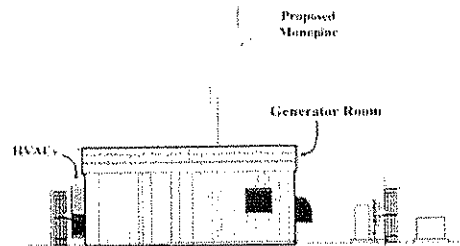
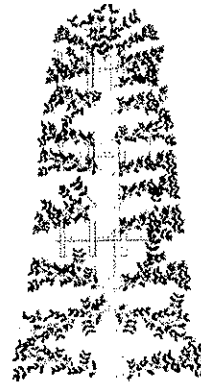


Environmental Noise Impact Evaluation



Wireless Communication Facility
21 New Lane
West Tisbury, Massachusetts

June 22, 2012

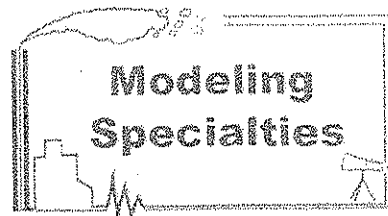
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ENVIRONMENTAL NOISE EVALUATION

Verizon Wireless is developing a Wireless Communication Facility (WCF) in West Tisbury, Massachusetts to support personal wireless communication in the area. The proposed Verizon Wireless antennas will be mounted on the proposed monopine tower. Environmentally sensitive electronic equipment will be enclosed in an equipment shelter at the foot of the monopine. The HVAC units will typically produce no sound, but will produce sound when they are actively providing cooling and ventilation to the equipment shelter. An emergency generator is proposed for installation in a separate compartment of the equipment shelter within the fenced site area. This generator will operate only during emergencies and for weekly routine daytime testing for about one-half hour.

This report addresses the existing sound levels and sensitive land uses in the area, as well as the sources of sound and sound levels expected at this installation.

1. Overview of Project and Site Vicinity

The project site is located at 21 New Lane in West Tisbury. Verizon Wireless has provided the necessary engineering and planning information to support the evaluation of project sounds. The nearest residences are on adjacent lots along New Lane and Runaway Lane. In accordance with the West Tisbury By-law, the nearest property line points are modeled as sensitive receptors in this study. Nearby residences are also modeled. Expected sound levels at residences are lower than the corresponding property lines.

Ambient sound levels were established by field measurements using standardized and calibrated equipment. The sound levels resulting from operation of the proposed equipment were estimated using vendor data and measurements made at similar installations. The corresponding sound levels expected at the nearby sensitive locations were estimated using noise modeling techniques prescribed in acoustical literature. One goal of the project is to meet the regulatory requirements of the Town of West Tisbury. However, based on the very low ambient levels in the area, additional mitigation will be incorporated to further reduce the expected sound level at the nearby residences. As a result of location and mitigation, the sound levels are expected to be well below the West Tisbury requirements.

Figure 1 is annotated on a backdrop of Mass GIS aerial photography to show the preferred site, property lines, surrounding area and nearby receptor locations, designated by their orientations and distances to the preferred equipment footprint. The ambient noise measurement location is also shown on Figure 1.



Figure 1:
Project Area Showing the Preferred Site and Nearest Sensitive Receptors

2. Discussion of General Noise Analysis Methods

There are a number of ways in which sound (noise) levels are measured and quantified. All of them use the logarithmic decibel (dB) scale. Following is a brief introduction to the noise measurement terminology used in this assessment.

2.1 Noise Metrics

The Sound Level Meter used to measure environmental is a standardized instrument.¹ It contains “weighting networks” to adjust the frequency response of the instrument to approximate that of the human ear under various circumstances. One of these is the *A-weighting* network. A-weighted sound levels emphasize the middle frequency sounds and de-emphasize lower and higher frequency sounds; they are reported in decibels designated as “dBA.” All broadband levels represented in this study are weighted using the A-weighting scale. Figure 2 illustrates typical sound levels produced by sources that are familiar to most people.

