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**EXHIBIT 11**  
**NOISE STUDY**

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**REPUBLIC SERVICES COFFIN BUTTE LANDFILL  
NOISE STUDY**

**September 25, 2023**

Prepared For:



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## **1.0 EXECUTIVE SUMMARY**

This Noise Study includes a summary of existing sound levels measured near the proposed expansion area, sound levels produced by equipment currently being used at the landfill, and discussion of applicable regulatory criteria. To assess sound emissions of fill operations in the new area, predictions were made for both beginning grade and maximum future grade conditions. Predicted sound levels included in this Noise Study comply with applicable regulatory criteria without the inclusion of noise mitigation. Although not required to comply with code limits, it is recommended that all backup alarms used on the site be replaced with ambient sensing broadband backup alarms, if permitted by safety regulations.

## **2.0 INTRODUCTION**

This Noise Study evaluates sound levels associated with the proposed expansion of the Republic Services Coffin Butte Landfill (project) located at 28972 Coffin Butte Road in Corvallis, Oregon. The proposed expansion is located on the south side of Coffin Butte Road, directly south of the existing landfill area.

In addition to the landfill expansion, a new 2,160 square foot employee building, scale house access road on the north side of Coffin Butte Road, access road on the south side of the proposed expansion area, and relocation of leachate ponds to support the landfill are proposed.

Equipment operating in the expansion area is anticipated to be similar to existing landfill operations: dozers, excavators, and compactors to move debris, tipping machines used to unload haul vehicles, and truck traffic.

This Noise Study includes a summary of sound level measurements made of existing operations and equipment, measurements of existing sound levels near the expansion area, predicted sound levels from future operations in the expansion area, and an analysis of compliance with regulatory criteria.

## **3.0 NOMENCLATURE**

The auditory response to sound is a complex process that occurs over a wide range of frequencies and intensities. The decibel level, or “dB,” is a form of shorthand that compresses this broad range of intensities into a convenient numerical scale. The decibel scale is logarithmic. For example, using the decibel scale, a doubling or halving of energy causes the sound level to change by 3 dB; it does not double or halve the perceived loudness as might be expected.

The minimum sound level variation perceptible to a human observer is generally around 3 dB. A 5 dB change is clearly perceptible, and an 8 to 10-dB change is associated with a perceived doubling or halving of loudness. Common sound pressure levels are reported in Table 3.1. Mathematical descriptors have been developed to provide better assessment of sounds that vary over time and the human response to them.

- Equivalent Sound Level,  $L_{eq}$ , is the level of a constant sound having the same energy content as the actual time-varying level during a specified interval. The  $L_{eq}$  is used to characterize complex, fluctuating sound levels with a single number. Typical intervals for  $L_{eq}$  are hourly, daily, and annually.
- Maximum Sound Level,  $L_{max}$ , is the maximum recorded root mean square (rms) sound level for a given time interval or event.  $L_{max}$  can be defined for two time weightings, “slow” and “fast.” “Slow” uses 1-second time constant, and “fast” uses a 125-millisecond time constant. For transient events of very short duration,  $L_{max}$  “fast” will be greater than  $L_{max}$  “slow.”  $L_{max}$  “fast” is used throughout this report.
- Percentage Sound Level,  $L_{(n)}$  –  $L_{(n)}$ , is the sound level that is exceeded n percent of the time; for example,  $L_{08}$  is the level exceeded 8% of the time.  $L_{25}$  is the sound level exceeded 25% of the time.
- Sound Power Level, PWL or  $L_wA$  (A-weighted PWL), is the amount of energy per second generated by a source, measured in watts. The sound power level (PWL) is a decibel representation with a reference value of 1 pico-watt (pW). Sound power is independent of distance, path, or influence from any nearby surfaces.
- Sound Pressure Level, SPL, correlates with what is heard by the human ear. SPL is defined as the squared ratio of the sound pressure with reference to 20 micropascal (μPa). Sound pressure is affected by distance, path, barriers, directivity, etc. All sound pressure levels referenced in this document utilize this reference pressure.

**Table 3.1 A-Weighted Levels of Common Sounds, dBA**

Sound	Sound Level	Approximate Relative Loudness <sup>1</sup>
Jet Plane at 100 feet	130	128
Rock Music with Amplifier	120	64
Thunder, Danger of Permanent Hearing Loss	110	32
Boiler Shop, Power Mower	100	16
Orchestral Crescendo at 25 feet	90	8
Busy Street	80	4
Interior of Department Store	70	2
Ordinary Conversation at 3 feet	60	1
Quiet Car at Low Speed	50	1/2
Average Office	40	1/4
City Residence, Interior	30	1/8
Quiet Country Residence, Interior	20	1/16
Rustle of Leaves	10	1/32
Threshold of Hearing	0	1/64

1. As compared to ordinary conversation at 3 feet

Source: US Department of Housing and Urban Development, Aircraft Noise Impact Planning Guidelines for Local Agencies, November 1972

#### 4.0 REGULATORY CRITERIA

The project is located within unincorporated Benton County and noise emissions are subject to the Benton County Code (BCC). However, the BCC does not include sound limits applicable to the site. Therefore, sound level limits default to requirements of the Oregon Administrative Rules (OAR).

OAR 340-035-0035 regulates sound emissions from commercial and industrial sound sources and are based on whether the site was previously used as a commercial or industrial site. The site has been used as an industrial site for over 20 years to support existing landfill operations and currently has two leachate ponds, soil stockpiles, and trucks hauling leachate. Based on existing operations at the site it is our understanding that the expansion area will be considered a new industrial or commercial sound source located on a previously used site and will be subject to OAR 340-035-0035(1)(A).

Under OAR 340-035-0035(1)(A) sound levels from the proposed operations could not exceed the levels shown in OAR 340-35-035 Table 8 (see Table 4.1). Additionally, if there is reasonable cause to believe these requirements do not adequately protect the health, safety, or welfare of the public, sound levels generated by the proposed operations would be subject to the octave band sound limits specified in OAR 340-35-035 Table 10 (see Table 4.2).

Sound level limits identified in OAR 340-35-035 Table 8 and OAR 340-35-035 Table 10 are only enforced at noise sensitive properties, which are defined in OAR 340-035-0015(38) as follows:

*“Noise Sensitive Property” means real property normally used for sleeping, or normally used as schools, churches, hospitals or public libraries. Property used in industrial or agricultural activities is not Noise Sensitive Property unless it meets the above criteria in more than an incidental manner.”*

Measurement locations used to enforce these sound limits are 25 feet towards the noise source from the point of the noise sensitive building nearest the noise source, or at the point on the noise sensitive property line nearest the noise source, whichever is further from the noise source.

**Table 4.1** OAR Hourly Sound Limits, dBA

Noise Metric	7:00 AM to 10:00 PM	10:00 PM to 7:00 AM
L <sub>50</sub>	55	50
L <sub>10</sub>	60	55
L <sub>01</sub>	75	60

Source: OAR 340-35-035 Table 8

**Table 4.2** OAR Octave Band Sound Limits, dB

Time	Frequency, Hz								
	31.5	63	125	250	500	1,000	2,000	4,000	8,000
7:00 AM to 10:00 PM	68	65	61	55	52	49	46	43	40
10:00 PM to 7:00 AM	65	62	56	50	46	43	40	37	34

Source: OAR 340-35-035 Table 10

OAR 340-035-0035(5) provides the following exemptions from OAR 340-35-035 Table 8 and Table 10 sound limits:

- Emergency equipment not operated on a regular or scheduled basis (OAR 340-035-0035(5)(a))
- Warning devices not operating continuously for more than 5 minutes (OAR 340-035-0035(5)(b))
- Sounds created by the tires or motor used to propel any road vehicle complying with the noise standards for road vehicles (OAR 340-035-0035(5)(c))
- Sounds created by bells, chimes, or carillons (OAR 340-035-0035(5)(e))

In addition to the regulations for commercial and industrial noise sources defined in OAR 340-35-0035, OAR 340-035-0030 includes policies for motor vehicle sound emissions (including road and off-road vehicles) and sound limits at noise sensitive properties when motor vehicles operate on private property within 1,000 feet of noise sensitive properties.

OAR 340-035-0015 defines motor vehicles, road vehicles, and off-road recreational vehicles as follows:

*“Motor Vehicle” means any vehicle which is, or is designed to be self-propelled or is designed or used for transporting persons or property. This definition excludes airplanes, but includes watercraft.”*

*“Off-Road Recreational Vehicle” means any motor vehicle, including watercraft, used off public roads for recreational purposes. When a road vehicle is operated off-road the vehicle shall be considered an off-road recreational vehicle if it is being used for recreational purposes.”*

*“Road Vehicle” means any motor vehicle registered for use on public roads, including any attached trailing vehicles.”*

OAR 340-035-0030(1)(d)(B) provides the following exemptions from the sound limits shown in OAR 340-35-030 Table 5, which apply to noise sensitive properties within 1,000 feet of vehicle operations:

- Motor vehicles initially entering or leaving property which is more than 1,000 feet from the nearest noise sensitive property or quiet area (OAR 340-035-0030(1)(d)(B)(ii))
- Motor vehicles operating on public roads (OAR 340-035-0030(1)(d)(B)(iii))
- Motor vehicles operating off-road for non-recreational purposes (OAR 340-030-0030(1)(d)(B)(iv))

Warning devices used on motor vehicles are exempt from all noise regulations under OAR 340-035-0030(3)(b).

Although OAR exemptions could be interpreted as exempting haul truck activities throughout the site given haul trucks are considered “road vehicles” and are operating off-road for non-recreational purposes, the Noise Study includes an evaluation of potential effects from trucking operations at nearby noise sensitive properties.

Increases to existing sound levels are not governed under the OAR for new industrial or commercial noise sources on previously used sites. However, this analysis includes an



assessment of increases to existing sound levels to address concerns expressed by the community. Increases to existing sound levels are compared with OAR regulatory criteria for new industrial and commercial noise sources on previously unused sites, which prohibits increasing existing  $L_{10}$  or  $L_{50}$  statistical noise levels by more than 10 dB.

Based on OAR regulatory criteria and measured ambient sound levels (see Section 5.1 for additional information) the resulting sound limits for the project are shown in Table 4.3. The operating hours of the landfill are 4:30 AM to 5:30 PM on weekdays and 7:30 AM to 5:30 PM on Saturdays. Therefore, both daytime and nighttime sound limits shown in Table 4.3 apply. This analysis assumes on-site operations do not vary between daytime and nighttime hours and assesses compliance using the more stringent nighttime sound limits in Table 4.3.

