



Memorandum

To: GMP Georgia Substation Project File

Date: April 3, 2026
Project #: 58901.00From: Sam Nadeau, Project Air Quality and Noise Analyst
Chris Bajdek, Director of Noise and Vibration
Re: Section 248 Sound Assessment

Introduction

Green Mountain Power ("GMP") is proposing to rebuild and upgrade their existing substation facility located at 2066 Ballard Road in Georgia, Vermont ("the Project"). VHB conducted a sound assessment of the existing and future noise conditions for the proposed updates at the Project site. The existing sound condition was determined using sound monitoring conducted by VHB at and around the Project site. This assessment includes a summary of the ambient sound monitoring, modeling of the future sound conditions with the planned improvements proposed by GMP, and an evaluation of the potential for undue sound conditions from the Project. This evaluation does not include an assessment of interim conditions, during which a temporary substation would be in place during the rebuild.

Project Description

The Project consists of upgrading the existing substation equipment and retiring obsolete equipment in order to increase the reliability of service and improve substation safety and operability for the towns of Georgia, Milton, and St. Albans. The upgrades to the substation yard will include new 34.5 kV and 12.47 kV equipment, a new expanded substation yard, new fence, oil containment system, security, lights, animal fence, surface material, new access drive, and ground grid. This includes, among other things, installation of a new transformer, circuit breakers, circuit regulators, remote terminal unit, switches, a new 18' x 28' control building, and other standard equipment to upgrade the existing substation with modern substation equipment. The overall height of the substation equipment will be approximately the same, and the fenced substation yard will increase from approximately 6,014 square feet to approximately 13,862 square feet. Additionally, the permanent access drive is proposed along the northern fence line of the rebuilt substation, which will facilitate access to the temporary substation yard and the transmission line serving the east side of the substation. The construction of the new access drive will require removal and/or trimming of existing vegetation north of the proposed access drive expansion. Vegetation trimming and/or removal to the west of the rebuilt substation will be required to provide access to the eastern portion of the Project, maintain the safety and reliability of the existing distribution lines west of the substation, as well as to facilitate safe sight lines for vehicles exiting the Project site. The Project will involve removal, replacement, and new overhead pole structures that are described in more detail, as the overall Project is, in the pre-filed testimony of John Fiske.

Sound conditions of the proposed Project are compared to ensure accordance with 30 VSA Section 248 requirements and in support of GMP's anticipated petition to the Vermont Public Utility Commission ("PUC") for a Certificate of Public Good ("CPG") for the Project.

Regulatory Context

World Health Organization Guidelines

The World Health Organization (WHO) has “Night Noise Limits for Europe” guidelines which do not constitute a regulation or requirement. This guideline is generally considered to be the most stringent restriction of nighttime sound. Based on research of nighttime noise effects, WHO recommends a target outdoor night noise guideline (NNG) level of 40 dBA to protect the public, including the most vulnerable groups such as children, the chronically ill, and the elderly. An outdoor nighttime noise level of 55 dB is recommended as an interim target for countries where the NNG cannot be achieved in the short term for various reasons, and where policymakers choose to adopt a stepwise approach. This noise limit is applied outside residential buildings where nighttime noise may cause an effect to people.

American National Standards Institute Noise Standard

The American National Standards Institute (ANSI) Standard S12.9 Parts 4 and 5 (2017), “American National Standard Quantities of Procedure for Description and Measurement of Environmental Sound – Part 4: Noise Assessment and Prediction of Long-term Community Response” and “Part 5: Sound Level Descriptors for Determination of Compatible Land Use” specify methods to assess environmental sounds and predict potential annoyance response of a residential community to long-term outdoor noise. This is a general noise guideline that is often used to evaluate noise from energy facilities; however, there is no regulatory requirement for the Project to meet this noise standard. The ANSI sound standard accounts for the characteristics of the sound, such as tonality, onset rate, impulsivity, time of day, and day of week. A 5 dB penalty is applied to sounds that are tonal, as they tend to produce higher levels of annoyance than broadband sounds at the same level. Since the Project has the potential to cause tonal conditions and would operate at night, an exterior nighttime noise limit of 40 dBA (Leq) for residential buildings has been used to evaluate the potential noise impact due to the transformer.

Town of Georgia

Since the Town of Georgia, Vermont has no quantitative noise limits applicable to the proposed Project, operational noise levels due to the proposed Project were evaluated against the WHO Guidelines, ANSI Noise Standards, and measured existing conditions.

