NCIA Regional Noise Management Plan (RNMP) Report

(covering the 2017 and 2018 Calendar Years)

Prepared for the

Albert Energy Regulator (AER)

And

The Alberta Utilities Commission (AUC)

December 2019

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NCIA Regional Noise Management Plan (RNMP)

Annual Report to the Alberta Energy Regulator (AER) and

The Alberta Utilities Commission (AUC)

2019 (covering the calendar years 2017 and 2018)

1 Executive Summary

The NCIA Regional Noise Model (RNM) was updated in 2018 (last update was in 2015). Details of the update are included in Section 3 and Appendix 1 of this report. A number of NCIA member site level noise models were updated in 2018, mostly due to expansions or changes at these facilities since the last model update in 2015, and those were included in the 2018 update to the RNM.

- Nutrien Redwater Fertilizer Operations updated their noise model in February of 2017.
- Plains Midstream Canada's Fort Saskatchewan Fractionation and Storage updated their noise model in October of 2016.
- Pembina's Redwater Operations updated their noise models for the Co-Generation Plant in March of 2016 and RFS1 and ROF in June of 2018.
- Shell Canada Refinery, Upgrader and Cogen noise models were updated in December of 2016.
- Shell Chemicals Styrene and MEG noise models were updated in November of 2016.
- Aux Sable's Off-Gas Plant noise model was updated in June of 2018.
- Keyera Energy Fort Saskatchewan Fractionation and Storage noise model was updated in July of 2018.

Field validation measurements for the Regional Noise Model were completed in 2017 and 2018 (conducted by ACI Acoustical Consultants Inc.). The field validation measurements are compared to the 2018 RNM in Section 4. In general, the model over predicts the measured values, as one would expect, given that the model assumes that a facility is operating with worst-case noise outputs.

Measured versus modeled results for the 2017 field data are shown in Table 6 and Figure 3. Measured versus modeled results for the 2018 field data are shown in Table 7 and Figure 4. A discussion of the results is presented in Section 4 of this report.

Figure 5 shows trend analysis that was completed for any location that had at least 4 years or more of data. It is evident from this Figure that there are no significant trends (either up or down) in the sound levels of the measured data over time when one considers the variability created by the meteorological conditions. These are best identified by the upper and lower ranges found in Figures 3 and 4.

2 AER Audits of NCIA Member Facilities

No Audits of NCIA member companies' Regional Noise Management Plans were conducted by AER in 2017 or 2018.

3 Regional Noise Model Update (2018, Appendix 1)

A number of NCIA member site level noise models were updated since 2015, mostly due to expansions or changes at these facilities, and those were included in the 2018 RNM update (as explained in the Executive Summary).

Road traffic data was also updated for the 2018 RNM (see Appendix 1) along with the railway noise data (see Appendix 1). These are provided as layers in the model that can be turned on or off depending on what the users interest is. A calm wind version of the 2018 RNM is available on the NCIA website for Cases 1 and 3.

Tables 1 to 3 are reproduced from Appendix 1 and show the current state of the site level models that make up the 2018 NCIA Regional Noise Model.

Table 4 is reproduced from Appendix 1 and shows the list of facilities included in the modeled cases which are:

- Case 1 – Existing Regulatory Case
- Case 2 – Future Regulatory Case
- Cases 3a to 3d – Model Validation Case

A sound level contour difference was generated showing the NCIA 2018 RNM minus the NCIA 2015 RNM and is presented in Figure 1 below with some discussion.

Table 1
Site Noise Models in 2018 RNM Prepared by SLR

Company	Plant / Unit	Model Date
Nutrien	**Redwater Fertilizer Operations Plant**	**February, 2017**
Air Liquide	Cogeneration Unit	June, 1998
Cenovus	North American Terminal Operations	March, 2010
Dow Chemical Canada	Ethylene; Fractionator; Polyethylene I, II & III; Ethylene Oxide / Ethylene Glycol; Ethane Storage; Power & Utilities; Cogeneration plants	December 15, 2014
Plains Midstream	**Fractionation and storage**	**October, 2016**
North West Redwater Partnership	Sturgeon Refinery (3 units)	November 22, 2007
Pembina	**RFS1; ROF**	**June, 2018**
Shell Canada	**Refinery; Upgrader (base plant and expansion plant); Cogen**	**December, 2016**
Shell Chemicals	**Styrene; MEG**	**November, 2016**
Sherritt Fort Saskatchewan Integrated Site:		
Nutrien	Nitrogen production	January, 2003
Corefco	Metal production	February, 2006 *
Sherritt International	Metal production	February, 2006
Oerlikon-Metco	Chemical preparation	February, 2006
Umicore	Metal products	February, 2006 *

* integrated into Sherritt model

Table 2
Site Noise Models in 2018 RNM Prepared by Others

Company	Plant / Unit	Acoustical Consultant	Model Date
Aux Sable	**Off-Gas Plant**	**Patching Associates**	**June, 2018**
Wolf Midstream	Sturgeon Terminal	FFA	July, 2010
Value Chain Solutions	Oilsands Upgrader	RWDI	May, 2004
Suncor	Fort Hills Sturgeon Upgrader	RWDI	September, 2008
Pembina	RFS2 Expansion	Stantec	June, 2013
Pembina	RFS3 Expansion	Stantec	December, 2014
Pembina	**Co-generation Plant**	**Stantec**	**March, 2016**
Keyera Energy	**Fractionation and storage**	**Patching Associates**	**July, 2018**

Table 3
Heartland Plants where Basic Noise Models were included in the 2018 RNM

Company	Plant / Unit	Data Provided	Model Date
Aux Sable Canada*	Extraction Plant	Sound Power Levels	September, 2010
Evonik Canada Inc.	Hydrogen Peroxide Plant	Fenceline Measurements	June, 2010
Chemtrade Logistics	Central Service Center	Diagnostic Measurements	September, 2010
Chemtrade Logistics	Sulfides Facility	Diagnostic Measurements	September, 2010
Praxair Canada Inc.	Air Separation Plant	Fenceline Measurements	June, 2010
Praxair Canada Inc.	Carbon Dioxide Plant	Fenceline Measurements	June, 2010
ATCO Midstream	Liquid Extraction Plant	Sound Power Levels	June 2011

* based on PWL's provided by the facility's acoustical specialist

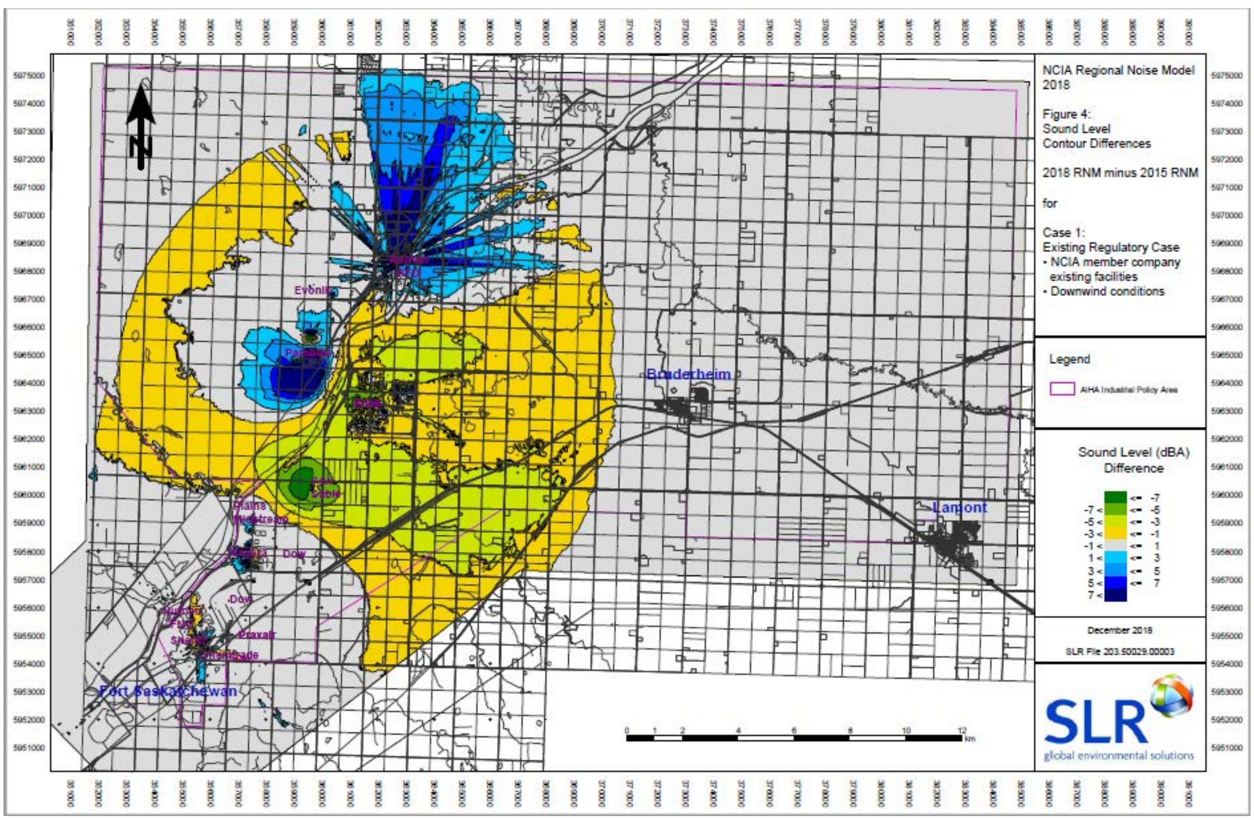
Table 4
List of Facilities included in the modeled cases

Company	Plant	Case 1	Case 2	Case 3
Air Liquide	Cogeneration Unit	•	•	•
ATCO Midstream	Liquid Extraction Plant			•
Aux Sable	Off-Gas Plant	•	•	•
	Extraction Plant		•	•
Cenovus	North American Terminal Operations	•	•	•
Chemtrade Logistics	Central Service Center	•	•	•
	Sulfides Facility	•	•	•
Corefco - Sherritt Integrated Site	Metal production	•	•	•
Dow Chemical Canada	Ethylene; Fractionator; Polyethylene I, II & III; Ethylene Oxide / Ethylene Glycol; Ethane Storage; Power & Utilities; Cogeneration plants	•	•	•
Evonik Canada Inc.	Hydrogen Peroxide Plant	•	•	•
Keyera Energy	Fractionation and storage	•	•	•
North West Redwater Partnership	Sturgeon Refinery (3 units)		•	•
Nutrien	Redwater Fertilizer Operations Plant	•	•	•
	Nitrogen production	•	•	•
Oerlikon-Metco - Sherritt Integrated Site	Chemical preparation	•	•	•
Pembina	RFS1 & ROF	•	•	•
	RFS2 Expansion	•	•	•
	RFS3 Expansion	•	•	•
	Co-generation Plant		•	•
Plains Midstream	Fractionation and storage	•	•	•
Praxair Canada Inc.	Air Separation Plant	•	•	•
	Carbon Dioxide Plant	•	•	•
Shell Canada	Refinery; Upgrader (base plant and expansion plant); Cogen	•	•	•
Shell Chemicals	Styrene; MEG	•	•	•

Table 4 (continued)
List of Facilities included in the modeled cases

Company	Plant	Case 1	Case 2	Case 3
Sherritt International - Sherritt Integrated Site	Metal production	•	•	•
Suncor	Fort Hills Sturgeon Upgrader		•	•
Umicore - Sherritt Integrated Site	Metal products	•	•	•
Value Chain Solutions	Oilsands Upgrader		•	•
Wolf Midstream	Sturgeon Terminal	•	•	•

Figure 1
Contours of modeled differences between 2018 and 2015 RNM's



These differences account for all changes to the Regional Noise Model arising from the 2018 update, including any slight differences between SoundPLAN calculation kernels for version 7.3 in 2015 and version 8.0 in 2018. The 2018 update to the RNM contains more data than the previous 2015 model did. This is mostly due to those facilities which had not updated their site models for a number of years, having completed updates with more accurate models representing changes and/or expansions to their facilities. Some of these updates were based on actual on-site noise measurements, providing a greater level of accuracy to the overall noise model. The contour differences shown in Figure 1 can be explained by the following updates to the RNM:

- For the Pembina Redwater Fractionation & Storage Facility, the apparent increase in sound levels is the result of performing detailed site noise measurements and updating the site noise model for the ROF and RFS1 units. The RFS2 expansion has not yet been updated, and remains unchanged in the site model as theoretical data. The RFS3 expansion unit is also based on theoretical data, yet the expansion has now been built so the model is included in Case 1.

- For the Nutrien Redwater Fertilizer Operations, the apparent increase in sound levels is the result of performing detailed site noise measurements for a number of areas in the plant that had not been updated for several years.

- For the Shell Scotford site, a number of updates were made to the site models based on detailed site noise measurements. In particular, updates were made to include the Quest expansion, as well as the Chemicals unit to improve accuracy of the site noise models. These updates resulted in small localized increases in noise in the areas within the plant site, yet a net decrease in noise offsite.

- For the Aux Sable facility, the Off-Gas Plant was updated based on site noise measurements to replace the previous theoretical based noise model, resulting in a net decrease in predicted sound levels.

- For the Keyera facility, site noise measurements were conducted to replace the previous theoretical based model, resulting in localized differences in predicted noise levels, but an insignificant net change in the surrounding area.

- For the Plains Midstream facility, there have been some expansions to the site which have been captured in the most recent site noise model. The expansions are based on theoretical data and result in a small localized increase in predicted sound levels.

- There are some changes to the predicted noise levels that appear around the Nutrien FNO and Sherritt Integrated Site, yet there have not been any changes to the site models in this area. It is expected that these slight differences appear due to improvements to the SoundPLAN modeling software's calculation kernel. Specifically, improvements that were made to the side diffraction calculations in SoundPLAN version 8.0.

4 2017 and 2018 Monitoring results for Regional Noise Model (Appendix 2 and 3)

ACI Acoustical Consultants Inc. (ACI), of Edmonton AB, was retained by the Northeast Capital Industrial Association (NCIA) to conduct an environmental noise survey within Alberta's Industrial Heartland (AIH) in 2017 and 2018. The purpose of the study was to conduct noise monitoring for a single 48-hour period at eleven (11) pre-specified locations within the AIH. Additional noise monitoring, spanning two (2) 48-hour periods, was conducted at a 12th monitoring location (referred to as Location 12) as an independent control/reference point. The noise monitoring was conducted in support of the NCIA's Regional Noise Management Plan. In addition, the results from the noise monitoring survey will be used to validate the Regional Noise Level Assessment Model (the Regional Noise Model). All noise monitoring procedures and equipment used was in accordance with the requirements of the Alberta Energy Regulator (AER) Directive 038 on Noise Control. Site work was conducted by ACI in July 2017 and then again in June and July 2018 by P. Froment, B.Sc., P.L.(Eng.).

As part of the study, 48-hour noise monitoring was conducted at a total of thirteen (13) locations throughout the Alberta's Industrial Heartland. It was found that the isolated LeqNight sound levels (both broadband and 1/3 octave band), from at least one (1) over-night period, were similar to those from previous measurements. The noise monitoring locations were the same for 2017 and 2018 and are shown in Table 5 (for 2018) and Figure 2 below. The complete details can be found in Appendix 2 (for 2017) and 3 (for 2018) of this report.

The noise levels at most locations consisted of low frequency components with occasional mid/high frequency components that could be attributed to the nearest facility relative to each individual noise monitoring location. Despite the noise being relatively low in frequency, none of the sites indicated any low frequency tonal components. As in previous years, the noise from train passages were again prevalent at all locations and tended to dominate the noise climate as they passed through, particularly when there were train whistles. This was particularly true for locations within proximity to a rail line and for locations further away from any of the large industrial sites.

Measured versus modeled results are shown in Table 6 (for 2017) and Table 7 (for 2018) and Figure 3 (for 2017) and Figure 4 (for 2018) below.

The results in Table 6 and Table 7 indicate some fairly large differences between measured and predicted sound levels at several locations. In previous assessments, it was noted that the field measured results often varied quite significantly between the two nighttime periods which made it difficult to draw conclusions on the data. Therefore, it was suggested that instead of comparing measured sound levels to predicted sound levels for a specific meteorological condition, it would be more meaningful to compare the measured levels to predicted levels based on a range of possible meteorological conditions.

The meteorological conditions used to define the extents of the predicted range are representative of temperature lapse conditions (calm wind with Pasquill Stability Class "b"), and temperature inversion conditions (calm wind with Pasquill Stability Class "F"). These represent the reasonable extremes of meteorological conditions that may exist at any given time in the region. The Case 3 model was run with these parameters to define the lower and upper limits of predicted sound levels at each monitoring location, and the measured sound levels are compared to these ranges, as shown in Figures 3 and 4.

The results indicate that the Regional Noise Model is generally over-predicting the measured noise level at most receptors by up to 5 dBA, with a few exceptions depending on the year. While over-predicting by this amount is not ideal, it points to the fact that some conservatism is built into the overall model and the noise levels are higher as a result, as would be expected for a model of this type where every facility is assumed to be operating with worst-case noise outputs.

Table 5
Monitoring Location Details

Monitoring Location	UTM Coordinates (Approximate) [2]		Start Time	End Time
	Easting (m)	Northing (m)		
1C	355210	5954157	7/24/18 12:00	7/26/18 12:00
2	358256	5957216	6/18/18 14:00	6/20/18 14:00
3B	358361	5959283	6/18/18 13:50	6/20/18 13:50
4C	361665	5960870	7/24/18 13:00	7/26/18 13:00
5	361777	5964711	6/18/18 13:30	6/20/18 13:30
6	364322	5967894	6/18/18 13:10	6/20/18 13:10
7	N/A			
8A	358897	5965430	7/24/18 15:00	7/26/18 15:00
9	355872	5957574	6/18/18 15:00	6/20/18 15:00
10	355925	5955818	6/18/18 14:30	6/20/18 14:30
11	358430	5963804	7/24/18 18:00	7/26/18 18:00
12B (1st 48-hour)	368223	5963070	6/18/18 13:00	6/20/18 13:00
12B (2nd 48-hour)			7/24/18 14:00	7/26/18 14:00
13	358667	5970180	7/24/18 15:00	7/26/18 15:00

The complete reports are included as Appendix 2 and 3 of this report.

