ACOUSTIC MODELING REPORT FOR THE DEVELOPMENT OF WIND ENERGY FACILITIES AT NAVSTA NEWPORT, RHODE ISLAND

March 2011

GEO-MARINE INCORPORATED

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1.0 EXECUTIVE SUMMARY

The U.S. Naval Station (NAVSTA) Newport proposes to build a wind energy project with a potential to support up to 9 Megawatts (MW) at 12 potential sites Newport, Rhode Island. This report presents sound levels for a potential layout of three PowerWind 56 – 900 kilowatt (kW) turbines, four GE 1.5sle – 1.5 MW turbines, and five Vestas V112 – 3.0 MW turbines; total capacity for this layout is 23.7 MW. The 12 Sites for the wind turbines are illustrated on the map in Figure 1.

Future sound levels at noise sensitive receivers in project area were calculated with the Cadna/A acoustic model following International Standard ISO 9613-2. All turbines were assumed to operate at design capacity. The acoustic modeling results are conservative due to the following assumptions:

1. All wind turbines were assumed to be operating simultaneously for the cumulative impact analysis. (The impacts of individual turbines are also presented.)
2. Wind turbine sound power levels correspond to the International Standard IEC 61400-11 maximum sound power level plus an uncertainty factor from IEC Technical Specification 61400-14 that quantifies sound power measurement uncertainty and unit-to-unit turbine production variability.
3. The acoustic model assumed the most favorable conditions for sound propagation, corresponding to a ground-based temperature inversion, such as might occur on a calm, clear night, or during a downwind condition (International Standard ISO 9613-2).
4. No attenuation from trees or other vegetation was assumed.
5. Winter frozen ground conditions were assumed for minimal ground absorption.
6. Excess attenuation from wind shadow effects and daytime air turbulence were ignored.

The sound criteria chosen for this study are:

- 45 A-weighted decibels (dBA) for off-base residences (to prevent sleep disruption).
- 90 G-weighted decibels (dBG) for NAVSTA training and housing buildings. The limit of 90 dBG is equivalent to 55 dBA.
- 55 dBA for the Waumetonomy Golf Club (to prevent annoyance in the daytime).

This study's conclusions are as follows. Please refer to Figure 1, which illustrates the 12 Sites for the wind turbines. The acoustic modeling results for 12 Sites with the selected wind turbines reveal maximum sound levels will be above the noise criterion for off-base residential areas (45 dBA) near Sites 1 through 4, and will be above the infrasound noise criterion (55 dBA) for NAVSTA training and housing buildings around Nimitz Field and on the north end of Coasters Island. In some cases the effects of individual turbines exceed the criteria, though in most instances it is the cumulative effect of two of more turbines that produces sound levels above the sound criteria.

To achieve compliance with the noise criteria while generating the most electricity, recommended changes are:

- Site1: Substitute a V52 turbine (or the equivalent in terms of sound power level).
- Site 2: Do not use this site because all turbine options exceed the sound criteria.
- Site 3: Move Site 3 200 feet north, or substitute a V52 turbine (or the equivalent in terms of sound power level).
- Site 4: Do not use this site because all turbine options exceed the sound criteria.
- Site 7: Substitute a GE 1.5sle turbine (or the equivalent in terms of sound power level).
- Site 10a: Do not use this site because all turbine options exceed the sound criteria.
- Site 11: Substitute a V52 turbine (or the equivalent in terms of sound power level).

The total generation capacity of the potential project with these changes ranges from 15.2 MW to 18.2 MW, above the goal of 9.0 MW for the project.

The Project will be audible at certain times in the residential areas next to the project area. The "swishing" sound characteristic of a wind turbine will be audible outdoors when these three conditions all occur: 1) the residential area is downwind of a wind turbine, 2) ambient sound levels are low (usually late at night with calm surface winds), and 3) wind speeds at the hub height of the turbine are high enough for wind turbine operation. The Project will also be audible at certain times at the Waumetonomy Golf Club.

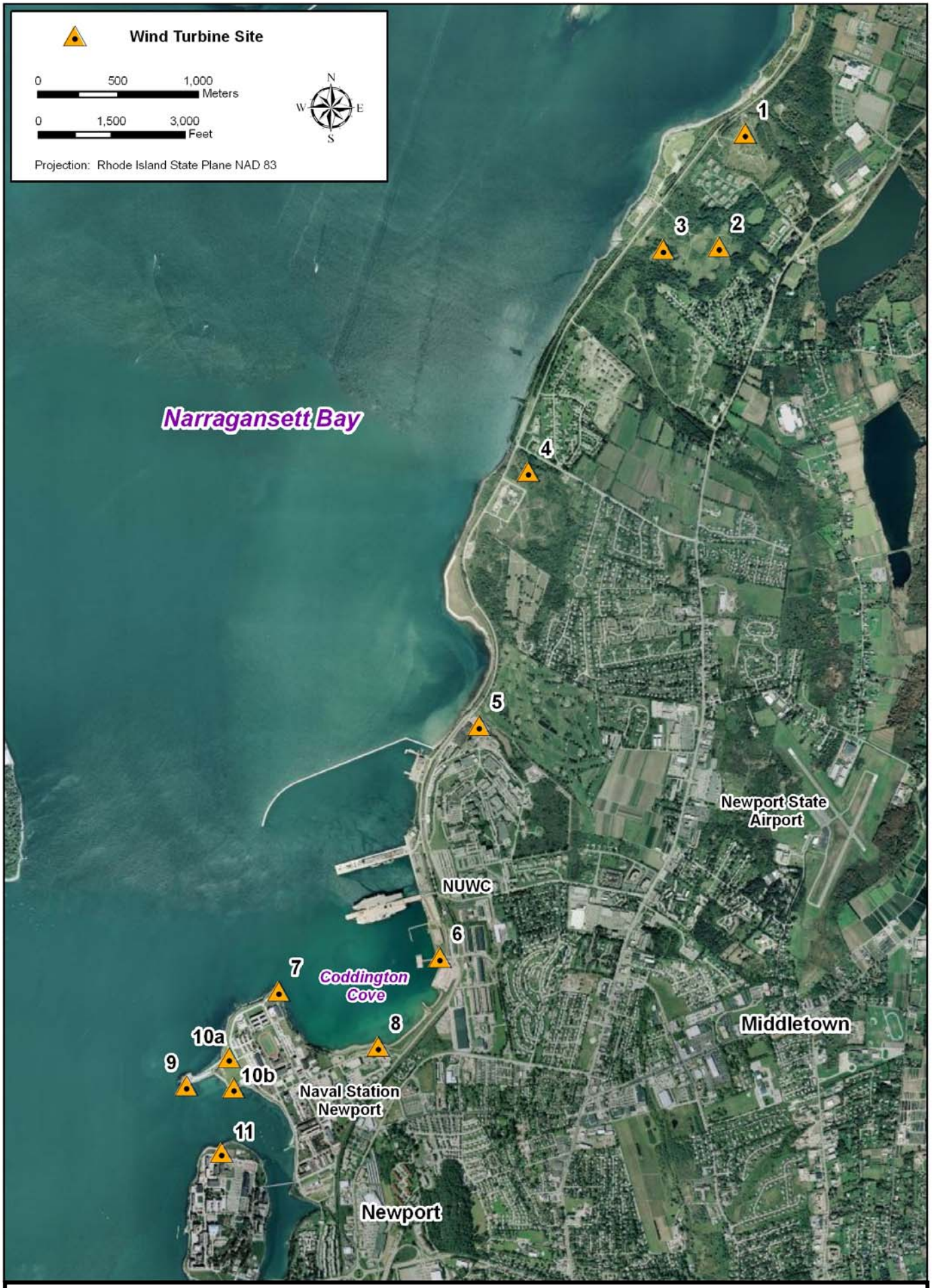

Figure 1.
Wind Turbine Sites

2.0 COMMON MEASURES OF COMMUNITY SOUND

All sounds originate with a source – a human voice, vehicles on a roadway, or an airplane overhead. The sound energy moves from the source to a person's ears as sound waves, which are minute variations in air pressure. The loudness of a sound depends on the sound pressure level[1], which has units of decibel (dB). The decibel scale is logarithmic to accommodate the wide range of sound intensities to which the human ear is subjected. On this scale, the quietest sound we can hear is 0 dB, while the loudest is 120 dB. Every 10 dB increase is perceived as a doubling of loudness. Most sounds we hear in our daily lives have sound pressure levels in the range of 30 dB to 90 dB.

A property of the decibel scale is that the numerical values of two separate sounds do not directly add. For example, if a sound of 70 dB is added to another sound of 70 dB, the total is only a 3 dB increase (or 73 dB) on the decibel scale, not a doubling to 140 dB. In terms of sound perception, 3 dB is the minimum change most people can detect. **Table 1** describes the subjective effect of different changes in sound levels.

TABLE 1

SUBJECTIVE EFFECT OF CHANGES IN SOUND PRESSURE LEVELS

Change in Sound Level	Apparent Change in Loudness
3 dB	Just perceptible
5 dB	Noticeable
10 dB	Twice (or half) as loud

[1] The sound pressure level is defined as $20*\log_{10}(P/P_o)$ where P is the sound pressure and P_o is the reference pressure of 20 micro-Pascals (20 μPa), which by definition corresponds to 0 dB.

Sound exposure in a community is commonly expressed in terms of the A-weighted sound level (dBA); A-weighting approximates the frequency response of the human ear. Typical sound levels associated with various activities in a rural area are presented in **Figure 2**. The distance to a major road often determines the acoustic environment in a non-urban area, such as the lands abutting NAVSTA Newport and NUWC.

Sound levels change from moment to moment. Some are sharp impulses lasting one second or less, while others rise and fall over much longer periods of time. There are various measures of sound pressure designed for different purposes. To establish the background ambient sound level in an area, the $\mathbf{L_{90}}$ metric, which is the sound level exceeded 90 % of the time, is sometimes used. The $\mathbf{L_{90}}$ can be thought of as the level representing the quietest 10 % interval of any time period. The $\mathbf{L_{eq}}$, or equivalent sound level, is the steady-state sound level over a period of time that has the same acoustic energy as the fluctuating sounds that actually occurred during that same period. It is commonly referred to as the energy-average sound level.

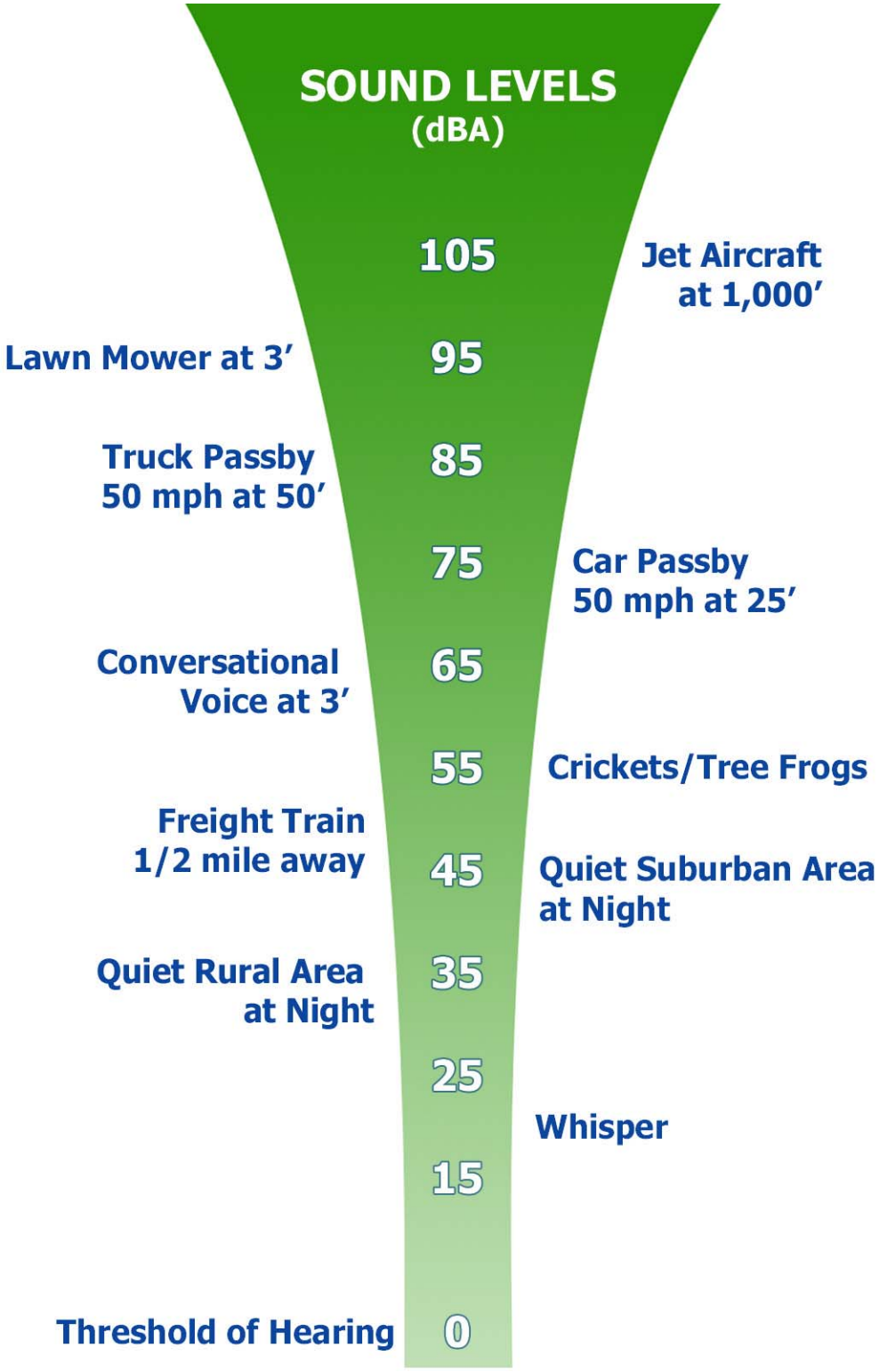

FIGURE 2.