Noise Monitoring

In April of 2023, VHB conducted noise monitoring at the existing GMP substation site in Georgia, Vermont. Noise monitoring included six short-term (approximately 10 to 15 minutes) measurements and one long-term measurement (a duration of approximately 3 days) to establish the ambient sound levels around the substation fence line and at a roughly equivalent distance to the closest noise-sensitive receptor. The noise measurements were conducted from April 6 to April 9, 2023. Measurements were conducted using a sound level meter meeting Type I accuracy according to ANSI Standard S1.4 "Specifications for Sound Level Meters." The sound level meter was calibrated in the field prior to and following measurements for both short- and long-term in addition to annually by a laboratory traceable to the National Institute of Standards and Technology. **Figure 1** shows the measurement locations around the Project site.

The sound measurement data includes one-second time histories and overall period results including A-weighted and one-third octave band sound levels. Measurement results include the minimum, maximum, energy-average (Leq), and sound level statistics such as the L10, L50, and L90. For constant sources of sound, such as transformers, the sound level statistic, L90, can be used to characterize the sound emissions. The L90 sound level excludes transient sources of sound such as cars passing and intermittent sources of sound such as birds or wind. See **Attachment 1** for further background on concepts of sound.



Path: \\vhb\gis\proj\SBurlington\58901.00 GMP Georgia Sound\Project\GMP_Georgia_Substation_Figure\GMP_Georgia_Substation_Figure.aprx (snadeau, 1/7/2026)



- Measurement Locations
- Short-term
 - Long-term
 - Proposed Substation Site
 - Proposed Transformer

vhb. **Figure 1: Noise Monitoring Locations**
Ballard Road
Georgia, Vermont

Source: Vermont Geodata Portal, NearMap, and VHB 2026.

Short-term Noise Monitoring

VHB conducted short-term noise measurements at six locations around the substation fence line to capture the sound emissions of the existing transformer and substation on April 9, 2023. During these measurements, atmospheric conditions did not adversely affect the measured values with low wind speeds and no precipitation. Around the fenced perimeter of the substation (Sites 1 through 4) with the transformer equipment operating, sound levels ranged from 47.6 dBA to 58.1 dBA (L90). This is a function of the orientation of the transformer and how far the sound monitor was from the transformer, between 38 to 56 feet apart. Additional measurement sites were conducted slightly further back from the substation fence line on the northern and eastern sides (Sites 5 and 6), about 58 feet away. Sound levels measured there were between 50.9 dBA and 53.8 dBA (L90). **Table 1** presents the measurement results that represent the contribution of both ambient sources and the existing substation.

Table 1 Short-term Sound Measurement Results

Measurement Site	Location	Distance (ft) ¹	Sound Level (L90, dBA)
1	Northern Fence Line	40	58.1
2	Eastern Fence Line	38	54.9
3	Southern Fence Line	43	54.8
4	Western Fence Line	56	47.6
5	Northern Fence Line	58	53.8
6	Eastern Fence Line	58	50.9

Source: VHB, 2023.

¹ Distance between the transformer and the measurement site.

Long-term Noise Monitoring

VHB conducted a long-term monitoring setup near the substation site from April 6 to April 9, 2023. The long-term monitoring was conducted continuously through the day and night to capture ambient sound when other sources of noise are generally quieter. The monitoring location was approximately 850 feet away from the transformer. Wind speeds exceeded 11 mph during daytime hours on April 7, otherwise the atmospheric conditions did not adversely affect the long-term monitoring setup as wind speeds were less than 11 mph for the majority of the balance of the monitoring period, and there was no precipitation. It should be noted that equipment from the nearby battery energy storage system (BESS) facility was audible in the long-term data. The long-term hourly sound levels ranged from 29.3 dBA to 39.5 dBA (L90), excluding periods with winds above 11 mph. During the nighttime (10:00 PM to 7:00 AM), hourly sound levels ranged from 30.1 dBA to 39.2 dBA (L90). The daytime (7:00 AM to 10:00 PM) ambient hourly sound levels ranged from 29.3 dBA to 39.5 dBA (L90). Sound measurement results by hour for the long-term measurement are included in **Attachment 2**.

Sound Modeling Methodology

VHB prepared a sound model of the proposed transformer using Cadna-A¹ sound prediction software. CadnaA is an internationally accepted sound prediction program that implements the International Standards Organization (ISO) 9613 (2024) sound propagation standard. The noise prediction model accounts for the sound emissions of equipment, ground cover, terrain, reflected sound (three orders of reflection), and intervening objects such as buildings or barriers. Sound propagation was assumed to occur over acoustically “soft” ground (G=1.0). Majority of ground at the substation would be crushed stone, assumed to be acoustically “mixed” ground (G=0.6)² while the concrete equipment pad and local roadways were modeled as acoustically “hard” ground (G=0.0). Receptors were modeled at the facades of the closest residences.

