Bull Run TREATMENT PROJECTS | Filtration

Technical Memorandum

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Subject: Acoustic Baseline Measurement

PWB Project: W02229

BC Project: 152606

Date: January 24, 2023

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Note:

Baseline noise measurements were made at six locations for the Portland Water Bureau filtration site in April 2019. The results of those measurements were provided in a Draft Acoustic Baseline Measurement technical memorandum in April 2019, with an updated draft provided in February 2020, and a final in November 2022. This document draws from that memorandum, and was finalized and stamped in January 2023.

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List of Abbreviations

BC	Brown and Caldwell
BRTP	Bull Run Treatment Program
CCC	Clackamas County Code
dB	decibel
dBA	"A" weighted decibel measurements
L_{eq}	Equivalent sound level
L_n	Percent sound level
MCC	Multnomah County Code
OAR	Oregon Administrative Rules
PWB	Portland Water Bureau

1.0 Introduction

The purpose of this technical memorandum (TM) is to present the results of baseline noise measurements made for the Portland Water Bureau (PWB) filtration facility (Site).

2.0 Nomenclature

The auditory response to sound is a complex process that occurs over a wide range of frequencies and intensities. Decibel levels (dB) are a form of shorthand that express this broad range of intensities with 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 sound loudness as might be expected.

The human ear has a unique response to sound pressure. It is less sensitive to those sounds falling outside the speech frequency range. Sound level meters and monitors use a filtering system to approximate human perception of sound. Measurements made using this filtering system are called “A weighted” and are referred to as “dBA”.

The following list defines frequently used terms related to sound levels.

Ambient Sound Level. A sound pressure level that describes the average sound environment at a specified location during a specified time period including contributions from all sound sources, both local and distant, excluding specific sources of interest or under investigation.

Equivalent Sound Level (L_{eq}). L_{eq} is the A-weighted 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.

Percent Sound Level (Ln). The sound level that is exceeded n percent of the time; for example, L_{08} is the level exceeded 8 percent of the time, L_{25} is the sound level exceeded 25 percent of the time, and L_{50} is the sound level exceeded 50 percent of the time (median sound level).

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 micropascals (µPa). Sound pressure is affected by distance, path, barriers, directivity, etc.

Common SPLs are presented below in Table 1.

Table 1. A-Weighted Levels of Common Sounds		
Sound	**Sound Level (dBA)**	**Approximate Relative Loudness[a]**
Jet plane @ 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

a. *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.

3.0 Regulatory Criteria

The Site is located on property in Multnomah County and borders properties located in Clackamas County. Therefore, activities at the Site are subject to the code requirements of both counties.

Because both Multnomah County Code (MCC) and Clackamas County Code (CCC) includes regulations governing sound level limits and sound measurement equipment, limits established by the Oregon Administrative Rules (OAR) do not apply. However, neither MCC nor CCC specify a noise metric for the sound level limits. Therefore, it was assumed that the noise metrics designated in OAR apply to the sound limits established by MCC and CCC. Noise metrics defined in OAR were also used to develop the Site's design criteria options.

4.0 Existing Sound Levels

Continuous sound level measurements were made at six locations between Friday, April 5 and Monday, April 8, 2019. However, due to an equipment malfunction, data collected at Location 4 was unusable and measurements at this location were taken a second time between Thursday, April 18 to Sunday, April 21, 2019.

For the measurements made between April 5 and April 8, 2019, winds were from the south, averaging between 1 and 2 miles per hour (mph). Temperatures were between 41 and 57 degrees Fahrenheit (°F), and rainfall was between 0.45 and 1.35 inches per day. For the April 18 and April 21, 2019, measurements, the winds were generally from the south and averaged 1 to 3 mph. Temperatures ranged between 45 and 74 °F and rainfall was between 0 and 0.27 inches per day.

The sound levels measured during periods of high precipitation were compared with those measured during dryer periods to verify the rain did not influence the results. The rain did not appear to significantly influence the data, but may have increased the ambient levels at measurement locations near roadways because of increased tire noise. Environmental windscreens were used on all microphones when measurements were taken. All equipment used meets the requirements outlined in Section 3.0 of this TM and is listed in Table 2.

