 1 meter (3 feet)	SPL (dBA) 3.1 miles
Derrick Barge	4,000	110	36
Support Tug	6,140	105	31
Diver-Support Vessel	1,800	103	29
Supply Vessel	4,000	112	38
Crew/Survey Vessel	1,200	92	18
DP Pipelay Vessel	24,000	138	64
Total (All Equipment combined)	**---**	**138**	**64**

Notes:
Source: USCG 2006a
Operation of the thrusters used to dynamically position the larger vessels could increase sound source levels by an additional 5 to 10 dB (USCG 2006b).
Key:
dBA = decibels, measured on A-weighted scale
hp = horsepower
SPL = sound pressure level

Eight suction anchors, approximately 26 feet in diameter and 30 feet in length, would be used to secure each STL Buoy. If necessary, driven piles could be used as an alternative to the suction anchors in the unlikely event geotechnical conditions preclude use of suction anchors. Pile driving, if required, from the hydraulic hammer would likely be the greatest sound source during proposed Project construction. Pile driving is considered an impulsive noise source and impulsive noise sources are short in duration (less than one second) and characterized by a rapid rise time. The sound source level for pile driving was estimated to be 154 dB re 20 µPa (peak pressure) for the purpose of airborne noise modeling. Acoustic modeling of pipe laying, vessel activity and pile driving was completed using a spherical spreading propagation model and the resulting received airborne sound levels at specified distances to onshore NSAs were calculated. Results are presented in Table 4.11-2.

Table 4.11-2. Estimated Received Airborne Sound Levels by Construction Activity at NSA Location (dBA)

Construction Activity	Distance to NSA Shoreline Location (miles)	Received Sound Level (Summer/Winter) (dBA)
Pipe Laying	2.2	65 / 68
Vessel Activity*	2.2	53 / 55
Pile Driving	21	26 / 46

Note: * Combined noise for all vessels operating at the same time, including thrusters.

Helicopters may be used for transport of personnel during emergencies that may occur during the construction phase of the proposed Project. Such flights would be at higher altitudes and would be circuitous with zero/minimal hover time. The Federal Aviation Administration (FAA) regulates helicopter flight patterns. Because of noise concerns, FAA Circular 91-36D encourages pilots making flights near NSAs to fly at altitudes higher than minimum altitudes (USDOT 2004). Pilots operating noise-producing aircraft over NSAs would make every effort to fly not less than 2,000 feet aboveground level, weather permitting. Departure from or arrival to an airport, climb after take-off, and descent for landing would be conducted so as to avoid prolonged flight at low altitudes near NSAs. In addition, guidelines and regulations issued by NOAA Fisheries under the authority of the MMPA include provisions specifying helicopter pilots to maintain an altitude of at least 1,000 feet within sight of marine mammals. With these flight patterns, impacts from construction-related helicopter noise would remain minimal, short-term and intermittent.

As presented in Section 3.12 and Table 3.12-8, the estimated ambient airborne sound levels onshore ranged from 45 A-weighted decibel (dBA) to 55 dBA in the nighttime and daytime hours, respectively. Therefore, depending on the activity and the time of day, there may be an incremental increase in onshore sound level generated by the proposed Project construction. Unavoidable noise impacts due to construction activity would be short-term and are not expected to be significant.

4.11.2.2 Underwater Construction Noise Impacts

Underwater construction noise impacts associated with the proposed Project were also analyzed. This section summarizes the underwater modelling results for the construction phase of the proposed Project, in the form of threshold distances where the relevant criterion is exceeded. Tables 4.11-3 and 4.11-4 provide the horizontal threshold distances from the underwater source location to the isopleth corresponding to criteria levels for cetaceans, sea turtles, and fish for the construction phase of the proposed Project. Where multiple locations have been modelled, the highest threshold distance from all locations is presented.

