

Sunrise Wind - Appendix G: Impact-Producing Factor Tables

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Appendix G: Impact Producing Factor Tables

Table G - 1 Definitions of Potential Beneficial Impact Levels

Impact Level	Physical, Biological, and Cultural Resources	Socioeconomic Resources
Negligible	Either no effect or no measurable impacts	Either no effect or no measurable impacts
Minor	<p>Small and measurable effects that would comprise at least one of the following:</p> <ul style="list-style-type: none"> • Improvement in ecosystem health • Increase in the extent and quality of habitat for both special status species and species common to the proposed Project Area • Increase in populations of species common to the proposed Project Area • Improvement in air or water quality • Limited spatial extent or short-term duration of improved protection of physical cultural resources 	<p>Small and measurable effects that would comprise at least one of the following:</p> <ul style="list-style-type: none"> • Improvement in human health • Increase in employment (job creation and workforce development) • Improvements to infrastructure/facilities and community services • Economic improvement (increase in local business expenditures and tax revenue) • Increase in tourism • Improvements for individuals and/or communities that result from enhanced protection of cultural resources
Moderate	<p>Notable and measurable effects comprising at least one of the following:</p> <ul style="list-style-type: none"> • Improvement in ecosystem health • Increase in the extent and quality of habitat for both special status species and species common to the proposed Project Area • Increase in populations of species common to the proposed Project Area • Improvement in air or water quality • Extensive/complete spatial extent, or long-term duration of, improved protection of physical cultural resources 	<p>Notable and measurable effects comprising at least one of the following:</p> <ul style="list-style-type: none"> • Improvement in human health • Increase in employment (job creation and workforce development) • Improvements to infrastructure/facilities and community services • Economic improvement (increase in local business expenditures and tax revenue)

Impact Level	Physical, Biological, and Cultural Resources	Socioeconomic Resources
		<ul style="list-style-type: none"> • Increase in tourism • Improvements for individuals and/or communities that result from enhanced protection of cultural resources
Major	<p>Regional or population-level effects comprising at least one of the following:</p> <ul style="list-style-type: none"> • Improvement in ecosystem health • Increase in the extent and quality of habitat for both special status and species common to the proposed Project Area • Increase in populations of species common to the proposed Project Area • Improvement in air or water quality • Permanent protection of physical cultural resources 	<p>Large local, or notable regional effects comprising at least one of the following:</p> <ul style="list-style-type: none"> • Improvement in human health • Increase in employment (job creation and workforce development) • Improvements to infrastructure/facilities and community services • Economic improvement (increase in local business expenditures and tax revenue) • Increase in tourism • Improvements for individuals and/or communities that result from enhanced protection of cultural resources

Table G - 2 Definitions of Potential Adverse Impact Levels

Impact Level	Biological and Physical Resources	Socioeconomic Resources	Cultural Resources	Visual Resources
Negligible	Either no impact or no measurable impacts	Either no impact or no measurable impacts	Impacts would be so small as to be unmeasurable (i.e., finding of “no historic properties affected” or “no historic properties adversely affected” pursuant to 36 CFR 800).	<u>Seascape/Landscape impact assessment</u> : Very little or no impact on seascape/landscape unit character, features, elements, or key qualities because unit lacks distinctive character, features, elements, or key qualities; values for these are low; and/or

Impact Level	Biological and Physical Resources	Socioeconomic Resources	Cultural Resources	Visual Resources
				<p>Project visibility is minimal.</p> <p><u>Visual impact assessment:</u> Very little or no impact on viewers' visual experience because view value is low, viewers are relatively insensitive to view changes, and/or Project visibility is minimal.</p>
Minor	<p>Most adverse impacts on the following affected resource(s) could occur AND the affected resource would recover completely without remedial or mitigating action, including local ecosystem health; the extent and quality of local habitat for both special status species and species common to the proposed project area; the richness or abundance of local species common to the proposed project area; and air or water quality.</p>	<p>Most adverse impacts on the affected activity or community, including traditional cultural practices, could be avoided; impacts would not disrupt the normal or routine functions of the affected activity or community, including traditional cultural practices; OR the affected activity or community, including traditional cultural practices, is expected to return to a condition with no measurable impacts without remedial or mitigating action.</p>	<p>Cultural resources (historic properties that include archaeological sites, buildings, structures, objects, and districts that are listed in or eligible for the NRHP) would be affected; however, conditions would be imposed to ensure consistency with the Secretary's Standards for the Treatment of Historic Properties (36 CFR 68) to avoid adverse impacts. (i.e., finding of "no historic properties adversely affected" pursuant to 36 CFR 800).</p>	<p><u>Seascape/landscape impact assessment:</u> Small but noticeable impact on seascape/landscape unit character, features, elements, or special qualities because project is somewhat inconsistent with unit character; negatively affects unit features, elements, or key qualities; and/or project visibility is low.</p> <p><u>Visual impact assessment:</u> Change to the view would have a small but noticeable impact on visual experience because view value is low, viewers are relatively insensitive to view changes, and/or project visibility is low.</p>
Moderate	<p>A notable and measurable adverse impact on the affected resource(s) could occur AND the affected resource would recover completely when remedial or mitigating action is</p>	<p>Mitigation would reduce adverse impacts substantially during the life of the proposed Project, including decommissioning; the affected activity or community, including traditional cultural practices, would have to</p>	<p>Characteristics of cultural resources would be altered in a way that would diminish the integrity of the property's location, design, setting, materials, workmanship, feeling, or association (i.e.,</p>	<p><u>Seascape/landscape impact assessment:</u> Substantial impact on seascape/landscape unit character, features, elements, or special qualities because the Project is clearly inconsistent with unit character; substantially</p>

