

11.0 INCIDENTAL TAKE STATEMENT

Section 9 of the ESA prohibits the take of endangered species of fish and wildlife. “Fish and wildlife” is defined in the ESA “as any member of the animal kingdom, including without limitation any mammal, fish, bird (including any migratory, non-migratory, or endangered bird for which protection is also afforded by treaty or other international agreement), amphibian, reptile, mollusk, crustacean, arthropod or other invertebrate, and includes any part, product, egg, or offspring thereof, or the dead body or parts thereof.” 16 U.S.C. 1532(8). “Take” is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct (16 U.S.C. 1532(19)). Harm is further defined by us to include any act which actually kills or injures fish or wildlife. Such an act may include significant habitat modification or degradation that actually kills or injures fish or wildlife by significantly impairing essential behavioral patterns including breeding, spawning, rearing, migrating, feeding, or sheltering (50 CFR 222.102). Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity (50 CFR 402.02). “Otherwise lawful activities” are those actions that meet all State and Federal legal requirements except for the prohibition against taking in ESA Section 9 (51 FR 19936, June 3, 1986), which would include any state endangered species laws or regulations. Section 9(g) makes it unlawful for any person “to attempt to commit, solicit another to commit, or cause to be committed, any offense defined [in the ESA.]” 16 U.S.C. 1538(g). A “person” is defined in part as any entity subject to the jurisdiction of the United States, including an individual, corporation, officer, employee, department or instrument of the Federal government (see 16 U.S.C. 1532(13)). Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited under the ESA provided that such taking is in compliance with the terms and conditions of this Incidental Take Statement.

The measures described below are non-discretionary, and must be undertaken by BOEM and any lessees/applicants, for the exemption in section 7(o)(2) to apply. BOEM has a continuing duty to regulate the activity covered by this Incidental Take Statement. If BOEM (1) fails to assume and implement the terms and conditions consistent with its authority or (2) fails to require any lessee/applicant, to adhere to the terms and conditions of the Incidental Take Statement through enforceable terms that are added any leases or approvals consistent with its authority, the protective coverage of section 7(o)(2) may lapse. In order to monitor the impact of incidental take, BOEM must report the progress of the actions and their impact on the species to us as specified in the Incidental Take Statement [50 CFR §402.14(i)(3)] (See U.S. Fish and Wildlife Service and National Marine Fisheries Service’s Joint Endangered Species Act Section 7 Consultation Handbook (1998) at 4-49).

In the Opinion, we concluded that the programmatic action is likely to result in take of North Atlantic right, humpback, fin, sei, and sperm whales in the form of harassment, where habitat conditions (i.e., sound levels above the 160 dB threshold for pulsed noise used to determine harassment under the MMPA) will temporarily impair normal behavior patterns. This harassment will occur in the form of avoidance or displacement from preferred habitat and behavioral and/or metabolic compensations to deal with short-term masking or stress. While whales may experience temporary impairment of behavior patterns, no significant impairment resulting in injury (i.e., “harm”) is likely due to: measures to ensure that no whales are exposed to sound levels that could result in injury, the ability of whales to easily move to areas beyond

the impact zone that also provide suitable prey, and the limited exposure time to disturbing levels of sound.

In 2016, we divided the globally listed endangered humpback whale species into 14 distinct population segments (DPS), removed the current species-level listing, and in its place listed four DPSs as endangered and one DPS as threatened. Based on their current statuses, we determined the remaining nine DPSs do not warrant listing. The humpback whales that occur in the action area belong to the West Indies DPS which was determined not to warrant listing. This final rule was effective on October 11, 2016 (81 FR 62260, September 8, 2016). As such, the ESA section 9 prohibitions on take no longer apply to humpback whales in the action area.

The Opinion includes an estimate of the number of whales that are likely to experience harassment due to the programmatic action. However, no instances of harassment of listed whales are exempt from the ESA's prohibition against take unless this incidental take statement is amended to include a project-specific estimate of incidental take of whales and that level of take has also been authorized by NMFS Office of Protected Resources through issuance of an Incidental Harassment Authorization (IHA) under the Marine Mammal Protection Act (MMPA).

This Incidental Take Statement has been amended as follows since issuance of the Opinion:

- to exempt the take of right, humpback and fin whales exposed to noise generated by Bay State Wind's high resolution geophysical survey scheduled to occur between August 13, 2016 to August 12, 2017. This take was authorized by NMFS Office of Protected Resources through the issuance of an IHA under the MMPA (81 FR 56589, August 22, 2016; see section 11.2 below).
- to exempt the take of fin whales exposed to noise generated by Ocean Wind's high resolution geophysical survey in 2017. This take was authorized by NMFS Office of Protected Resources through the June 9, 2017, issuance of an Incidental Harassment Authorization (IHA) through the issuance of an IHA under the MMPA (82 FR 31562, July 7, 2017; see section 11.3 below).
- to exempt the take of right, fin, sperm and sei whales exposed to noise generated by Deepwater Wind's high resolution geophysical surveys scheduled to begin in June 2017 in lease area OCS A-0486. This take was authorized by NMFS Office of Protected Resources through the issuance of an IHA under the MMPA (82 FR 32330, July 13, 2017; see section 11.4 below).
- to exempt the take of right, fin and sperm whales exposed to noise generated by Statoil-Empire Wind's high resolution geophysical surveys scheduled to begin in April 2018 in lease area OCS A-0512. This take was authorized by NMFS Office of Protected Resources through the issuance of an IHA under the MMPA (83 FR 19532, May 3, 2018; see section 11.5 below).
- to exempt the take of right, fin, sei and sperm whales exposed to noise generated by Deepwater Wind's high resolution geophysical surveys scheduled to begin in June 2018 in lease area OCS A-0486. This take was authorized by NMFS Office of Protected Resources through the issuance of an IHA under the MMPA (June 13, 2018; see section 11.6 below).
- to exempt the take of fin and sperm whales exposed to noise generated by Bay State Wind's high resolution geophysical surveys scheduled to begin in June 2018 in lease

area OCS A-0500. This take was authorized by NMFS Office of Protected Resources through the issuance of an IHA under the MMPA (July 24, 2018; see section 11.7 below).

- to exempt the take of North Atlantic right, fin, sei, and sperm whales exposed to noise generated by Orsted's high resolution geophysical surveys scheduled to begin no sooner than September 2019 in lease areas OCS A-0486, 0487 and 0500. This take was authorized by NMFS Office of Protected Resources through the issuance of an IHA under the MMPA (September 26, 2019; see section 11.8 below).
- to exempt the take of North Atlantic right, fin, sei, and sperm whales exposed to noise generated by Atlantic Shore's high resolution geophysical surveys scheduled to begin no sooner than April 15, 2020 in lease areas OCS A-0499. This take was authorized by NMFS Office of Protected Resources through the issuance of an IHA under the MMPA (April 10, 2020; see section 11.9 below).

If future takes of right, fin, sperm, or sei whales are authorized under section 101(a)(5) of the MMPA, this Opinion may be further amended to include an incidental take exemption for these species, as appropriate.

11.1 Anticipated Amount or Extent of Incidental Take Considered in the Biological Opinion

In Sections 11.1.1 and 11.1.2, we first identify the amount of take exempted for sea turtles and Atlantic sturgeon, respectively, considering all of the activities considered in this Opinion on a programmatic basis.

11.1.1 Sea Turtles

As established in the Biological Opinion, loggerhead, Kemp's ridley, green and leatherback sea turtles and Atlantic sturgeon from all five DPSs are likely to be exposed to increased underwater noise that will cause behavioral disruption. We have determined that the programmatic action is likely to result in take of these species, in the form of harassment, where habitat conditions (i.e., increased underwater noise) will temporarily impair normal behavior patterns. This harassment will occur in the form of avoidance or displacement from ensonified areas and the temporary disruption of normal foraging, resting and migratory behaviors. Affected individuals will expend additional energy to swim away from ensonified areas. No mortality, injury or harm is anticipated. This is due to the level of noise that individuals will be exposed to as well as the temporary nature of this exposure and the extent of available habitat in the action area where noise levels will not be elevated, in addition to the ability of individuals to avoid noisy areas and move to areas without disturbing levels of underwater noise. Exposure of sea turtles to sound levels greater than 166 dB re 1uPa RMS will be considered harassment because that level of noise will disturb sea turtles and their normal behaviors (i.e., resting, foraging, or migrating through the area) will be interrupted. Given the large size of the area where noise of this level will be experienced (approximately 162 square km during pile driving and 14 square km when the boomer is operated) there will be behavioral and/or metabolic (e.g., temporary increase in energy expenditure) costs associated with avoidance or displacement from the affected habitat.

For sea turtles, we are able to use published density estimates to estimate the number of sea turtles that may be exposed to increased underwater noise that would cause harassment during geophysical surveys where a sub-bottom profiler (e.g., boomer) is used and during pile driving. For loggerheads, the density estimates indicate that up to 7 loggerheads and 1 leatherback sea turtle are likely to be exposed to potentially disturbing levels of noise each time the boomer is operated. If we assume that the entirety of the NY, NJ, RI/MA and MA WEA are surveyed, an area that totals approximately 5,439 square kilometers, we would expect that a total of up to 201 leatherbacks and up to 2,774 loggerheads may be exposed to potentially disturbing levels of noise associated with the sub-bottom profiler surveys over a five-year period. No density estimates are available for Kemp's ridley or green sea turtles; however, we expect fewer sea turtles of these species than leatherbacks in the action area. Therefore, each time the boomer is operated, no more than 1 Kemp's ridley and 1 green sea turtles are likely to experience potentially disturbing levels of noise. In total, we expect up to 201 Kemp's ridley and 201 green sea turtles to be exposed to potentially disturbing levels of noise from the sub-bottom profilers.

Our calculations based on reported density estimates indicate that up to 83 loggerheads and up to 6 leatherback sea turtles are likely to be exposed to potentially disturbing levels of noise for each pile that is installed. Depending on the type of met tower installed (monopole or tripod) and the total number of met towers installed, there could be a total of 9-27 piles installed over the entirety of the RI/MA and MA WEAs. In total, we would expect that no more than 2,774 loggerheads and no more than 162 leatherback sea turtles may be exposed to potentially disturbing levels of noise. No density estimates are available for Kemp's ridley or green sea turtles; however, we expect fewer sea turtles of these species than leatherbacks in the action area. Therefore, for each pile that is installed, we expect no more than 6 Kemp's ridley and 6 green sea turtles are likely to experience potentially disturbing levels of noise. In total, we expect no more than 162 Kemp's ridleys and 162 green sea turtles to be exposed to potentially disturbing levels of noise from pile driving.

As explained in the Opinion, these calculations are likely to result in overestimates of the number of individuals exposed. For the geophysical surveys, we consider this a worst case estimate because: (1) it assumes that sea turtle density will be at the maximum reported level throughout the action area, which is unlikely to occur; (2) it uses the maximum distances modeled by BOEM for noise attenuation; and, (3) it assumes that all surveys will occur at a time of year when sea turtles are present (June – November) and that sea turtles will be present at every location that the boomer is operated. For pile driving, we consider this a worst case estimate because: (1) it assumes that sea turtle density will be at the maximum reported level throughout the action area, which is unlikely to occur; (2) it uses the maximum distances modeled by BOEM for noise attenuation; and, (3) it assumes that sea turtles will be present at every location that a pile is installed.

Despite these assumptions, this is the best available estimate of the number of sea turtles that may be exposed to disturbing levels of noise from the sub-bottom profiler. Because both the distribution and numbers of sea turtles in the action area during a geophysical survey or pile driving is likely to be highly variable and a function of the time of year, the behavior of individual turtles, the distribution of prey and other environmental variables, and because incidental take is indirect and likely to occur from effects to habitat, the amount of take resulting

from harassment is difficult, if not impossible, to estimate. In addition, because of the large size of ensonified area, we do not expect that BOEM or the lessees will be able to monitor the behavior of all sea turtles in the action area in a manner which would detect responses to geophysical surveys or pile driving; therefore, the likelihood of discovering take attributable to exposure to increased underwater noise is very limited. In such circumstances, NMFS uses a surrogate to estimate the extent of take. The surrogate must be rationally connected to the taking and provide a threshold of exempted take which, if exceeded, provides a basis for reinitiating consultation. For this proposed action, the spatial and temporal extent of the area where underwater noise is elevated above 166 dB re 1uPa RMS will serve as a surrogate for estimating the amount of incidental take from harassment as it allows NMFS to determine the area and time when loggerhead, leatherback, Kemp's ridley and green sea turtles will be exposed to noise would result in behaviors consistent with the definition of harassment. Based on the known distribution of sea turtles in the action area, we only anticipate harassment during pile driving and geophysical surveys that occur from May – November. In the accompanying biological opinion, we determined that this level of anticipated take is not likely to result in jeopardy to any of the affected species.

11.1.2 Atlantic sturgeon

As established in the Biological Opinion, Atlantic sturgeon from all five DPSs are likely to be exposed to increased underwater noise that will cause behavioral disruption. We have determined that the programmatic action is likely to result in take of these species, in the form of harassment, where habitat conditions (i.e., increased underwater noise) will temporarily impair normal behavior patterns. This harassment will occur in the form of avoidance or displacement from ensonified areas and the temporary disruption of normal foraging, resting and migratory behaviors. Affected individuals will expend additional energy to swim away from ensonified areas. No mortality, injury or harm is anticipated. This is due to the level of noise that individuals will be exposed to as well as the temporary nature of this exposure and the extent of available habitat in the action area where noise levels will not be elevated and the ability of individuals to avoid noisy areas and move to areas without disturbing levels of underwater noise. Exposure of Atlantic sturgeon to sound levels greater than 150 dB re 1uPa RMS will be considered harassment because that level of noise will disturb Atlantic sturgeon and their normal behaviors (i.e., resting, foraging or migrating through the area) will be interrupted. Given the large size of the area where noise of this level will be experienced (approximately 4,979 square km during pile driving and 22.9 square km when the boomer is operated) there will be behavioral and/or metabolic (e.g., temporary increase in energy expenditure) costs associated with avoidance or displacement from the affected habitat.