In addition to vessel traffic, marine species (i.e., marine mammals and sea turtles) would likely be disturbed as a result of over-flights of helicopters supporting offshore construction activities. The Applicant would abide by the rules and regulations set forth by the FAA (FAA Circular 91-36D) and NOAA Fisheries (MMPA). With these flight patterns, impacts from construction-related helicopter noise would be expected to be minor, short-term and intermittent.

Because impact piling was assessed to have the highest potential for sound generation (over the widest area) associated with the proposed Project, the decision was made that the anchors would be installed at the proposed Project using suction anchors. All sound sources from the construction phase of the proposed Project are considered to have a minor impact on species of marine mammals, sea turtles, and fish. Because the behavioral response of marine mammals, sea turtles, and fish to a perceived marine sound depends on a range of factors, including: (1) the SPL; (2) frequency, duration, and novelty of the sound; (3) the physical and behavioral state of the animal at the time of perception; and (4) the ambient acoustic features of the environment (Hildebrand 2004), it is more difficult to predict behavioral shifts due to anthropogenic sounds. The radiation of sound to marine waters during the construction phase of the proposed Project would be within the immediate vicinity of the proposed Project and effects would be expected to be short-term, hence “harassment” (TTS) for all species would be expected to be minor. Although species abundance varies by season in the ROI, the likelihood of “harm” (PTS) or “harassment” (TTS) from the proposed Project to individuals or species due to underwater sound is unlikely because of the transient and seasonal nature of the species moving through the ROI (see Section 4.11.6), and the ability of animals to move away from sound sources.

4.11.3 Impacts of Operation

Impacts of proposed Project operation were also reviewed. Proposed Project operational activities include those associated with LNGRV transiting and regasification. The Proposed Port would be operational all year long; however, LNGRV and regasification activities would predominantly occur during winter during the peak of the heating season. Underwater noise is anticipated to be produced by the LNGRVs during the approach, mooring, maneuvering on the buoy and regasification procedures. A standby support vessel would also be located in close proximity to the LNGRVs during mooring and regasification. The highest-energy source of underwater sound during the operation phase would be from vessel transits near the proposed Port and from mooring activities. Vessel sounds during operations would result from propeller cavitation and propulsion, in addition to flow noise from water dragging across the hull and bubbles breaking in the wake. The dominant sound source from vessels would be propeller cavitation with noise intensity dependent upon size and speed of the vessel. Noise impacts from LNGRVs would be expected to be comparable to those generated by common and existing vessel traffic in the New York Bight. Both airborne and underwater operational acoustic impacts are presented in the following sections.

Table 4.11-3. Summary of Relevant Construction Phase Threshold Distances for Cetaceans

Activity	Month	LF Cetaceans		MF Cetaceans		HF Cetaceans	
		PTS Threshold [m]	TTS Threshold [m]	PTS Threshold [m]	TTS Threshold [m]	PTS Threshold [m]	TTS Threshold [m]
Suction piling	May	124	3,110	<20 a/	438	209	3,790
	Oct	121	2,850	<20 a/	400	194	3,610
Lateral pipeline installation	May	247	4120	168	375	193	3,140
	Oct	238	3630	168	349	191	2,920
Lateral pipeline lowering and backfilling	May	288	1,950	<20 a/	288	288	1,060
	Oct	288	1,790	<20 a/	290	288	990
Mainline installation	May	343	4,820	219	479	262	3,780
	Oct	327	4,510	219	453	260	3,580
Mainline lowering and backfilling	May	327	2,190	<20 a/	327	326	1,350
	Oct	338	2,040	<20 a/	327	326	1,260
Pipeline lowering by jetting	May	165	3,440	<20 a/	529	270	4,090
	Oct	143	3,230	<20 a/	494	253	3,890

Notes:
a/ Levels corresponding to the relevant noise criterion are predicted to occur within threshold distances of less than 20 meters.
LF - low frequency
MF - mid frequency
HF - high frequency

Table 4.11-4. Summary of Relevant Construction Phase Threshold Distances for Seals, Sea Turtles, and Fish