Table 2. Measurement Equipment

Make and Model	Description	Serial
Location 1		
Brüel & Kjaer 2250	Meter	3006756
Brüel & Kjaer 4189	Microphone	2550228
Brüel & Kjaer ZC-0032	Preamp	24600
Brüel & Kjaer 4231	Calibrator	2545696
Location 2		
Rion NL-52	Meter	821097
Rion UC-59	Microphone	6064
Rion NH-25	Preamp	21138
LD CAL200	Calibrator	9253
Location 3		
NTi XL2	Meter	A2A-14825-EO
MC230A	Microphone	A16453
MA220	Preamp	8109
LD CAL200	Calibrator	9253
Location 4[a]		
Svantek 958	Meter	95108
Mk255	Microphone	12529
Svantek SV12L	Preamp	57961
LD CAL200	Calibrator	9253
Location 5		
NTi XL2	Meter	A2A-15003-EO
MC230A	Microphone	A16691
MA220	Preamp	8117
LD CAL200	Calibrator	9253
Location 6		
Svantek 958	Meter	95108
Mk255	Microphone	12529
Svantek SV12L	Preamp	57961
LD CAL200	Calibrator	9253

a. *Equipment used during second measurement at Location 4.*

All equipment was factory calibrated within 1 year of the measurement date. Field calibrations were performed before the measurements were taken and verified immediately after the measurements were completed. Measurement setups for all six locations are shown in Figure 1. Figure 2 below shows the six measurement locations in relation to the site.

Location 1

Location 2

Location 3

Location 4

Location 5

Location 6

Figure 1. Measurement setups by location

The highest average daytime and nighttime sound levels were measured at Location 6. This is likely due to the proximity of Southeast Carpenter Lane and Southeast Dodge Park Boulevard. It should be noted that MCC and CCC do not identify the noise metric used for the sound level limits. Therefore, metrics provided in OAR 340-035-0035 were used. The measured hourly L_{eq} sound levels are also reported for information purposes.