**Table 4.3** Project Sound Limits, ( $L_{01}$  /  $L_{10}$  /  $L_{50}$ ), dBA

Location	Time	OAR Table 8 Limits (X)	Existing Sound Levels <sup>1</sup>	Existing Sound Levels + 10 dB (Y)	Project Limit (lowest of X and Y)
Location 1	Daytime	75 / 60 / 55	- <sup>2</sup> / 39 / 32	- / 49 / 42	75 / 49 / 42
	Nighttime	60 / 55 / 50	- / 28 / 22	- / 38 / 32	<b>60 / 38 / 32</b>
Location 2	Daytime	75 / 60 / 55	- / 41 / 38	- / 51 / 48	75 / 51 / 48
	Nighttime	60 / 55 / 50	- / 33 / 29	- / 43 / 39	<b>60 / 43 / 39</b>
Location 3 <sup>3</sup>	Daytime	75 / 60 / 55	- / 58 / 53	- / 68 / 63	75 / 60 / 55
	Nighttime	60 / 55 / 50	- / 50 / 36	- / 60 / 46	<b>60 / 55 / 46</b>
Location 4	Daytime	75 / 60 / 55	- / 46 / 39	- / 56 / 49	75 / 56 / 49
	Nighttime	60 / 55 / 50	- / 35 / 29	- / 45 / 39	<b>60 / 45 / 39</b>
Noise Sensitive Properties	Daytime	75 / 60 / 55	-	-	75 / 60 / 55
	Nighttime	60 / 55 / 50	-	-	<b>60 / 55 / 50</b>

1. OAR 340-035-0035(1)B only prohibits  $L_{10}$  and  $L_{50}$  ambient sound levels from being exceeded by 10 dB
2. Indicates a non-applicable value
3. Measured sound levels may be influenced by the existing power plant, which will remain in place during the expansion

## 5.0 SOUND LEVEL MEASUREMENTS

Sound levels were measured near noise sensitive properties in the vicinity of the proposed expansion area to document the existing acoustic environment. Measurements were also made of existing operations at the current site for use in the analysis. Equipment used during the measurements are identified in Table 5.1.

**Table 5.1** Measurement Equipment

Make and Model	Description	Serial Number
Svantek SV307	Sound Level Analyzer	78647
Svantek ST30	Microphone	82351
Svantek SV307	Sound Level Analyzer	78633
Svantek ST30	Microphone	103657
Svantek SV307	Sound Level Analyzer	106247
Svantek ST30	Microphone	111967
Svantek SV307	Sound Level Analyzer	78646
Svantek ST30	Microphone	114514
Larson Davis CAL200	Acoustic Calibrator	18605
Svantek 971	Sound Level Analyzer	51818
Svantek SV18	Preamplifier	49561
Aco Pacific 7052E	Microphone	62522
Larson Davis CAL200	Acoustic Calibrator	9512

All equipment was calibrated at a certified laboratory within one year of the measurement date. Field calibrations were made before and immediately after the measurements were completed. Environmental windscreens were used on all microphones during the measurements.

### 5.1 Existing Sound Levels

Existing sound levels were measured at three locations near noise sensitive properties between Friday October 15 and Tuesday October 19, 2021, and at a fourth location between Thursday January 13 and Saturday January 22, 2022. Wind conditions during the October measurements ranged from calm to 10 miles per hour and were generally from the south. Temperatures ranged between 40- and 69-degrees Fahrenheit. Precipitation ranged from 0 to 0.15 inches per day. Wind conditions during the January measurements ranged from calm to 12 miles per hour and were typically from the south. Temperatures during the January measurements ranged between 33- and 57-degrees Fahrenheit and precipitation ranged from 0 to 0.26 inches per day.

The four Svantek SV307 sound level analyzers shown in Table 5.1 were used to measure the existing acoustic environment. At all measurement locations, equipment collected hourly and 1-second  $L_{eq}$ , broadband  $L_{max}$  sound levels at both 1-second and hourly intervals, and 1-hour  $L_n$  data were also measured. To help identify local noise sources, audio recordings were made when sound levels exceeded 40 dBA at Locations 1 and 2, 50 dBA at Location 3, and 65 dBA at Location 4. The locations of the measurements are illustrated in Figure 5.1 and photos of the measurement equipment are shown in Figure 5.2 through Figure 5.5.

**Figure 5.1 Measurement Locations**



**Figure 5.2 Location 1**



**Figure 5.3 Location 2**



**Figure 5.4 Location 3**



**Figure 5.5 Location 4**



The range and median hourly  $L_{10}$  and  $L_{50}$  sound levels at each measurement location are shown in Table 5.2 and graphically in the Appendix. It should be noted that due to equipment connectivity issues, some hours of data were incomplete. Levels in this document only include data collected over complete hours. Times when data was not recorded over a complete hour are identified in the Appendix.

**Table 5.2 Measured Hourly Sound Levels, Low-High (Median)**

Measurement Location	Daytime, dBA		Nighttime, dBA	
	$L_{10}$	$L_{50}$	$L_{10}$	$L_{50}$
Location 1	28-54 (39)	21-51 (32)	22-52 (28)	15-50 (22)
Location 2	33-53 (41)	30-50 (38)	27-49 (33)	26-48 (29)
Location 3	53-60 (58)	45-56 (53)	38-59 (50)	27-53 (36)
Location 4	30-55 (46)	26-47 (39)	26-51 (35)	24-46 (29)

Measured median  $L_{10}$  and  $L_{50}$  sound levels were below OAR sound limits at all measurement locations. Dominant sound sources at the measurement locations included birds, other nature sounds, and vehicle traffic on Soap Creek Road, Coffin Butte Road, and Highway 99 West. Sound levels were generally louder at locations closer to Highway 99 West and traffic noise became more prevalent. The existing on-site power plant may have contributed to the measured sound levels at Location 3.

## 5.2 Equipment Sound Levels

Sound levels from existing equipment and operations at the landfill were measured the morning of October 15, 2021, using the Svantek 971 sound level analyzer. Measurements were made of individual pieces of equipment including, excavators, dozers, compactors, tippers, and haul trucks, at distances of 15 feet to 75 feet.

For mobile equipment and equipment not operating continuously, reported sound levels only include the loudest portions of the measurements. Because the data was collected at a variety of distances, measured sound pressure levels were used to compute equipment sound power levels, which are independent of distance. Measurement distances, sound pressure levels, and calculated sound power levels are shown in Table 5.3. A graph showing the frequency spectrum of the equipment is shown in Figure 5.6.

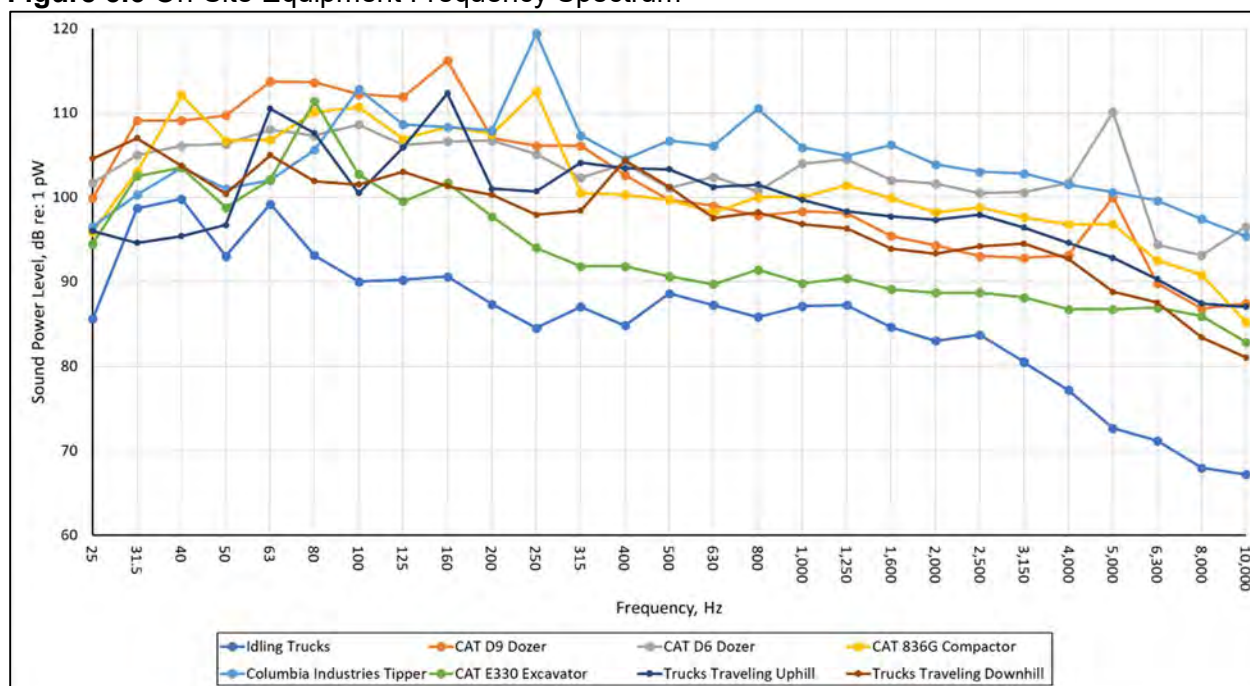
**Table 5.3 Equipment Sound Levels,  $L_{eq}$**

Equipment	Measurement Distance, Feet	Sound Pressure Level, dBA	Sound Power Level, $L_{wA}$
CAT D9 Dozer	75	75	110
CAT D6 Dozer <sup>1</sup>	75	80	115
CAT 836G Compactor	45	81	111
Columbia Industries Tipper	30	90	117
CAT 330 Excavator	60	68	102
Idling Trucks	25	70	96
Trucks Traveling Uphill <sup>2</sup>	15	89	110
Trucks Traveling Downhill <sup>3</sup>	26	81	108

1. Reported sound levels are the logarithmic average of two measurements
2. Reported sound levels are the logarithmic average of eight measurements
3. Reported sound levels are the logarithmic average of five measurements



**Figure 5.6** On-Site Equipment Frequency Spectrum



## 6.0 ANALYSIS

The primary tool used to predict sound levels at neighboring properties from proposed future operations was the 3-D computer noise modeling software environment, Cadna/A. Cadna/A utilizes the CADNA (Control of Accuracy and Debugging for Numerical Applications) computation engine developed by the Pierre et Marie Curie University of Paris. The models used for this project utilized the International Organization for Standardization 9613 Part II algorithms, implemented in the Cadna/A software, which accounted for the effects of distance, topography, and surface reflections.