Activity	Month	Seals		Sea Turtles		Fish	
		PTS Threshold [m]	TTS Threshold [m]	Harm Threshold [m]	Harassment Threshold [m]	Harm Threshold [m]	Harassment Threshold [m]
Suction Piling	May	157	1,660	N/A b/	<20 a/	1,400	N/A c/
	Oct	150	1,510		<20 a/	900	
Lateral pipeline installation	May	274	2190		<20 a/	850	
	Oct	260	1980		<20 a/	1050	
Lateral pipeline lowering and backfilling	May	288	990		<20 a/	1050	
	Oct	290	895		<20 a/	650	
Mainline installation	May	379	2590		<20 a/	1500	
	Oct	367	2440		<20 a/	1400	
Mainline lowering and backfilling	May	327	1220		<20 a/	900	
	Oct	328	1140		<20 a/	850	
Pipeline lowering by jetting	May	220	1920		<20 a/	1050	
	Oct	205	1780		<20 a/	1050	

Notes:
a/ Both $_c$SEL and dB_{peak} noise levels for impact piling were assessed against the NOAA Fisheries criteria for cetaceans. Levels corresponding to the relevant noise criterion are predicted to occur within threshold distances of less than 20 meters.
b/ Since the harm criterion for turtles is a dB_{peak} criterion, and threshold distances in terms of dB_{peak} are not available, distances could not be calculated for the harm threshold for turtles.
c/ Since no data on behavioral shifts (harassment) in Atlantic sturgeon due to noise from similar construction activity exists, harassment distance for Atlantic sturgeon was not estimated.

4.11.3.1 Airborne Deepwater Port Operations Noise Impacts

Due to the approximately 16.1 nautical mile distance from shore, noise generated by the proposed Project operations would be expected to have negligible noise impacts on onshore NSAs. Support vessel trips would originate from existing facilities onshore and would follow established routes and speed restrictions in nearshore waters, reducing noise effects. Machinery noise generated during normal proposed Port operations would vary in duration and intensity and is assumed to be similar to noise generated by fixed offshore oil and gas structures.

The main source of noise would be due to vaporization of the LNG at the STL Buoy. Noise levels in the offshore area would be elevated when more than one LNGRV is on an STL Buoy (separated by a distance of approximately 1.0 nautical mile) at the same time. A Safety Zone would be established at 1,640 feet around each buoy that excludes all vessel traffic, and an NAA of 3,281 feet around each buoy would restrict recreation and commercial vessels from being close to the LNGRVs, which would lessen the impact on transient, non-Project-related receptors (i.e., other boats and ships) from operation noises.

Routine operations of the proposed Project would result in noise due to normal shipboard equipment associated with the LNGRV and support vessel. Table 4.11-5 shows the typical equipment on vessels that would be noise contributors during routine operations, along with associated engine horsepower ratings and auxiliary equipment that might be expected based on similar projects (USCG 2006a; 2009).

Table 4.11-5. Estimated Source Sound Levels from Equipment Used During Routine Operations on the LNG Regasification Vessel

Equipment a/	Horsepower	Sound Level in A-weighted Decibels (dBA)		
		3 feet b/	Proposed No Anchor Area 0.6 mile	3 miles
Air Compressor	125	98	38	24
Gas Compressor	1,200	108	48	34
Boil-off Gas Compressor	720	108	48	34
LNG Tank Pump	310	97	37	23
LNG Sendout Pump	2,060	97	37	23
Mobile Crane	100-450	109	49	35
Crane	274	108	48	34
Jib Crane	550	105	45	31
Total (all equipment combined)		**115**	**55**	**41**

Sources: USCG 2006a and USCG 2009.
Notes:
a/ One emergency generator and a firewater pump also would be onboard each vessel. The firewater pump would be powered from the emergency generator. Both pieces of equipment are not part of normal vessel operations and would not be exercised at the buoy; therefore, sound emissions for this equipment are not included.
b/ Estimated sound emission levels do not include attenuation due to vessel structure.
Key:
dBA = decibels, measured on A-weighted scale
LNG = liquefied natural gas