Because there are no available estimates of Atlantic sturgeon density in the programmatic action area, we are not able to estimate the number of Atlantic sturgeon of any DPS that may be taken by harassment due to the overall program. Because both the distribution and numbers of Atlantic sturgeon in the action area during a geophysical survey or pile driving is likely to be highly variable and a function of the time of year, the behavior of individual fish, the distribution of prey and other environmental variables, and because incidental take is indirect and likely to occur from effects to habitat, the amount of take resulting from harassment is difficult, if not impossible, to estimate. In addition, because there are no known means to detect the presence of Atlantic sturgeon during geophysical surveys or pile driving activities, it would be extremely

difficult, if not impossible, to monitor the behavior of all Atlantic sturgeon in the action area in a manner which would detect responses to geophysical surveys or pile driving, the likelihood of discovering take attributable to exposure to increased underwater noise is very limited. In such circumstances, NMFS uses a surrogate to estimate and monitor the extent of take. The surrogate must be rationally connected to the taking and provide a threshold of exempted take which, if exceeded, provides a basis for reinitiating consultation. For the programmatic action, the spatial and temporal extent of the area where underwater noise is elevated above 150 dB re 1uPa RMS (a distance of 2.7km from the source when the boomer is used and a distance of 39.8 km during pile driving) will serve as a surrogate for estimating and monitoring the amount of incidental take from harassment as it allows NMFS to determine the area and time when sturgeon will be exposed to noise would result in behaviors consistent with the definition of harassment and when the anticipated level of incidental take has been exceeded.

11.2 Amount or Extent of Take Anticipated during Activities Proposed by Bay State Wind (OCS A-0500) – AMENDED AUGUST 12, 2016

Bay State Wind will carry out a high resolution geophysical (HRG) survey over a thirty-day period scheduled from mid-August to mid-September 2016. They will also carry out a geotechnical investigation and install two meteorological buoys.

11.2.1 Sea turtles and Sturgeon- Bay State Wind

As explained in the Opinion, sea turtles and Atlantic sturgeon can only perceive noise at frequencies less than 1,000 Hz (1 kHz). The only equipment being used by Bay State Wind that operates below 1000 Hz is the sparker (200-800 Hz), which is a type of boomer. The effects of using boomers for HRG surveys are considered in the Opinion. However, the boomer being used by Bay State Wind is less powerful than the “worst-case scenario” analyzed in the programmatic Opinion; thus, the distances to the isopleths of concern are smaller than those considered in the programmatic Opinion.

The table below contains the distances to the 180 and 160 dB re 1uPa RMS isopleth from each of the equipment types being used in the HRG surveys as reported in the SAP and the IHA application.

HRG Equipment	Distance from source to 180 dB _{RMS} re 1 μPa (m)*	Distance from source to 160 dB _{RMS} re 1 μPa (m)
ixBlue GAPS (pinger)	< 10	25
Sonardyne Scout USBL (pinger)	0	25
GeoPulse Sub-bottom Profiler (chirper)	30	75
Geo-Source 800 (sparker)	80	250
Geo-Source 200 (sparker)	90	380

As required by the lease, a 200-meter exclusion zone will be maintained by Bay State Wind. This ensures that, as explained in the Opinion, no sea turtles will be exposed to underwater noise that could result in injury. Because we do not expect any sea turtles to be exposed to noise greater than 180 dB re 1uPa RMS, no injury is anticipated or exempted.

In the Opinion, we calculated the amount of sea turtles to be taken by harassment by applying the density estimates to the total area that would experience disturbing levels of noise. For the Bay State Wind HRG survey, the boomer that will be used will pulse for less than one second. One pulse will occur approximately every 12 meters as the survey vessel moves along the survey track lines. During each pulse, an area extending 240 m from the source will have noise levels exceeding 166 dB re 1uPa RMS. Assuming that the survey track lines will extend to the border of the lease area and given that the track lines will cover the entirety of the lease area, the total area that will experience disturbing levels of noise over the 30-day survey period includes the 759 km² lease area and extends 240m in every direction from the edge of the lease area. Applying the density estimates used in the Opinion (0.51 loggerheads/km² and 0.037 leatherbacks/km²) and considering that we expect fewer green and Kemp's ridley sea turtles in the action area than leatherbacks, we calculate that no more than 387 loggerheads, 28 leatherbacks, 28 green and 28 Kemp's ridley sea turtles will be harassed during the 30-day Bay State Wind HRG survey. Given the large area to be affected by disturbing levels of sound we do not expect that all of these sea turtles will be observed. Even though we have identified numbers of sea turtles likely to be adversely affected, in situations in which monitoring numbers of individuals is difficult or impossible, a surrogate measure of incidental take that can be monitored provides an alternative means of determining when anticipated incidental take levels have been exceeded. Given the large area to be affected, the fact that sea turtles would swim underwater when disturbed, and the resulting difficulty in monitoring sea turtle impacts, the spatial and temporal extent of the area where underwater noise is elevated above 166 dB re 1uPa RMS, which is anticipated to be 0.18 km² during each pulse of the boomer, and a total area that includes the 759 km² lease area and extends 240m in every direction from the lease area, will serve as a surrogate for estimating the amount of incidental take from harassment. Monitoring the spatial and temporal extent of this area will allow NMFS to determine the area and time when loggerhead, leatherback, Kemp's ridley and green sea turtles will be exposed to noise that would result in behaviors consistent with the definition of harassment and when the anticipated level of incidental take has been exceeded.

As explained in the Opinion, injury to sturgeon is expected if exposed to pulsed noise louder than 212 dB re 1uPa peak. Peak noise greater than 212 dB re 1uPa is only experienced within 1 m of the sparker. As explained in the Opinion we do not expect any sturgeon to be exposed to noise greater than 212 dB re 1uPa peak because we do not expect any to occur within 1 m of the source. Therefore, no injury is anticipated or exempted.

In the Opinion, we explained that without density estimates, we could not calculate the total number of Atlantic sturgeon, or of any DPS, to be taken by harassment. We explain that the area with noise above 150 dB re 1uPa RMS will serve as a surrogate for estimating the amount of incidental take from harassment as it allows NMFS to determine the area and time when Atlantic sturgeon will be exposed to noise would result in behaviors consistent with the definition of harassment. For this action, the spatial and temporal extent of the area where underwater noise is elevated above 150dB re 1uPa RMS is anticipated to be 4.08 km² during each pulse of the boomer, and a total area that includes the 759 km² lease area and extends 1.14km in every direction from the 759 km² lease area.).

11.2.2 Whales -- Bay State Wind

BOEM has approved a Site Assessment Plan (SAP) for Bay State Wind's lease area off the coast of Massachusetts. NMFS' OPR has determined the proposed high resolution geophysical survey, to be carried out over an approximately 7-day period in August 2016, is likely to result in the harassment, due to exposure to underwater noise between 160 and 179 dB re 1uPa RMS, of one right whale, one humpback whale and seven fin whales. The IHA will be effective for one year and no renewals are anticipated as the surveys are anticipated to occur only once. While the effective period of the IHA is August 15, 2016 through August 14, 2017, survey work, and associated take, is only expected to occur over a one-week period in August 2016. No take of any whale species is anticipated as a result of the proposed geotechnical survey or the installation of the meteorological buoys.

The amount of exempted take will be exceeded if the number of right, humpback, or fin whales taken by acoustic harassment as defined above exceeds the estimate of one right whales, one humpback whale and seven fin whales as a result of the HRG survey. No right, humpback or fin whales are anticipated to be harmed, injured, or killed as a result of the HRG survey; therefore, no such take is exempted.

11.2.3 Exceedence of the ITS for Bay State Wind

We will consider the ITS for Bay State Wind to be exceeded if any of the following occur during Bay State Wind's geophysical survey of Lease Area OCS A-0500:

- Peak noise for any equipment operating below 1,000 Hz is louder than 212 dB re 1uPa at a distance of more than 1 m from the source (this suggests that unanticipated injury to Atlantic sturgeon occurred).
- The extent of the 180 dB re 1uPa RMS isopleth for any equipment operating below 1,000 Hz exceeds 200m (this means that the exclusion zone is not big enough to prevent sea turtle injury).
- The extent of the area ensonified with noise louder than 166 dB re 1uPa RMS, which is anticipated to be 0.18 km² during each pulse of the boomer, and a total area that includes the 759 km² lease area and extends 240m in every direction from the 759 km² lease area, is exceeded.
- The extent of the area ensonified with noise louder than 150 dB re 1uPa RMS, which is anticipated to be 4.08 km² during each pulse of the boomer, and a total area that extends 1.14km in every direction from the 759 km² lease area, is exceeded.
- The HRG survey takes place on more than 30 days.
- A total area greater than 759 km² is surveyed with equipment operating below 1,000 Hz.
- Any sea turtles or Atlantic sturgeon are harmed, injured or killed as a result of the HRG survey.
- Any right, humpback or fin whales are harmed, injured, or killed as a result of the HRG survey.
- If the number of such whales taken by acoustic harassment as defined above exceeds the estimate of one right whale, one humpback whale and seven fin whales.

11.3 Amount or Extent of Take Anticipated during Activities Proposed by Ocean Wind (OCS A-0498) – AMENDED JUNE 12, 2017

Ocean Wind will carry out marine site characterization surveys in the approximately 160,480-acre (649.4 square km) Lease Area located approximately 9 nautical miles (nm) southeast of Atlantic City, New Jersey. Marine site characterization surveys will consist of both HRG and geotechnical survey activities. The purpose of the marine site characterization surveys is to: support the siting, design, and deployment of up to two meteorological data collection buoys referred to as floating light and detection ranging buoys (FLIDARs) and up to two metocean and current buoys; and obtain a baseline assessment of seabed/sub-surface soil conditions in the Lease Area. There will be a total of approximately 42 survey days scheduled to begin in June 2017. No take is anticipated or exempted for the installation, operation or decommissioning of the buoys or the geotechnical survey (anticipated over 12 days in September 2017).

11.3.1 Sea turtles and Sturgeon- Ocean Wind

As explained in the Opinion, sea turtles and Atlantic sturgeon can only perceive noise at frequencies less than 1,000 Hz (1 kHz). The only equipment being used by Ocean Wind that operates below 1000 Hz is the sparker (200-800 Hz), which is a sub-bottom profiler with similar operational frequencies and source levels as a boomer. The effects of using sub-bottom profilers for HRG surveys are considered in the Opinion. The source level of the sub-bottom profiler being used by Ocean Wind is equivalent to the “worst-case scenario” analyzed in the programmatic Opinion; however, the distances to the isopleths of concern are smaller than the modelled distances considered in the programmatic Opinion as a result of more recent empirical data collection (see Table below, BSW 2016)). The distances to the 180, 166, 160 and 150 dB re 1µPa RMS isopleth for the sparker being used in the HRG surveys as reported by Bay State Wind are 3 m, 14m, 27 m and 87 m, respectively. The actual isopleth distances will be verified through sound source verification in the field.

BOEM Sound Level Isopleth	Chirp SBP	Sparker (600J)	Sparker (800J)
207dB re 1 µPa SPL _{RMS90%} Injurious Thresholds for Marine Turtles	0m	0m	0m
180dB re 1 µPa SPL _{RMS90%} Marine Mammal Level A Harassment Zone	0m	2m	3m
166dB re 1 µPa SPL _{RMS90%} Behavioral Threshold for Marine Turtles	2m	6m	14m
160dB re 1 µPa SPL _{RMS90%} Marine Mammal Level B Harassment Zone	4m	12m	27m
150dB re 1 µPa SPL _{RMS90%} Behavioral Threshold for Atlantic Sturgeon	13m	37m	87m
187dB re 1 µPa ² .s cSEL Physiological Effects on Fish	6m	12m	31m

As required by the lease, a 200-meter exclusion zone will be maintained by Ocean Wind. This ensures that, as explained in the Opinion, no sea turtles will be exposed to underwater noise that could result in injury. Because we do not expect any sea turtles to be exposed to noise greater than 180 dB re 1µPa RMS, no injury is anticipated or exempted.

In the Opinion, we calculated the amount of sea turtles to be taken by harassment by applying the density estimates to the total area that would experience disturbing levels of noise. The distances

to the 180, 166, 160 and 150 dB re 1uPa RMS isopleth surveys as reported by BOEM in regards to the 2016 Bay State Wind SAP survey plan are 90 m, 240 m, 380 m and 1,140 m, respectively. For the Ocean Wind HRG survey, the sparker that will be used will pulse for less than one second. One pulse will occur approximately every 12 meters as the survey vessel moves along the survey track lines. During each pulse, an area extending approximately 75 m from the source will have noise levels exceeding 166 dB re 1uPa RMS. Assuming that the survey track lines will extend to the border of the lease area and given that the track lines will cover the entirety of the lease area, the total area that will experience disturbing levels of noise over the 42-day survey period includes the 649.4 km² lease area and extends 240m in every direction from the edge of the lease area. Applying the density estimates used in the Opinion (0.51 loggerheads/km² and 0.037 leatherbacks/km²) and considering that we expect fewer green and Kemp's ridley sea turtles in the action area than leatherbacks, we calculate that no more than 331 loggerheads, 24 leatherbacks, 24 green and 24 Kemp's ridley sea turtles will be harassed during the Ocean Wind HRG survey. Given the large area to be affected by disturbing levels of sound we do not expect that all of these sea turtles will be observed. Even though we have identified numbers of sea turtles likely to be adversely affected, in situations in which monitoring numbers of individuals is difficult or impossible, a surrogate measure of incidental take that can be monitored provides an alternative means of determining when anticipated incidental take levels have been exceeded. Given the large area to be affected, the fact that sea turtles would swim underwater when disturbed, and the resulting difficulty in monitoring sea turtle impacts, the spatial and temporal extent of the area where underwater noise is elevated above 166 dB re 1uPa RMS, which is anticipated to be 0.18 km² during each pulse of the boomer, and a total area that includes the 649.4 km² lease area and extends 240m in every direction from the lease area, will serve as a surrogate for estimating the amount of incidental take from harassment. Monitoring the spatial and temporal extent of this area will allow NMFS to determine the area and time when loggerhead, leatherback, Kemp's ridley and green sea turtles will be exposed to noise that would result in behaviors consistent with the definition of harassment and when the anticipated level of incidental take has been exceeded.

As explained in the Opinion, injury to sturgeon is expected if exposed to pulsed noise louder than 212 dB re 1uPa peak. Peak noise greater than 212 dB re 1uPa is only experienced within 1 m of the sparker. As explained in the Opinion we do not expect any sturgeon to be exposed to noise greater than 212 dB re 1uPa peak because we do not expect any to occur within 1 m of the source. Therefore, no injury is anticipated or exempted.

In the Opinion, we explained that without density estimates, we could not calculate the total number of Atlantic sturgeon, or of any DPS, to be taken by harassment. We explain that the area with noise above 150 dB re 1uPa RMS will serve as a surrogate for estimating the amount of incidental take from harassment as it allows NMFS to determine the area and time when Atlantic sturgeon will be exposed to noise would result in behaviors consistent with the definition of harassment. For this action, the spatial and temporal extent of the area where underwater noise is elevated above 150dB re 1uPa RMS is anticipated to be 4.08 km² during each pulse of the sparker, and a total area that includes the 649.4 km² lease area and extends 1.14km in every direction from the 649.4 km² lease area. It should be noted that the modelled distances in the Opinion are conservative when compared to the sound source verification results presented in the table above.