Figure 2: NCIA Regional Noise Monitoring Locations (as per Table 5)

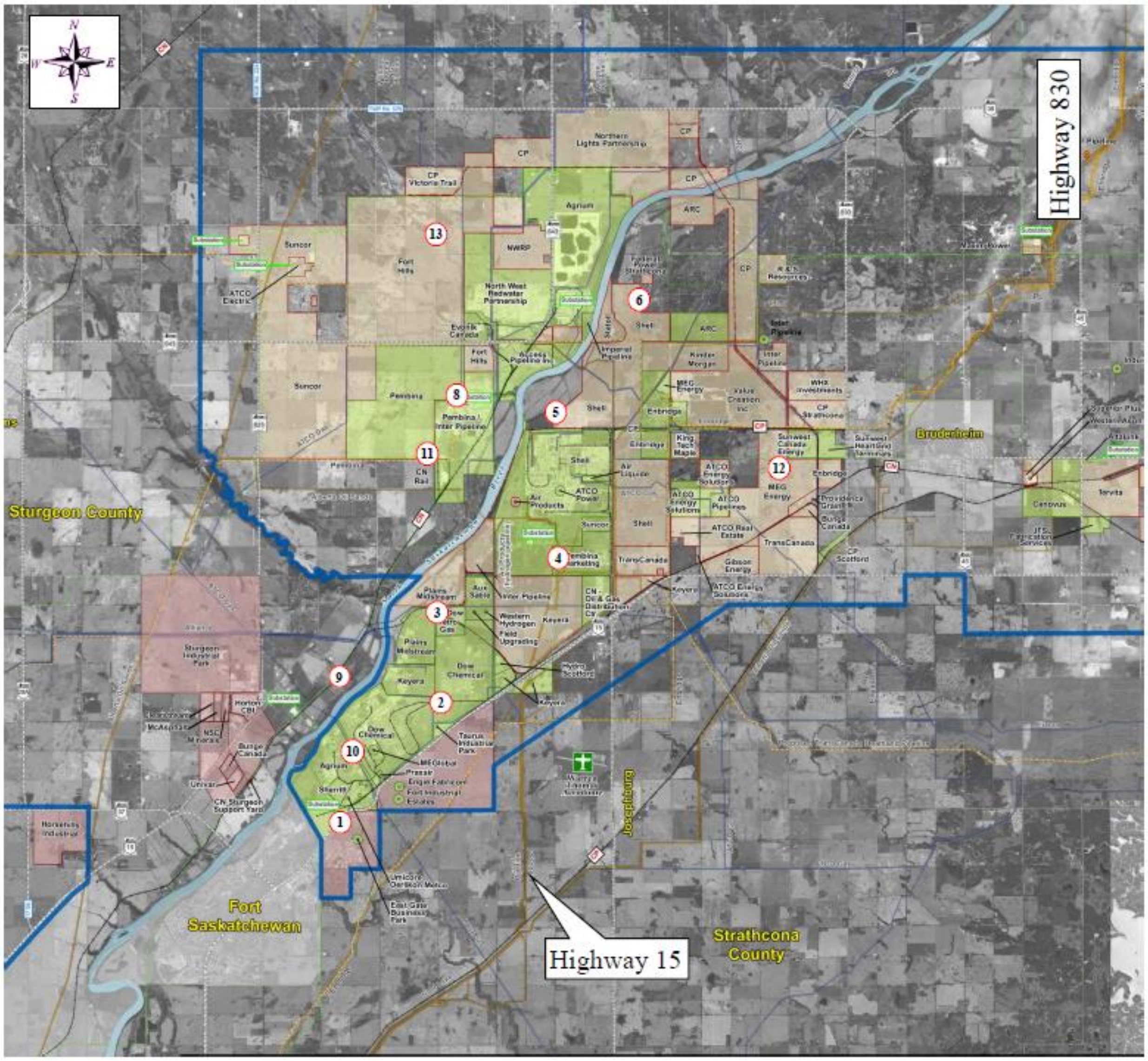
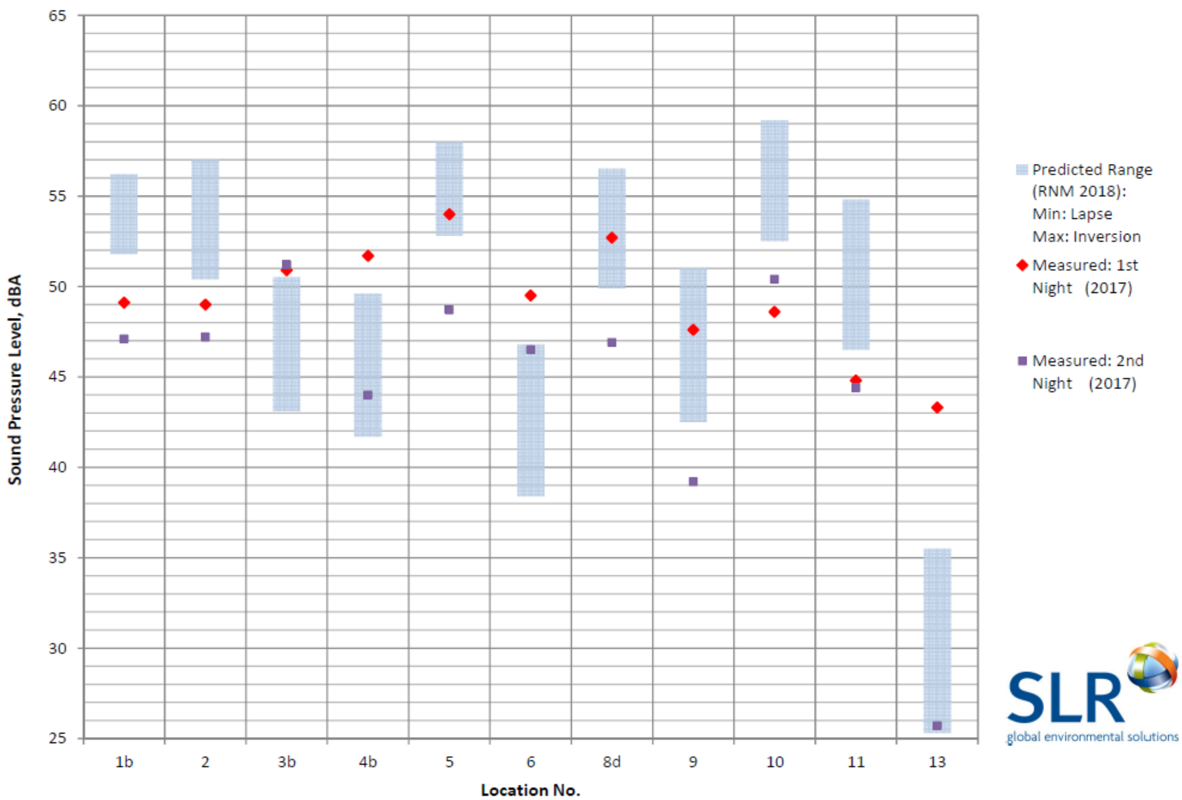


Table 6
Comparison of Measured versus Modelled results for 2017

Receptor Number	Receptor Location Change	Measured (M) and Predicted (P) Nighttime Sound Levels (Isolated dBA Leq)						Average Difference: (dBA)
		1st Nighttime Period			2nd Nighttime Period			
		Measured	Predicted	Delta (Predicted minus Measured)	Measured	Predicted	Delta (Predicted minus Measured)	
1b	Moved in 2017	49.1	54.6	+5.5	47.1	54.5	+7.4	+6.5
2		49.0	54.1	+5.1	47.2	53.7	+6.5	+5.8
3b	Moved in 2017	50.9	45.2	-5.7	51.2	45.0	-6.2	-6.0
4b	Moved in 2015	51.7	45.9	-5.8	44.0	46.3	+2.3	-1.8
5		54.0	54.9	+0.9	48.7	54.1	+5.4	+3.2
6		49.5	40.1	-9.4	46.5	41.3	-5.2	-7.3
7		Monitoring not conducted						
8d	Moved in 2016	52.7	52.0	-0.7	46.9	53.0	+6.1	+2.7
9		47.6	44.9	-2.7	39.2	46.1	+6.9	+2.1
10		48.6	55.7	+7.1	50.4	55.2	+4.8	+6.0
11		44.8	48.9	+4.1	44.4	52.2	+7.8	+6.0
12 (Period 1)		37.3	n/a	n/a	34.8	n/a	n/a	n/a
12 (Period 2)		37.3	n/a	n/a	33.0	n/a	n/a	n/a
13	New in 2016	43.3	27.6	-15.7	25.7	28.4	+2.7	-6.5

Figure 3: Predicted Range versus Measured Sound Levels (2017)



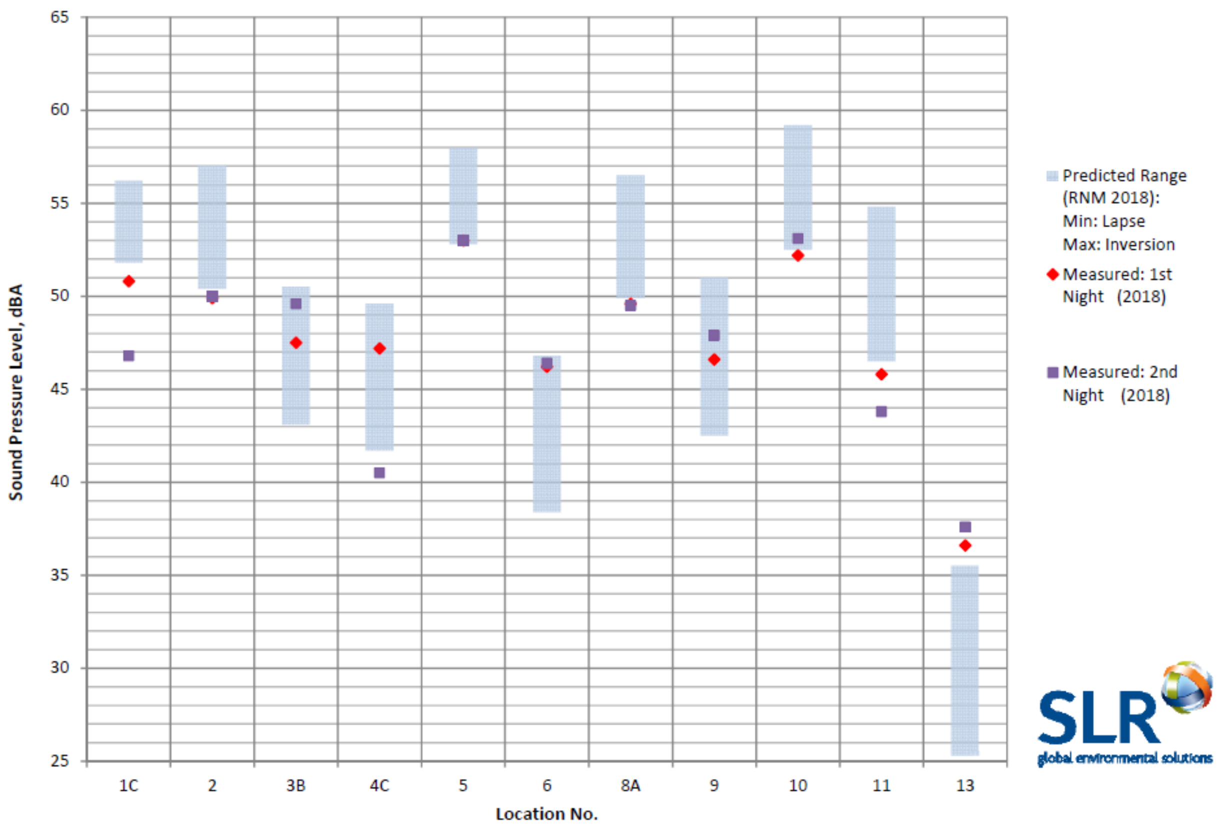
For the 2017 comparison, the model is generally over-predicting the noise level at most receptors by up to approximately 5 dBA, with the exception of locations 3b, 4b, and 6 where measurement levels are up to approximately 3 dBA higher than the upper predicted level. Location 13 is affected by the Sturgeon Refinery, which is not included in the Existing Case model yet. It should also be noted that 2017 was challenging for noise monitoring given the large number of rainy and stormy days.

Table 7

Comparison of Measured versus Modelled results for 2018

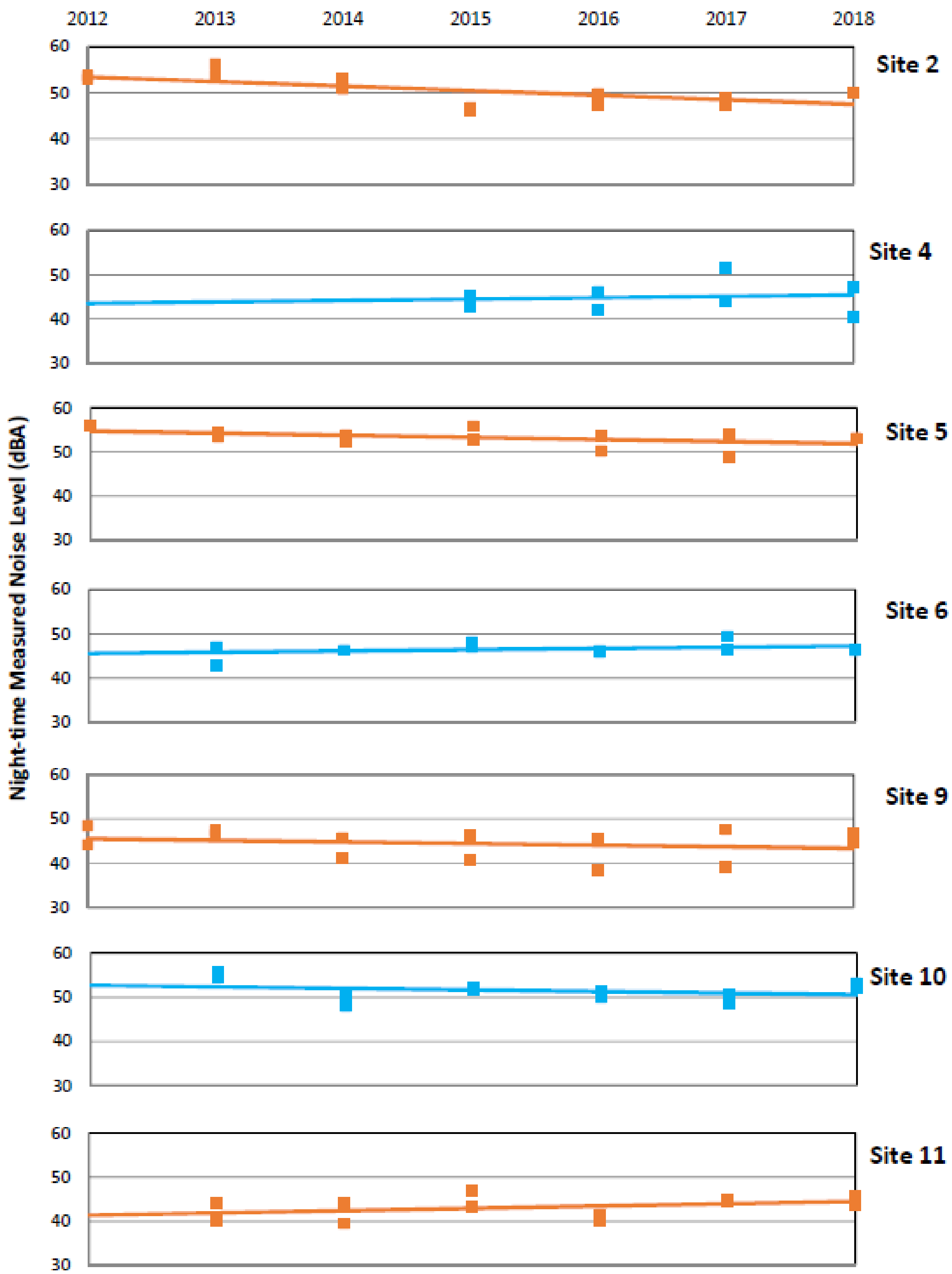
Location	1st Nighttime Period			2nd Nighttime Period			Average Difference (dBA)
	Measured	Predicted	delta (Predicted - Measured)	Measured	Predicted	delta (Predicted - Measured)	
1C	50.8	55	4.2	46.8	54.8	8.0	6.1
2	49.9	54.3	4.4	50	54.3	4.3	4.4
3B	47.5	44.2	-3.3	49.6	44	-5.6	-4.5
4C	47.2	47.2	0.0	40.5	47.4	6.9	3.5
5	53	52.9	-0.1	53	52.7	-0.3	-0.2
6	46.2	41.3	-4.9	46.4	41	-5.4	-5.2
8A	49.6	53.6	4.0	49.5	52.6	3.1	3.6
9	46.6	44.7	-1.9	47.9	44.6	-3.3	-2.6
10	52.2	55.2	3.0	53.1	55.3	2.2	2.6
11	45.8	53.5	7.7	43.8	52.7	8.9	8.3
12B (1st 48 hour)	36	26.3	-9.7	36.6	26	-10.6	-10.2
12B (2nd 48 hour)	28.6	25.6	-3.0	31.1	26.8	-4.3	-3.7
13	36.6	29.9	-6.7	37.6	28	-9.6	-8.2

Figure 4: Predicted Range versus Measured Sound Levels (2018)



For the 2018 comparison, the model is generally over-predicting the noise level at most receptors by up to approximately 5 dBA, with the exception of location 13 where measurement levels are up to approximately 3 dBA higher than the upper predicted level. Location 13 is affected by the Sturgeon Refinery which is not included in the Existing Case model yet. Overall, the 2018 results are more reflective of the typical noise climate of this area in comparison to 2017.

Figure 5: Trend Analysis of Measured Data (2012 to 2018)



As we saw for the previous trend report (in the 2017 Annual Report for Calendar year 2016), there is no clear trend in noise levels across the region. Site 3 was removed from the analysis due to the location being moved a fair distance. Site 4 was added to the analysis as it meets the criteria number of years now.

5 NCIA Member Compliance

Table 8 summarizes the compliance requirements for NCIA member and non-member companies' vis-a-vis the NCIA RNMP.

Table 8
Compliance Requirements for NCIA Member Companies

NCIA Member	AER Regulated	RNMP Participant	Compliance Vehicle
Yes	Yes	Yes	NCIA - RNMP
No	Yes	No	AER to Determine
Yes	No	No	Municipality/AEP
Yes	No	Yes	NCIA - RNMP
No	No	Yes	Potential NCIA-RNMP
No	No	No	Other Regulatory Jurisdictions

As of this date, Table 9 summarizes the NCIA member companies and their status with respect to Table 8 above.

Table 9
Summary of NCIA Member Company Information for RNMP

NCIA Member[1]	AER Regulated Status for Noise Control Directive 038	Filed an Annual Update with NCIA for 2017/2018 (Appendix 4 and 5)	Developed a Site Noise Management Plan
Access Pipeline (now Wolf Midstream)	AER regulated under Noise Control Directive 038.	Yes/Yes	Not Yet
Air Liquide Canada	Not regulated	Yes/Yes	Partly
Arc Resources (now ACCEL Energy)	AER regulated under Noise Control Directive 038.	NA[2]/No	
ATCO Power[3]	Heartland facility not operational.	No/NA	Yes
Aux Sable Canada	Regulated under Section 11 of the OSCA and therefore D-038.	No/Yes	Yes
Cenovus	Not regulated	Yes/No	Not Yet

NCIA Member[1]	AER Regulated Status for Noise Control Directive 038	Filed an Annual Update with NCIA for 2017/2018 (Appendix 4 and 5)	Developed a Site Noise Management Plan
Chemtrade West	Not regulated	Yes/Yes	Yes
Dow Chemical Canada	Regulated under D-038 Operator No. 0F05	Yes/Yes	Yes
Enbridge Pipelines	Is regulated	Yes/Yes	Yes
Evonik	Not regulated	Yes/Yes	Partly
Fort Hills Energy Partnership[4]	Not operational but will be regulated Operator No. 0XP9	No/NA	Not Yet
Keyera Corp.	Regulated under D-038 Operator No. A5W1 LSD - 02-14-055-22W4 Facility No. F-12695	Yes/Yes	Yes
MEG Energy	Has no noise generating assets in the region now	Covered by Wolf Midstream	NA
MEGlobal	Not regulated	Included with Dow's submission	Yes
North West Redwater Partnership	Not fully operational but will be regulated. LSD - E1/2-18-56-21-W4M	No/No	Yes
Nutrien Fort Saskatchewan	Not regulated	Yes/Yes	Yes
Nutrien Redwater	Not regulated	Yes/Yes	Yes
Oerlikon Metco (Canada)	Not regulated	Yes/Yes	Yes
Pembina NGL Corporation	Regulated under D-038	Yes/Yes	Yes
Plains Midstream Canada	Regulated under D-038 Operator No. 60 LSD - 14-55-22 W4M Facility No. 12699	Yes/Yes	Yes
Praxair Canada	Not regulated	No/No	Partly
Shell Chemicals	Not regulated	Yes/Yes	Yes
Shell Refinery	Regulated under Section 11 of the OSCA and therefore Noise Control Directive 038. AER Approval No. 11640.	Yes/Yes	Yes

NCIA Member[1]	AER Regulated Status for Noise Control Directive 038	Filed an Annual Update with NCIA for 2017 and 2018 (Appendix 4 and 5)	Developed a Site Noise Management Plan
Shell Upgrader	AER Approval No. 8522 regulated under D-038.	Yes/Yes	Yes
Sherritt International	Not regulated	Yes/Yes	Yes
Umicore Canada	Not Regulated	Yes/Yes	Yes
Value Creation (now Value Chain Solutions)	Not operational, but will be regulated.	No/No	Not Yet

[1]**Bold** type in the above table signifies that these members have operational assets on the ground within Alberta's Industrial Heartland. Non-bold type means these companies are members, but do not have operational assets, at this time, in the region and were therefore not required to complete the annual input form, although some did provide updates on their projects.

[2] NA means Not Applicable as the entity was either not a member of NCIA, or their project was cancelled along with their membership in NCIA.

[3] ATCO Power ceased membership with NCIA in 2018 as they decided not to proceed with their project in Alberta's Industrial Heartland.

[4] Suncor (Fort Hills) ended its membership with NCIA in 2018 as it was no longer proceeding with the project in Alberta's Industrial Heartland.