Impact Level	Biological and Physical Resources	Socioeconomic Resources	Cultural Resources	Visual Resources
	<p>taken, including local ecosystem health; the extent and quality of local habitat for both special status species and species common to the proposed project area; the richness or abundance of local species common to the proposed project area; and air or water quality.</p>	<p>adjust somewhat to account for disruptions due to notable and measurable adverse impacts of the Project; OR once the impacting agent is gone, the affected activity or community, including traditional cultural practices, is expected to return to a condition with no measurable impacts, when remedial or mitigating action is taken.</p>	<p>finding of “historic properties adversely affected” pursuant to 36 CFR 800). Measures to resolve adverse effects would minimize impacts, and the adversely affected property would remain NRHP eligible.</p>	<p>negatively affects unit features, elements, or key qualities; and/or Project visibility is moderate.</p> <p><u>Visual impact assessment:</u> The change to the view would have a substantial impact on the viewers’ visual experience because view value is moderate, the viewers are moderately sensitive to the changes in the view, and/or the visibility of the Project is moderate.</p>
Major	<p>A regional or population-level adverse impact on the affected resource(s), could occur AND the affected resource would not fully recover, even after the impacting agent is gone and remedial or mitigating action is taken, including ecosystem health; the extent and quality of habitat for both special-status species and species common to the proposed project area; species common to the proposed project area; and air or water quality.</p>	<p>Mitigation would reduce adverse impacts somewhat during the life of the Project, including decommissioning; the affected activity or community, including traditional cultural practices, would have to adjust to significant disruptions due to large local or notable regional adverse impacts of the Project; AND the affected activity or community, including traditional cultural practices, may retain measurable impacts indefinitely, even after the impacting agent is gone and remedial action is taken.</p>	<p>Characteristics of cultural resources would be affected in a way that would diminish the integrity of the property’s location, design, setting, materials, workmanship, feeling, or association (i.e., finding of “historic properties adversely affected” pursuant to 36 CFR 800).</p> <p>Measures to resolve adverse effects would mitigate impacts; however, important characteristics would be altered to the extent that the adversely affected property would no longer be listed in or eligible for the NRHP.</p>	<p><u>Seascape/landscape impact assessment:</u> Dominant impact on seascape/landscape unit character, features, elements, or key qualities; fundamentally changes unit character, features, elements, or key qualities, and visibility of the Project is high.</p> <p><u>Visual impact assessment:</u> Dominate visual experience either because view value is moderate to high, viewers are moderately to highly sensitive to view changes, and the visibility of the Project is moderate to high.</p>

1.1 Physical Resources

1.1.1 Air Quality

Table G - 3 Potential Impact Producing Factors on Air Quality

Contributing IPFs*	Issue	Impact Indicator
<ul style="list-style-type: none"> Air emissions 	Compliance with NAAQS and General Conformity Emission Thresholds	Emissions from marine vessels, vehicles, and equipment activity within 25 nm (28.77 mi; 46.3 km) of the center of the Lease Area, within 25 nm of the state seaward boundary, within state boundaries, within state territorial waters (3 nm [3.45 mi; 5.56 km] of the shore), and within a non-attainment area.
<ul style="list-style-type: none"> Climate change Accidental releases 	GHG emissions	Emissions from marine vessels, vehicles, and equipment activity within 25 nm (28.77 mi; 46.3 km) of the center of the Lease Area, within 25 nm (28.77 mi; 46.3 km) of the state seaward boundary, within state boundaries, within state territorial waters (3 nm [3.45 mi; 5.56 km] of the shore), and within a non-attainment area.

* All listed IPFs may not necessarily contribute to each individual issue.

Negligible: Project emissions would not be detected.

Minor to Moderate: Project emissions would be detectable but would not exceed NAAQS or de minimis thresholds.

Major: Project emissions would exceed NAAQS.

1.1.2 Water Quality

Table G - 4 Potential Impact Producing Factors on Water Quality

Contributing IPFs*	Issue	Impact Indicator
<ul style="list-style-type: none"> Accidental releases Anchoring Cable emplacement and maintenance 	Runoff, sedimentation, sediment movement, suspension or resuspension, changes to stratification or mixing patterns of sediments, or spills of hazardous materials	Changes to turbidity, nutrients, DO, temperature, salinity, and/or Chlorophyll- <i>a</i> . Introduction of new contaminants/oil or changes to sediments
<ul style="list-style-type: none"> Discharges Land disturbance Port utilization Presence of structures 	Disturbance or seepage to groundwater resources	Changes to turbidity, nutrients, DO, temperature, salinity, and/or Chlorophyll- <i>a</i> . Introduction of new contaminants/oil or changes to sediments

* All listed IPFs may not necessarily contribute to each individual issue.

Negligible: changes would be undetectable.

Minor: changes would be detectable but would not result in degradation of water quality in exceedance of water quality standards.

Moderate: changes would be detectable and would result in localized, short-term degradation of water quality in exceedance of water quality standards.

Major: changes would be detectable and would result in extensive, long-term degradation of water quality in exceedance of water quality standards.

1.2 Biological Resources

1.2.1 Bats

Table G - 5 Potential Impact Producing Factors on Bats

Contributing IPFs*	Issue	Impact Indicator
<ul style="list-style-type: none"> Land disturbance 	Loss of habitat	Acreage loss compared to suitable acreage available in the region for bats
<ul style="list-style-type: none"> Traffic 	Noise duration and extent of exclusion from preferred habitats and normal behaviors	Qualitative estimate of displacement impact
<ul style="list-style-type: none"> Lighting 	Potential collision risk and displacement	Qualitative risk assessment of collision mortality risk for vessels and onshore traffic
<ul style="list-style-type: none"> Presence of structures 	Potential for concentration of insect prey base	Qualitative estimate of prey availability and analysis of collision mortality associated with lighted structures

* All listed IPFs may not necessarily contribute to each individual issue.

Negligible: There would be no measurable impacts.

Minor: Most impacts could be avoided with environmental protection measures (EPMs); if impacts occur, the loss of one or few individuals or temporary alteration of habitat could represent a minor impact, depending on the time of year and number of individuals involved.

Moderate: Impacts are unavoidable but would not result in population-level effects or threaten overall habitat function.

Major: Impacts would result in severe, long-term habitat or population-level effects to species.

