Environmental Sound Assessment

Wireless Telecommunications Facility

12 Mortimer Road

Boxford, MA

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Prepared For:

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ENVIRONMENTAL SOUND EVALUATION

1. Overview of Project and Site Vicinity

Varsity Wireless plans to develop and operate a telecommunications facility in Boxford, MA at 12 Mortimer Road. The facility includes antennas on a Monopine Tower. Cabling and electronic equipment will be installed inside an equipment shelter at the base of the tower. Verizon Wireless is a proposed tenant of this facility, has engineering details provided in the plans. The tower provides an opportunity for several co-location carriers, but they are not part of this proposal. The purpose of this study is to estimate the proposed facility sound emissions at the fence, property lines and nearest sensitive locations.

The facility is located on a large lot that is open, but is surrounded by forested conservation land and residential parcels. Because of the size of the lot, the equipment will be relatively distant from neighbors compared to many installations. The compound at the base of the tower will be enclosed by an 8 foot fence. Beyond the fence, there is a buffer of distance to the host property line. The operating equipment will be about 400 feet from the nearest residence to the south or east. It is over 350 feet to the residence to the North. And the western property line abuts conservation land. Because of these significant distances, this site is less sensitive to equipment sound than sites which have residential receivers much nearer to the equipment. .

While only one antenna level is under agreement, the tower is designed for additional tenants. Co-locations are encouraged to minimize the building of new towers. For this reason, it is a reasonable expectation that other carriers would find a home on this tower. For that reason, Varsity Wireless has requested an analysis of the full build-out configuration. Modeling Specialties has supported all major carriers in analyzing sound from their equipment, the types and configurations of wireless equipment varies widely from site to site even for the same carrier. For this analysis, we have assumed a full build-out configuration based on the highest sound level that is typical for each carrier. Because of this, the actual installation is expected to produce less sound than predicted here.

A graphic is shown in Figure 1 to show the orientation of the host property and equipment to the neighboring land uses. Figure 2 shows the equipment layout that is proposed as part of this project. Figure 3 adds the elevation references for the proposed equipment.

