ATLANTIC SHORES OFFSHORE WIND

ONSHORE NOISE REPORT

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1.0 EXECUTIVE SUMMARY

This Onshore Noise Report was prepared by Epsilon Associates, Inc. (Epsilon) as part of the Construction & Operations Plan (COP) for Atlantic Shores Offshore Wind, LLC. The report includes a baseline sound monitoring program that measured existing ambient sound levels in the vicinity of the proposed onshore substations and/or converter stations, computer modeling that predicted future sound levels when the onshore substations and/or converter stations are operational, computer modeling of construction noise, and a comparison of predicted sound levels with applicable noise criteria.

The Onshore Noise Report analyzed potential sound level impacts from both construction and operation of the onshore portions of the project. The construction analysis examined expected sound levels from onshore substation and/or converter station construction, typical in-street noise levels associated with underground installation of the onshore interconnection cables, and horizontal directional drilling (HDD) at the export cable landfall sites. The operational analysis examined expected sound levels from the onshore substation and/or converter station site anticipated for the Cardiff point of interconnection (POI) and the associated onshore substation and/or converter station at Fire Road. Results of the modeling were compared to the State of New Jersey Department of Environmental Protection (NJ DEP) noise regulations which limit sound levels based on the type of land use (residential, commercial, industrial) and time of day. While the NJ DEP sound level limits do not apply to construction noise, construction noise is regulated at the local level by allowing construction activity during specific hours and days of the week.

In summary, operation of the Atlantic Shores onshore substations and/or converter stations will be designed to comply with the applicable NJ DEP residential or commercial sound level limits and will include sound level mitigation as needed. Mitigation elements under consideration include designs for the proposed converter station to included certified enclosures as well as natural barriers and landscaping around the substation and/or converter station at the point of interconnection. While temporary onshore construction noise may occur, Atlantic Shores is proposing to adhere to seasonal construction restrictions during the peak tourist season to minimize impacts. No onshore construction in areas near the coast, including HDD at the landfall sites, will occur during the summer (generally from Memorial to Labor Day), subject to ongoing coordination with local authorities. Additionally, the daily hours of operation for onshore construction activities, including HDD, will be developed in accordance with municipal noise ordinances. Any work that needs to extend outside allowed construction hours will be discussed with local officials and waivers will be obtained if necessary. To further minimize the effects of construction noise, Atlantic Shores will maintain strong communication and public outreach with adjacent neighbors about the time and nature of construction activities.

2.0 INTRODUCTION

Atlantic Shores Offshore Wind, LLC (Atlantic Shores) is proposing to construct an offshore wind farm within the southern portion of New Jersey Wind Energy Lease Area OCS-A 0499 located on the Outer Continental Shelf. Energy from Atlantic Shores will be delivered to shore via 275-kV high voltage alternating current (HVAC) export cables. The export cables will traverse federal and state waters to deliver energy from Atlantic Shores to landfall sites located in Atlantic County (the "Atlantic Landfall Site"), New Jersey.

From the Atlantic Landfall Site, new 275-kV HVAC onshore interconnection cables will travel underground primarily along existing roadway, utility rights-of-way (ROWs), and/or along bike paths to one new onshore substation and/or converter station site, where transmission voltage will be stepped up or stepped down in preparation for interconnection with the electrical grid. At the onshore HVAC substation and/or converter station, the voltage will be stepped up or stepped down to match the electrical grid voltage. Onshore interconnection cables will continue from the new onshore substation and/or converter station at Fire Road Substation Site to the proposed POI for connection into the electrical grid at the existing Cardiff Substation in Egg Harbor Township, New Jersey.

This report has been updated to reflect refinements in engineering design, including updates to the location of the proposed landfall site and the onshore substation and/or converter station site.

This Onshore Noise Report includes the following elements:

- Discussion of sound level limits and regulations
- Description of existing condition sound level measurement program
- Operational sound level modeling procedures and results
- Construction sound level modeling procedures and results
- Evaluation of modeling results to applicable regulations

3.0 PROJECT DESCRIPTION – ONSHORE FACILITIES

The Project will require one onshore substations and/or converter stations (for the onshore POI). At the Project onshore substation and/or converter station sites, transmission voltage will be stepped up or stepped down in preparation for interconnection with the electrical grid. The onshore substation and/or converter station design and specific equipment will depend on whether the transmission cables are HVAC or HVDC.

From the Atlantic Landfall Site, onshore interconnection cables will travel underground along existing roadway or utility ROWs and/or along bike paths to the proposed onshore substation and/or converter station. From the proposed onshore substation and/or converter station, onshore interconnection cables will continue to the proposed POI at the existing Cardiff Substation in Egg Harbor Township for interconnection to the electrical grid. Atlantic Shores has identified an onshore substation and/or converter station site on the Cardiff Onshore Interconnection Cable Routes. Figure 3-1 illustrates the route for the Atlantic Landfall Site and onshore interconnection cable route. Section 9 discusses the negligible onshore sound levels expected from offshore operations.

Existing noise conditions at the proposed onshore substation and/or converter station site are described in Sections 5 and 6.

The Cardiff Onshore Interconnection Route is an approximately 12-14 mi (27 km) underground transmission route that largely uses existing linear infrastructure corridors from the Atlantic Landfall Site to the existing Cardiff Substation POI. The Atlantic Landfall Site will be located at a lot on S. California Avenue within Atlantic City in Atlantic County, New Jersey. Potential noise levels were modeled for this landfall site.

For the Cardiff POI, the onshore substation and/or converter station site is located at an undeveloped parcel situated on approximately 19.7 acres (0.08 km^2) along Fire Road in Egg Harbor Township (see Figure 3-1). This site is referred to as the "Fire Road" site.

Figure 3-1 Cardiff Onshore Interconnection Cable Route and Substation and/or Converter Station

4.0 NOISE REGULATIONS

4.1 Federal Regulations

There are no federal community noise regulations applicable to operation and/or construction of onshore substations and/or converter stations.

4.2 New Jersey State Regulations

The State of New Jersey's Noise Control Act of 1971 authorized the NJ Department of Environmental Protection (DEP) to promulgate codes, rules, and regulations relating to the control and abatement of noise. The NJ DEP promulgated noise regulations to control noise from stationary commercial and industrial sources in 1974 pursuant to the Noise Control Act of 1971 (NJ DEP 7:29). Within the noise regulations, there are established broadband (A-weighted) limits as well as octave band level limits for daytime (7:00 a.m. to 10:00 p.m.) and nighttime (10:00 p.m. to 7:00 a.m.) continuous noise sources. These limits are based on the land use categorization of the source and adjacent property, and are summarized below in Table 4-1.

The Atlantic Shores onshore substation and/or converter station falls under the category of "industrial facility." Based on these standards, the most stringent noise limits for off-site residences or commercial receptors due to noise from the onshore substation and/or converter station would be 65 dBA during the day, and 50 dBA at night. In addition, noise from impulsive (very short duration) noise sources is also regulated; impulsive noise sources occurring less than four times per hour must have levels less than 80 dBA. If they occur more often, they are considered to be continuous noise sources. However, impulsive noise is not applicable to the onshore substation and/or converter station. The noise from public roadways is specifically exempt from the noise level standards [7:29-1.4(a)(9)]. The sound level limits in Table 4-1 do not apply to construction noise which is regulated at the local level by allowing construction activity during specific hours and days of the week.

Table 4-1 New Jersey Sound Level Standards (dBA)

Octave Band Center Frequency	Receptor		
	Residential/Day	Residential/Night	Commercial/ All
A-weighted (dBA)	**65**	**50**	**65**
31.5 Hz	96	86	96
63 Hz	82	71	82
125 Hz	74	61	74
250 Hz	67	53	67
500 Hz	63	48	63
1000 Hz	60	45	60
2000 Hz	57	42	57
4000 Hz	55	40	55
8000 Hz	53	38	53

4.3 Local Regulations – Cardiff Onshore Interconnection Cable Route and Substation and/or Converter Station

The NJ Noise Control Act allows municipalities to adopt noise control ordinances that are more stringent than the State regulations. The sound level limits set by the NJ DEP apply statewide but the NJ DEP does not investigate noise complaints. Noise complaints are handled at the county level by the Atlantic County Department of Human Services, Division of Public Health, Environmental Health, Noise Control Program.