1.2.2 Benthic Resources

Table G - 6 Potential Impact Producing Factors on Benthic Resources

Contributing IPFs*	Issue	Impact Indicator
<ul style="list-style-type: none"> • Seafloor disturbance 	Crushing, burial, and entrainment	Estimated extent of potential disturbance, injury, and mortality-level effects on fish and invertebrates (including eggs and larvae) from; crushing or burial by construction equipment and materials placement; entrainment by construction equipment; and burial effects from suspended sediment deposition.
<ul style="list-style-type: none"> • Presence of structures 	Seabed and water column alteration	Short-term and long-term effects on water column and benthic habitats by habitat displacement by monopiles; habitat modification by placement of scour protection and concrete mattresses; short-term alteration of soft-bottom benthic habitat function; and long-term alteration of complex benthic habitat function.
<ul style="list-style-type: none"> • Sediment suspension and deposition 	Water quality impacts	Duration and intensity of suspended sediment impacts (quantitative); also effects described under seafloor disturbance
<ul style="list-style-type: none"> • Noise 	Underwater noise and vibration	Extent, frequency, and duration of noise above established effects thresholds, and/or other quantifiable effects as follows: Invertebrates: Varies Finfish: Varies by hearing group
<ul style="list-style-type: none"> • EMF** 	Power transmission	Theoretical extent of potentially detectable EMF and substrate heating effects, as follows: Benthic eggs and larvae, EFH: area exposed to magnetic field effects >1,000 mG, electrical field effects >500 mV/m Invertebrates: Benthic infauna: Magnetic fields >1 mG, inhabited substrates exposed to measurable heating effects Squid: >800 mG Finfish: Theoretical extent of potentially detectable EMF effects by species group as follows: ¹ Demersal and pelagic finfish and invertebrates: area exposed to magnetic field effects >1,000 mG, electrical field effects 20 mV/m Electrosensitive species (sturgeon, skates, sharks): area exposed to magnetic field effects >250 mG, electrical field effects 20 mV/m (at 60 Hz)
<ul style="list-style-type: none"> • Discharge and releases 	Water quality impacts	Accidental spills, releases of trash and debris (qualitative assessment relative to baseline conditions)
<ul style="list-style-type: none"> • Trash and debris 	Water quality impacts	Accidental spills, releases of trash and debris (qualitative assessment relative to baseline conditions)

Notes: μPa = micropascal; dB = decibel; Hz = hertz; mG = milligauss; mV/m = millivolts per meter

* All listed IPFs may not necessarily contribute to each individual issue.

** EMF sensitivity varies widely, no effect threshold guidance has been established. The minimum EMF levels needed to produce behavioral responses observed in available research are one or more orders of magnitude larger than the anticipated EMF effects likely to result from the Proposed Action. Electrosensitive fish can detect low-frequency bioelectric fields at very weak levels but are unable to detect higher frequency fields >20 Hz {Bedore, 2013 #68}.

Negligible: No measurable impacts to species or habitat would occur.

Minor: Most impacts to species are avoided; if impacts occur, they may result in the loss of a few individuals. Impacts to sensitive habitats are avoided; impacts that do occur are short term or temporary in nature.

Moderate: Impacts to species are unavoidable but would not result in population-level effects. Impacts to habitat may be short term, long term, or permanent and may include impacts to sensitive habitats but would not result in population-level effects to species that rely on them.

Major: Impacts would affect the viability of the population and would not be fully recoverable. Impacts to habitat would result in population-level impacts to species that rely on them.

1.2.3 Birds

Table G - 7 Potential Impact Producing Factors on Birds

Contributing IPFs*	Issue	Impact Indicator
• Seafloor disturbance	Seafloor pile driving disturbance	Qualitative analysis of seafloor disturbance, loss, or conversion for foraging diving birds
• Sediment suspension and deposition	Displacement effects of sediment suspension and deposition from pile driving and export cable laying and maintenance	Qualitative analysis on relative impact on prey availability and alteration of habitat supporting prey resources for foraging birds
• Noise	Underwater noise from construction pile driving /conceptual decommissioning	Qualitative analysis of displacement effects on diving birds
	Airborne noise duration and extent of exclusion from preferred habitats and normal behaviors	Qualitative analysis of displacement on foraging, roosting, and flying birds
• Traffic	Habitat loss/displacement	Area of suitable natural nesting, foraging, and roosting habitat converted to developed land
• Accidental releases	Potential toxicity to diving and foraging birds from discharges	Qualitative analysis of potential discharges (fuel, lubricants, chemicals, and cooling water)
• Lighting	Potential debris entanglement/ingestion	Qualitative analysis of potential effects of trash and debris
• Presence of structures	Vehicle/vessel traffic collision mortality and displacement	Qualitative estimate of potential collision risk/mortality and temporary displacement
	Potential collision risk by and/or displacement at/by structures	Qualitative analysis of potential collision risk mortality and displacement

* All listed IPFs may not necessarily contribute to each individual issue.

Negligible: There would be no measurable impact.

Minor: Most impacts could be avoided with EPMS; if impacts occur, the loss of one or few individuals or temporary alternation of habitat could represent minor impact, depending on the time of year and number of individuals involved.

Moderate: Impacts are unavoidable but would not result in population-level effects or threaten overall habitat function.

Major: Impacts would result in severe, long-term habitat or population-level effects to species.

1.2.4 Coastal Habitat and Fauna

Table G - 8 Potential Impact Producing Factors on Coastal Habitat and Fauna

Contributing IPFs*	Issue	Impact Indicator
<ul style="list-style-type: none"> • Accidental releases (pollutants) • Air emissions (pollutants) • Anchoring (sediment disturbance) • Discharges (during HDD) 	Habitat loss, death of faunal individuals/habitat modification	Acres of impacted or modified habitat and/or numbers of individuals killed
<ul style="list-style-type: none"> • Cable emplacement/maintenance • Land disturbance (trenching, HDD, construction) • Light (onshore) 	Disturbance/displacement	Estimated time to expected recovery/return to habitat; duration and/or extent of activity (accidental release, discharge, cable installation, light, noise) and/or volume (traffic).
<ul style="list-style-type: none"> • Noise (onshore) • Presence of structures (cable infrastructure, onshore converter station) • Traffic (onshore and vessels) 	Collision/injury	Qualitative estimate of collision risk

* All listed IPFs may not necessarily contribute to each individual issue.