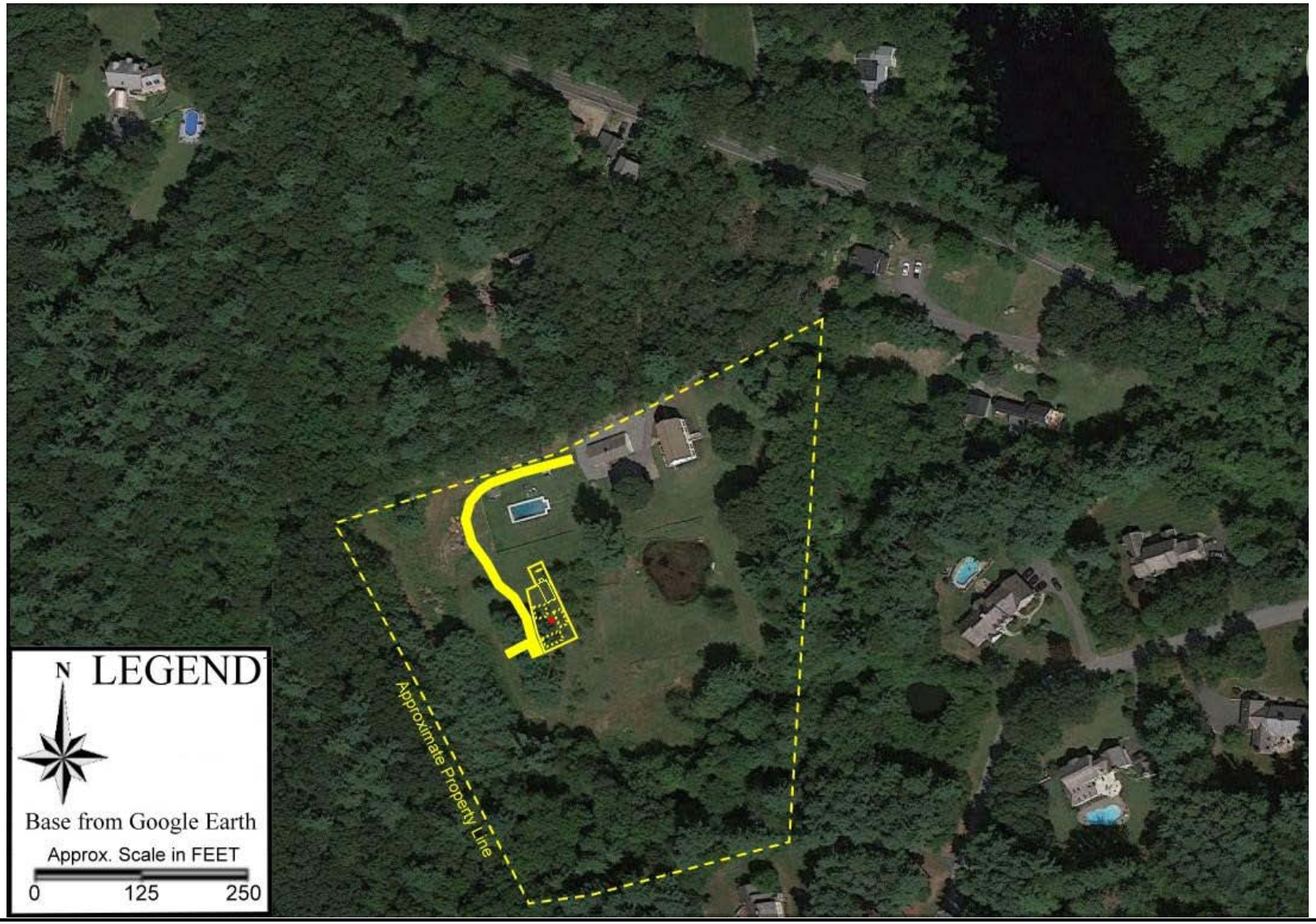

Figure 1
Aerial Photo of the Project Area Showing Site and Area Residences

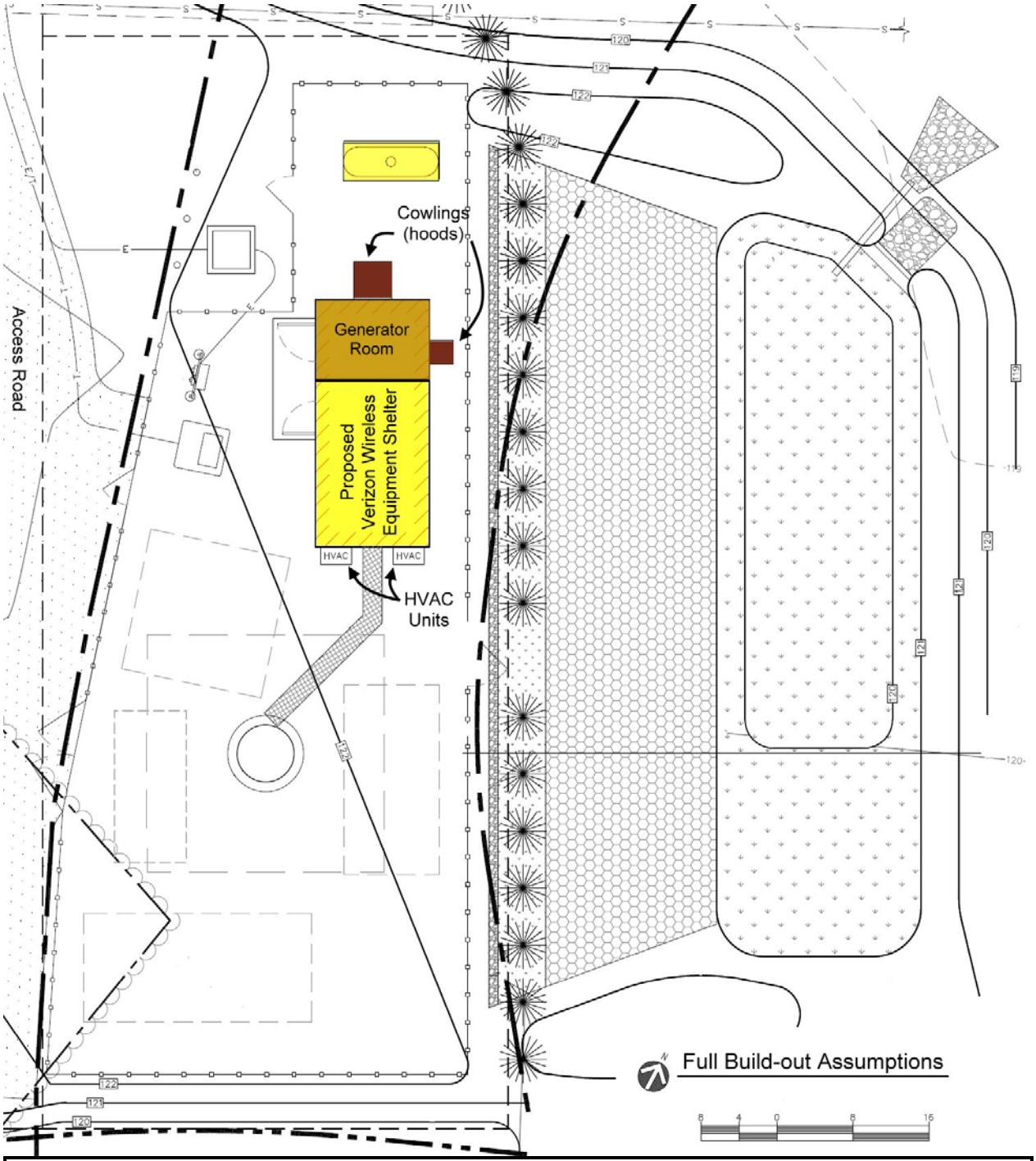

Figure 2
Layout of the proposed Project Site Showing the Pole and Ground Equipment