The modeling process is typically accurate within 3 dB. Conservative assumptions were used in the model created for this project to ensure sufficient design margin within the predicted sound levels, allowing for direction comparison with project criteria.

Locations of equipment and future on-site topography were determined from drawings provided by Civil and Environmental Consultants, Inc. Offsite topographical information was based on LIDAR images of the area. Property line locations, zoning information, and locations of structures were determined from Benton County Geographical Information System (GIS) data.

To account for changes to the topography in the expansion area over time, both the beginning of landfill operations, when the site is nearly empty (Scenario 1), and when on-site operations are nearing completion and the site is nearly full (Scenario 2) were modeled. Near the beginning of operations, the middle of the expansion area will be approximately 260 feet above sea level and near the end of operations the expansion area will be approximately 450 feet above sea level.

Equipment measured on October 15, 2021, was modeled within the proposed expansion area. Operations within the expansion area are expected to be similar to existing operations and generate similar sound levels. In Scenario 1, equipment was placed near the southern portion of

the expansion area to produce conservative results at noise sensitive properties located south of the site. Equipment in Scenario 2 were distributed along at the highest point of the expansion area. Trucks using the landfill were modeled entering from Highway 99 West, using the scale house, proceeding to the expansion area, and returning to Highway 99 West. The hourly vehicle counts included in the noise models are shown in Table 6.1 and all vehicles were modeled traveling at 15 miles per hour.

OAR sound limits are based on hourly  $L_{01}$ ,  $L_{10}$ , and  $L_{50}$  percentile sound levels. Percentile sound levels present modeling challenges due to variability in the duration of equipment operations, changes in sound levels produced by the equipment, and times when multiple pieces of equipment may operate simultaneously. This analysis predicts hourly  $L_{01}$  and  $L_{50}$  percentile sound levels as follows:

- $L_{01}$  was modeled with all equipment operating simultaneously and each piece of equipment generating the loudest one-second sound level produced during the on-site equipment measurements. The  $L_{01}$  captures loud, transient events, such as banging truck gates and loud noises from unloading. Calculated pass-by levels were used to estimate the  $L_{01}$  sound level from trucks at individual properties. These predicted levels were then combined with predicted sound levels from other on-site equipment. While  $L_{01}$  sound levels themselves are not appropriately combined in this way, it represents a conservative prediction for  $L_{01}$  sound levels from the site.
- $L_{50}$  is modeled with the assumption that  $L_{50}$  sound levels are similar to measured  $L_{eq}$  equipment sound levels. Equipment was modeled generating the loudest 1-second  $L_{eq}$  sound levels produced by each piece of equipment during the on-site measurements with a usage factor applied. The percentage of an hour that each piece of equipment produces the loudest sound levels (acoustical usage factors) were applied based on Federal Highway Administration (FHWA) Construction Noise Control Specification 721.560 and estimated operating times noted during the on-site equipment measurements.

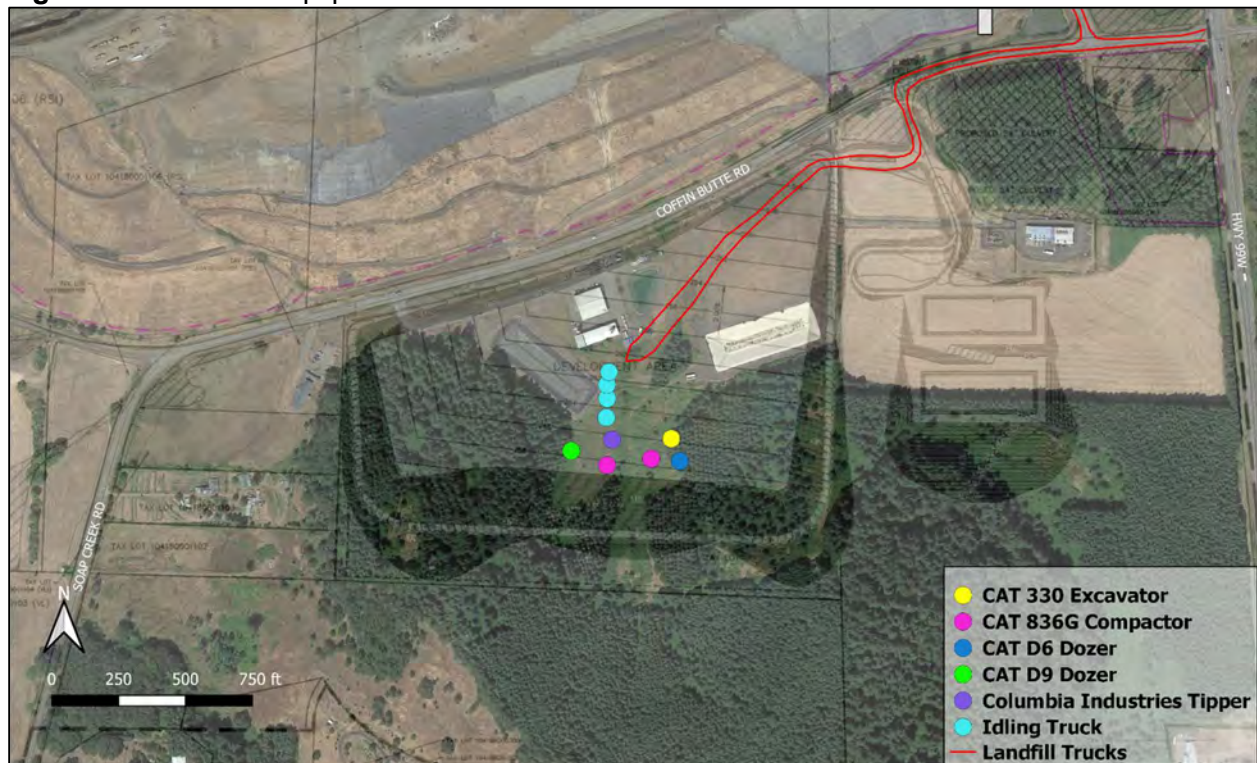
Equipment types and quantities included in the noise models are shown in Table 6.1.

**Table 6.1** Modeled Equipment

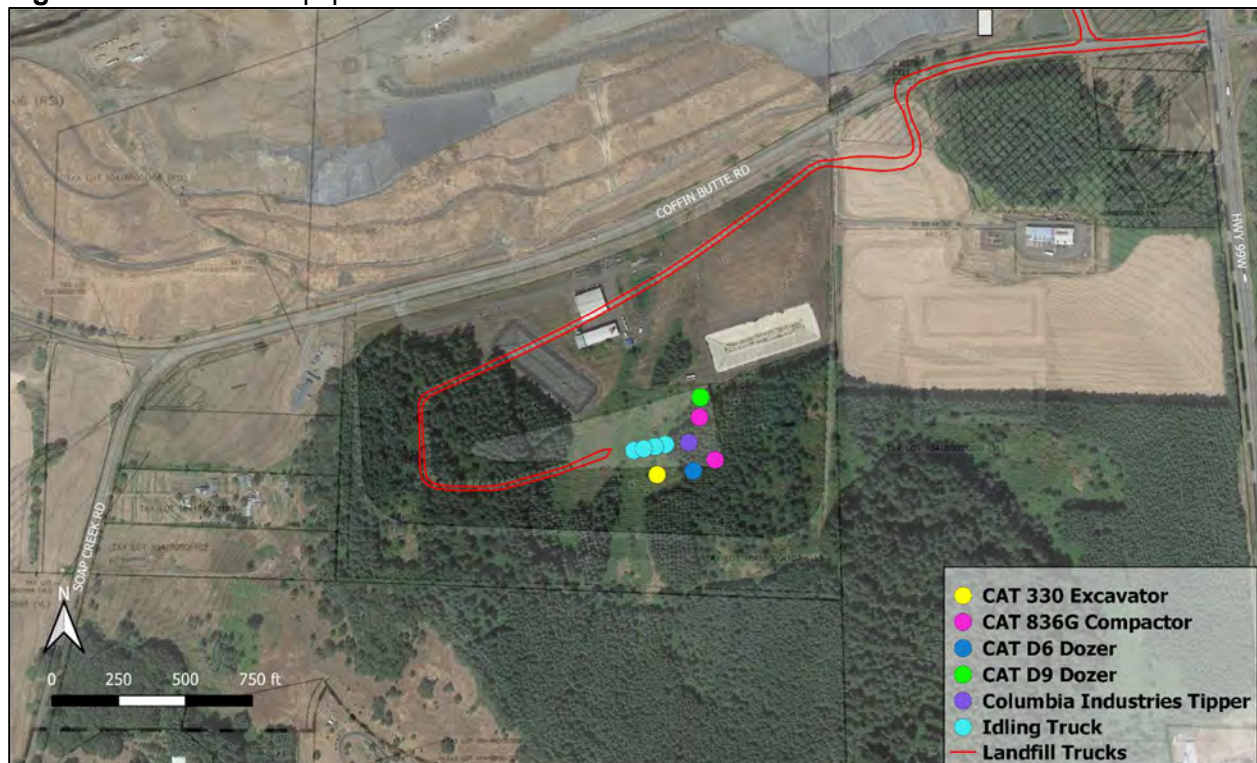
Equipment	Quantity	Usage Factor (%) <sup>1</sup>
CAT D9 Dozer	1	40
CAT D6 Dozer	1	40
CAT 836G Compactor	2	50
Columbia Industries Tipper	1	50
CAT 330 Excavator	1	40
Idling Trucks	4	100
Landfill Trucks <sup>2</sup>	47/hour	100

1. Based on information in the FHWA Construction Noise Control Specification 721.560 and operating times noted during on-site measurements.
2. Sound levels from trucks traveling uphill were used in the models.

**Figure 6.1** Modeled Equipment Locations – Scenario 1



**Figure 6.2** Modeled Equipment Locations – Scenario 2





## 7.0 MODELING RESULTS

Predicted sound levels included in this document represent the loudest sound levels anticipated at receiving noise sensitive properties and at the locations where existing sound levels were measured. The evaluation point locations are shown in Figure 7.1. These predicted sound levels represent on-site operations only and do not include contributions from off-site sound sources or safety devices such as backup alarms.

**Figure 7.1** Evaluation Point Locations



Predicted unmitigated broadband sound levels from Scenario 1 are shown in Table 7.1 and predicted sound levels in each octave band are shown in Table 7.2.