Negligible: No measurable impacts to species or habitat would occur.

Minor: Most impacts to species are avoided; if impacts occur, they may result in the loss of a few individuals. Impacts to sensitive habitats are avoided; impacts that do occur are short term or temporary in nature.

Moderate: Impacts to species are unavoidable but would not result in population-level effects. Impacts to habitat may be short term, long term, or permanent and may include impacts to sensitive habitats but would not result in population-level effects to species that rely on them.

Major: Impacts would affect the viability of the population and would not be fully recoverable. Impacts to habitats would result in population-level impacts to species that rely on them.

1.2.5 Finfish, Invertebrates, and Essential Fish Habitat

Table G - 9 Potential Impact Producing Factors on Finish, Invertebrates, and Essential Fish Habitat

Contributing IPFs*	Issue	Impact Indicator
<ul style="list-style-type: none"> Accidental releases and discharges 	Underwater noise and vibration	Extent, frequency, and duration of noise above established effects thresholds, and/or other quantifiable effects as follows: Invertebrates: Varies Finfish: Varies by hearing group
<ul style="list-style-type: none"> Anchoring Cable emplacement and maintenance 	Crushing, burial, and entrainment	Estimated extent of potential disturbance, injury, and mortality-level effects on fish and invertebrates (including eggs and larvae) from; crushing or burial by construction equipment and materials placement; entrainment by construction equipment; and burial effects from suspended sediment deposition.
<ul style="list-style-type: none"> EMF Gear utilization 	Seabed and water column alteration	Short-term and long-term effects on water column and benthic habitats by habitat displacement by monopiles; habitat modification by placement of scour protection and concrete mattresses; Short-term alteration of soft-bottom benthic habitat function; and long-term alteration of complex benthic habitat function.
<ul style="list-style-type: none"> Lighting Noise 	Water quality impacts	Duration and intensity of suspended sediment impacts (quantitative). Accidental spills, releases of trash and debris (qualitative assessment relative to baseline conditions).
<ul style="list-style-type: none"> Port utilization Presence of structures 	Artificial light	Extent and duration of artificial light effects (qualitative assessment relative to baseline conditions).
<ul style="list-style-type: none"> Seafloor disturbance Sediment deposition Regulated fishing effort Climate change 	Power transmission	Theoretical extent of potentially detectable electromagnetic field (EMF) and substrate heating effects, as follows: Benthic eggs and larvae, EFH: area exposed to magnetic field effects > 1,000 mG, electrical field effects > 500 mV/m Invertebrates: Benthic infauna: Magnetic fields > 1 mG, Inhabited substrates exposed to measurable heating effects Squid: > 800 mG Finfish: Theoretical extent of potentially detectable EMF effects by species group as follows:** Demersal and pelagic finfish and invertebrates: area exposed to magnetic field effects > 1,000 mG, electrical field effects 20 mV/m

Contributing IPFs*	Issue	Impact Indicator
		Electrosensitive species (sturgeon, skates, sharks): area exposed to magnetic field effects > 250 mG, electrical field effects 20 mV/m (at 60 Hz)

* All listed IPFs may not necessarily contribute to each individual issue.

** EMF sensitivity varies widely, no effect threshold guidance has been established. The minimum EMF levels needed to produce behavioral responses observed in available research are one or more orders of magnitude larger than the anticipated EMF effects likely to result from the Proposed Action. Electrosensitive fish can detect low-frequency bioelectric fields at very weak levels but are unable to detect higher frequency fields > 20 Hz (Bedore and Kajiura 2013).

Negligible: No measurable impacts to species or habitat would occur.

Minor: Most impacts to species are avoided; if impacts occur, they may result in the loss of a few individuals. Impacts to sensitive habitats are avoided; impacts that do occur are short term or temporary in nature.

Moderate: Impacts to species are unavoidable but would not result in population-level effects. Impacts to habitat may be short term, long term, or permanent and may include impacts to sensitive habitats but would not result in population-level effects to species that rely on them.

Major: Impacts would affect the viability of the population and would not be fully recoverable. Impacts to habitats would result in population-level impacts to species that rely on them.

1.2.6 Marine Mammals

Table G - 10 Potential Impact Producing Factors on Marine Mammals

Contributing IPFs*	Issue	Impact Indicator
<ul style="list-style-type: none"> Accidental releases 	Seabed and water column disturbance/alteration	Water column volume and acres of seabed disturbance, loss, or conversion by structure presence
	<ul style="list-style-type: none"> Seafloor disturbance 	Water quality
<ul style="list-style-type: none"> Sediment suspension and deposition 		Noise - Underwater noise from construction/ conceptual decommissioning
	<ul style="list-style-type: none"> EMF 	
<ul style="list-style-type: none"> Gear utilization 		
<ul style="list-style-type: none"> Lighting 		
<ul style="list-style-type: none"> Noise 	Noise – Non-impulsive underwater noise from operation	Magnitude, duration, and extent of exposure above established effects thresholds, as noted below. Behavioral effect thresholds (SPL): ³ 120 dB SPL _a Permanent threshold shift (PTS) thresholds for all species: Not expected to be reached, sound levels below “effective quiet”
<ul style="list-style-type: none"> Presence of structures 	Noise - Airborne noise	Magnitude, duration, and extent of exposure above established effects thresholds, as noted below: Behavioral effect thresholds: ⁴ Phocid pinniped: 90 dB SPL Cetaceans: Not applicable
<ul style="list-style-type: none"> Traffic 	Power transmission	Theoretical extent of detectable EMF effects

Contributing IPFs*	Issue	Impact Indicator
<ul style="list-style-type: none"> Port utilization 	Vessel traffic	Qualitative estimate of potential collision risk
	Artificial light	Intensity, frequency, and duration relative to baseline
	Visible infrastructure	Qualitative analysis of scale of impact and alterations to habitat and behavior

* All listed IPFs may not necessarily contribute to each individual issue.

¹ Behavioral effect thresholds for impact and vibratory pile driving defined by the NMFS (NMFS, 2018). dB_{RMS} = root mean square decibels re: 1 micropascal (μPa).