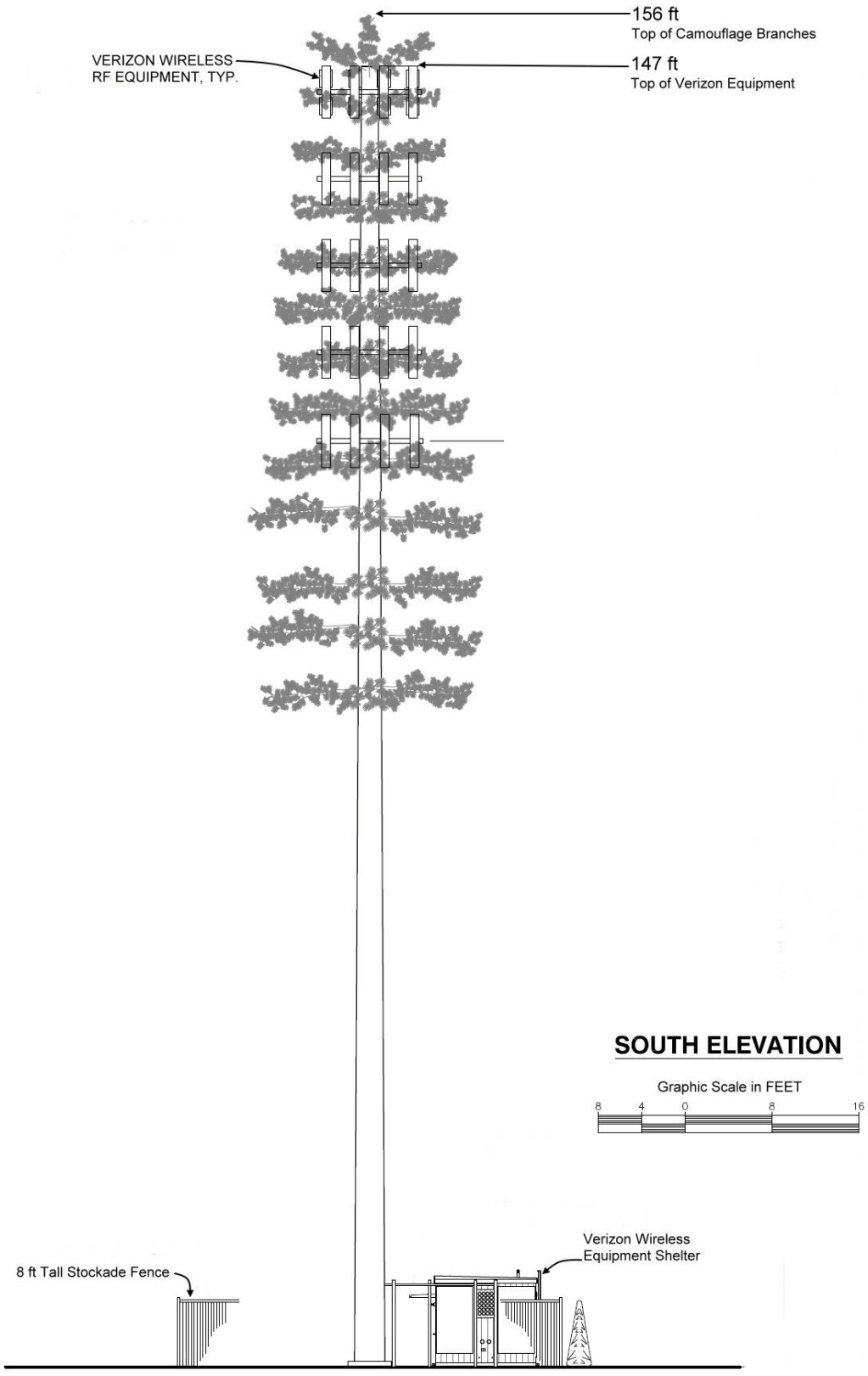

Figure 3
Elevation Drawing of the proposed Project Site Showing the Pole and Ground Equipment

3 Equipment Sound Levels

In order to estimate the facility sound levels, the individual sources of sound must be identified. A computer model (CadnaA) was used to evaluate the combined sound from multiple sources, interaction with the shelters and propagation losses. The estimate of the project sounds is based on conservative sound propagation principles prescribed in acoustics literature as summarized in Table 1. 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 sound from each source is estimated at the source and 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.