Common Outdoor Sound Levels

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3.0 NOISE REGULATIONS AND CRITERIA

There is no applicable Rhode Island State noise regulation, and thus the acoustic analysis of the NAVSTA wind project will consider a number of well-accepted sound level guidelines for preventing annoyance and sleep disturbance in populated areas. The U.S. Environmental Protection Agency (EPA) Residential Noise Guideline is 55 dBA daytime to prevent activity interference and annoyance and 45 dBA at night to prevent sleep disturbance.[2] The World Health Organization (WHO) recommends: "At nighttime, outside sound levels about 1 m (3.28 ft) from facades of living spaces should not exceed 45 dBA L_{eq} so that people may sleep with bedroom windows open."[3] For the NAVSTA wind project, a 45 dBA sound limit will be used at residences, to provide 24-hour protection from annoyance and sleep disturbance. A 55 dBA daytime limit will be applied at the Waumetonomy Golf Club to prevent activity interference.

Infrasound is low-frequency sound at frequencies below 20 Hz, a sound wave oscillating 20 cycles per second. For comparison, the lowest key on a piano produces a tone of 28 Hz, and human speech is in the range of 500 to 2,000 Hz. The hearing threshold for infrasound at 16 Hz is 90 un-weighted decibels (dB).[4] Infrasound is always present in the outdoor environment due to sounds generated by air turbulence, meteors, shoreline waves, motor vehicle traffic and aircraft. Infrasound we encounter from these everyday sources is typically in the range of 50 to 70 dB and is inaudible. The EPA has concluded that infrasound below the hearing threshold produces no physiological or psychological effects, and the amount of infrasound from a single wind turbine at typical setback distances is no more than that in the natural environment.[5]

The G-weighting network is defined by ISO[6] to specifically deal with infrasound and calculating G-weighted sound pressure levels (dBG) for the octave bands down to 4 Hz allows a comparison with

[2] U.S. Environmental Protection Agency, "Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety," Publication EPA-550/9-74-004, 1974, pp. 3 and 21.
[3] World Health Organization, "Guidelines for Community Noise," Geneva, 1995, page xiii. WHO has reaffirmed the 45-dBA residential limit in its 2009 "Night Noise Guidelines for Europe."
[4] International Standards Organization, ISO 226:2003. The unit dB denotes un-weighted decibels.
[5] U.S. Environmental Protection Agency, "Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety," Publication EPA-550/9-74-004, page G-11.
[6] International Standards Organization, International Standard ISO 7196, "Acoustics – Frequency weighting characteristic for infrasound measurements," Geneva, March 15, 1995

noise criteria expressed in dBG. A White Paper on wind turbine sound from the University of Massachusetts states "there is no reliable evidence that infrasound below the perception threshold produces physiological or psychological effects," and the report lists the infrasound perception threshold as 100 dBG.[7] A report prepared for the British government[8] suggests that perception threshold for infrasound is in the range of 85-90 dBG. The Danish EPA[9] has set a limit for infrasound at 85 dBG to protect the most sensitive (not average) members of its population. Specific health impacts from infrasound have not been documented except at much higher exposure levels of 115 dBG or higher (those effects include fatigue, apathy, interference with motor skills). The proposed criterion for infrasound at NAVSTA training and housing buildings is 90 dBG, equal to the mid-range of estimated perception thresholds. This criterion should protect NAVSTA personnel from any adverse effects of infrasound.

There are five potential wind turbines proposed on or near to Coddington Point (Turbines 7, 9, 10a, 10b, and 11). Due to the concentration of sound energy from this group, an assessment of infrasound impacts on NAVSTA Newport training and housing buildings around Nimitz Field was performed. For the NAVSTA classrooms and sleeping quarters closest to Sites 7, 10a, and 10b on Coddington Point, the predicted maximum infrasound level is 89.4 dBG; at these same locations the maximum broadband (audible) sound level of 55 dBA (see **Figure 4**). These results allow a link to be made between the infrasound criterion of 90 dBG and a predicted audible sound level of 55 dBA. The infrasound criterion in this study is thus 55 dBA.

[7] Rogers, Anthony L., Ph.D., "Wind Turbine Acoustic Noise – A White Paper," Renewable Energy Research Laboratory, University of Massachusetts at Amherst, January 2006.

[8] Leventhall, G., "Report for the Department of Environment, Food and Rural Affairs – A Review of Published Research on Low Frequency Noise and Its Effects," London, 2003, page 13.

[9] Danish EPA, "Orientering om lavfrekvent stoj, infralyd og vibrationer i ekstennt miljo," Information No.9/1997, 1997.

4.0 CALCULATED FUTURE SOUND LEVELS

4.1 Methodology

Future sound levels from the wind energy facilities at NAVSTA Newport, consisting of 12 wind turbines, were calculated with the Cadna/A acoustic model. Cadna/A is a sophisticated 3-D model for sound propagation and attenuation based on International Standard ISO 9613[10]. Atmospheric absorption, the process by which sound energy is absorbed by the air, was calculated using ANSI S1.26-1995.[11] Absorption of sound assumed standard day conditions and is significant at large distances. Digital terrain heights were obtained from Rhode Island GIS. The decibel contour maps shown in this section assume the maximum sound levels (for the worst-case conditions listed below) can occur for any wind direction and present a composite sound level map that assumes all receiver locations are downwind of all wind turbines.

The acoustic modeling results are conservative due to the following assumptions:

1. All wind turbines were assumed to be operating simultaneously for the cumulative impact analysis. (The impacts of individual turbines are also presented.

2. Wind turbine sound power levels correspond to the International Standard IEC 61400-11 maximum sound power level plus the uncertainty factor K in IEC Technical Specification 61400-14 that quantifies the sound power measurement uncertainty and the unit-to-unit turbine production variability. For this analysis a typical value of K = 2.0 dBA was included in the turbine sound power levels.

3. The acoustic model assumed the most favorable conditions for sound propagation, corresponding to a ground-based temperature inversion, such as might occur on a calm, clear night, or during a downwind condition (International Standard ISO 9613-2).

4. No attenuation from trees or other vegetation was assumed.

5. Winter frozen ground conditions were assumed for minimal ground absorption.

6. Excess attenuation from wind shadow effects and daytime air turbulence were ignored.

[10] International Standard, ISO 9613-2, Acoustics – Attenuation of Sound During Propagation Outdoors, -- Part 2 General Method of Calculation.

[11] American National Standards Institute, ANSI S1.26-1995, American National Standard Method for the Calculation of the Absorption of Sound by the Atmosphere, 1995.

Sound power level is on a decibel scale[12], leading to possible confusion since sound power (energy density) and sound pressure (what we hear) are not the same. The acoustic model uses the sound power level of a wind turbine along with other assumptions to calculate the sound pressure level heard at a receiver located a certain distance from the wind turbine. The maximum sound power level, including an uncertainty level, was employed for the three wind turbines included in this study. The maximum sound power levels are given in parentheses below, the spectra are provided in Appendix A:

- PowerWind 56 – 900 kW (106.5 dBA)
- GE 1.5sle – 1.5 MW (106.0 dBA)
- Vestas V112 – 3.0 MW (108.5 dBA)

The PowerWind 56 is assumed for Site Nos. 1, 2, and 4. The GE 1.5sle is assumed for Site Nos. 3, 5, 6, and 8. The Vestas V112 is assumed for Site Nos. 7, 9, 10a, 10b, and 11. In the discussion that follows, a Vestas V52 turbine (850 kW) is also considered as an alternative due to the fact it produces almost as much electricity as the PowerWind 56 yet it has a lower sound power level at 104.2 dBA.

4.2 Maximum Sound Levels at Noise Sensitive Receivers

Maximum sound levels at a list of 12 noise sensitive receivers near the turbines are given in **Tables 2 through 14**. These receivers represent the closest off-base, residential properties to the project's wind turbines. **Table 2** presents the cumulative impacts with all turbines operating, while **Tables 3 through 14** provide the sound impacts for single turbine operation at Sites 1 through 11, respectively. **Figure 3** shows color-coded decibel contours (5 feet above ground level) overlaid on the entire project area for simultaneous operation of all 12 wind turbines at the design wind speed (maximum sound power level). **Figures 4 and 5** give zoomed-in views for the southern and northern portions of the project area, respectively, where turbines are close to each other. Decibel contour maps for single turbine operation are provided in **Figures 6 through 17**. In **Figures 4 through 17**, the receptors listed in **Tables 2 through 14** are noted by a black-and-white symbol and labeled by name.

[12] The sound power level is defined as $10*\log_{10}(W/W_o)$, where W is the sound power of the source in Watts and W_o is the reference power of 10^{-12} Watts.

4.3 Comparison of Maximum Sound Levels to Noise Criteria

The cumulative effects of the 12 selected wind turbines are discussed below and the results for individual turbines are called upon to gain insight into the relative contributions from each turbine. The sound criteria chosen for this study are:

- 45 dBA for residences (to prevent sleep disruption).
- 50 dBA for NAVSTA classrooms and sleeping quarters around Nimitz Field (to prevent perception of infrasound vibrations).
- 55 dBA for the Waumetonomy Golf Club (to prevent annoyance in the daytime).

These three thresholds (45, 50, and 55 dBA) correspond to the green, yellow, and red contour lines, respectively, on **Figures 3 through 17**.

Figure 5 shows the maximum predicted sound levels around Sites 1, 2, and 3 at the northern end of the project area. Site 1, in conjunction with Sites 2 and 3, produces 47.2 dBA at the residences on Rolling Hill Road (R1), which is above the 45 dBA limit; that result suggests Site 1 is too close to the receiver R1. **Figure 6** and **Table 3** reveal that even without the sound from Site 2 and Site 3, Site 1 will produce 45.9 dBA at receiver R1. Since Site 1 cannot be moved, the only compliance option is to substitute a turbine with a lower sound power level. Using a Vestas V52 850-kW turbine at Site 1, lowers the sound level by 2.3 dBA to 43.6 dBA, which complies with the 45-dBA criterion.

Figure 7 and **Table 4** show that Site 2, by itself, produces a sound level of 48.3 dBA at residences on Harbor View Road (R5) and in conjunction with Sites 1 and 3 produces a cumulative sound level of 48.9 dBA at receiver R5 (see Table 2), both of which are above the 45 dBA limit. Since a V52 turbine for Site 2 would still exceed 45 dBA at residences, all turbine options for Site 2 exceed the sound criteria.

Figure 8 and **Table 5** reveal that Site 3, by itself, produces a sound level of 45.8 dBA at residences on Redwood Road (R4) and in conjunction with Sites 1 and 2 produces a cumulative sound level of 47.1 dBA at receiver R4 (see **Table 2**), both of which are above the 45 dBA limit. If Site 3 could be moved 200 feet to the north and Site 2 was not used, the sound level at R4 might reduce to 45 dBA. The other option is to leave Site 3 where it is now, and substitute a quieter turbine such as a Vestas V52 for Site 3.

For the northern project area, the options that will ensure compliance with the 45-dBA limit at nearby residences are:

1. Substitute a V52 turbine (or the equivalent in terms of sound power level) at Sites 1 and 3 and do not use Site 2 (because all turbine options exceed the sound criteria at Site 2); or

2. Substitute a V52 turbine (or the equivalent in terms of sound power level) at Site 1, move Site 3 200 feet to the north, and do not use Site 2 (because all turbine options exceed the sound criteria at Site 2).

Option 1 provides 1.7 MW of generation capacity at Sites 1 and 3. Option 2 provides 2.35 MW of generation capacity at Sites 1 and 3.

Figure 9 and **Table 6** reveal the maximum predicted sound level from Site 4 at residences on Mayflower Drive (R7) will be 50.9 dBA, which is 5.9 dBA above the 45 dBA limit. Since Site 4 cannot be moved south (away from R7) and a V52 turbine substitution would only reduce sound levels 2.3 dBA, all turbine options for Site 4 exceed the sound criteria.

Figure 10 and **Table 7** show that the maximum predicted sound level from Site 5 is 52.2 dBA at the closest tee on the Waumetonomy Golf Course and that level is below the 55 dBA daytime noise criterion used in this study. The maximum predicted sound levels from Site 5 at residences on Brown Lane will be 38.0 dBA, well below the 45 dBA limit. Site 5 provides 1.5 MW of generation capacity.

Figure 11 and **Table 8** reveal that the maximum predicted sound level from Site 6 is 41.0 dBA at residences on Semmes Street (R10) and that level is below the 45 dBA residential noise criterion. Site 6 provides 1.5 MW of generation capacity.

Tables 9 through 14 establish that Sites 7 through 11 produce maximum sound levels well below 45 dBA at the nearest off-base residential locations (R10, R11, and R12). Thus, the evaluation of Sites 7 through 11 hinges on impacts on the main base. **Figures 4 and 12** reveal that Site 7 produces a maximum sound level at or above the infrasound criterion of 55 dBA at Training Building 1112. Using a GE 1.5sle turbine at Site 7 lowers the sound level by 2.5 dBA, which complies with the 55 dBA criterion. Under this option, Site 7 provides 1.5 MW of generation capacity.

Figures 4 and 13 establish that maximum sound levels from Site 8 at the nearest NAVSAT classroom and housing buildings are well below the infrasound criterion of 55 dBA. Site 8 produces 1.5 MW of generation capacity.

Figure 4 shows that the four Vestas V112 turbines at Sites 9, 10a, 10b and 11 together would produce maximum sound levels at or above the infrasound criterion of 55 dBA and thus some changes to this group of four sites is required. Sites 10a and 10b are alternatives for one site; both cannot be used because their spacing is too close. **Figures 15 and 16** reveal that Site 10a has higher sound impacts than Site 10b, and Site 10a by itself produces a maximum sound level at or above the infrasound criterion of 55 dBA at Housing Building 197. For these reasons, Site 10a should not be used and Site 10b should be retained.