² NMFS, 2018 defines a permanent hearing threshold shift as the onset of physical injury from underwater noise exposure. NMFS has identified different PTS thresholds for the low-, mid-, and high-frequency cetacean, and phocid pinnipeds based on group-specific hearing sensitivity.

³ Behavioral effect threshold for vibratory pile driving defined by NMFS, 2018, assuming WTGs similarly produce continuous low-frequency underwater noise.

⁴ Airborne exposure threshold defined by NMFS, 2018. No PTS threshold established for pinnipeds. No thresholds established for cetaceans. § Airborne exposure threshold (unweighted decibels) defined by NOAA (2018). Distance to phocid pinniped thresholds estimated using methods described by the Washington State Department of Transportation (2020). No airborne PTS threshold established for pinnipeds. No airborne thresholds established for cetaceans.

Negligible*: The impacts on individual marine mammals and/or their habitat, if any, would be at the lowest levels of detection and barely measurable, with no perceptible consequences to individuals or the population.

Minor: Impacts on individual marine mammals and/or their habitat are detectable and measurable; however, they are of low intensity, short term, and localized. Impacts on individuals and/or their habitat do not lead to population-level effects.

Moderate: Impacts on individual marine mammals and/or their habitat are detectable and measurable; they are of medium intensity, can be short term or long term, and can be localized or extensive. Impacts on individuals and/or their habitat could have population-level effects, but the population can sufficiently recover from the impacts or enough habitat remains functional to maintain the viability of the species both locally and throughout their range.

Major: Impacts on individual marine mammals and/or their habitat are detectable and measurable; they are of severe intensity, can be long lasting or permanent, and are extensive. Impacts to individuals and/or their habitat would have severe population-level effects and compromise the viability of the species.

* These significance criteria are intended to serve NEPA purposes only, and they are not intended to incorporate similar terms of art used in other statutory or regulatory reviews. For example, the term “negligible” will be used for NEPA purposes as defined here and is not necessarily intended to indicate a negligible impact or effect under the MMPA. Similarly, the use of “detectable” or “measurable” in the NEPA significance criteria is not necessarily intended to indicate whether an effect is “insignificant” or “adverse” for purposes of ESA Section 7 consultation. For ESA Section 7 consultation, “insignificant effects” relate to the size of the impact and should never reach the scale where take occurs. Based on best judgment, a person would not be able to meaningfully measure, detect, or evaluate insignificant effects.

1.2.7 Sea Turtles

Table G - 11 Potential Impact Producing Factors on Sea Turtles

Contributing IPFs ¹	Issue	Impact Indicator
<ul style="list-style-type: none"> • Accidental releases • Seafloor disturbance 	Seabed and water column disturbance/alteration	Water column volume and acres of seabed disturbance, loss, or conversion by structure presence
	Water quality	Quantitative estimate of intensity and duration of suspended sediment effects Qualitative analysis of potential accidental discharges (fuel, lubricants, chemicals, cooling water, trash, and debris) relative to baseline Relative impact on prey availability and alteration of habitat supporting prey resources
<ul style="list-style-type: none"> • Sediment suspension and deposition • Electrical and magnetic fields • Gear utilization 	Noise – Underwater noise from construction/conceptual decommissioning	Extent, frequency, and duration of noise above established effects thresholds relative to species occurrence, as noted below: Behavioral effects: ² 175 dB re 1 μ Pa Injury/harm: Lpk (dB re 1 μ Pa): 207 (potentially mortal) ³ , 232 (PTS) ⁴ , 226 (TTS) ⁴ SEL (dB re 1 μ Pa ² s): 210 (potentially mortal) ³ , 204 (PTS) ⁴ , 189 (TTS) ⁴
<ul style="list-style-type: none"> • Lighting • Noise 	Noise – Underwater noise from operation	Extent, frequency, and duration of noise above established effects thresholds relative to species occurrence, as noted below: Behavioral effects: ² SPL: 175 dB re 1 μ Pa
<ul style="list-style-type: none"> • Presence of structures • Traffic 	Noise – In-air noise/disturbance	Biologically significant behavioral response
<ul style="list-style-type: none"> • Port utilization 	Power transmission	Theoretical extent of detectable EMF effects
	Vessel traffic	Qualitative estimate of potential collision risk
	Artificial light	Intensity, frequency, and duration relative to baseline
	Visible infrastructure	Qualitative analysis of scale of impact and alterations to habitat and behavior

Notes: μ Pa = micropascal; μ Pa² = squared micropascal; dB = decibel(s); dBpeak = peak dB re: 1 μ Pa; dB_{RMS} = root mean square decibels re: 1 μ Pa; dBSEL = cumulative sound exposure level in dB re: 1 μ Pa²/second; EMF = electric and magnetic fields; IPF = impact-producing factor; PTS = permanent threshold shift; TTS = temporary threshold shift

¹ All listed IPFs may not necessarily contribute to each individual issue.

² Behavioral effect threshold for impact and vibratory pile driving defined by (DoN, 2017).

³ Injury/harm effect threshold defined by (Popper, 2014).

⁴ Injury/harm effect threshold defined by (DoN, 2017).

Negligible: Impacts on sea turtles are undetectable or barely measurable, with no consequences to individuals or populations.

Minor: Impacts on sea turtles are detectable and measurable, but are low-intensity, highly localized, and temporary or short term in duration. May include impacts to or loss of individuals, but these impacts would not result in population-level effects.

Moderate: Impacts on sea turtles are detectable and measurable. These impacts could result in population-level effects, but those effects would likely be recoverable and would not affect stock or population viability.

Major: Impacts on sea turtles are significant and extensive, long term in duration, and could have population-level effects that are not recoverable, even with mitigation.