**Table 7.1** Predicted Unmitigated Broadband Sound Levels – Scenario 1, dBA

Location	Project Limits <sup>1</sup>		Predicted Sound Level		Satisfies OAR Limits?	
	L <sub>01</sub> <sup>3</sup>	L <sub>50</sub>	L <sub>01</sub>	L <sub>50</sub>	L <sub>01</sub>	L <sub>50</sub>
Location 1 <sup>2</sup>	-	32	-	27	-	Yes
Location 2 <sup>2</sup>	-	39	-	35		
Location 3 <sup>2</sup>	-	46	-	39		
Location 4 <sup>2</sup>	-	39	-	39		
North	60	50	44	42	Yes	Yes
South			36	35		
West			41	39		
East			42	40		
Southeast			38	36		

1. Based on nighttime OAR sound limits and 10 dB increase to existing sound levels
2. See Figure 5.1 for locations where existing sound levels were measured
3. OAR increases to existing sound levels only apply to L<sub>10</sub> and L<sub>50</sub> sound levels

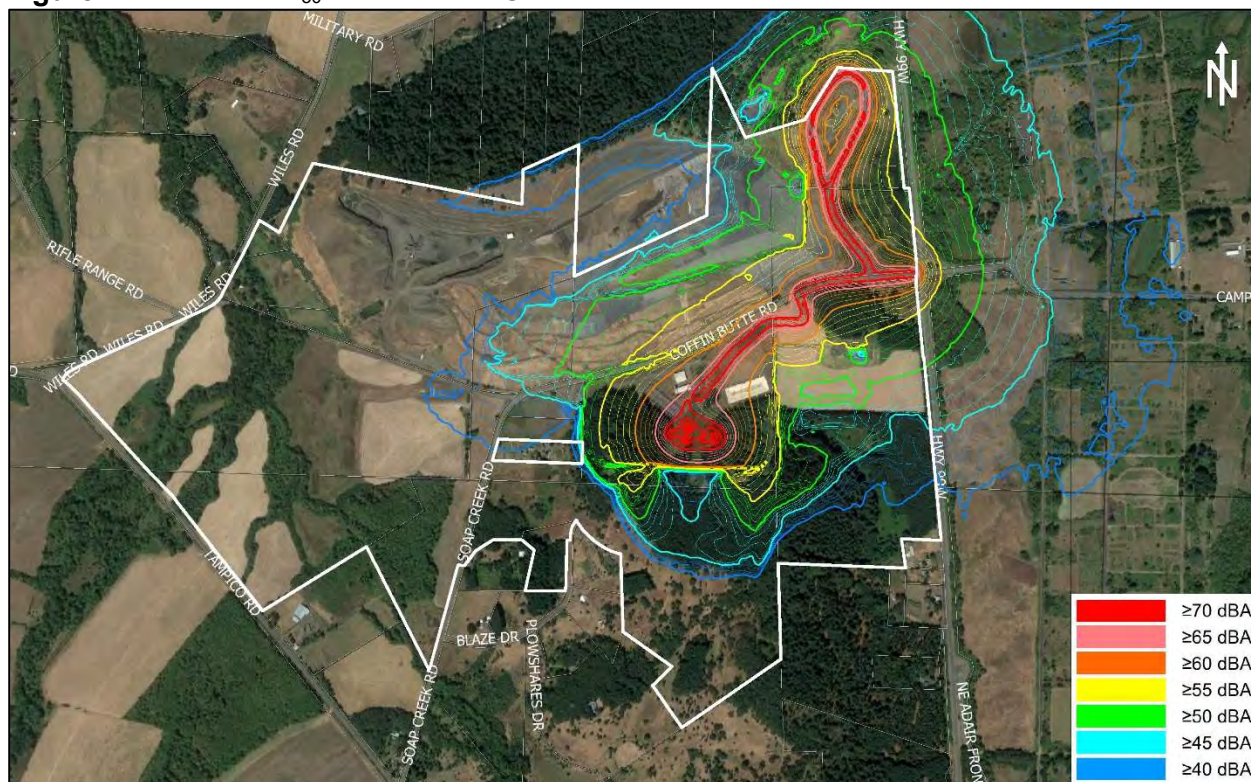
**Table 7.2** Predicted Unmitigated L<sub>50</sub> Octave Band Sound Levels – Scenario 1, dB

	Frequency, Hz								
	31.5	63	125	250	500	1,000	2,000	4,000	8,000
<b>OAR Sound Limits<sup>1</sup></b>	<b>65</b>	<b>62</b>	<b>56</b>	<b>50</b>	<b>46</b>	<b>43</b>	<b>40</b>	<b>37</b>	<b>34</b>
<i>Location</i>									
Location 1	36	38	36	30	23	21	14	1	-
Location 2	44	46	44	39	32	27	20	10	-
Location 3	38	46	45	37	38	33	26	6	-
Location 4	47	49	48	43	35	30	21	10	-
North	41	47	44	39	39	39	30	7	-
South	41	44	43	37	33	28	19	1	-
West	46	48	47	43	35	30	23	13	-
East	42	53	42	37	39	37	29	2	-
Southeast	36	44	42	35	35	31	24	1	-
<b>Satisfies OAR Limits?</b>	<b>Yes</b>	<b>Yes</b>	<b>Yes</b>	<b>Yes</b>	<b>Yes</b>	<b>Yes</b>	<b>Yes</b>	<b>Yes</b>	<b>Yes</b>

1. Based on OAR 340-35-035 Table 10

As shown in Table 7.1 and Table 7.2 sound levels from Scenario 1 are anticipated to comply with OAR sound limits at all nearby noise sensitive properties and locations where existing sound levels were measured. Predicted sound levels are also below the median ambient sound levels measured during times when existing landfill operations were taking place. Predicted sound contours five feet above grade from Scenario 1 are shown in Figure 7.2.

**Figure 7.2** Predicted L<sub>50</sub> Sound Level Contours – Scenario 1



Predicted broadband sound levels from Scenario 2 are shown in Table 7.3 and predicted sound levels in each octave band are shown in Table 7.4. Sound levels at the locations where existing sound levels were measured are not included because existing sound level when the site is filled are not known.

**Table 7.3** Predicted Unmitigated Broadband Sound Levels – Scenario 2, dBA

Location	Project Limits <sup>1</sup>		Predicted Sound Level		Satisfies OAR Limits?	
	L <sub>01</sub>	L <sub>50</sub>	L <sub>01</sub>	L <sub>50</sub>	L <sub>01</sub>	L <sub>50</sub>
North	60	50	45	43	Yes	Yes
South			47	43		
West			51	45		
East			43	41		
Southeast			40	37		

1. Based on nighttime OAR sound limits

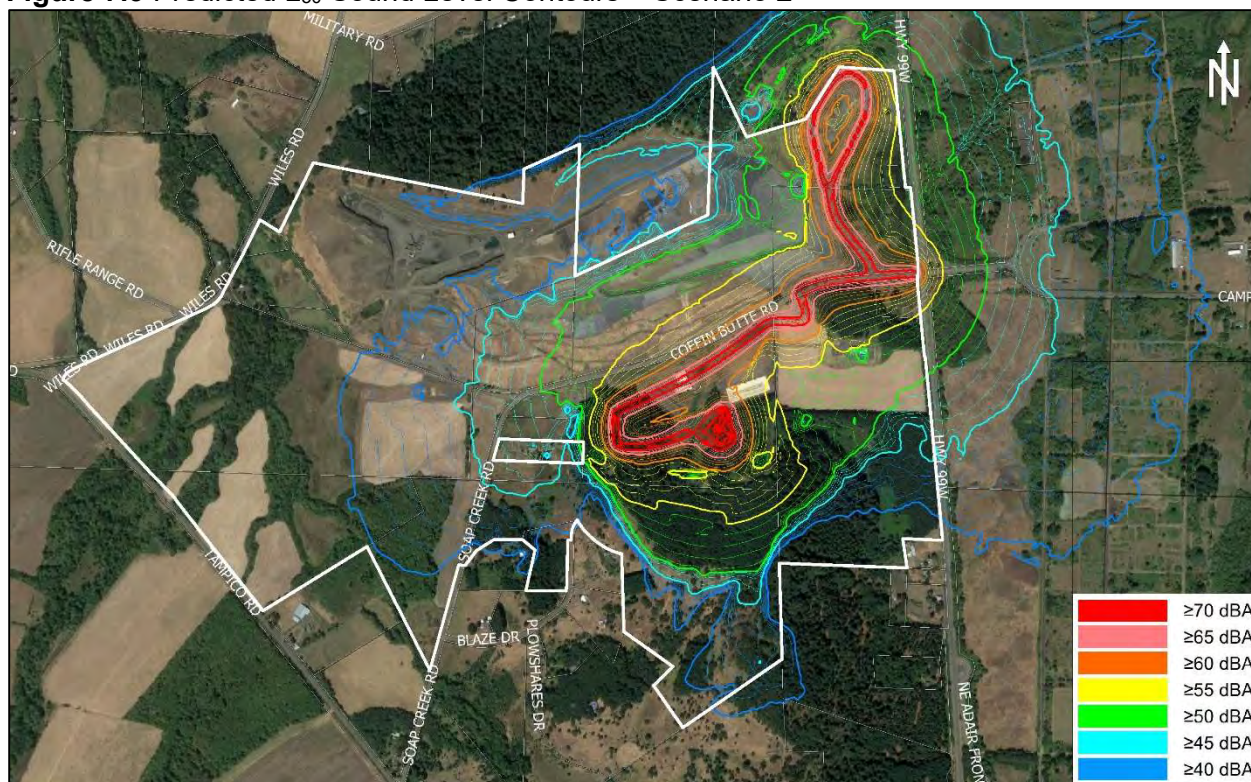
**Table 7.4** Predicted Unmitigated L<sub>50</sub> Octave Band Sound Levels – Scenario 2, dB

	Frequency, Hz								
	31.5	63	125	250	500	1,000	2,000	4,000	8,000
<b>OAR Sound Limits<sup>1</sup></b>	<b>65</b>	<b>62</b>	<b>56</b>	<b>50</b>	<b>46</b>	<b>43</b>	<b>40</b>	<b>37</b>	<b>34</b>
<i>Location</i>									
North	42	48	45	40	40	40	32	9	-
South	45	52	49	43	40	38	33	20	-
West	45	52	52	44	44	40	35	26	4
East	47	54	43	38	39	38	29	2	-
Southeast	42	46	44	38	36	31	24	2	-
<b>Satisfies OAR Limits?</b>	<b>Yes</b>	<b>Yes</b>	<b>Yes</b>	<b>Yes</b>	<b>Yes</b>	<b>Yes</b>	<b>Yes</b>	<b>Yes</b>	<b>Yes</b>

1. Based on OAR 340-35-035 Table 10

Sound levels from the end of operations are anticipated to comply with OAR sound limits at all nearby noise sensitive properties. Predicted unmitigated sound contours five feet above grade from Scenario 2 are shown in Figure 7.3.