11.3.2 Whales -- Ocean Wind

BOEM will approve a Survey Plan for Ocean Wind's lease area off the coast of New Jersey upon amendment of this ITS. NMFS' OPR has determined the proposed high resolution geophysical survey, to be carried out over an approximately 42-day period beginning in June 2017, is likely to result in Level B harassment (temporary avoidance or alteration of opportunistic foraging behavior), due to exposure to underwater noise between 160 and 179 dB re 1uPa RMS, of five fin whales. The IHA will be effective for one year and no renewals are anticipated as the surveys are anticipated to occur only once. While the IHA will be effective from June 9, 2017 through June 8, 2018, survey work, and associated take, is only expected to occur over a 42-day period in June and July 2017. No take of any whale species is anticipated as a result of the proposed geotechnical survey or the installation of the meteorological buoys.

The amount of exempted take will be exceeded if the number of fin whales taken by acoustic harassment as defined above exceeds the estimate of five fin whales as a result of the HRG survey. No right, sperm or sei whales are anticipated to be harassed as a result of the HRG survey; therefore, no such take is exempted. No whales of any species are anticipated to be harmed, injured, or killed as a result of the HRG survey; therefore, no such take is exempted.

11.3.3 Exceedence of the ITS for Ocean Wind

We will consider the ITS for Ocean Wind to be exceeded if any of the following occur during Ocean Wind's geophysical survey of Lease Area OCS A-0498:

- Peak noise for any equipment operating below 1,000 Hz is louder than 212 dB re 1uPa at a depth of ≥ 50 m from the source (this suggests that unanticipated injury to Atlantic sturgeon occurred).
- The extent of the 180 dB re 1uPa RMS isopleth for any equipment operating below 1,000 Hz exceeds 200m (this means that the exclusion zone is not big enough to prevent sea turtle injury).
- The extent of the area ensonified with noise louder than 166 dB re 1uPa RMS, which is anticipated to be 0.18 km² during each pulse of the sparker, and a total area that includes the 649.4 km² lease area and extends 240m in every direction from the 649.4 km² lease area, is exceeded.
- The extent of the area ensonified with noise louder than 150 dB re 1uPa RMS, which is anticipated to be 4.08 km² during each pulse of the sparker, and a total area that extends 1.14km in every direction from the 649.4 km² lease area, is exceeded.
- The HRG survey takes place on more than 42 days.
- A total area greater than 649.4 km² is surveyed with equipment operating below 1,000 Hz.
- Any sea turtles or Atlantic sturgeon are harmed, injured or killed as a result of the HRG survey.
- Any whales are harmed, injured, or killed as a result of the HRG survey.
- If the number of such whales taken by acoustic harassment as defined above exceeds the estimate of five fin whales.

11.4 Amount or Extent of Take Anticipated during Activities Proposed by Deepwater Wind’s 2017 Survey Activities (OCS A-0486) – AMENDED JUNE 21, 2017

Deepwater Wind will carry out marine site characterization surveys in the approximately 97,498-acre (394 km²) Lease Area within the RI-MA WEA, including along potential submarine cable routes to a potential landfall location in Easthampton, New York. Marine site characterization surveys will consist of both HRG and geotechnical survey activities. The purpose of the marine site characterization surveys are to support the characterization of the existing seabed and subsurface geological conditions in the project area. The geophysical surveys are anticipated to commence in June 2017 and will last for approximately 168 days, including estimated weather down time. Geotechnical surveys will begin in June 2017, and will last approximately 75 days excluding weather downtime.

11.4.1 Sea turtles and Sturgeon- Deepwater Wind

As explained in the Opinion, sea turtles and Atlantic sturgeon can only perceive noise at frequencies less than 1,000 Hz (1 kHz). The only equipment being used by Deepwater Wind that operates below 1,000 Hz are the chirp, boomer and sparker. The effects of using sub-bottom profilers for HRG surveys are considered in the Opinion. The source level of the sub-bottom profiler being used by Deepwater Wind is equivalent to the “worst-case scenario” analyzed in the programmatic Opinion; however, the distances to the isopleths of concern are smaller than the modelled distances considered in the programmatic Opinion as a result of more recent empirical data collection (see Table below, BSW 2016)). The distances to the 180, 166, 160 and 150 dB re 1µPa RMS isopleth for the sparker being used in the HRG surveys as reported by Deepwater Wind are 3 m, 14m, 27 m and 87 m, respectively. The actual isopleth distances will be verified through sound source verification in the field.

BOEM Sound Level Isopleth	Chirp SBP	Sparker (600J)	Sparker (800J)
207dB re 1 µPa SPL_{RMS90%} Injurious Thresholds for Marine Turtles	0m	0m	0m
180dB re 1 µPa SPL_{RMS90%} Marine Mammal Level A Harassment Zone	0m	2m	3m
166dB re 1 µPa SPL_{RMS90%} Behavioral Threshold for Marine Turtles	2m	6m	14m
160dB re 1 µPa SPL_{RMS90%} Marine Mammal Level B Harassment Zone	4m	12m	27m
150dB re 1 µPa SPL_{RMS90%} Behavioral Threshold for Atlantic Sturgeon	13m	37m	87m
187dB re 1 µPa^{2.s} cSEL Physiological Effects on Fish	6m	12m	31m

As required by the lease, a 200-meter exclusion zone will be maintained by Deepwater Wind. This ensures that, as explained in the Opinion, no sea turtles will be exposed to underwater noise that could result in injury. Because we do not expect any sea turtles to be exposed to noise greater than 180 dB re 1µPa RMS, no injury is anticipated or exempted.

In the Opinion, we calculated the amount of sea turtles to be taken by harassment by applying the density estimates to the total area that would experience disturbing levels of noise. For the Deepwater Wind HRG survey, the equipment that will be used will pulse for less than one second. One pulse will occur every few meters (with spacing dependent on the area being

surveyed) as the survey vessel moves along the survey track lines. During each pulse, an area extending approximately 240 m from the source will have noise levels exceeding 166 dB re 1uPa RMS. Assuming that the survey track lines will extend to the border of the lease area and given that the track lines will cover the entirety of the lease area, the total area that will experience disturbing levels of noise over the 168-day survey period includes the 394 km² lease area and extends 240m in every direction from the edge of the lease area. Applying the density estimates used in the Opinion (0.51 loggerheads/km² and 0.037 leatherbacks/km²) and considering that we expect fewer green and Kemp's ridley sea turtles in the action area than leatherbacks, we calculate that no more than 201 loggerheads, 15 leatherbacks, 15 green and 15 Kemp's ridley sea turtles will be harassed during the 168-day Deepwater Wind HRG survey. Given the large area to be affected by disturbing levels of sound we do not expect that all of these sea turtles will be observed. Even though we have identified numbers of sea turtles likely to be adversely affected, in situations in which monitoring numbers of individuals is difficult or impossible, a surrogate measure of incidental take that can be monitored provides an alternative means of determining when anticipated incidental take levels have been exceeded. Given the large area to be affected, the fact that sea turtles would swim underwater when disturbed, and the resulting difficulty in monitoring sea turtle impacts, the spatial and temporal extent of the area where underwater noise is elevated above 166 dB re 1uPa RMS, which is anticipated to be 0.18 km² during each pulse of the boomer, and a total area that includes the 394 km² lease area and extends 240m in every direction from the lease area, will serve as a surrogate for estimating the amount of incidental take from harassment. Monitoring the spatial and temporal extent of this area will allow NMFS to determine the area and time when loggerhead, leatherback, Kemp's ridley and green sea turtles will be exposed to noise that would result in behaviors consistent with the definition of harassment and when the anticipated level of incidental take has been exceeded.

As explained in the Opinion, injury to sturgeon is expected if exposed to pulsed noise louder than 212 dB re 1uPa peak. Peak noise greater than 212 dB re 1uPa is only experienced within 1 m of the sparker and boomer. As explained in the Opinion we do not expect any sturgeon to be exposed to noise greater than 212 dB re 1uPa peak because we do not expect any to occur within 1 m of the source. Therefore, no injury is anticipated or exempted.

In the Opinion, we explained that without density estimates, we could not calculate the total number of Atlantic sturgeon, or of any DPS, to be taken by harassment. We explain that the area with noise above 150 dB re 1uPa RMS will serve as a surrogate for estimating the amount of incidental take from harassment as it allows NMFS to determine the area and time when Atlantic sturgeon will be exposed to noise would result in behaviors consistent with the definition of harassment. For this action, the spatial and temporal extent of the area where underwater noise is elevated above 150dB re 1uPa RMS is anticipated to be 4.08 km² during each pulse of the sub-bottom profiler and a total area that includes the 394 km² lease area and extends 1.14km in every direction from the 394 km² lease area. The modelled estimates in the Opinion are much larger than the empirical data submitted in previous sound source verification reports, including those submitted by Deepwater Wind for surveys that occurred in the same lease area in the Fall of 2015.

11.4.2 Whales -- Deepwater Wind

BOEM is in the process of approving a Survey Plan for Deepwater Wind's lease area (OCS-A 0486). NMFS' OPR has determined the proposed high resolution geophysical survey, to be carried out over an approximately 168-day period beginning in June 2017, is likely to result in the harassment, due to exposure to underwater noise between 160 and 179 dB re 1uPa RMS, of 105 right whales, 73 fin whales, 3 sperm whales and 3 sei whales. The IHA will be effective for one year and no renewals are anticipated as the surveys are anticipated to occur only once. While the effective period of the IHA is June 16 2017 through June 15, 2018, survey work, and associated take, is only expected to occur over a total of 168 survey days beginning in June 2017. No take of any whale species is anticipated as a result of the proposed geotechnical survey.

The amount of exempted take will be exceeded if the number of right, fin, sperm or sei whales taken by acoustic harassment as defined above exceeds the estimate of 108 right whales, 75 fin whales, 3 sperm whales and 3 sei whales. No whales are anticipated to be harmed, injured, or killed as a result of the HRG survey; therefore, no such take is exempted.

11.4.3 Exceedence of the ITS for Deepwater Wind

We will consider the ITS for Deepwater Wind to be exceeded if any of the following occur during their geophysical survey of Lease Area OCS A-0486:

- Peak noise for any equipment operating below 1,000 Hz is louder than 212 dB re 1uPa at a depth of more than 15 m from the source (this suggests that unanticipated injury to Atlantic sturgeon occurred).
- The extent of the 180 dB re 1uPa RMS isopleth for any equipment operating below 1,000 Hz exceeds 200m (this means that the exclusion zone is not big enough to prevent sea turtle injury).
- The extent of the area ensonified with noise louder than 166 dB re 1uPa RMS, which is anticipated to be 0.18 km² during each pulse of the boomer/sparker, and a total area that includes the 394 km² lease area and extends 240m in every direction from the 394 km² lease area, is exceeded.
- The extent of the area ensonified with noise louder than 150 dB re 1uPa RMS, which is anticipated to be 4.08 km² during each pulse of the boomer/sparker, and a total area that extends 1.14km in every direction from the 394 km² lease area, is exceeded.
- The HRG survey takes place on more than a total of 168 days.
- A total area greater than 394 km² is surveyed with equipment operating below 1,000 Hz.
- Any sea turtles or Atlantic sturgeon are harmed, injured or killed as a result of the HRG survey.
- Any whales are harmed, injured, or killed as a result of the HRG survey.
- If the number of such whales taken by acoustic harassment as defined above exceeds the estimate of 108 right whales, 75 fin whales, 3 sperm whales and 3 sei whales.

11.5 Amount or Extent of Take Anticipated during Activities Proposed by Statoil-Empire Wind (OCS A-0512) – AMENDED APRIL 26, 2018

Statoil-Empire Wind will carry out marine site characterization surveys including high-resolution geophysical (HRG) and geotechnical surveys in the approximately 79,350-acre Lease Area located approximately 11.5 nautical miles (nm) from Jones Beach, New York (see Figure 1 in the IHA application), within the NY WEA. Additionally, one or more cable route corridors will be established between the Lease Area and New York, identified as the Cable Route Area (see Figure 1 in the IHA application). Cable route corridors are anticipated to be 152 meters (500 feet) wide and may have an overall length of as much as 135 nm (250 km; for a total cable corridor of approximately 9,390 acres. The total area to be surveyed would be approximately 88,740 acres (359 km²). Marine site characterization surveys will consist of both HRG and geotechnical survey activities. The purpose of the marine site characterization surveys are to support the characterization of the existing seabed and subsurface geological conditions in the project area. Surveys would begin in April 2018. Based on 24-hour operations, the estimated duration of the HRG survey activities would be approximately 142 days (including estimated weather down time).

11.5.1 Sea turtles and Sturgeon: Statoil-Empire Wind

As explained in the Opinion, sea turtles and Atlantic sturgeon can only perceive noise at frequencies less than 1,000 Hz (1 kHz). The only equipment being used by Statoil-Empire Wind that operates below 1,000 Hz are the chirp (EdgeTech 412i) and the sparker (SIG ELC 820). The effects of using sub-bottom profilers for HRG surveys are considered in the Opinion. The source level of the chirp and sparker being used by Statoil-Empire Wind is less than the “worst-case scenario” analyzed in the programmatic Opinion (186 and 215 dB re 1uPa Peak compared to 212 and 222 dB re 1uPa Peak) and the distances to the isopleths of concern are smaller than the modelled distances considered in the programmatic Opinion as a result of more recent empirical data collection (see Table below for expected distances to isopleths of concern for the equipment being used by Statoil-Empire Wind; (BOEM 2018)).

Source	Distance to 150 dB RMS (m)	Distance to 166 dB RMS (m)	Distance to 180 dB RMS (m)	Distance to 206 dB (m)
EdgeTech 512i chirp	32	6	<5	0
SIG ELC 820 Sparker	1,996	252	<100	51

A 200-meter exclusion zone will be maintained during the surveys. This ensures that, as explained in the Opinion, no sea turtles will be exposed to underwater noise that could result in injury. Because we do not expect any sea turtles to be exposed to injurious levels of noise, no injury is anticipated or exempted.