6 Regional Noise Model General

6.1 Improvements/Corrective Actions implemented in 2017 (Appendix 4)

1. Access Pipeline – A noise complaint was received in August of 2017 from a landowner and a Keyera employee. The cause of the noise may have been related to cavitation on a valve at the Keyera River Road Pipeline River Road meter station (04-18-055-21W4M). The control valve was checked for anti-cavitation trim. While it was not conclusive that the noise came from the Access Pipeline system, it was determined that the mode of operation was normal.
2. Nutrien – Nutrien Redwater hired SLR Consulting to complete a Noise Model Update to address discrepancies in the existing NCIA Regional Noise Model. This update was captured in the 2018 RNM update.
3. Sherritt International – Fence line monitoring was completed in 2017 by SLR Consulting (Canada) Ltd. The five measurement locations used were the same as the ones used in previous surveys. The results for the 2017 survey are generally lower than the 2011 values, although the 2017 values are generally consistent with the measurement results from the 2013 survey. It appears that the 2017 are slightly higher than the 2015 due to non-routine construction activities. At this time, it is believed that an updated Site model is not required as a result of the 2017 survey.

6.2 Improvements/Corrective Actions implemented in 2018 (Appendix 5)

1. Aux Sable – Patching Associates Acoustical Engineering conducted noise measurements at the site in October 2018 and May 2019. This assessment was completed and can be found in Appendix 5. The noise model for the facility based on 2016 and 2017 measurements was submitted to SLR in June of 2018 and included in the 2018 RNM update.
2. Keyera – removed a couple of existing air intake silencers. The silencers were proven to be a fire hazard, and were thus removed for safety reasons. Keyera also plans to expand the injection facilities and install an Inlet Quality (IQ) building, although the IQ building is expected to have a negligible noise impact. The above changes were assessed by Patching Associates Acoustical Engineering Ltd. in June 2018. The results of the assessment indicated that these changes do not result in any perceivable noise increase at the nearby residences. The noise impact assessment report is provided in Appendix 5. An updated site noise model was completed and is included in the 2018 RNM update.
3. Pembina – RFSIII became fully operational in 2018. RFS I, ROF and Perimeters Noise Survey and subsequent Noise Model was completed/updated in 2018. The updated model was incorporated in to the NCIA Regional Noise Model.
4. Plains Midstream – The Facility continued with the Phase 3 expansion plans in 2018. This included the construction and commissioning of new underground storage caverns, mercaptan oxidation plant, and additional earthworks to facilitate required surface water drainage upgrades. The site model was updated in 2018 and incorporated in the RNM update for 2018.
5. Shell Scotford – Site model updates were completed for the Refinery HCU Debottleneck Project and the Refinery Fin-Fan Cooler. These were captured in the 2018 RNM update.
6. Sherritt International – An offsite complaint was received on July 3, 2018 regarding a noise (described as truck motor, low rumble with vibration) observed on July 1, 2018. An investigation was initiated to determine potential issues that occurred during the time and date identified. There was no source found. The external stakeholder was contacted once the investigation was completed. The sites complaint process and findings of the investigation were discussed.

6.3 Other Items for Follow-up Based on 2017 and 2018 Field Measurements

1. The RNM is generally over predicting the noise levels in the region as explained on page 10 of this report.
2. The NWR Sturgeon Refinery not yet included in the Existing Case RNM (that will change for the next RNM update in 2021).
3. The IPL Heartland Petrochemical Complex that is not yet included in the RNM but will be for the next update in 2021.
4. We will continue to conduct annual field monitoring and compare it to the RNM predicted ranges.

5. As noted with the trend analysis, Figure 5 on Page 17 of this report, there is no clear trend (up or down) of measured noise levels in the region.

6.4 Next Steps for 2019/2020

1. Keyera – Work began on the replacement of the Hot Oil Heater in Frac 1 in 2019 which will reduce the overall site noise level when the new heater is commissioned in Q2 2020.
2. Nutrien – Nutrien Redwater is in the process of planning and purchasing silencers for the Phos 30 # Steam Vents. Noise Curtains are now scheduled to be installed during the turnaround in 2019.
3. Pembina – A new 45 MW Cogen facility will start up in April 2019. The theoretical model is already included in the site noise model. Once the Cogen is operational, a noise survey will be completed in 2019 to update the model with actual data.
4. Plains Midstream – The Facility will be installing new pumps to support cavern storage activities and additional earthworks to facilitate required surface water drainage upgrades. These activities may result in changes that require the facility to update the Regional Noise Model. This will be evaluated as we proceed with expansion activities. An update, if required, will be conducted in conjunction with the next regional noise model update.

APPENDIX 1

Northeast Capital Industrial Association
2018 Regional Noise Model Update

NCIA Regional Noise Model

Northeast Capital Industrial Association

2018 Noise Model Update (rev1)

SLR Project No.: 203.50029.00003

December 2019

NCIA REGIONAL NOISE MODEL
2018 NOISE MODEL UPDATE (rev1)

SLR PROJECT NO.: 203.50029.00003

Prepared By
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December 3, 2019

This document has been prepared by SLR Canada. The material and data in this report were prepared under the supervision and direction of the undersigned.

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Permit to Practice P05449

Distribution: 1 copy (PDF) – Northeast Capital Industrial Association
1 copy – SLR Consulting (Canada) Ltd.

EXECUTIVE SUMMARY

The 2018 NCIA Regional Noise Model provides an update and additions to the previous model update, being the 2015 NCIA Regional Noise Model. This project involved gathering updated noise databases in various formats from many NCIA member company facilities. All of the acquired data was converted into a format acceptable for a common software platform, being SoundPLAN 8.0, and subsequently imported into one large, region-encompassing computer noise model.

The Regional Noise Model was designed and built with independent sets of input data for each facility, in order to allow for separation of its output data, to be able to depict independent noise contributions from: ● NCIA member company existing regulated facilities; ● NCIA member company proposed facilities (with regulatory approval); ● non-member company existing facilities (voluntary participation); ● road noise contribution; ● rail noise contribution; and ● modeling parameter of downwind conditions. This report contains example output results of combined sound level contours for commonly used scenarios of: ● an Existing Regulatory Case; ● a Future Regulatory Case; and ● four Model Validation Cases.

The results are formatted in such a way that an NCIA user can download pre-run Regional Noise Model contour results files. This can be done in both SoundPLAN and in CadnaA formats, being two of the major computer noise model software platforms in widespread use by acoustical consultants. The user could then combine these results with their separately run results for their proposed facility, and that resultant contour would then be representative of the cumulative effects in the region. Accordingly, results from this Regional Noise Model can be used in future environmental assessment applications, comparisons of the change in noise environment in the region over time, and as a tool to illustrate various sound assessment aspects to the public. The Regional Noise Model database is also set up to allow for special model runs such as the determination of the relative sound level contributions from neighbouring facilities.

The results presented in this report will serve as an updated baseline since 2015 and are representative of the noise environment at the time of this report. Furthermore, the Regional Noise Model has been developed in such a way as to keep it as versatile as possible for future work.

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1. PURPOSE

The Regional Noise Management Plan Steering Committee of the Northeast Capital Industrial Association ("NCIA") developed a Regional Noise Management Plan ("RNMP") for their member companies in Alberta's Industrial Heartland, in collaboration with the Alberta Energy Regulator and the Alberta Utilities Commission that took effect in 2012. As part of the ongoing development of the Regional Noise Model, SLR Consulting (Canada) Ltd. ("SLR") (previously HFP Acoustical Consultants Ltd.) was asked by NCIA to perform various tasks to keep the evolution of the Regional Noise Model current. This report has been prepared to present the results of this project.

This report presents the 2018 update to NCIA's Regional Noise Model. The initial version of the model was previously presented in a report entitled "NCIA Regional Noise Model Project", dated March 12, 2012, as issued by HFP, and a subsequent revision of the model was presented in a report entitled "NCIA Regional Noise Model, 2015 Noise Model Update", dated June 18, 2015, as issued by SLR.

2. SCOPE OF WORK

The scope of work for NCIA's 2018 Regional Noise Model update was sub-divided into seven "Tasks", as follows:

- Update NCIA's Regional Noise Model
- Provide Contours of Modeled Differences
- Create Tables & Figures of 2017 Measured Differences
- Create On-line Access to Interactive Model Predictions
- Update Road Noise Contributions
- Update Rail Noise Contributions
- Provide SoundPLAN and CadnaA Output Files with Microsoft SharePoint Coordination

2.1 UPDATE NCIA'S REGIONAL NOISE MODEL

An overview of the Alberta Industrial Heartland area, with the various industrial landholdings, is presented in Figure 1.

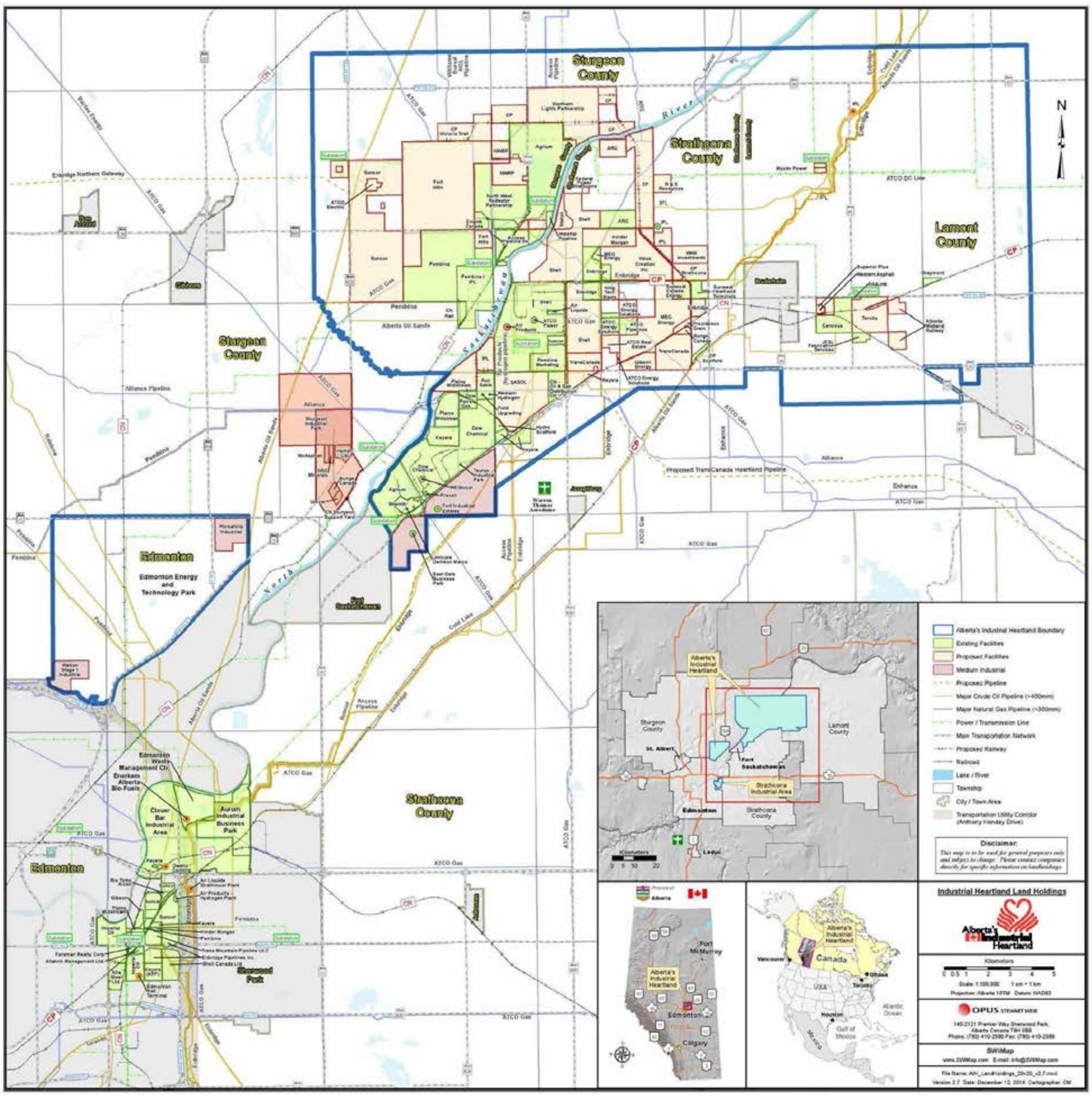
NCIA implemented a strategy to update the Regional Noise Model periodically, as required by the Alberta Energy Regulator ("AER"). These periodic updates are to be performed when a sufficient amount of individual site computer noise models have been updated. This process has been developed to involve the following steps:

- Each NCIA member company[1] works independently with their own acoustical consultant, to periodically update their site's computer noise model, as part of each site's independent **Noise Management Plan**, when significant site changes have occurred. This should be performed as defined by Site Modeling Requirements, as separately presented to member companies. Each

[1] Or NCIA non-member company, on a voluntary basis, as well – inferred throughout this document

NCIA member company then provides this updated computer noise model, in electronic database format, to NCIA.

Figure 1
Regional Map of Facilities in the Alberta Industrial Heartland



- NCIA, through their acoustical consultant, then compiles all of the received site computer noise models. This may include conversion of the site noise model to SoundPLAN, coordinate transformations and ground elevation changes, and upgrade NCIA's Regional Noise Model into the then-current software version. Once compiled, the Regional Noise Model is run to produce updated regional noise contours. The results are provided to NCIA along with interactive imaging files for public distribution. A composite report is prepared for NCIA to provide to the AER, as per their regulatory agreement.

- Pre-run component / contour results files are then provided by NCIA, in a format compatible with SoundPLAN and CadnaA, on their SharePoint site, so that each NCIA member company can continue working with their own acoustical consultant to perform cumulative effects modeling (results already include the contributions of all existing facilities) to suit their own site's purposes.

Table 1, as presented below, lists the individual site computer models included in the Regional Noise Model that have been prepared by SLR, and indicates when each model was last updated. Updated site computer models were received from third-parties for inclusion in the Regional Noise Model as well. These Heartland area plants, for which other acoustical consultants had prepared the computer noise models, and which were provided through their client to NCIA, are listed in Table 2, as presented below. All site computer models were then upgraded to SoundPLAN 8.0 for inclusion in this 2018 update to the Regional Noise Model. Entries shown in **bold** font represent facilities with updated site models for the 2018 Regional Noise Model whereas the other facilities are based on the same site model that was previously included in the 2015 Regional Noise Model.

Table 1
Site Noise Models in 2018 Regional Noise Model Prepared by SLR

Company	Plant / Unit	Model Date
Nutrien	**Redwater Fertilizer Operations Plant**	**February, 2017**
Air Liquide	Cogeneration Unit	June, 1998
Cenovus	North American Terminal Operations	March, 2010
Dow Chemical Canada	Ethylene; Fractionator; Polyethylene I, II & III; Ethylene Oxide / Ethylene Glycol; Ethane Storage; Power & Utilities; Cogeneration plants	December 15, 2014
Plains Midstream	**Fractionation and storage**	**October, 2016**
North West Redwater Partnership	Sturgeon Refinery (3 units)	November 22, 2007
Pembina	**RFS1; ROF**	**June, 2018**
Shell Canada	**Refinery; Upgrader (base plant and expansion plant); Cogen**	**December, 2016**
Shell Chemicals	**Styrene; MEG**	**November, 2016**
Sherritt Fort Saskatchewan Integrated Site:		
Nutrien	Nitrogen production	January, 2003
Corefco	Metal production	February, 2006 *
Sherritt International	Metal production	February, 2006
Oerlikon-Metco	Chemical preparation	February, 2006
Umicore	Metal products	February, 2006 *

* integrated into Sherritt model

Table 2
Site Noise Models in 2018 Regional Noise Model Prepared by Others

Company	Plant / Unit	Acoustical Consultant	Model Date
Aux Sable	**Off-Gas Plant**	**Patching Associates**	**June, 2018**
Wolf Midstream	Sturgeon Terminal	FFA	July, 2010
Value Chain Solutions	Oilsands Upgrader	RWDI	May, 2004
Suncor	Fort Hills Sturgeon Upgrader	RWDI	September, 2008
Pembina	RFS2 Expansion	Stantec	June, 2013
Pembina	RFS3 Expansion	Stantec	December, 2014
Pembina	**Co-generation Plant**	**Stantec**	**March, 2016**
Keyera Energy	**Fractionation and storage**	**Patching Associates**	**July, 2018**

In order to be able to encompass each individual plant operation's contribution into the Regional Noise Model, in 2012 HFP created a number of "Basic Noise Models". This was undertaken by conducting noise measurements around the perimeter of these plant sites and creating a simplified computer noise model. These facilities are listed in Table 3, and are explained in more detail and presented in Table 3 in Appendix C. Some facility Basic Noise Models remain unchanged from 2012's Regional Noise Model, while others have been replaced by detailed site noise models in the 2018 Regional Noise Model. Note that the Basic Noise Models for the facilities shown in Table 3 have not been updated since the first Regional Noise Model in 2012.

Table 3
Heartland Plants where Basic Noise Models were included in the 2018 Regional Noise Model

Company	Plant / Unit	Data Provided	Model Date
Aux Sable Canada*	Extraction Plant	Sound Power Levels	September, 2010
Evonik Canada Inc.	Hydrogen Peroxide Plant	Fenceline Measurements	June, 2010
Chemtrade Logistics	Central Service Center	Diagnostic Measurements	September, 2010
Chemtrade Logistics	Sulfides Facility	Diagnostic Measurements	September, 2010
Praxair Canada Inc.	Air Separation Plant	Fenceline Measurements	June, 2010
Praxair Canada Inc.	Carbon Dioxide Plant	Fenceline Measurements	June, 2010
ATCO Midstream	Liquid Extraction Plant	Sound Power Levels	June 2011

* based on PWL's provided by the facility's acoustical specialist

The 2018 update of the Regional Noise Model was run for the following scenarios and presented in the corresponding figures listed below:

- Case 1 – Existing Regulatory Case (AER & AUC); Figure 2
  - NCIA member company existing facilities
  - Downwind conditions
- Case 2 – Future Regulatory Case (AER & AUC); Figure 3
  - NCIA member company existing facilities
  - NCIA member company proposed facilities
  - Downwind conditions
- Sound Level Contour Differences Figure 4
- 2018 RNM minus 2015 RNM – Case 1;
  - NCIA member company existing facilities
  - Downwind conditions
- Case 3a – Model Validation Case; Figure D - 1
  - NCIA member company existing facilities
  - Non-member company existing facilities
  - Calm wind conditions
- Case 3b – Model Validation Case; Figure D - 2
  - NCIA member company existing facilities
  - Non-member company existing facilities
  - Road Noise Contribution
  - Calm wind conditions
- Case 3c – Model Validation Case; Figure D - 3
  - NCIA member company existing facilities
  - Non-member company existing facilities
  - Rail Noise Contribution
  - Calm wind conditions
- Case 3d – Model Validation Case; Figure D - 4
  - NCIA member company existing facilities
  - Non-member company existing facilities
  - Road & Rail Noise Contributions
  - Calm wind conditions.

All facility models listed in Table 1, Table 2 and Table 3, as presented above, are included in Cases 1, 2 and/or 3 in various combinations. A list of facilities that are included in each case is shown in Table 4.

Tabular results for the Regional Noise Model include the following:

- A computer noise model input database, in spreadsheet format, depicting the following;
  - Plant equipment;
    - Description (e.g. name, tag number)
    - Grid coordinates and elevations
    - Octave band Sound *Power* Levels

These technical parameters are described in greater detail in Appendix B.

Graphical results for the Regional Noise Model consist of colour contour maps, depicting the A-weighted equivalent sound level. Figure 2 presents predicted noise contributions for Case 1, and Figure 3 presents predicted noise contributions for Case 2, as presented below. Figures for Cases 3a to 3d are presented in Appendix 0.