The sounds in our environment usually vary with time so they cannot always be described with a single number. Two methods are used for describing variable sounds. These are *exceedance levels* and *equivalent level*. Both are derived from a large number of moment-to-moment A-weighted sound level measurements. Exceedance levels are designated L_n , where “n” can have any value from 0 to 100 percent. For example:

- ◆ L_{10} is the sound level in dBA exceeded only 10 percent of the time. It is close to the maximum level observed during the measurement period. The L_{10} is sometimes called the *intrusive* sound level because it is caused by occasional louder noises like those from passing motor vehicles.
- ◆ L_{50} is the median sound level: the sound level in dBA exceeded 50 percent of the time during the measurement period.
- ◆ L_{90} is the sound level in dBA exceeded 90 percent of the time during the measurement period. The L_{90} is close to the lowest sound level observed. It is essentially the same as the *residual* sound level, which is the sound level observed when there are no loud, transient noises.

¹ American National Standard Specification for Sound Level Meters, ANSI S1.4-1983, published by the Standards Secretariat of the Acoustical Society of American, NY.

Common Indoor Sounds

Common Outdoor Sounds

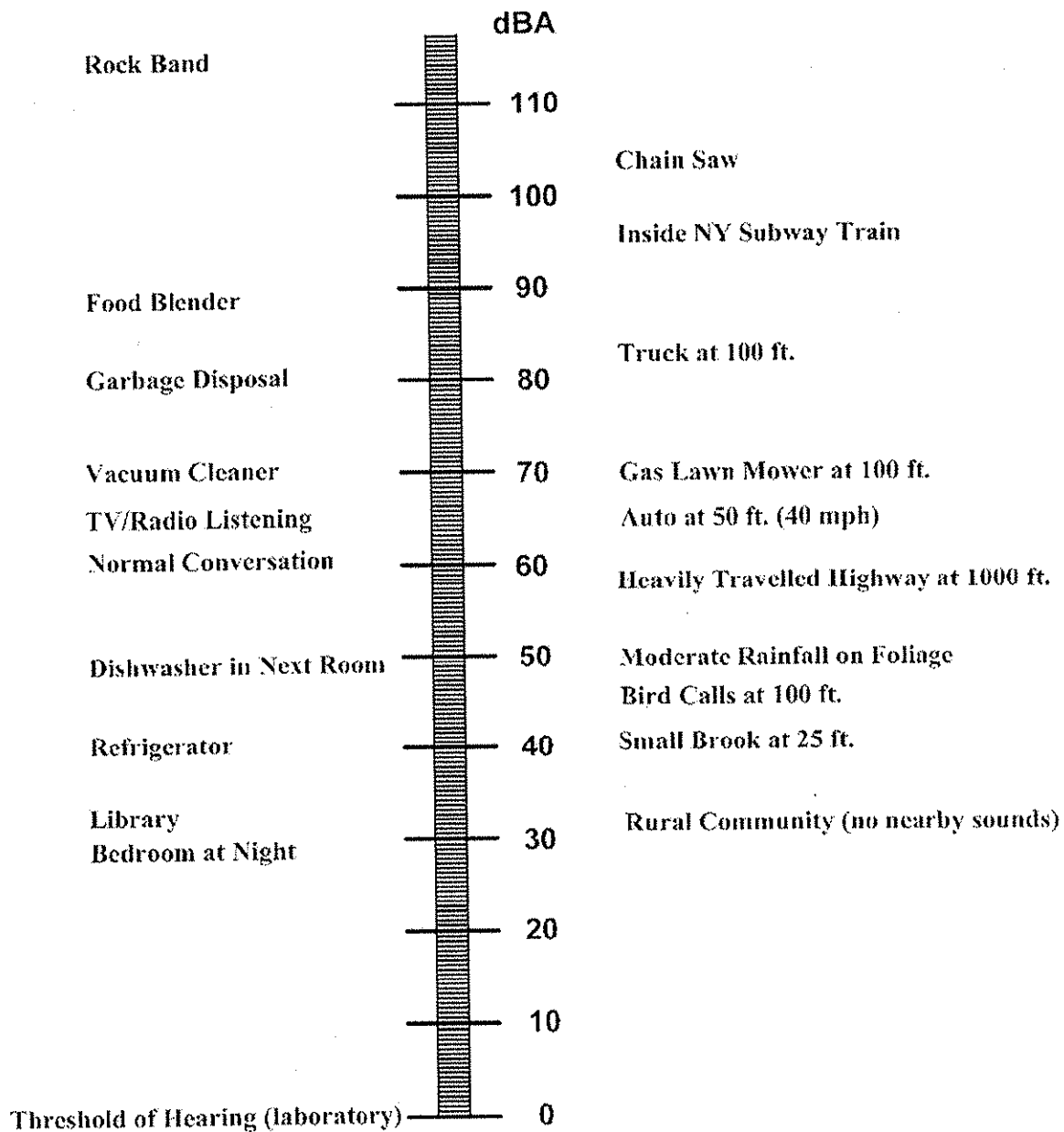


Figure 2:
Typical Sound Levels from Everyday Experience

By using exceedance levels it is possible to separate prevailing, steady sounds (L_{90}) from occasional, louder sounds (L_{10}) in the environment.

The *equivalent level* is the level of a hypothetical steady sound that has the same energy as the actual fluctuating sound observed. The equivalent level is designated L_{eq} , and is also A-weighted. The equivalent level is strongly influenced by occasional loud, intrusive noises. When a steady sound is observed, all of the L_n and L_{eq} are equal.