In the Opinion, we calculated the amount of sea turtles to be taken by harassment by applying the density estimates to the total area that would experience disturbing levels of noise. For the Statoil-Empire Wind HRG survey, the equipment that will be used will pulse for less than one

second. One pulse will occur every few meters (with spacing dependent on the area being surveyed) as the survey vessel moves along the survey track lines. During each pulse, an area extending approximately 252 m from the source will have noise levels exceeding 166 dB re 1uPa RMS. Assuming that the survey track lines will extend to the border of the lease area and cable corridor and given that the track lines will cover the entirety of those areas, the total area that will experience disturbing levels of noise over the 142-day survey period includes the 359 km² area to be surveyed and extends 252m in every direction from the edge of that area. Applying the density estimates used in the Opinion (0.51 loggerheads/km² and 0.037 leatherbacks/km²) and considering that we expect fewer green and Kemp's ridley sea turtles in the action area than leatherbacks, we calculate that no more than 183 loggerheads, 13 leatherbacks, 13 green and 13 Kemp's ridley sea turtles will be harassed during the 142-day Statoil-Empire Wind HRG survey. Given the large area to be affected by disturbing levels of sound we do not expect that all of these sea turtles will be observed. Even though we have identified numbers of sea turtles likely to be adversely affected, in situations in which monitoring numbers of individuals is difficult or impossible, a surrogate measure of incidental take that can be monitored provides an alternative means of determining when anticipated incidental take levels have been exceeded. Given the large area to be affected, the fact that sea turtles would swim underwater when disturbed, and the resulting difficulty in monitoring sea turtle impacts, the spatial and temporal extent of the area where underwater noise is elevated above 166 dB re 1uPa RMS, which is anticipated to be 0.2 km² during each pulse of the sparker, and a total area that includes the 359 km² area to be surveyed and extends 252m in every direction from that area, will serve as a surrogate for estimating the amount of incidental take from harassment. Monitoring the spatial and temporal extent of this area will allow NMFS to determine the area and time when loggerhead, leatherback, Kemp's ridley and green sea turtles will be exposed to noise that would result in behaviors consistent with the definition of harassment and when the anticipated level of incidental take has been exceeded.

As explained in the Opinion, injury to sturgeon is expected if exposed to pulsed noise louder than 206 dB re 1uPa peak. The peak noise of the chirp is less than this; peak noise greater than 206 dB re 1uPa is only experienced within 51 m of the sparker. As explained in the Opinion we do not expect any sturgeon to be exposed to noise greater than 206 dB re 1uPa peak because we do not expect any to occur within 51 m of the source. Therefore, no injury is anticipated or exempted.

In the Opinion, we explained that without density estimates, we could not calculate the total number of Atlantic sturgeon, or of any DPS, to be taken by harassment. We explain that the area with noise above 150 dB re 1uPa RMS will serve as a surrogate for estimating the amount of incidental take from harassment as it allows NMFS to determine the area and time when Atlantic sturgeon will be exposed to noise would result in behaviors consistent with the definition of harassment. For this action, the spatial and temporal extent of the area where underwater noise is elevated above 150dB re 1uPa RMS is anticipated to be 12.44 km² during each pulse of the sub-bottom profiler and a total area that includes the 359 km² area to be surveyed and extends 1.99km in every direction from the 359 km² area to be surveyed. The modelled estimates in the Opinion are much larger than the empirical data submitted in previous sound source verification reports.

11.5.2 Whales: Statoil/Empire Wind

BOEM is in the process of approving a Survey Plan for Deepwater Wind's lease area (OCS-A 0512). NMFS' OPR has determined the proposed high resolution geophysical survey, to be carried out over an approximately 142-day period beginning in March 2018, is likely to result in the harassment, due to exposure to underwater noise between 160 and 179 dB re 1uPa RMS, of 18 right whales, 96 fin whales, and 6 sperm whales. The IHA will be effective for one year and no renewals are anticipated as the surveys are anticipated to occur only once. While the effective period of the IHA is April 24, 2018 through April 23, 2019, survey work, and associated take, is only expected to occur over a total of 142 survey days beginning in April 2018. No take of any whale species is anticipated as a result of the proposed geotechnical survey.

The amount of exempted take will be exceeded if the number of right, fin, or sperm whales taken by acoustic harassment as defined above exceeds the estimate of 18 right whales, 96 fin whales, and 6 sperm whales. No whales are anticipated to be harmed, injured, or killed as a result of the HRG survey; therefore, no such take is exempted.

11.5.3 Exceedence of the ITS for Statoil/Empire Wind

We will consider the ITS for Statoil/Empire Wind to be exceeded if any of the following occur during their geophysical survey of Lease Area OCS A-0512:

- Peak noise for any equipment operating below 1,000 Hz is louder than 212 dB re 1uPa at a depth of more than 15 m from the source (this suggests that unanticipated injury to Atlantic sturgeon occurred).
- The extent of the 180 dB re 1uPa RMS isopleth for any equipment operating below 1,000 Hz exceeds 200m (this means that the exclusion zone is not big enough to prevent sea turtle injury).
- The extent of the area ensonified with noise louder than 166 dB re 1uPa RMS, which is anticipated to be 0.2 km² during each pulse of the sparker, and a total area that includes the 359 km² area to be surveyed and extends 240m in every direction from the 394 km² lease area, is exceeded.
- The extent of the area ensonified with noise louder than 150 dB re 1uPa RMS, which is anticipated to be 12.44 km² during each pulse of the sparker, and a total area that extends 1.99km in every direction from the 359 km² area to be surveyed, is exceeded.
- The HRG survey takes place on more than a total of 142 days.
- A total area greater than 359 km² is surveyed with equipment operating below 1,000 Hz.
- Any sea turtles or Atlantic sturgeon are harmed, injured or killed as a result of the HRG survey.
- Any whales are harmed, injured, or killed as a result of the HRG survey.
- If the number of such whales taken by acoustic harassment as defined above exceeds the estimate of 18 right whales, 96 fin whales, and 6 sperm whales.
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11.6 Amount or Extent of Take Anticipated during Activities Proposed by Deepwater Wind's 2018 Site Characterization Surveys (OCS A-0486) – AMENDED June 13, 2018

Deepwater Wind will carry out marine site characterization surveys including high-resolution geophysical (HRG) and geotechnical surveys in the approximately 98,000-acre Lease Area within the RI-MA WEA, including along potential submarine cable routes to a potential landfill location in New York, Rhode Island and Massachusetts (see Figure 1 in the IHA application¹). Marine site characterization surveys will consist of both HRG and geotechnical survey activities. The purpose of the marine site characterization surveys is to support the characterization of the existing seabed and subsurface geological conditions in the project area. Surveys would occur from approximately June 15, 2018 through December 31, 2018. Based on 24-hour operations, the estimated duration of the geophysical survey activities would be approximately 200 days (including estimated weather down time) and approximately 100 days of geotechnical surveys.

11.6.1 Sea turtles and Sturgeon: Deepwater Wind 2018 Surveys

As explained in the Opinion, sea turtles and Atlantic sturgeon can only perceive noise at frequencies less than 1,000 Hz (1 kHz). The only equipment being used by Deepwater Wind that operates below 1,000 Hz is the medium penetration sub-bottom profilers (Fugro boomer, S-Boom system, 800 Joule Sprker, HMS 620 Bubble Gun and the Dura-Spark 240). The effects of using sub-bottom profilers for HRG surveys are considered in the Opinion. The source level of the medium penetration sub-bottom profilers being used by Deepwater Wind is less than or within the “worst-case scenario” analyzed in the programmatic Opinion (185 to 223 and 215 dB re 1uPa Peak anticipated for these surveys compared to 212 and 226 dB re 1uPa Peak analyzed in the Opinion) and the distances to the isopleths of concern are smaller than the modelled distances considered in the programmatic Opinion as a result of more recent empirical data collection (see Table below for expected distances to isopleths of concern for the types of equipment being used by Deepwater Wind (BOEM 2018)).

Source	Distance to 150 dB RMS (m) <i>(sturgeon “behavioral impact” threshold)</i>	Distance to 166 dB RMS (m) <i>(sea turtle “behavioral impact” threshold)</i>	Distance to 180 dB RMS (m) <i>(sea turtle “injury” threshold)</i>	Distance to 206 dB Peak (m) <i>(sturgeon “injury” threshold)</i>
Boomer	708	113	23-51	<1
Sparkers/Bubble Gun	1,996	252	23-51	<1
Chirp	32	6	NA	NA

Presented in BOEM 2018, developed using the highest power levels for each sound source reported in Crocker and Fratantonio (2016)

¹ IHA Application and other supporting documents available at: <https://www.fisheries.noaa.gov/action/incidental-take-authorization-deepwater-wind-new-england-llc-marine-site-characterization>

A 200-meter exclusion zone will be maintained during the surveys. This ensures that, as explained in the Opinion, no sea turtles will be exposed to underwater noise that could result in injury (i.e., noise greater than 180 dB re 1uPa RMS). Because we do not expect any sea turtles to be exposed to injurious levels of noise, no injury is anticipated or exempted.

In the Opinion, we calculated the amount of sea turtles to be taken by harassment by applying the density estimates to the total area that would experience disturbing levels of noise. For the Deepwater Wind 2018 survey, the equipment that will be used will pulse for less than one second. One pulse will occur every few meters (with spacing dependent on the area being surveyed) as the survey vessel moves along the survey track lines. During each pulse, an area extending up to 252 m from the source will have noise levels exceeding 166 dB re 1uPa RMS. Assuming that the survey track lines will extend to the border of the lease area and cable corridor and given that the track lines will cover the entirety of those areas, the total area that will experience disturbing levels of noise over the 200-day survey period includes the 394 km² area to be surveyed and extends 252 m in every direction from the edge of that area.

Applying the density estimates used in the Opinion (0.51 loggerheads/km² and 0.037 leatherbacks/km²) and considering that we expect fewer green and Kemp's ridley sea turtles in the action area than leatherbacks, we calculate that no more than 201 loggerheads, 15 leatherbacks, 15 green and 15 Kemp's ridley sea turtles will be harassed during the 200-day Deepwater Wind HRG survey. Given the large area to be affected by disturbing levels of sound we do not expect that all of these sea turtles will be observed. Even though we have identified numbers of sea turtles likely to be adversely affected, in situations in which monitoring numbers of individuals is difficult or impossible, a surrogate measure of incidental take that can be monitored provides an alternative means of determining when anticipated incidental take levels have been exceeded. Given the large area to be affected, the fact that sea turtles would swim underwater when disturbed, and the resulting difficulty in monitoring sea turtle impacts, the spatial and temporal extent of the area where underwater noise is elevated above 166 dB re 1uPa RMS, which is anticipated to be 0.2 km² during each pulse, and a total area that includes the 394 km² area to be surveyed and extends 252 m in every direction from that area, will serve as a surrogate for estimating the amount of incidental take from harassment. Monitoring the spatial and temporal extent of this area will allow NMFS to determine the area and time when loggerhead, leatherback, Kemp's ridley and green sea turtles will be exposed to noise that would result in behaviors consistent with the definition of harassment and when the anticipated level of incidental take has been exceeded.

As explained in the Opinion, injury to sturgeon is expected if exposed to pulsed noise louder than 206 dB re 1uPa peak. The peak noise of the chirp is less than this; peak noise greater than 206 dB re 1uPa is only experienced within less than 1 m of the sparker, bubble gun and boomer. As explained in the Opinion we do not expect any sturgeon to be exposed to noise greater than 206 dB re 1uPa peak because we do not expect any to occur within 1 m of the source. Therefore, no injury is anticipated or exempted.

In the Opinion, we explained that without density estimates, we could not calculate the total number of Atlantic sturgeon, or of any DPS, to be taken by harassment. We explain that the area with noise above 150 dB re 1uPa RMS will serve as a surrogate for estimating the amount of

incidental take from harassment as it allows NMFS to determine the area and time when Atlantic sturgeon will be exposed to noise would result in behaviors consistent with the definition of harassment. For this action, the spatial and temporal extent of the area where underwater noise is elevated above 150dB re 1uPa RMS is anticipated to be 12.52 km² during each pulse of the sub-bottom profiler and a total area that includes the 394 km² area to be surveyed and extends 1.99km in every direction from the 394 km² area to be surveyed. The modelled estimates in the Opinion are much larger than the empirical data submitted in previous sound source verification reports.

11.6.2 Whales -- Deepwater Wind 2018 Surveys

NMFS OPR issued an Incidental Harassment Authorization (IHA) for Deepwater Wind's 2018 survey activities on June 13, 2018. This IHA authorizes the take, by Level B harassment (due to exposure to noise associated with the survey equipment) of 3 right whales, 42 fin whales, 2 sei whales and 1 sperm whale. The IHA will be effective for one year and no renewals are anticipated as the surveys are anticipated to occur only once. While the effective period of the IHA is June 13, 2018 through June 12, 2019, survey work, and associated take, is only expected to occur over a total of 200 survey days beginning in June 2018. No take of any whale species is anticipated as a result of the proposed geotechnical survey and no injury is anticipated from exposure to any noise source.

The amount of exempted take will be exceeded if the number of right, fin, or sperm whales taken by acoustic harassment as defined above exceeds the estimate of 3 right whales, 42 fin whales, 2 sei whales and 1 sperm whale. No whales are anticipated to be harmed, injured, or killed as a result of the HRG survey; therefore, no such take is exempted.

11.6.3 Exceedence of the ITS for Deepwater Wind 2018 Surveys

We will consider the ITS for Deepwater Wind to be exceeded if any of the following occur during their 2018 geophysical survey of Lease Area OCS A-0486:

- Peak noise for any equipment operating below 1,000 Hz is louder than 212 dB re 1uPa at a depth of more than 1 m from the source (this suggests that unanticipated injury to Atlantic sturgeon occurred).
- The extent of the 180 dB re 1uPa RMS isopleth for any equipment operating below 1,000 Hz exceeds 200m (this means that the exclusion zone is not big enough to prevent sea turtle injury).
- The extent of the area ensonified with noise louder than 166 dB re 1uPa RMS, which is anticipated to be 0.2 km² during each pulse of any equipment operating below 1,000 Hz, and a total area that includes the 394 km² area to be surveyed and extends 252m in every direction from the 394 km² lease area, is exceeded.
- The extent of the area ensonified with noise louder than 150 dB re 1uPa RMS, which is anticipated to be 12.44 km² during each pulse of the sparker, and a total area that extends 1.99 km in every direction from the 394 km² area to be surveyed, is exceeded.
- The HRG survey takes place on more than a total of 200 days.
- A total area greater than 394 km² is surveyed with equipment operating below 1,000 Hz.

- Any sea turtles or Atlantic sturgeon are harmed, injured or killed as a result of the HRG survey.
- Any whales are harmed, injured, or killed as a result of the HRG survey.
- If the number of such whales taken by acoustic harassment as defined above exceeds the estimate of 3 right whales, 42 fin whales, 2 sei whales and 1 sperm whale.