Table 1: Modeling Input Parameters

Item	Modeling Input and Description
Terrain	Flat Terrain assumed
Temperature	10^{o}C
Relative Humidity	70%
Weather Condition	6.5 mph, directly from facility to receptor*
Ground Attenuation	0.4, soft ground (0.5 = soft ground, 0.0 = pure reflection)
Atmospheric Inversion	CONCAWE – Category F**
# of Sound Reflections	2
Receptor Height	1.5 meter above ground level

** Propagation calculations incorporate the adverse effects of certain atmospheric and meteorological conditions on sound propagation, such as gentle breeze of 1 to 5 m/s (ISO 1996-2: 1987) from source to receiver. **CONCAWE – Category F indicates the presence of stable atmosphere that promotes sound propagation.*

Environmental Control Equipment. A proposed equipment shelter will house electronics that are environmentally sensitive. Environmental control units will maintain the necessary conditions in the shelter. A pair of wall mounted HVAC units will maintain a safe temperature inside the shelter. The sound is emitted only when the condensers are operating, so that is presented here to represent the worst-case HVAC sound emissions. It would seldom operate during cool or cold seasonal conditions.

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 30 kW standby generator unit manufactured by Generac and is powered by a 3.2 liter gas (LP) powered engine. Since the generator is mounted inside the shelter with mitigation applied, the specific generator model will not affect the sound emission significantly.

1. Sound Level Estimate

To calculate the nighttime level, the sound from the condenser equipment is modeled at community receptor locations. The results of the modeling are shown in Table 2 for periods when the 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.

The condensers will produce the same sound during the daytime as at night but tend to operate less frequently without direct sunny conditions. The equipment is never expected to operate continuously as assumed in this study. The results of Table 1 represent the few times in the summer when the unit will need to cycle on and off during the quietest hours of the night.

Technical drawings and photos were used to define elevations of equipment and receptors. No terrain effects were included in this conservative analysis. Figure 5 shows both the discrete modeling location and sound contour details that are expected during the equipment operation.

Noise Mitigation Assumptions

There are several notable mitigation measures in place to achieve the low sound levels shown above. The emergency generator will be installed inside a separate room of the shelter whose walls will effectively shield the direct generator sound. There are two louvered openings in the generator room walls that will open to allow fresh air in and radiator cooling air out. The radiator exhaust opening will be fitted with metal cowlings (downward turned hoods). The generator exhaust stack on the shelter roof will be installed with an upgraded silencer to reduce its sound to match the benefits of the hoods. These features are incorporated in the modeling.

7 Conclusions

Sound level modeling was conducted to simulate the sound emissions at the Boxford site of the proposed telecommunications facility. Conservative assumptions were made based on the proposed plans provided by Varsity Wireless. The reported levels are only based on the proposed equipment from Varsity Wireless and Verizon Wireless. During the generator test, the sound is expected to be 31 dBA or less at all offsite residence.