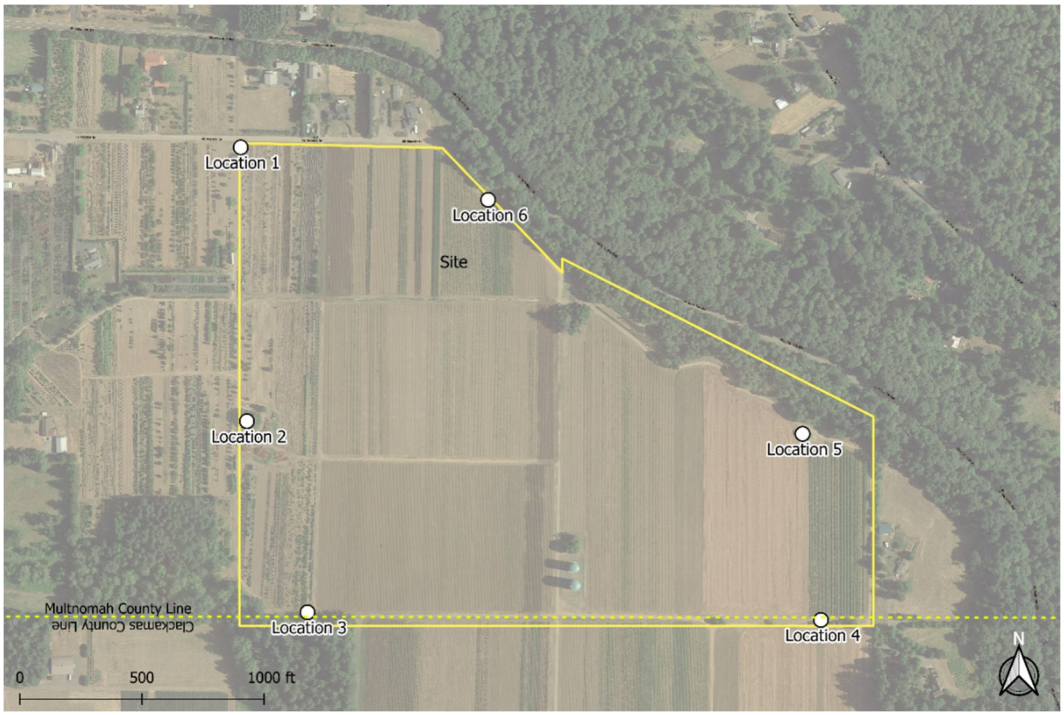

Figure 2. Measurement location overview

Measured sound levels are listed in Table 3 and shown graphically in Figures A-1 to A-6 in Attachment A.

Table 3. Measured Hourly Sound Levels, min-max (median), dBA

Location	Daytime (7 a.m. – 10 p.m.)				Nighttime (10 p.m. – 7 a.m.)			
	L_{01}	L_{10}	L_{50}	L_{eq}	L_{01}	L_{10}	L_{50}	L_{eq}
Location 1	47-70 (**58**)	41-55 (**49**)	37-46 (**41**)	41-58 (**47**)	39-61 (**46**)	34-54 (**42**)	33-47 (**38**)	33-50 (**40**)
Location 2	51-65 (**57**)	42-54 (**50**)	38-51 (**44**)	41-52 (**48**)	40-60 (**51**)	35-54 (**48**)	33-49 (**44**)	34-51 (**45**)
Location 3	48-59 (**56**)	40-53 (**49**)	36-49 (**44**)	41-51 (**47**)	36-59 (**50**)	33-51 (**45**)	31-48 (**42**)	34-50 (**43**)
Location 4	48-66 (**57**)	46-58 (**48**)	46-50 (**46**)	46-55 (**48**)	46-55 (**48**)	46-48 (**46**)	46-47 (**46**)	46-47 (**46**)
Location 5	48-62 (**57**)	44-59 (**51**)	38-54 (**45**)	42-55 (**48**)	40-56 (**50**)	36-51 (**44**)	34-47 (**41**)	35-49 (**42**)
Location 6	56-65 (**61**)	48-58 (**54**)	47-53 (**49**)	48-57 (**52**)	47-66 (**56**)	47-57 (**52**)	46-52 (**49**)	46-56 (**50**)
MCC and CCC Code Limits[a]	60				50			

a. *Noise metric not defined in MCC or CCC limits.*

The existing median hourly daytime L_{50} sound levels at the Site range between 41 dBA and 49 dBA and median nighttime L_{50} sound levels range between 38 dBA and 49 dBA.

References

Clackamas County Code Chapter 6.05.

Multnomah County Code Chapter 15.

Oregon Administrative Code 340-035.