11.7 Amount or Extent of Take Anticipated during Activities Proposed by Bay State Wind’s 2018 Site Characterization Surveys (OCS A-0486) – AMENDED July 24, 2018

Bay State Wind will carry out a geophysical survey in association with lease OCS A-0500 between the potential landfall locations of the export cable route and the portion of the export cable route corridor previously surveyed, as well as filling a data gap in cross line coverage for an approximately 28 kilometer (km) long section within the planned and already surveyed export cable corridor. The surveys along the Export Cable Route Corridors will be conducted across 1,640 ft (500 m) and 3,480 ft (1,000 m) wide survey corridors in state and federal waters, respectively. The purpose of the marine site characterization surveys is to support the final siting, design, and installation of offshore project facilities, turbines and subsea cables within the project area; and collect the data necessary to support the Project review requirements associated with Section 106 of the National Historic Preservation Act of 1966, as amended. Surveys would occur from approximately July 1, 2018 through October 31, 2018. Based on 24-hour operations, the estimated duration of the geophysical survey activities would be approximately 100 days (including estimated weather down time).

11.7.1 Sea turtles and Sturgeon- Deepwater Wind 2018 Surveys

As explained in the Opinion, sea turtles and Atlantic sturgeon can only perceive noise at frequencies less than 1,000 Hz (1 kHz). The only equipment being used by Bay State Wind that operates below 1,000 Hz is the sparker and two boomers (both sub-bottom profilers). The effects of using sub-bottom profilers for HRG surveys are considered in the Opinion. The source level of the sub-bottom profilers being used by Bay State Wind is less than or within the “worst-case scenario” analyzed in the programmatic Opinion (209 to 222 dB re 1uPa Peak compared to 212 and 226 dB re 1uPa Peak) and the distances to the isopleths of concern are smaller than the modelled distances considered in the programmatic Opinion as a result of more recent empirical data collection (see Table below for expected distances to isopleths of concern for the types of equipment being used by Deepwater Wind (BOEM 2018)).

Source	Distance to 150 dB RMS (m) <i>(sturgeon “behavioral impact” threshold)</i>	Distance to 166 dB RMS (m) <i>(sea turtle “behavioral impact” threshold)</i>	Distance to 180 dB RMS (m) <i>(sea turtle “injury” threshold)</i>	Distance to 206 dB (m) <i>(sturgeon “injury” threshold)</i>

Boomer	708	113	23-51	<1
Sparkers/Bubble Gun	1,996	252	23-51	<1

Presented in BOEM 2018, developed using the highest power levels for each sound source reported in Crocker and Fratantonio (2016)

A 200-meter exclusion zone for sea turtles will be maintained during the surveys. This ensures that, as explained in the Opinion, no sea turtles will be exposed to underwater noise that could result in injury (i.e., noise greater than 180 dB re 1uPa RMS). Because we do not expect any sea turtles to be exposed to injurious levels of noise, no injury is anticipated or exempted.

In the Opinion, we calculated the amount of sea turtles to be taken by harassment by applying the density estimates to the total area that would experience disturbing levels of noise. For the Bay State Wind 2018 survey, the equipment that will be used will pulse for less than one second. One pulse will occur every few meters (with spacing dependent on the area being surveyed) as the survey vessel moves along the survey track lines. During each pulse, an area extending up to 252 m from the source will have noise levels exceeding 166 dB re 1uPa RMS. The total area to be surveyed is 282 km². Assuming that the survey track lines will extend to the border of the lease area and cable corridor and given that the track lines will cover the entirety of those areas, the total area that will experience disturbing levels of noise over the 100-day survey period includes the 282 km² area to be surveyed and extends 252 m in every direction from the edge of that area. Applying the density estimates used in the Opinion (0.51 loggerheads/km² and 0.037 leatherbacks/km²) and considering that we expect fewer green and Kemp’s ridley sea turtles in the action area than leatherbacks, we calculate that no more than 144 loggerheads, 11 leatherbacks, 11 green and 11 Kemp’s ridley sea turtles will be harassed during the 100-day Bay State Wind HRG survey. Given the large area to be affected by disturbing levels of sound we do not expect that all of these sea turtles will be observed. Even though we have identified numbers of sea turtles likely to be adversely affected, in situations in which monitoring numbers of individuals is difficult or impossible, a surrogate measure of incidental take that can be monitored provides an alternative means of determining when anticipated incidental take levels have been exceeded. Given the large area to be affected, the fact that sea turtles would swim underwater when disturbed, and the resulting difficulty in monitoring sea turtle impacts, the spatial and temporal extent of the area where underwater noise is elevated above 166 dB re 1uPa RMS, which is anticipated to be 0.2 km² during each pulse, and a total area that includes the 394 km² area to be surveyed and extends 252 m in every direction from that area, will serve as a surrogate for estimating the amount of incidental take from harassment. Monitoring the spatial and temporal extent of this area will allow NMFS to determine the area and time when loggerhead, leatherback, Kemp’s ridley and green sea turtles will be exposed to noise that would result in behaviors consistent with the definition of harassment and when the anticipated level of incidental take has been exceeded.

As explained in the Opinion, injury to sturgeon is expected if exposed to pulsed noise louder than 206 dB re 1uPa peak. Peak noise greater than 206 dB re 1uPa is only experienced within less than 1 m of the sparker and boomer. As explained in the Opinion we do not expect any

sturgeon to be exposed to noise greater than 206 dB re 1uPa peak because we do not expect any to occur within 1 m of the source. Therefore, no injury is anticipated or exempted.

In the Opinion, we explained that without density estimates, we could not calculate the total number of Atlantic sturgeon, or of any DPS, to be taken by harassment. We explain that the area with noise above 150 dB re 1uPa RMS will serve as a surrogate for estimating the amount of incidental take from harassment as it allows NMFS to determine the area and time when Atlantic sturgeon will be exposed to noise would result in behaviors consistent with the definition of harassment. For this action, the spatial and temporal extent of the area where underwater noise is elevated above 150dB re 1uPa RMS is anticipated to be 12.52 km² during each pulse of the sub-bottom profiler and a total area that includes the 282 km² area to be surveyed and extends 1.99km in every direction from the 282 km² area to be surveyed. The modelled estimates in the Opinion are much larger than the empirical data submitted in previous sound source verification reports.

11.7.2 Whales -- Bay State Wind 2018 Surveys

NMFS OPR issued an Incidental Harassment Authorization (IHA) for Bay State Wind's 2018 survey activities on July 24, 2018. This IHA authorizes the take, by Level B harassment (due to exposure to noise associated with the survey equipment) of 32 fin whales and 5 sperm whales. The IHA will be effective for one year and no renewals are anticipated as the surveys are anticipated to occur only once. While the effective period of the IHA is July 24, 2018 through July 23, 2019, survey work, and associated take, is only expected to occur over a total of 100 survey days beginning in July 2018. No take of any whale species is anticipated as a result of the proposed geotechnical survey and no injury is anticipated from exposure to any noise source.

The amount of exempted take will be exceeded if the number of fin or sperm whales taken by acoustic harassment as defined above exceeds the estimate of 32 fin whales and 5 sperm whales. No whales are anticipated to be harmed, injured, or killed as a result of the HRG survey; therefore, no such take is exempted.

11.7.3 Exceedence of the ITS for Bay State Wind 2018 Surveys

We will consider the ITS for Bay State Wind to be exceeded if any of the following occur during their 2018 geophysical survey of Lease Area OCS A-0500:

- Peak noise for any equipment operating below 1,000 Hz is louder than 206 dB re 1uPa at a depth of more than 1 m from the source (this suggests that unanticipated injury to Atlantic sturgeon occurred).
- The extent of the 180 dB re 1uPa RMS isopleth for any equipment operating below 1,000 Hz exceeds 200m (this means that the exclusion zone is not big enough to prevent sea turtle injury).
- The extent of the area ensonified with noise louder than 166 dB re 1uPa RMS, which is anticipated to be 0.2 km² during each pulse of any equipment operating below 1,000 Hz, and a total area that includes the 282 km² area to be surveyed and extends 240m in every direction from the 282 km² lease area, is exceeded.
- The extent of the area ensonified with noise louder than 150 dB re 1uPa RMS, which is anticipated to be 12.44 km² during each pulse of the sparker, and a total

area that extends 1.99km in every direction from the 282 km² area to be surveyed, is exceeded.

- The HRG survey takes place on more than a total of 100 days.
- A total area greater than 282 km² is surveyed with equipment operating below 1,000 Hz.
- Any sea turtles or Atlantic sturgeon are harmed, injured or killed as a result of the HRG survey.
- Any whales are harmed, injured, or killed as a result of the HRG survey.
- If the number of such whales taken by acoustic harassment as defined above exceeds the estimate of 32 fin whales and 5 sperm whales.

11.8 Amount or Extent of Take Anticipated during Activities Proposed for Orsted’s 2019-2020 Site Characterization Surveys (OCS A-0486, 0487, and 0500) – AMENDED September 27, 2019

Orsted will carry out a geophysical survey in association within lease areas OCS A-0486, 0487, and 0500 as well as along potential electrical cable corridors. The surveys will occur a total transect length of 46,620 km (70 km/day over 666 survey days). The purpose of the marine site characterization surveys is to support the final siting, design, and installation of offshore project facilities, turbines and subsea cables within the project area; and collect the data necessary to support the Project review requirements associated with Section 106 of the National Historic Preservation Act of 1966, as amended. Surveys would occur over the course of a year beginning no sooner than September 2019.

11.8.1 Sea turtles and Sturgeon- Orsted 2019-2020 Surveys

As explained in the Opinion, sea turtles and Atlantic sturgeon can only perceive noise at frequencies less than 1,000 Hz (1 kHz). The only equipment being used by Orsted that operates below 1,000 Hz is the chirp, sparker, and boomer (sub-bottom profilers). The effects of using sub-bottom profilers for HRG surveys are considered in the Opinion. The source level of the sub-bottom profilers being used by Orsted is less than or within the “worst-case scenario” analyzed in the programmatic Opinion (211 to 225 dB re 1uPa Peak compared to 212 and 226 dB re 1uPa Peak) and the distances to the isopleths of concern are smaller than the modelled distances considered in the programmatic Opinion as a result of more recent empirical data collection (see Table below for expected distances to isopleths of concern for the types of equipment being used by Orsted (BOEM 2018)).

Source	Distance to 150 dB RMS (m) <i>(sturgeon “behavioral impact” threshold)</i>	Distance to 166 dB RMS (m) <i>(sea turtle “behavioral impact” threshold)</i>	Distance to 180 dB RMS (m) <i>(sea turtle “injury” threshold)</i>	Distance to 206 dB (m) <i>(sturgeon “injury” threshold)</i>

Boomer	708	113	<40	<1
Sparkers	1,996	252	23-51	<1
Chirp	32	6	N/A	N/A

Presented in BOEM 2018, developed using the highest power levels for each sound source reported in Crocker and Fratantonio (2016)

A 100-meter exclusion zone for sea turtles will be maintained during the surveys. This ensures that, as explained in the Opinion, no sea turtles will be exposed to underwater noise that could result in injury (i.e., noise greater than 180 dB re 1uPa RMS). Because we do not expect any sea turtles to be exposed to injurious levels of noise, no injury is anticipated or exempted.

In the Opinion, we calculated the total number of sea turtles to be taken by harassment by applying available density estimates to the total area that would experience disturbing levels of noise. Here, we produce that estimate for the Orsted surveys. The equipment that will be used will pulse for less than one second. One pulse will occur every few meters (with spacing dependent on the area being surveyed) as the survey vessel moves along the survey track lines. During each pulse, an area extending up to 252m from the source will have noise levels that may be disturbing to sea turtles. The total track lines to be surveyed is 46,620 km. Density of sea turtles in the survey area varies seasonally, with the highest number of sea turtles present in the late summer and early fall and no sea turtles present in the winter. However, because we do not know the seasonality of the surveys, we are calculating this estimate of incidental take with the highest seasonal density for each species (0.0274/100km² for leatherbacks, 0.1192/100 km² for loggerheads, and 0.0105/100km² for Kemp’s ridley and green sea turtles). Applying the density estimates to the area that may experience disturbing levels of noise (46,620 km x .5 km = 23,310 km²), we calculate that no more than 28 loggerheads, 7 leatherbacks, 3 green and 3 Kemp’s ridley sea turtles will be harassed during the Orsted survey. Given the large area to be affected by disturbing levels of sound we do not expect that all of these sea turtles will be observed. Even though we have identified numbers of sea turtles likely to be adversely affected, in situations in which monitoring numbers of individuals is difficult or impossible, a surrogate measure of incidental take that can be monitored provides an alternative means of determining when anticipated incidental take levels have been exceeded. Given the large area to be affected, the fact that sea turtles would swim underwater when disturbed, and the resulting difficulty in monitoring sea turtle impacts, the spatial and temporal extent of the area where underwater noise is elevated above 166 dB re 1uPa RMS, which is anticipated to be 0.2 km² during each pulse, and a total area that includes the 46,620 km transects to be surveyed and extends 252 m in every direction from that area, will serve as a surrogate for estimating the amount of incidental take from harassment. Monitoring the spatial and temporal extent of this area will allow NMFS to determine the area and time when loggerhead, leatherback, Kemp’s ridley and green sea turtles will be exposed to noise that would result in behaviors consistent with the definition of harassment and when the anticipated level of incidental take has been exceeded.

As explained in the Opinion, injury to sturgeon is expected if exposed to pulsed noise louder than 206 dB re 1uPa peak. Peak noise greater than 206 dB re 1uPa is only experienced within

less than 1 m of the sparker and boomer. As explained in the Opinion we do not expect any sturgeon to be exposed to noise greater than 206 dB re 1uPa peak because we do not expect any to occur within 1 m of the source. Therefore, no injury is anticipated or exempted.

In the Opinion, we explained that without density estimates, we could not calculate the total number of Atlantic sturgeon, or of any DPS, to be taken by harassment. We explain that the area with noise above 150 dB re 1uPa RMS will serve as a surrogate for estimating the amount of incidental take from harassment as it allows NMFS to determine the area and time when Atlantic sturgeon will be exposed to noise would result in behaviors consistent with the definition of harassment. For this action, the spatial and temporal extent of the area where underwater noise is elevated above 150dB re 1uPa RMS is anticipated to be 12.52 km² during each pulse of the sub-bottom profiler and a total area that includes the 46,620 km transects to be surveyed and extends 1.99km in every direction from the transects to be surveyed. The modelled estimates in the Opinion are much larger than the empirical data submitted in previous sound source verification reports.

11.8.2 Whales -- Orsted 2019-2020 Surveys

NMFS OPR issued an Incidental Harassment Authorization (IHA) for Bay State Wind's 2019-2020 survey activities on September 26, 2019. This IHA authorizes the take, by Level B harassment (due to exposure to noise associated with the survey equipment) of 5 sperm whales, 2 sei whales, 52 fin whales, and 3 North Atlantic right whales. The IHA will be effective for one year and no renewals are anticipated as the surveys are anticipated to occur only once. No injury or mortality is anticipated from exposure to any noise source.