An additional source of noise would be LNGRV foghorns, which would generate warning signals at a sound level of 146 dBA (100 Hz) at 1 meter, as required by USCG regulation (33 CFR 67.10). This level is required in order for the foghorn to be audible at 1.1 nautical miles. In addition, the device must sound a 2-second blast every 20 seconds during low visibility conditions (less than 1.1-nautical mile visibility). Foghorn operation would be intermittent and infrequent and at this distance would be inaudible at onshore receptors. In addition, during operations, the proposed Project's support vessel would transit near shore and produce perceivable airborne sound. These additional trips would be within existing navigation channels and the noise produced would not exceed that of existing vessel traffic.

4.11.3.2 Underwater Deepwater Port Operations Noise Impacts

Underwater operational noise impacts associated with the proposed Project were also analyzed. Activities such as an LNGRV transiting, docking, and weathervaning were included in the analysis. Operational support vessels and regasification were also reviewed. This section summarizes the JASCO underwater modelling results for the operation phase of the proposed Project, in the form of threshold distances where the relevant criterion is exceeded. Tables 4.11-6 and 4.11-7 provide the horizontal threshold distances from the underwater source location to the isopleth corresponding to criteria levels for cetaceans, seals, sea turtles, and fish for the operational phase of the proposed Project. Where multiple locations have been modeled, the highest threshold distance from all locations is presented. Transit and mooring activities were split for per-pulse results, and these activities were combined for $_c$SEL results. To assess the peak and root mean square (RMS) levels, the threshold distances from mooring activities were adopted, as mooring produces higher noise levels than transit activities.

Table 4.11-6. Summary of Relevant Operation Phase Threshold Distances for LF, MF, and HF Sensitive Cetaceans

Activity	Month	LF Cetaceans		MF Cetaceans		HF Cetaceans	
		PTS Threshold [m]	TTS Threshold [m]	PTS Threshold [m]	TTS Threshold [m]	PTS Threshold [m]	TTS Threshold [m]
LNGRV transit and mooring	Feb	270	16,300	270	ND	270	35,000
	May	270	18,800	270	ND	270	36,300
	Oct	270	22,500	270	ND	270	37,300
	Dec	270	18,700	270	ND	270	36,600
LNGRV weathervaning	Feb	244	4,550	<20 a/	384	157	3,320
	May	239	4,020	<20 a/	375	152	3,090
	Oct	228	3,540	<20 a/	344	147	2,860
	Dec	238	4,300	<20 a/	374	154	3,180
Regasification	Feb	<20 a/	729	<20 a/	705	21	776
	May	<20 a/	728	<20 a/	705	21	771
	Oct	<20 a/	725	<20 a/	705	21	758
	Dec	<20 a/	728	<20 a/	705	21	766

Notes:
a/ Levels corresponding to the relevant noise criterion are predicted to occur within threshold distances of less than 20 meters according to the JASCO tabulated results.
ND=No accurate data for MF cetaceans available for TTS.

Table 4.11-7. Summary of Relevant Operation Phase Threshold Distances for Seals, Sea Turtles, and Fish

Activity	Month	Seals		Sea Turtles		Fish	
		PTS Threshold [m]	TTS Threshold [m]	Harm Threshold [m]	Harassment Threshold [m]	Harm Threshold [m]	Harassment Threshold [m]
LNGRV transit and mooring	Feb	270	914	N/A a/	240	423 b/	N/A d/
	May	270	903		240	410 b/	
	Oct	270	779		240	385 b/	
	Dec	270	861		240	403 b/	
LNGRV weathervaning	Feb	281	2,380		<20 c/	1,800	
	May	274	2,240		<20 c/	1,700	
	Oct	251	1,990		<20 c/	1,700	
	Dec	268	2,290		<20 c/	1,800	
Regasification	Feb	<20 c/	717		<20 c/	717	
	May	<20 c/	717		<20 c/	717	
	Oct	<20 c/	717		<20 c/	717	
	Dec	<20 c/	717		<20 c/	717	