Figures 4 and 17 reveal that Site 11 produces a maximum sound level at or above the infrasound criterion of 55 dBA at Training Buildings 1362 and A138. Using a V52 turbine at Site 11 lowers the sound level by 4.3 dBA, which is below the criterion of 55 dBA. **Figures 4, 14, and 16** establish that with the selection of Site 10b from the pair of 10a/10b, and the use of a smaller turbine at Site 11, the combined impacts of Sites 9, 10b, and 11 will be below the infrasound criterion of 55 dBA at NAVSTA training and housing buildings. This option provides 6.85 MW of generation capacity.

The initial acoustic modeling results for 12 Sites with the selected wind turbines reveal maximum sound levels will be above the noise criterion for residential areas (45 dBA) near Sites 1 through 4, and will be at or above the infrasound noise criterion (55 dBA) for NAVSTA training and housing buildings around Nimitz Field and on the north end of Coasters Island near Sites 7, 9, 10a, 10b, and 11. To achieve compliance with the noise criteria while generating the most electrical power, recommended changes are:

- Site1: Substitute a V52 turbine (or the equivalent in terms of sound power level).
- Site 2: Do not use this site because all turbine options exceed the sound criteria.
- Site 3: Move Site 3 200 feet north, or substitute a V52 turbine (or the equivalent in terms of sound power level).
- Site 4: Do not use this site because all turbine options exceed the sound criteria.

- Site 7: Substitute a GE 1.5sle turbine (or the equivalent in terms of sound power level).
- Site 10a: Do not use this site because all turbine options exceed the sound criteria.
- Site 11: Substitute a V52 turbine (or the equivalent in terms of sound power level).

The total generation capacity of the potential project with these changes ranges from 15.2 MW to 18.2 MW, above the goal of 9.0 MW for the project.

The Project will be audible at certain times in the residential areas next to the project area. The "swishing" sound characteristic of a wind turbine will be audible outdoors when these three conditions all occur: 1) the residential area is downwind of the wind turbine, 2) ambient sound levels are low (usually late at night with calm surface winds), and 3) wind speeds at the hub height of the turbine are high enough for wind turbine operation. The Project will also be audible at certain times at the Waumetonomy Golf Club.

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TABLE 2

MAXIMUM PREDICTED SOUND LEVELS
FROM OPERATION OF ALL WIND TURBINES SIMULTANEOUSLY

Sensitive Noise Receiver	Project Sound Level (dBA)
R1. Residence on Rolling Hill Road near Site 1	47.2
R2. Residence on Rolling Hill Road near Site 2	47.8
R3. Residence on Lawton Brook Road near Site 1	43.7
R4. Residence on Redwood Road near Site 3	47.1
R5. Residence on Harbor View Road near Site 2	48.9
R6. Residence on Greene Lane near Site 4	42.4
R7. Residence on Mayflower Drive near Site 4	50.9
R8. Residence on Brown Lane near Site 5	38.8
R9. Waumetonomy Golf Club, nearest tee to Site 5	52.2
R10. Residence on Semmes Street near Site 6	42.3
R11. Residence on Chases Lane near Site 6	40.4
R12. Residence on Maple Avenue near Site 7	43.0

TABLE 3

MAXIMUM PREDICTED SOUND LEVELS
FROM SINGLE TURBINE OPERATION
AT SITE 1

Sensitive Noise Receiver	Project Sound Level (dBA)
R1. Residence on Rolling Hill Road near Site 1	**45.9**
R2. Residence on Rolling Hill Road near Site 2	**39.0**
R3. Residence on Lawton Brook Road near Site 1	**40.3**
R4. Residence on Redwood Road near Site 3	**29.2**
R5. Residence on Harbor View Road near Site 2	**29.2**
R6. Residence on Greene Lane near Site 4	< 20
R7. Residence on Mayflower Drive near Site 4	< 20
R8. Residence on Brown Lane near Site 5	< 20
R9. Waumetonomy Golf Club, nearest tee to Site 5	< 20
R10. Residence on Semmes Street near Site 6	< 20
R11. Residence on Chases Lane near Site 6	< 20
R12. Residence on Maple Avenue near Site 7	< 20

TABLE 4

MAXIMUM PREDICTED SOUND LEVELS
FROM SINGLE TURBINE OPERATION
AT SITE 2

Sensitive Noise Receiver	Project Sound Level (dBA)
R1. Residence on Rolling Hill Road near Site 1	**39.1**
R2. Residence on Rolling Hill Road near Site 2	**45.8**
R3. Residence on Lawton Brook Road near Site 1	**39.9**
R4. Residence on Redwood Road near Site 3	**40.8**
R5. Residence on Harbor View Road near Site 2	**48.3**
R6. Residence on Greene Lane near Site 4	**20.3**
R7. Residence on Mayflower Drive near Site 4	**24.4**
R8. Residence on Brown Lane near Site 5	< 20
R9. Waumetonomy Golf Club, nearest tee to Site 5	< 20
R10. Residence on Semmes Street near Site 6	< 20
R11. Residence on Chases Lane near Site 6	< 20
R12. Residence on Maple Avenue near Site 7	< 20

TABLE 5

MAXIMUM PREDICTED SOUND LEVELS
FROM SINGLE TURBINE OPERATION
AT SITE 3

Sensitive Noise Receiver	Project Sound Level (dBA)
R1. Residence on Rolling Hill Road near Site 1	**37.0**
R2. Residence on Rolling Hill Road near Site 2	**41.6**
R3. Residence on Lawton Brook Road near Site 1	**34.8**
R4. Residence on Redwood Road near Site 3	**45.8**
R5. Residence on Harbor View Road near Site 2	**39.2**
R6. Residence on Greene Lane near Site 4	**26.8**
R7. Residence on Mayflower Drive near Site 4	**27.3**
R8. Residence on Brown Lane near Site 5	< 20
R9. Waumetonomy Golf Club, nearest tee to Site 5	< 20
R10. Residence on Semmes Street near Site 6	< 20
R11. Residence on Chases Lane near Site 6	< 20
R12. Residence on Maple Avenue near Site 7	< 20

TABLE 6

MAXIMUM PREDICTED SOUND LEVELS
FROM SINGLE TURBINE OPERATION
AT SITE 4

Sensitive Noise Receiver	Project Sound Level (dBA)
R1. Residence on Rolling Hill Road near Site 1	< 20
R2. Residence on Rolling Hill Road near Site 2	< 20
R3. Residence on Lawton Brook Road near Site 1	< 20
R4. Residence on Redwood Road near Site 3	**27.1**
R5. Residence on Harbor View Road near Site 2	**24.1**
R6. Residence on Greene Lane near Site 4	**42.1**
R7. Residence on Mayflower Drive near Site 4	**50.9**
R8. Residence on Brown Lane near Site 5	**29.6**
R9. Waumetonomy Golf Club, nearest tee to Site 5	**26.1**
R10. Residence on Semmes Street near Site 6	< 20
R11. Residence on Chases Lane near Site 6	< 20
R12. Residence on Maple Avenue near Site 7	< 20

TABLE 7

MAXIMUM PREDICTED SOUND LEVELS
FROM SINGLE TURBINE OPERATION
AT SITE 5

Sensitive Noise Receiver	Project Sound Level (dBA)
R1. Residence on Rolling Hill Road near Site 1	< 20
R2. Residence on Rolling Hill Road near Site 2	< 20
R3. Residence on Lawton Brook Road near Site 1	< 20
R4. Residence on Redwood Road near Site 3	< 20
R5. Residence on Harbor View Road near Site 2	< 20
R6. Residence on Greene Lane near Site 4	**26.8**
R7. Residence on Mayflower Drive near Site 4	**25.8**
R8. Residence on Brown Lane near Site 5	**38.0**
R9. Waumetonomy Golf Club, nearest tee to Site 5	**52.2**
R10. Residence on Semmes Street near Site 6	**23.5**
R11. Residence on Chases Lane near Site 6	**28.7**
R12. Residence on Maple Avenue near Site 7	< 20

TABLE 8

MAXIMUM PREDICTED SOUND LEVELS
FROM SINGLE TURBINE OPERATION
AT SITE 6

Sensitive Noise Receiver	Project Sound Level (dBA)
R1. Residence on Rolling Hill Road near Site 1	< 20
R2. Residence on Rolling Hill Road near Site 2	< 20
R3. Residence on Lawton Brook Road near Site 1	< 20
R4. Residence on Redwood Road near Site 3	< 20
R5. Residence on Harbor View Road near Site 2	< 20
R6. Residence on Greene Lane near Site 4	< 20
R7. Residence on Mayflower Drive near Site 4	< 20
R8. Residence on Brown Lane near Site 5	**24.3**
R9. Waumetonomy Golf Club, nearest tee to Site 5	**23.2**
R10. Residence on Semmes Street near Site 6	**41.0**
R11. Residence on Chases Lane near Site 6	**38.9**
R12. Residence on Maple Avenue near Site 7	**31.2**

TABLE 9

MAXIMUM PREDICTED SOUND LEVELS
FROM SINGLE TURBINE OPERATION
AT SITE 7

Sensitive Noise Receiver	Project Sound Level (dBA)
R1. Residence on Rolling Hill Road near Site 1	< 20
R2. Residence on Rolling Hill Road near Site 2	< 20
R3. Residence on Lawton Brook Road near Site 1	< 20
R4. Residence on Redwood Road near Site 3	< 20
R5. Residence on Harbor View Road near Site 2	< 20
R6. Residence on Greene Lane near Site 4	< 20
R7. Residence on Mayflower Drive near Site 4	< 20
R8. Residence on Brown Lane near Site 5	< 20
R9. Waumetonomy Golf Club, nearest tee to Site 5	< 20
R10. Residence on Semmes Street near Site 6	**30.6**
R11. Residence on Chases Lane near Site 6	**29.7**
R12. Residence on Maple Avenue near Site 7	**33.3**

TABLE 10

MAXIMUM PREDICTED SOUND LEVELS
FROM SINGLE TURBINE OPERATION
AT SITE 8

Sensitive Noise Receiver	Project Sound Level (dBA)
R1. Residence on Rolling Hill Road near Site 1	< 20
R2. Residence on Rolling Hill Road near Site 2	< 20
R3. Residence on Lawton Brook Road near Site 1	< 20
R4. Residence on Redwood Road near Site 3	< 20
R5. Residence on Harbor View Road near Site 2	< 20
R6. Residence on Greene Lane near Site 4	< 20
R7. Residence on Mayflower Drive near Site 4	< 20
R8. Residence on Brown Lane near Site 5	< 20
R9. Waumetonomy Golf Club, nearest tee to Site 5	< 20
R10. Residence on Semmes Street near Site 6	**32.8**
R11. Residence on Chases Lane near Site 6	**31.1**
R12. Residence on Maple Avenue near Site 7	**39.1**

TABLE 11

MAXIMUM PREDICTED SOUND LEVELS
FROM SINGLE TURBINE OPERATION
AT SITE 9

Sensitive Noise Receiver	Project Sound Level (dBA)
R1. Residence on Rolling Hill Road near Site 1	< 20
R2. Residence on Rolling Hill Road near Site 2	< 20
R3. Residence on Lawton Brook Road near Site 1	< 20
R4. Residence on Redwood Road near Site 3	< 20
R5. Residence on Harbor View Road near Site 2	< 20
R6. Residence on Greene Lane near Site 4	< 20
R7. Residence on Mayflower Drive near Site 4	< 20
R8. Residence on Brown Lane near Site 5	< 20
R9. Waumetonomy Golf Club, nearest tee to Site 5	< 20
R10. Residence on Semmes Street near Site 6	< 20
R11. Residence on Chases Lane near Site 6	< 20
R12. Residence on Maple Avenue near Site 7	**31.5**

TABLE 12

MAXIMUM PREDICTED SOUND LEVELS
FROM SINGLE TURBINE OPERATION
AT SITE 10A

Sensitive Noise Receiver	Project Sound Level (dBA)
R1. Residence on Rolling Hill Road near Site 1	< 20
R2. Residence on Rolling Hill Road near Site 2	< 20
R3. Residence on Lawton Brook Road near Site 1	< 20
R4. Residence on Redwood Road near Site 3	< 20
R5. Residence on Harbor View Road near Site 2	< 20
R6. Residence on Greene Lane near Site 4	< 20
R7. Residence on Mayflower Drive near Site 4	< 20
R8. Residence on Brown Lane near Site 5	< 20
R9. Waumetonomy Golf Club, nearest tee to Site 5	< 20
R10. Residence on Semmes Street near Site 6	**27.7**
R11. Residence on Chases Lane near Site 6	**25.3**
R12. Residence on Maple Avenue near Site 7	**33.1**

TABLE 13

MAXIMUM PREDICTED SOUND LEVELS
FROM SINGLE TURBINE OPERATION
AT SITE 10B

Sensitive Noise Receiver	Project Sound Level (dBA)
R1. Residence on Rolling Hill Road near Site 1	< 20
R2. Residence on Rolling Hill Road near Site 2	< 20
R3. Residence on Lawton Brook Road near Site 1	< 20
R4. Residence on Redwood Road near Site 3	< 20
R5. Residence on Harbor View Road near Site 2	< 20
R6. Residence on Greene Lane near Site 4	< 20
R7. Residence on Mayflower Drive near Site 4	< 20
R8. Residence on Brown Lane near Site 5	< 20
R9. Waumetonomy Golf Club, nearest tee to Site 5	< 20
R10. Residence on Semmes Street near Site 6	**27.4**
R11. Residence on Chases Lane near Site 6	< 20
R12. Residence on Maple Avenue near Site 7	**34.1**