1.2.8 Wetlands and Other Waters of the United States

Table G - 12 Potential Impact Producing Factors on Wetlands and other Waters of the United States

Contributing IPFs*	Issues	Impact Indicator
<ul style="list-style-type: none"> • Land disturbance • Sediment Suspension & Deposition • Discharges & Releases 	Habitat loss/modification	Acres of impacted habitat
	Water quality impacts	Qualitative assessment of potential increased sedimentation into wetlands
		Qualitative assessment of potential changes in water quality from HDD activity and spills
		Qualitative assessment of trash and debris relative to baseline condition

* All listed IPFs may not necessarily contribute to each individual issue.

Negligible: no measurable loss or modification of wetlands or other WOTUS would occur; no measurable change in wetland quality or function would occur.

Minor: most impact to wetlands or other WOTUS could be avoided with mitigation; impacts that do occur are short term or temporary in nature

Moderate: impacts to wetlands or other WOTUS are unavoidable, but the overall wetland or other WOTUS function would not be threatened.

Major: impacts to wetland or other WOTUS could be severe and long lasting and result in loss of function.

1.3 Socioeconomic Conditions and Cultural Resources

1.3.1 Commercial Fisheries and For-Hire Recreational Fishing

Table G - 13 Potential Impact Producing Factors on Commercial Fisheries and For-Hire Recreational Fishing

Contributing IPFs*	Issue	Impact Indicator
<ul style="list-style-type: none"> Anchoring 	Port access	Vessel traffic congestion and reduced access to high-demand port services
<ul style="list-style-type: none"> Noise Port utilization 	Fishing access	Increased operating costs (e.g., additional fuel to arrive at more distant locations; additional crew compensation due to more days at sea); lower revenue (e.g., less-productive area; less-valuable species); increased conflict among fishermen; avoidance of area by fishermen because of safety concerns.
<ul style="list-style-type: none"> Presence of structures 	Loss of or damage to fishing gear	Costs of gear repair or replacement; lost fishing revenue while gear is being repaired or replaced
<ul style="list-style-type: none"> Vessel traffic 	Change in catch of target species	Change in revenue due to change in catch

* All listed IPFs may not necessarily contribute to each individual issue.

Negligible: No measurable impacts would occur.

Minor: Adverse impacts to the affected activity or community could be avoided with the EPMs and impacts would not disrupt the normal or routine functions of the affected activity or community. Once the impacting agent is eliminated, the affected activity or community would return to condition with no measurable effects.

Moderate: Impacts to the affected activity or community are unavoidable, but EPMs would reduce impacts substantially during the life of the Project. The affected activity or community would have to adjust somewhat to account for disruptions due to impacts of the Project, or, once the impacting agent is eliminated, the affected activity or community would return to a condition with no measurable effects if proper remedial action is taken.

Major: The affected activity or community would experience substantial disruptions, and, once the impacting agent is eliminated, the affected activity or community could retain measurable effects indefinitely, even if remedial action is taken.

1.3.2 Cultural Resources

Table G - 14 Potential Impact Producing Factors on Cultural Resources

Contributing IPFs*	Issue	Impact Indicator
<ul style="list-style-type: none"> • Accidental releases • Anchoring • Gear utilization and dredging 	Seabed disturbance and potential marine cultural resource damage	<p>Qualitative analysis of potential physical damage to known or undiscovered shipwrecks, downed aircraft, and other post-contact historic properties.</p> <p>Qualitative analysis of impacts on pre-contact ancient, submerged landforms with high archaeological sensitivity and/or cultural and historic significance to Native American Tribes (Traditional Cultural Properties)</p>
<ul style="list-style-type: none"> • Light (vessels and structures) • Port utilization/expansion • Presence of structures (viewshed) 	Terrestrial ground disturbance and impacts to terrestrial cultural resources	<p>Qualitative discussion of potential physical damage to previously recorded or undiscovered terrestrial archaeological sites</p> <p>Qualitative discussion of potential physical damage or viewshed impacts to previously documented or unknown Native American Traditional Cultural Properties</p>
<ul style="list-style-type: none"> • New cable emplacement/maintenance • Land disturbance/onshore construction • Climate change 	Viewshed changes due to presence of structures and lighting resulting in impacts to identified historic properties	<p>Qualitative assessment of viewshed impacts to NRHP-listed/eligible sites (historic properties) from which project components are visible</p> <p>Qualitative assessment of viewshed impact to previously documented or unknown Native American Traditional Cultural Properties</p>

* All listed IPFs may not necessarily contribute to each individual issue.

Negligible: No significant impacts would occur (i.e., effects on historic properties pursuant to 36 CFR part 800 would not rise to the level of being adverse effects).

Minor: Significant impacts to NRHP characteristics could be avoided with environmental protection measures (i.e., with use of EPMs, no adverse effect would result).

Moderate: EPMs would minimize, but not fully resolve, significant impacts to NRHP characteristics (i.e., alteration diminishing important historic property characteristics, yet the adversely affected property remains NRHP eligible).

Major: Significant impacts to NRHP characteristics are unavoidable even with EPMs (i.e., alteration or loss of an important characteristic to an extent that it no longer supports the adversely affected property's NRHP eligibility).

1.3.3 Demographics, Employment, and Economics

Table G - 15 Potential Impact Producing Factors on Demographics, Employment, and Economics

Contributing IPFs*	Issue	Impact Indicator
<ul style="list-style-type: none"> • Energy security/generation • Cable emplacement and maintenance • Land disturbance • Lighting • Noise • Port utilization • Presence of structures • Traffic • Climate change 	Development and construction expenditures and employment	Changes in GDP Changes in tax revenues for state and local governments Changes in full-time equivalent (FTE) jobs and income Changes in the demand for housing Changes in the local supply chain for offshore wind farm components
	Operational expenditures and employment	Changes in FTE jobs and income
	Conceptual decommissioning expenditures and employment	Changes in FTE jobs and income

* All listed IPFs may not necessarily contribute to each individual issue.

Negligible: No measurable impacts would occur.

Minor: Adverse impacts to the affected activity or geographic place could be avoided with EPMs and impacts would not disrupt the normal or routine functions of the affected activity or geographic place. Once the impacting agent is eliminated, the affected activity or geographic place would return to a condition with no measurable effects.