Attachment A: Baseline Sound Levels

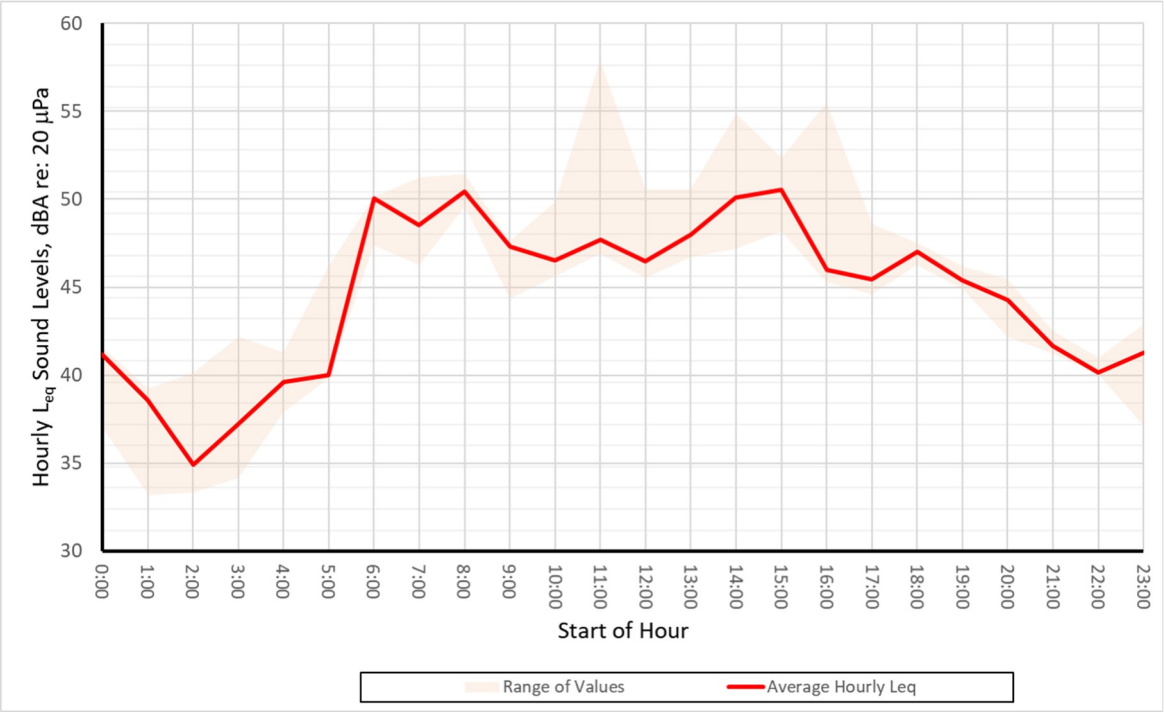

Figure A-1. Hourly Sound Levels at Location 1

Measured between 11 a.m. on April 5, 2019, and 12 p.m. on April 8, 2019.
L_{eq} Average is the median L_{eq}

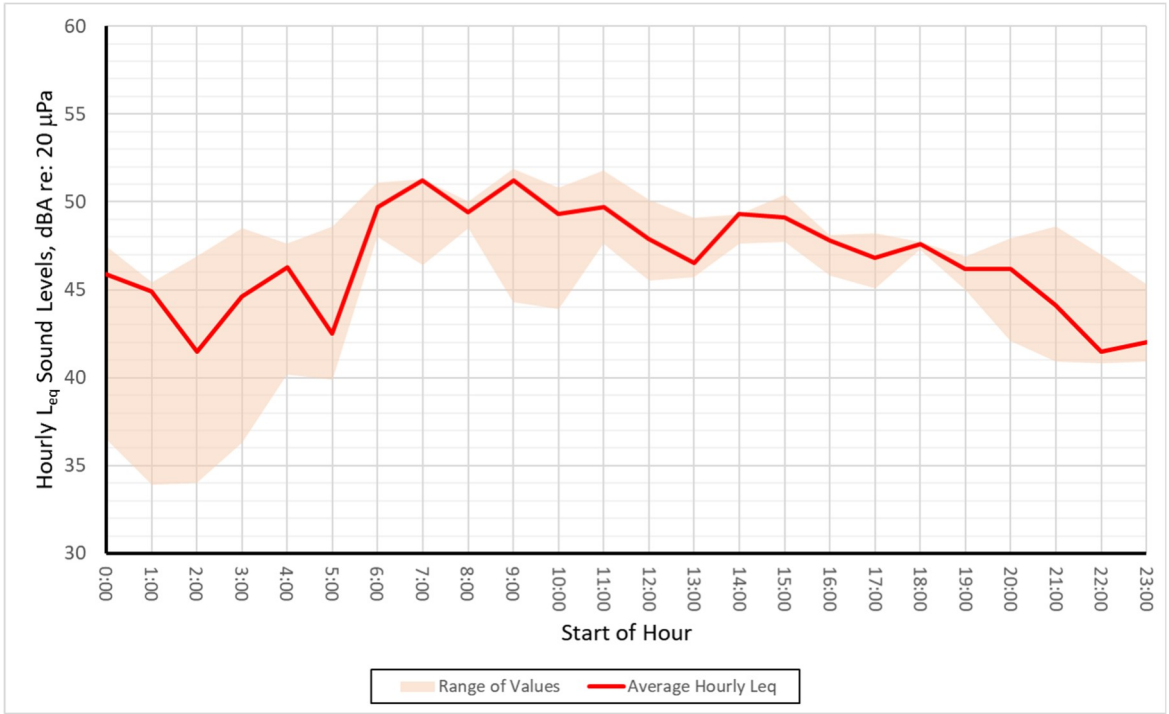

Figure A-2. Hourly Sound Levels at Location 2

Measured between 11 a.m. on April 5, 2019 and 12 p.m. on April 8, 2019
L_{eq} Average is the median L_{eq}