Table 4
List of facilities included in the modeled cases

Company	Plant	Case 1	Case 2	Case 3
Air Liquide	Cogeneration Unit	•	•	•
ATCO Midstream	Liquid Extraction Plant			•
Aux Sable	Off-Gas Plant	•	•	•
	Extraction Plant		•	•
Cenovus	North American Terminal Operations	•	•	•
Chemtrade Logistics	Central Service Center	•	•	•
	Sulfides Facility	•	•	•
Corefco - Sherritt Integrated Site	Metal production	•	•	•
Dow Chemical Canada	Ethylene; Fractionator; Polyethylene I, II & III; Ethylene Oxide / Ethylene Glycol; Ethane Storage; Power & Utilities; Cogeneration plants	•	•	•
Evonik Canada Inc.	Hydrogen Peroxide Plant	•	•	•
Keyera Energy	Fractionation and storage	•	•	•
North West Redwater Partnership	Sturgeon Refinery (3 units)		•	•
Nutrien	Redwater Fertilizer Operations Plant	•	•	•
	Nitrogen production	•	•	•

Company	Plant	Case 1	Case 2	Case 3
Oerlikon-Metco - Sherritt Integrated Site	Chemical preparation	•	•	•
Pembina	RFS1 & ROF	•	•	•
	RFS2 Expansion	•	•	•
	RFS3 Expansion	•	•	•
	Co-generation Plant		•	•
Plains Midstream	Fractionation and storage	•	•	•
Praxair Canada Inc.	Air Separation Plant	•	•	•
	Carbon Dioxide Plant	•	•	•
Shell Canada	Refinery; Upgrader (base plant and expansion plant); Cogen	•	•	•
Shell Chemicals	Styrene; MEG	•	•	•
Sherritt International - Sherritt Integrated Site	Metal production	•	•	•
Suncor	Fort Hills Sturgeon Upgrader		•	•
Umicore - Sherritt Integrated Site	Metal products	•	•	•
Value Creation	Oilsands Upgrader		•	•
Wolf Midstream	Sturgeon Terminal	•	•	•

2.2 CONTOURS OF MODELED DIFFERENCES

SLR has generated "***contours of the modeled differences***", which are the differences between the calculated results of the 2018 Regional Noise Model update as compared to the calculated results of the 2015 Regional Noise Model. Figure 4 presents the difference contour for Case 1. These differences account for all changes to the Regional Noise Model arising from the 2018 update, including any slight differences between SoundPLAN calculation kernels for version 7.3 in 2015 and version 8.0 in 2018.

2.2.1 INTERPRETATION

The 2018 update to the Regional Noise Model contains more data than the previous 2015 model did. This is mostly because some of the facilities which were not updated for a number of years, have updated their databases with more accurate models representing changes and/or expansions to their facilities. Some of these updates were based upon actual on-site noise measurements, providing a greater level of accuracy to the overall noise model. The contour differences shown in Figure 4 can be explained by the following updates to the Regional Noise Model:

- For the Pembina Redwater Fractionation & Storage Facility, the apparent increase in sound levels is the result of performing detailed site noise measurements and updating the site noise model for the ROF and RFS1 units. The RFS2 expansion unit has not yet been updated and remains unchanged in the site model as theoretical data. The RFS3 expansion unit is also based on theoretical data, yet the expansion has now been built so the model is included in Case 1.
- For the Nutrien Redwater Fertilizer Operations plant, the apparent increase in sound levels is the result of performing detailed site noise measurements for a number of areas in the plant that had not been updated for several years.
- For the Shell Scotford site, a number of updates were made to the site models based on detailed site noise measurements. In particular, updates were made to include the Quest expansion, as well as the Chemicals unit to improve the accuracy of the site noise models. These updates resulted in small localized increases in noise in areas within the plant site, yet a net decrease in noise is seen off site.
- For the Aux Sable facility, the Off-gas Plant was updated based on site noise measurements to replace the previous theoretical based noise model, resulting in a net decrease in predicted sound levels.
- For the Keyera facility, site noise measurements were conducted to replace the previous theoretical based model, resulting in localized differences in predicted noise levels, but an insignificant net change in the surrounding area.
- For the Plains Midstream facility, there have been some expansions to the site which have been captured in the most recent site noise model. The expansions are based on theoretical data and result in a small localized increase in predicted sound levels.
- There are some changes to the predicted noise levels that appear around the Nutrien FNO and Sherritt Integrated Site, yet there have not been any changes to the facility site models in this area. It is expected that these slight differences appear due to improvements to the SoundPLAN modeling software's calculation kernel. Specifically, improvements that were made to the side diffraction calculations in SoundPLAN version 8.0.

2.3 TABLES OF MEASURED DIFFERENCES

Annual noise monitoring surveys are conducted at several locations in the AIH by ACI Acoustical Consultants. The noise monitoring data for the 2017 surveys (from the ACI report dated November 14, 2017) are compared with the 2018 RNM results in this report section. This comparison is presented as the "***tables of measured differences***", which are the differences between the predictions of the 2018 update to the Regional Noise Model in SoundPLAN 8.0 as compared to the measured results from the noise monitoring surveys conducted by ACI Acoustical Consultants in 2017. SLR completed a model run of the updated 2018 Regional Noise Model using the meteorological conditions encountered during the 2017 field survey and generated predictions for the locations chosen for the noise monitoring surveys. Table 5 presents a comparison of the differences between the measurement results and the updated modeled predictions.

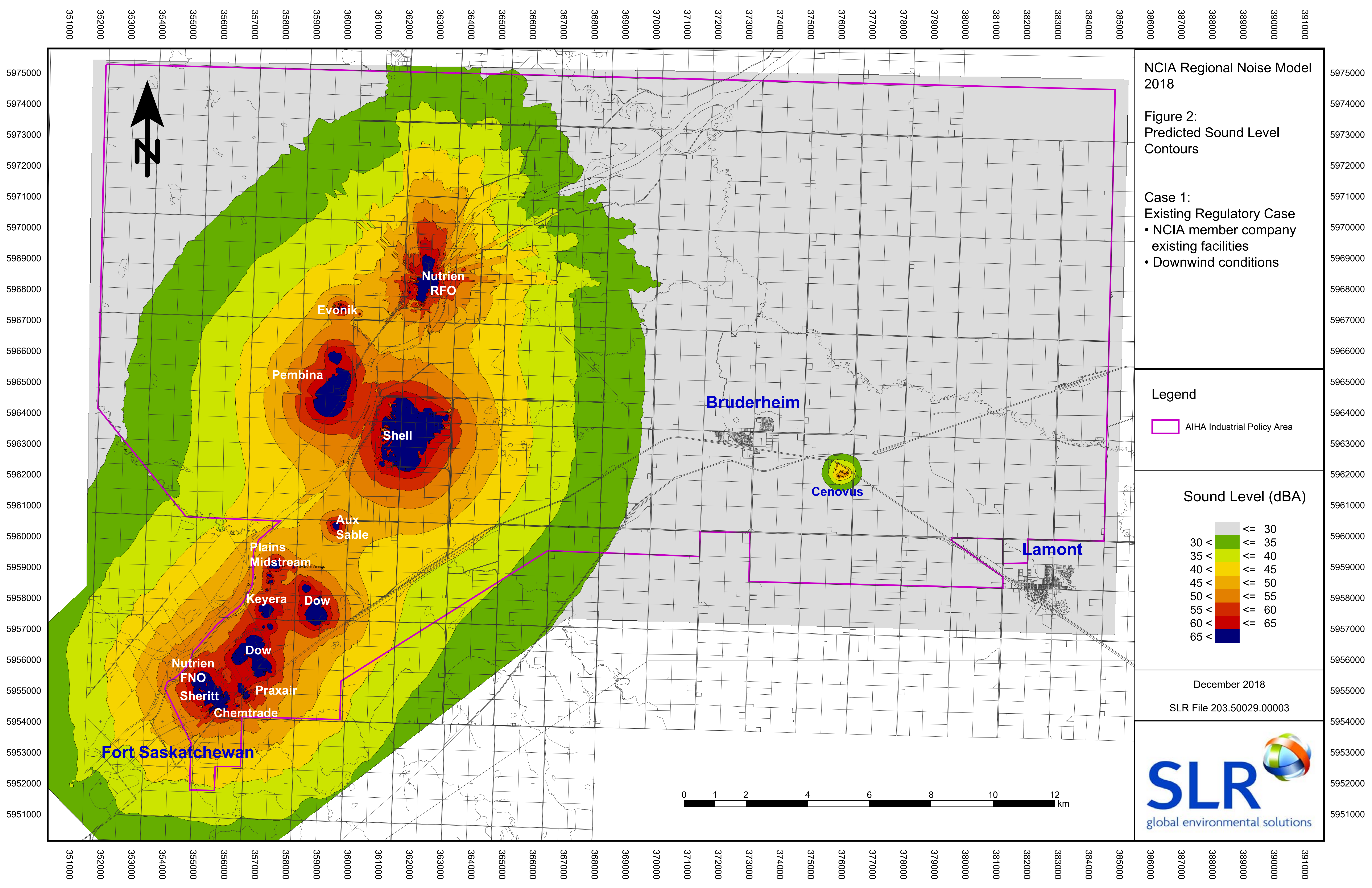
2.4 INTERACTIVE MAP UPDATE

For the 2018 Regional Noise Model update, SLR has created an interactive map using the ESRI ArcGIS Online platform[2]. This online cloud-based platform allows for users to access the latest model output maps through a web-based application. SLR has uploaded colour noise contours for the six scenarios described in Section 2.1. These maps geo-reference the contours to the correct coordinates and coordinate system, using Graphical Information Systems (GIS) to provide interactive zoom-dependent levels of information and infinite image resolution, including selectable reference values on the contour maps. It is important to note that these contours are not suitable for regulatory applications, but rather are provided for public information.

2.4.1 3D BUILDINGS

SLR has included 3D buildings in the interactive maps to provide a virtual 3D representation of all major structures within the company facilities. This consisted of exporting all geographic position and height information from structures, vessels, buildings and other obstacles contained in each company noise model for inclusion in the interactive ArcGIS maps. This adds a level of enhancement to the interactive colour contours, by allowing viewers to tilt the view and see all the relevant structures affecting the noise propagation.

[2] The maps can be accessed at the following link: https://slr-pro.maps.arcgis.com/apps/webappviewer3d/index.html?id=08e0ea98bf89443aafe8ea76d438eb99



NCIA Regional Noise Model 2018
Figure 2:
Predicted Sound Level Contours
Case 1:
Existing Regulatory Case
• NCIA member company existing facilities
• Downwind conditions
Legend
AIHA Industrial Policy Area
Sound Level (dBA)
<= 30
30 < <= 35
35 < <= 40
40 < <= 45
45 < <= 50
50 < <= 55
55 < <= 60
60 < <= 65
65 <
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SLR
global environmental solutions
Nutrien RFO
Evonik
Pembina
Shell
Aux Sable
Plains Midstream
Keyera
Dow
Dow
Nutrien FNO
Sheritt
Praxair
Chemtrade
Fort Saskatchewan
Bruderheim
Cenovus
Lamont
N
0
1
2
4
6
8
10
12
km
351000
352000
353000
354000
355000
356000
357000
358000
359000
360000
361000
362000
363000
364000
365000
366000
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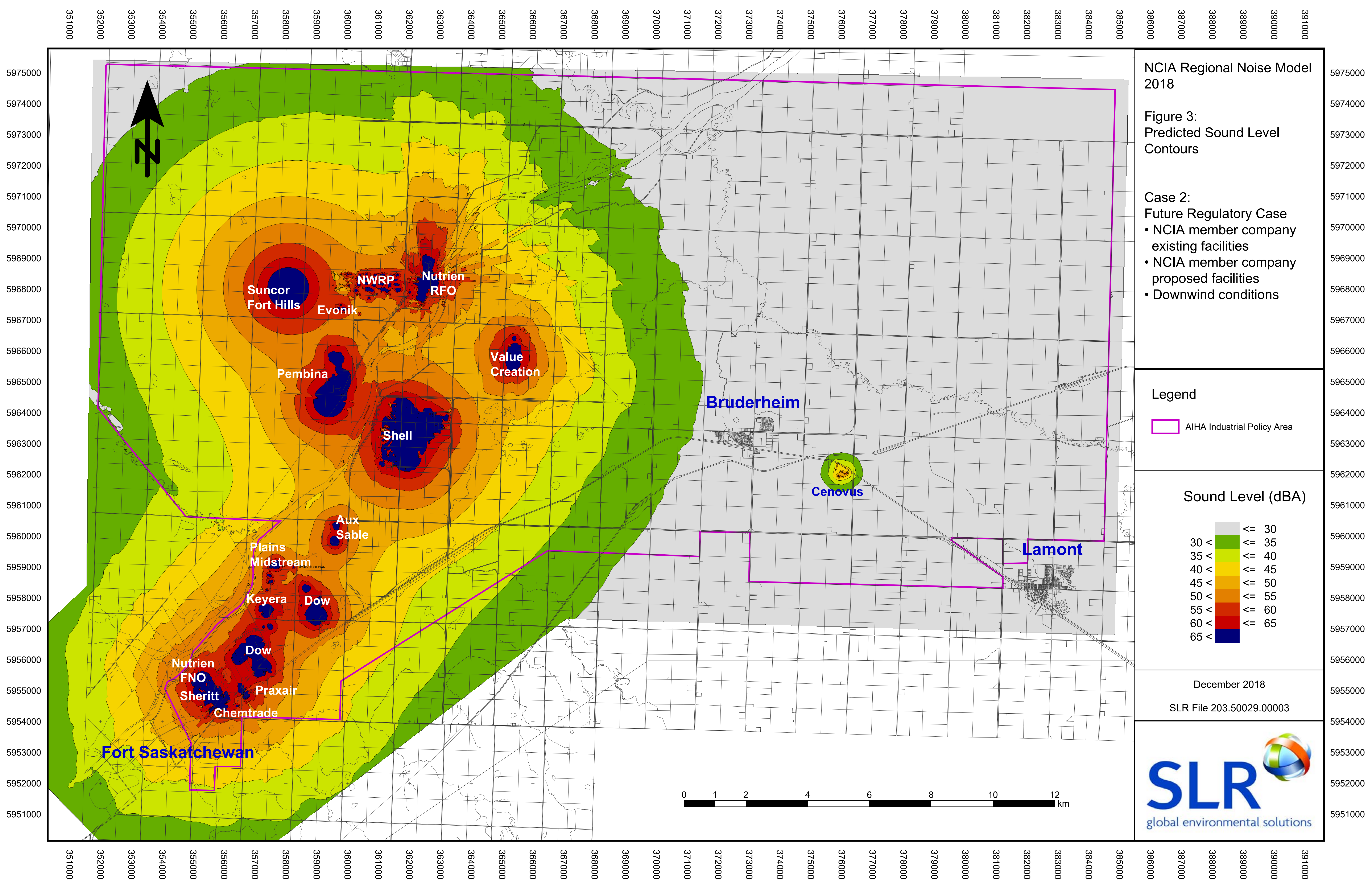

NCIA Regional Noise Model 2018
Figure 3:
Predicted Sound Level Contours
Case 2:
Future Regulatory Case
• NCIA member company existing facilities
• NCIA member company proposed facilities
• Downwind conditions
Legend
AIHA Industrial Policy Area
Sound Level (dBA)
<= 30
30 < <= 35
35 < <= 40
40 < <= 45
45 < <= 50
50 < <= 55
55 < <= 60
60 < <= 65
65 <
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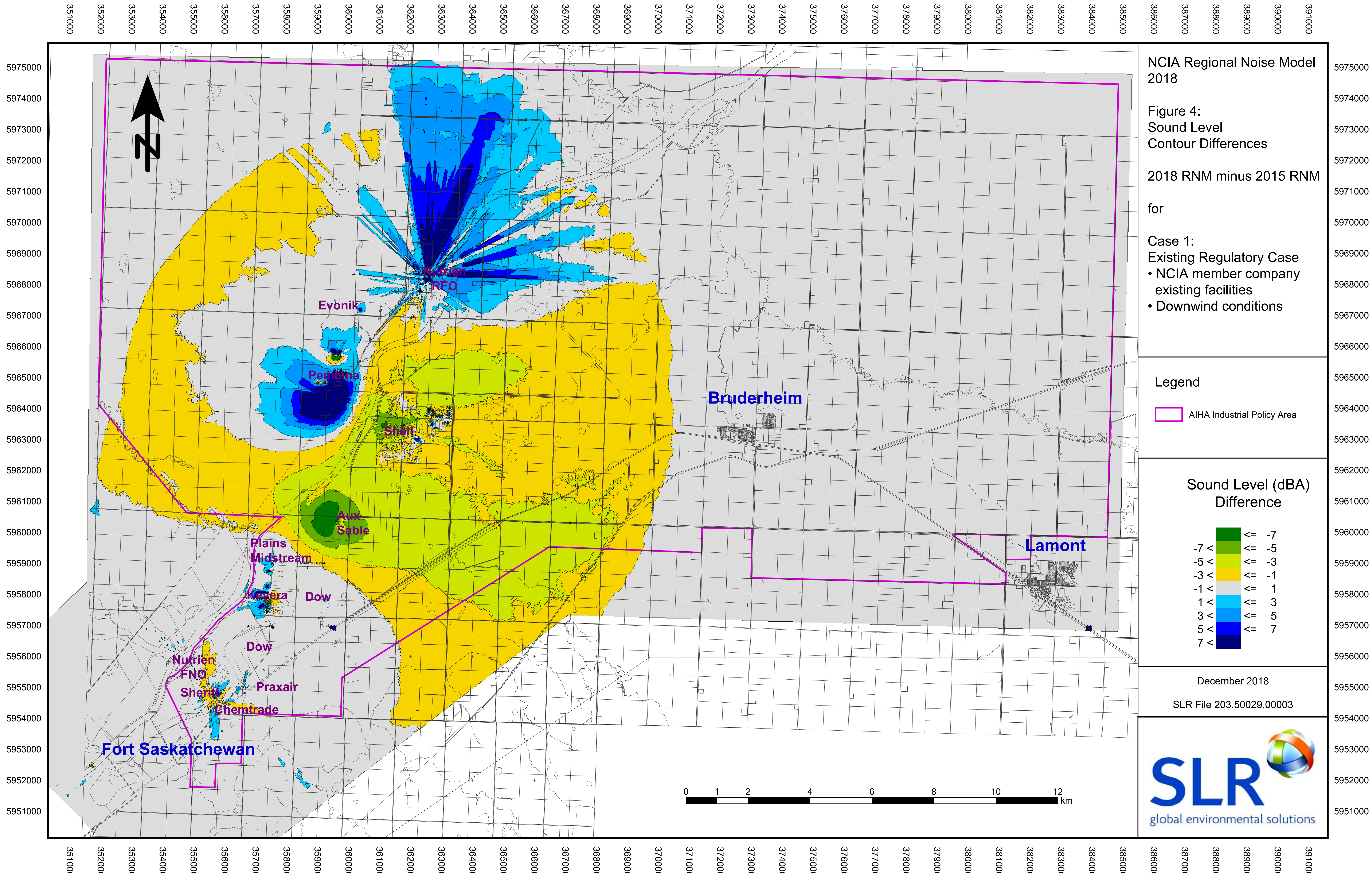
global environmental solutions
Suncor Fort Hills
NWRP
Nutrien RFO
Evonik
Value Creation
Pembina
Shell
Aux Sable
Plains Midstream
Keyera
Dow
Dow
Nutrien FNO
Sheritt
Praxair
Chemtrade
Fort Saskatchewan
Bruderheim
Cenovus
Lamont
0 1 2 4 6 8 10 12 km



NCIA Regional Noise Model 2018
Figure 4:
Sound Level
Contour Differences
2018 RNM minus 2015 RNM
for
Case 1:
Existing Regulatory Case
• NCIA member company existing facilities
• Downwind conditions
Legend
AIHA Industrial Policy Area
Sound Level (dBA)
Difference
<= -7
-7 < <= -5
-5 < <= -3
-3 < <= -1
-1 < <= 1
1 < <= 3
3 < <= 5
5 < <= 7
7 <
December 2018
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SLR
global environmental solutions
N
Nutrien RFO
Evonik
Pembina
Shell
Aux Sable
Plains Midstream
Keyera
Dow
Dow
Nutrien FNO
Sherritt
Praxair
Chemtrade
Fort Saskatchewan
Bruderheim
Lamont
0 1 2 4 6 8 10 12 km

2.5 UPDATE ROAD NOISE CONTRIBUTIONS

Road traffic data was updated for the 2018 Regional Noise Model based on average hourly traffic volumes as derived from Annual Average Daily Traffic (AADT) data for 2017 (Alberta Highways 1-986, Traffic Volume, Vehicle Classification, Travel and ESAL Statistics Report 2017, produced March 5, 2018). This was the most current data available at the time of the assessment. Sound level values are calculated separately for daytime and nighttime traffic, as there may be a substantial difference between daytime and nighttime traffic volumes and noise. The assumed day / night traffic volume splits used are 90% / 10% for all roads in the region. The daytime sound levels for traffic noise are presented in the contour maps. As most of the roads have a similar distribution of vehicle types, a global correction factor of -7.3 dB can be applied to the daytime level to arrive at approximated nighttime noise levels. Similarly, a correction factor of -1.4 dB can be applied to the daytime level to arrive at approximated $L_{eq(24\ hr)}$ noise levels.