The Cardiff Onshore Interconnection Cable Route passes through three towns or cities including Egg Harbor Township, Pleasantville City, and Atlantic City. The proposed location of the onshore substation and/or converter station at the Fire Road Site is located within Egg Harbor Township. Relevant local noise regulations for each municipality are described below.

Egg Harbor Township. Chapter 158 Noise was adopted by the Township of Egg Harbor April 22, 2015. Egg Harbor Township adopted the same sound level limits as NJ DEP (Section 158-7). These were approved by the NJ DEP. Section 158-4.C exempts construction and demolition activities from the sound level limits. Section 158-9.C limits hours of construction to 7:00 AM-6:00 PM weekdays, and 7:00 AM-6:00 PM on weekends and federal holidays, unless such construction noise can meet the NJ DEP limits. All construction equipment shall be operated with a muffler and/or sound reduction device.

Pleasantville City. No information on construction hours was found through a series of emails, phone calls, and a search of on-line ordinances. Specific hours of work in Pleasantville will be refined as the projects get closer to construction.

Atlantic City. Chapter 186 Noise was adopted by the City Council of Atlantic City May 11, 2011. Atlantic City adopted the same sound level limits as NJ DEP (Section 186-6). These were approved by the NJ DEP. Section 186-3.C exempts construction and demolition activities from the sound level limits. Section 186-8.C limits hours of construction to 7:00 AM-6:00 PM weekdays, and 9:00 AM-6:00 PM on weekends and federal holidays, unless such construction noise can meet the NJ DEP limits. All construction equipment shall be operated with a muffler and/or sound reduction device.

5.0 BASELINE SOUND LEVEL MONITORING PROGRAM

To characterize the existing soundscape of the Project area, an ambient (baseline) monitoring program was conducted around the proposed onshore substation and/or converter station in the fall of 2022. This section outlines the structure of the ambient program.

In accordance with ANSI S12.9-1992/Part 2 (R2013), the deterministic spatial sampling technique was used to select measurement locations. In other words, sound monitoring locations were selected to be representative of nearby residences in various directions from the project. Thus, the selected locations are representative of potentially impacted receptors. The program was intended to measure total ambient sound in the area which includes all noise sources.

Short-term attended monitoring was conducted during both daytime and nighttime hours at each location. Daytime measurements were generally conducted between 10:45 AM and 12:45 PM while nighttime measurements were made between 12:00 AM and 2:00 AM. The sound level meter measured and stored broadband (A-weighted) and one-third octave band sound level statistics. Measurements were made for 20 minutes at each location.

5.1 Sound Level Measurement Locations—Fire Road Site

Figure 5-1 shows the measurement locations for the Fire Road Site. The coordinates for the sound level measurement locations are listed in Table 5-1. Each sound level monitoring location is described in the following subsections.

Table 5-1 GPS Coordinates – Sound Level Measurement Locations — Fire Road Site (Cardiff)

Location	Latitude	Longitude
1	39.396052	-74.557063
2	39.394782	-74.553826
3	39.392433	-74.555147
4	39.390476	-74.560584

Figure 5-1 Baseline Monitoring Locations - Proposed Cardiff Onshore Substation and/or Converter Station—Fire Road Site

5.1.1 Location 1—Fire Road

One programmable, attended sound level meter was placed on the south side of Fire Road across from Easy Street and Higbee Avenue. This location is representative of the residential development north of the Project site. Refer to Figure 5-2 for a photo of the monitoring setup. Sound levels at this location were influenced by vehicular traffic on Fire Road, vegetation rustle, wind, insect noise, birds, and distant construction activity.

Daytime measurements were made at this location on Wednesday, September 21, 2022 beginning at 12:25 PM. Nighttime measurements were made at this location on Thursday, September 22, 2022 beginning at 1:32 AM.

Figure 5-2 Location 1 - Sound Level Meter

5.1.2 Location 2 – Old Egg Harbor Road

One programmable, attended sound level meter was placed on the side of Old Egg Harbor Road. The sound level meter was in the corner of Old Egg Harbor Road and Oxford Village, near apartment unit #1. This location is representative of existing sound levels in the eastern area of the Project Site and along Old Egg Harbor Road. Refer to Figure 5-3 for a photo of the monitoring setup. Sound levels at this location were influenced by vehicular traffic, activity at Walmart on the other side of Old Egg Harbor Road, window AC units, insects, vegetation rustle, birds, and occasional aircraft.

Daytime measurements were made at this location on Wednesday, September 21, 2022 beginning at 10:44 AM. Nighttime measurements were made at this location on Thursday, September 22, 2022 beginning at 12:39 AM.

Figure 5-3 Location 2 - Sound Level Meter

5.1.3 Location 3 — Hingston Avenue (East)

One programmable, attended sound level meter was placed on the side of Hingston Avenue near Tilton Club. This location is representative of existing sound levels in the southern area of the Project Site and along Hingston Avenue. Refer to Figure 5-4 for a photo of the monitoring setup. Sound levels at this location were influenced by vehicular traffic, vegetation rustle, insects, birds, and occasional aircraft.

Daytime measurements were made at this location on Wednesday, September 21, 2022 beginning at 11:17 AM. Nighttime measurements were made at this location on Thursday, September 22, 2022 beginning at 12:12 AM.

Figure 5-4 Location 3 - Sound Level Meter

5.1.4 Location 4 — Hingston Avenue (West)

One programmable, attended sound level meter was placed on the side of Hingston Avenue near Penny Point Park. This location is representative of existing sound levels in the western area of the Project Site and along Hingston Avenue. Refer to Figure 5-5 for a photo of the monitoring setup. Sound levels at this location were influenced by vehicular traffic, window AC units, activity in an adjacent strip mall, insects, and occasional aircraft.

Daytime measurements were made at this location on Wednesday, September 21, 2022 beginning at 11:46 AM. Nighttime measurements were made at this location on Thursday, September 22, 2022 beginning at 1:06 AM.

Figure 5-5 Location 4 - Sound Level Meter

5.2 Sound Level Measurement Instrumentation

Each of the monitoring locations utilized a Larson Davis (LD) model 831[1] sound level meter (SLM) to measure A-weighted (dBA) and one-third octave bands from 6.3 Hz to 10,000 Hz. The instrument was equipped with a LD PRM831 preamplifier and a 377C20 half-inch microphone. The SLM was paired with a manufacturer 3" wind screen to reduce wind-induced noise over the microphone. The microphone was tripod-mounted at a height of approximately five feet (1.5 meters) above ground level in accordance with ANSI S12.9-1992/Part 2 (R2013).

The LD831 meets Type 1 ANSI/ASA S1.4, ANSI S1.43-1997 (R2007), and IEC 61672 Class 1 standards for sound level meters and was calibrated and certified as accurate to standards set by the National Institute of Standards and Technology. The octave band filters for all instrumentation meet ANSI S1.11-2004 (R2009). The calibration was conducted by an independent laboratory within 12 months of field placement and certificates of calibration are provided in Appendix A. All measurement equipment was calibrated in the field before and after the surveys with the manufacturer's acoustical calibrator which meets the standards of IEC 60942-2003 Class 1L and ANSI/ASA S1.40-2006 (R2016).

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1 Noise floor specified in manufacturer's manual with use of PRM831 preamplifier and 377B02 microphone for A-weighted sound pressure levels is 18 dB at a 0 dB gain and 17 at a 20 dB gain. Noise floor specified for Z-weighted sound pressure levels is 23 dB at a 0 dB gain and 21 at a 20 dB gain.

Meteorological observations were made during each sound level monitoring program using handheld instrumentation.   For this project, a Kestrel 3000 was used to observe the local wind speed, relative humidity, and temperature.

6.0 BASELINE SOUND LEVEL MONITORING RESULTS

This section discusses the results from the detailed ambient (baseline) monitoring program outlined in the previous section. Specifically, the logic for data validity and sound level results for the monitoring locations are provided.