The Project will include the reconstruction of the current Georgia substation including the replacement of the transformer.³ The proposed 10/14 MVA 34.5kV x 12.47kV transformer sound test guaranteed a sound level of 61 dBA. In order to model a transformer as a source of sound, a sound power level must be assigned in Cadna-A. Sound power levels for transformers are calculated using the specified sound pressure level, the height of the transformer and the path length of a specified perimeter around transformer⁴. The standard for a transformer utilizes the following equation:

$$L_W = L_{p,spec} + 10 \log_{10} S \quad [Equation 1]$$

Where S is an imaginary surface surrounding the transformer with surface area equal to:

$$S = 1.25 * D_p * H \quad [Equation 2]$$

D_p is the specified perimeter in meters and H is the height of the transformer in meters.

To determine the sound power level of the transformers [Equation 1 above], their physical size is required. The size of the proposed transformer was estimated to be 2.4 m wide, 4.7 m deep and 3.1 m high, which results in a sound power level emission of 81.6 dBA. The full spectra data used in the sound assessment is presented in **Table 2**.

Table 2 Equipment Sound Level Emissions

Equipment ID	Overall	Sound Power Level (dBA) by Octave Band Center Frequency (Hz)								
	dBA	31.5	63	125	250	500	1000	2000	4000	8000
Transformer ¹	81.6	36.2	42.3	66.4	74.8	79.5	72.6	64.9	57.7	50.9

¹ OTC Services - Transformer Test Report, Serial No. 62092N24001, February 17, 2024. Sound level spectrum was calculated using the “transformer plus fans” curve shown in Figure 35-1 in C.M. Harris (ed.), Handbook of Acoustical Measurements and Noise Control, Third Edition, McGraw-Hill p. 35.2, 1991.

¹ DataKustik GmbH, 2025. Computer Aided Noise Abatement Model.

² Kaliski, et al, “An overview of sound from commercial photovoltaic facilities,” Proceedings of Noise-Con, 2020.

³ Note that while a temporary substation will be utilized for the duration of construction, only the permanent substation was analyzed for the purposes of this sound assessment.

⁴ IEEE C57.12.90-2015.

Sound Modeling Predictions

Sound levels were predicted for the proposed equipment to evaluate the potential for undue sound conditions from the Project. **Figure 2** presents the predicted sound level contours (i.e. lines of constant sound level) from the transformer between 10 dBA and 40 dBA. The closest receptor, R2 at 1900 Ballard Road, had the maximum predicted sound level from the Project of 15.9 dBA. Because the sound levels from the ambient monitoring were 29.3 dBA or above, the contribution of the Project will be negligible. At other receptors in relative proximity of the substation along Ballard Road and Sodom Road, the Project sound level contributions would range from 9.3 to 10.6 dBA. These levels are more than 10 dBA below the ambient noise monitoring sound levels, therefore the Project would not increase sound levels in this area of Georgia, Vermont.



Path: \\vhb\gis\proj\SBurlington\58901.00 GMP Georgia Sound\Project\GMP_Georgia_Substation_Figure\GMP_Georgia_Substation_Figure.aprx (snadeau, 1/22/2026)

- Sound Level Contours ● Receptors
- 10 dBA
 - 20 dBA
 - 30 dBA
 - 40 dBA

vhb. **Figure 2: Operational Sound Contours**
Ballard Road
Georgia, Vermont

Source: Vermont Geodata Portal, NearMap, and VHB 2026.

Conclusions

VHB conducted a noise analysis to evaluate the proposed improvements at the GMP Georgia substation located in Georgia, Vermont. The planned improvements include the demolition and reconstruction of the existing facility and replacing the existing transformer with a new 10/14 MVA and 34.5/12.47 kV transformer. VHB's noise analysis included both short-term and long-term noise monitoring at the site and a noise model using CadnaA software to predict the sound emissions from the proposed Project. The existing daytime sound levels at the long-term measurement site ranged from 29.3 dBA to 39.5 dBA (L90) and from 30.1 dBA to 39.2 dBA (L90) during the nighttime. Long-term monitoring occurred approximately 850 feet away from the existing transformer, which is roughly equivalent to the distance of the nearest noise-sensitive receptor.