2.6 UPDATE RAIL NOISE CONTRIBUTIONS

In previous versions of the Regional Noise Model, the railway noise data was estimated based on limited information. Substantial changes were made to the rail noise predictions in the 2018 Regional Noise Model. Average rail volumes and speeds were obtained from both Canadian National (CN) and Canadian Pacific (CP) for the main rail lines throughout the region. A total of 12 separate track segments were included and modeled using the Ontario MoE Sound from Trains Environmental Analysis Method (STEAM) calculation method to determine the source sound power levels and then modeled with the Calculation of Railway Noise (CoRN) calculation standard to determine the environmental sound levels. This represents a significant improvement in the predicted railway noise levels in the region over past models.

The calculated rail noise values are 24-hour equivalent continuous sound levels. These values represent the composite average of the daytime and nighttime sound levels, calculated for a typical day and night when the rail line movements occur. These values are not maximum hourly values; however, they do incorporate the effects of higher hourly results.

2.7 SOUNDPLAN AND CADNA/A OUTPUT FILES

SLR provided, under separate cover, pre-run component / contour results files in formats compatible with both SoundPLAN and CadnaA. NCIA has uploaded each set of files (separate file formats are required for SoundPLAN and CadnaA) to their SharePoint site, so that each NCIA member company can continue working with their own acoustical consultant to perform cumulative effects modeling to suit their own site's purposes.

3. COMPUTER NOISE MODEL VALIDATION

As part of the quality assurance procedure, to ensure that the Regional Noise Model represents the reality of the facility's noise emission characteristics, it is vital that each facility's computer noise model be validated. This is a step to ensure the facility's computer noise model's accuracy. Validation methodologies utilized are from SLR's best practical experience. As meteorological conditions and ground conditions have a significant effect on sound propagation, it is important to recognize that the

Regional Noise Model should be validated to the local weather conditions experienced at each monitored location.

Together with NCIA, 10 locations were initially selected as validation measurement locations in 2012. The measurement locations have since been altered to accommodate site conditions and some were added to further enhance the validation program. The most recent validation program consists of 12 measurement locations in the region. This selection was based on covering the majority of the Heartland area evenly, not being too close to major roadways, and with locations where the predominant noise contribution is from industry in the area. A map of the chosen validation measurement locations is shown in Figure 5.

ACI Acoustical Consultants Inc. (ACI) was responsible for carrying out the validation measurements in 2017. The 2017 validation survey consisted of 11 locations, plus a 12th control location.

The reported validation noise measurements most closely match Case 3a, the Model Validation Case. The weather conditions were monitored at several locations during the measurements. These weather conditions were then used to determine the average weather conditions during the nighttime periods which, in turn were incorporated into the Regional Noise Model to produce the model predictions for the validation noise measurement locations. Although ambient effects are sometimes analyzed alongside modeled results, ambient values themselves are typically not incorporated into industrial facility noise models. Further information about the validation procedure is available from SLR upon request.

The results of the validation noise measurements are reported in Table 5. Therein, one can observe both the noise model predictions and the measurement results. Furthermore, the difference between the noise model predictions and the measurement results are also shown. The presented sound levels are L_{eq} values. Location 12 was not included as a receptor point, as it was a control location chosen to measure ambient sound levels in the region, absent of industrial noise contributions.

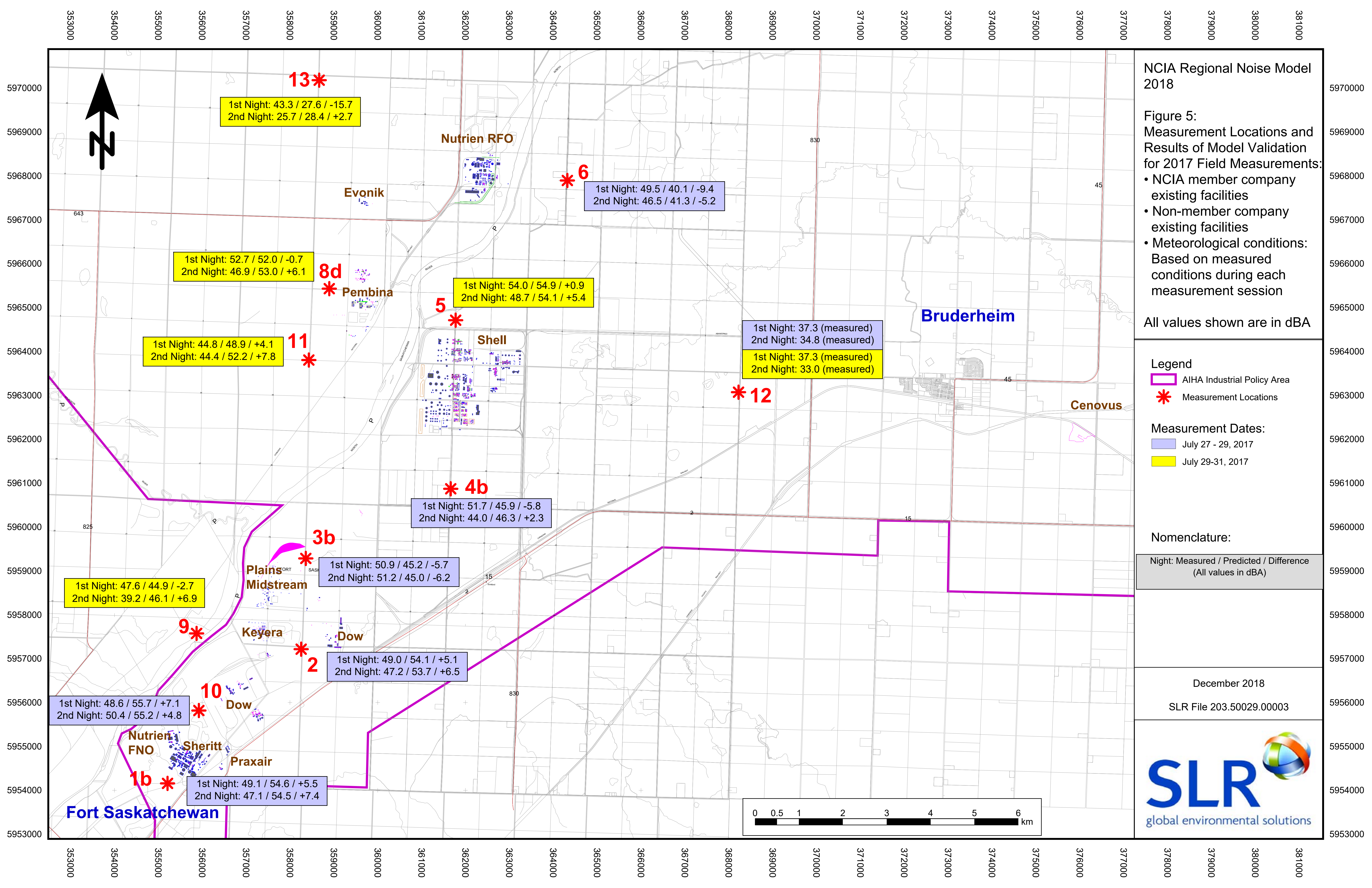
Table 5
2018 Noise Measurement Locations and Results for Model Validation

Receptor Number	Receptor Location Change	Measured (M) and Predicted (P) Nighttime Sound Levels (Isolated dBA Leq)						Average Difference: (dBA)
		1st Nighttime Period			2nd Nighttime Period			
		Measured	Predicted	Delta (Predicted minus Measured)	Measured	Predicted	Delta (Predicted minus Measured)	
1b	Moved in 2017	49.1	54.6	+5.5	47.1	54.5	+7.4	+6.5
2		49.0	54.1	+5.1	47.2	53.7	+6.5	+5.8
3b	Moved in 2017	50.9	45.2	-5.7	51.2	45.0	-6.2	-6.0
4b	Moved in 2015	51.7	45.9	-5.8	44.0	46.3	+2.3	-1.8
5		54.0	54.9	+0.9	48.7	54.1	+5.4	+3.2
6		49.5	40.1	-9.4	46.5	41.3	-5.2	-7.3
7		Monitoring not conducted						
8d	Moved in 2016	52.7	52.0	-0.7	46.9	53.0	+6.1	+2.7
9		47.6	44.9	-2.7	39.2	46.1	+6.9	+2.1
10		48.6	55.7	+7.1	50.4	55.2	+4.8	+6.0
11		44.8	48.9	+4.1	44.4	52.2	+7.8	+6.0
12 (Period 1)		37.3	n/a	n/a	34.8	n/a	n/a	n/a
12 (Period 2)		37.3	n/a	n/a	33.0	n/a	n/a	n/a
13	New in 2016	43.3	27.6	-15.7	25.7	28.4	+2.7	-6.5

The results in the table indicate some fairly large differences between measured and predicted sound levels at several monitoring locations. In previous assessments, it was noted that the measurement results often varied quite significantly between the two nighttime periods which made it difficult to draw conclusions on the data. Therefore, it was suggested that instead of comparing measured levels to predicted levels for a specific meteorological condition, it would be more meaningful to compare the measured levels to predicted levels based on a range of possible meteorological conditions.

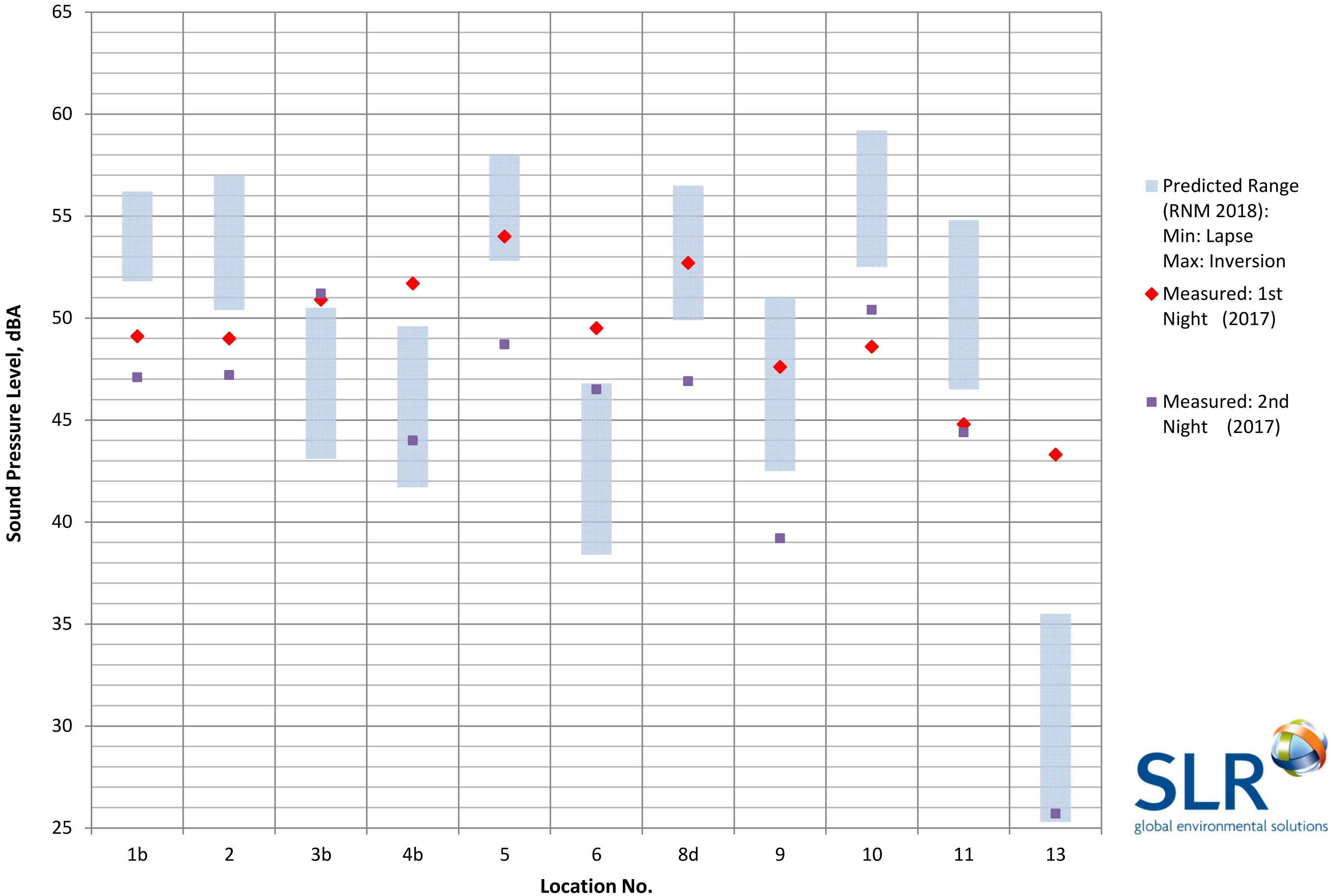
The meteorological conditions used to define the extents of the predicted range are representative of temperature lapse conditions (calm wind with Pasquill Stability Class “B”), and temperature inversion conditions (calm wind with Pasquill Stability Class “F”). These represent the reasonable extremes of meteorological conditions that may exist at any given time in the region. The Case 3 model was run with these parameters to define the lower and upper limits of predicted sound levels at each monitoring location, and the measured sound levels are compared to these ranges, as shown in Figure 6.

The results indicate that the Regional Noise Model is generally over-predicting the noise level at most receptors by up to approximately 5 dBA, with exception to locations 3b, 4b and 6 where measured levels are up to approximately 3 dBA higher than the upper predicted level. While over-predicting by this amount is not ideal, it points to the fact that some conservatism is built in to the overall model and the noise levels are higher as a result, as would be expected for a model of this type where every facility is assumed to be operating with worst-case noise outputs.



NCIA Regional Noise Model 2018
Figure 5:
Measurement Locations and Results of Model Validation for 2017 Field Measurements:
• NCIA member company existing facilities
• Non-member company existing facilities
• Meteorological conditions: Based on measured conditions during each measurement session
All values shown are in dBA
Legend
AIHA Industrial Policy Area
Measurement Locations
Measurement Dates:
July 27 - 29, 2017
July 29-31, 2017
Nomenclature:
Night: Measured / Predicted / Difference
(All values in dBA)
December 2018
SLR File 203.50029.00003
SLR
global environmental solutions
13
1st Night: 43.3 / 27.6 / -15.7
2nd Night: 25.7 / 28.4 / +2.7
Nutrien RFO
6
1st Night: 49.5 / 40.1 / -9.4
2nd Night: 46.5 / 41.3 / -5.2
Evonik
8d
1st Night: 52.7 / 52.0 / -0.7
2nd Night: 46.9 / 53.0 / +6.1
Pembina
5
1st Night: 54.0 / 54.9 / +0.9
2nd Night: 48.7 / 54.1 / +5.4
Shell
11
1st Night: 44.8 / 48.9 / +4.1
2nd Night: 44.4 / 52.2 / +7.8
12
1st Night: 37.3 (measured)
2nd Night: 34.8 (measured)
1st Night: 37.3 (measured)
2nd Night: 33.0 (measured)
Bruderheim
Cenovus
4b
1st Night: 51.7 / 45.9 / -5.8
2nd Night: 44.0 / 46.3 / +2.3
3b
1st Night: 50.9 / 45.2 / -5.7
2nd Night: 51.2 / 45.0 / -6.2
Plains Midstream
1st Night: 47.6 / 44.9 / -2.7
2nd Night: 39.2 / 46.1 / +6.9
9
Keyera
Dow
2
1st Night: 49.0 / 54.1 / +5.1
2nd Night: 47.2 / 53.7 / +6.5
10
Dow
1st Night: 48.6 / 55.7 / +7.1
2nd Night: 50.4 / 55.2 / +4.8
Nutrien FNO
Sheritt
Praxair
1b
1st Night: 49.1 / 54.6 / +5.5
2nd Night: 47.1 / 54.5 / +7.4
Fort Saskatchewan
0 0.5 1 2 3 4 5 6 km

Figure 6
Predicted Range versus Measured Sound Levels (2017)



4. REGIONAL NOISE MODEL RESULTS

This Regional Noise Model report includes pre-run model results for 14 selected scenarios, as listed in Table 6. The results are provided as both SoundPLAN and CadnaA native component results files. These will allow a user to combine various files to generate a desired scenario. An identification of what constitutes Case 1 and Case 2, the two base cases selected as an example within this report, is depicted in Table 7. Within the noise modeling software, one can combine multiple pre-run contour results files, to assemble a specific desired scenario. This way, each user can decide the following:

- Whether to select or omit NCIA member company plants that have received AER (or AUC) regulatory approval but are not yet constructed and / or not yet operating
- Whether to select or omit non-member plants that are not under the jurisdiction of the AER (or AUC)
- Whether to select or omit the road noise contribution
- Whether to select or omit the rail noise contribution
- Whether the Model should include or not include omnidirectional downwind sound propagation effects.

The model results are organized this way for a distinct purpose, in that NCIA prefers not taking a position on how environmental Noise Impact Assessments or other internal reporting are strategized, how work should be performed, or what data they should contain. Giving the user the ability to select or to omit various components and features provides flexibility, allowing the Regional Noise Model to facilitate differing strategic options. As an example, for meteorological conditions to meet the requirements of AER Directive 038 (or AUC Rule 012), the datasets for Downwind Conditions can be selected. As another example, to include for cumulative effects, the datasets for Proposed Regulatory Facilities can be selected. Also, to include for road and / or rail noise contributions, their respective datasets can be selected. In summary, these strategic decisions become user choices; with NCIA providing the databases only.

The hyperlinks in Table 6 lead the user to NCIA's SharePoint website to obtain the pre-run Regional Noise Model contour results files. The permissioned user must be a member of NCIA or must be an authorized consultant and must have the appropriate password to access these files. In the modeling software, the user combines these results with the separately run results of a specific computer noise model that they have built for their proposed facility, and that resultant contour would therefore be representative of the predicted cumulative effects in the region.

Several examples of commonly utilized combinations of these pre-run computer noise model results have also been prepared. Case 1, termed the "Existing Regulatory Case", represents what would typically be regarded as a pre-existing baseline condition, before a new development occurs. It incorporates existing facilities from NCIA member companies, modeled for a downwind situation. Case 2, termed the "Future Regulatory Case", also represents a pre-existing baseline condition before a new development occurs, but in addition to the Case 1 situation also incorporates proposed facilities that have already been approved by the AER (or by the AUC) but are not yet constructed.