6.1 Data Formatting Overview

During warm months, insect noise can dominate sound levels especially in wooded, grassy, or wet areas. This insect noise can overwhelm other sources and sometimes result in a very different sound level than if the insects were not present, such as the winter season. While insect noise was not a significant contributor during the ambient measurements, this seasonal noise was conservatively removed from the ambient sound level measurements using a high-frequency natural sound (HFNS) filter applied to the measured one-third octave-band data from which a broadband sound level was calculated. This technique removes all sound energy above the 1,250 Hertz frequency band. The methodology for the filtration process is as specified in ANSI/ASA S12.100-2014 and the sound pressure levels presented in this report using this methodology are indicated as ANS-weighted levels (presented in dBA). This HFNS analysis provides an indication of what ambient sound levels may be in colder weather without the influence of insect noise. Appendix B contains a more detailed discussion of acoustic terminology used in this report.

The 20-minute measured steady-state (L_{90}) and equivalent (L_{eq}) A-weighted sound levels are summarized below in Table 6-1 for the Fire Road substation and/or converter station along with the calculated ANS-weighted L_{90} and L_{eq} sound levels. In addition to broadband sound levels, the L_{90} octave-band data are also summarized in Table 6-1. The time in each table represents the start time of the 20-minute measurement.

6.2 Cardiff Onshore Substation and/or Converter Station Results – Fire Road Site

Table 6-1 presents the measured sound levels from the Fire Road site for the proposed Cardiff onshore substation and/or converter station.

Table 6-1 Sound Level Measurement Results — Fire Road (Cardiff)

Loc.	Day/ Night	Start Time	LA_{eq}	LA_{90}	ANS-LA_{eq}	ANS-LA_{90}	L_{90} Sound Pressure Level by Octave-Band Center Frequency (Hz)								
							31.5	63	125	250	500	1k	2k	4k	8k
			dBA	dBA	dBA	dBA	dB	dB	dB	dB	dB	dB	dB	dB	dB
1	Day	12:25 PM	69	55	67	53	58	58	55	49	46	51	47	37	42
2	Day	10:44 AM	66	48	65	46	57	57	53	46	40	41	38	30	30
3	Day	11:17 AM	66	47	65	45	55	53	48	43	40	41	36	30	35
4	Day	11:46 AM	64	51	63	50	60	58	54	49	45	47	42	34	31
1	Night	1:32 AM	58	54	54	38	46	48	42	39	35	35	34	52	33
2	Night	12:39 AM	54	43	52	39	51	46	46	41	35	34	31	38	30
3	Night	12:12 AM	58	54	53	37	46	45	42	37	35	34	37	53	38
4	Night	1:06 AM	55	50	51	39	48	48	46	42	36	35	34	48	28

7.0 OPERATIONAL SOUND LEVELS

7.1 Overview and Noise Sources

Electricity generated by the Project will be delivered to shore via 275 kV high voltage alternating current (HVAC) export cables. The proposed HVAC substation and/or converter station design includes up to four 450 MVA power transformers, eight 170 MVA iron core shunt reactors, six harmonic filters, two static synchronous compensators (STATCOMs), and several onsite buildings.

Table 7-1 summarizes the onshore substation and/or converter station components in the HVAC design along with the type or rating, quantity, and indication of whether the component is in the site yard or part of a STATCOM. Broadband sound power level ranges for each major piece of equipment were provided to Epsilon. Sound modeling was initially performed using the highest sound power level in that range to be conservative, and these sound levels are identified in Table 7-1 as the “Base Case” sound levels. Other electrical and mechanical components of the onshore substation and/or converter station, either in the site yard, in the STATCOMs, or contained within site buildings, are assumed to be insignificant sources of sound and were excluded from the modeling, e.g., auxiliary transformers with sound power levels that are 10 dBA lower than the quietest piece of equipment included in the model.

Table 7-1 Onshore Substation and/or Converter Station Noise Sources

Component	Type/Rating	Qty.	Site Yard or STATCOM Component	“Base Case” Broadband Sound Power Level in dBA (per unit)
Power Transformer	450 MVA	4	Site Yard	108
VSR (Iron Core)	170 MVAr	8	Site Yard	101
Harmonic Filter Reactor	100 MVAr	18	Site Yard	95
Harmonic Filter Capacitor	100 MVAr	18	Site Yard	90
Harmonic Filter Resistor	100 MVAr	18	Site Yard	80
VSC Reactor (Air Core)	250 MVA	2	STATCOM	95
DRC Step-up Transformer	250 MVA	2	STATCOM	108
Fan Bank	Unknown	2	STATCOM	100
Valve Hall HVAC Unit	Unknown	2	STATCOM	82
BARD Wall-mounted HVAC Unit	Unknown	8	STATCOM	80

7.2 Cadna/A Sound Model and Methodology

Sound level impacts from the onshore substation and/or converter station electrical and mechanical equipment were analyzed using Cadna/A noise calculation software[2]. This predictive software uses the ISO 9613-2 international standard for sound propagation.[3] The Cadna/A software includes a refined set of computations accounting for local topography, ground attenuation, drop-off with distance, barrier shielding, diffraction around building edges, reflection off building facades, and atmospheric absorption of sound from multiple noise sources.

Inputs and significant parameters employed in the model are described below:

- **Project Layout:** A conceptual site plan was provided to Epsilon by Atlantic Shores on October 10, 2022.
- **Sensitive Receptors**: Sound levels were evaluated at modeling locations (discrete points) representing the closest residentially or commercially used or zoned property lines surrounding the site. The modeling locations include measurement locations presented in Section 5 and additional property line receptors based on a review of the site plan.[4] A total of 12 receptors were modeled at the Fire Road Site. All receptors were modeled with a height of 1.5 meters above ground level to mimic the ears of a typical standing observer.
- **Modeling Grid:** A modeling grid with 10-meter spacing was calculated in the vicinity of the proposed onshore substation and/or converter station site. The grid was modeled at a height of 1.5 meters above ground level for consistency with the discrete modeling points. This modeling grid allowed for the creation of sound level isolines.
- **Terrain Elevation:** Elevation contours for the modeling domain, derived from a National Elevation Dataset from the Natural Resources Conservation Service at a 3-meter resolution, were directly imported into Cadna/A, which allowed for consideration of terrain shielding and differences in elevation between sources and receivers, where appropriate.
- **Source Sound Power Levels:** Broadband sound power level ranges for each major piece of equipment described in Section 7.1 were provided to Epsilon. Sound modeling was initially performed using the highest sound power level in that range to be conservative

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2 DataKustik Corporation GmbH

3 *Acoustics – Attenuation of sound during propagation outdoors – Part 2: General method of calculation,* International Standard ISO 9613-2:1996 (International Organization for Standardization, Geneva, Switzerland, 1996).

4 The site parcel shown on figures in this report is based on publicly available parcel data; however, the receptors were positioned based on the site boundary shown in the site plan that was georeferenced for modeling use including for the placement of sound sources.

("base case"). In some cases, the sound power level of certain equipment was reduced within the model to reduce impacts at the nearest noise-sensitive property lines. Therefore, a tabular summary of the modeled reference sound power level data is provided in the subsequent section. The Project is in the early design stage and octave band sound level data were not available for the equipment included in the model. Therefore, octave band sound levels were unable to be modeled.

- **Meteorological Conditions:** A temperature of 10°C (50°F) and a relative humidity of 70% were assumed in the model to minimize atmospheric attenuation in the 500 Hz and 1,000 Hz octave bands where the human ear is most sensitive. As per ISO 9613-2, the modeling assumed favorable conditions for sound propagation, corresponding to a moderate, well-developed ground-based temperature inversion, as might occur on a calm, clear night or equivalently downwind propagation.
- **Ground Attenuation:** Spectral ground absorption was calculated using a global G-factor of 0.5 to represent a moderately reflective surface.
- No additional attenuation due to tree shielding, air turbulence, or wind shadow effects was considered in the model.

7.3 Proposed Cardiff Onshore Substation Modeling – Fire Road Site

7.3.1 Modeled Sound Power Levels

A tabular summary of the noise-controlled reference sound power level data for each noise source, as included in the model for the Cardiff onshore substation and/or converter station, is presented in Table 7-2. Base-case sound levels are included in the table for reference purposes. All modeled sources were assumed to be operating simultaneously at the sound levels shown in Table 7-2.