TABLE 14

MAXIMUM PREDICTED SOUND LEVELS
FROM SINGLE TURBINE OPERATION
AT SITE 11

Sensitive Noise Receiver	Project Sound Level (dBA)
R1. Residence on Rolling Hill Road near Site 1	< 20
R2. Residence on Rolling Hill Road near Site 2	< 20
R3. Residence on Lawton Brook Road near Site 1	< 20
R4. Residence on Redwood Road near Site 3	< 20
R5. Residence on Harbor View Road near Site 2	< 20
R6. Residence on Greene Lane near Site 4	< 20
R7. Residence on Mayflower Drive near Site 4	< 20
R8. Residence on Brown Lane near Site 5	< 20
R9. Waumetonomy Golf Club, nearest tee to Site 5	< 20
R10. Residence on Semmes Street near Site 6	< 20
R11. Residence on Chases Lane near Site 6	< 20
R12. Residence on Maple Avenue near Site 7	**33.6**

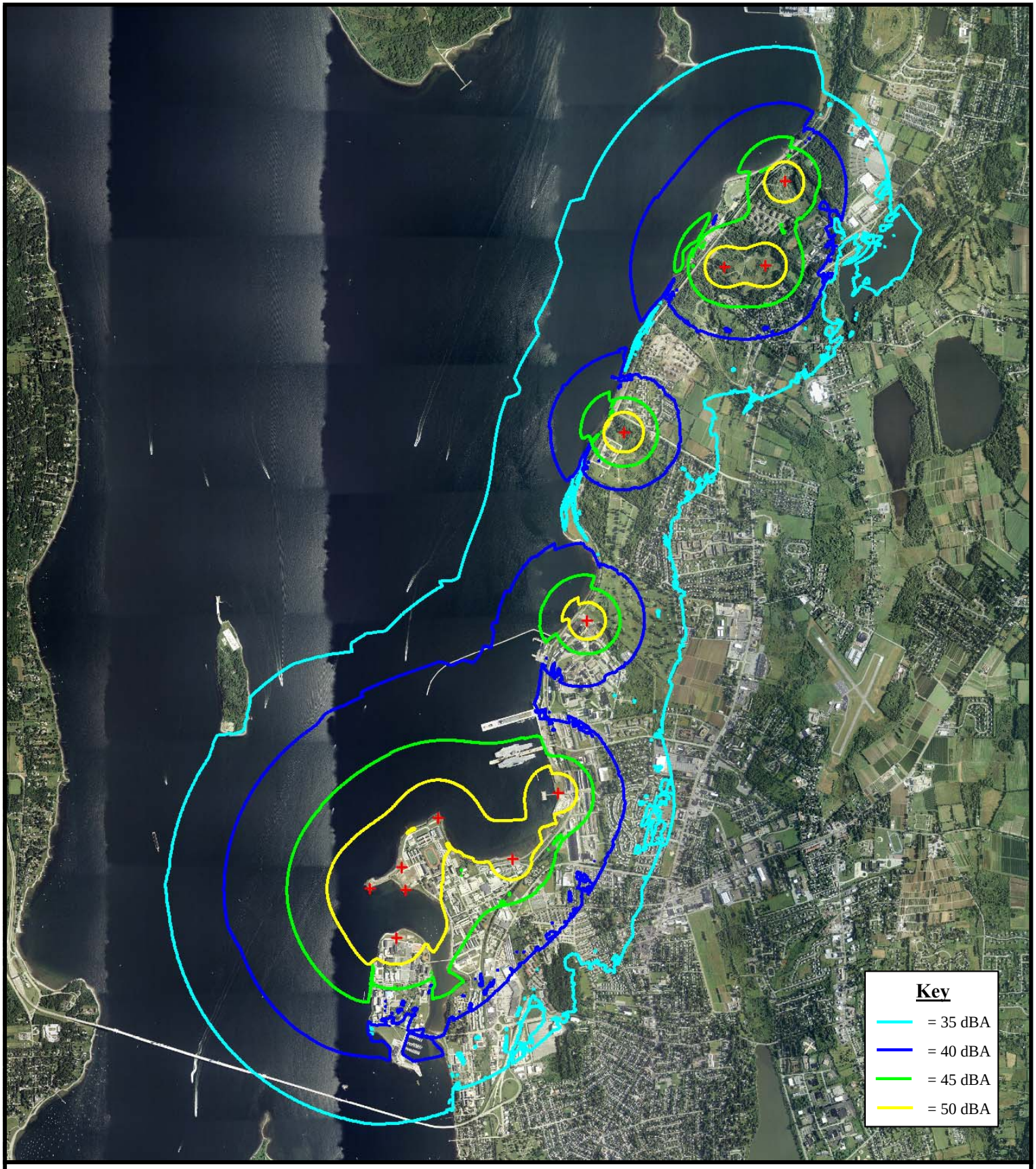

Figure 3.

Maximum Predicted Sound Levels
For All Turbines
Wind Energy Facilities at NAVSTA Newport

TECH environmental
FOCUSED KNOWLEDGE. REAL SOLUTIONS.

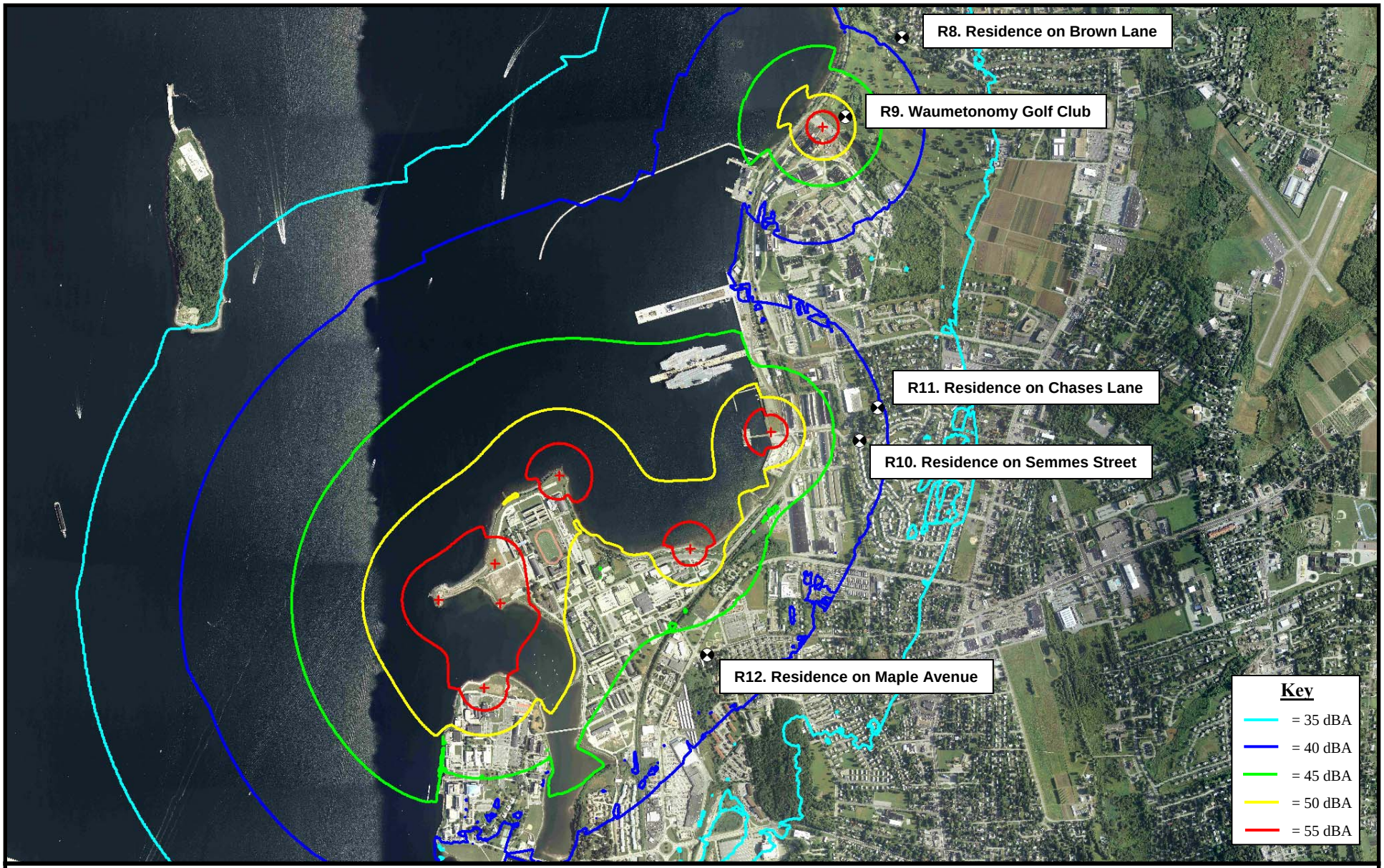

Figure 4.

Maximum Predicted Sound Levels for All Turbines
Southern Project Area
Wind Energy Facilities at NAVSTA Newport

TECH environmental
FOCUSED KNOWLEDGE. REAL SOLUTIONS.

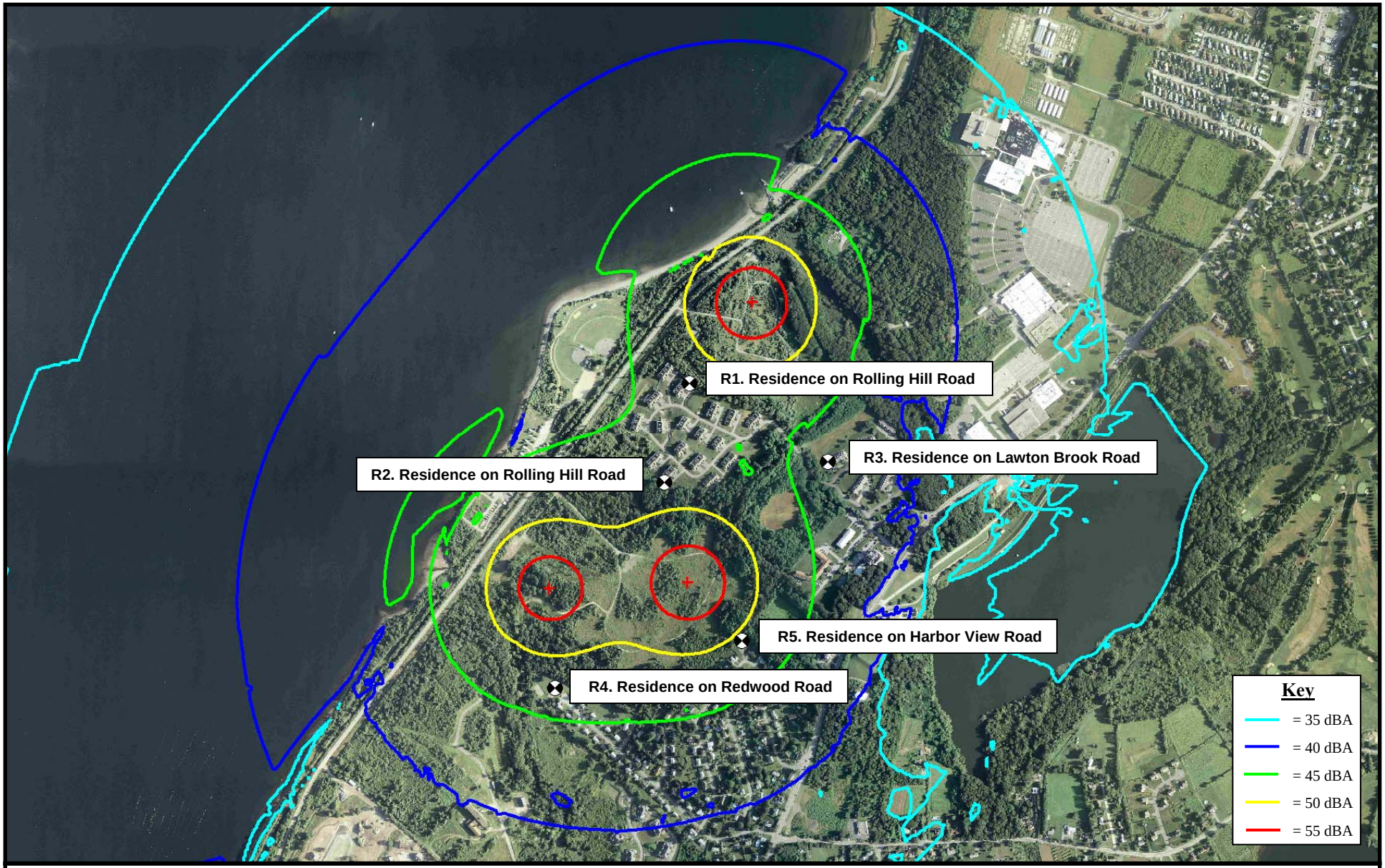

Figure 5.

Maximum Predicted Sound Levels for All Turbines
Sites 1, 2 and 3
Wind Energy Facilities at NAVSTA Newport

TECH environmental
FOCUSED KNOWLEDGE. REAL SOLUTIONS.