Moderate: Impacts to the affected activity or geographic place are unavoidable, but EPMs would reduce impacts substantially during the life of the Project. The affected activity or geographic place would have to adjust somewhat to account for disruptions due to impacts of the Project, or, once the impacting agent is eliminated, the affected activity or geographic place would return to a condition with no measurable effects if proper remedial action is taken.

Major: The affected activity or geographic place would experience unavoidable disruptions to a degree beyond what is normally acceptable, and, once the impacting agent is eliminated, the affected activity or geographic place could retain measurable effects indefinitely, even if remedial action is taken.

1.3.4 Environmental Justice

Table G - 16 Potential Impact Producing Factors on Environmental Justice

Contributing IPFs*	Issue	Impact Indicator
<ul style="list-style-type: none"> • Accidental releases • Cable emplacement and maintenance • Discharges 	Potential public health and safety impacts	Qualitative assessment of impacts to minority and low-income populations from Project impacts that could affect public health and safety, including air quality, water quality, noise, and land use impacts
<ul style="list-style-type: none"> • Land disturbance • Lighting • Noise • Port utilization 	Potential job and income losses due to disruption of commercial fisheries or for-hire recreational fishing**	Qualitative assessment of economic impacts to minority and low-income populations due to Project impacts to commercial fisheries and for-hire recreational fishing
<ul style="list-style-type: none"> • Presence of structures • Traffic 	Potential underrepresentation of minority or low-income populations in the public participation process	Qualitative assessment of impacts on the natural or physical environment

* All listed IPFs may not necessarily contribute to each individual issue.

** This analysis does not assess economic impacts to minority or low-income populations that could occur as a result of employment and income changes in sectors of the ocean economy other than the commercial fishing and for-hire recreational fishing industries. As discussed in Section 3.5.3.2.3 (Demographics, Employment, and Economics), Project construction and installation would support new employment and economic activity in the marine construction and transportation sectors. As described in Table G-1 in Appendix G, where possible, local workers would be hired to meet labor needs for Project construction. These employment and income benefits are expected to be no greater for minority or low-income populations than those experienced by non-minority or non-low-income members of the general population who also reside in the analysis area. Section 3.5.3.2.3 also notes that the adverse or beneficial economic impacts of Project construction activities on other sectors in the ocean economy aside from marine construction and transportation and would be temporary and negligible to moderate. The adverse or beneficial economic impacts of Project O&M activities on sectors in the ocean economy are also expected to be negligible to moderate but long term.”]

Negligible: No measurable impacts would occur.

Minor to moderate: Adverse impacts to the affected environmental justice population could be avoided with EPMs or would be unavoidable but not disproportionately high and adverse.

Major: The affected environmental justice population would experience disproportionately high and adverse effects due to 1) impacts on the natural or physical environment; 2) impacts that appreciably exceed or are expected to appreciably exceed those on the general population or other appropriate comparison group; or 3) impacts that occur or would occur in a minority or low-income population, or Native American tribe affected by cumulative or multiple adverse exposures from environmental hazards

1.3.5 Land Use and Coastal Infrastructure

Table G - 17 Potential Impact Producing Factors on Land Use and Coastal Infrastructure

Contributing IPFs*	Issue	Impact Indicator
<ul style="list-style-type: none"> • Accidental releases and discharges • Land disturbance 	Public health and safety	Construction- or operation-related volume increases, traffic delays, traffic re-routes, and noise
<ul style="list-style-type: none"> • Lighting • Port utilization 	Port improvements and operations	Changes to vehicle, vessel traffic volumes, and infrastructure demands
<ul style="list-style-type: none"> • Presence of structures • Traffic 	Land use code and zoning	Qualitative assessment of compliance with local land use regulations

* All listed IPFs may not necessarily contribute to each individual issue.

Negligible: No measurable/detectable change to area land use would occur.

Minor: Impacts would be detectable but would be short term and localized.

Moderate: Impacts would be detectable and broad-based, affecting a variety of land uses, but would be short term and would not result in long-term change.

Major: Impacts would be detectable, long term, extensive, and result in permanent land use change.

1.3.6 Navigation and Vessel Traffic

Table G - 18 Potential Impact Producing Factors on Navigation and Vessel Traffic

Contributing IPFs*	Issue	Impact Indicator
<ul style="list-style-type: none"> • Anchoring • Cable emplacement and maintenance 	Vessel or structural damage due to incident	Increased frequency of strikes/allisions, collisions, and groundings
<ul style="list-style-type: none"> • Presence of structures 	Vessel traffic	Increased vessel traffic or congestion
<ul style="list-style-type: none"> • Port utilization • Traffic 	Navigation	Changes to navigational patterns and increased risk of navigational hazards

* All listed IPFs may not necessarily contribute to each individual issue.

Negligible: No measurable impacts would occur.

Minor: Impacts to vessels and turbines could be avoided with EPMs. Impacts would not disrupt the normal or routine functions or navigation of the vessel or turbine.

Moderate: Impacts are unavoidable, although EPMs would reduce impacts substantially during the life of the Project. The vessel would have to adjust somewhat to account for disruptions due to impacts of the Project.

Major: Vessel traffic would experience unavoidable disruptions to a degree beyond what is normally acceptable.

1.3.7 Other Uses (Marine Minerals, Military Use, Aviation, Scientific Research, and Surveys)

Table G - 19 Potential Impact Producing Factors on Other Uses (Marine Minerals, Military Use, Aviation, Scientific Research, and Surveys)

Contributing IPFs*	Issue	Impact Indicators
<ul style="list-style-type: none"> • Presence of structures • Traffic 	Military and National Security Uses: Reduction in the military's ability to access and use the site due to construction vessel traffic and WTG installation	Level of interruption to military exercises
	Reduced availability of offshore energy (oil/gas) production at the site	Acreage of oil and gas activities excluded due to WTGs or offshore SRWEC
	Reduced access to sand and minerals on the OCS	Acreage of mineral extraction area excluded due to WTGs or offshore SRWEC
	Aviation and Air Traffic: Risk to aviation traffic	Qualitative assessment of risk to flight vectors to regional airports
	Radar Systems: Impact to land-based radar (air traffic control, NOAA weather, high-frequency ocean observation radar)	Qualitative assessment of potential for radar shadow
	Impacts to other renewable energy projects, particularly if there is overlap in ports to be used; transit lane orientation	Qualitative assessment of potential for exclusion of other renewable energy projects
	Cables and Pipelines: Impact to any proposed/approved pipelines; electricity/telecom transmission lines	Qualitative assessment of potential for exclusion of or damage to other undersea cables
	Scientific Research and Surveys: Impacts to scientific research and surveys	Qualitative assessment of potential for reduced or eliminated survey opportunities
	Impact to dredged material ocean disposal sites	Project overlap with ocean disposal sites

* All listed IPFs may not necessarily contribute to each individual issue.