The amount of exempted take will be exceeded if the number of right, fin, sei, or sperm whales taken by acoustic harassment as defined above exceeds the estimate of 5 sperm whales, 2 sei whales, 52 fin whales, and 3 North Atlantic right whales. No whales are anticipated to be harmed, injured, or killed as a result of the HRG survey; therefore, no such take is exempted.

11.8.3 Exceedence of the ITS for Orsted's 2019-2020 Surveys

We will consider the ITS for the Orsted surveys to be exceeded if any of the following occur during their 2019-2020 geophysical survey of Lease Area OCS A-0486, 0487 or 0500:

- Peak noise for any equipment operating below 1,000 Hz is louder than 206 dB re 1uPa at a depth of more than 1 m from the source (this suggests that unanticipated injury to Atlantic sturgeon occurred).
- The extent of the 180 dB re 1uPa RMS isopleth for any equipment operating below 1,000 Hz exceeds 100m (this means that the exclusion zone is not big enough to prevent sea turtle injury).
- The extent of the area ensonified with noise louder than 166 dB re 1uPa RMS, which is anticipated to be 0.2 km² during each pulse of any equipment operating below 1,000 Hz, and a total area that includes the 46,620 km line transect length to be surveyed and extends 252 m in every direction from the survey transects is exceeded.
- The extent of the area ensonified with noise louder than 150 dB re 1uPa RMS, which is anticipated to be 12.44 km² during each pulse of the sub-bottom profiler

and a total area that extends 1.99km in every direction from the survey transects to be surveyed, is exceeded.

- The HRG survey takes place on more than a total of 666 survey days.
- Total transect length greater than 46,620 km is surveyed with equipment operating below 1,000 Hz.
- Any sea turtles or Atlantic sturgeon are harmed, injured or killed as a result of the HRG survey.
- Any whales are harmed, injured, or killed as a result of the HRG survey.
- If the number of such whales taken by acoustic harassment as defined above exceeds the estimate of 5 sperm whales, 2 sei whales, 52 fin whales, and 3 North Atlantic right whales.

11.9 Amount or Extent of Take Anticipated during Activities Proposed for Atlantic Shore’s 2020-2021 Site Characterization Surveys (OCS A-0499) – AMENDED April 10, 2020

Atlantic Shores Offshore Wind (ASOW) will carry out a geophysical survey in association within lease areas OCS A-0499 as well as along potential submarine cable routes to landfall locations in either New York or New Jersey. ASOW proposes to conduct marine reconnaissance high-resolution geophysical (HRG) surveys within the approximately 183,353 acre Lease Area, located approximately 18 nautical miles southeast of Atlantic City, New Jersey; and along up to 5 export cable routes. Survey work would end for the season on September 30, 2020 but may resume in 2021. The purpose of the marine site characterization surveys is to support the final siting, design, and installation of offshore project facilities, turbines and subsea cables within the project area; and collect the data necessary to support the Project review requirements associated with Section 106 of the National Historic Preservation Act of 1966, as amended.

11.9.1 Sea turtles and Sturgeon- ASOW 2020 Surveys

As explained in the Opinion, sea turtles and Atlantic sturgeon can only perceive noise at frequencies less than 1,000 Hz (1 kHz). The only equipment being used by ASOW that operates below 1,000 Hz are the sub-bottom profilers. The effects of using sub-bottom profilers for HRG surveys are considered in the Opinion. The source level of the sub-bottom profilers being used by ASOW is less than or within the “worst-case scenario” analyzed in the programmatic Opinion (211 to 225 dB re 1uPa Peak compared to 212 and 226 dB re 1uPa Peak) and the distances to the isopleths of concern are smaller than the modelled distances considered in the programmatic Opinion as a result of more recent empirical data collection (see Table below for expected distances to isopleths of concern for the types of equipment being used by ASOW (BOEM 2018)).

Source	Distance to 150 dB RMS (m) <i>(sturgeon “behavioral</i>	Distance to 166 dB RMS (m) <i>(sea turtle “behavioral</i>	Distance to 180 dB RMS (m)	Distance to 206 dB (m) <i>(sturgeon “injury” threshold)</i>

	<i>impact” threshold)</i>	<i>impact” threshold)</i>	<i>(sea turtle “injury” threshold)</i>	
Boomer	708	113	<40	<1
Sparkers	1,996	252	23-51	<1
Chirp	32	6	N/A	N/A

Presented in BOEM 2018, developed using the highest power levels for each sound source reported in Crocker and Fratantonio (2016)

A 100-meter exclusion zone for sea turtles will be maintained during the surveys. This ensures that, as explained in the Opinion, no sea turtles will be exposed to underwater noise that could result in injury (i.e., noise greater than 180 dB re 1uPa RMS). Because we do not expect any sea turtles to be exposed to injurious levels of noise, no injury is anticipated or exempted.

In the Opinion, we calculated the total number of sea turtles to be taken by harassment by applying available density estimates to the total area that would experience disturbing levels of noise. Here, we produce that estimate for the ASOW surveys. The equipment that will be used will pulse for less than one second. One pulse will occur every few meters (with spacing dependent on the area being surveyed) as the survey vessel moves along the survey track lines. During each pulse, an area extending up to 252m from the source will have noise levels that may be disturbing to sea turtles. The total track lines to be surveyed is 17,850 km (85 km/day for 210 survey days). Density of sea turtles in the survey area varies seasonally, with the highest number of sea turtles present in the late summer and early fall and no sea turtles present in the winter. However, because we do not know the seasonality of the surveys, we are calculating this estimate of incidental take with the highest seasonal density for each species (0.0274/100km² for leatherbacks , 0.1192/100 km² for loggerheads, and 0.0105/100km² for Kemp’s ridley and green sea turtles). Applying the density estimates to the area that may experience disturbing levels of noise (17,850 km x .5 km = 8,925 km²), we calculate that no more than 3 loggerheads, 11 leatherbacks, 1 green and 1 Kemp’s ridley sea turtle will be harassed during the ASOW survey. Given the large area to be affected by disturbing levels of sound we do not expect that all of these sea turtles will be observed. Even though we have identified numbers of sea turtles likely to be adversely affected, in situations in which monitoring numbers of individuals is difficult or impossible, a surrogate measure of incidental take that can be monitored provides an alternative means of determining when anticipated incidental take levels have been exceeded. Given the large area to be affected, the fact that sea turtles would swim underwater when disturbed, and the resulting difficulty in monitoring sea turtle impacts, the spatial and temporal extent of the area where underwater noise is elevated above 166 dB re 1uPa RMS, which is anticipated to be 0.2 km² during each pulse, and a total area that includes the 17,850 km transects to be surveyed and extends 252 m in every direction from that area, will serve as a surrogate for estimating the amount of incidental take from harassment. Monitoring the spatial and temporal extent of this area will allow NMFS to determine the area and time when loggerhead, leatherback, Kemp’s ridley and green sea turtles will be exposed to noise that would result in behaviors consistent

with the definition of harassment and when the anticipated level of incidental take has been exceeded.

As explained in the Opinion, injury to sturgeon is expected if exposed to pulsed noise louder than 206 dB re 1uPa peak. Peak noise greater than 206 dB re 1uPa is only experienced within less than 1 m of the sparker and boomer. As explained in the Opinion we do not expect any sturgeon to be exposed to noise greater than 206 dB re 1uPa peak because we do not expect any to occur within 1 m of the source. Therefore, no injury is anticipated or exempted.

In the Opinion, we explained that without density estimates, we could not calculate the total number of Atlantic sturgeon, or of any DPS, to be taken by harassment. We explain that the area with noise above 150 dB re 1uPa RMS will serve as a surrogate for estimating the amount of incidental take from harassment as it allows NMFS to determine the area and time when Atlantic sturgeon will be exposed to noise would result in behaviors consistent with the definition of harassment. For this action, the spatial and temporal extent of the area where underwater noise is elevated above 150dB re 1uPa RMS is anticipated to be 12.52 km² during each pulse of the sub-bottom profiler and a total area that includes the 17,850 km transects to be surveyed and extends 1.99km in every direction from the transects to be surveyed. The modelled estimates in the Opinion are much larger than the empirical data submitted in previous sound source verification reports.

11.9.2 Whales -- ASOW 2020-2021 Surveys

NMFS OPR issued an Incidental Harassment Authorization (IHA) for ASOW's planned survey activities on **April 10, 2020**. This IHA authorizes the take, by Level B harassment (due to exposure to noise associated with the survey equipment) of 3 sperm whales, 2 sei whales, 20 fin whales, and 9 North Atlantic right whales. The IHA will be effective for one year with the potential for renewal should surveys continue in 2021. No injury or mortality is anticipated from exposure to any noise source.

The amount of exempted take will be exceeded if the number of right, fin, sei, or sperm whales taken by acoustic harassment as defined above exceeds the estimate of 3 sperm whales, 2 sei whales, 20 fin whales, and 9 North Atlantic right whales. No whales are anticipated to be harmed, injured, or killed as a result of the HRG survey; therefore, no such take is exempted.

11.9.3 Exceedence of the ITS for ASOW's 2019-2020 Surveys

We will consider the ITS for the ASOW surveys to be exceeded if any of the following occur during their geophysical survey of Lease Area OCS A-0499:

- Peak noise for any equipment operating below 1,000 Hz is louder than 206 dB re 1uPa at a depth of more than 1 m from the source (this suggests that unanticipated injury to Atlantic sturgeon occurred).
- The extent of the 180 dB re 1uPa RMS isopleth for any equipment operating below 1,000 Hz exceeds 100m (this means that the exclusion zone is not big enough to prevent sea turtle injury).
- The extent of the area ensonified with noise louder than 166 dB re 1uPa RMS, which is anticipated to be 0.2 km² during each pulse of any equipment operating below 1,000 Hz, and a total area that includes the 46,620 km line transect length

- to be surveyed and extends 252 m in every direction from the survey transects is exceeded.
- The extent of the area ensonified with noise louder than 150 dB re 1uPa RMS, which is anticipated to be 12.44 km² during each pulse of the sub-bottom profiler and a total area that extends 1.99km in every direction from the survey transects to be surveyed, is exceeded.
 - The HRG survey takes place on more than a total of 210 survey days.
 - Total transect length greater than 17,850 km is surveyed with equipment operating below 1,000 Hz.
 - Any sea turtles or Atlantic sturgeon are harmed, injured or killed as a result of the HRG survey.
 - Any whales are harmed, injured, or killed as a result of the HRG survey.
 - If the number of such whales taken by acoustic harassment as defined above exceeds the estimate of 3 sperm whales, 2 sei whales, 20 fin whales, and 9 North Atlantic right whales.

11.10 Reasonable and Prudent Measures and Terms and Conditions Included in the Programmatic ITS

Reasonable and prudent measures (RPMs) are those measures necessary and appropriate to minimize and monitor incidental take of a listed species. These RPMs are in addition to the project design criteria proposed by BOEM that will be required for all lessees (see section 3.6 of the Opinion). The RPMs and Terms and Conditions (T&Cs) identified below are the ones developed for the programmatic Opinion as a whole. Following that list, we identify those that are required for specific activities being carried out under the programmatic Opinion; this is based on the actual activities proposed by the applicants (e.g., if an applicant is not proposing any pile driving, the programmatic RPMs and T&Cs related to pile driving would not be relevant).

We believe the following reasonable and prudent measures are necessary and appropriate to minimize and monitor impacts of incidental take of sea turtles and Atlantic sturgeon due to the program as a whole.

1. BOEM must provide NMFS with notice and opportunity to comment on the proposed issuance of leases, approval of SAPs, data collection plans, and decommissioning applications for facilities constructed under an approved SAP. This notification may occur through e-mail to NMFS staff that will be identified annually.
2. Prior to electromechanical survey equipment operating below 200 kHz being used for any survey activities, the lessee must either (a) carry out field verification of modeled noise levels within the lease area; or (b) submit to NMFS existing sound source verification data including justification for why the submitted results are appropriate for the proposed survey.
3. In order to monitor the acoustic effects of pile driving, acoustic monitoring of pile driving must be conducted to confirm the sound levels modeled by BOEM and reported in the BA.
4. BOEM must keep NMFS informed of all geophysical and geotechnical surveys and

pile driving activity conducted by BOEM lessees in support of a SAP, COP, or GAP in the MA/RI, MA, NY and NJ WEAs.

In order to be exempt from prohibitions of section 9 of the ESA, BOEM must comply with the following programmatic terms and conditions, which implement the programmatic reasonable and prudent measures described above and which outline required minimization and monitoring requirements. These terms and conditions are non-discretionary.

1. To implement RPM #1, BOEM must provide NMFS (by e-mail to the NERO PRD Section 7 coordinator, or other contact provided annually by NMFS) with written notification of any proposed issuance of a lease. This must contain information on the location of the lease blocks and any proposed activities that will occur on the lease.
2. To implement RPM #1, BOEM must review each SAP, data collection plan, and/or decommissioning application for facilities in a BOEM-approved SAP to determine if it is wholly consistent with the activities considered in this consultation. At least 30 days prior to review of a survey plan, approval of a SAP or decommissioning application for facilities approved in a SAP BOEM will provide NMFS with written notification of its determination that the site assessment, data collection activities, or decommissioning application are wholly consistent with the activities and conditions outlined in this consultation. If BOEM has determined that the applicant's proposal is not consistent with the activities and conditions outlined in this consultation, BOEM must provide NMFS with a written explanation of how the plan will be modified. If the plan will not be modified, BOEM must request a separate section 7 consultation.
3. To implement RPM #2(a): sound source verification must be conducted prior to the commencement of surveys that involve the operation of the electromechanical survey equipment operating below 200 kHz. Acoustic measurements must be sufficient to establish the following: source level (peak at 1 meter) and distance to the 180, 160 and 150 dB re 1uPa RMS isopleths. Results of this monitoring must be reported to NMFS as soon as practicable.
4. To implement RPM#2(b): at least 14 days prior to the planned commencement of surveys involving the operation of the electromechanical equipment operating below 200kHz, BOEM must submit to NMFS existing sound source verification data for the proposed survey. This submission must include: source level (peak at 1 meter) and distance to the 180, 160 and 150 dB re 1uPa RMS isopleths for each equipment type to be used (operating below 200 kHz) and an explanation for why the existing data is expected to be representative of the sounds sources for the equipment and area to be surveyed. This explanation must include a discussion of any differences between the equipment tested and the equipment to be used and an explanation for how those differences would affect sound levels and a discussion of any differences between the conditions (depth, water temperature and bottom conditions (e.g., presence of boulders)) at the test site and the area to be surveyed and an explanation for how those differences would affect sound levels. No surveys may begin until either (i) NMFS agrees that use of the existing data is acceptable or (ii) if NMFS disagrees,

field verification occurs.