From the noise modeling effort, the maximum predicted sound levels of the proposed Project would be 15.9 dBA at the closest residential building (R2 at 1900 Ballard Road). The Project contribution is less than the sound level limit of 40 dBA, which had been established for the Project, based upon ANSI Standard S12.9 Parts 4 and 5 (2017), since the locality does not have any applicable sound level limits. The Project levels are also more than 10 dBA below the ambient sound levels at the closest residence, therefore the Project would not increase sound levels in this area of Georgia, Vermont, and the proposed Project will not cause undue sound conditions according to Section 248.

Attachments:

1. Sound Level Concepts
2. Sound Measurement Results

Attachment 1: Sound Level Concepts

Sound is the rapid fluctuations of air pressure above and below ambient pressure levels. Noise is defined as unwanted or excessive sound. Sound becomes unwanted when it interferes with normal activities such as sleep, work, communication or recreation. How people perceive sound depends on several measurable physical characteristics including:

Sound Level - Sound level is based on the amplitude change in pressure and is related to the loudness or intensity. Human hearing covers a wide range of changes in sound pressure amplitude. Therefore, sound levels are most often measured on a logarithmic scale of decibels (dB) relative to 20 micro-pascals. The decibel scale compresses the audible range of acoustic pressure levels, which can vary from the threshold of hearing (0 dB) to the threshold of pain (120 dB). Because sound levels are measured in dB, the addition of two sound levels is not linear. For example, adding two equal sound levels results in a 3 dB increase in the overall level. Research indicates the general relationships between sound level and human perception are as follows:

- A 3-dB increase is a doubling of acoustic energy and is approximately the smallest difference in sound level that can be perceived in most environments.
- A 10-dB increase is a tenfold increase in acoustic energy and is generally perceived as a doubling in loudness to the average person.

Frequency - Sounds are comprised of acoustic energy distributed over a range of frequencies. Acoustic frequencies, commonly referred to as tone or pitch, are typically measured in Hertz. Human hearing generally ranges from 20 to 20,000 Hz; however, the human ear does not perceive sound levels from each frequency as equally loud. To compensate for this phenomenon in perception, a frequency filter known as A-weighting is commonly used to evaluate environmental noise levels and sound levels are denoted as "dBA".

- Sound levels reported in octave or one-third-octave frequency bands are often used to describe the frequency content of different sounds. Some sources of sound can generate "pure tones" which is when there is a concentration of sound within a narrow frequency range such as a whistle. Humans can hear pure tones very well and such conditions can be a cause of increased annoyance.

A variety of sound level descriptors can be used for environmental noise analyses. These descriptors relate to the way sound varies in level over time. The following is a list of common sound level descriptors:

- **Statistical Sound Levels** – Sound level metrics, such as L_{10} , L_{50} or L_{90} , represent the levels that are exceeded for a particular percentage of time over a given period. For example, L_{10} is the level that is exceeded for 10 percent of the time. Therefore, it represents the higher end of the range of sound levels. The L_{90} , on the other hand, is the level that is exceeded 90 percent of the time, and therefore, is representative of the background sound level and of constant sources of sound that are present.
- **Equivalent Continuous Sound Level (Leq)** - Leq is a single value, which represents the same acoustic energy as the fluctuating levels that exists over a given period of time. The Leq takes into account how loud noise events are during the period, how long they last, and how many times they occur. Leq is commonly used to describe environmental noise and relates well to human annoyance.
- **Day-night Average Sound Level (Ldn)** - Ldn is similar to the Leq in that it is a single value, which represents the same acoustic energy as the fluctuating levels, that exists over a 24-hour period. The Ldn takes into account how loud sound events are, how long they last, how many times they occur over a 24-hour period, and whether they occur during the day (7:00 AM to 10:00 PM) or night (10:00 PM to 7:00 AM). Sound that occurs during the night is given a 10-dB penalty to account for the increased human sensitivity to noise at night. If sound levels are constant over a 24-hour period, the Ldn level is 6.4 dB greater than the Leq level due to the 10-dB nighttime penalty.
- **Maximum Sound Level (Lmax)** – Many sources of sound, including mobile sources and stationary sources, change over time. It is common to describe sound in terms of the maximum (Lmax) sound level emissions. The following figure presents a list of the maximum sound levels of common outdoor and indoor sources.