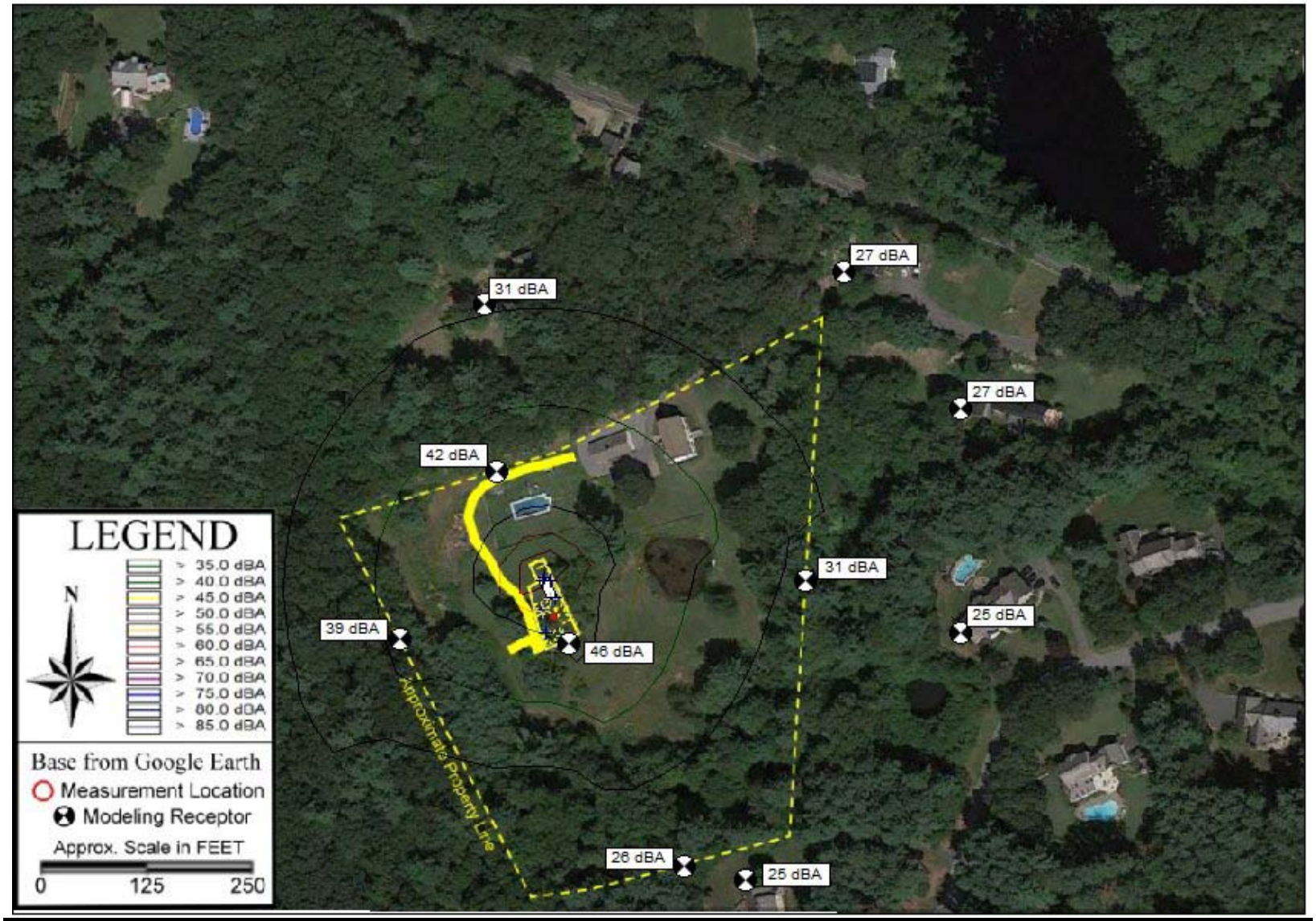

Figure 4
Aerial Photo of the Project Area Showing Site and Area Residences

APPENDIX A: SOUND ANALYSIS BASED ON FULL BUILD-OUT

1. Overview of study assumptions

Verizon Wireless is the only current tenant for the proposed tower. But the tower is designed to support five tenants. Co-locations are encouraged to minimize the building of new towers. For this reason, it is a reasonable expectation that other carriers would find a home on this tower. Varsity Wireless has requested an analysis of the full build-out configuration. Modeling Specialties has supported all major carriers in analyzing sound from their equipment, the types and configurations of wireless equipment varies widely from site to site even for the same carrier. For this analysis, we have assumed a full build-out configuration based on the highest sound level that is typical for each carrier. Because of this, the actual installation is expected to produce less sound than predicted here. Figure A-1 shows the equipment compound assumed in this modeling study.

Based on hundreds of similar sites that have been analyzed, Verizon Wireless is often the only carrier that installs an emergency generator. But at some sites, AT&T also provides an emergency generator. So a second generator is assumed in this study. Figure A-2 is a field image of a site that includes a Verizon Wireless shelter right next to an AT&T shelter. At this reference site, the AT&T shelter is not supported by its own generator.

T-Mobile and MetroPCS generally use freestanding equipment cabinets instead of equipment shelters. These cabinets have fans that move air vertically through the cabinet for cooling. Unlike the wall-mounted condensers on the equipment shelters, these fans tend to be continuously operating. They can often be heard up to about 75 feet, depending on the quietness of the ambient condition. The do not contribute significantly to the sound at hundreds of feet away as are the nearest residences for this site. A field image of this type of cabinet is shown in Figure A-3

Other carriers like Sprint and MediaONE, use even smaller cabinets to house their electronic support equipment. These cabinets take several forms. Some have small fans to move air through the cabinets. Others do not have fans, so are silent. In either case, they have no potential to affect the sound field hundreds of feet from the equipment.

Based on a typical Build-Out scenario, the sound field from the combined facility will be dominated by wall-mounted HVAC equipment that is similar in size and design to residential air conditioning units. Once a week for about ½ hour, the facility sound includes sound from the generator(s). The modeling summary for the combined condition is provided in Figure A-5.