Table 6
Pre-Run Computer Noise Model Component Results Available

	Downloadable Hyperlinks from NCIA's SharePoint™ Website	
	Calm Wind Conditions	**Downwind Conditions**
Existing regulated facilities – NCIA member companies	01. Existing NCIA Regulated Facilities - Calm Conditions-2015	02.Existing NCIA Regulated Facilities - Downwind Conditions-2015
Proposed regulated facilities – NCIA member companies (with regulatory approval)	03. Proposed NCIA Regulated Facilities - Calm Conditions-2015	04. Proposed NCIA Regulated Facilities - Downwind Conditions-2015
All existing facilities – including non-member companies (voluntary participation)	05. All Existing Facilities - Calm Conditions-2015	06. All Existing Facilities - Downwind Conditions-2015
Road noise contribution	07. Road Noise Contribution -2015	Not available *
Rail noise contribution	08. Rail Noise Contribution	Not available *
Existing facilities + road	09. Existing Facilities (Calm) + Road Contribution-2015	10. Existing Facilities (Downwind) + Road Contribution-2015
Existing facilities + rail	11. Existing Facilities (Calm) + Rail Contribution-2015	12. Existing Facilities (Downwind) + Rail Contribution-2015
Existing facilities + road + rail	13. Existing Facilities (Calm) + Road + Rail Contribution-2015	14. Existing Facilities (Downwind) + Road + Rail Contribution-2015

* the chosen road and rail calculation standards do not provide the opportunity to choose different wind settings

If the user of the Regional Noise Model were assembling an environmental Noise Impact Assessment for a newly proposed facility as a regulatory application to the AER under Directive 038 (or to the AUC under Rule 012), then Case 1 or Case 2 can include information that is typically desired representing the "baseline" condition; equivalent to what may be determined by conducting "background" (with industrial presence) noise monitoring. In either of these cases, the concept of "downwind in all directions" has been selected. This is a worst-case scenario, simulating wind blowing downwind in all directions simultaneously. The *downwind in all directions* concept is based upon noise propagation standard ISO 9613-2. Downwind conditions are accepted by and consistent with the "representative conditions" as defined within AER Directive 038 (and AUC Rule 012), for which shorter-term compliance monitoring (i.e. 24 hours) and regulatory modeling is performed. Alternatively, if the user of the Regional Noise Model is seeking typical representative values, then omitting the downwind conditions defaults to "calm wind conditions". This concept could be judged to be more representative of reality (e.g. reviewing yearly changes to a facility for an internal review). Calm wind conditions are more consistent with the long-term noise environment (i.e. months). This is because "such a period will normally include a variety of meteorological conditions, both favourable and unfavourable to sound propagation" (ISO 9613). Also, over the long-term, the wind blows in multiple directions, and calm wind results correspond with long-term averages

After the user has generated a computer noise model of their proposed facility, the user would then logarithmically combine the Case 1 or Case 2 component results files with those of their computer noise model of their proposed facility, to form a new case representing the proposed cumulative effects of other facilities and their proposed facility. This logarithmic summing of different contour results files is performed within the noise modeling software. An identification of what constitutes Case 1, the Existing Regulatory Case, and Case 2, the Future Regulatory Case, is described in Table 7.

The contour results for Case 1, the Existing Regulatory Case, were shown in Figure 2; and the contour results for Case 2, the Future Regulatory Case, were shown in Figure 3.

Table 7
Computer Noise Model Results Presented in Report Body

	Case 1 Existing Regulatory Case	Case 2 Future Regulatory Case	Sound Level Contour Differences
Existing regulated facilities – NCIA member companies	included	included	included
Proposed regulated facilities – NCIA member companies (with regulatory approval)	not included	included	not included
Existing facilities – non-member companies (voluntary participation)	not included	not included	not included
Road noise contribution	not included	not included	not included
Rail noise contribution	not included	not included	not included
Downwind condition	included	included	included

Case 3, termed the "Model Validation Case", represents sound levels that would be expected to be measured during noise monitoring under calm wind conditions. Herein, Case 3 has been subdivided into four slightly differing sub-cases, including various considerations of selecting or omitting road noise and / or rail noise. An identification of what constitutes Cases 3a, 3b, 3c, and 3d, the four Model Validation Cases, is depicted in Table 8.

Table 8
Computer Noise Model Results Presented in Report Appendix D

	Case 3a	Case 3b	Case 3c	Case 3d
	Model Validation Cases			
Existing regulated facilities – NCIA member companies	included	included	included	included
Proposed regulated facilities – NCIA member companies (with regulatory approval)	not included	not included	not included	not included
Existing facilities – non-member companies (voluntary participation)	included	included	included	included

	Case 3a	Case 3b	Case 3c	Case 3d
Road noise contribution	not included	included	not included	included
Rail noise contribution	not included	not included	included	included
Downwind contribution	not included	not included	not included	not included

The contour results for Cases 3a, 3b, 3c, and 3d, the Model Validation Cases, are presented in Figure D - 1, Figure D - 2, Figure D - 3, and Figure D - 4, respectively, which are presented in Appendix D of this report.

Differences between the results previously presented in Table 5, and the graphical presentation for Case 3 result from identified differences. Some of those differences could be explained as being due to variations in facility operating conditions. Other differences can occur due to variations between actual weather conditions during the validation noise measurements and the defined weather parameters for the projected Case 3 results. When comparing validation noise measurement results to computer noise modeled results, the specific weather conditions that occurred during the validation measurement period were input into the Regional Noise Model for these specialized calculations. For the Case 3 results, calm weather condition parameters were used for the computer noise model calculations.

5. FORECAST

The results presented in this report for the Regional Noise Model are valid for the situation within the Alberta Industrial Heartland area at the time of acquiring the updated site models and preparation of this report. The results are a depiction of the current sound situation in the Heartland area. Since an industrial area of this size is not a static entity and will undergo many changes over time, periodic updates to the Regional Noise Model will be required to keep the Model valid. Updates to the Model will also provide the opportunity to assess the changes of the noise situation in the area over time (i.e. mitigation effects), and to predict the noise impact of future changes (i.e. cumulative effects).

Recommendation for future areas of investigation is as follows:

- Establishing procedures for future facility additions and software updates to the Regional Noise Model are imperative. Due to the size and complexity of the computer noise modeling databases, it is not recommended for third-parties to be allowed to simply make changes or additions (e.g. a new facility model) to the existing database. Similarly, allowing a software change (e.g. software version update) without first studying its implications is not recommended. Accordingly, NCIA needs to keep close control of those permitted to access and change the Regional Noise Model database.

Recommendations for future model enhancements are as follows:

- Improving the model validation exercise, by taking into account atypical facility operating conditions not considered in member company's models, as some facilities have noisy intermittent operations (e.g. steam header steam vents, furnace boiler deaerator vents) which can significantly increase a facility's short-term noise footprint.

- Inclusion of C-weighting analysis, for producing contours of the dBC minus dBA results, which could be useful as a tool for evaluating whether a low frequency noise (LFN) issue might be prevalent.
- Some situations of individual site computer noise models were based on situations from years ago. Improved accuracy could be achieved by updating older site computer noise models as they become out-dated, to be more representative of the actual current situation.
- Improved accuracy could be achieved by updating the remaining Basic Noise Models with detailed diagnostic computer noise models developed using accepted noise modeling formats.
- Validation of the rail noise predictions would be useful to verify the noise levels currently being predicted. This would be achieved by conducting long-term measurements along some sections of rail in the region.
- The continued development of a prescribed calculation methodology for all the Heartland area is helpful. A standardized approach allows easier comparison between environmental Noise Impact Assessment reports and the accompanying imported computer noise models in the Regional Noise Model.
- Prepare a greatly abridged version of this report for public use and assist NCIA in the public participation process.

It is expected that the Regional Noise Model will continue to evolve and improve over time as further detailed and updated information from facilities becomes available in the future. One of the main intentions when developing the Regional Noise Model was to try to keep the Model as versatile as possible, to be able to use it for yet unknown applications in the future.

6. CONCLUSIONS

This report presents the 2018 update to NCIA's Regional Noise Model. It represents a significant update since the first model run in 2012 and the previously issued Regional Noise Model update in 2015. For the 2018 update, many of the various NCIA member companies have updated their own site's computer noise models as part of each site's independent Noise Management Plan, and these updated site models have been imported into the 2018 Regional Noise Model. Furthermore, while improvements in the SoundPLAN computer noise modeling software have occurred by updating from version 7.3 to 8.0, these software changes have minimal effect on the sound level predictions for the Regional Noise Model.

7. STATEMENT OF LIMITATIONS

This report has been prepared and the work referred to in this report has been undertaken by SLR Consulting (Canada) Ltd. (SLR) for the Northeast Capital Industrial Association, hereafter referred to as the "Client". The report has been prepared in accordance with the Scope of Work and agreement between SLR and the Client. It is intended for the sole and exclusive use of Client. Other than by the Client and as set out herein, copying or distribution of this report or use of or reliance on the information contained herein, in whole or in part, is not permitted unless payment for the work has been made in full and express written permission has been obtained from SLR.

This report has been prepared for specific application to this site and site conditions existing at the time work for the report was completed. Any conclusions or recommendations made in this report reflect SLR's professional opinion.

Information contained within this report may have been provided to SLR from third party sources. This information may not have been verified by a third party and/or updated since the date of issuance of the external report and cannot be warranted by SLR. SLR is entitled to rely on the accuracy and completeness of the information provided from third party sources and no obligation to update such information.

Nothing in this report is intended to constitute or provide a legal opinion. SLR makes no representation as to the requirements of compliance with environmental laws, rules, regulations or policies established by federal, provincial or local government bodies. Revisions to the regulatory standards referred to in this report may be expected over time. As a result, modifications to the findings, conclusions and recommendations in this report may be necessary.

The Client may submit this report to environmental regulatory authorities or persons for review and comment purposes.

Appendix A
Environmental Acoustics

Northeast Capital Industrial Association
NCIA Regional Noise Model
2018 Noise Model Update (rev1)
SLR Project No.: 203.50029.00003

A-1. ENVIRONMENTAL NOISE DESCRIPTORS

Environmental noise is typically not steady but varies over time. For environmental noise in the vicinity of an industrial facility, there is usually a continuous background noise from facility sources that varies over time mainly because of changes in atmospheric and/or ground cover conditions. Along with the continuous background noise there may also be intermittent, fluctuating, higher-level noises. These are usually associated with road, rail or air traffic in the surrounding area. Other sources of environmental noise may include community or agricultural activity and natural sounds.

To account for the time-varying nature of environmental noise, a single number descriptor known as equivalent continuous sound level (L_{eq}) is typically used. This descriptor quantifies sound that varies over time, such as that commonly occurring in outdoor environments. L_{eq} is the average sound level (based on acoustical energy) of time varying sound measured over a specific time period. Time periods commonly used for L_{eq} sound levels are 1-hour, daytime (07:00 to 22:00), nighttime (22:00 to 07:00), and 24-hours. L_{eq} is generally accepted and used for environmental noise measurements and criteria. It is also the noise descriptor used by Alberta Utilities Commission (AUC) Rule 012.

Sound is acoustic pressure waves that propagate through air. Because the range of audible sound pressures is very wide, sound is measured on a logarithmic scale in units of decibels (dB). The logarithmic scale compresses the range of audible sound pressures into a range that approximately corresponds to human hearing perception. When comparing sound level values, the following rule of thumb may be used:

- A difference in sound level of 3 dB is barely perceptible to human hearing;
- A difference of 5 dB is noticeable;
- A difference of 10 dB corresponds to a halving or doubling in perceived loudness; and
- A difference of 20 dB corresponds to a four-fold difference in perceived loudness.

Sound level values for environmental noise are normally A-weighted and expressed in units of A-weighted decibels (dBA). The A-weighting accounts for the frequency content of the sound and assesses it with a frequency response similar to that of human hearing. As with human hearing, the A-weighting is most sensitive to audible sound in the mid-frequency range; its sensitivity to high frequency sound is moderately lower and its sensitivity to low frequency sound is substantially lower.

Some types of industrial noise sources can produce significant low frequency sound energy. The presence of low frequency sound can potentially cause adverse effects if it occurs at high sound levels (e.g., perceptible vibration in building structures). Since the A-weighted frequency response filters out sound in the low frequency range, A-weighted sound levels are not a good descriptor for environmental noise containing significant low frequency sound components. The C-weighted frequency response provides a much better measurement of low frequency sound because it has a uniform sensitivity to sound over most of the audible frequency range (except at highest and lowest frequencies where it diminishes moderately). Although the C-weighting is not similar to the frequency response of human hearing at low to moderate sound levels, it is significantly more sensitive to low frequency sound than the A-weighting.

In environmental noise assessments, the daytime and nighttime periods are normally differentiated, especially for areas where ambient sound levels may be affected by community or traffic noise sources. Ambient sound levels are typically higher during the daytime as a result of increased community and traffic activity. During the nighttime, ambient sound levels are usually lower because community and traffic activity is significantly reduced. In order to understand the range of sound levels typically occurring in outdoor environments, Table A - 1 shows typical outdoor sound levels* at various locations ranging from a rural setting to an urban environment.

Table A - 1: Typical Sound Levels at Various Outdoor Locations

Location Description	Sound Level (dBA)	
	Daytime	Nighttime
Farm in Valley	35 - 45	29 - 37
Suburban Residential at City Outskirts	42 - 58	35 - 45
Urban Residential	48 - 59	45 - 57

* Harris, C.M., ed., Handbook of Noise Control, Second Edition, McGraw-Hill, 1979, p. 35-11

Appendix E presents a glossary of acoustical terms for the reader's reference.

A-2. OUTDOOR SOUND PROPAGATION

Outdoor sound propagation between a sound source and a receptor is affected by several sound attenuation mechanisms. These include the following:

- Geometric spreading: sound naturally decreases with increasing distance from a source;
- Ground attenuation: sound is absorbed by the ground that it passes over;
- Atmospheric attenuation: sound is absorbed by the atmosphere it passes through;
- Barrier attenuation: sound can be blocked by physical barriers (e.g., buildings or hills);
- Foliage attenuation: sound can be absorbed by extensive areas of bush or forest;
- Sound is affected by wind gradients: a distant noise source will be louder under downwind conditions than it will be under calm conditions; a distant source will be quieter under upwind conditions than it will be under calm conditions; and
- Sound is affected by temperature gradients: a distant noise source will be louder under atmospheric inversion conditions than it will be under neutral conditions; a distant source will be quieter under atmospheric lapse conditions than it will be under neutral conditions.

Temperature and relative humidity do have effects on some of these sound attenuation mechanisms, however, they do not have specific sound propagation effects associated with them.

Ground cover throughout the study area consists of predominantly rough fields and pasture, with some areas of tree cover and a large river. This type of ground cover would be sound absorptive during summer conditions, apart from the river which is a reflective surface. During the winter, variations in the sound absorption may occur with different ground surface conditions (e.g. frozen ground or crusty snow - reflective; fresh snow - absorptive).

The effects of wind gradients on outdoor sound propagation can cause variations in the sound level of a distant facility. Similar effects are caused by temperature gradients in the atmosphere. The sound level variations caused by wind and temperature gradients are most pronounced for large source/receptor distances. Sound from a distant facility that propagates in a downwind direction (and/or during atmospheric inversion conditions) results in higher sound levels at a receptor than for calm conditions and a neutral atmosphere. This effect is caused by the downward refraction (or bending) of sound rays as they propagate through the atmosphere. Conversely, sound propagating in an upwind direction (and/or during lapse conditions in the atmosphere) is refracted upwards, which results in lower sound levels at the receptor. Sound propagating in a crosswind direction (and a neutral atmosphere) does not exhibit refraction effects and is essentially the same as sound propagation during calm conditions and a neutral atmosphere. The Alberta Energy Regulator (AER) requires noise assessments to be conducted for atmospheric conditions that produce moderate downward refraction. This condition results in efficient outdoor sound propagation between a source and receptor, and is representative of adverse noise impact effects associated with meteorological factors.

Appendix B
Computer Noise Modeling

Northeast Capital Industrial Association
NCIA Regional Noise Model
2018 Noise Model Update (rev1)
SLR Project No.: 203.50029.00003

B-1. COMPUTER NOISE MODEL DEVELOPMENT – BACKGROUND INFORMATION

B-1-1 INTRODUCTION

Advanced computer noise modeling software is commonly utilized for the prediction and mitigation of industry related noise. Computer noise modeling software predicts what changes may happen to environmental sound levels as a result of the construction and operation of proposed facilities. The development of detailed and accurate computer noise models typically provides a means to clearly identify which industries might impact receptor areas before facilities are in place. The advantage of using computer noise models are realized in their ability to forecast environmental noise impacts by order-ranking various contributing plants in an industrial area with a significant amount of facilities.

The accuracy and usefulness of the NCIA Regional Noise Model is critically dependent on the quality of inputs that are provided. These inputs include the Sound Power Levels (PWL) of specific noise emitting equipment, barrier effects as a result of buildings and related structures within a facility and the terrain surrounding the facility, sound absorption by ground cover, and other sound attenuations caused by atmospheric and meteorological conditions. Good computer noise modeling utilizes three-dimensional topographical and structure / building databases, to ensure that the environment is accurately modeled. The computer noise modeling takes into account these environmental factors when performing sound level calculations and predictions. The output of computer noise modeling may include sound level isopleths in the form of colour sound level contours.

One computer noise modeling software product that was considered for this project was "**SoundPLAN**", as developed by Braunstein + Berndt GmbH of Germany. An alternate software product that that was considered was "**CadnaA**", as developed by DataKustic GmbH of Germany. The use of either the SoundPLAN or the CadnaA software is consistent with the guidance provided in various regulatory codes, as they represent an industry best practices approach. After detailed investigation, the computer noise modeling software which was selected was SoundPLAN for the following reasons:

- The only accepted sound propagation standards mentioned in AER Noise Directive 038 (or AUC Rule 12) which can be used are ISO 9613 and CONCAWE, thus allowing SoundPLAN, CadnaA, and Predictor
- Both SoundPLAN and CadnaA are widely used throughout North America
- NCIA wanted the ability to model under various wind conditions and wind directions; which implied the full implementation of the CONCAWE standard would be necessary (ISO 9613 will not do this, it only considers downwind in all directions)
- SoundPLAN was the only widely used software package to offer the CONCAWE standard implemented correctly and functionally (at the time the decision was made)
- The majority of the existing large-scale models were already developed in previous versions of SoundPLAN

- Importation of data between different software packages is very time consuming and may involve a significant amount of model reconstruction and cross checking. Upgrading within a software package is generally easier because the program recognizes the specific items used. Therefore, staying with SoundPLAN was more time efficient and minimized potential errors in model development
- SoundPLAN's integrated organizational structure is well suited for NCIA's Regional Noise Model.

The CONCAWE algorithms for ground attenuation, meteorological effects, and source height effects that SoundPLAN utilizes are defined in CONCAWE Report No. 4/81. An evaluation was conducted by CONCAWE, whereby they analyzed predictions using their standard, for a petrochemical plant and an oil refinery, together having 1,145 receptor points around the two facilities, at distances up to 1.3 km from the process areas. The predicted results were compared to octave band Sound Pressure Level measurements taken over a period of one year. The average difference between predicted and measured values (i.e. measured minus predicted) were +0.5 dBA for neutral wind and temperature gradients, and +0.5 dBA for strong downwind (> 10 km/hr.) or strong inversion conditions. The 95% confidence limits for the predicted sound levels were +/-5.7 dBA for neutral wind and temperature gradients, and +/-4.5 dBA for strong downwind (> 10 km/hr.) or strong inversion conditions. (This information appears in a report "*The CONCAWE Model for Calculating the Propagation of Noise from Open-Air Industrial Plants*" by K.J. Marsh, dated January 4, 1982.

B-1-2 SOUND POWER LEVELS

Sound Power Levels (PWL) from a plant's mechanical, rotating, and process equipment are required for input into the computer noise models. Sound Power Levels are intrinsic properties indicating the total acoustical energy radiated by the operating equipment. For existing facilities, these Sound Power Levels can be calculated from noise measurements of Sound Pressure Levels taken close to the operating equipment. The approaches taken are highly specialized, and experienced acoustical specialists have developed their own procedures to conduct these studies. (It is necessary to understand that sound pressure is a measurable quantity, indicating loudness at a prescribed distance – whereas sound power is not measurable, yet is a theoretical quantity, indicating total acoustical energy radiated regardless of distance.) For proposed facilities in design where direct noise measurements cannot be taken, Sound Pressure Levels are usually determined or estimated from one of the following approaches:

- From noise measurements made on similar equipment
- From data in SLR's database from past projects (only accessible without contractual confidentiality agreements)
- From manufacturer's data (which in itself may be derived from noise measurements of similar equipment)
- From algorithms within international standards (ISO, ANSI, CONCAWE, ASA etc.)
- From data in the technical literature.

B-1-3 EQUIPMENT NOISE MEASUREMENTS

Those well versed with the complexities of industrial plant sound measurements isolate the independent noise radiation effects of various plant equipment, to enable noise modeling of individual equipment noise sources. Diagnostic noise measurements are conducted to "isolate" the individual noise emissions from each source, independent of noise from other equipment that may be operating nearby. This is usually done with a standard Type 1 microphone but may include specialized noise measurement instruments and techniques.

B-1-4 MODELING INPUTS

The inputs to the computer noise models were:

- Equipment Sound Power Levels (per octave band sound frequency)
- Equipment noise source type (radiation as a point source, line source, or area source)
- Equipment noise source coordinates, elevation and radiation directivity
- Building size, geometric and physical location
- Building wall and roof construction
- Reflection parameters for buildings and structures
- Temperature and relative humidity
- Ground cover type
- Terrain elevations (topographic contours)
- Algorithm (calculation standard)
- Time variance of noise sources
- Noise control mitigation (where installed or proposed).