Notes:
a/ The harm criterion for turtles is a dB_{peak} criterion. Since threshold distances in terms of dB_{peak} have not been provided, no predictions can be made.
b/ Threshold distances were not predicted for levels less than 190 dB $_c$SEL for fish during LNGRV transit and mooring; therefore, the harm threshold distance for the 190 dB level was used.
c/ Levels corresponding to the relevant noise criterion are predicted to occur within threshold distances of less than 20 meters.
d/ Because no data on behavioral shifts (harassment) in Atlantic sturgeon due to noise from similar construction activity exists, harassment distance for Atlantic sturgeon was not estimated.

Regarding operation, all sound sources are considered to have minor consequences to species of marine mammals, sea turtles, and fish relative to harm criteria (PTS). The radiation of sound to marine waters during operations is expected to be short-term, hence "harassment" (TTS) for all species is considered minor. Although species abundance varies by season and species in the ROI, the likelihood of "harm" (PTS) or "harassment" (TTS) from the proposed Project to individuals or species due to underwater sound is unlikely because of the transient and seasonal nature of the species moving through the ROI, and the ability of animals to move away from sound sources. For instance, as shown in Table 4.11-7, noise levels predicted for LNGRV transit and mooring activities show the TTS criterion to be exceeded for HF cetaceans (harbor porpoises) within 38 km of the source, and PTS threshold to be exceeded for HF cetaceans within 270 meters. In particular, the 38 km distance seems fairly large; however, both the TTS and PTS threshold distances are for 24 hours of continuous exposure. Therefore, the likelihood of the LNGRV transit causing TTS or PTS in harbor porpoises is expected to be rare. The overall risk level to harbor porpoises for LNGRV transit and mooring is low for PTS and TTS occurrence.

Overall, the greatest noise impact of underwater sound to protected species was assessed to be the use of driven pilings as a mooring anchoring system. However, this source of underwater noise was removed from the proposed Project scope and was replaced with suction piling. However, if necessary, driven piles could be used as an alternative to the suction anchors in the unlikely event geotechnical conditions preclude use of suction anchors. All other sound sources from the construction and operations phase of the proposed Project were considered to have insignificant impacts on species of marine mammals, turtles, and fish relative to the "harm" criteria (PTS). The radiation of sound to marine waters during the construction and operations phase of the proposed Project would be within the immediate vicinity of the proposed Project, hence "harassment" (TTS) for all species was also considered insignificant. Underwater sound generated from planned maintenance, decommissioning and unplanned events would be similar to those from the construction and operation phases of the proposed Project and as such were not modeled as unique sound sources.

4.11.3.3 Planned and Unplanned Maintenance and Repair

The results of the maintenance and repairs modeled underwater analysis (LGL and JASCO 2005; JASCO 2006) for construction vessels for a similar project (i.e., Neptune LNG) determined that pipe repair activities would generate continuous but transient sound and would likely result in variable sound levels during the repair period (estimated to be one to four weeks). Underwater noise impacts related to maintenance would generally be related to small vessels. According to BOEM, underwater noise from small vessels ranges from 145 to 170 dB at 1 meter. According to the USCG, underwater noise associated with vessels with an engine between 1,200 hp and 6,140 hp ranges from 92 to 112 dB at 1 meter (Table 4.11-1). Non-continuous noise associated with small vessel movement and positioning is below the zone of injury as given in the MMPA for Level A and Level B harassment; therefore, impact on marine mammals from planned maintenance would be minimized. At a maximum, every 7 years an intelligent pig would be run down the proposed Mainline and pipeline laterals to assess the condition of the proposed Mainline system. This particular activity would require several large construction-type vessels and several weeks to complete. According to BOEM, noise associated with larger vessels can range from 169 to 198 dB at 1 meter (MMS 2004b; Hildebrand 2009; NRC 2003).