In the design of noise control treatments, it is essential to know something about the frequency spectrum of the sound of interest. Noise control treatments do not function like the human ear, so simple A-weighted levels are not useful for noise-control design or the identification of tones. The spectra of sounds are usually stated in terms of *octave band sound pressure levels*, in dB, with the octave frequency bands being those established by standard.² The sounds at the proposed site have been evaluated with respect to the octave band sound pressure levels, as well as the A-weighted equivalent sound level. Only the A-weighted values are presented here, since they represent the more easily recognized sound scale.

2.2 Noise Regulations and Criteria

Sound compliance is judged on two bases: the extent to which governmental regulations or guidelines are met, and the extent to which it is estimated that the community is protected from the excessive sound levels. The governmental regulations that may be applicable to sound produced by activities at the project site are summarized below.

Federal

- Occupational noise exposure standards: 29 CFR 1910.95. This regulation restricts the noise exposure of employees at the workplace as referred to in OSHA requirements. Workers will not routinely attend this facility. Furthermore, the facility will emit only occasional sounds of modest levels, as demonstrated by this study.

State

- 310 CMR §7.10 U qualitatively prohibits “unnecessary emissions from [a] source of sound that may cause noise”. This is interpreted quantitatively by MDEP’s Form BWP AQ SFP3 and their DAQC Policy 90-001.

In Massachusetts, noise is regulated as an air pollutant. The MDEP’s Noise Policy states that a new noise intrusion may not increase the broadband sound level by more than 10 dBA over the pre-existing L_{90} ambient level. Tonal sounds, defined

² American National Standard Specification for Octave, Half-octave and Third-octave Band Filter Sets, ANSI S1.11-1966(R1975).

as any octave band level that exceeds the levels in adjacent octave bands by 3 dB or more, are also prohibited.

Local

- West Tisbury zoning bylaw Section 8.8-13(D) provides project Noise Requirements. The facility sound levels must not exceed 50 dB (Ldn) at the nearest property line(s). Filing requirement related to noise are also specified. This assessment is prepared to address the West Tisbury requirements.