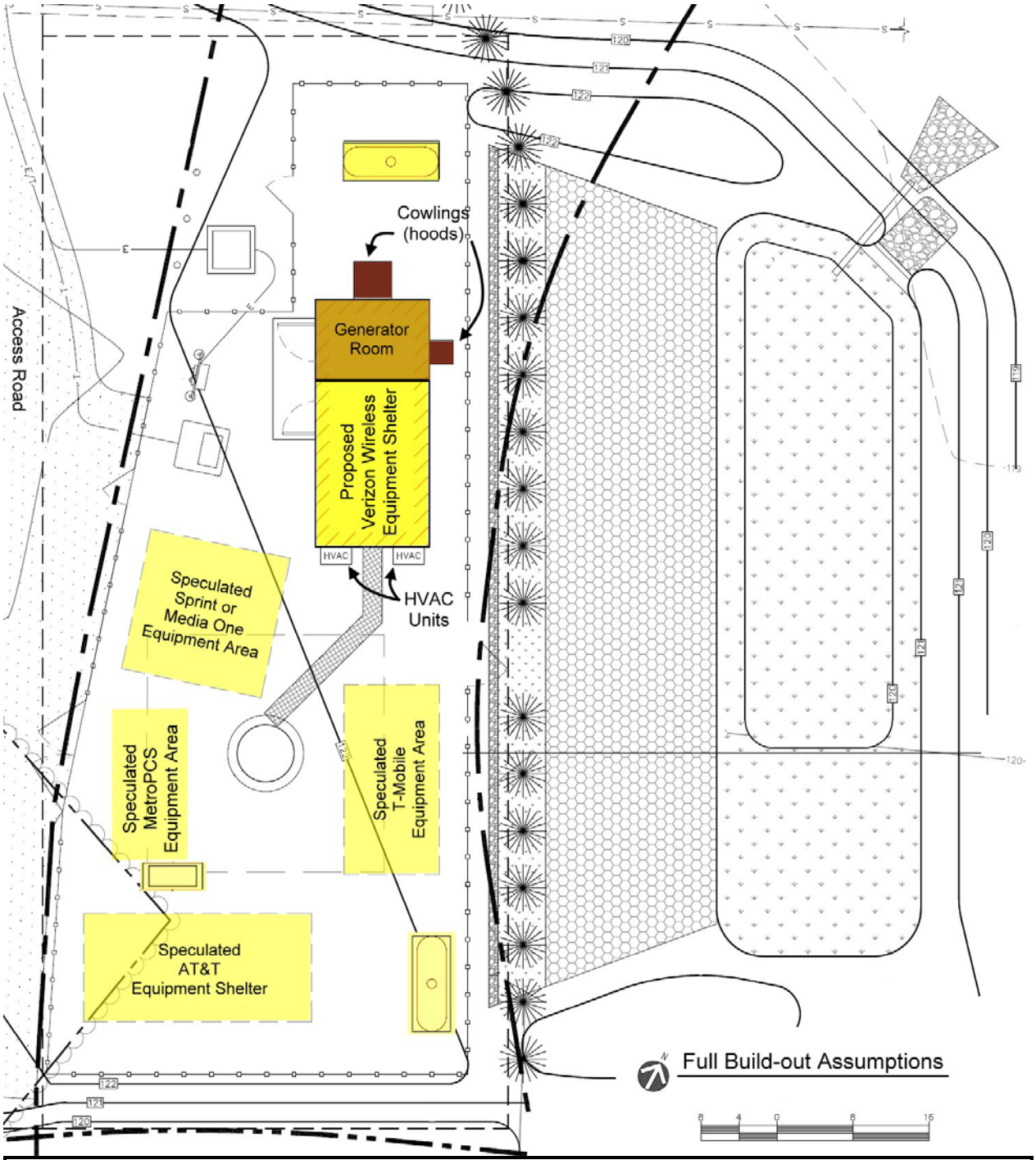

Figure A-1
Layout of the Analyzed Full Build-out Project Scenario

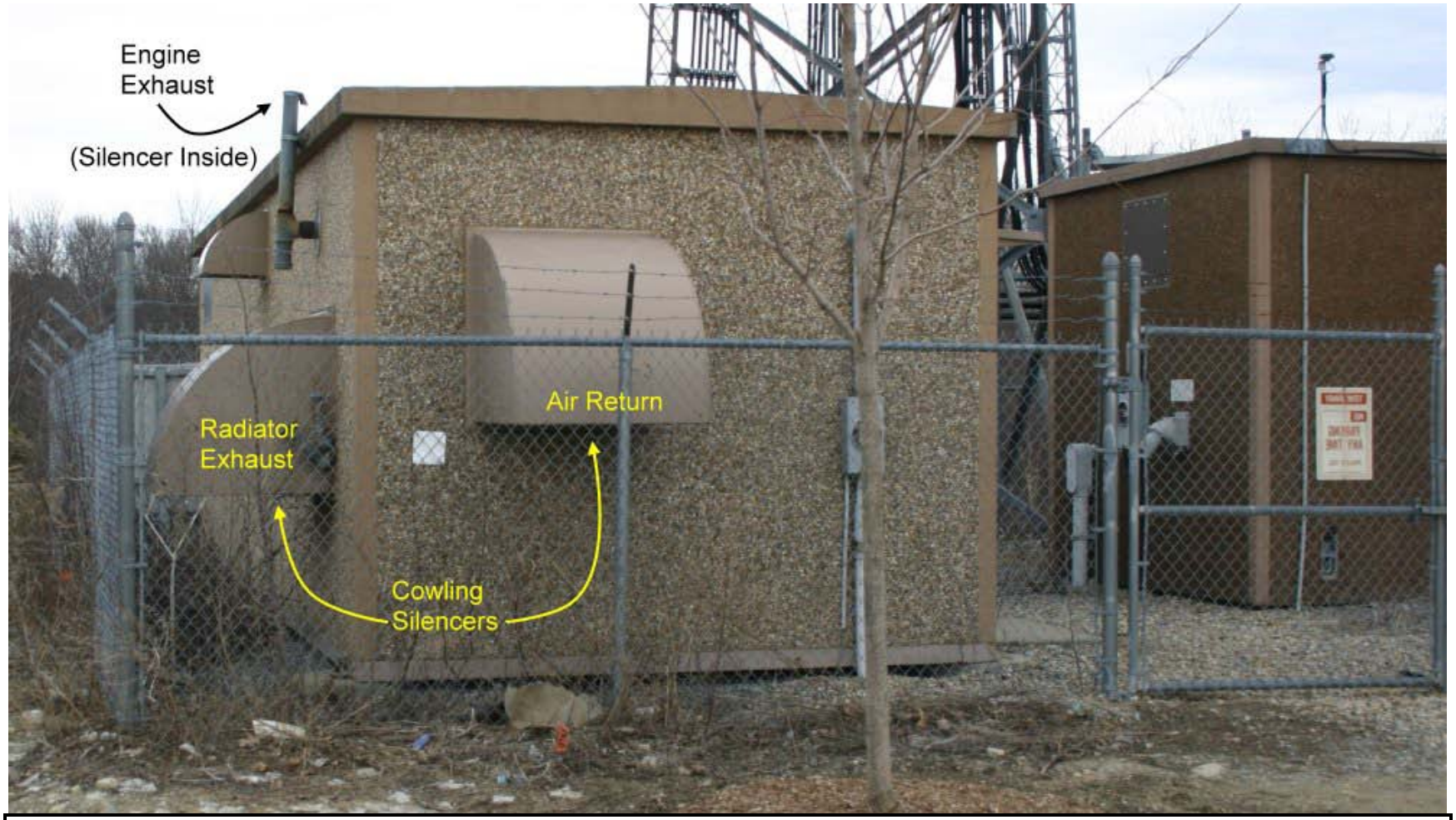

Figure A-2
Field Image of Equipment Shelters used by Verizon Wireless (with generator) and AT&T (on right)

Figure A-3
Field Images of BTS Equipment used by T-Mobile. MetroPCS uses similar cabinets.