Major repairs to the proposed Project would likely generate additional underwater sound in the area. During repair of the proposed Project, underwater sound levels would be temporarily elevated. Examples of major repairs are damage to the riser or umbilical line and their possible replacement, damage to the proposed Mainline system and manifolds, or anchor chain replacement. These types of repairs could take up to two to four weeks. To provide a worst-case scenario, it was assumed that the noise generated by maintenance and repair activities would be similar to that generated during the construction of the facilities (LGL and JASCO 2005). The results of the Neptune LNG noise modeling for the pipeline route indicates that the 120-dB contour during pipeline repair activities would extend out 3.5 to 4.1 nautical

miles encompassing an area from 35 to 44 nautical square miles. These modeling results are also expected to be a representative worst-case scenario of maintenance and repair activities for the proposed Project. This worst-case scenario is anticipated to occur no more than once per five-year period, lasting no more than 28 days. These underwater sound levels could cause some species to temporarily disperse from or avoid repair areas, but they are expected to return shortly after the completion of repairs.

4.11.4 Impacts of Decommissioning

Potential noise impacts associated with proposed Project decommissioning would be expected to be similar to those generated during construction as discussed below.

4.11.4.1 Decommissioning Airborne Noise Impacts

Direct impacts on existing sound levels from decommissioning activities would mainly involve vessel engine operation noise. It would be expected that noise impacts from decommissioning would be limited to the immediate vicinity of the proposed Project and would be similar to construction noise. Decommissioning would result in temporary noise due to diesel-powered vehicles, cranes, compressors, generators and other miscellaneous tools.

4.11.4.2 Decommissioning Underwater Noise Impacts

Noise generated by decommissioning vessels, machinery, and activities would create a temporary, localized increase in underwater noise levels. Direct impacts on existing sound levels from decommissioning activities would mainly involve vessel engine operation noise. Noise impacts from vehicle traffic would only last the length of decommissioning operations (i.e., 45 to 60 days) and would be similar to noise from vehicle traffic associated with construction. Mitigation measures for decommissioning activities would be similar to those used for construction activities described in Section 4.11.6.1.

4.11.5 Impacts of Alternatives

The following sections discuss how selection of identified proposed Project alternatives would affect potential noise impacts.

4.11.5.1 Anchoring Alternative

Because impact piling was assessed to have the highest potential for sound generation (over the widest area) associated with the proposed Project, the decision was made that the anchors would be installed using suction anchors. If necessary, driven piles could be used as an alternative to the suction anchors in the unlikely event geotechnical conditions preclude use of suction anchors. Several different anchor alternatives have been considered for the proposed Project, including suction anchors, driven piles, fluke anchors, gravity-based anchors, and grouted pile anchors. Underwater noise impacts would vary based on the alternative selected. As discussed previously, pile driving generates the highest underwater noise levels during construction, which is required when using driven piles. Other alternatives are installed using different methods, which would likely generate underwater noise but likely to a lesser extent; however, the risk of potential impacts must also be balanced against the effectiveness and reliability of the anchoring system.

4.11.5.2 Alternate Port Location

The predicted impacts for each alternative Port location (Study Areas C and D) studied would vary based on site-specific factors, such as distance to shore and bathymetry. For example, Area C is situated approximately 19 miles off Jones Beach, New York, which is an additional 5.5 miles from the shoreline in comparison to the alternative port location in Study Area D. Water depths in this area are dependent on distance from shore (ranging from a low of 60 feet to several hundred feet deep). Study Area D is located

13.5 miles from the coastline with more shallow bathymetry characteristics and water depths exceeding the minimum depth of 100 feet only occurring at the eastern end of Area D.

As noted in Topic Report II, the airborne and underwater sound environments are very similar at these two Study Areas in terms of construction, operations, maintenance and repair, and decommissioning. Although the Study Area D port location is located 5 miles closer to the shoreline, this difference in location was not expected to alter the impacts on sensitive onshore noise receptors. It was anticipated that disturbances related to construction noise would be minor and temporary for both port locations. However, since the Port location in Study Area D was located in a large sport fishing ground, the Port location in Study Area C was preferred to avoid noise disturbances to commercial and recreational fisheries by avoiding designated fishing grounds.