3. Existing Community Sound Levels

A site survey and noise measurement study was conducted in the area around the proposed site. Field measurements made on December 4 and 5, 2011 established the existing sound levels. The observed sounds included intrusive sound from occasional sources such as passing cars and aircraft over-flights. Measurement methodologies are not specified in the West Tisbury bylaw, so the conservative background measurement methodology of the DEP was used. Since it is based on the L90 metric, all intrusive sounds such as local traffic and aircraft over-flights are statistically excluded.

3.1 Measurement Locations

The purpose of the ambient survey was to characterize the ambient sound conditions at the site. The community surrounding the site was surveyed to identify the areas that had the greatest potential to be affected by sound emissions at the site. The area has a rural, residential character. The area surrounding the site is generally flat and wooded. The property is adjacent to Mill Brook/Town Cove to the west of the site but there were little or no sounds related to the water. Sound level measurements were made on the site, at locations representative of nearby residences' sound field. The measurements provided representative background sound levels for the site and adjacent residential receptors. Attended measurements were made in the evening and late night. Continuous measurements were taken in the same area to show the fluctuating sound levels over a 20 hour period.

3.2 Measurement Methodology

Since sound impacts are greatest when existing noise levels are lowest, the study was designed to measure community sound levels under conditions typical of a "quiet period" for the area. Meteorological conditions during the attended measurement included clear skies, a temperature of about 41 F, and calm winds. Conditions during the continuous survey period included varied cloud cover, temperatures of 37-55 F and varying winds less than 7 mph. The meteorological conditions during the measurements were noted from field observations and confirmed by record data for nearby Martha's Vineyard (KMVY) airport.

Attended sound level measurements were made using a Rion NA-28 sound level meter. The meter was mounted at approximately 5 feet above the ground. The microphone was fitted with the factory recommended 3-inch foam windscreen. The meter was used to sample the environmental sound and to process the sound into various statistical metrics for use in this analysis. The L_{90} (90th percentile) level is used in this study to represent the ambient background sound levels. The meter is equipped with a real time octave band filter set, which allows the meter to process sound levels into 1/3 octave bands. While frequency specific data were collected, the survey results are reported only in combined A-weighted levels for simplicity. The filter complies with the requirements of the ANSI S1-11 for octave band filter sets.

In order to capture the fluctuating levels during the various community conditions, continuous noise measurements were made using a Rion NL-31 sound level meter. The monitor was programmed to take continuous ten-minute samples and store processed statistical measurement data. The results of the continuous monitoring are presented graphically in Figure 3. The microphone was fitted with a factory recommended 8 inch environmental windscreen. This windscreen is designed for environmental conditions and sheds precipitation away from the microphone, keeping it safe and protected from varying weather conditions. Both meters meet the requirements of ANSI S1.4 for Type 1 - Precision sound level meters. All equipment was factory verified within one year of the study and was calibrated in the field using a Rion NC-74 sound level calibrator before and after the measurement sessions. The results of the field calibration indicated that the meters did not drift during the study.

In addition to the measurements, notes were made during the survey describing the observed sources of measured sound. The results of the survey allow both quantitative and qualitative analyses of the acoustical environment surrounding the proposed equipment. The characterization of ambient sound levels reflects the variations caused by volume of roadway traffic.

3.3 Measurement Results

Existing sound levels in the project area are dominated by sounds from local traffic along Edgartown West Tisbury Road and New Lane. Other area sources included daytime bird sounds and occasional commercial aircraft over-flights. The attended measured background levels in the project area ranged from as low as 27 dBA during the evening to 25 dBA in the quietest hours of the night. The results are summarized in Table 1.

Table 1: Measured Sound Levels in the Project Area

Location	Evening	L_{90}	Nighttime	L_{90}
Site	6:00 PM	27 dBA	12:30 AM	25 dBA

In addition to the attended measurements, a sound level monitor was mobilized at the site for a 20 hour period. The monitor results shown in Figure 3 fluctuate based on the sound level from evening to the following daytime period. The daytime levels are generally at or above 35 dBA, and as high as 40 dBA. The characterization of ambient sound levels reflects the variations caused by volume of roadway traffic and nearby aircraft and residential activities.