Common Outdoor and Indoor A-weighted Sound Levels

Outdoor Sound Levels	Sound Pressure (μ Pa)*		Sound Level dB(A)**	Indoor Sound Levels
	6,324,555	-	110	Rock Band at 5 m
Jet Over Flight at 300 m		-	105	
	2,000,000	-	100	Inside New York Subway Train
Gas Lawn Mower at 1 m		-	95	
	632,456	-	90	Food Blender at 1 m
Diesel Truck at 15 m		-	85	
Noisy Urban Area—Daytime	200,000	-	80	Garbage Disposal at 1 m
		-	75	Shouting at 1 m
Gas Lawn Mower at 30 m	63,246	-	70	Vacuum Cleaner at 3 m
Suburban Commercial Area		-	65	Normal Speech at 1 m
	20,000	-	60	
Quiet Urban Area—Daytime		-	55	Quiet Conversation at 1 m
	6,325	-	50	Dishwasher Next Room
Quiet Urban Area—Nighttime		-	45	
	2,000	-	40	Empty Theater or Library
Quiet Suburb—Nighttime		-	35	
	632	-	30	Quiet Bedroom at Night
Quiet Rural Area—Nighttime		-	25	Empty Concert Hall
Rustling Leaves	200	-	20	
		-	15	Broadcast and Recording Studios
	63	-	10	
		-	5	
Reference Pressure Level	20	-	0	Threshold of Hearing

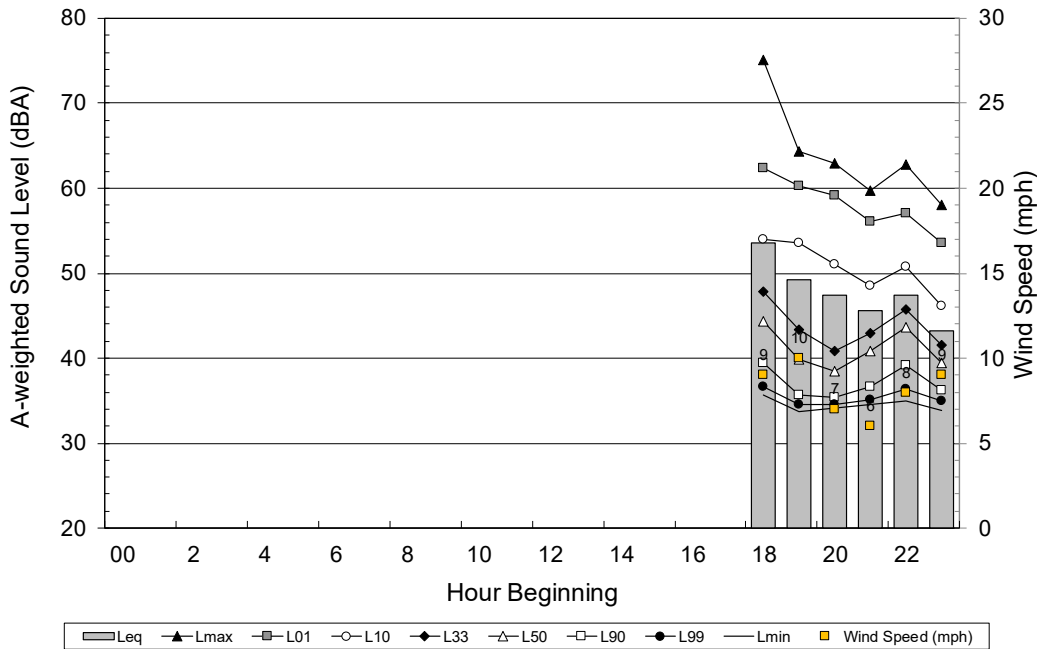
Source: Highway Noise Fundamentals. Federal Highway Administration, September 1980.

* mPA – MicroPascals, which describe pressure. The pressure level is what sound level monitors measure.

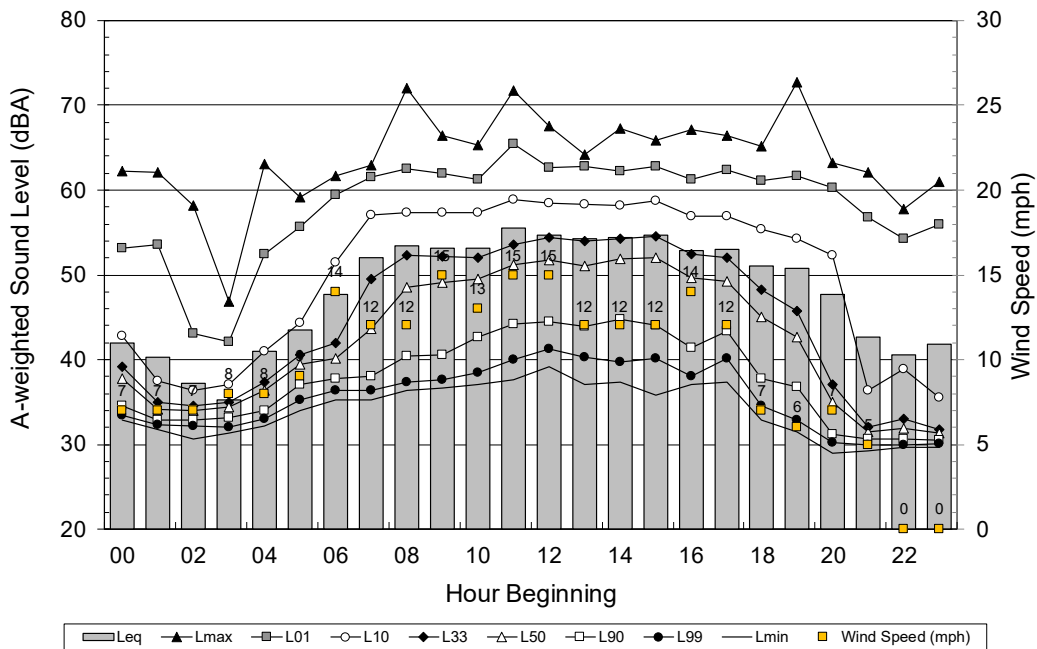
** dB(A) – A-weighted decibels, which describe sound pressure logarithmically with respect to 20 mPa (the reference pressure level).