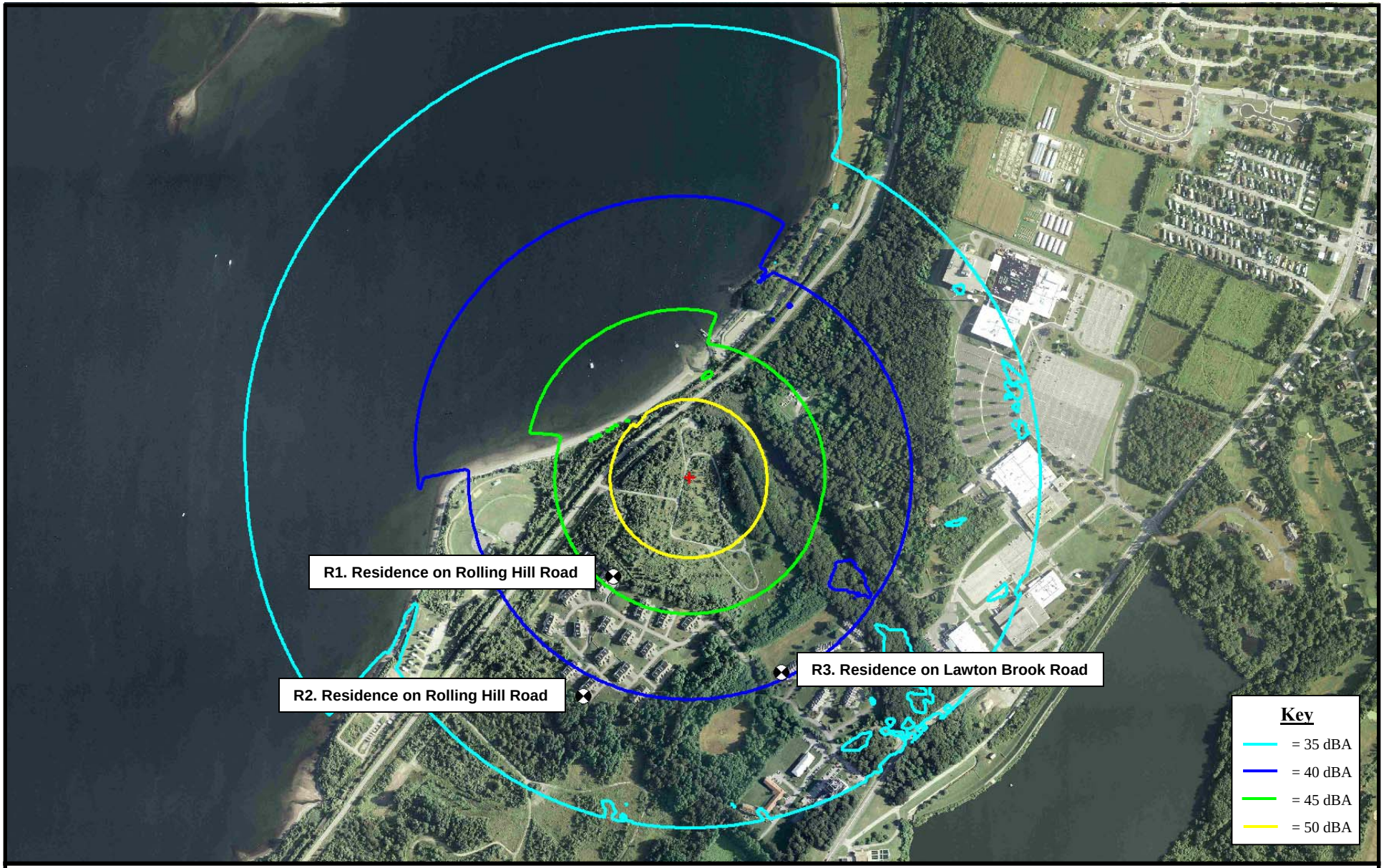

Figure 6.

Site #1 – Tank Farm 3 Turbine A (PowerWind 56)
Maximum Predicted Sound Levels for One Turbine
Wind Energy Facilities at NAVSTA Newport

TECH environmental
FOCUSED KNOWLEDGE. REAL SOLUTIONS.

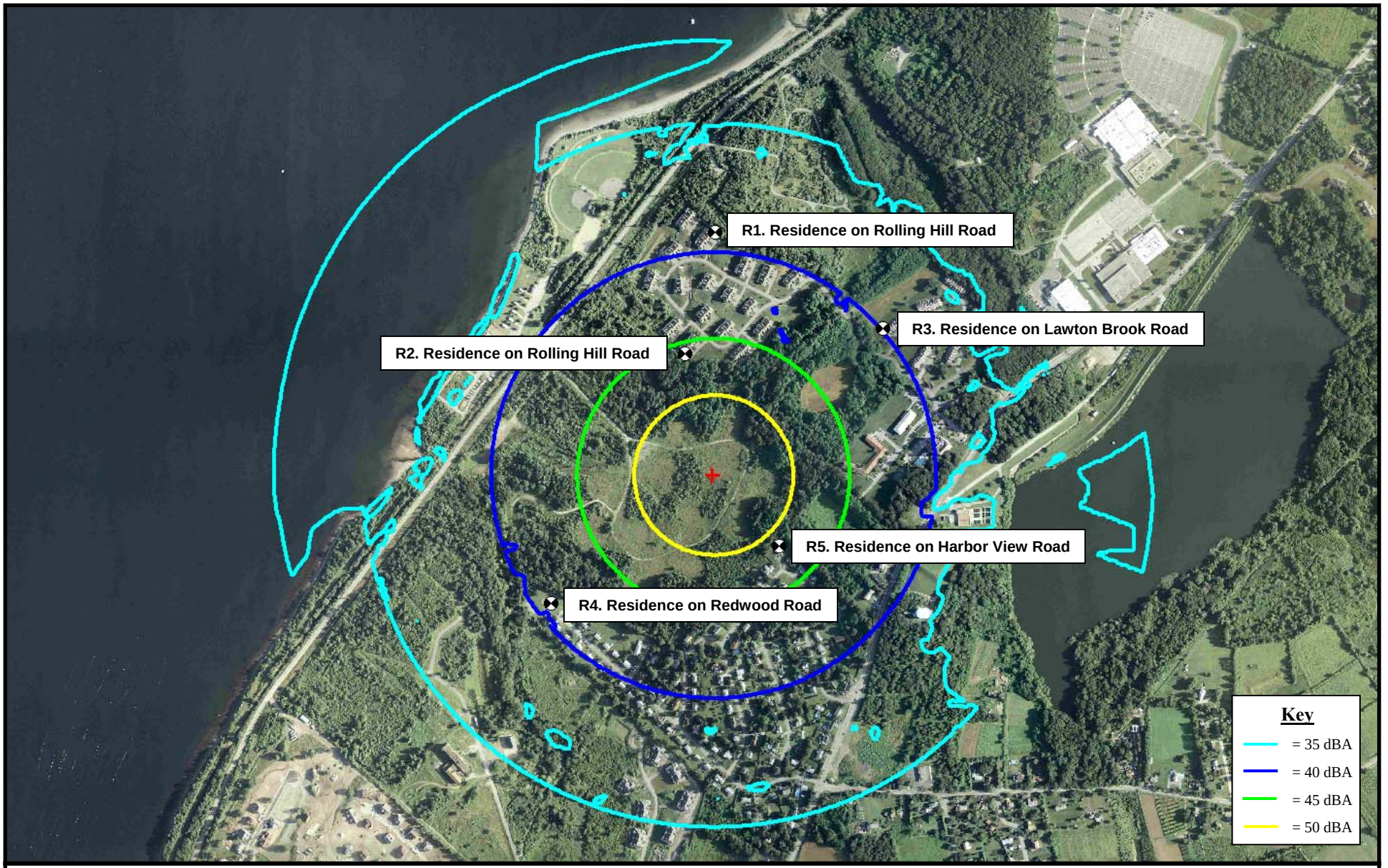

Figure 7.

Site #2 – Tank Farm 4 Turbine B (PowerWind 56)
Maximum Predicted Sound Levels for One Turbine
Wind Energy Facilities at NAVSTA Newport

TECH environmental
FOCUSED KNOWLEDGE. REAL SOLUTIONS.

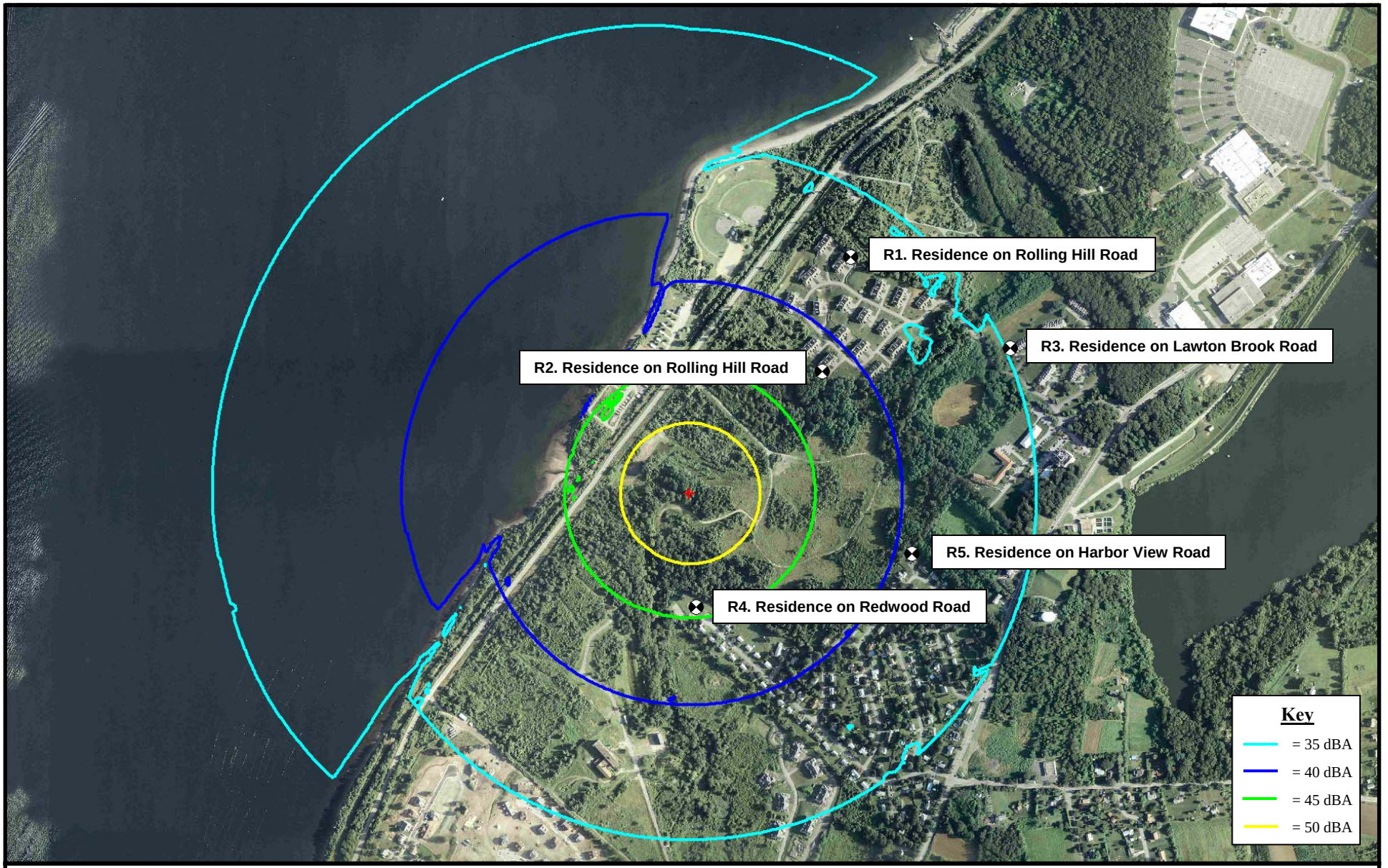

Figure 8.

Site #3 – Tank Farm 4 Turbine A (GE 1.5sle)
Maximum Predicted Sound Levels for One Turbine
Wind Energy Facilities at NAVSTA Newport

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Figure 9.

Site #4 – Tank Farm 5 Turbine C (PowerWind 56)
Maximum Predicted Sound Levels for One Turbine
Wind Energy Facilities at NAVSTA Newport

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FOCUSED KNOWLEDGE. REAL SOLUTIONS.

Figure 10.

Site #5 – NUWC Stillwater Basin (GE 1.5sle)
Maximum Predicted Sound Levels for One Turbine
Wind Energy Facilities at NAVSTA Newport

TECH environmental
FOCUSED KNOWLEDGE. REAL SOLUTIONS.

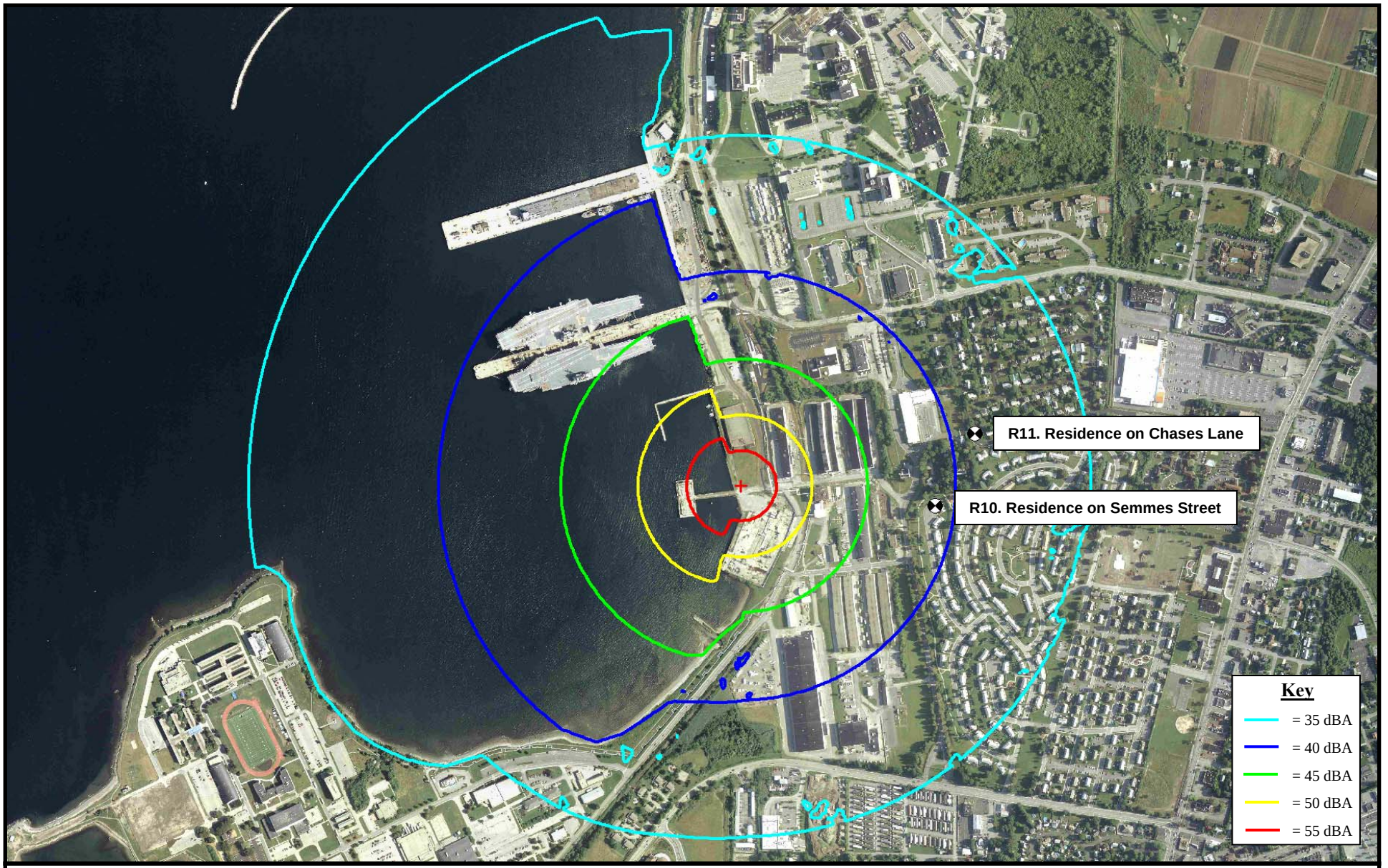

Figure 11.