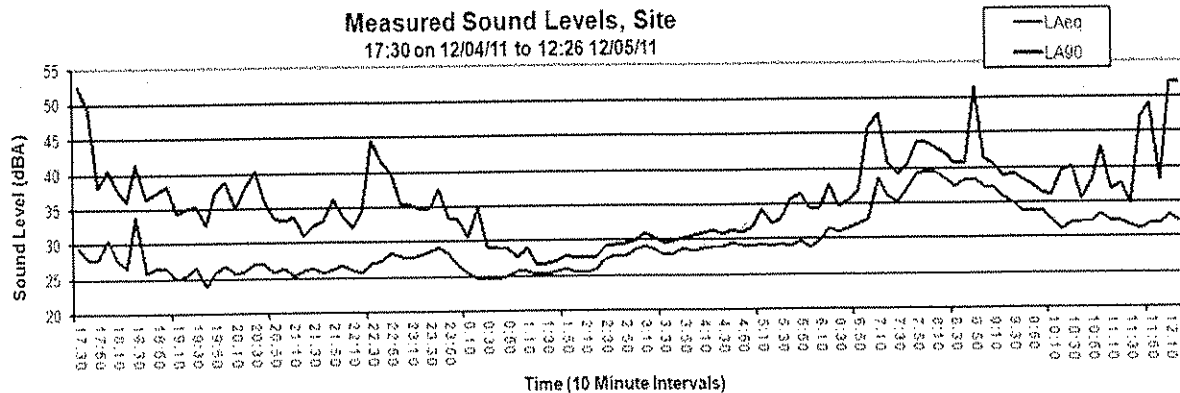


Figure 3: Summary of Monitored sound levels

4. Sounds from the Proposed Installation

The proposed installation has been designed to minimize the effect on the sound environment. Most of the equipment planned for the installation will produce no sound. Sounds that will be produced by the equipment will be adequately mitigated to prevent any significant effects at sensitive locations. Details of the modeling and assumptions are provided below.

This analysis represents the most likely sound levels to be expected as a result of the normal operation of the equipment using data from potential equipment vendors and measurements of other similar equipment.

The proposed equipment will include antennas located on the proposed monopole tower and a cable tray that will contain the supporting cabling. This equipment will produce no significant environmental sound. As noted above, there are two proposed sources of sound related to this project. Wall-mounted HVAC units provide cooling for the shelter equipment and a standby generator will provide system power during periods when utility support is lost. The equipment is described and quantified below:

Environmental Control Equipment. The equipment shelter will house equipment that is environmentally sensitive. Environmental control units will maintain the necessary conditions inside it. A typical enclosure uses 24,000 Btu/hr wall mounted air conditioning units with 1000 Watt heaters. The air conditioner will be used to maintain a temperature that remains below 90° F. It would seldom operate during cool or cold seasonal conditions. The heater could be used during cold periods, but produces no significant sound outside the shelter and requires only the fan to operate. The most sound is emitted when the condensers are operating, so is presented here to represent the worst-case HVAC sound emissions.

Emergency Generator. The emergency generator will produce somewhat higher levels than the HVAC units during operation, but it will operate much less frequently. This unit will not be operated to provide routine power to the facility. There are only two occasions when the generator will be used. The first is the routine periodic testing of the unit. This is a maintenance function and assures that the equipment is available when needed for emergency use. Each test will last for one-half hour or less, no more than once per week and only during the daytime hours. The other occasion when the generator will operate is during the loss of utility power. These rare events are most likely to occur during exceptional conditions like major storms. The emergency use is considered an upset condition that is not addressed in this report. The resulting equipment sounds will be the same as described below, but would have the potential of requiring extended periods of generator operation.

The generator set that has been specified for installation at the site is a Generac SD060. It is rated at approximately 60 kWA of power. The unit will be powered by a 4.9 liter diesel-fired engine.