Table 7-2 Modeled Reference Sound Power Levels

Component	Site Yard or STATCOM Component	"Base Case" Broadband Sound Power Level	Noise Controlled Broadband Sound Power Level
		dBA	dBA
Power Transformer	Site Yard	108	93
VSR (Iron Core)	Site Yard	101	90
Harmonic Filter Reactor	Site Yard	95	85
Harmonic Filter Capacitor	Site Yard	90	85
Harmonic Filter Resistor	Site Yard	80	80
VSC Reactor (Air Core)	STATCOM	95	90
DRC Step-up Transformer	STATCOM	108	95
Fan Bank	STATCOM	100	95
Valve Hall HVAC Unit	STATCOM	82	82
BARD Wall-mounted HVAC Unit	STATCOM	80	80

7.3.2 Mitigation Measures

At the proposed onshore substation and/or converter station site, noise control features are needed to limit sound level impacts in the neighboring communities. In some cases, low-noise designs were utilized for certain equipment, i.e., the maximum (base case) sound power level was not used in the model. The low-noise specifications are reflected in the mitigated reference sound power data provided in Table 7-2. The table lists both the unmitigated ("base case") and mitigated ("noise-controlled") sound power levels for each piece of equipment.

Sound level modeling also includes strategically placed sound barriers and "firewalls" of various lengths. Sound walls are solely placed and designed to attenuate sound, whereas firewalls are typically constructed between two transformers but also attenuate sound. The barriers/firewalls are conceptual in design, and noise control features for the Project will be advanced once the final site is selected and the layout is refined. For purposes of modeling at this stage, the barriers/firewalls included in the noise models for Scenario 1 and Scenario 2 are as described in Table 7-3. The respective scenarios are identified in the table. Once final design is complete, the noise modeling will be finalized, and mitigation refined. Atlantic Shores is also considering designs for the proposed substation and/or converter station to included equipment enclosures as well as natural barriers and landscaping.

Table 7-3 Modeled Sound Barrier / Firewall Details

Mitigated Scenario	ID	Height (feet)	Approximate Length (feet)
Scenario 1	1	35	45
	2	35	50
	3	30	55
	4	35	55
	5	35	105
	6	30	115
	7	20	45
	8	20	70
	9	35	235
	10	35	160
	11	20	70
	12	20	65
	13	35	50
	14	20	80
	15	35	80
	16	30	105
	17	20	10
	18	20	70
	19	20	25
	20	20	225
	21	15	80
	22	15	30
Scenario 2	1	35	45
	2	35	50
	3	15	100
	4	20	550
	5	20	345
	6	25	220
	7	25	220
	8	25	190
	9	25	45

7.3.3 Predicted Operational Sound Levels

Broadband sound level results at the 12 modeling receptors at the Fire Road Site are presented in Table 7-4. Both base case and noise-controlled (i.e., proposed) results are shown. Two noise-controlled, or "mitigated", scenarios were modeled using different noise control features as described in the prior section. Figure 7-1 provides noise-controlled sound contours from the operation of the onshore substation and/or converter station under Scenario 1. Figure 7-2 provides noise-controlled sound contours from the operation of the onshore substation and/or converter station under Scenario 2. Included on the figures are the 12 modeling locations, the on-site buildings included in the model, and sound barrier and firewall locations. The noise-controlled Project-only broadband sound levels range from 40 to 59 dBA at the 12 modeling locations under Scenario 1 with the highest sound level modeled at a residential property line of 50 dBA as represented by Receptor FR7 and FR9 and as demonstrated by the sound results shown in Figure 7-1. Under Scenario 2, the noise-controlled Project-only broadband sound levels range from 39 to 59 dBA with the highest sound level modeled at a residential property line of 50 dBA as represented by Receptor FR9 and as demonstrated by the sound results shown in Figure 7-2.

Table 7-4 Project-Only Sound Level Results – Fire Road Site

Receptor ID	Description/Land Use	Modeled Project-Only L_{eq} Sound Level (dBA)		
		Base Case	Mitigated Scenario 1	Mitigated Scenario 2
FR1	Onsite (Msmt. Loc. 1)	57	47	49
FR2	Res. (Msmt. Loc. 2)	57	41	42
FR3	Onsite (Msmt. Loc. 3)	66	52	43
FR4	Res. (Msmt. Loc. 4)	50	40	39
FR5	Residential	61	49	47
FR6	Residential	62	49	47
FR7	Residential	68	50	48
FR8	Residential	69	49	47
FR9	Residential	66	50	50
FR10	Commercial	68	57	56
FR11	Commercial	69	59	59
FR12	Residential	60	50	50

Figure 7-1 Cardiff Onshore Substation and/or Converter Station Site Fire Road Sound Level Modeling Results (Scenario 1)

Figure 7-2 Cardiff Onshore Substation and/or Converter Station Site Fire Road Sound Level Modeling Results (Scenario 2)

7.4 Sound Level Evaluation

This section summarizes the onshore substation and/or converter station operational modeling results (noise-controlled) and compares them to the applicable NJ DEP daytime and nighttime A-weighted sound level limits. The onshore substation and/or converter station is expected to operate 24-hours per day; therefore, the nighttime sound level limits are the most restrictive. As noted previously, the onshore substation and/or converter station is in the early design stage and octave band sound level data were not available for the equipment included in the model. Therefore, octave band sound levels in the community could not be evaluated against the NJ DEP octave band limits.

Broadband sound level modeling results at the Cardiff onshore substation and/or converter station location are compared to the applicable NJ DEP daytime and nighttime sound level limits under modeling noise-controlled Scenario 1 and Scenario 2 in Table 7-5 and Table 7-6, respectively. The results show that compliance is expected at all locations under both scenarios. While the modeling receptors FR1 and FR3 are included in the tables for completeness, these receptors are located on the proposed site, so the sound level limits do not apply.

Table 7-5 Project Sound Level Results Compared to Limits – Scenario 1

Receptor ID	Land Use	Modeled Project-Only Sound Level	NJ DEP Sound Level Limit (Day)	NJ DEP Sound Level Limit (Night)
		dBA	dBA	dBA
FR1	Onsite (Msmt. Loc. 1)	47	N/A	N/A
FR2	Res. (Msmt Loc. 2)	41	65	50
FR3	Onsite (Msmt Loc. 3)	52	N/A	N/A
FR4	Res. (Msmt Loc. 4)	40	65	50
FR5	Residential	49	65	50
FR6	Residential	49	65	50
FR7	Residential	50	65	50
FR8	Residential	49	65	50
FR9	Residential	50	65	50
FR10	Commercial	57	65	65
FR11	Commercial	59	65	65
FR12	Residential	50	65	50

Table 7-6 Project Sound Level Results Compared to Limits – Scenario 2

Receptor ID	Land Use	Modeled Project-Only Sound Level	NJ DEP Sound Level Limit (Day)	NJ DEP Sound Level Limit (Night)
		dBA	dBA	dBA
FR1	Onsite (Msmt. Loc. 1)	49	N/A	N/A
FR2	Res. (Msmt Loc. 2)	42	65	50
FR3	Onsite (Msmt Loc. 3)	43	N/A	N/A
FR4	Res. (Msmt Loc. 4)	39	65	50
FR5	Residential	47	65	50
FR6	Residential	47	65	50
FR7	Residential	48	65	50
FR8	Residential	47	65	50
FR9	Residential	50	65	50
FR10	Commercial	56	65	65
FR11	Commercial	59	65	65
FR12	Residential	50	65	50

8.0 ONSHORE CONSTRUCTION NOISE

Onshore construction will be performed using standard construction equipment typical for onshore infrastructure projects such as the installation of new transmission lines. Onshore construction activities can be broken into three key components: the onshore substation and/or converter station, the onshore interconnection cables/duct bank, and the landfall site where the export cables transition from offshore to onshore.

Onshore substation and/or converter station construction will resemble typical construction at a power plant or mainland substation. Vehicles necessary for this construction can be expected to include excavators, concrete trucks, and backhoes. Typical grading equipment would be used for any clearing and grading needed at the sites, and the equipment would be delivered by large trucks and may include oversized-load deliveries. Installation of the equipment could also require the use of cranes and other support vehicles.