**Figure 7.3** Predicted L<sub>50</sub> Sound Level Contours – Scenario 2



Predicted sound levels from trucks using the landfill and on-site equipment comply with OAR sound limits at all nearby noise sensitive properties under both modeling scenarios. Anticipated sound levels from landfill operations under Scenario 2 are higher than those from Scenario 1 due to the increased elevation of the site as it becomes filled, which decreases the effectiveness of the screening provided by the hillside south of the site, and rerouting trucks to travel up the



north, west, and south slopes of the expansion area. Although not required to comply with codified sound limits, it is recommended that all backup alarms used on the site be replaced with ambient sensing broadband backup alarms, if permitted by safety regulations.

## 8.0 APPENDIX

### 8.1 Location 1 Ambient Sound Levels

Bolded and underlined values shown in Table 8.1 and Table 8.2 represent hours when the landfill was operating.

**Table 8.1** Hourly L<sub>10</sub> Sound Levels - Location 1, dBA

Start of Hour	L <sub>10</sub>				
	Friday 10/15/2021	Saturday 10/16/2021	Sunday 10/17/2021	Monday 10/18/2021	Tuesday 10/19/2021
12:00 AM		27	24	48	25
1:00 AM		26	23	42	27
2:00 AM		23	23	36	25
3:00 AM		22	24	33	25
4:00 AM		24	23	<b><u>33</u></b>	<b><u>32</u></b>
5:00 AM		30	26	<b><u>39</u></b>	<b><u>41</u></b>
6:00 AM		30	27	<b><u>40</u></b>	<b><u>42</u></b>
7:00 AM		<b><u>34</u></b>	34	<b><u>46</u></b>	<b><u>44</u></b>
8:00 AM		<b><u>40</u></b>	37	<b><u>45</u></b>	<b><u>46</u></b>
9:00 AM		<b><u>39</u></b>	43	<b><u>46</u></b>	<b><u>47</u></b>
10:00 AM		<b><u>40</u></b>	42	<b><u>44</u></b>	<b><u>46</u></b>
11:00 AM		<b><u>44</u></b>	36	<b><u>42</u></b>	<b><u>45</u></b>
12:00 PM		<b><u>41</u></b>	37	<b><u>43</u></b>	
1:00 PM	<b><u>43</u></b>	<b><u>38</u></b>	36	<b><u>45</u></b>	
2:00 PM	-	<b><u>39</u></b>	38	<b><u>44</u></b>	
3:00 PM	<b><u>41</u></b>	<b><u>42</u></b>	35	<b><u>44</u></b>	
4:00 PM	<b><u>42</u></b>	<b><u>38</u></b>	35	<b><u>44</u></b>	
5:00 PM	<b><u>39</u></b>	<b><u>41</u></b>	39	<b><u>45</u></b>	
6:00 PM	38	36	35	39	
7:00 PM	35	38	32	33	
8:00 PM	31	31	54	28	
9:00 PM	30	31	54	29	
10:00 PM	28	29	52	31	
11:00 PM	26	28	49	27	

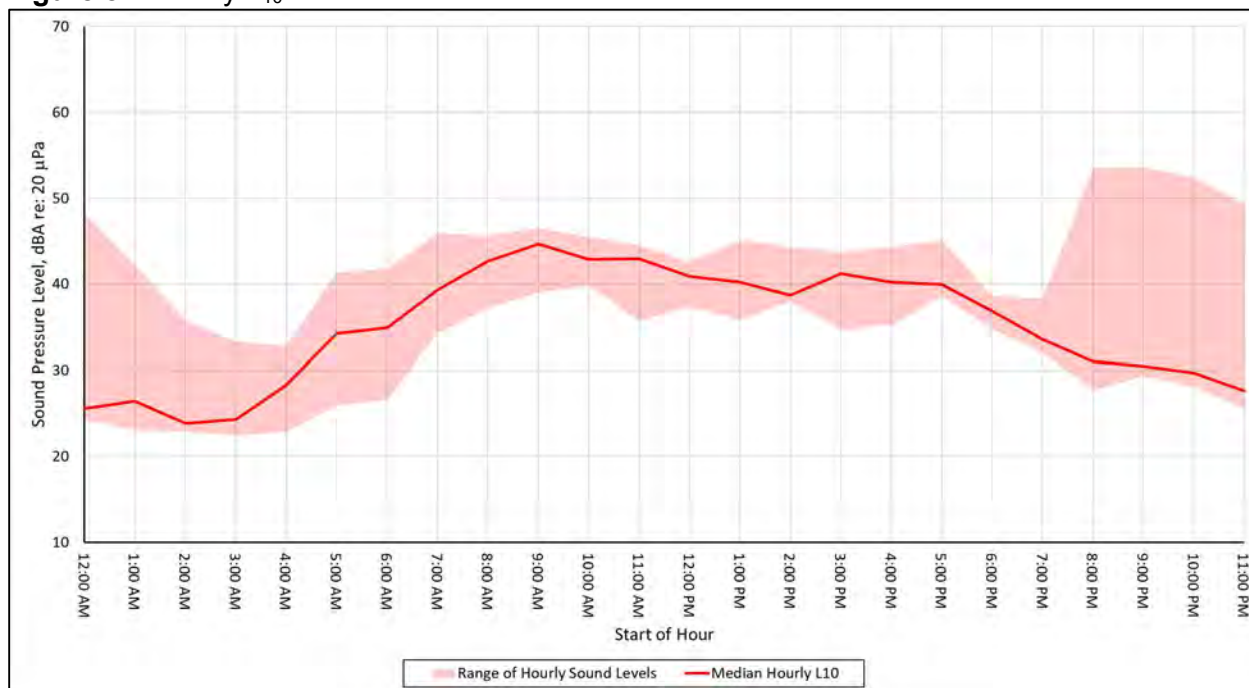
Note: “-” denotes hours when a complete hour of data was not collected

**Table 8.2** Hourly L<sub>50</sub> Sound Levels - Location 1, dBA

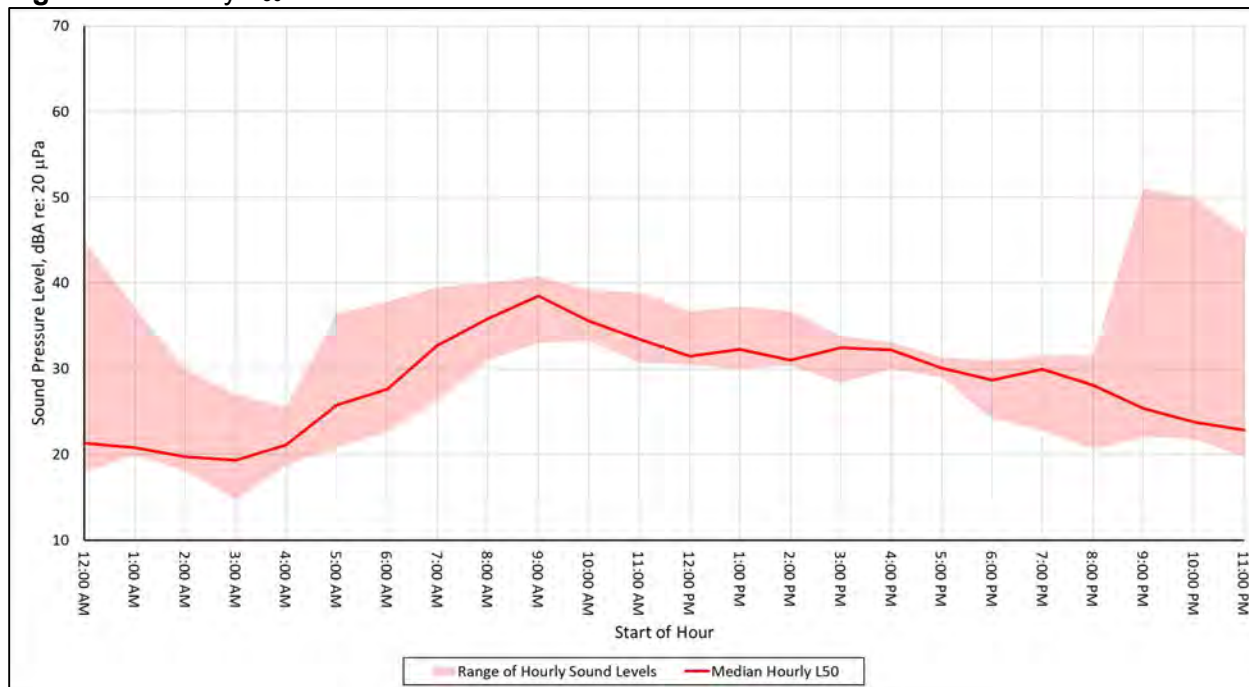
Start of Hour	L <sub>50</sub>				
	Friday 10/15/2021	Saturday 10/16/2021	Sunday 10/17/2021	Monday 10/18/2021	Tuesday 10/19/2021
12:00 AM		22	20	45	18
1:00 AM		21	20	37	20
2:00 AM		18	20	30	19
3:00 AM		15	20	27	18
4:00 AM		19	19	<u>26</u>	<u>23</u>
5:00 AM		21	21	<u>30</u>	<u>36</u>
6:00 AM		23	23	<u>32</u>	<u>38</u>
7:00 AM		<u>27</u>	26	<u>39</u>	<u>40</u>
8:00 AM		<u>33</u>	31	<u>40</u>	<u>39</u>
9:00 AM		<u>33</u>	37	<u>40</u>	<u>41</u>
10:00 AM		<u>34</u>	33	<u>38</u>	<u>39</u>
11:00 AM		<u>32</u>	31	<u>35</u>	<u>39</u>
12:00 PM		<u>31</u>	32	<u>37</u>	
1:00 PM	<u>34</u>	<u>31</u>	30	<u>37</u>	
2:00 PM	-	<u>31</u>	30	<u>37</u>	
3:00 PM	<u>34</u>	<u>32</u>	28	<u>33</u>	
4:00 PM	<u>33</u>	<u>32</u>	30	<u>32</u>	
5:00 PM	<u>31</u>	<u>31</u>	29	<u>29</u>	
6:00 PM	31	30	27	24	
7:00 PM	31	32	29	23	
8:00 PM	27	29	32	21	
9:00 PM	24	27	51	22	
10:00 PM	23	24	50	22	
11:00 PM	22	23	46	20	

Note: “-” denotes hours when a complete hour of data was not collected

**Figure 8.1** Hourly L<sub>10</sub> Sound Levels over Measurement Period - Location 1



**Figure 8.2** Hourly L<sub>50</sub> Sound Levels over Measurement Period - Location 1



## 8.2 Location 2 Ambient Sound Levels

Bolded and underlined values shown in Table 8.3 and Table 8.4 represent hours when the landfill was operating.