B-1-5 NOISE SOURCE DIRECTIVITY

Some types of equipment do not radiate noise equally in all directions, and the directivity characteristics of certain types of noise sources (e.g. stacks and vents) are well understood. Directivity factors are utilized as appropriate, to account for directional sound radiation from these noise sources. Modeling of directional noise sources are thus accomplished using an industry best practices approach. Each acoustical specialist makes appropriate decisions in these regards, and alterations to source directivity parameters determined by others were not necessary nor considered.

B-1-6 SOUND PROPAGATION MECHANISMS

The computer noise modeling takes into account the following important outdoor sound propagation mechanisms:

- Geometric spreading (which is the geometrical dissipation of sound with respect to distance)
- Ground attenuation (which is the effect of sound absorption by the ground as sound passes over various types of open terrain)
- Atmospheric absorption (which is the effect of sound absorption by the atmosphere between source and receiver)
- Barrier attenuation (which is a noise shielding effect caused by intervening buildings, landforms, etc. between source and receiver)

- Wind effects (which enhance sound propagation in downwind directions and attenuate sound propagation in upwind directions)
- Temperature gradient effects (which enhance sound propagation under atmospheric inversion conditions and attenuate sound propagation under atmospheric lapse conditions).

Temperature and relative humidity do have effects on some of the mechanisms already mentioned above, although they are not in themselves a consideration with respect to sound propagation.

The computer noise models utilize three-dimensional topographical and structure / building databases to ensure that industrial facility environments are accurately modeled. Weather parameters and ground cover are also utilized in the program in order that the modeled sound propagation from the site may be compared to measured data.

Computer noise models typically define ground attenuation values for the plant site and for surrounding off-site areas. Plant site ground is generally considered as a more or less hard surface, with a ground absorption factor ranging from “0” to “0.4”. Off-site areas are generally considered as more or less absorbing, with ground absorption factors ranging from “0.7” to “1”. In order to provide consistency in the Regional Noise Model, all plant site areas have been assigned a ground absorption factor of “0.2” and all off-site areas have been assigned a ground absorption factor of “0.8”. Large bodies of water such as large containment ponds and the North Saskatchewan River have been considered as perfect reflecting surfaces with a ground absorption factor of “0”. In some cases, the extents of ground absorption areas have been adjusted to fit the plant site, to ensure that ground absorption areas do not overlap. A comparison between the calculation of the Regional Noise Model with the submitted ground absorption areas and the Regional Noise Model with uniform ground absorption areas (as described above) resulted in minor (up to plus 1 dB) to no differences. The values referenced above are appropriate for this project.

B-1-7 WEATHER (WIND SPEED AND DIRECTION)

Various scenarios can be modeled that take into account weather conditions (temperature and wind direction) and plant operating conditions. The wind speed, direction, and profile (how the wind speed changes with height) and the temperature profile are the most significant factors associated with the variations in outdoor sound propagation due to weather conditions. Upwind of a noise source, variations of up to a 20 dB may be observed. Downwind, the variation is typically on the order of 5 dB, depending upon distance from a facility. These meteorological effects may be calculated using the methods outlined in CONCAWE (the Oil Companies International Study Group For Conservation Of Clean Air And Water – Europe) Report No. 4/81, *"The Propagation Of Noise From Petroleum And Petrochemical Complexes To Neighboring Communities"*, Prepared by C.J. Manning M.Sc., M.I.O.A. Acoustic Technology Limited (Ref.AT 931) CONCAWE, Den Haag, May 1981.

B-1-8 MODELING ACCURACY

The accuracy of detailed computer noise models, whereby the inputs are derived from accurate individual plant equipment noise measurements, are typically as follows:

- Within +/– 1½ dBA at plant perimeter, based upon actual noise measurements of operating plants
- Within +/– 3 dBA at 1 – 2 km *, based upon actual noise measurements of operating plants
- Within +/– 3 dBA at plant perimeter, based upon assumptions during new plant design
- Within +/– 5 dBA at 1 – 2 km *, based upon assumptions during new plant design.

* over flat ground under calm weather conditions

Appendix C
Regional Noise Model Development

Northeast Capital Industrial Association
NCIA Regional Noise Model
2018 Noise Model Update (rev1)
SLR Project No.: 203.50029.00003

C-1. PHASE 2 – REPRESENTATIVE COMPUTER NOISE MODELING DEVELOPMENT

C-1-1 BACKGROUND

In 2012, the work approach for the NCIA RNMP was to provide a cost-effective methodology, with the intent of achieving a usable Regional Noise Model. Computer noise modeling requires significant time and effort, and accordingly all efforts were made to reduce the extent of new detailed modeling necessary for development of the Regional Noise Model. To this end, SLR utilized the following noise information for Regional Noise Model facilities, as presented in their descending order of precision:

- Input files of existing computer noise models that were prepared by SLR
- Input files of existing computer noise models that were prepared by other acoustical specialists (i.e. acoustical engineer, acoustical consultant)
- Noise data (octave band or A–weighted) of plant / unit noise contributions, as available from reliable sources
- Sound level isopleths (contours), as available from published environmental Noise Impact Assessments results of any other noise studies available.

For any facility where the above noise data was not available (or not adequate), non-diagnostic plant measurements were conducted and a "Basic Noise Model" of the facility was created, as follows:

- Conduct noise measurements around the plant site perimeter (within the fenceline), and at various distances and directions from the plant site
- Calculate octave band Sound Power Levels that were reasonably representative of the entire facility
- Quantify the ground cover conditions and weather conditions for the day of the measurements
- Build a simple computer noise model
- Validate the model, based upon the noise measurements conducted
- Utilize the model as representative of the facility's composite acoustical energy.

It must be understood that the level of detail for required for a Basic Noise Model, which utilizes composite plant noise measurements, produces representative results that are NOT diagnostic. This means that the results are the generalized composite sound level contribution of the plant, with no definition of individual sound level contributions of specific plant equipment. In certain cases where plant equipment was significantly separated from the main plant area itself, e.g. a bank of cooling towers, then attempts were made to treat the equipment as a separate source within the Basic Noise Model.

C-1-2 DEVELOP REGIONAL MAP WITHIN COMPUTER NOISE MODEL

Building the Regional Noise Model required a digital map to be imported, encompassing the entire region including all of the plants and neighbouring communities. The digital map included all ground elevation data, highways, local roads, railway lines and communities. All individual plant plot plans were added into this base map. An overview of the Alberta Industrial Heartland area, with the various industrial landholdings, was previously presented in Figure 1.

C-1-3 INPUT EACH PLANT'S COORDINATE LOCATION

The base map for the Regional Noise Model consists of topographical data based on the 6-degree Universal Transverse Mercator coordinate system (UTM 12), as referenced to the NAD83 datum. Some of the computer noise models were already modeled in UTM coordinates and did not need any coordinate transformation. Other models were modeled using other coordinate systems that did not coincide with the UTM grid. These were relocated within the UTM coordinate system by appropriate coordinate transformation (i.e., translation and rotation). After coordinate transformation, the new location of the facility was verified based upon the UTM grid map, and with other maps such as Google Earth and a map of Heartland's landholdings provided by NCIA.

C-1-4 CONNECT EACH PLANT'S OVERALL SOUND POWER LEVELS

A common obstacle when import attempts are made from one software package to another, or when common database libraries have been used, is a disconnection between plant equipment grid coordinate locations and plant equipment Sound Power Levels compiled in the model's noise source library. In such cases, plant equipment Sound Power Levels need to be re-linked to their new grid coordinate locations and verified by cross-checking. After re-linking, this information is retained in the model and updates to newer versions of SoundPLAN do not require re-linking of noise sources to the source library.

C-1-5 INPUT ROADWAY LOCATIONS AND TRAFFIC FLOW PARAMETERS

The accuracy of road traffic noise calculations is an important aspect of the NCIA Regional Noise Model. Firstly, the accuracy depends on the estimation of sound emissions from vehicle traffic traveling on diverse pavements. Secondly, the ground effects must account for the shallow angles of reflection when the sources (i.e., engine and tire/pavement noise) are nearly at grade, and for the greater distances required for calculations of sound propagation within the NCIA region. Thirdly, there should be future flexibility for modeling the refractive, sound-curving effects of wind profiles and temperature gradients.

The calculation method chosen by SLR for the road noise model is the Traffic Noise Model (TNM), 1998, developed by the US Federal Highway Administration (FHWA). The traffic noise algorithms used by this program are very similar to other traffic noise models used in North America, such as the Canada Mortgage and Housing Corporation (CMHC) road traffic noise model and the Ontario Ministry of the Environment (MOE) Stamson road traffic noise model. SLR considered the various standards available and deemed that the TNM computer noise model would best represent the sound emissions from road traffic and pavements within the Heartland. There are few engineering differences between sound emissions from all types of North American vehicles, whereas there are documented differences in source heights between heavy trucks manufactured for use in Canada as compared to those for the European market.

The computer noise modeling software calculates equivalent continuous sound levels (L_{eq}) for road traffic noise, based on traffic data (vehicles per hour, percentage cars / trucks), and road data (posted speed, pavement types, road gradients). Average hourly traffic volumes for automobiles and heavy vehicles (i.e. buses and trucks), are derived from Annual Average Daily Traffic (AADT) data published by Alberta Transportation. Predicted traffic noise levels are considered separately for daytime and nighttime traffic, as there may be a substantial difference between daytime and nighttime traffic volumes. The day / night traffic volume splits used for the AIH roadways are 90% / 10%. Posted speeds and pavement types consistent with the Alberta road system are assumed in the model, and road gradient data is computed by the model based on the digital ground elevation data in the AIH regional map (Section C-1-2).

The predicted traffic noise levels calculated by the road model are considered to be accurate within 250 m of the roadway. The traffic noise prediction results do not include the effects of background noise in the study area, such as noise from minor roads, community activity or other transportation sources, such as trains and aircraft.

C-1-6 INPUT MAINLINE RAILWAY LOCATIONS AND TRAFFIC FLOW PARAMETERS

Previous version of the Regional Noise Model assessed rail noise based on estimated volumes and modeled the track segments as industrial line sources. For the 2018 Regional Noise Model, average rail volumes and speeds were obtained for all main rail lines in the region from the rail operators. There are a total of 12 separate track segments that were identified for the Heartland region. An average Sound Power Level for each segment was calculated, based on the Ontario Ministry of Environment (MoE) Sound from Trains Environmental Analysis Method (STEAM). The propagation of noise from the rail line was modeled using the Calculation of Railway Noise (CoRN) calculation standard.

The calculated rail noise values are 24-hour equivalent continuous sound levels. These values represent the composite average of the daytime and nighttime sound levels, calculated for a typical day and night when the rail line movements occur. These values are not maximum hourly values; however they incorporate the effects of higher hourly results.

C-2. DETAILED COMPUTER NOISE MODELING RUNS

In 2012, SLR had 37 computer noise model databases in all for Regional Noise Model facilities. This represented approximately 50% of the computer noise models that exist for the Heartland area plants. Many of the computer noise models existed in several scenarios, ranging from preliminary conceptual designs, to engineering design changes, to optimization options with different noise control mitigating measure alternatives (not all of which were implemented). Time was spent to re-assemble the most current and most appropriate model per plant / unit. Also, all calculated results were checked to ensure that data incorporated into the Regional Noise Model matched up with the data presented in reports. Some differences occurred due to the use of different calculation standards and calculation settings between original model reports and the Regional Noise Model, and the upgrade to higher versions within SoundPLAN. There are situations in which the original model was calculated, for example, with the ISO 9613 standard, whereas the Regional Noise Model calculates on the basis of CONCAWE. Also differences in settings, for example, the air absorption standards, resulted in some variations. Furthermore, discrepancies sometimes occur between software versions, e.g. with industrial buildings or floating barriers. All of these aspects were normalized to the best extent possible on a case-by-case basis.

C-2-1 REVIEW ALL AVAILABLE MODEL ELECTRONIC FILES PER PLANT

SLR requested provision of computer noise modeling databases from NCIA member companies who have facilities where computer noise modeling may have been conducted, as well as from non-member companies who have facilities where computer noise modeling may have been conducted. Provision of databases from NCIA member companies was deemed compulsory by NCIA. Provision of databases from non-member companies was voluntary; and NCIA appreciates those non-member’s cooperation.

Contacting facilities, retrieving permissions to use their noise data, making sure that computer noise models were current, and retrieving data from facilities that utilized other noise consultants was all an extensive exercise

The computer noise models received from other acoustical consultants ranged from very simple models with a few sound sources representing whole units, to very detailed models with many sound sources. SLR did not alter the models received, as those models presumably were used for regulatory applications which had been approved. The models were reviewed to verify modelling procedures only. SLR imported the models as delivered. When converting models from CadnaA to SoundPLAN, some adjustments needed to be made. SLR believes the quality of some of those simpler models was approximately the same as a Basic Noise Model survey previously referenced, with the same limitations as listed under Task 1.3.

The general context of computer noise model development for the Regional Noise Model is summarized in tabular format, as presented in Table C-1 below.

Table C - 1
General Context of Computer Noise Modeling Development

Comparative Feature	Detailed Computer Noise Modeling
Includes all NCIA member facilities	Yes
Includes road transportation noise	Yes
Includes railway transportation noise	Yes
Type of noise data used when models exist	Complete existing computer noise models, somewhat detailed
Type of noise data used when models do not exist	Fenceline noise measurements (Basic Noise Model), diagnostic noise measurements when fenceline noise measurements are not possible, or Sound Power Levels
Diagnostic capability to identify plant / unit contributions	Yes
Diagnostic capability to identify individual plant equipment noise contributions	No – however NCIA holds database to be able to do so upon specific requests
Accuracy of representing current sound levels	+/– 3 dBA at 1 – 2 km
Predictive capability for new plants	+/– 5 dBA at 1 – 2 km
Predictive capability for expansions / debottleneckings	+/– 5 dBA at 1 – 2 km
Identified data gaps for further follow-up	Some models need updating or detailing
Updatable and expandable	Yes
Annual maintenance work suggested to maintain model	Determine site-specific noisy plant equipment changes, and update models accordingly – on a regular interval, as requested by a facility – there is no established process for such updates
Model input files provided	On individual equipment basis
Model output files provided – tabular results order–ranking	Plant / unit order-ranked lists

C-2-2 UPDATE FILES WITHIN CADNAA® OR SOUNDPLAN® TO CURRENT VERSION

Older CadnaA models were converted to the current version of CadnaA, and then imported into SoundPLAN. Older SoundPLAN models were converted to the current version of SoundPLAN.

Most computer noise models were "validated" (i.e., calibrated) with noise measurements when they were individually developed, which required extensive efforts to accomplish. Recalibration of computer noise models would have been too time-consuming and cost prohibitive for this project. SLR evaluated the options below, and then along with the NCIA Noise Committee selected option C as the most opportune methodology:

A. Recalibrate the models, requiring a significant expansion to the Scope of Work

B. Recalibrate the models, using correction factors, without detailed justification

C. Update the models to the current version of SoundPLAN "as-is" without further calibration

D. Keep the models in SoundPLAN 6.5 without further calibration.

The validation exercise for the 2018 Regional Noise Model is discussed in Section 3 of this report, which reports on the validation evaluation with the 2017 noise monitoring surveys conducted by ACI Acoustical Consultants.

C-2-3 EXPORT / IMPORT INTO COMMON MODEL PLATFORM

Another issue was that even though a computer noise model may have been "validated" in one software package, it may not provide identical results in the other software package. Also, differences between calculation standards and calculation settings between the facility model and the Regional Noise Model may lead to other differences. As previously discussed, updating to newer versions of SoundPLAN could also result in changes in calculation results.

In order to assure that the facility models were imported properly into the Regional Noise Model, firstly the original model was recalculated to ensure that the data in the report matched up with the selected model. Models were converted to SoundPLAN, and recalculated with the original calculation settings, to preserve the work already performed, leaving only the differences due to the software update. The next step, when necessary, involved coordinate transformation of the model to the common grid system. The model was then recalculated with the Regional Noise Model digital ground model and the Regional Noise Model calculation settings. The input data of this model was then imported in a test version of the Regional Noise Model. A calculation was run with the Regional Noise Model settings, and the results of this calculation were compared to the previous calculation of the original model with Regional Noise Model settings. If results matched up, the test model was coded, grouped and imported into the Regional Noise Model. Another calculation run of the model was performed to ensure that the results still matched up with those from before the importation. If they did, then the import was deemed successful. In various steps of this exercise, discrepancies arose and were investigated. Certain causes were beyond our control, like changes due to software upgrade, differences between absolute and relative objects, items not imported, or items in the wrong geofile. All such discrepancies were resolved.

C-2-4 REVIEW AND ORGANIZE MODEL DATA

The success of producing a usable model is based upon good organization and documentation of the computer noise model's data files. This is necessary for future diagnostic model runs. Allowing for all these scenarios required accomplishing a common database organization set-up procedure. SoundPLAN's integrated organizational structure is well suited for this task. The terminology of SoundPLAN's structure includes equipment noise "source groups", "geofiles", and "situations", which are explained as follows:

- Source Groups: SoundPLAN structure permits organizing the noise sources into noise "***source groups***", to enable separate model runs (e.g. with various noise control mitigation scenarios). Where possible, equipment noise sources have been added to source groups to ensure possible future uses to address noise source groups. The noise source groups are derived from the noise source types, which were developed in a previous project for the NCIA Regional Noise Management Plan and reported in a document entitled "*Report on Noise Reduction Strategies, Noise Best Practices Sub-Committee, Northeast Capital Industrial Association, HFP Project 05-C 1773-2.0*", dated March 15, 2006.

- Geofiles: Each situation consists of a number of "***geofiles***", which consist of several noise modeling elements representing the noise sources, receivers; ground absorption, buildings / barriers, and other relevant information for the specific computer noise model for a facility. The geofiles names start with a code indicating the facility and the unit in question.

- Situations: SoundPLAN permits compiling geofiles into "***situations***" (i.e. a selected set of modeling compositions). Situations are compiled with a selected calculation standard [e.g. ISO 9613 or CONCAWE], selected weather conditions and selected calculation parameters to enable noise model runs. Each facility is organized in one "situation". Noise model runs for any combination of facilities can be made by combining various situations.

C-2-5 PERFORM COORDINATE TRANSFORMATION TO COMMON GRID

A common grid coordinate system is required for the Regional Noise Model. All plant coordinates were adjusted using a standard coordinate transformation process, so all plant process areas and buildings have their grid coordinates based on the common grid coordinate system.

Most plant models used a local plant-based coordinate system, which was reassigned to the common grid coordinate system. This allowed plant equipment locations from existing individual plant computer noise models to be imported to the Regional Noise Model. Similarly, in some cases, elevations also needed to be reassigned.

C-2-6 BUILDING BASIC NOISE MODELS

SLR created "Basic Noise Models" for plants that did not already have detailed diagnostic noise models. In most cases, this was undertaken by conducting non-diagnostic noise measurements around the perimeter of these plant sites and validating the computer noise model to the measured sound levels, utilizing the acoustical specialist's expertise. Basic Noise Model reports were separately presented to the plants where this work was performed. The noise sources in the Regional Noise Model for these facilities should not be considered diagnostic. However, in some cases where fenceline noise measurements were not possible because of the significant influence of neighbouring plants, diagnostic noise measurements were conducted. Also, a number of Basic Noise Models have been developed, based on delivered Sound Power Levels for plant equipment. These Basic Noise Models did not need to be further validated, as they represent field measured values. Some operating and meteorological conditions were recorded and presented in the Basic Noise Model reports. The Basic Noise Models currently in the Regional Noise Model are discussed in Section 2 of this report.

C-2-7 RUN INDIVIDUAL PLANT MODELS

Individual plant models can be run by selecting the situation for the facility in question. For each calculation run, different calculation settings may be chosen, with results presented for the selected model situation. In the case where a number of surrounding facilities are of interest as well, a new situation combining all geofiles for these facilities and the facility in question can be made and calculated. Results will then show the combined contribution of all the selected facilities. Contributions per facility are generated by running the situations for the facilities separately and then comparing them to each other by exporting result files to a spreadsheet. Future specialized model runs will allow the opportunity to provide a source order–ranking for any desired resident or receptor.