Installation of the onshore interconnection cables and concrete duct bank will require the use of typical construction equipment such as dump trucks, front-end loaders, concrete trucks, and excavators. The cable installation will also require construction vehicles that are more specifically designed for cable management such as winches and cable reel trucks.

The offshore-to-onshore export cable transition will be accomplished using horizontal directional drilling (HDD), a trenchless method that will avoid nearshore impacts as well as impacts directly along the shoreline. HDD, in comparison to trenching, also results in a deeper burial depth for cables in the nearshore environment, facilitating sufficient burial over the life of the Projects and decreasing the likelihood that cables will become exposed over time.

Construction hours will adhere to local ordinances, and Atlantic Shores anticipates that typical construction hours will extend between 7 am and 6 pm, depending on local noise ordinances. While Atlantic Shores is not anticipating significant nighttime work, any nighttime work deemed necessary will be requested through a waiver and coordinated with the local authorities.

8.1 Onshore Substation and/or Converter Station

8.1.1 General Information

Activities involved in construction of each onshore substation and/or converter station will include:

- Land clearing and rough grading and fencing: The entire parcel may need to be disturbed during clearing and grading. Only a few trees currently exist on any given onshore substation and/or converter station parcel, and these will likely need to be removed.
- Trenching and excavation (for ground grid, equipment foundations, cable and conduit trenches/duct banks)

- Installation of equipment foundations
- Installation of onshore substation and/or converter station equipment
- Wiring and connections
- Final grading
- Commissioning
- Energization
- System testing

A crane may be used to erect equipment and poles, to set major onshore substation and/or converter station equipment (e.g., transformers, reactors, STATCOMs, harmonic filters, buswork, switchgear, breakers, switches, pre-fabricated buildings) onto foundations, and to move construction equipment (e.g., storage containers, offices, welders, generators, cable reels, cable pullers) around the site.

8.1.2 Onshore Substation and/or Converter Station Construction Sound Levels

At this point in the permitting phase, details of the precise quantity, location, and type of specific construction equipment are not yet known. However, a document[5] published by the U.S. Environmental Protection Agency (EPA) provides quantitative information on the five major phases of construction. These phases are shown below along with the reference sound level at 50 feet for each phase under full (maximum) operation. This reference sound level includes a specific mix of equipment typically used for the phase at construction sites in suburban residential areas and reflects an energy average sound level with all pertinent equipment present at the site. Maximum sound levels during these phases are listed in Table 8-1 at a reference distance of 50 feet. Table 8-2 lists expected sound levels at additional distances.

[5] "Noise From Construction Equipment and Operations, Building Equipment, and Home Appliances"; U.S. Environmental Protection Agency Office of Noise Abatement and Control; prepared by Bolt, Beranek, and Newman, December 31, 1971.

Table 8-1 Reference Sound Levels of Construction Equipment at 50 feet

Phase Number	Phase Description	Max. Sound Level (dBA) at 50 feet
1	Ground Clearing	84
2	Excavation	88
3	Foundations	88
4	Erection	79
5	Finishing	84

Table 8-2 Maximum Sound Levels of Construction Phases Extrapolated to Additional Distances

Phase Number	Phase Description	Sound Level (dBA) at Distance (ft)					
		25	50	100	250	500	1000
1	Ground Clearing	90	84	78	70	64	58
2	Excavation	94	88	82	74	68	62
3	Foundations	94	88	82	74	68	62
4	Erection	85	79	73	65	59	53
5	Finishing	90	84	78	70	64	58

In general, the sound levels from construction activities will be dominated by the loudest piece of equipment operating at the time. Therefore, at any given point in the work area, the loudest piece of equipment will be the most representative of the expected sound levels in that area. Construction equipment is generally not operated continuously at maximum load but runs with significant variation in power and usage. Actual received sound levels would fluctuate, depending on the construction activity, equipment type, and separation distances between source and receiver. Other factors such as terrain and obstacles such as buildings will act to further limit the impact of construction noise levels.

8.1.3 Proposed Cardiff Onshore Substation and/or Converter Station Construction Sound Level Impacts—Fire Road Site

An estimate of construction sound levels by phase at the two nearby ambient sound level measurement locations presented in Section 5 is provided in Table 8-3. For additional reference, residences are generally scattered around the Fire Road Site. Based on a review of aerial imagery, the closest residence is roughly 23 feet (7 m) to the Fire Road Site.

Table 8-3 Maximum Sound Levels of Construction Phases Extrapolated to Fire Road Site Sound Monitoring Locations

Location	Approx. Dist. to Perimeter (ft)	Estimated Sound Level (dBA) by Construction Phase				
		Phase 1	Phase 2	Phase 3	Phase 4	Phase 5
Location 2	325	68	72	72	63	68
Location 4	1200	56	60	60	51	56

8.1.4 Onshore Substation and/or Converter Station Construction Mitigation

The following measures will be considered to reduce sound levels in the community during onshore substation and/or converter station construction:

- Atlantic Shores will adhere to the municipal noise control ordinances established for construction in each of the cities, towns, or boroughs in which the Project's onshore facilities are located.
- Atlantic Shores will maintain strong communication and public outreach with adjacent neighbors.
- Atlantic Shores will consider replacing back-up alarms on trucks and equipment with strobes, as allowed within Occupational Safety and Health Administration regulations, to eliminate the potentially loud impulsive sound.
- Atlantic Shores will assure that equipment is functioning properly and is equipped with mufflers and other noise-reducing features.
- Implementation of quieter construction equipment and methods, as feasible, such as smaller backhoes will be used.
- Implementation of path noise control measures such as portable enclosures for small equipment (e.g., jackhammers, saws) will be used.
- Construction activities will be conducted outside of the peak tourism season (generally Memorial Day to Labor Day).

8.2 Onshore Interconnection Cables

Regardless of the type of cable, the onshore interconnection cables will be contained within a buried concrete duct bank, with individual cables residing in conduits composed of high-density polyethylene (HDPE) or Polyvinyl Chloride (PVC). Onshore interconnection cables will typically require splices every 1,640 to 3,280 ft (500 to 1,000 m). At each splice location, a concrete splice vault will be installed.

Installation of the concrete duct bank for onshore interconnection cables will typically be accomplished via open trenching, although some specialty techniques are anticipated at unique features such as busy roadways and wetlands. During typical open trenching, the trench will be up to 14.8 ft (4.5 m) wide by 11.5 ft (3.5 m) deep. Typical cover over the buried duct bank (e.g., along roadway ROWs) will be approximately 3 ft (0.9 m), though maximum coverage over the top of the cable conduits could be up to 30 ft (9 m) in some specialty installation scenarios.

Specialty installation techniques are trenchless techniques that avoid surface disturbance and hence can avoid impacts to busy roadways, wetlands, or existing developments or features. These specialty techniques primarily include:

- Horizontal directional drilling: HDD is typically used to cross beneath relatively wide features such as interstate highways and water bodies. HDD commonly involves drilling a hole in an arc under the surface feature, then enlarging that hole and pulling either a large PVC or HDPE casing or several smaller PVC or HDPE pipes (in a bundle) back through the bore hole. More detail on HDD techniques is found in Section 8.3 below.

- Pipe jacking: In this method, a casing pipe originating in a jacking shaft is driven through the soil by powerful hydraulic jacks to excavate a tunnel that leads to a receiving shaft on the opposite side of the obstacle being avoided on the surface. This method results in a flexible, structural, watertight, and finished pipeline for installation of cables.

- Jack-and-bore: This trenchless crossing technique is used to install a casing beneath the surface feature being avoided. Relative to HDD, jack-and-bore is typically used for shorter crossings (less than approximately 200 ft [61 m]), such as those under streams or highways. A jack-and-bore is performed by excavating a bore pit and a receiving pit, located on opposite sides of the obstacle. Drilling and jacking activities are initiated from the bore pit, while the steel or concrete casing is driven into the receiving pit. As a borehole is drilled, the casing is pushed into the borehole. After the casing is in place, it is cleaned and then smaller HDPE or PVC pipes are installed inside the casing.

Locations where these specialty techniques may be utilized are described below in the context of the Cardiff Onshore Interconnection Cable Route.