Site #6 – Building 6 CC (GE 1.5sle)
Maximum Predicted Sound Levels for One Turbine
Wind Energy Facilities at NAVSTA Newport

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FOCUSED KNOWLEDGE. REAL SOLUTIONS.

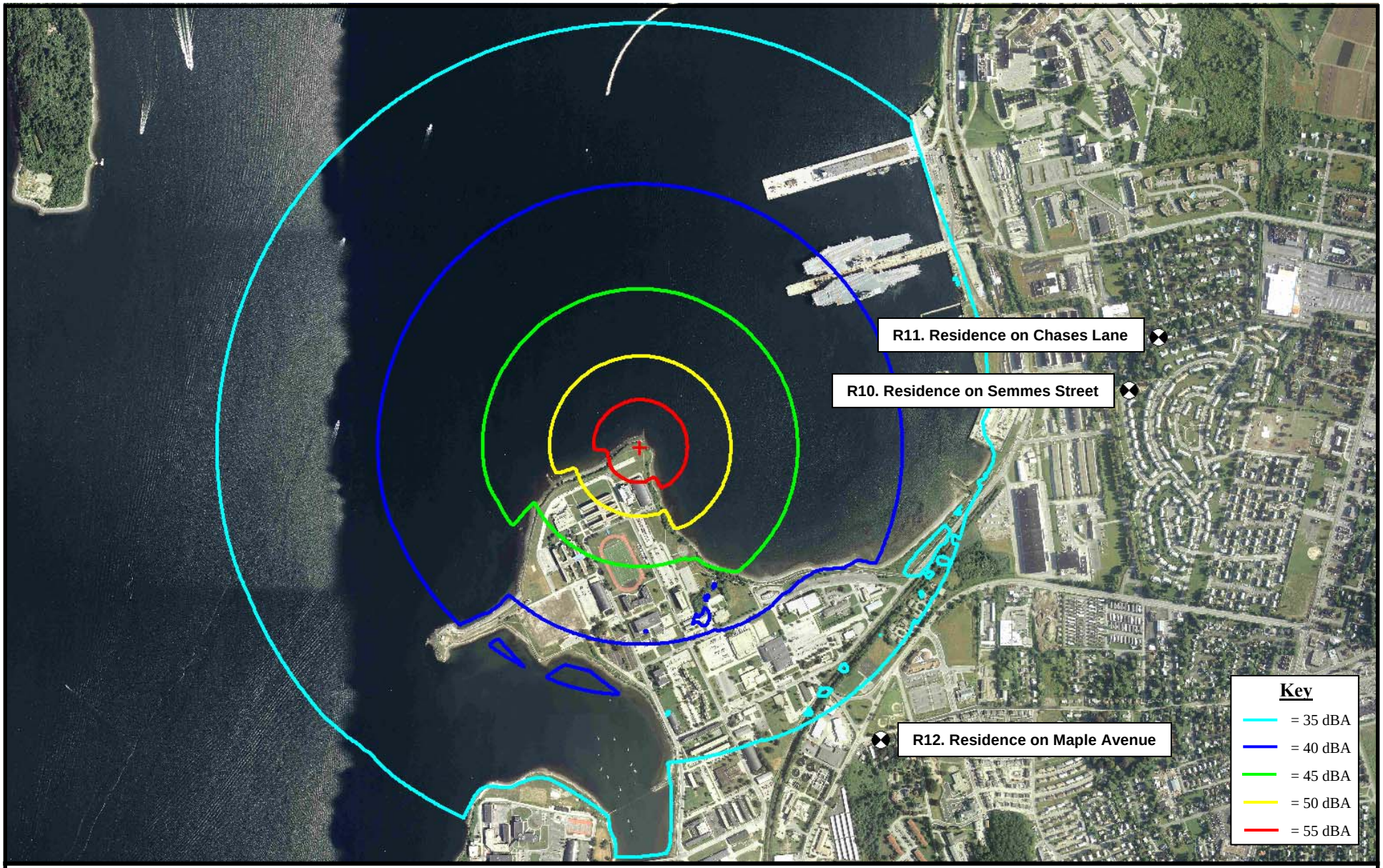

Figure 12.

Site #7 – Building 1112 (Vestas V112)
Maximum Predicted Sound Levels for One Turbine
Wind Energy Facilities at NAVSTA Newport

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Figure 13.

Site #8 – Building 1285 (GE 1.5sle)
Maximum Predicted Sound Levels for One Turbine
Wind Energy Facilities at NAVSTA Newport

TECH environmental
FOCUSED KNOWLEDGE. REAL SOLUTIONS.

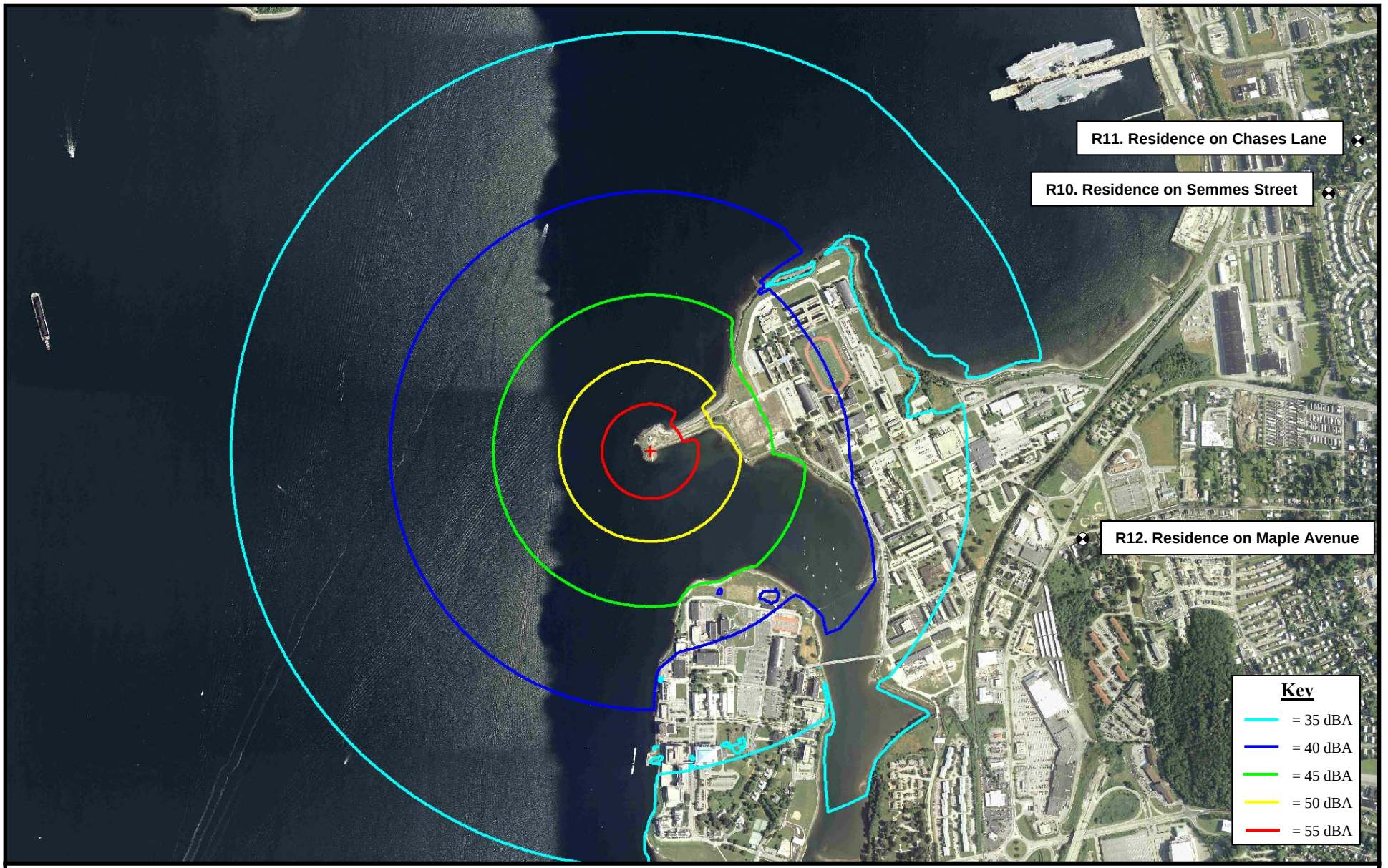

Figure 14.

Site #9 – Bishops Rock (Vestas V112)
Maximum Predicted Sound Levels for One Turbine
Wind Energy Facilities at NAVSTA Newport

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FOCUSED KNOWLEDGE. REAL SOLUTIONS.

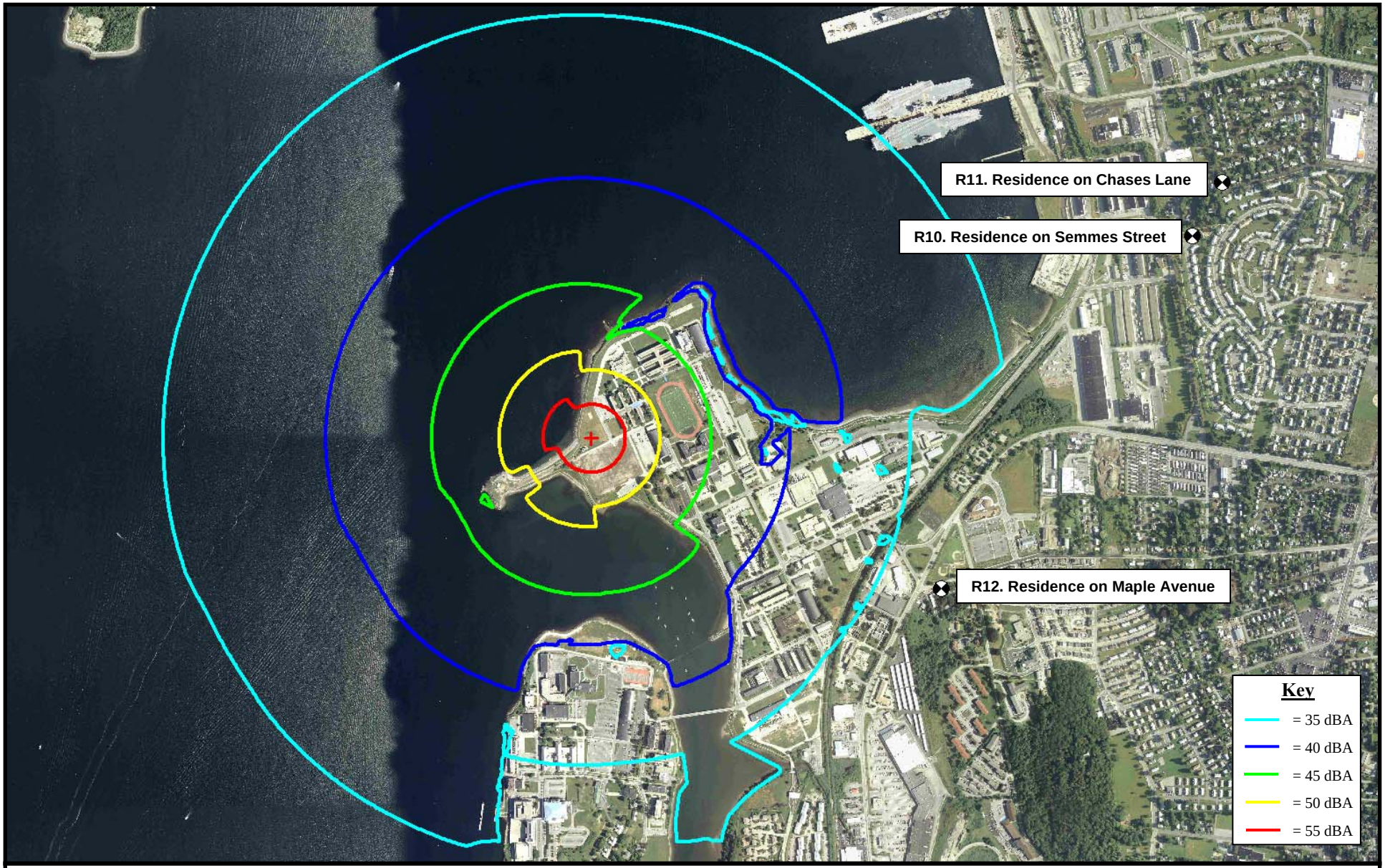

Figure 15.