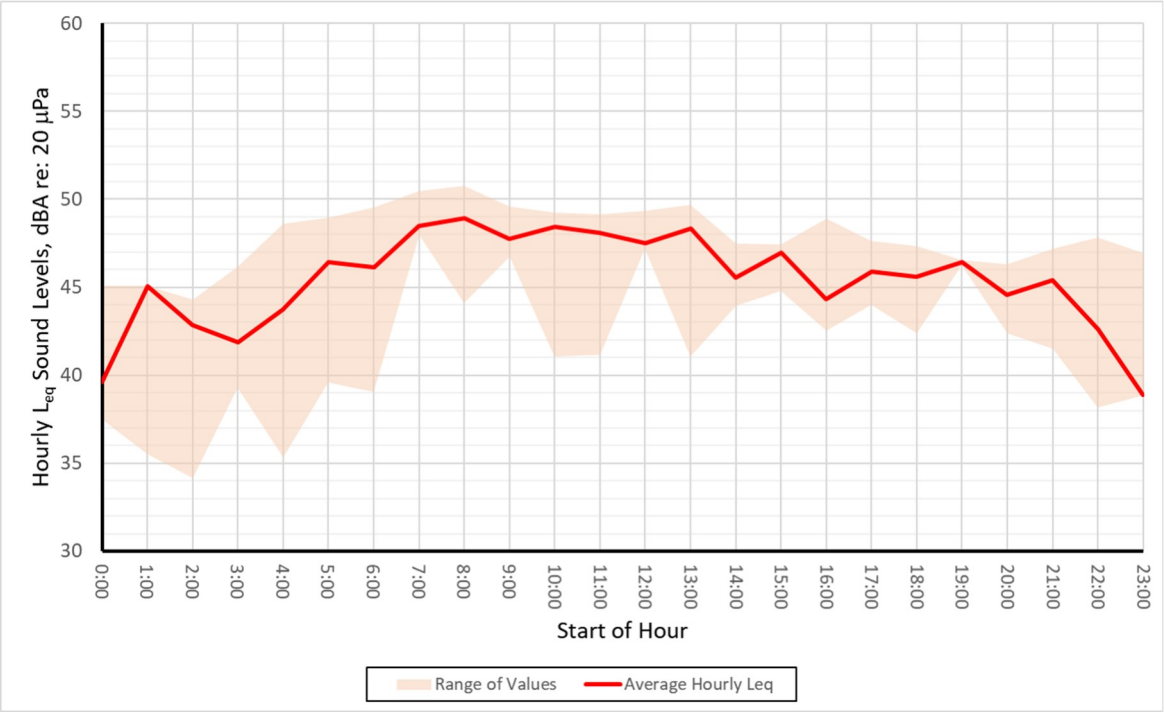

Figure A-3. Hourly Sound Levels at Location 3

Measured between 12 p.m. on April 5, 2019, and 1 p.m. on April 8, 2019.
L_{eq} Average is the median L_{eq}