However, the selected alternative deepwater port locations are within the same general vicinity as the proposed Project location, and construction, operation, and decommissioning activities would be similar for all locations. The alternative deepwater port locations would not reduce impacts associated with noise during construction or operation. Biological impacts from noise generated during construction and operation at alternative deepwater port locations would not differ compared to those at the proposed Project site.

4.11.5.3 Vaporization Alternative

Both open-loop and closed-loop vaporization systems are being considered for the proposed Project and within these two general system processes, there are a variety of specific technologies available. Changes to expected underwater noise impacts could occur based on the vaporization technology selected since each technology likely has its own unique acoustic characteristics.

4.11.5.4 Construction Schedule Alternative

From a noise perspective, there would be no change on potential in-air noise impacts due to differences in the proposed construction schedule; however, analysis of underwater noise impacts takes into account site-specific sound speed profile. The sound speed profile of an underwater environment is characterized by the water's temperature, salinity and depth and varies on a monthly basis and affects sound propagation and attenuation. Therefore, changing the time of year when an activity would occur would mean incorporating a different sound speed profile, which would then influence underwater noise impacts on marine species.

4.11.5.5 Alternate Pipeline Routes

The predicted impacts for each alternative Mainline route studied would vary based on site-specific factors, such as distance to shore and bathymetry. For example, and as noted in Topic Report II, the pipeline lengths associated with Alternative Mainline Routes D-1 and C-2 were considered to have larger predicted impacts due to longer installation times, thus increasing the time of exposure of marine species to temporary noise disturbances during the construction of the Mainline.

4.11.6 Mitigations and Monitoring

Liberty is proposing to use noise mitigation measures during construction and operation, which are described further below.

4.11.6.1 Construction Noise Mitigation Measures

During the construction (and maintenance) phase, mitigation measures to minimize ambient and underwater noise from construction (or maintenance) activities would include the following:

- Construction activities would be scheduled to occur for the minimum practical, total duration to reduce the likelihood that protected species would be exposed to noise from construction activities;
- Dedicated and trained personnel would be assigned as protected species observers (PSOs)[6] during construction activities;
- Exclusion and observation zones for marine mammals and turtles would be determined in consultation with NOAA Fisheries and monitored as follows:
    - In the observation zone, the movement of marine species should be monitored to determine whether they are approaching or entering the exclusion zone;
    - PSOs operate at all times during daylight hours (dawn to dusk – i.e., from about 30 minutes before sunrise to 30 minutes after sunset) when construction activities are being conducted, unless conditions (fog, rain, darkness) make sea surface observations impossible. If conditions deteriorate during daylight hours such that the sea surface observations are halted, visual observations would resume as soon as conditions permit;
    - If a marine mammal or sea turtle is observed approaching or within the exclusion zones (as outlined above), the observer would call for the shutdown of the construction operation. The vessel operator would comply with such a call by an on-watch visual observer; and,
- Start-up of the construction equipment would continue only after it is determined that a marine mammal or sea turtle has left the exclusion zone or has not been sighted for 30 minutes.

In addition to the above measures to mitigate and monitor noise impacts, the following measures would be implemented if pile driving (i.e., hydraulic impact hammer) is used to install the STL Buoy anchors:

- A safety zone (exclusion and observation zones) would be established, in coordination with NOAA Fisheries, around pile driving activity to cover the 180 dB impact and buffer zones to account for animals that are approaching the impact zone. This safety zone would be monitored visually by NOAA Fisheries-approved PSOs for at least 30 minutes prior to the start of any pile-driving activity. Pile-driving activity would not commence until the observer has declared the safety zone clear of sea turtles and whales;
- Each time a pile-driving hammer is started, dry-firing and ramping-up of the hammer would be conducted for at least 30 minutes to allow animals the opportunity to leave the area. Dry firing of a pile-driving hammer is a method of raising and dropping the hammer with no compression of the pistons, producing a lower-intensity sound than the full power of the hammer. Ramp-up involves slowly increasing the power of the hammer and noise produced over the ramp-up period;
- A bubble curtain is also being considered as a potential noise mitigation measure during pile driving. Bubble curtains introduce specifically sized air bubbles into the water surrounding the pile in a controlled manner, thus dampening the shock waves and helping to minimize the effects on marine species. The feasibility and the effectiveness of the use of a bubble curtain in the area of the proposed Project will have to be analyzed prior to construction;
- Following the initial 30-minute observations for protected species, visual observations would occur continuously during daylight hours to monitor for sea turtles and whales in the area. If at any time animals are detected in the safety zone during pile driving, the pile-driving activity would cease until the animal has left the area of its own volition. Pile driving can resume (following ramp-up procedures) once the animal has been visually confirmed beyond the safety zone, or 30 minutes have passed without re-sighting the animal;

[6] A Prudent Mariner's Guide to Right Whale Protection (available at http://www.nero.noaa.gov/shipstrike/doc/mtr.html)

- If pile driving commences during daylight hours, pile driving may continue into nighttime hours provided that there has been no interruption in activity. However, pile driving would not be initiated during nighttime hours when visual clearance of the zone cannot be conducted;
- Records would be maintained of all sea turtle and marine mammal sightings in the area, including date and time, weather conditions, species identification, approximate distance from the pile, direction and heading in relation to the pile driving, and behavioral observations. When animals are observed in the safety zone, additional information would be recorded, including corrective actions taken (e.g., shutdown of the pile driver and duration of the shutdown), behavior of the animal, and time the animal spent in the safety zone; and
- Sound pressure levels would be monitored on the first day of pile-driving activity to ensure that the predicted 180 dB contour is accurate. The safety zone may be adjusted to accommodate any difference between predicted and measured sound levels.

4.11.6.2 Deep Water Operations Mitigation Measures

During both construction and normal operations, all equipment would be operated according to manufacturers' recommendations, all installed sound-muffling devices would be maintained accordingly and vessel speed restrictions would be complied with:

- Specifications would call for equipment such as pumps, compressors, and generators to be installed on the LNGRVs in accordance with certifying entity or agency (Det Norske Veritas, American Bureau of Shipping, Lloyds Register, USCG) requirements for safety and operability;
- Location of most equipment within the LNGRV would reduce the noise emissions;
- Mufflers and shielding would be employed in accordance with certifying entity or agency requirements;
- The required separation distance for North Atlantic right whales of 500 yards or greater, in order to reduce disturbance and collision risks, would be followed as per 50 CFR 224.103 (62 *Federal Register* [FR] 6729 and 73 FR 60173);
- A SMA is designated within 20 nautical miles of the entrance to the Port of New York and New Jersey between November 1 and April 30;
- In order to comply with the Right Whale Ship Strike Reduction Rule (50 CFR 224.105), all vessels over 19.8 meters in overall length are to be restricted to 10 knots. Vessel speeds during construction activities are slow (less than 10 knots). When vessels are transiting to and from the proposed Project area, speeds of 10 knots or less would be maintained when mother/calf pairs, groups, or large assemblages of cetaceans are observed near an underway vessel, when safety permits (NOAA 2008). The vessels would attempt to route around the animals, maintaining a minimum distance of 100 yards whenever possible. If vessels transit the North Atlantic right whale SMA, 10-knot speeds would also be maintained;
- In order to avoid vessel strikes during transit and operations, the Early Warning System, Sighting Advisory System, and Mandatory Ship Reporting System notifying mariners of right whale presence would be monitored; and
- Vessel crews would report sightings of any injured or dead protected species immediately, regardless of whether the injury or death is caused by the proposed Project's vessels. Marine mammals would be reported to the U.S. Stranding Hotline and sea turtles would be reported to NOAA Fisheries Regional Offices. Any injured, dead, or entangled right whales would be immediately reported to the USCG via VHF Channel 16.