Site #10a – Prichard Field North (Vestas V112)
Maximum Predicted Sound Levels for One Turbine
Wind Energy Facilities at NAVSTA Newport

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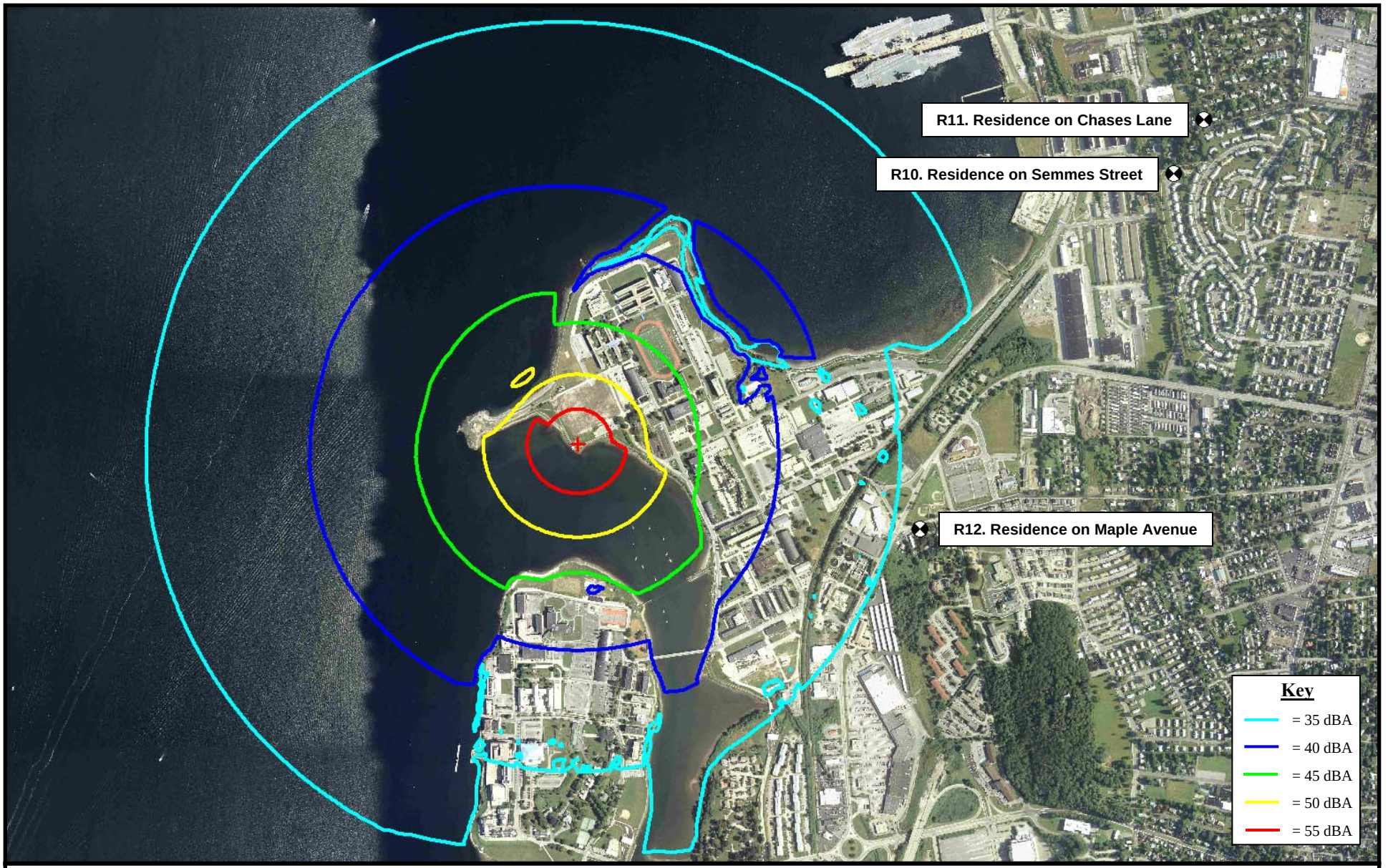

Figure 16.

Site #10b – Prichard Field South (Vestas V112)
Maximum Predicted Sound Levels for One Turbine
Wind Energy Facilities at NAVSTA Newport

TECH environmental
FOCUSED KNOWLEDGE. REAL SOLUTIONS.

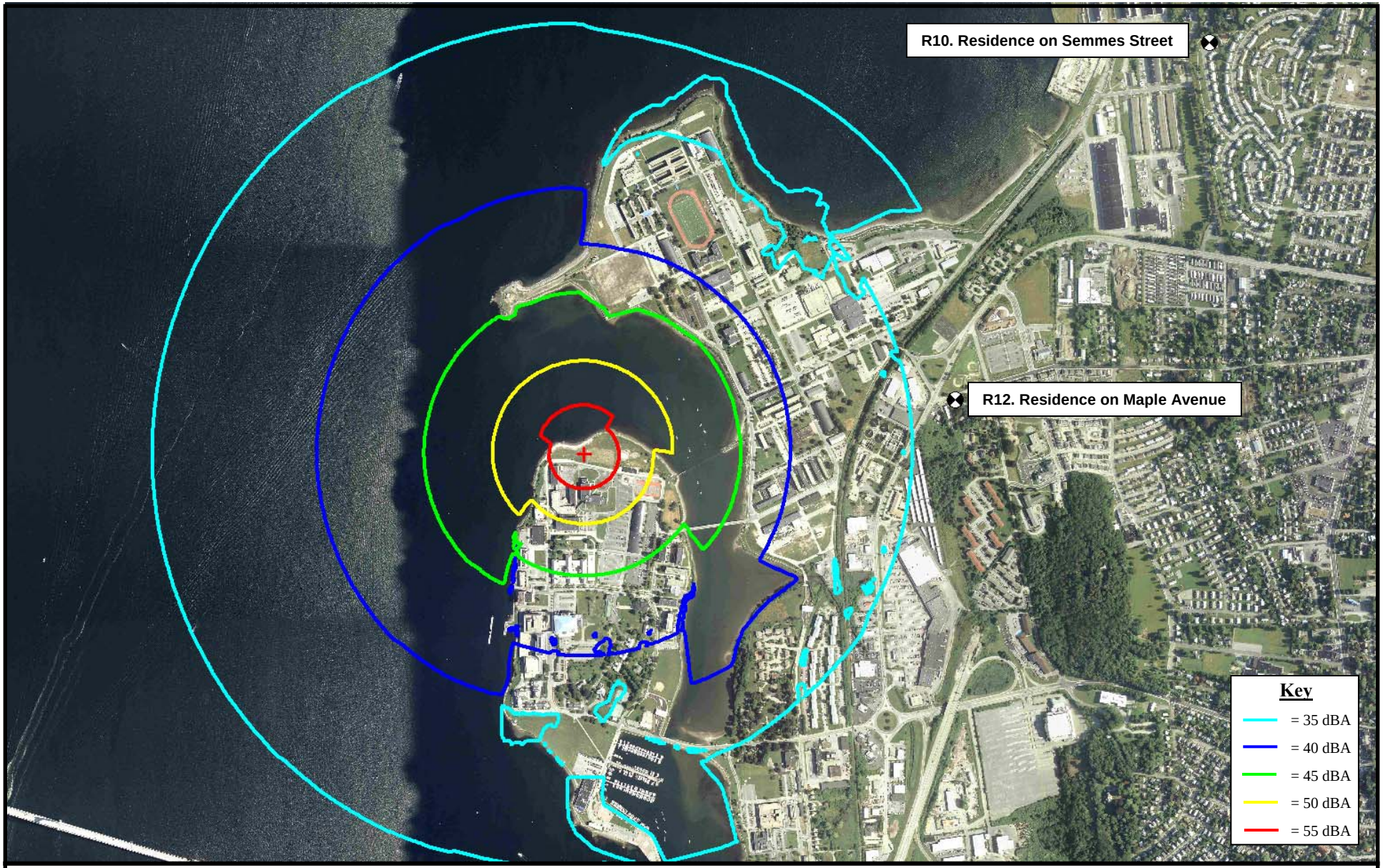

Figure 17.

Site #11 – Katy Field (Vestas V112)
Maximum Predicted Sound Levels for One Turbine
Wind Energy Facilities at NAVSTA Newport

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FOCUSED KNOWLEDGE. REAL SOLUTIONS.

APPENDIX A

TURBINE SOUND POWER LEVEL SPECTRA

TABLE A-1

SOUND POWER LEVELS FOR THE NAVSTA NEWPORT WIND TURBINE PROJECT

PowerWind 56 900 kW	Octave Band Center Frequency (Hz)									Calculated	Calculated
	31	63	125	250	500	1000	2000	4000	8000	Linear	dB(A)
Maximum Lw, dB PowerWind 56 Design WS	**117.7**	**113.3**	**107.5**	**106.8**	**102.1**	**100.3**	**99.8**	**95.8**	**88.0**	119.8	**106.5**

GE 1.5 sle 1.5 MW	Octave Band Center Frequency (Hz)									Calculated	Calculated
	31	63	125	250	500	1000	2000	4000	8000	Linear	dB(A)
Maximum Lw, dB GE 1.5sle Design WS	**117.0**	**111.6**	**110.3**	**108.4**	**104.7**	**99.6**	**94.2**	**87.6**	**85.7**	119.4	**106.0**

Vestas V112 3.0 MW	Octave Band Center Frequency (Hz)									Calculated	Calculated
	31	63	125	250	500	1000	2000	4000	8000	Linear	dB(A)
Maximum Lw, dB Vestas V112 Design WS	**123.7**	**119.7**	**114.0**	**108.4**	**105.7**	**101.6**	**98.8**	**97.9**	**94.0**	125.6	**108.5**

Source: Manufacturers' data for the maximum sound power level, including an uncertainty K-factor of 2.0 dBA per IEC TS 61400-14.
Infrasound sound power levels for the Vestas V112 are estimated to be 16 Hz = 130.3 dB; 8 Hz = 135.7 dB, and 4 Hz = 137.7 dB using data from Anthony Rogers, Ph.D., "Wind Turbine Acoustic Noise - A White Paper," UMass-Amherst Renewable Energy Research Laboratory, January 2006, Figure 8.

APPENDIX B

CADNA-A ACOUSTIC MODELING RESULTS

ALL Turbines

Name	ID	Level Lr Day (dBA)	Height (m)	Coordinates X (m)	Y (m)	Z (m)
Rolling Hill Road near Turbine 1	R1	47.2	1.52	117486.77	54005.87	25.42
Rolling Hill Road near Turbine 2	R2	47.8	1.52	117424.41	53755.26	22.27
Lawton Brook near Turbine 1	R3	43.7	1.52	117837.19	53805.93	31.98
Redwood Road near Turbine 3	R4	47.1	1.52	117146.49	53236	15.54
Harbor View Road near Turbine 2	R5	48.9	1.52	117620.29	53355.37	35.15
Greene Lane near Turbine 4	R6	42.4	1.52	116642.27	51960.93	24.25
Mayflower Drive near Turbine 4	R7	50.9	1.52	116391.46	52204.37	13.42
Brown Lane near Turbine 5	R8	38.8	1.52	116354.91	50929.24	18.08
Waumetonomy Golf Club, nearest tee to Turbine 5	R9	52.2	1.52	116085.73	50552.38	11.91
Semmes Street near Turbine 6	R10	42.3	1.52	116154.63	49009.69	22.94
Chases Lane near Turbine 6	R11	40.4	1.52	116241.47	49166.21	31.01
Maple Avenue near Turbine 8	R12	43	1.52	115427.7	47988.22	20.61

Turbine 1 Only

Name	ID	Level Lr Day (dBA)	Height (m)	Coordinates X (m)	Y (m)	Z (m)
Rolling Hill Road near Turbine 1	R1	45.9	1.52	117486.77	54005.87	25.42
Rolling Hill Road near Turbine 2	R2	39	1.52	117424.41	53755.26	22.27
Lawton Brook near Turbine 1	R3	40.3	1.52	117837.19	53805.93	31.98
Redwood Road near Turbine 3	R4	29.2	1.52	117146.49	53236	15.54
Harbor View Road near Turbine 2	R5	29.2	1.52	117620.29	53355.37	35.15
Greene Lane near Turbine 4	R6	-88	1.52	116642.27	51960.93	24.25
Mayflower Drive near Turbine 4	R7	-88	1.52	116391.46	52204.37	13.42
Brown Lane near Turbine 5	R8	-88	1.52	116354.91	50929.24	18.08
Waumetonomy Golf Club, nearest tee to Turbine 5	R9	-88	1.52	116085.73	50552.38	11.91
Semmes Street near Turbine 6	R10	-88	1.52	116154.63	49009.69	22.94
Chases Lane near Turbine 6	R11	-88	1.52	116241.47	49166.21	31.01
Maple Avenue near Turbine 8	R12	-88	1.52	115427.7	47988.22	20.61