Negligible: No measurable impacts would occur.

Minor: Adverse impacts to the affected activity could be avoided with EPMs, and impacts would not disrupt the normal or routine functions of the affected activity. Once the Project is decommissioned, the affected activity would return to a condition with no measurable effects.

Moderate: Impacts to the affected activity are unavoidable, but EPMs would reduce impacts substantially during the life of the Project. The affected activity would have to adjust somewhat to account for disruptions due to impacts of the Project, or, once the Project is decommissioned, the affected activity would return to a condition with no measurable effects if proper remedial action is taken.

Major: The affected activity would experience unavoidable disruptions to a degree beyond what is normally acceptable, and, once the Project is decommissioned, the affected activity could retain measurable effects indefinitely, even if remedial action is taken.

1.3.8 Recreation and Tourism

Table G - 20 Potential Impact Producing Factors on Recreation and Tourism

Contributing IPFs*	Issue	Impact Indicator
<ul style="list-style-type: none"> • Anchoring • Cable emplacement and maintenance • Lighting • Noise • Presence of structures • Port utilization • Traffic 	Changes to recreation access and opportunity	Qualitative assessment of changes to the following: <ul style="list-style-type: none"> • Vehicle/vessel traffic volume • Viewshed • Navigation hazards • Access restrictions

*All listed IPFs may not necessarily contribute to each individual issue.

Negligible: No measurable impacts to the recreation setting, recreation opportunities, or recreation experiences would occur.

Minor: Most impacts could be avoided with EPMs.

Moderate: EPMs would minimize, but not fully resolve impacts.

Major: Impacts would be unavoidable even with EPMs; additional mitigation could be required.

1.3.9 Visual Resources

Table G - 21 Potential Impact Producing Factors on Visual Resources

Contributing IPFs*	Issue	Impact Indicator
<ul style="list-style-type: none"> • Cable emplacement and maintenance • Land disturbance • Light • Presence of structures • Port utilization • Traffic • Anchoring • Noise • Accidental releases 	Change in scenic quality of the landscape and seascape	Visual contrast and dominance of Project component structures and activities onshore and offshore visible in the viewshed

*All listed IPFs may not necessarily contribute to each individual issue.

Negligible:

Seascape, landscape, Ocean impact assessment (SLIA): Very little or no effect on seascape/landscape/ocean unit features, elements, or key qualities, either because unit has minimal visibility/susceptibility or lacks value (distinctive character or key features/elements/qualities)

Visual impact assessment (VIA): Very little or no effect on viewers experiences, because project visibility/contrast/magnitude of change are minimal, and/or view receptor sensitivity/susceptibility/value is minimal.

Minor:

SLIA: The project would introduce features that may have noticeable low to medium levels of visual prominence within the geographic area of an ocean/ seascape/ landscape character unit. The project features may introduce a visual character that is somewhat inconsistent with the character of the unit, which may have minor to medium negative effects to the unit's features, elements, or key qualities, but the unit's features, elements, or key qualities have low susceptibility or value.

VIA: The visibility of the project would introduce a small but noticeable to medium level of change to the view's character; have a low to medium level of visual prominence that attracts but may or may not hold the viewer's attention; and have a small to medium effect on the viewer's experience. The viewer receptor sensitivity/susceptibility/value is low. If the value, susceptibility, and viewer concern for change is medium or high, then evaluate the nature of the sensitivity to determine if elevating the impact to the next level is justified. For instance, a KOP with a low magnitude of change, but has a high level of viewer concern (combination of susceptibility/value) may justify adjusting to a moderate level of impact.

Moderate:

SLIA: The project would introduce features that would have medium to large levels of visual prominence within the geographic area of an ocean/seascape/landscape character unit. The project would introduce a visual character that is inconsistent with the character of the unit, which may have a moderate negative effect to the unit's features, elements, or the key qualities. In areas affected by large magnitudes of change, the unit's features, elements or key qualities have low susceptibility and/ or value.

VIA: The visibility of the project would introduce a moderate to large level of change to the view's character; may have a moderate to large levels of visual prominence that attracts and holds, but may or may not dominate the viewer's attention; and has a moderate effect on the viewer's visual experience. The viewer receptor sensitivity/susceptibility/value is medium to low. Moderate impacts are typically associated with medium viewer receptor sensitivity (combination of susceptibility/value) in areas where the view's character has medium levels of change; or low viewer receptor sensitivity (combination of susceptibility/value) in areas where the view's character has large changes to the character. If the value, susceptibility, and viewer concern for change is high, then evaluate the nature of the sensitivity to determine if elevating the impact to the next level is justified.

Major:

SLIA: The project would introduce features that would have dominant levels of visual prominence within the geographic area of an ocean/seascape/landscape character unit. The project would introduce a visual character that is inconsistent with the character of the unit, which may have a major negative effect to the unit's features, elements, or key qualities. The concern for change (susceptibility/value) to the character unit is high.

VIA: The visibility of the project would introduce a major level of character change to the view; would attract, hold, and dominate the viewer's attention; and have a moderate to major effect on the viewer's visual experience. The viewer receptor sensitivity/susceptibility/value is medium to high. If the magnitude of change to the view's character is medium, but the susceptibility or value at the KOP is high, and, then evaluate the nature of the sensitivity to determine if elevating the impact to major is justified. If the susceptibility and value at the KOP is low in an area where the magnitude of change is large, then evaluate the nature of the sensitivity to determine if lowering the impact to moderate is justified.