5. To implement RPM #3, acoustic monitoring must be conducted during the installation each meteorological tower requiring pile driving. Acoustic monitoring must be sufficient to determine the following: source level (peak at 1 meter) and distance to the 180, 160 and 150 dB re 1 μ Pa RMS isopleths as well as 187 dB re 1 μ Pa CSEL. Results of this monitoring must be reported to NMFS as soon as practicable after the completion of the pile driving activity.
6. To implement RPM #4, BOEM must provide NMFS with notice (email or telephone, to a contact provided annually by NMFS) no later than three days prior to scheduled geological and geophysical surveys and meteorological tower construction. BOEM must also provide notice when these activities are completed.
7. To implement RPM #4, prior to April 1 of each year, BOEM must submit a report to NMFS detailing the activities that occurred in the previous calendar year that were subject to this consultation and any impacts to listed species from those activities.

The reasonable and prudent measures, with their implementing terms and conditions, are designed to minimize and monitor the impact of incidental take that might otherwise result from the proposed action. Specifically, these RPMs and Terms and Conditions will ensure that no listed species are exposed to injurious levels of sound and will verify the modeling results provided by BOEM based on which NMFS has made conclusions regarding take. The RPMs and Terms and Conditions also serve to monitor and track individual and cumulative effects of activities subject to this programmatic consultation. Below, we explain why each of the RPMs from the programmatic ITS and its implementing terms and conditions are necessary and appropriate and why they are not considered to be more than a minor change.

RPM #1 and Term and Condition #1 and #2 are necessary and appropriate because they will allow BOEM and NMFS to keep track of the activities that are being considered for coverage under this Opinion and ITS and will allow both agencies to track individual and cumulative effects of the activities considered here. This is only a minor change because it is not expected to result in any delay to the project or increased cost and will merely involve occasional communications and coordination between BOEM and NMFS staff.

RPM #2 and 3 and Term and Condition #3, 4 and 5 are necessary and appropriate because they are designed to verify that the sound levels modeled by BOEM are valid and that the estimated areas where sound levels are expected to be greater than the threshold levels for effects to listed species are accurate. Any increases in cost or time are expected to be minor as these measurements will not be required for all survey activities or for the installation of all piles.

RPM #4 and Term and Condition # 6 and 7 are necessary and appropriate because they will serve to ensure that we are aware of the dates and locations of all survey and pile driving activities. This will allow us to monitor the duration and seasonality of these activities as well as give us an opportunity to provide BOEM with any updated contact information for NMFS staff. This is only a minor change because it is not expected to result in any delay to the project and will merely involve an occasional telephone call or e-mail between BOEM and NMFS staff.

11.9.1 RPMs and Terms and Conditions for Bay State Wind Activities in BOEM Lease Area (OCS A-0500) AMENDED AUGUST 12, 2016

Reasonable and prudent measures are those measures necessary and appropriate to minimize and monitor incidental take of a listed species. These reasonable and prudent measures are in addition to the project design criteria proposed by BOEM that are incorporated into the lease issued for Bay State Wind (OCS A-0501; see pages C-11 to C-16²). We have reviewed the RPMs and Terms and Conditions developed for the programmatic Opinion as a whole and identify those that are required for the Bay State Wind surveys; this is based on the actual activities proposed by Bay State Wind.

The following reasonable and prudent measures are necessary and appropriate to minimize and monitor impacts of incidental take of sea turtles, Atlantic sturgeon, right, humpback and fin whales.

Reasonable and Prudent Measures—Bay State Wind (OCS A-0500)

1. Field verification of modeled noise levels must be undertaken for electromechanical survey equipment operating below 200 kHz in the lease area. This verification must take place prior to the equipment being used for any survey activities³.
2. BOEM must keep NMFS informed of all geophysical and geotechnical surveys conducted by Bay State Wind in support of the SAP.
3. BOEM must require Bay State Wind to report all project-related observations of listed species to NMFS Greater Atlantic Region.

Terms and Conditions – Bay State Wind (OCS A-0500)

In order to be exempt from prohibitions of section 9 of the ESA, BOEM and Bay State Wind must comply with the following terms and conditions, which implement the reasonable and prudent measures described above and which outline required minimization and monitoring requirements. These terms and conditions are non-discretionary.

1. To implement RPM #1, sound source verification must be conducted prior to the commencement of surveys that involve the operation of the electromechanical survey equipment operating below 200 kHz in the lease area. Acoustic measurements must be sufficient to establish the following: source level (peak at 1 meter) and distance to the 180, 160 and 150 dB re 1uPa RMS isopleths. Results of this monitoring must be reported to NMFS as soon as practicable, but no later than 48 hours after completion, (by email to Julie.Crocker@noaa.gov and incidental.take@noaa.gov).
2. To implement RPM #2, BOEM must provide NMFS with notice (email or telephone, to a contact provided annually by NMFS) no later than three days prior to scheduled geological and geophysical surveys and meteorological tower construction. BOEM

² A copy of the lease is available at <http://www.boem.gov/Lease-OCS-A-0501/>

³ It is reasonable to expect that noise levels recorded during the sound source verification will be representative of the noise levels that will be experienced during the entirety of the survey. This is because the verification will occur in an area expected to result in the “worst case scenario”; that is, the area where the isopleths would be expected to be largest.

must also provide notice when these activities are completed.

3. To implement RPM #3, within 60 days of the end of the survey period, BOEM must submit a report to NMFS detailing the activities that occurred pursuant to the SAP that were subject to this consultation and any impacts to listed species from those activities.
4. To implement RPM #3, BOEM must report any observations of injured or dead whales, sea turtles or Atlantic sturgeon observed in the lease area to NMFS within 24-hours. This report must include photographs whenever possible; date, time and coordinates of sighting; and a summary of project activities occurring in the previous 24-hours. These reports must be submitted by email to incidental.take@noaa.gov.
5. To implement RPM #3, BOEM must ensure:
 - a. Bay State Wind immediately reports any whale taken in a manner not authorized by the Incidental Harassment Authorization (e.g., injury, serious injury, or mortality) to NMFS Greater Atlantic Region (978-281-9328) and via email to incidental.take@noaa.gov.
 - b. Bay State Wind submits to the NMFS Greater Atlantic Region a report that documents the survey activities along with a detailed description of any observation and/or takes of ESA listed species including right, humpback and fin whales.

6. To implement RPM #3, the requirements of the Incidental Harassment Authorization (August 11, 2016) issued under section 101(a)(5)(A) of the MMPA are incorporated by reference herein.

11.9.2 RPMs and Terms and Conditions for Ocean Wind Activities in BOEM Lease Area (OCS A-0498) AMENDED JUNE 12, 2017

Reasonable and prudent measures are those measures necessary and appropriate to minimize and monitor incidental take of a listed species. These reasonable and prudent measures are in addition to the project design criteria proposed by BOEM that are incorporated into the lease issued for Ocean Wind (OCS A-0498; see pages C-6 to C-17⁴). We have reviewed the RPMs and Terms and Conditions developed for the programmatic Opinion as a whole and identify those that are required for the Ocean Wind surveys; this is based on the actual activities proposed by Ocean Wind.

The following reasonable and prudent measures are necessary and appropriate to minimize and monitor impacts of incidental take of sea turtles, Atlantic sturgeon, and fin whales.

Reasonable and Prudent Measures—Ocean Wind (OCS A-0498)

1. Field verification of modeled noise levels must be undertaken for electromechanical survey equipment operating below 200 kHz in the lease area. This verification must take place prior to the equipment being used for any survey activities⁵.

⁴ A copy of the lease is available at <https://www.boem.gov/NJ-SIGNED-LEASE-OCS-A-0498/>

⁵ It is reasonable to expect that noise levels recorded during the sound source verification will be representative of the noise levels that will be experienced during the entirety of the survey. This is because the verification will occur

2. BOEM must keep NMFS informed of all geophysical and geotechnical surveys conducted by Ocean Wind in support of the SAP.
3. BOEM must require Ocean Wind to report all project-related observations of listed species to NMFS Greater Atlantic Region.

Terms and Conditions – Ocean Wind (OCS A-0498)

In order to be exempt from prohibitions of section 9 of the ESA, BOEM and Bay State Wind must comply with the following terms and conditions, which implement the reasonable and prudent measures described above and which outline required minimization and monitoring requirements. These terms and conditions are non-discretionary.

1. To implement RPM #1, sound source verification must be conducted prior to the commencement of surveys that involve the operation of the electromechanical survey equipment operating below 200 kHz in the lease area. Acoustic measurements must be sufficient to establish the following: source level (peak at 1 meter) and distance to the 180, 160 and 150 dB re 1uPa RMS isopleths. Results of this monitoring must be reported to NMFS as soon as practicable, but no later than 48 hours after completion, (by email to Julie.Crocker@noaa.gov and incidental.take@noaa.gov).
2. To implement RPM #2, BOEM must provide NMFS with notice (email or telephone, to a contact provided annually by NMFS) no later than three days prior to scheduled geological and geophysical surveys and meteorological tower construction. BOEM must also provide notice when these activities are completed.
3. To implement RPM #3, within 60 days of the end of the survey period, BOEM must submit a report to NMFS detailing the activities that occurred pursuant to the SAP that were subject to this consultation and any impacts to listed species from those activities.
4. To implement RPM #3, BOEM must report any observations of injured or dead whales, sea turtles or Atlantic sturgeon observed in the lease area to NMFS within 24-hours. This report must include photographs whenever possible; date, time and coordinates of sighting; and a summary of project activities occurring in the previous 24-hours. These reports must be submitted by email to incidental.take@noaa.gov.
5. To implement RPM #3, BOEM must ensure:
 - a. Ocean Wind immediately reports any whale taken in a manner not authorized by the Incidental Harassment Authorization (e.g., injury, serious injury, or mortality) to NMFS Greater Atlantic Region (978-281-9328) and via email to incidental.take@noaa.gov.
 - b. Ocean Wind submits to the NMFS Greater Atlantic Region a report that documents the survey activities along with a detailed description of any observation and/or takes of ESA listed species including ESA listed whales.
6. To implement RPM #3, the requirements of the Incidental Harassment Authorization

in an area expected to result in the “worst case scenario”; that is, the area where the isopleths would be expected to be largest.

(June 9, 2017) issued under section 101(a)(5)(A) of the MMPA are incorporated by reference herein.

11.9.3 RPMs and Terms and Conditions for Deepwater Wind Activities in BOEM Lease Area (OCS A-0486) AMENDED JUNE 21, 2017

Reasonable and prudent measures are those measures necessary and appropriate to minimize and monitor incidental take of a listed species. These reasonable and prudent measures are in addition to the project design criteria proposed by BOEM that are incorporated into the lease issued for Deepwater Wind (OCS A-0486; see Appendix C of that lease⁶). We have reviewed the RPMs and Terms and Conditions developed for the programmatic Opinion as a whole and identify those that are required for the Deepwater Wind surveys; this is based on the actual activities proposed by Deepwater Wind.

The following reasonable and prudent measures are necessary and appropriate to minimize and monitor impacts of incidental take of sea turtles, Atlantic sturgeon, right, fin, sei and sperm whales.

Reasonable and Prudent Measures—Deepwater Wind (OCS A-0486)

1. Field verification of modeled noise levels must be undertaken for electromechanical survey equipment operating below 200 kHz in the lease area. This verification must take place prior to the equipment being used for any survey activities⁷.
2. BOEM must keep NMFS informed of all geophysical and geotechnical surveys conducted by Deepwater Wind in support of the SAP.
3. BOEM must require Deepwater Wind to report all project-related observations of listed species to NMFS Greater Atlantic Region.

Terms and Conditions – Deepwater Wind (OCS A-0486)

In order to be exempt from prohibitions of section 9 of the ESA, BOEM and Deepwater Wind must comply with the following terms and conditions, which implement the reasonable and prudent measures described above and which outline required minimization and monitoring requirements. These terms and conditions are non-discretionary.

1. To implement RPM #1, sound source verification must be conducted prior to the commencement of surveys that involve the operation of the electromechanical survey equipment operating below 200 kHz in the lease area. Acoustic measurements must be sufficient to establish the following: source level (peak at 1 meter) and distance to the 180, 160 and 150 dB re 1uPa RMS isopleths. Results of this monitoring must be reported to NMFS as soon as practicable, but no later than 48 hours after completion, (by email to Julie.Crocker@noaa.gov and incidental.take@noaa.gov).

⁶ A copy of the lease is available at <https://www.boem.gov/Renewable-Energy-Program/State-Activities/RI/Executed-Lease-OCS-A-0486.aspx>

⁷ It is reasonable to expect that noise levels recorded during the sound source verification will be representative of the noise levels that will be experienced during the entirety of the survey. This is because the verification will occur in an area expected to result in the “worst case scenario”; that is, the area where the isopleths would be expected to be largest.

2. To implement RPM #2, BOEM must provide NMFS with notice (email or telephone, to a contact provided annually by NMFS) no later than three days prior to scheduled geological and geophysical surveys and meteorological tower construction. BOEM must also provide notice when these activities are completed.
3. To implement RPM #3, within 60 days of the end of the survey period, BOEM must submit a report to NMFS detailing the activities that occurred pursuant to the SAP that were subject to this consultation and any impacts to listed species from those activities.
4. To implement RPM #3, BOEM must report any observations of injured or dead whales, sea turtles or Atlantic sturgeon observed in the lease area to NMFS within 24-hours. This report must include photographs whenever possible; date, time and coordinates of sighting; and a summary of project activities occurring in the previous 24-hours. These reports must be submitted by email to incidental.take@noaa.gov.
5. To implement RPM #3, BOEM must ensure:
 - a. Deepwater Wind immediately reports any whale taken in a manner not authorized by the Incidental Harassment Authorization (e.g., injury, serious injury, or mortality) to NMFS Greater Atlantic Region (978-281-9328) and via email to incidental.take@noaa.gov.
 - b. Deepwater Wind submits to the NMFS Greater Atlantic Region a report that documents the survey activities along with a detailed description of any observation and/or takes of ESA listed species including right, fin, sei and sperm whales.
6. To implement RPM #3, the requirements of the Incidental Harassment Authorization (June 16, 2017) issued under section 101(a)(5)(A) of the MMPA are incorporated by reference herein.