8.2.1 Specialty Installation Techniques – Cardiff Onshore Interconnection Cable Route

Atlantic Shores will develop a Traffic Management Plan to avoid and minimize traffic impacts and will adhere to seasonal construction restrictions (generally from Memorial to Labor Day) near the shoreline. The use of specialty installation techniques, most likely either HDD or pipe jacking, will also avoid and minimize these impacts, particularly at the following locations:

- A former railroad tunnel crossing the Garden State Parkway

- Route 40 crossing

8.2.2 Onshore Interconnection Cables – Construction Sound Levels

Civil construction activities related to the onshore interconnection cables will consist generally of the following five principal noise-producing phases:

- Trench excavation
- Duct bank installation
- Manhole installation
- Backfill and Compaction
- Final pavement restoration

Each of these phases will be conducted in sequence at each location; it is possible that several phases of construction will be ongoing simultaneously along various sections of the onshore interconnection cable route.

The potential for noise impacts from Project construction is a function of the specific receptors along the route as well as the equipment used and proposed hours of operation. Construction is anticipated to occur during typical work hours (7:00 AM to 6:00 PM), though in specific instances at some locations, or at the request of any given municipality, the Projects may seek municipal approval to work at night. Nighttime work will be minimized and performed only on an as-needed basis, such as when crossing a busy road, and will be requested through a waiver and coordinated with each Town.

Onshore interconnection cable installation will periodically generate noise levels that are audible along the route, conductor-pulling sites, and staging and maintenance areas. Proposed construction equipment will be similar to that used during typical public works projects (e.g., road resurfacing, storm sewer installation, interconnection cable installation).

In general, sound levels from construction activities will be dominated by the loudest piece of equipment operating at the time. Therefore, at any given point along the onshore interconnection cable route, the loudest piece of equipment will be the most representative of the expected sound levels in that area. Maximum sound levels from typical equipment proposed during construction are listed in Table 8-4 at a reference distance of 50 feet (15.2 m).

Table 8-4 Reference Sound Levels of Construction Equipment at 50 feet

Equipment	Max. Sound Level (dBA) at 50 feet
Mobile Crane *(duct bank and manhole installation)*	85 (1)
Pavement Saw *(trench excavation)*	90 (1)
Asphalt Paver *(manhole installation, street restoration)*	85 (1)
Pneumatic Hammer *(trench excavation)*	85 (1)
Mounted Impact Hammer (Hoe Ram) *(trench excavation if ledge)*	90 (1)
Backhoe *(trench excavation)*	80 (1)
Dump Truck *(manhole installation, trench excavation)*	84 (1)
Generator *(cable pulling and splicing)*	82 (2)
Air Conditioning *(cable splicing)*	60 (at 3 feet) (2)

Source:

1. Thalheimer, E., "Construction Noise Control Program and Mitigation Strategy at the Central Artery/Tunnel Project", Noise Control Eng. Journal 48 (5), 2000 Sep-Oct.
2. US EPA, "Noise from Construction Equipment and Operations, Building Equipment, and Home Appliances", prepared by Bolt, Beranek and Newman, Report No. NTID300.1, December 31, 1971.

Construction equipment proximity to noise-sensitive land uses will vary along the proposed onshore interconnection cable route. Because sound levels from a point source drop off due to geometric divergence (hemispherical spreading) at a rate of 6 dB per doubling of distance, the reference sound levels at 50 feet (15.2 m) in Table 8-4 will decrease by 6 dBA for locations 100 feet (30.5 m) back from the edge of construction. For example, maximum backhoe sound levels at 100 feet (30.5 m) would be expected to be approximately 74 dBA. In a more urbanized area, setbacks may be only 25 feet (7.6 m) from construction activity, thus increasing the sound levels from each piece of equipment by 6 dBA. Therefore, the same backhoe at 25 feet (7.6 m) would be expected to produce a maximum sound level of 86 dBA. To reiterate, the 80 dBA is the maximum expected backhoe sound level, while typical levels would be much lower. See Table 8-5 for more examples. The distance of residences to the onshore interconnection cable route construction varies along the route. In the east, the interconnection cable route runs through dense residential areas where homes are located closer to the road. In these areas, homes may be located as close as 50 feet (15.2 m) from the road. Farther west, the residential area becomes less densely populated allowing the homes to be farther offset from the road and are, on average, located farther away from the onshore interconnection cable routes. These homes can be up to thousands of feet from construction activity.

Table 8-5 Reference Sound Levels of Construction Equipment at Arbitrary Distances

Equipment	Sound Level [dBA] at Distance [ft]					
	25	50	100	250	500	1000
Mobile Crane (duct bank and manhole installation)	91	85	79	71	65	59
Pavement Saw (trench excavation)	96	90	84	76	70	64
Asphalt Paver (manhole installation, street restoration)	91	85	79	71	65	59
Pneumatic Hammer (trench excavation)	91	85	79	71	65	59
Mounted Impact Hammer (Hoe Ram) (trench excavation if ledge)	96	90	84	76	70	64
Backhoe (trench excavation)	86	80	74	66	60	54
Dump Truck (manhole installation, trench excavation)	90	84	78	70	64	58
Generator *(cable pulling and splicing)*	88	82	76	68	62	56
Air Conditioning *(cable splicing)*	42	36	30	22	< 20	< 20

Construction equipment is generally not operated continuously at maximum load, with significant variation in power and usage. Actual received sound levels would fluctuate depending on the construction activity, equipment type, and separation distances between source and receiver. Other factors, such as terrain and obstacles such as buildings, will act to further limit the impact of construction-period noise levels.

Trench excavation and manhole installation are typically the loudest phases of construction. Under normal trenching conditions (i.e., no ledge, no excessive underground utilities), the construction crews involved in trench excavation are expected to progress at an average rate of approximately 100 feet (30.5 m) to 200 feet (61 m) per day for an average duration of approximately seven days at any one location. If rock is encountered during construction, equipment such as a hoe ram will be used, which would temporarily increase noise levels.

In general, cable pulling and splicing phases are not expected to generate significant noise. Once adjacent cable sections are installed, they will be spliced together inside the manholes. Splicing high-voltage solid-dielectric transmission cable is a complex operation; splicing activities will not be continuous but will take place over four or five extended workdays at each manhole location. The splicing operation requires a splicing van and a generator, and an air conditioning unit may be used to control the moisture content in the manhole. A portable generator will provide electrical power for the splicing van and air conditioning unit and will be muffled to minimize noise; this technique has been used successfully in locations with sensitive receptors. Typically, the splicing van will be located at one manhole access cover while the air conditioner will be located near a second manhole access cover, and the generator will be located in a convenient area that does not restrict traffic movement around the work zone.

The electric generator and truck with ventilation fans will generate some noise when manholes are occupied; however, Atlantic Shores will make every practicable effort to limit noise disturbance from this source. If necessary, mitigation measures may include use of a low-noise/muffled generator, portable sound walls (temporary noise barriers) as needed, blocking the path of generators, and working with municipalities to coordinate work schedules.

8.2.3 Onshore Interconnection Cables Mitigation

In addition to the measures described in Section 8.1.4 for the onshore substation and/or converter station construction mitigation, Atlantic Shores is proposing to adhere to seasonal construction restrictions for certain portions of the onshore interconnection cable routes to avoid impacts during peak usage. For the Cardiff Onshore Interconnection Cable Route between the Atlantic Landfall Site and Pleasantville, no onshore construction will occur during the summer (generally from Memorial to Labor Day), subject to ongoing coordination with local authorities. These restrictions will minimize disruptions and noise during the peak tourist season. To further minimize the effects of construction noise, Atlantic Shores will maintain strong communication and public outreach with adjacent neighbors.

8.3 Specialty Installation Techniques – Horizontal Directional Drilling

The offshore-to-onshore transition will be accomplished using HDD, a trenchless method that will avoid nearshore impacts as well as impacts directly along the shoreline. HDD, in comparison to trenching, also ensures a deeper burial depth for cables in the nearshore environment, decreasing the likelihood that cables will become exposed over time.