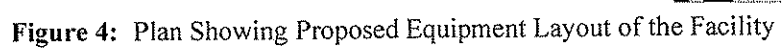
4.1 Equipment Sound Level Modeling

A computer model was developed for the project sounds based on conservative sound propagation principles prescribed in acoustics literature. This analysis represents the most likely sound levels to be expected as a result of the normal operation of the equipment. Each of the expected sources during routine operation of the facility was identified and quantified. The equipment layout plan is shown in Figure 4. An elevation drawing of the proposed monopine and facility is shown in Figure 5.

The sound from each source is estimated at the source, and at the nearest part of the property line and residential receptors. Sound levels decrease with distance, so the resulting sound level will be lower at more distant locations. The noise modeling accounts for specific source and propagation path assumptions for each modeled receiver location.

4.2 Results of Sound Level Modeling

To calculate the nighttime level, the sound from the HVAC equipment is modeled at the property line and neighboring properties. The property line, residential receptors and their orientation to the proposed equipment are shown in Figure 1. The results of the nighttime modeling are shown in Table 2 for periods when the HVAC equipment is operating. It is noted that these calculations are based on worst-case project equipment assumptions during the few hottest days of the summer.



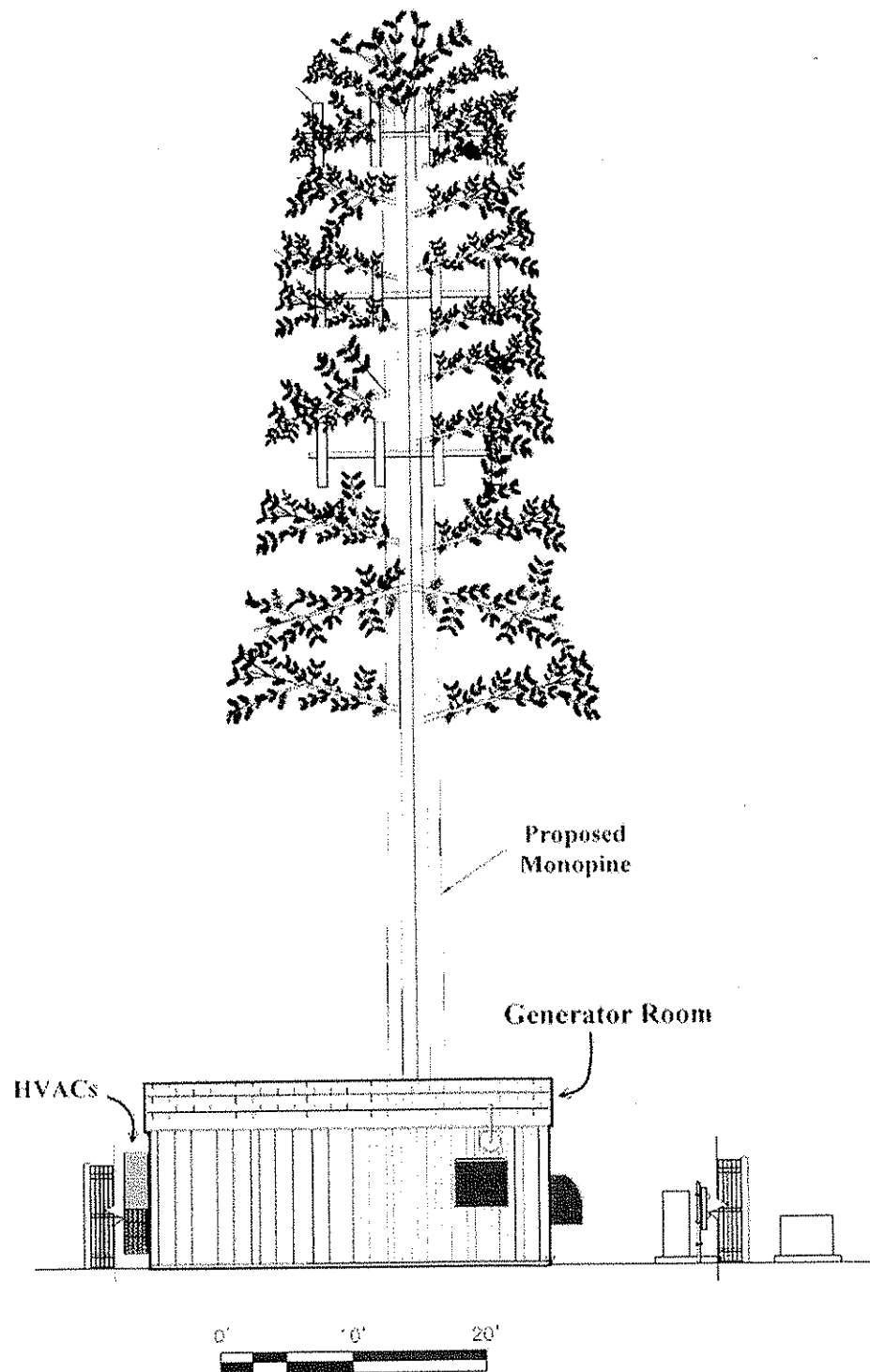


Figure 5: Elevation Plan Showing Monopine Tower and Facility Equipment

4.3 Equipment Location Options

The West Tisbury bylaws have specific setback requirements from the protect property lines based on the installed equipment and the tower height. Because of the large size of the site, there is a large portion of the site that would be acceptable. Working with the underlying landowner, three different site options were developed and analyzed separately in this study. The three sites are shown on a backdrop of the Google Aerial Photo in Figure 6.

The preferred equipment option has the compound located just east of the existing residence garage. This location makes it more distant from both the north and east property lines than other options, so results in least offsite sound. The results of the noise modeling at the nearest property lines for the west option are shown in Table 4. This is based on combined operation of all sources at the mid site location. While the equipment layout was optimized differently for this location, the same mitigation options were used for the three options. This is the facility's preferred layout.