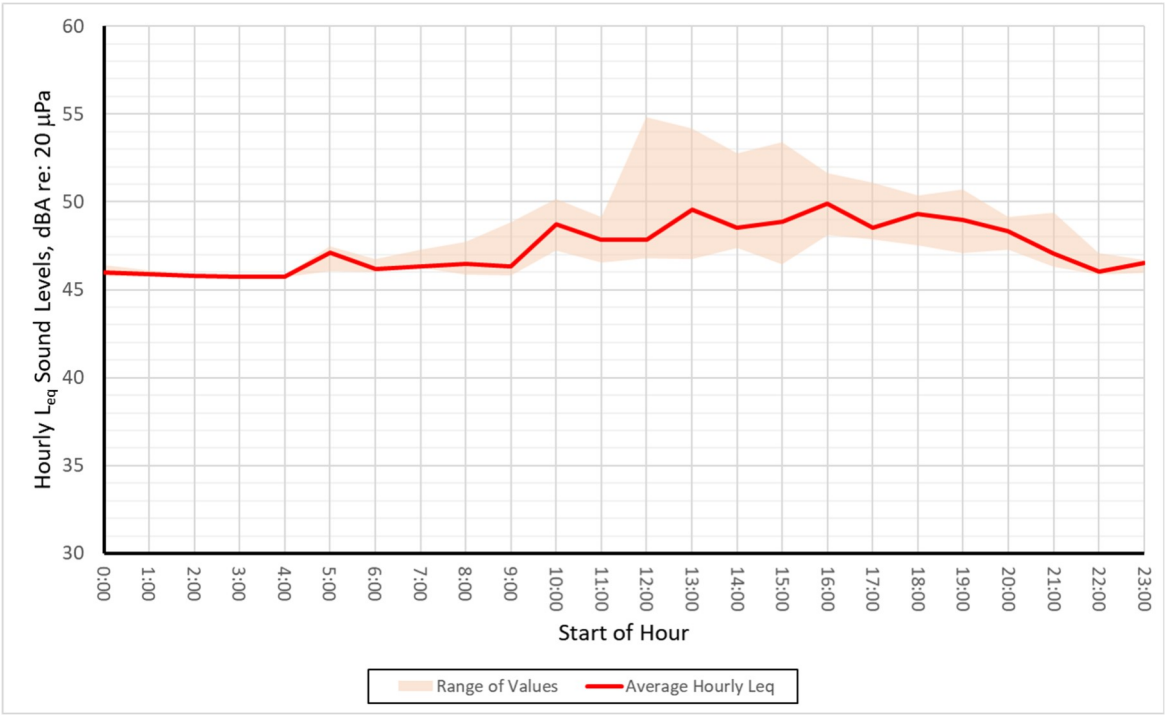

Figure A-4. Hourly Sound Levels at Location 4

Measured between 12 p.m. on April 18, 2019, and 10 a.m. on April 21, 2019.
L_{eq} Average is the median L_{eq}