**Table 8.3** Hourly L<sub>10</sub> Sound Levels - Location 2, dBA

Start of Hour	L <sub>10</sub>				
	Friday 10/15/2021	Saturday 10/16/2021	Sunday 10/17/2021	Monday 10/18/2021	Tuesday 10/19/2021
12:00 AM		-	30	45	30
1:00 AM		34	30	37	33
2:00 AM		30	28	31	30
3:00 AM		27	30	29	29
4:00 AM		31	28	<b><u>31</u></b>	<b><u>33</u></b>
5:00 AM		37	33	<b><u>37</u></b>	<b><u>39</u></b>
6:00 AM		-	38	<b><u>40</u></b>	<b><u>41</u></b>
7:00 AM		<b><u>39</u></b>	41	<b><u>42</u></b>	<b><u>42</u></b>
8:00 AM		-	42	<b><u>42</u></b>	<b><u>42</u></b>
9:00 AM		-	41	<b><u>41</u></b>	<b><u>41</u></b>
10:00 AM		<b><u>41</u></b>	43	<b><u>41</u></b>	<b><u>43</u></b>
11:00 AM		-	46	<b><u>41</u></b>	<b><u>43</u></b>
12:00 PM		-	47	<b><u>41</u></b>	
1:00 PM	<b><u>44</u></b>	<b><u>43</u></b>	44	<b><u>41</u></b>	
2:00 PM	-	-	45	<b><u>41</u></b>	
3:00 PM	<b><u>39</u></b>	-	43	<b><u>43</u></b>	
4:00 PM	<b><u>40</u></b>	<b><u>42</u></b>	39	<b><u>45</u></b>	
5:00 PM	<b><u>39</u></b>	<b><u>43</u></b>	40	<b><u>44</u></b>	
6:00 PM	40	40	42	39	
7:00 PM	-	42	38	37	
8:00 PM	38	39	53	35	
9:00 PM	37	37	51	33	
10:00 PM	34	36	49	35	
11:00 PM	33	36	46	31	

Note: "-" denotes hours when a complete hour of data was not collected

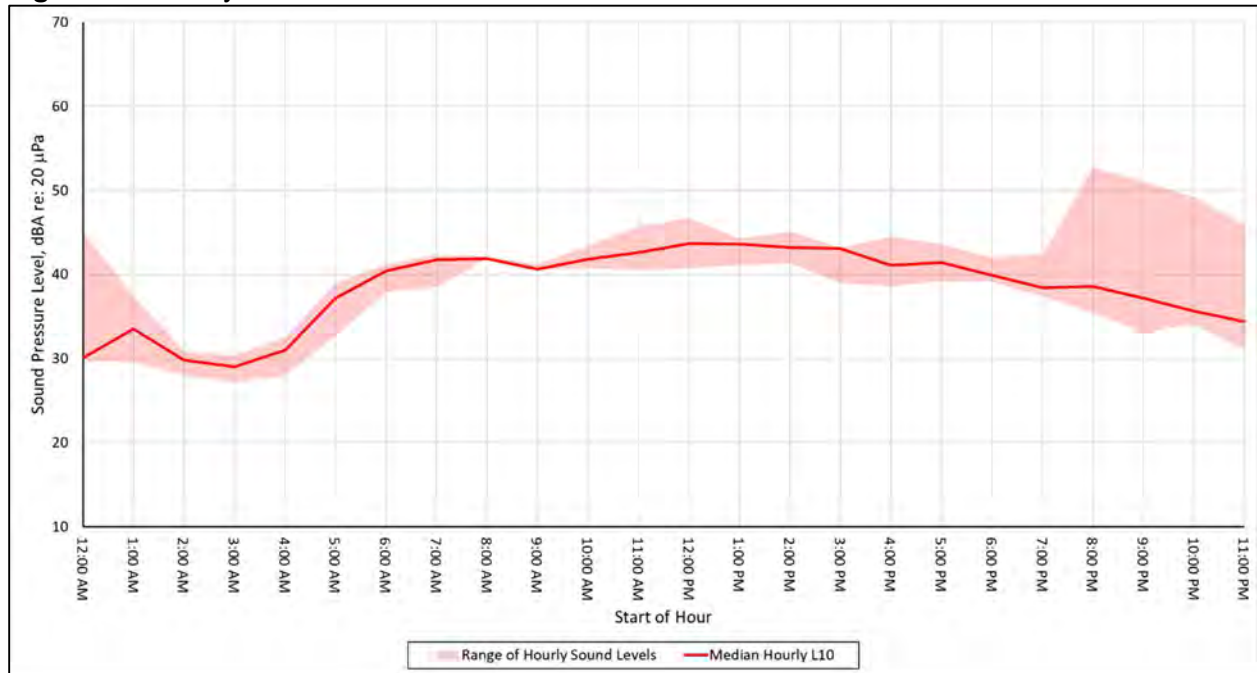


**Table 8.4** Hourly L<sub>50</sub> Sound Levels - Location 2, dBA

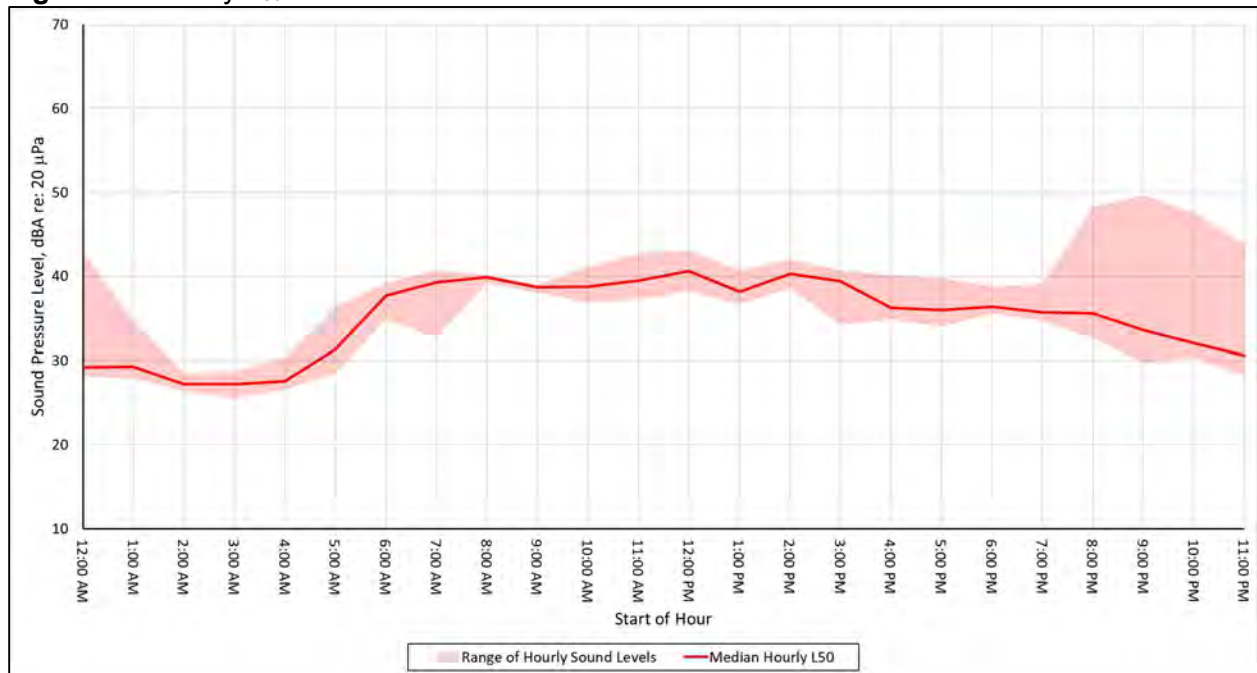
Start of Hour	L <sub>50</sub>				
	Friday 10/15/2021	Saturday 10/16/2021	Sunday 10/17/2021	Monday 10/18/2021	Tuesday 10/19/2021
12:00 AM		-	29	43	28
1:00 AM		28	29	35	30
2:00 AM		26	27	29	28
3:00 AM		26	29	27	28
4:00 AM		27	27	<u>28</u>	<u>30</u>
5:00 AM		29	29	<u>34</u>	<u>36</u>
6:00 AM		-	35	<u>38</u>	<u>39</u>
7:00 AM		<u>33</u>	38	<u>40</u>	<u>41</u>
8:00 AM		-	39	<u>40</u>	<u>40</u>
9:00 AM		-	38	<u>39</u>	<u>39</u>
10:00 AM		<u>37</u>	39	<u>38</u>	<u>41</u>
11:00 AM		-	43	<u>37</u>	<u>40</u>
12:00 PM		-	43	<u>38</u>	
1:00 PM	<u>37</u>	<u>38</u>	41	<u>38</u>	
2:00 PM	-	-	42	<u>39</u>	
3:00 PM	<u>34</u>	-	41	<u>39</u>	
4:00 PM	<u>35</u>	<u>36</u>	36	<u>40</u>	
5:00 PM	<u>34</u>	<u>35</u>	37	<u>40</u>	
6:00 PM	37	36	39	36	
7:00 PM	-	39	36	35	
8:00 PM	35	36	48	33	
9:00 PM	33	34	50	30	
10:00 PM	30	34	48	31	
11:00 PM	29	32	44	28	

Note: “-” denotes hours when a complete hour of data was not collected

**Figure 8.3** Hourly L<sub>10</sub> Sound Levels over Measurement Period - Location 2



**Figure 8.4** Hourly L<sub>50</sub> Sound Levels over Measurement Period - Location 2



### 8.3 Location 3 Ambient Sound Levels

Bolded and underlined values shown in Table 8.5 and Table 8.6 represent hours when the landfill was operating.