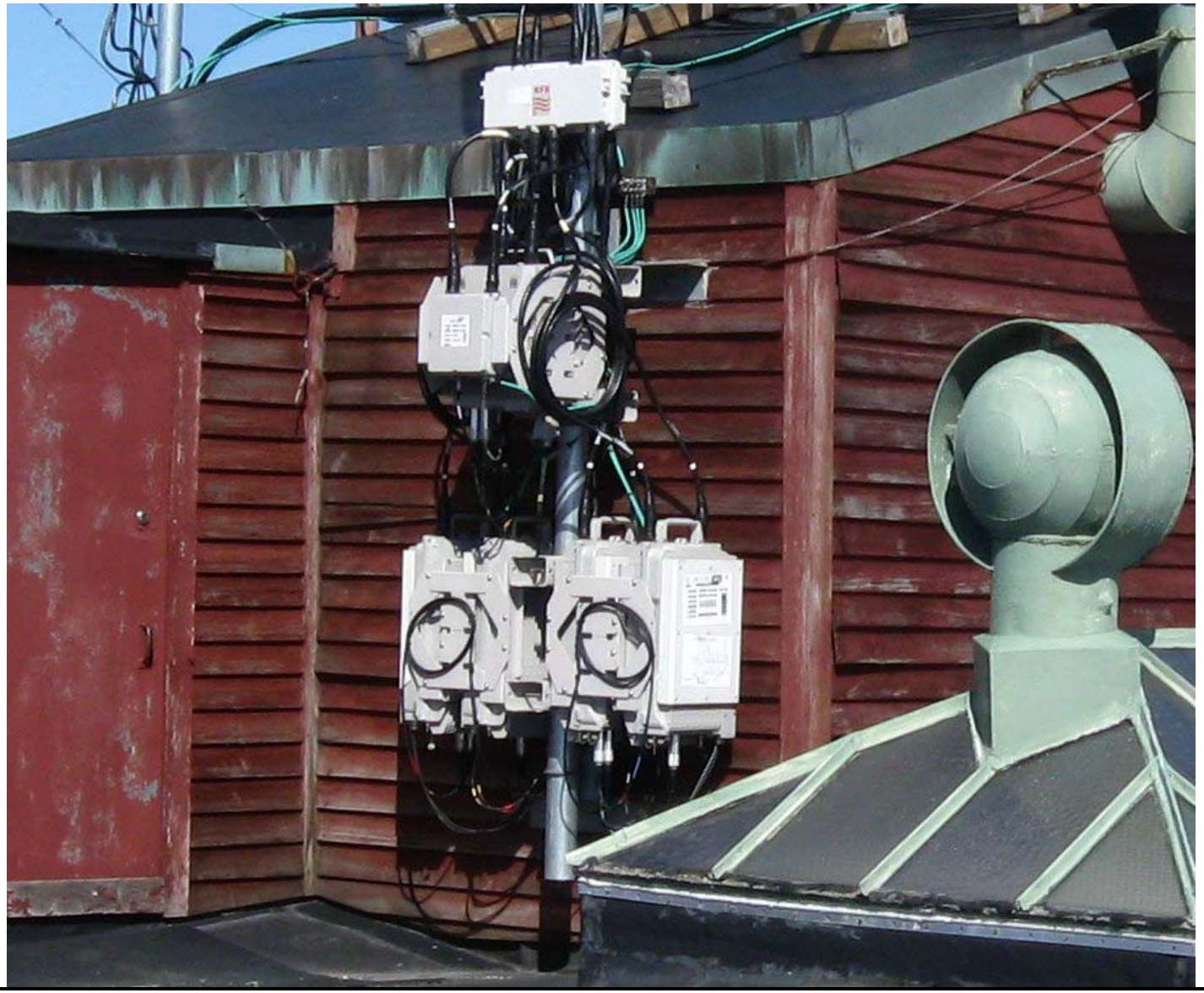

Figure A-4
Field Images of Small Cabinets used by Sprint or Media One

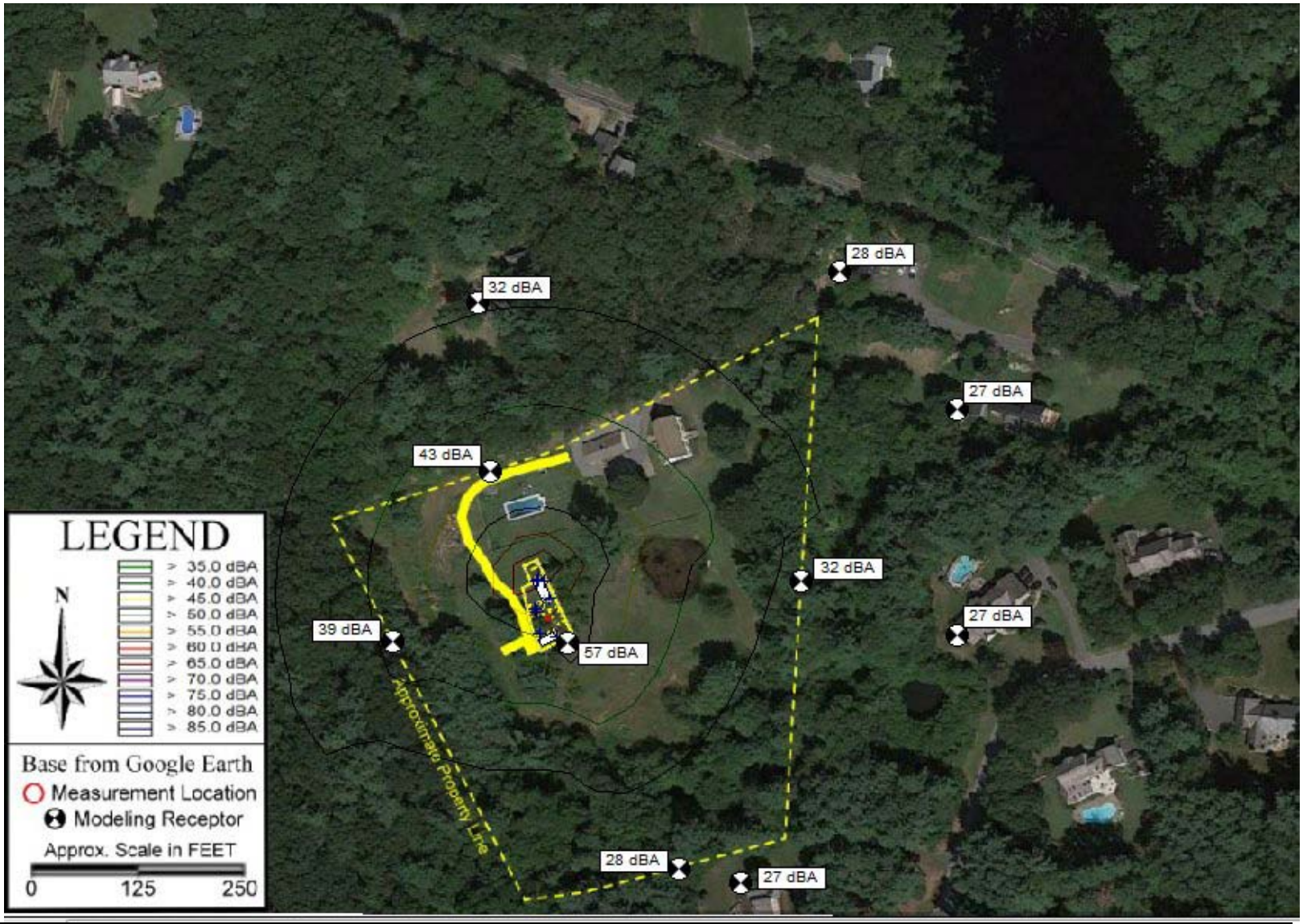

Figure A-5
Summary of Expected Sound Levels from the Full-Buildout Condition