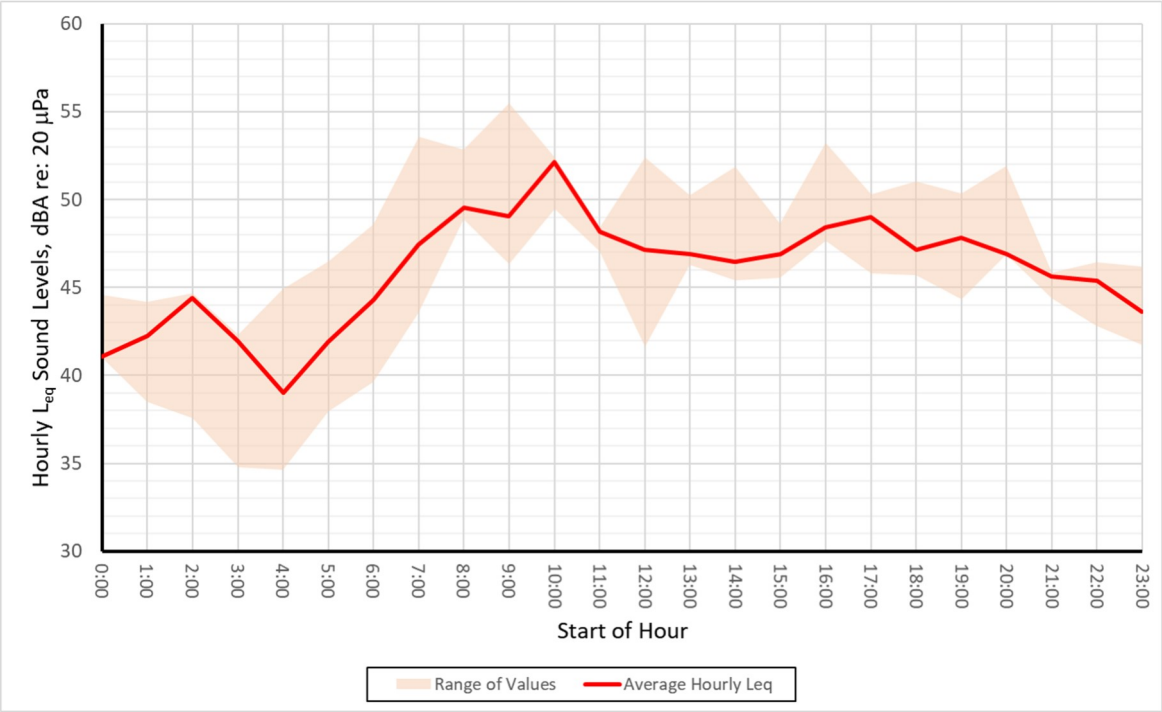

Figure A-5. Hourly Sound Levels at Location 5

Measured between 2 p.m. on April 5, 2019, and 2 p.m. on April 8, 2019.
L_{eq} Average is the median L_{eq}

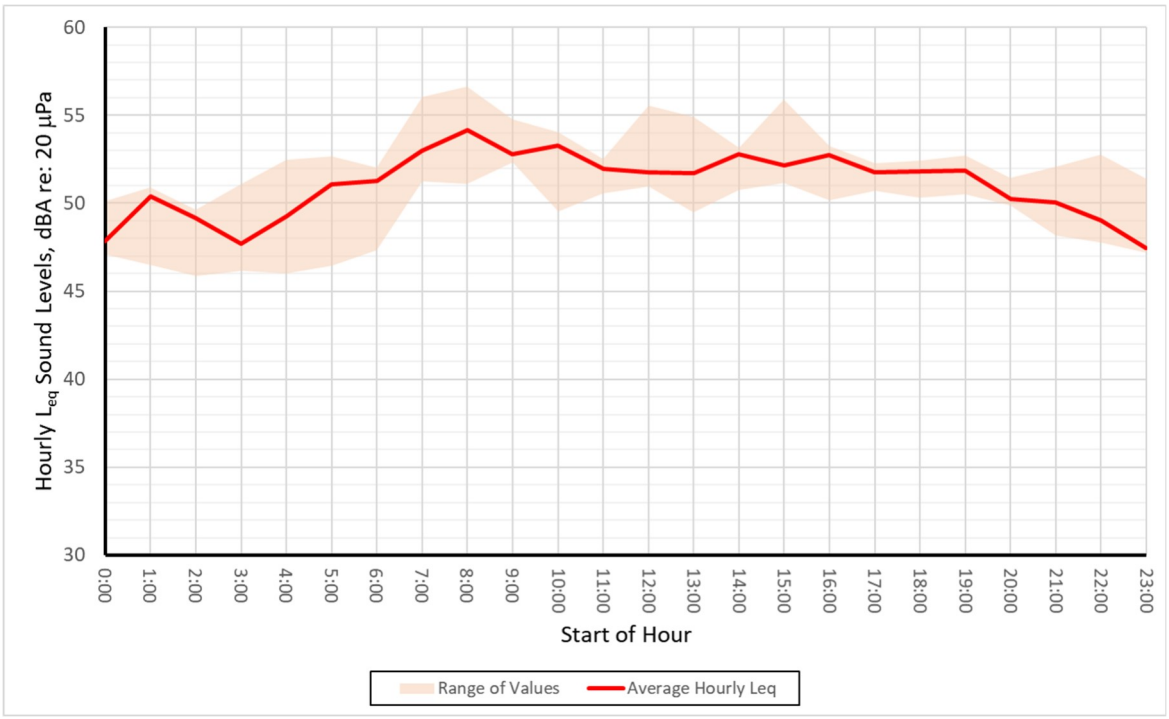

Figure A-6. Hourly Sound Levels at Location 6

Measured between 12 p.m. on April 5, 2019, and 1 p.m. on April 8, 2019.
L_{eq} Average is the median L_{eq}