**Table 8.5** Hourly L<sub>10</sub> Sound Levels - Location 3, dBA

Start of Hour	L <sub>10</sub>				
	Friday 10/15/2021	Saturday 10/16/2021	Sunday 10/17/2021	Monday 10/18/2021	Tuesday 10/19/2021
12:00 AM		53	50	47	45
1:00 AM		51	48	43	48
2:00 AM		46	43	43	39
3:00 AM		42	38	48	46
4:00 AM		49	46	<b><u>53</u></b>	<b><u>51</u></b>
5:00 AM		51	50	<b><u>57</u></b>	<b><u>56</u></b>
6:00 AM		55	51	<b><u>59</u></b>	<b><u>58</u></b>
7:00 AM		<b><u>55</u></b>	54	<b><u>60</u></b>	<b><u>59</u></b>
8:00 AM		<b><u>57</u></b>	56	<b><u>59</u></b>	<b><u>58</u></b>
9:00 AM		-	56	<b><u>60</u></b>	<b><u>59</u></b>
10:00 AM		<b><u>59</u></b>	57	<b><u>60</u></b>	<b><u>58</u></b>
11:00 AM		<b><u>59</u></b>	58	<b><u>59</u></b>	
12:00 PM		<b><u>59</u></b>	58	<b><u>59</u></b>	
1:00 PM		<b><u>59</u></b>	58	<b><u>58</u></b>	
2:00 PM	<b><u>60</u></b>	<b><u>59</u></b>	58	<b><u>58</u></b>	
3:00 PM	<b><u>60</u></b>	<b><u>59</u></b>	58	<b><u>60</u></b>	
4:00 PM	-	<b><u>59</u></b>	58	<b><u>60</u></b>	
5:00 PM	<b><u>59</u></b>	<b><u>59</u></b>	57	<b><u>60</u></b>	
6:00 PM	-	57	57	58	
7:00 PM	56	56	56	56	
8:00 PM	-	55	54	55	
9:00 PM	56	53	53	54	
10:00 PM	55	52	51	52	
11:00 PM	52	51	50	49	

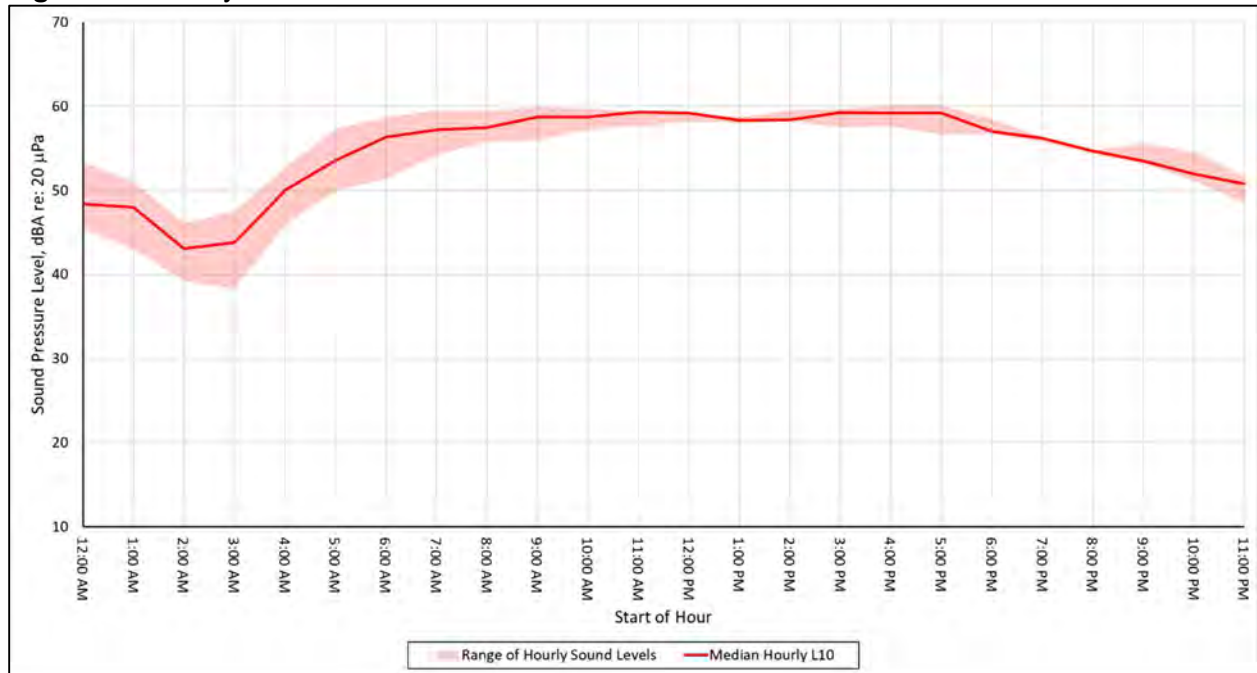
Note: "-" denotes hours when a complete hour of data was not collected

**Table 8.6** Hourly L<sub>50</sub> Sound Levels - Location 3, dBA

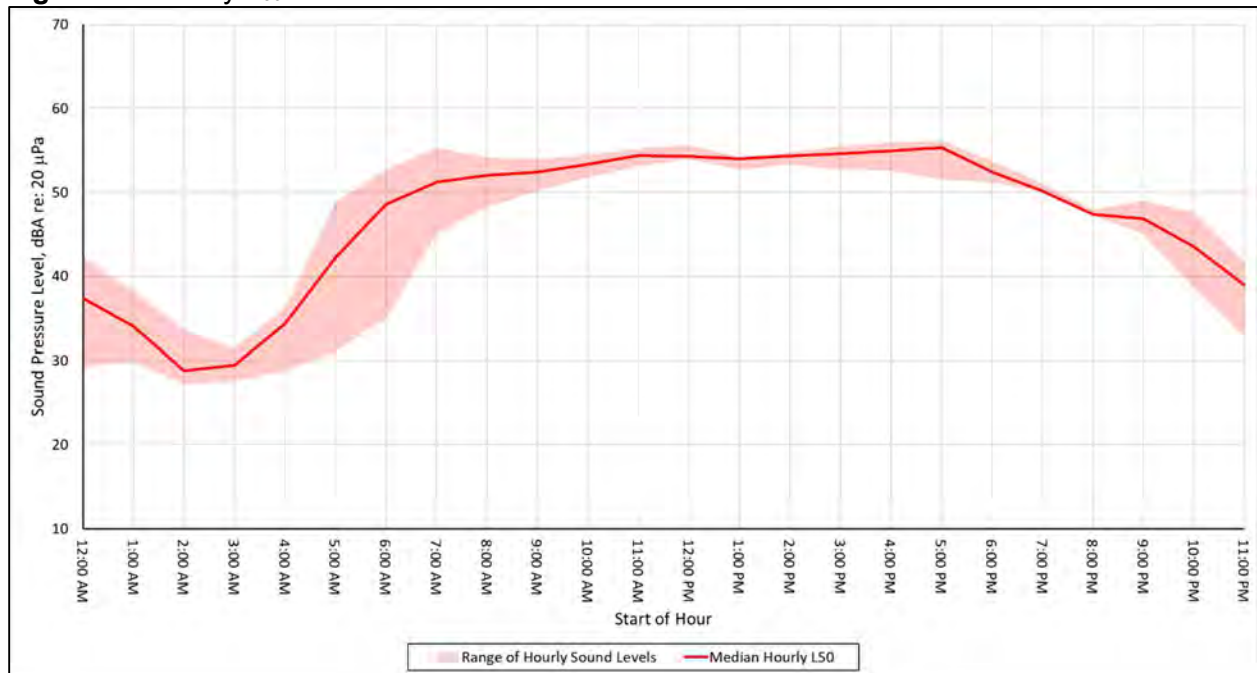
Start of Hour	L <sub>50</sub>				
	Friday 10/15/2021	Saturday 10/16/2021	Sunday 10/17/2021	Monday 10/18/2021	Tuesday 10/19/2021
12:00 AM		42	34	41	29
1:00 AM		38	30	37	32
2:00 AM		28	27	34	29
3:00 AM		28	28	32	31
4:00 AM		34	29	<u>35</u>	<u>36</u>
5:00 AM		37	31	<u>49</u>	<u>47</u>
6:00 AM		46	35	<u>53</u>	<u>52</u>
7:00 AM		<u>47</u>	45	<u>55</u>	<u>55</u>
8:00 AM		<u>51</u>	48	<u>54</u>	<u>53</u>
9:00 AM		-	50	<u>54</u>	<u>52</u>
10:00 AM		<u>54</u>	52	<u>54</u>	<u>53</u>
11:00 AM		<u>55</u>	53	<u>54</u>	
12:00 PM		<u>56</u>	54	<u>54</u>	
1:00 PM		<u>54</u>	54	<u>53</u>	
2:00 PM	<u>55</u>	<u>55</u>	54	<u>53</u>	
3:00 PM	<u>56</u>	<u>55</u>	53	<u>54</u>	
4:00 PM	-	<u>55</u>	53	<u>56</u>	
5:00 PM	<u>56</u>	<u>55</u>	52	<u>56</u>	
6:00 PM	-	52	51	54	
7:00 PM	51	50	50	50	
8:00 PM	-	48	47	47	
9:00 PM	49	45	48	46	
10:00 PM	48	43	44	39	
11:00 PM	36	42	42	33	

Note: “-” denotes hours when a complete hour of data was not collected

**Figure 8.5** Hourly L<sub>10</sub> Sound Levels over Measurement Period - Location 3



**Figure 8.6** Hourly L<sub>50</sub> Sound Levels over Measurement Period - Location 3



#### 8.4 Location 4 Ambient Sound Levels

Bolded and underlined values shown in Table 8.5 and Table 8.6 represent hours when the landfill was operating.