Table 2: West Site: Predicted Equipment Sound Levels at Property Lines

Receptor Location	Distance from Equipment (Ft)	Ambient Sound Level Day / Night (L ₉₀)	Verizon HVAC Level (dBA)	Gen Test Level (dBA)	Standard (dBA)
Property Line, West	347	36 / 25	37	39	50
Property Line, North	228	36 / 25	36	44	50
Property Line, East	527	36 / 25	22	37	50
Property Line, South	550	36 / 25	28	38	50

Note: It is customary to conduct all calculations using precise values, but to round the result to whole dBA. All results are rounded to units (dBA).

The second option is south of the residential access road, more distant from the residence, but closer to the eastern property line. The results of the noise modeling at the nearest property lines for the mid option are shown in Table 3. This is based on combined operation of all sources at the mid site location. While the equipment layout was optimized differently for this site location, the same mitigation options were used.

Table 3: Mid Site: Predicted Equipment Sound Levels at Property Lines

Receptor Location	Distance from Equipment (Ft)	Ambient Sound Level Day / Night (L ₉₀)	Verizon HVAC Level (dBA)	Gen Test Level (dBA)	Standard (dBA)
Property Line, West	444	36 / 25	35	38	50
Property Line, North	209	36 / 25	37	44	50
Property Line, East	330	36 / 25	26	42	50
Property Line, South	560	36 / 25	27	35	50



Figure 6:
Project Area Showing the Three Equipment Location Options

The third option analyzed was on a cart path to the east of the residential driveway. It is approximately 150 feet from three adjacent properties. Noise modeling was conducted based on all sources (even the infrequent generator operation) at the nearest property lines. Affected residences are more distant, so will encounter lower sound levels than corresponding property lines. The results of the noise modeling of all combined sources are shown in Table 2. Mitigation options were identified that would bring the equipment into compliance with West Tisbury requirements at this location. It is noted that these calculations are based on worst-case project equipment assumptions during the few hottest days of the summer.