Attachment 2: Sound Measurement Results

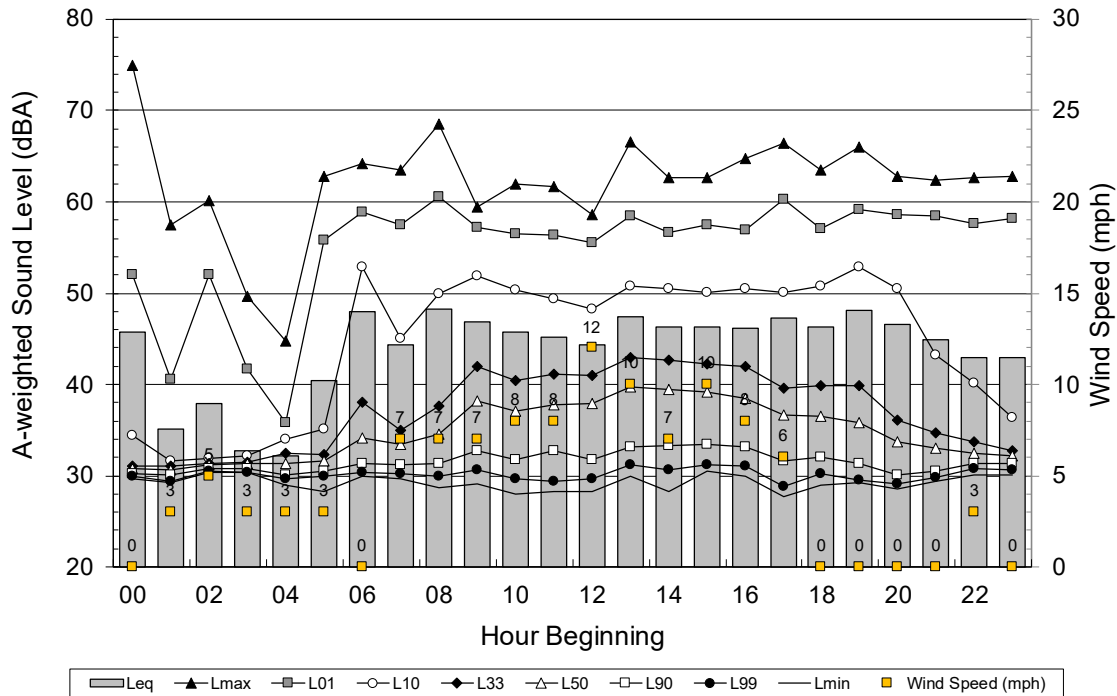
GMP Georgia Substation (04/06/2023)