Turbine 2 Only

Name	ID	Level Lr Day (dBA)	Height (m)	Coordinates X (m)	Y (m)	Z (m)
Rolling Hill Road near Turbine 1	R1	39.1	1.52	117486.77	54005.87	25.42
Rolling Hill Road near Turbine 2	R2	45.8	1.52	117424.41	53755.26	22.27
Lawton Brook near Turbine 1	R3	39.9	1.52	117837.19	53805.93	31.98
Redwood Road near Turbine 3	R4	40.8	1.52	117146.49	53236	15.54
Harbor View Road near Turbine 2	R5	48.3	1.52	117620.29	53355.37	35.15
Greene Lane near Turbine 4	R6	20.3	1.52	116642.27	51960.93	24.25
Mayflower Drive near Turbine 4	R7	24.4	1.52	116391.46	52204.37	13.42
Brown Lane near Turbine 5	R8	-88	1.52	116354.91	50929.24	18.08
Waumetonomy Golf Club, nearest tee to Turbine 5	R9	-88	1.52	116085.73	50552.38	11.91
Semmes Street near Turbine 6	R10	-88	1.52	116154.63	49009.69	22.94
Chases Lane near Turbine 6	R11	-88	1.52	116241.47	49166.21	31.01
Maple Avenue near Turbine 8	R12	-88	1.52	115427.7	47988.22	20.61

Turbine 3 Only

Name	ID	Level Lr Day (dBA)	Height (m)	Coordinates X (m)	Y (m)	Z (m)
Rolling Hill Road near Turbine 1	R1	37	1.52	117486.77	54005.87	25.42
Rolling Hill Road near Turbine 2	R2	41.6	1.52	117424.41	53755.26	22.27
Lawton Brook near Turbine 1	R3	34.8	1.52	117837.19	53805.93	31.98
Redwood Road near Turbine 3	R4	45.8	1.52	117146.49	53236	15.54
Harbor View Road near Turbine 2	R5	39.2	1.52	117620.29	53355.37	35.15
Greene Lane near Turbine 4	R6	26.8	1.52	116642.27	51960.93	24.25
Mayflower Drive near Turbine 4	R7	27.3	1.52	116391.46	52204.37	13.42
Brown Lane near Turbine 5	R8	-88	1.52	116354.91	50929.24	18.08
Waumetonomy Golf Club, nearest tee to Turbine 5	R9	-88	1.52	116085.73	50552.38	11.91
Semmes Street near Turbine 6	R10	-88	1.52	116154.63	49009.69	22.94
Chases Lane near Turbine 6	R11	-88	1.52	116241.47	49166.21	31.01
Maple Avenue near Turbine 8	R12	-88	1.52	115427.7	47988.22	20.61

Turbine 4 Only

Name	ID	Level Lr Day (dBA)	Height (m)	Coordinates X (m)	Y (m)	Z (m)
Rolling Hill Road near Turbine 1	R1	-88	1.52	117486.77	54005.87	25.42
Rolling Hill Road near Turbine 2	R2	-88	1.52	117424.41	53755.26	22.27
Lawton Brook near Turbine 1	R3	-88	1.52	117837.19	53805.93	31.98
Redwood Road near Turbine 3	R4	27.1	1.52	117146.49	53236	15.54
Harbor View Road near Turbine 2	R5	24.1	1.52	117620.29	53355.37	35.15
Greene Lane near Turbine 4	R6	42.1	1.52	116642.27	51960.93	24.25
Mayflower Drive near Turbine 4	R7	50.9	1.52	116391.46	52204.37	13.42
Brown Lane near Turbine 5	R8	29.6	1.52	116354.91	50929.24	18.08
Waumetonomy Golf Club, nearest tee to Turbine 5	R9	26.1	1.52	116085.73	50552.38	11.91
Semmes Street near Turbine 6	R10	-88	1.52	116154.63	49009.69	22.94
Chases Lane near Turbine 6	R11	-88	1.52	116241.47	49166.21	31.01
Maple Avenue near Turbine 8	R12	-88	1.52	115427.7	47988.22	20.61

Turbine 5 Only

Name	ID	Level Lr Day (dBA)	Height (m)	Coordinates X (m)	Y (m)	Z (m)
Rolling Hill Road near Turbine 1	R1	-88	1.52	117486.77	54005.87	25.42
Rolling Hill Road near Turbine 2	R2	-88	1.52	117424.41	53755.26	22.27
Lawton Brook near Turbine 1	R3	-88	1.52	117837.19	53805.93	31.98
Redwood Road near Turbine 3	R4	-88	1.52	117146.49	53236	15.54
Harbor View Road near Turbine 2	R5	-88	1.52	117620.29	53355.37	35.15
Greene Lane near Turbine 4	R6	26.8	1.52	116642.27	51960.93	24.25
Mayflower Drive near Turbine 4	R7	25.8	1.52	116391.46	52204.37	13.42
Brown Lane near Turbine 5	R8	38	1.52	116354.91	50929.24	18.08
Waumetonomy Golf Club, nearest tee to Turbine 5	R9	52.2	1.52	116085.73	50552.38	11.91
Semmes Street near Turbine 6	R10	23.5	1.52	116154.63	49009.69	22.94
Chases Lane near Turbine 6	R11	28.7	1.52	116241.47	49166.21	31.01
Maple Avenue near Turbine 8	R12	-88	1.52	115427.7	47988.22	20.61

Turbine 6 Only

Name	ID	Level Lr Day (dBA)	Height (m)	Coordinates X (m)	Y (m)	Z (m)
Rolling Hill Road near Turbine 1	R1	-88	1.52	117486.77	54005.87	25.42
Rolling Hill Road near Turbine 2	R2	-88	1.52	117424.41	53755.26	22.27
Lawton Brook near Turbine 1	R3	-88	1.52	117837.19	53805.93	31.98
Redwood Road near Turbine 3	R4	-88	1.52	117146.49	53236	15.54
Harbor View Road near Turbine 2	R5	-88	1.52	117620.29	53355.37	35.15
Greene Lane near Turbine 4	R6	-88	1.52	116642.27	51960.93	24.25
Mayflower Drive near Turbine 4	R7	-88	1.52	116391.46	52204.37	13.42
Brown Lane near Turbine 5	R8	24.3	1.52	116354.91	50929.24	18.08
Waumetonomy Golf Club, nearest tee to Turbine 5	R9	23.2	1.52	116085.73	50552.38	11.91
Semmes Street near Turbine 6	R10	41	1.52	116154.63	49009.69	22.94
Chases Lane near Turbine 6	R11	38.9	1.52	116241.47	49166.21	31.01
Maple Avenue near Turbine 8	R12	31.2	1.52	115427.7	47988.22	20.61

Turbine 7 Only

Name	ID	Level Lr Day (dBA)	Height (m)	Coordinates X (m)	Y (m)	Z (m)
Rolling Hill Road near Turbine 1	R1	-88	1.52	117486.77	54005.87	25.42
Rolling Hill Road near Turbine 2	R2	-88	1.52	117424.41	53755.26	22.27
Lawton Brook near Turbine 1	R3	-88	1.52	117837.19	53805.93	31.98
Redwood Road near Turbine 3	R4	-88	1.52	117146.49	53236	15.54
Harbor View Road near Turbine 2	R5	-88	1.52	117620.29	53355.37	35.15
Greene Lane near Turbine 4	R6	-88	1.52	116642.27	51960.93	24.25
Mayflower Drive near Turbine 4	R7	-88	1.52	116391.46	52204.37	13.42
Brown Lane near Turbine 5	R8	-88	1.52	116354.91	50929.24	18.08
Waumetonomy Golf Club, nearest tee to Turbine 5	R9	-88	1.52	116085.73	50552.38	11.91
Semmes Street near Turbine 6	R10	30.6	1.52	116154.63	49009.69	22.94
Chases Lane near Turbine 6	R11	29.7	1.52	116241.47	49166.21	31.01
Maple Avenue near Turbine 8	R12	33.3	1.52	115427.7	47988.22	20.61

Turbine 8 Only

Name	ID	Level Lr Day (dBA)	Height (m)	Coordinates X (m)	Y (m)	Z (m)
Rolling Hill Road near Turbine 1	R1	-88	1.52	117486.77	54005.87	25.42
Rolling Hill Road near Turbine 2	R2	-88	1.52	117424.41	53755.26	22.27
Lawton Brook near Turbine 1	R3	-88	1.52	117837.19	53805.93	31.98
Redwood Road near Turbine 3	R4	-88	1.52	117146.49	53236	15.54
Harbor View Road near Turbine 2	R5	-88	1.52	117620.29	53355.37	35.15
Greene Lane near Turbine 4	R6	-88	1.52	116642.27	51960.93	24.25
Mayflower Drive near Turbine 4	R7	-88	1.52	116391.46	52204.37	13.42
Brown Lane near Turbine 5	R8	-88	1.52	116354.91	50929.24	18.08
Waumetonomy Golf Club, nearest tee to Turbine 5	R9	-88	1.52	116085.73	50552.38	11.91
Semmes Street near Turbine 6	R10	32.8	1.52	116154.63	49009.69	22.94
Chases Lane near Turbine 6	R11	31.1	1.52	116241.47	49166.21	31.01
Maple Avenue near Turbine 8	R12	39.1	1.52	115427.7	47988.22	20.61

Turbine 9 Only

Name	ID	Level Lr Day (dBA)	Height (m)	Coordinates X (m)	Y (m)	Z (m)
Rolling Hill Road near Turbine 1	R1	-88	1.52	117486.77	54005.87	25.42
Rolling Hill Road near Turbine 2	R2	-88	1.52	117424.41	53755.26	22.27
Lawton Brook near Turbine 1	R3	-88	1.52	117837.19	53805.93	31.98
Redwood Road near Turbine 3	R4	-88	1.52	117146.49	53236	15.54
Harbor View Road near Turbine 2	R5	-88	1.52	117620.29	53355.37	35.15
Greene Lane near Turbine 4	R6	-88	1.52	116642.27	51960.93	24.25
Mayflower Drive near Turbine 4	R7	-88	1.52	116391.46	52204.37	13.42
Brown Lane near Turbine 5	R8	-88	1.52	116354.91	50929.24	18.08
Waumetonomy Golf Club, nearest tee to Turbine 5	R9	-88	1.52	116085.73	50552.38	11.91
Semmes Street near Turbine 6	R10	-88	1.52	116154.63	49009.69	22.94
Chases Lane near Turbine 6	R11	-88	1.52	116241.47	49166.21	31.01
Maple Avenue near Turbine 8	R12	31.5	1.52	115427.7	47988.22	20.61

Turbine 10a Only

Name	ID	Level Lr Day (dBA)	Height (m)	Coordinates X (m)	Y (m)	Z (m)
Rolling Hill Road near Turbine 1	R1	-88	1.52	117486.77	54005.87	25.42
Rolling Hill Road near Turbine 2	R2	-88	1.52	117424.41	53755.26	22.27
Lawton Brook near Turbine 1	R3	-88	1.52	117837.19	53805.93	31.98
Redwood Road near Turbine 3	R4	-88	1.52	117146.49	53236	15.54
Harbor View Road near Turbine 2	R5	-88	1.52	117620.29	53355.37	35.15
Greene Lane near Turbine 4	R6	-88	1.52	116642.27	51960.93	24.25
Mayflower Drive near Turbine 4	R7	-88	1.52	116391.46	52204.37	13.42
Brown Lane near Turbine 5	R8	-88	1.52	116354.91	50929.24	18.08
Waumetonomy Golf Club, nearest tee to Turbine 5	R9	-88	1.52	116085.73	50552.38	11.91
Semmes Street near Turbine 6	R10	27.7	1.52	116154.63	49009.69	22.94
Chases Lane near Turbine 6	R11	25.3	1.52	116241.47	49166.21	31.01
Maple Avenue near Turbine 8	R12	33.1	1.52	115427.7	47988.22	20.61

Turbine 10b Only

Name	ID	Level Lr Day (dBA)	Height (m)	Coordinates X (m)	Y (m)	Z (m)
Rolling Hill Road near Turbine 1	R1	-88	1.52	117486.77	54005.87	25.42
Rolling Hill Road near Turbine 2	R2	-88	1.52	117424.41	53755.26	22.27
Lawton Brook near Turbine 1	R3	-88	1.52	117837.19	53805.93	31.98
Redwood Road near Turbine 3	R4	-88	1.52	117146.49	53236	15.54
Harbor View Road near Turbine 2	R5	-88	1.52	117620.29	53355.37	35.15
Greene Lane near Turbine 4	R6	-88	1.52	116642.27	51960.93	24.25
Mayflower Drive near Turbine 4	R7	-88	1.52	116391.46	52204.37	13.42
Brown Lane near Turbine 5	R8	-88	1.52	116354.91	50929.24	18.08
Waumetonomy Golf Club, nearest tee to Turbine 5	R9	-88	1.52	116085.73	50552.38	11.91
Semmes Street near Turbine 6	R10	27.4	1.52	116154.63	49009.69	22.94
Chases Lane near Turbine 6	R11	-88	1.52	116241.47	49166.21	31.01
Maple Avenue near Turbine 8	R12	34.1	1.52	115427.7	47988.22	20.61

Turbine 11 Only

Name	ID	Level Lr Day (dBA)	Height (m)	Coordinates X (m)	Y (m)	Z (m)
Rolling Hill Road near Turbine 1	R1	-88	1.52	117486.77	54005.87	25.42
Rolling Hill Road near Turbine 2	R2	-88	1.52	117424.41	53755.26	22.27
Lawton Brook near Turbine 1	R3	-88	1.52	117837.19	53805.93	31.98
Redwood Road near Turbine 3	R4	-88	1.52	117146.49	53236	15.54
Harbor View Road near Turbine 2	R5	-88	1.52	117620.29	53355.37	35.15
Greene Lane near Turbine 4	R6	-88	1.52	116642.27	51960.93	24.25
Mayflower Drive near Turbine 4	R7	-88	1.52	116391.46	52204.37	13.42
Brown Lane near Turbine 5	R8	-88	1.52	116354.91	50929.24	18.08
Waumetonomy Golf Club, nearest tee to Turbine 5	R9	-88	1.52	116085.73	50552.38	11.91
Semmes Street near Turbine 6	R10	-88	1.52	116154.63	49009.69	22.94
Chases Lane near Turbine 6	R11	-88	1.52	116241.47	49166.21	31.01
Maple Avenue near Turbine 8	R12	33.6	1.52	115427.7	47988.22	20.61