Table 4: East Site: Predicted Equipment Sound Levels at Property Lines

Receptor Location	Distance from Equipment (Ft)	Ambient Sound Level Day / Night (L ₉₀)	Verizon HVAC Level (dBA)	Gen Test Level (dBA)	Standard (dBA)
Property Line, West	444	36 / 25	32	44	50
Property Line, North	209	36 / 25	45	50	50
Property Line, East	330	36 / 25	44	50	50
Property Line, South	560	36 / 25	22	34	50

4.4 Noise Mitigation Assumptions

The HVAC equipment will produce the same sound during the daytime as at night but will operate less frequently at night because of lower temperatures and without direct sunlight exposure. The equipment is never expected to operate continuously as assumed in this study. Approximately once per week, the emergency generator will be tested. This is important for equipment reliability and will involve about one half hour during daytime periods only. The Generator will be installed inside a separate room of the equipment shelter which provides substantial noise reduction compared to freestanding generators. During generator operation, louvers open to allow air to enter the side of the generator room and also allow radiator cooling air to be exhausted from the end of the generator room. In order to meet the requirements of the first location option, active silencers are proposed for both the air inlet and air exhaust louvers. In addition, the engine exhaust system will be upgraded from a critical silencer to a supercritical silencer to reduce the engine exhaust sound. The modeling is based on the mitigated sound from the emergency generator combined with the HVAC sound. The distance to each modeled receptor is shown in the second column of Table 3. The result of the modeling estimate of generator and HVAC sound is also shown along with the potential increase to ambient sound at the receptors.

Additional Noise Mitigation:

The noise modeling demonstrates that the resulting sound levels are well within the West Tisbury standards at the preferred equipment location. However, it is also noted that the ambient levels in this area are quite low. For that reason, an addition noise mitigation measure is added to the design to make the sound from the equipment even less noticeable to existing neighbors. The compound will be installed with a stockade

style security fence. This fence will be lined with a noise barrier blanket in areas near the HVAC and generator radiator exhaust silencer. This will provide significant additional noise reduction at in the southern and western directions. This feature is similar to the installation on Fire Tower Road. The resulting sound levels at property line locations are provided in Table 5.

**Table 5: West Site: Predicted Sound Levels at Property Lines
Preferred Site Configuration with Additional Noise Mitigation**

Receptor Location	Distance from Equipment (Ft)	Ambient Sound Level Day / Night (L ₉₀)	Verizon HVAC Level (dBA)	Gen Test Level (dBA)	Standard (dBA)
Property Line, West	444	36 / 25	29	36	50
Property Line, North	209	36 / 25	36	44	50
Property Line, East	330	36 / 25	22	34	50
Property Line, South	560	36 / 25	19	32	50

5. Conclusions

The potential noise impact of the proposed Wireless Communication Facility was evaluated using measured field data and numerical modeling methods. Ambient sound levels were established by field measurements using equipment that is standardized to the current ANSI standards. Equipment operating sound levels were quantified by using vendor estimates and confirmed by representative field measurement at other installations. Most of the time, the proposed equipment will produce no sound. During typical condition when only the HVAC units will cycle on and off, the resulting sound expected at the property lines will range from 19 dBA to 36 dBA. This is far below the Town's 50 dBA property line criteria. It is also near the existing ambient levels measured at the site so will have a minor effect on the existing quiet conditions of the area.

Infrequently, the proposed equipment will include the once-per-week daytime half-hour testing of the emergency generator. During the test, the sound level is assumed to include the combined sound from the Verizon Wireless HVAC unit, generator exhaust and generator openings in the shelter. For that half hour, the sound at neighboring property lines is expected to range from 32 dBA to 44 dBA. Again, this level is near the daytime ambient levels. In this way, the facility is designed to meet all by-law requirements with a significant margin with the intent of minimizing the effect on the existing quiet conditions at the site.