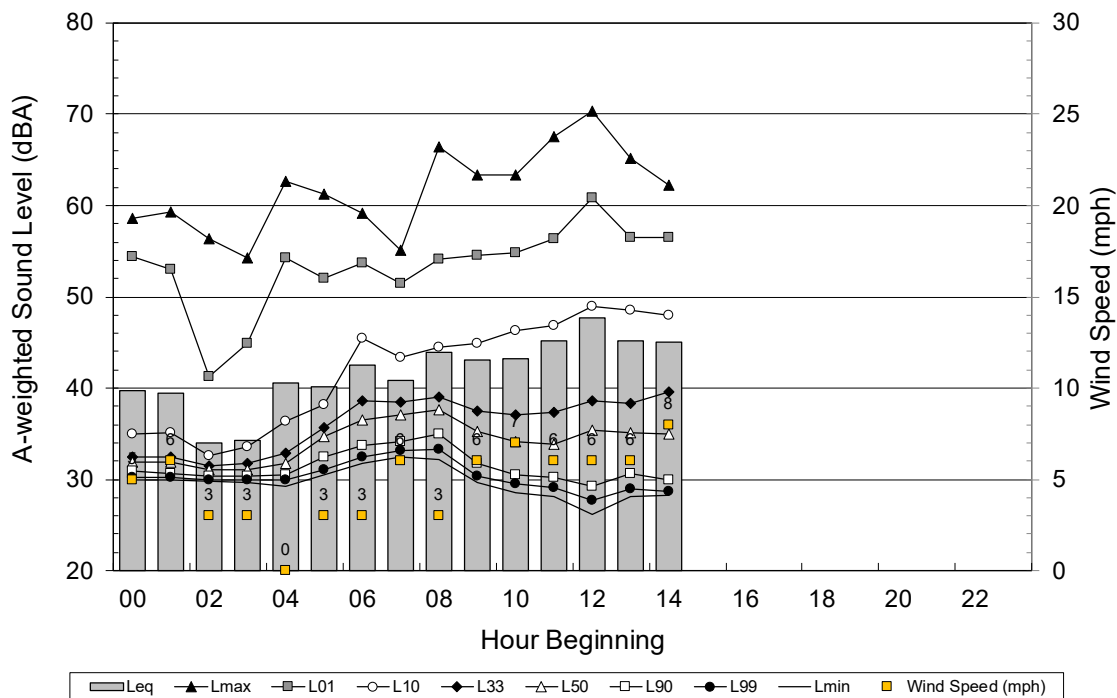
GMP Georgia Substation (04/07/2023)



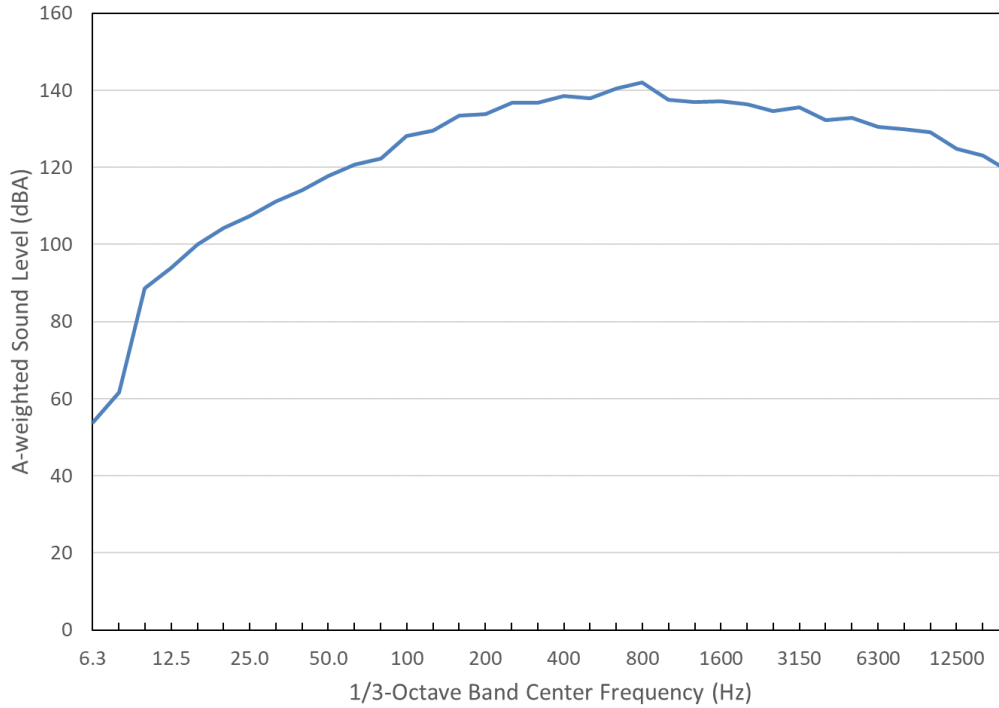
GMP Georgia Substation (04/08/2023)