**Table 8.7** Hourly L<sub>10</sub> Sound Levels - Location 4, dBA

Start of Hour	L <sub>10</sub>									
	Thursday 1/13/2022	Friday 1/14/2022	Saturday 1/15/2022	Sunday 1/16/2022	Monday 1/17/2022	Tuesday 1/18/2022	Wednesday 1/19/2022	Thursday 1/20/2022	Friday 1/21/2022	Saturday 1/22/2022
12:00 AM		44	34	31	27	33	31	45	46	33
1:00 AM		41	36	28	27	36	31	44	43	30
2:00 AM		38	31	30	26	31	27	37	41	32
3:00 AM		38	30	32	27	33	28	35	39	33
4:00 AM		<b><u>39</u></b>	27	31	<b><u>29</u></b>	<b><u>33</u></b>	<b><u>37</u></b>	<b><u>42</u></b>	<b><u>41</u></b>	31
5:00 AM		<b><u>45</u></b>	27	32	<b><u>42</u></b>	<b><u>44</u></b>	<b><u>47</u></b>	<b><u>48</u></b>	<b><u>47</u></b>	29
6:00 AM		<b><u>44</u></b>	27	31	<b><u>46</u></b>	<b><u>46</u></b>	<b><u>51</u></b>	<b><u>46</u></b>	<b><u>48</u></b>	29
7:00 AM		<b><u>52</u></b>	<b><u>33</u></b>	33	<b><u>50</u></b>	<b><u>49</u></b>	<b><u>49</u></b>	<b><u>52</u></b>	<b><u>53</u></b>	<b><u>38</u></b>
8:00 AM		<b><u>55</u></b>	<b><u>42</u></b>	37	<b><u>54</u></b>	<b><u>51</u></b>	<b><u>51</u></b>	<b><u>51</u></b>	<b><u>54</u></b>	<b><u>46</u></b>
9:00 AM		<b><u>55</u></b>	<b><u>41</u></b>	36	<b><u>52</u></b>	<b><u>50</u></b>	<b><u>53</u></b>	<b><u>53</u></b>		<b><u>45</u></b>
10:00 AM		<b><u>55</u></b>	<b><u>40</u></b>	38	<b><u>53</u></b>	<b><u>48</u></b>	<b><u>51</u></b>	<b><u>54</u></b>	<b><u>53</u></b>	<b><u>46</u></b>
11:00 AM		<b><u>52</u></b>	<b><u>41</u></b>	36	<b><u>50</u></b>	<b><u>49</u></b>	<b><u>52</u></b>	<b><u>52</u></b>	<b><u>54</u></b>	<b><u>45</u></b>
12:00 PM		<b><u>53</u></b>	<b><u>42</u></b>	40	<b><u>50</u></b>	<b><u>47</u></b>	<b><u>51</u></b>	<b><u>52</u></b>	<b><u>54</u></b>	<b><u>43</u></b>
1:00 PM	<b><u>53</u></b>	<b><u>49</u></b>	<b><u>39</u></b>	38	<b><u>50</u></b>	<b><u>47</u></b>	<b><u>51</u></b>	<b><u>53</u></b>	<b><u>54</u></b>	<b><u>45</u></b>
2:00 PM	<b><u>53</u></b>	<b><u>51</u></b>	<b><u>42</u></b>	38	<b><u>50</u></b>	<b><u>47</u></b>	<b><u>52</u></b>	<b><u>52</u></b>	<b><u>50</u></b>	<b><u>46</u></b>
3:00 PM	<b><u>50</u></b>	<b><u>50</u></b>	<b><u>40</u></b>	39	<b><u>49</u></b>	<b><u>48</u></b>	<b><u>49</u></b>	<b><u>53</u></b>	<b><u>50</u></b>	
4:00 PM	<b><u>48</u></b>	<b><u>48</u></b>	<b><u>41</u></b>	39	<b><u>45</u></b>	<b><u>45</u></b>	<b><u>48</u></b>	<b><u>50</u></b>	<b><u>47</u></b>	
5:00 PM	<b><u>43</u></b>	<b><u>46</u></b>	<b><u>39</u></b>	39	<b><u>43</u></b>	<b><u>44</u></b>	<b><u>45</u></b>	<b><u>47</u></b>	<b><u>44</u></b>	
6:00 PM	44	47	40	36	40	38	39	49	46	
7:00 PM	41	47	40	34	36	30	40	48	43	
8:00 PM	46	45	41	33	32	30	41	48	43	
9:00 PM	43	41	38	32	35	37	41	46	39	
10:00 PM	40	39	35	28	33	28	40	45	35	
11:00 PM	45	37	30	33	37	32	42	45	33	

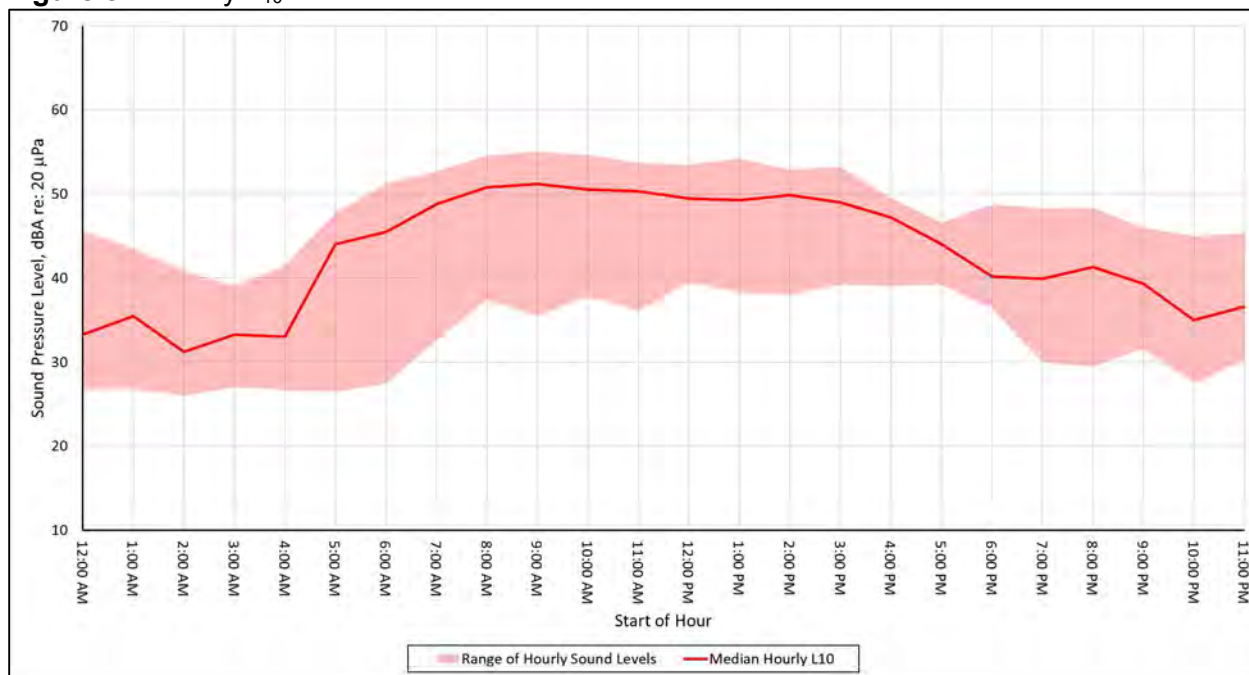
Note: "-" denotes hours when a complete hour of data was not collected

**Table 8.8** Hourly L<sub>50</sub> Sound Levels - Location 4, dBA

Start of Hour	L <sub>50</sub>									
	Thursday 1/13/2022	Friday 1/14/2022	Saturday 1/15/2022	Sunday 1/16/2022	Monday 1/17/2022	Tuesday 1/18/2022	Wednesday 1/19/2022	Thursday 1/20/2022	Friday 1/21/2022	Saturday 1/22/2022
12:00 AM		40	30	27	24	26	27	42	42	29
1:00 AM		39	29	25	25	25	26	40	40	27
2:00 AM		34	27	26	24	25	25	35	38	29
3:00 AM		34	25	28	24	25	24	34	35	29
4:00 AM		<u>34</u>	24	27	<u>25</u>	<u>27</u>	<u>30</u>	<u>34</u>	<u>37</u>	28
5:00 AM		<u>40</u>	24	27	<u>34</u>	<u>34</u>	<u>38</u>	<u>43</u>	<u>41</u>	26
6:00 AM		<u>39</u>	24	27	<u>37</u>	<u>39</u>	<u>46</u>	<u>42</u>	<u>42</u>	26
7:00 AM		<u>44</u>	<u>28</u>	26	<u>40</u>	<u>41</u>	<u>41</u>	<u>41</u>	<u>46</u>	<u>30</u>
8:00 AM		<u>45</u>	<u>33</u>	28	<u>42</u>	<u>43</u>	<u>43</u>	<u>42</u>	<u>46</u>	<u>39</u>
9:00 AM		<u>45</u>	<u>32</u>	29	<u>42</u>	<u>42</u>	<u>44</u>	<u>43</u>		<u>38</u>
10:00 AM		<u>45</u>	<u>31</u>	30	<u>44</u>	<u>40</u>	<u>43</u>	<u>44</u>	<u>45</u>	<u>39</u>
11:00 AM		<u>43</u>	<u>31</u>	28	<u>41</u>	<u>41</u>	<u>41</u>	<u>42</u>	<u>45</u>	<u>35</u>
12:00 PM		<u>43</u>	<u>32</u>	29	<u>41</u>	<u>40</u>	<u>42</u>	<u>42</u>	<u>45</u>	<u>34</u>
1:00 PM	<u>47</u>	<u>40</u>	<u>31</u>	28	<u>41</u>	<u>39</u>	<u>42</u>	<u>43</u>	<u>45</u>	<u>37</u>
2:00 PM	<u>46</u>	<u>43</u>	<u>33</u>	30	<u>40</u>	<u>39</u>	<u>42</u>	<u>43</u>	<u>41</u>	<u>35</u>
3:00 PM	<u>45</u>	<u>41</u>	<u>33</u>	29	<u>38</u>	<u>39</u>	<u>41</u>	<u>43</u>	<u>41</u>	
4:00 PM	<u>40</u>	<u>36</u>	<u>31</u>	31	<u>35</u>	<u>38</u>	<u>37</u>	<u>40</u>	<u>39</u>	
5:00 PM	<u>36</u>	<u>38</u>	<u>30</u>	31	<u>30</u>	<u>33</u>	<u>34</u>	<u>39</u>	<u>38</u>	
6:00 PM	39	43	37	32	31	29	35	46	43	
7:00 PM	37	43	38	30	30	27	37	46	40	
8:00 PM	40	41	38	28	27	27	38	46	40	
9:00 PM	37	37	35	28	26	28	38	44	34	
10:00 PM	37	36	32	25	26	25	37	42	32	
11:00 PM	41	33	27	28	26	27	39	41	29	

Note: "-" denotes hours when a complete hour of data was not collected

**Figure 8.7** Hourly L<sub>10</sub> Sound Levels over Measurement Period - Location 4



**Figure 8.8** Hourly L<sub>50</sub> Sound Levels over Measurement Period - Location 4