11.9.4 RPMs and Terms and Conditions for Statoil/Empire Wind Activities in BOEM Lease Area (OCS A-0512) AMENDED APRIL 26, 2018

Reasonable and prudent measures are those measures necessary and appropriate to minimize and monitor incidental take of a listed species. These reasonable and prudent measures are in addition to the project design criteria proposed by BOEM that are incorporated into the lease issued for Statoil/Empire Wind (OCS A-0512; see Addendum C of that lease⁸). We have reviewed the RPMs and Terms and Conditions developed for the programmatic Opinion as a whole and identify those that are required for the Statoil/Empire Wind surveys; this is based on the actual activities proposed by Statoil/Empire Wind.

The following reasonable and prudent measures are necessary and appropriate to minimize and monitor impacts of incidental take of sea turtles, Atlantic sturgeon, right, fin, and sperm whales.

Reasonable and Prudent Measures—Statoil/Empire Wind (OCS A-0512)

1. BOEM must keep NMFS informed of all geophysical and geotechnical surveys conducted by Statoil/Empire Wind in support of the SAP.
2. BOEM must require Statoil/Empire Wind to report all project-related observations of

⁸ A copy of the lease is available at <https://www.boem.gov/OCS-A-0512/>

listed species to NMFS Greater Atlantic Region.

Terms and Conditions – Statoil/Empire Wind (OCS A-0512)

In order to be exempt from prohibitions of section 9 of the ESA, BOEM and Statoil/Empire Wind must comply with the following terms and conditions, which implement the reasonable and prudent measures described above and which outline required minimization and monitoring requirements. These terms and conditions are non-discretionary.

1. To implement RPM #2, BOEM must provide NMFS with notice (incidental.take@noaa.gov) no later than three days prior to scheduled geological and geophysical surveys and meteorological tower construction. BOEM must also provide notice within three days following the completion of these activities.
2. To implement RPM #3, within 60 days of the end of the survey period, BOEM must submit a report to NMFS detailing the activities that occurred pursuant to the SAP that were subject to this consultation and any impacts to listed species from those activities.
3. To implement RPM #3, BOEM must report any observations of injured or dead whales, sea turtles or Atlantic sturgeon observed in the lease area to NMFS within 24-hours. This report must include photographs whenever possible; date, time and coordinates of sighting; and a summary of project activities occurring in the previous 24-hours. These reports must be submitted by email to incidental.take@noaa.gov.
4. To implement RPM #3, BOEM must ensure:
 - a. Statoil/Empire Wind immediately reports any whale taken in a manner not authorized by the Incidental Harassment Authorization (e.g., injury, serious injury, or mortality) to NMFS Greater Atlantic Region (978-281-9328) and via email to incidental.take@noaa.gov.
 - b. Statoil/Empire Wind submits to the NMFS Greater Atlantic Region a report that documents the survey activities along with a detailed description of any observation and/or takes of ESA listed species including right, fin, and sperm whales.
5. To implement RPM #3, the requirements of the Incidental Harassment Authorization (April 24, 2018) issued under section 101(a)(5)(A) of the MMPA are incorporated by reference herein.

11.9.5 RPMs and Terms and Conditions for Deepwater Wind 2018 Surveys in BOEM Lease Area (OCS A-0486) AMENDED JUNE 13, 2018

Reasonable and prudent measures are those measures necessary and appropriate to minimize and monitor incidental take of a listed species. These reasonable and prudent measures are in addition to the project design criteria proposed by BOEM that are incorporated into the lease issued for Deepwater Wind (OCS A-0486; see Addendum C of that lease⁹). We have reviewed

⁹ A copy of the lease is available at <https://www.boem.gov/Renewable-Energy-Program/State-Activities/RI/Executed-Lease-OCS-A-0486.aspx>

the RPMs and Terms and Conditions developed for the programmatic Opinion as a whole and identify those that are required for the Deepwater Wind surveys; this is based on the actual activities proposed by Deepwater Wind.

The following reasonable and prudent measures are necessary and appropriate to minimize and monitor impacts of incidental take of sea turtles, Atlantic sturgeon, right, fin, sei and sperm whales.

Reasonable and Prudent Measures—Deepwater Wind 2018 Surveys (OCS A-0486)

1. BOEM must keep NMFS informed of all geophysical and geotechnical surveys conducted by Deepwater Wind.
2. BOEM must require Deepwater Wind to report all project-related observations of listed species to NMFS Greater Atlantic Region.

Terms and Conditions – Deepwater Wind 2018 Surveys (OCS A-0486)

In order to be exempt from prohibitions of section 9 of the ESA, BOEM and Statoil/Empire Wind must comply with the following terms and conditions, which implement the reasonable and prudent measures described above and which outline required minimization and monitoring requirements. These terms and conditions are non-discretionary.

1. To implement RPM #1, BOEM must provide NMFS with notice (incidental.take@noaa.gov) no later than three days prior to scheduled geological and geophysical surveys. BOEM must also provide notice within three days following the completion of these activities.
2. To implement RPM #2, within 60 days of the end of the survey period, BOEM must submit a report to NMFS detailing the activities that occurred pursuant to the SAP that were subject to this consultation and any impacts to listed species from those activities.
3. To implement RPM #2, BOEM must report any observations of injured or dead whales, sea turtles or Atlantic sturgeon observed in the lease area to NMFS within 24-hours. This report must include photographs whenever possible; date, time and coordinates of sighting; and a summary of project activities occurring in the previous 24-hours. These reports must be submitted by email to incidental.take@noaa.gov.
4. To implement RPM #3, BOEM must ensure:
 - a. Deepwater Wind immediately reports any whale taken in a manner not authorized by the Incidental Harassment Authorization (e.g., injury, serious injury, or mortality) to NMFS Greater Atlantic Region (978-281-9328) and via email to incidental.take@noaa.gov.
 - b. Deepwater Wind submits to the NMFS Greater Atlantic Region a report that documents the survey activities along with a detailed description of any observation and/or takes of ESA listed species including right, fin, sei and sperm whales.
5. To implement RPM #3, the requirements of the Incidental Harassment Authorization

(June 13, 2018) issued under section 101(a)(5)(A) of the MMPA are incorporated by reference herein.

11.9.6 RPMs and Terms and Conditions for Bay State Wind 2018 Surveys in BOEM Lease Area OCS A-0500 AMENDED JULY 24, 2018

Reasonable and prudent measures are those measures necessary and appropriate to minimize and monitor incidental take of a listed species. These reasonable and prudent measures are in addition to the project design criteria proposed by BOEM that are incorporated into the lease issued for Bay State Wind (OCS A-0500; see Addendum C of that lease¹⁰). We have reviewed the RPMs and Terms and Conditions developed for the programmatic Opinion as a whole and identify those that are required for the Bay State Wind surveys; this is based on the actual activities proposed by Bay State Wind.

The following reasonable and prudent measures are necessary and appropriate to minimize and monitor impacts of incidental take of sea turtles, Atlantic sturgeon, fin and sperm whales.

Reasonable and Prudent Measures: Bay State Wind 2018 Surveys (OCS A-0486)

1. BOEM must keep NMFS informed of all geophysical and geotechnical surveys conducted by Bay State Wind.
2. BOEM must require Bay State Wind to report all project-related observations of listed species to NMFS Greater Atlantic Region.

Terms and Conditions: Bay State Wind 2018 Surveys (OCS A-0500)

In order to be exempt from prohibitions of section 9 of the ESA, BOEM and Bay State Wind must comply with the following terms and conditions, which implement the reasonable and prudent measures described above and which outline required minimization and monitoring requirements. These terms and conditions are non-discretionary.

1. To implement RPM #1, BOEM must provide NMFS with notice (incidental.take@noaa.gov) no later than three days prior to scheduled geological and geophysical surveys. BOEM must also provide notice within three days following the completion of these activities.
2. To implement RPM #2, within 60 days of the end of the survey period, BOEM must submit a report to NMFS detailing the activities that occurred pursuant to the survey plan that were subject to this consultation and any impacts to listed species from those activities.
3. To implement RPM #2, BOEM must report any observations of injured or dead whales, sea turtles or Atlantic sturgeon observed in the lease area to NMFS within 24-hours. This report must include photographs whenever possible; date, time and coordinates of sighting; and a summary of project activities occurring in the previous 24-hours. These reports must be submitted by email to incidental.take@noaa.gov.

¹⁰ A copy of the lease is available at <https://www.boem.gov/Lease-OCS-A-0500/>

4. To implement RPM #3, BOEM must ensure:
 - a. Bay State Wind immediately reports any whale taken in a manner not authorized by the Incidental Harassment Authorization (e.g., injury, serious injury, or mortality) to NMFS Greater Atlantic Region (978-281-9328) and via email to incidental.take@noaa.gov.
 - b. Bay State Wind submits to the NMFS Greater Atlantic Region a report that documents the survey activities along with a detailed description of any observation and/or takes of ESA listed species including right, fin, sei and sperm whales.
5. To implement RPM #3, the requirements of the Incidental Harassment Authorization (July 24, 2018) issued under section 101(a)(5)(A) of the MMPA are incorporated by reference herein.

11.9.7 RPMs and Terms and Conditions for Orsted's 2019-2020 Surveys in BOEM Lease Area OCS A-0486, 0487 and 0500 AMENDED SEPTEMBER X, 2019

Reasonable and prudent measures are those measures necessary and appropriate to minimize and monitor incidental take of a listed species. These reasonable and prudent measures are in addition to the project design criteria proposed by BOEM that are incorporated into the lease issued for Bay State Wind (OCS A-0486, 0487, and 0500; see Addendum C of that lease¹¹). We have reviewed the RPMs and Terms and Conditions developed for the programmatic Opinion as a whole and identify those that are required for the Orsted surveys; this is based on the actual activities proposed by Orsted.

The following reasonable and prudent measures are necessary and appropriate to minimize and monitor impacts of incidental take of sea turtles, Atlantic sturgeon, North Atlantic right, sei, fin and sperm whales.

Reasonable and Prudent Measures: Orsted 2019-2020 Surveys

1. BOEM must keep NMFS informed of all geophysical and geotechnical surveys conducted by Orsted.
2. BOEM must require Orsted to report all project-related observations of listed species to NMFS Greater Atlantic Region.

Terms and Conditions: Orsted 2019-2020 Surveys

In order to be exempt from prohibitions of section 9 of the ESA, BOEM and Orsted must comply with the following terms and conditions, which implement the reasonable and prudent measures

¹¹ A copy of the lease is available at <https://www.boem.gov/Lease-OCS-A-0500/>

described above and which outline required minimization and monitoring requirements. These terms and conditions are non-discretionary.

1. To implement RPM #1, BOEM must provide NMFS with notice (incidental.take@noaa.gov) no later than three days prior to scheduled geological and geophysical surveys. BOEM must also provide notice within three days following the completion of these activities.
2. To implement RPM #2, within 60 days of the end of the survey period, BOEM must submit a report to NMFS detailing the activities that occurred pursuant to the survey plan that were subject to this consultation and any impacts to listed species from those activities.
3. To implement RPM #2, BOEM must report any observations of injured or dead whales, sea turtles or Atlantic sturgeon observed in the lease area to NMFS within 24-hours. This report must include photographs whenever possible; date, time and coordinates of sighting; and a summary of project activities occurring in the previous 24-hours. These reports must be submitted by email to incidental.take@noaa.gov.
4. To implement RPM #3, BOEM must ensure:
 - a. Orsted immediately reports any whale taken in a manner not authorized by the Incidental Harassment Authorization (e.g., injury, serious injury, or mortality) to NMFS Greater Atlantic Region (978-281-9328) and via email to incidental.take@noaa.gov.
 - b. Orsted submits to the NMFS Greater Atlantic Region a report that documents the survey activities along with a detailed description of any observation and/or takes of ESA listed species including right, fin, sei, and sperm whales.
5. To implement RPM #3, the requirements of the Incidental Harassment Authorization (September 26, 2019) issued under section 101(a)(5)(A) of the MMPA are incorporated by reference herein.

11.9.8 RPMs and Terms and Conditions for ASOW's 2020-2021 Surveys in BOEM Lease Area OCS A-099 AMENDED April X, 2020

Reasonable and prudent measures are those measures necessary and appropriate to minimize and monitor incidental take of a listed species. These reasonable and prudent measures are in addition to the project design criteria proposed by BOEM that are incorporated into the lease issued for ASOW (OCS A-0499; see Addendum C of that lease¹²). We have reviewed the RPMs and Terms and Conditions developed for the programmatic Opinion as a whole and identify those that are required for the ASOW surveys; this is based on the actual activities proposed by ASOW.

The following reasonable and prudent measures are necessary and appropriate to minimize and monitor impacts of incidental take of sea turtles, Atlantic sturgeon, North Atlantic right, sei, fin

¹² A copy of the lease is available at <https://www.boem.gov/sites/default/files/renewable-energy-program/State-Activities/NJ/NJ-LEASE-OCS-A-0499.pdf>

and sperm whales.

Reasonable and Prudent Measures: ASOW Surveys

1. BOEM must keep NMFS informed of all geophysical and geotechnical surveys conducted by ASOW.
2. BOEM must require ASOW to report all project-related observations of listed species to NMFS Greater Atlantic Region.

Terms and Conditions: ASOW Surveys

In order to be exempt from prohibitions of section 9 of the ESA, BOEM and ASOW must comply with the following terms and conditions, which implement the reasonable and prudent measures described above and which outline required minimization and monitoring requirements. These terms and conditions are non-discretionary.

1. To implement RPM #1, BOEM must provide NMFS with notice (incidental.take@noaa.gov) no later than three days prior to scheduled geological and geophysical surveys. BOEM must also provide notice within three days following the completion of these activities.
2. To implement RPM #2, within 60 days of the end of the survey period, BOEM must submit a report to NMFS detailing the activities that occurred pursuant to the survey plan that were subject to this consultation and any impacts to listed species from those activities.
3. To implement RPM #2, BOEM must report any observations of injured or dead whales, sea turtles or Atlantic sturgeon observed in the lease area to NMFS within 24-hours. This report must include photographs whenever possible; date, time and coordinates of sighting; and a summary of project activities occurring in the previous 24-hours. These reports must be submitted by email to incidental.take@noaa.gov.
4. To implement RPM #3, BOEM must ensure:
 - a. Orsted immediately reports any whale taken in a manner not authorized by the Incidental Harassment Authorization (e.g., injury, serious injury, or mortality) to NMFS Greater Atlantic Region (978-281-9328) and via email to incidental.take@noaa.gov.
 - b. Orsted submits to the NMFS Greater Atlantic Region a report that documents the survey activities along with a detailed description of any observation and/or takes of ESA listed species including right, fin, sei, and sperm whales.
5. To implement RPM #3, the requirements of the Incidental Harassment Authorization (April X, 2020) issued under section 101(a)(5)(A) of the MMPA are incorporated by reference herein.