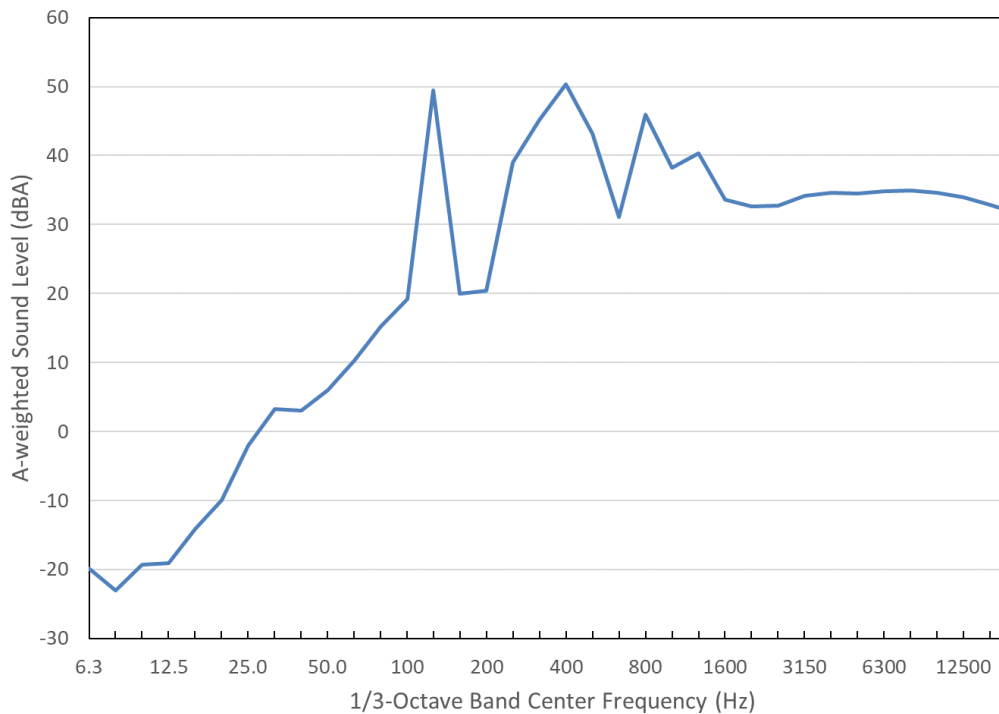
GMP Georgia Substation (04/09/2023)



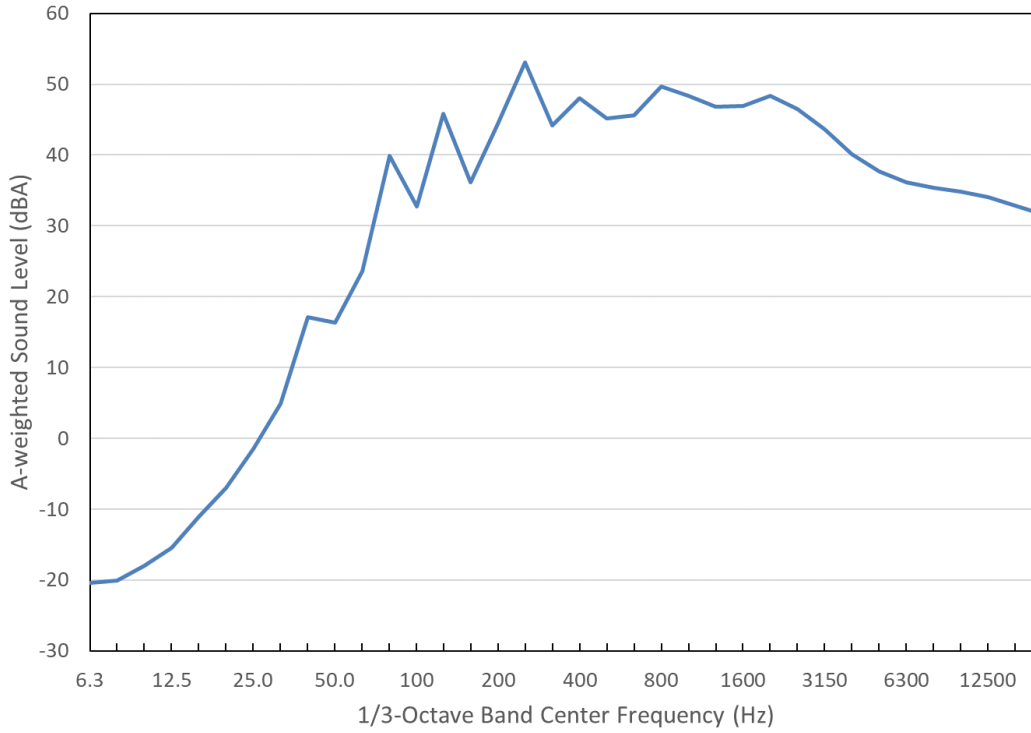
Short-term Measurement Site 1



Short-term Measurement Site 2



Short-term Measurement Site 3



Short-term Measurement Site 4