The landfall site HDD will consist of the following steps:

- Excavation of a pit at the landfall site: Each HDD path will originate or terminate in an pit excavated at the landfall site's onshore staging area. This pit will also contain drilling fluids, consisting of water and natural clay.

- Drilling of pilot hole: An approximately 12.4-inch (315-mm) pilot hole will be drilled between the pit at the onshore staging area and the offshore HDD exit/entrance location in an arcing fashion beneath the shoreline and nearshore zone. If HDD is initiated onshore, when the pilot hole exits the seabed, the contractor may use water to carry drill cuttings back to the approach pit rather than drilling fluids in order to avoid release of clay to the water column (even though bentonite is a natural substance that poses little to no risk to the marine environment).

- Reaming and conduit insertion: The drill will be equipped with a larger cutter head that will enlarge the pilot hole in preparation for insertion of an HDPE or PVC conduit. The same drill head can pull the conduit through the enlarged bore hole.

- Cable insertion: Following installation of the conduit, the export cable will be inserted into the opening at the seabed and pulled through the conduit towards shore. The end of the conduit exposed on the seabed will then be buried, possibly by divers using hand-jets.

- Disposal of drill cuttings: Drilling the HDD trajectory will produce a mixture of drill cuttings from the bore hole, water, and bentonite clay (used to lubricate and cool the drill bit). This mixture will be collected on-site and filtered to separate solids from fluids. Drill cuttings and drill fluids are typically classified as clean fill, and it is anticipated they will be disposed of at an appropriate facility such as a local landfill, a gravel pit, or other facility permitted to take such material.

- Pull-back to transition vaults: Cables installed through the HDD conduit will be pulled into onshore transition vaults, where they will be split into separate onshore cables. The transition vaults at the landfall site will be approximately 11.5 ft wide by 46 ft long by 14.8 ft deep (3.5 m wide by 14 m long by 4.5 m deep). It is anticipated that the transition vaults will also include fiber optic splice boxes.

- Site restoration: The onshore HDD staging areas will be restored to be consistent with existing conditions, while the transition vaults will be entirely underground except for at-grade manhole covers.

At this point of permitting, exact details of the HDD operation are not yet known. For example, drilling may be done either from offshore to onshore or vice versa. If drilling proceeds offshore to onshore, a temporary offshore platform (i.e., jack-up barge) may be needed to support the HDD drilling rig. In order to estimate maximum sound levels for the community, this analysis assumed the loudest portion of HDD activity was onshore. Table 8-6 presents the three loudest sources typically found in an HDD operation and their estimated sound power levels. Sound level modeling was done at the landfall site using the same software and standards discussed in Section 7.2. A gridded set of receptors were used to generate sound level contours of the HDD operation, and sound levels at the nearest residences were also included in the modeling.

Table 8-6 Reference Sound Power Levels of HDD Equipment

Equipment	Sound Power Level (dBA)
Excavator	117
Drill rig	117
Pump	109

8.3.1 HDD at the Atlantic Landfall Site

The Atlantic Landfall Site will be located at a lot on S. California Avenue in Atlantic City in Atlantic County, New Jersey. Potential noise levels from HDD activity were modeled at this site.

Figure 8-1 shows the approximate location of the HDD activity associated with the Atlantic Landfall Site. This same figure shows the sound level contours expected from HDD activity without taking into account any mitigation. Specific mitigation measures can be provided as the design advances (see Section 8.2.3). Table 8-7 below summarizes the expected sound levels at the discrete residential receptors.

Table 8-7 Modeled Sound Levels from HDD activity – Atlantic Landfall Site

Receptor	Sound Level (dBA)
2923 Sunset Ave	77
403 E Main St	61
24 S California Ave	67
43 N Stenton Pl	59

8.3.2 HDD Mitigation

Based on local permit requirements, Atlantic Shores expects that HDD activity will be seasonally restricted from Memorial to Labor Day. Atlantic Shores will work with municipal officials to finalize the construction schedule and hours, but the proposed HDD schedule is generally from 7:00 AM to 6:00 PM on Monday through Saturday (some municipalities do not allow work to start until 8:00 AM). Certain activities, such as conduit pull-in, cannot stop once they are started, so work may need to continue around the clock. Any work that needs to extend outside allowed construction hours will be discussed with local officials along with any necessary waivers.

To further minimize the effects of HDD construction noise, Atlantic Shores will maintain strong communication and public outreach with adjacent neighbors. If necessary, mitigation measures may include use of a low-noise/muffled generator, portable sound walls (temporary noise barriers) as needed, blocking the path of equipment, and working with municipalities to coordinate work schedules.

8.4 Construction Noise Evaluation

While intermittent increases in noise levels are expected during construction activities, Atlantic Shores will make every reasonable effort to minimize noise impacts from construction. Specific mitigation measures for each onshore construction activity that may generate temporary noise are provided in Sections 8.1.4, 8.2.3, and 8.3.2. There are no quantitative construction noise limits in any of the municipalities along the onshore interconnection cable routes. Atlantic Shores will be guided by the hours of construction allowed in each municipality.

Figure 8-1 Modeled Sound Levels from HDD activity -- Atlantic Landfall Site

9.0 ONSHORE NOISE FROM OFFSHORE ACTIVITIES

There will be sound generated from activities in the Atlantic Shores Offshore Project Area. However, at its closest point, the wind energy generation facility is approximately 8.7 miles (7.6 nautical miles [nm]) from the New Jersey shoreline. Therefore, onshore noise from offshore activities will be negligible. Two examples of these activities are briefly described below.

Mariner Radio Activated Sound Signals (MRASS) will be located on corner towers/significant peripheral structures and perimeter structures of the wind farm. The MRASS are required to have an audible range of 2 nm but they may be louder. No sound level modeling was done for these sources due to their distance. It is possible that the MRASS may be heard on land under certain circumstances but they would only be activated at certain times and thus any effect would be limited.

With respect to noise from operational wind turbine generators (WTGs), sounds of different frequencies are emitted by WTGs as they operate, related to both the aerodynamics of the turbine blades as they rotate and the mechanical sounds of the internal mechanism of the turbine. Noise levels near the WTG will be audible but sound levels diminish rapidly with distance. At a distance of 1,000 ft (~300 m), the sound pressure is on the order of 50 dBA, a level lower than normal conversation.[6] In this case, operational noise from the offshore WTGs will not be audible onshore.

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[6] Wind Turbine-Related Noise: Current Knowledge and Research Needs. New York State Energy Research and Development Authority (NYSERDA), NYSERDA Report 13-14, June 2013.

10.0 CONCLUSIONS

A sound level impact assessment was conducted for the Atlantic Shores onshore substation and/or converter station, onshore interconnection cable route, and horizontal directional drilling activity associated with the Cardiff POI. The onshore substation and/or converter station analysis was done to determine compliance with the NJ DEP sound level regulations. An existing condition sound level measurement program was completed in the area around the proposed onshore substation and/or converter station site. Several of the monitoring locations measured existing sound levels above the NJ DEP sound level limits.

Operational sound levels from the proposed onshore substation and/or converter station were evaluated at one site.

Modeled sound levels around the onshore substation and/or converter station site showed all nearby land-use would be in compliance with their respective residential or commercial A-weighted sound limits with some sound level mitigation. Since the onshore substation and/or converter station is in the early design stage, no octave band sound level data were available for the equipment included in the model. Therefore, octave band data will be evaluated in the future when specific equipment types are identified, and Atlantic Shores will apply design criteria or mitigation measures as needed to meet the NJ DEP octave band limits.

At this early stage of design, no equipment-specific sound level data were available so worst-case approximations of potential sound power levels of each piece of equipment were assumed. The modeling results showed that some combination of quieter equipment and/or barrier walls may be needed at the potential onshore substation and/or converter station site in order to meet the NJ DEP sound limits. The results of this modeling may be used to inform the onshore substation and/or converter station design and equipment procurement.

There will also be temporary noise from construction of the onshore substation and/or converter station, onshore interconnection cables, and horizontal directional drilling. While the NJ DEP does not regulate construction noise, construction activity is controlled at the local level by limiting work to certain times of the day and days of the week. A possible mix of construction equipment for in-street onshore interconnection cable route work, onshore substation and/or converter station work, and the landfall sites was used to calculate worst-case expected construction sound levels at various distances from the activity. Since there are no quantitative limits on noise from construction, these sound levels are provided for informational purposes only. Atlantic Shores anticipates that construction hours will typically adhere to local ordinances to minimize potential effects of construction noise, and Atlantic Shores will work with municipal officials to finalize the construction schedule and hours.

In conclusion, operation of the Atlantic Shores onshore substation and/or converter station will be designed to comply with the NJ DEP sound level limits and will include sound level mitigation as needed. While temporary onshore construction noise may occur, Atlantic Shores is proposing to adhere to seasonal construction restrictions during the peak tourist season to minimize impacts. No onshore construction in areas near the coast, including HDD at the landfall sites, will occur during the summer (generally from Memorial to Labor Day), subject to ongoing coordination with local authorities. Additionally, the daily hours of operation for onshore construction activities, including HDD, will be developed in accordance with municipal noise ordinances. Any work that needs to extend outside allowed construction hours will be discussed with local officials and waivers will be obtained if necessary. To further minimize the effects of construction noise, Atlantic Shores will maintain strong communication and public outreach with adjacent neighbors about the time and nature of construction activities.

Appendix A

Certificates of Sound Level Instrument Calibration

Appendix B

Acoustical Terminology and Metrics

The unit of sound pressure is the decibel (dB). The decibel scale is logarithmic to accommodate the large dynamics of sound intensities to which the human ear is subjected. An inherent property of the logarithmic decibel scale is that the sound pressure levels of two separate sounds are not directly additive. For example, if a sound of 50 dB is added to another sound of 50 dB, the total is a 3-decibel increase (or 53 dB), not an arithmetic doubling to 100 dB. The human ear does not perceive changes in the sound pressure level as equal changes in loudness. Scientific research demonstrates that the following general relationships hold between sound level and human perception for two sound levels with the same or very similar frequency characteristics:

- 1 dB is the practically achievable limit of the accuracy of sound measurement systems and corresponds to an approximate 10 percent variation in sound pressure. A 1 dB increase or decrease is a non-perceptible change in sound.

- 3 dB increase or decrease is a doubling (or halving) of acoustic energy and it corresponds to the threshold of perceptibility of change. In practice, a 3 dB change in environmental sound is at the margin of perceptibility to the average person[7].

- 5 dB increase or decrease is described as a perceptible change in sound level and is a discernible change in an outdoor environment.

- 10 dB increase or decrease is a tenfold increase or decrease in acoustic energy, but is perceived as a doubling or halving in sound (i.e., the average person will judge a 10 dB change in sound level to be twice or half as loud)[8].

Environmental sound is typically composed of acoustic energy across a wide range of frequencies, referred to as the frequency spectra; however, the human ear does not interpret the sound level from each frequency as equally loud. To compensate for the physical response of the human ear, the A-weighting filter is commonly used for describing environmental sound levels. The A-weighting filters the frequency spectrum of sound levels to correspond to the frequency response of the human ear (attenuating low and high frequency energy similar to the way people hear sound). Sound levels that are A-weighted to reflect human response are presented as "dBA". The A-weighted sound level is the most widely accepted descriptor for community noise assessments. Unweighted sound levels are referred to as linear decibels and given in units of "dB" or "dBZ".

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7 2009 ASHRAE Handbook – Fundamentals, American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc., Atlanta, GA, 2009.

8 Procedures for the Computation of Loudness of Steady Sounds, American National Standard, ANSI S3.4-2007, Annex A, NY.

Sound levels can be measured and presented in various formats. The most common sound metric used in community sound surveys is the equivalent sound level (L_{eq}). The L_{eq} level is the energy averaged, A-weighted sound pressure level that occurs over a given time period, i.e., the steady, continuous sound level which has the same acoustic energy as the time-varying sound levels over the same time period. The L_{eq} has been shown to provide both an effective and uniform method for comparing time-varying sound levels and is routinely employed.

Statistical levels help further characterize the sound environment. The percentile sound levels ($L_{\%}$) indicate the sound level exceeded for that percentage of the measurement period. The L_{90} level is commonly referred to as the residual sound level as it excludes short-term intrusive noise events, so it is effective in defining the quietest periods. The L_{90} is the statistical level that is the level exceeded during 90 percent of the measurement period. In comparison, the L_{10} is referred to as the intrusive level and is the sound level that is exceeded for 10 percent of the time during the measurement.

The L_{max} is the maximum sound level over a given time period. The L_{max} is typically due to discrete, identifiable events such as an airplane overflight, car or truck pass by, or a dog bark for example.

The noise metrics defined are broadband (i.e., inclusive of sound across the entire audible frequency spectrum). In addition to broadband, sound level data typically includes an analysis of the various frequency components of the sound spectrum to determine the potential for tonal characteristics and for use in identifying candidate noise mitigation measures. The unit of frequency is Hertz (Hz), measuring the cycles per second of the sound pressure waves, and typically the frequency analysis is presented in octave bands established by standard (ANSI S1.11, 1986).

A few additional terms are defined below.

ANS-weighted - A high-frequency natural sound (HFNS) filter applied to the measured one-third octave-band data to remove seasonal noise like insects. This technique removes all sound energy above the 1,250 Hertz frequency band. The methodology for the filtration process is specified in ANSI/ASA S12.100-2014 and the sound pressure levels presented using this methodology are indicated as ANS-weighted levels (presented in dBA).

G - The portion of ground that is considered porous as defined under ISO 9613-2. This is used as part of the ground attenuation calculation between the source and receiver. For example, a G-factor of 0.5 corresponds to “mixed ground” consisting of half hard and half porous ground cover. A G-factor of zero (0) corresponds to “hard ground” consisting of surfaces with low porosity including water, and a G of 1 represents all porous ground.

Infrasound - Sound in the frequencies below 20 Hz.

ISO 9613-2 - An international standard which specifies an engineering method for calculating the attenuation of sound during outdoor propagation in order to predict the levels of environmental noise at a distance from a variety of sources. The method predicts the equivalent continuous A-weighted sound level under meteorological conditions favorable to propagation from sources of known sound emission and is used throughout the United States and the world.

L_{DN} - the day-night average sound level, sometimes abbreviated as DNL, presented in dBA. The DNL is the 24-hour average sound level obtained by the logarithmic average of the average daytime sound level (L_D) and the average nighttime sound level (L_N) that incorporates a 10-decibel "penalty" to each nighttime-hour sound level. This penalty accounts for the greater sensitivity to sound events during nighttime hours. The L_D and L_N are both calculated using hourly equivalent sound levels ($L_{eq(h)}$). The Environmental Protection Agency defines daytime as the 15 hours from 7:00 AM-10:00 PM and nighttime as the 9 hours from 10:00 PM-7:00 AM.

Low frequency- Sound contained in the frequencies from 20 Hz to 200 Hz.

Octave bands - The International Standards Organization (ISO) has agreed upon "preferred" frequency bands for sound measurement and by agreement the octave band is the widest band for frequency analysis. The upper frequency limit of the octave band is approximately twice the lower frequency limit, and each band is identified by its geometric mean called the band center frequency. The octave band center frequencies typically used for sound level analyses are 31.5, 63, 125, 250, 500, 1000, 2000, 4000, and 8000 Hz. When more detailed information about a noise is required, standardized one-third octave band analysis may be used.

Weighting - The sound level meter used to measure noise is a standardized instrument.[9] It contains "weighting networks" to adjust the frequency response of the instrument to approximate that of the human ear under various conditions. One network is the A-weighting network, which most closely approximates how the human ear responds to sound as a function of frequency, and is the accepted scale used for community sound level measurements. Sounds are frequently reported as detected with the A-weighting network of the sound level meter in dBA. A-weighted sound levels emphasize middle frequencies (i.e., middle pitched—around 1,000 Hertz sounds), and de-emphasize lower and higher frequencies. The C-weighting network has a nearly flat response for frequencies between 63 Hz and 4000 Hz and is noted as dBC.

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9 *American National Standard Electroacoustics – Sound Level Meters – Part 1: Specifications,* ANSI S1.4-2014 (R2019), published by the Standards Secretariat of the Acoustical Society of America, Melville, NY.