C-2-8 RUN DETAILED REGIONAL COMPUTER NOISE MODEL

The Regional Noise Model has been run as a whole, without dividing the area into smaller segments. Since SoundPLAN® provides provisions to combine selected geofiles into one model situation for calculation, it was therefore not deemed necessary to break the Regional Noise Model into pieces. Running the Model as a whole to calculate noise contours takes several days to complete, because of the large size of the area and large number of noise sources in the model. Future optimization and future changes in processor speed will likely improve calculation times.

C-2-9 COMPILE TABULAR RESULTS

Tabular results within the Regional Noise Model include the following:

- A computer noise model <u>input</u> database, in spreadsheet format, depicting the following;
    - Plant equipment;
        - Description (e.g. name, tag number)
        - Grid coordinates and elevations
        - Octave band Sound *Power* Levels
        - Directivity (if applicable)
        - Acoustic source type (e.g. area source, line source, point source)
    - Identification, dimensions and coordinates of buildings, structures and barriers
    - Identification of noise sources inside buildings
- A computer noise model <u>output</u> database, in spreadsheet format, depicting the following;
    - <u>Plant / unit</u> order–ranked lists for selected receptor locations
        - Description (e.g. plant or unit name)
        - Octave band Sound <u>Pressure</u> Level contributions at receptor

        - › A–weighted sound level contribution at receptor
    - Sum of octave band Sound Pressure Level contributions per receptor location assessed
    - Sum of A–weighted sound level contributions per receptor location assessed.

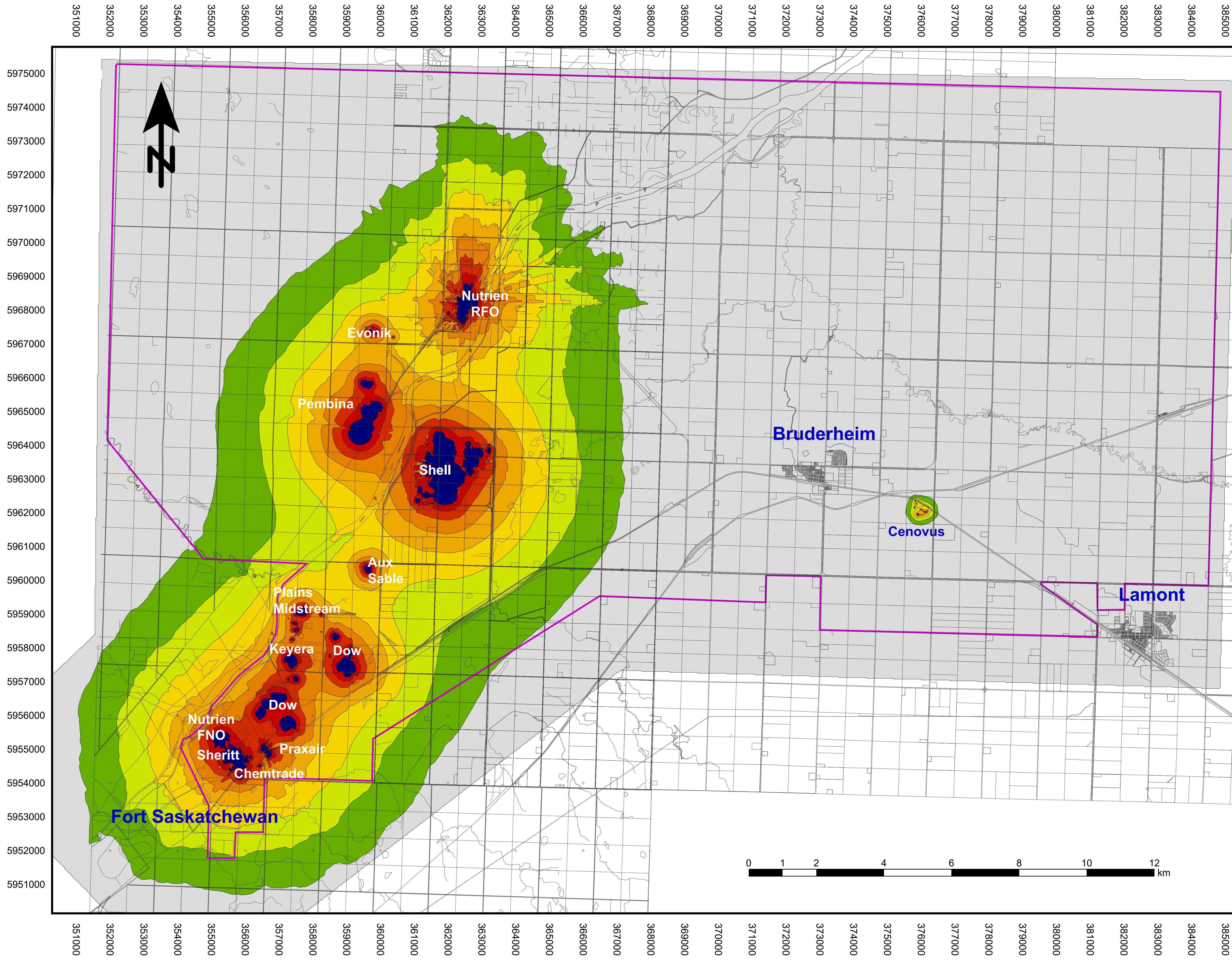
C-2-10 COMPILE GRAPHICAL RESULTS

Graphical results within the Regional Noise Model include the following:

- A computer noise model output database, in isopleth format, depicting the following;
    - Physical layout of the region
    - Rivers, roads, railway lines, communities, etc.
    - Plant locations, identified by fencelines and labelled names
    - A–weighted sound level isopleths (contours)
    - Above performed for the entire Heartland area
    - Above performed for a multiple number of pre-determined sub-regions or areas.
    - Topography (see Figure 1).

Appendix D
Sound Level Contours

Northeast Capital Industrial Association
NCIA Regional Noise Model
2018 Noise Model Update (rev1)
SLR Project No.: 203.50029.00003



NCIA Regional Noise Model 2018

Figure D-1:
Predicted Sound Level Contours

Case 3a:
Model Validation Case
- NCIA member company existing facilities
- Non-member company existing facilities
- Calm wind conditions

Legend

AIHA Industrial Policy Area

Sound Level (dBA)

<= 30
30 < <= 35
35 < <= 40
40 < <= 45
45 < <= 50
50 < <= 55
55 < <= 60
60 < <= 65
65 <

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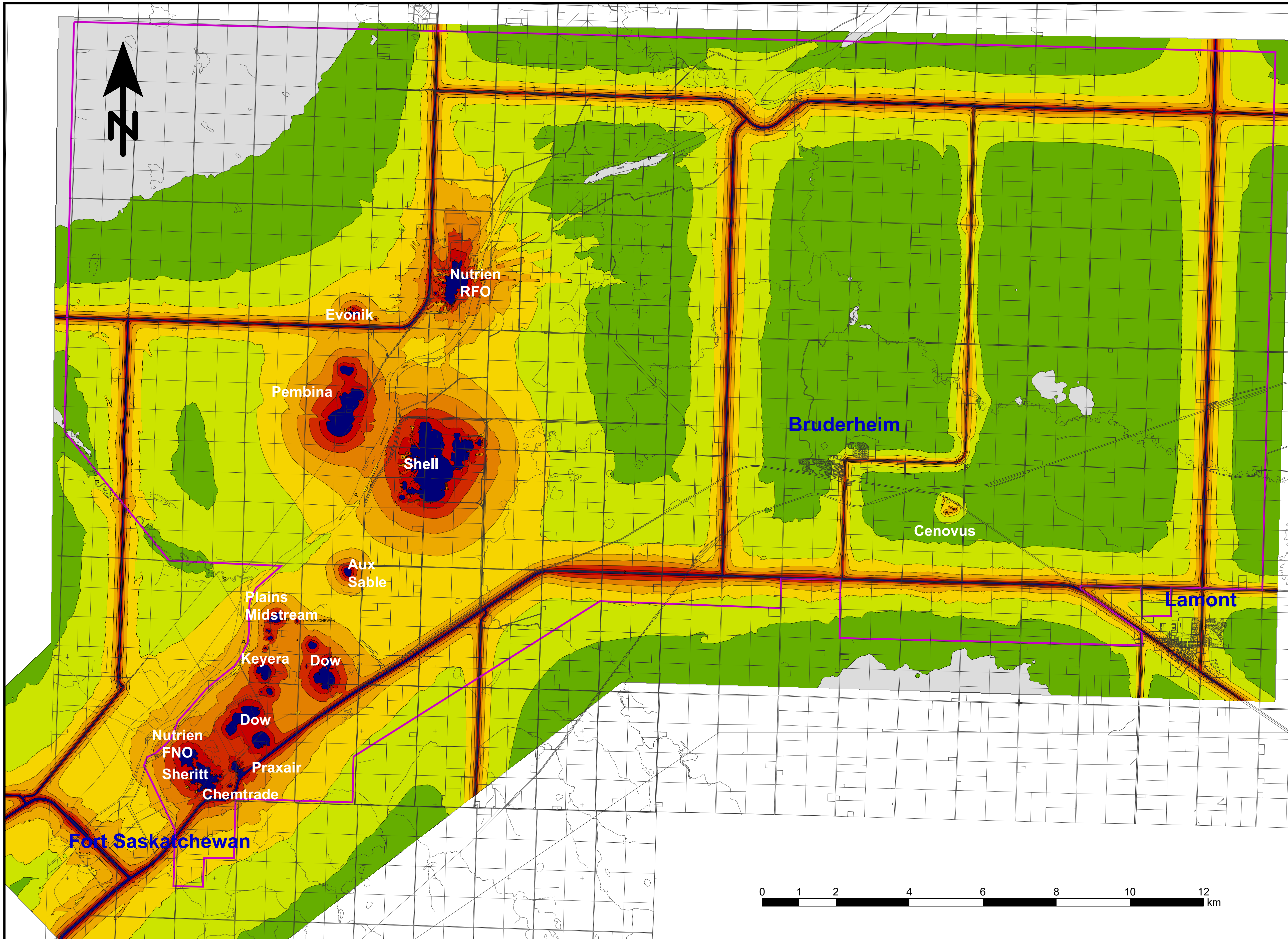
SLR File 203.50029.00003

SLR global environmental solutions



NCIA Regional Noise Model 2018

Figure D-2:
Predicted Sound Level Contours

Case 3b:
Model Validation Case
- NCIA member company existing facilities
- Non-member company existing facilities
- Road noise contribution
- Calm wind conditions

Legend

AIHA Industrial Policy Area

Sound Level (dBA)

<= 30
30 < <= 35
35 < <= 40
40 < <= 45
45 < <= 50
50 < <= 55
55 < <= 60
60 < <= 65
65 <

December 2018

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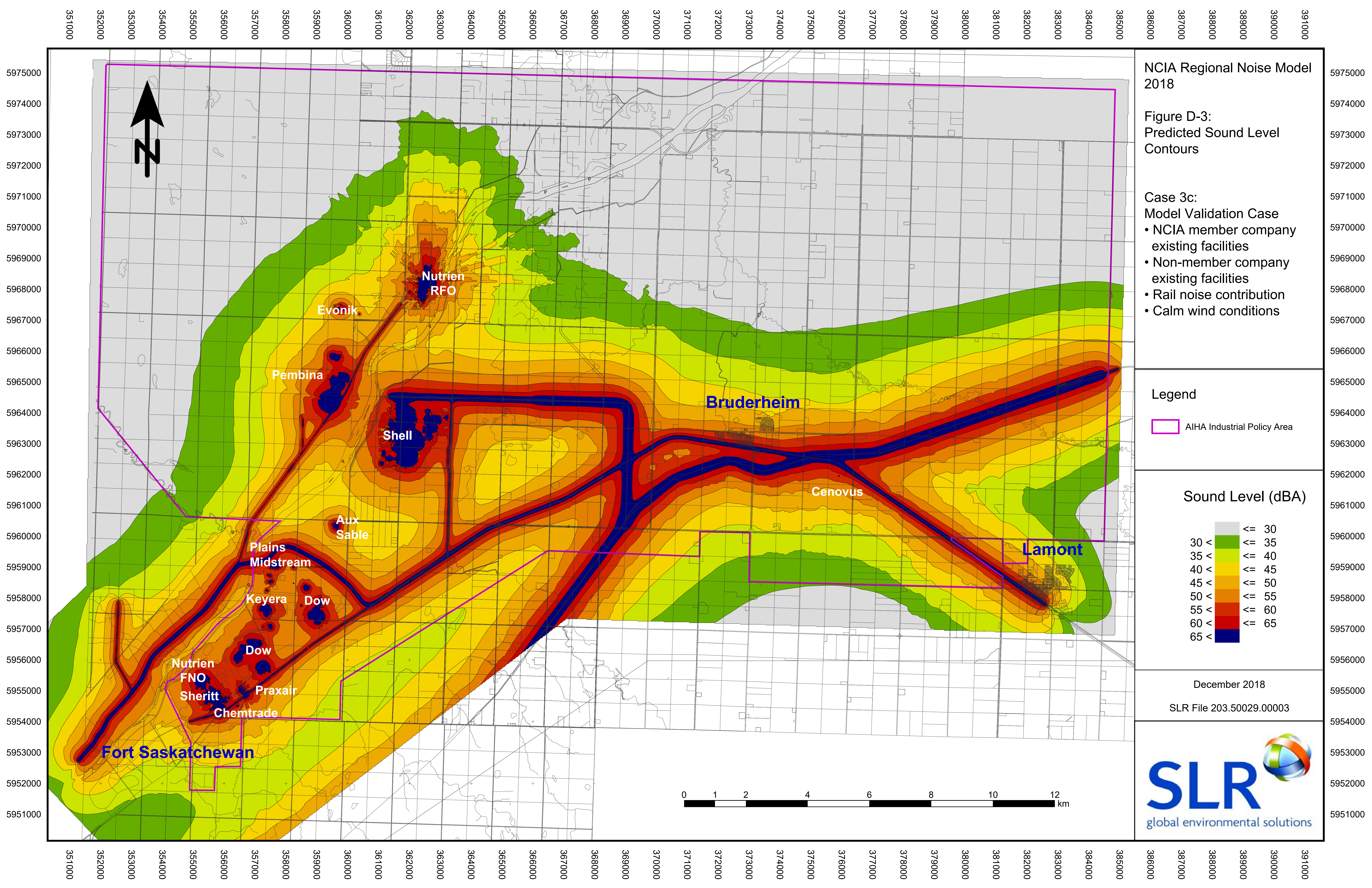
SLR global environmental solutions


NCIA Regional Noise Model 2018
Figure D-3:
Predicted Sound Level Contours
Case 3c:
Model Validation Case
• NCIA member company existing facilities
• Non-member company existing facilities
• Rail noise contribution
• Calm wind conditions
Legend
AIHA Industrial Policy Area
Sound Level (dBA)
<= 30
30 < <= 35
35 < <= 40
40 < <= 45
45 < <= 50
50 < <= 55
55 < <= 60
60 < <= 65
65 <
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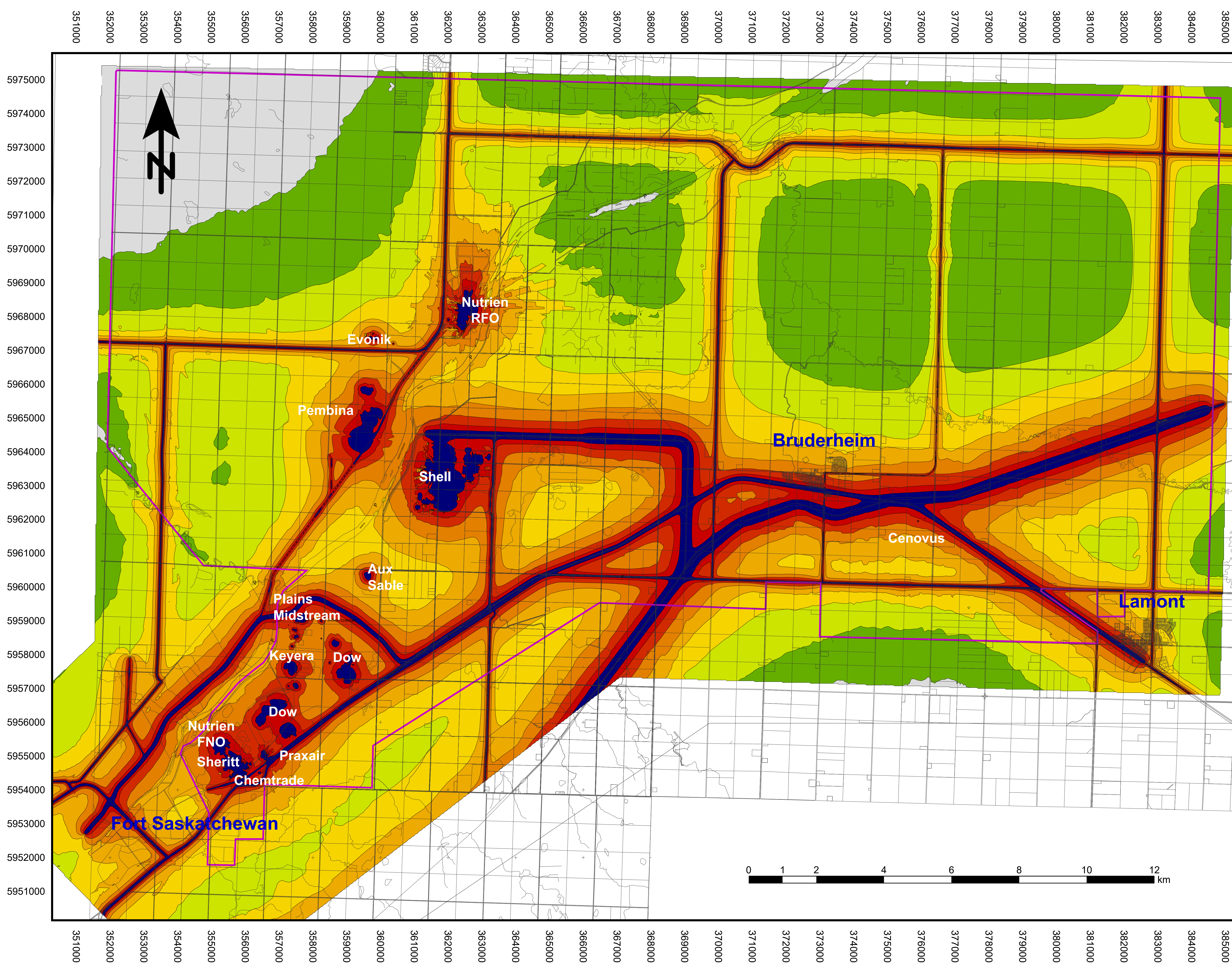
Nutrien RFO
Evonik
Pembina
Shell
Bruderheim
Cenovus
Aux Sable
Plains Midstream
Keyera
Dow
Dow
Nutrien FNO
Sheritt
Praxair
Chemtrade
Fort Saskatchewan
Lamont
N
0 1 2 4 6 8 10 12 km



NCIA Regional Noise Model 2018

Figure D-4:
Predicted Sound Level Contours

Case 3d:
Model Validation Case
- NCIA member company existing facilities
- Non-member company existing facilities
- Road noise contribution
- Rail noise contribution
- Calm wind conditions

Legend

AIHA Industrial Policy Area

Sound Level (dBA)

	<= 30
30 <	<= 35
35 <	<= 40
40 <	<= 45
45 <	<= 50
50 <	<= 55
55 <	<= 60
60 <	<= 65
65 <	

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Appendix E
Glossary of Acoustical Terms

Northeast Capital Industrial Association
NCIA Regional Noise Model
2018 Noise Model Update (rev1)
SLR Project No.: 203.50029.00003

A-WEIGHTED SOUND LEVEL OR dBA: A measurement of overall Sound Pressure Level which accounts for the frequency content of the measured sound and assesses it with a frequency response similar to that of the human ear.

AMBIENT OR BACKGROUND NOISE: The noise in the environment, other than the noise from the source of interest.

ATMOSPHERIC ATTENUATION: The effect of sound absorption by moisture in the air.

ATTENUATION: A reduction in sound level that occurs with sound propagation over distance by means of physical dissipation or absorption mechanisms, or a reduction in sound level that occurs by means of noise control measures applied to a sound source.

BARRIER DIFFRACTION OR ATTENUATION: The effect of an acoustical shadow created by building or landform interposed between a source and a receiver.

BROADBAND NOISE: A noise with frequency components distributed over a broad frequency range, e.g. noise from distant road traffic.

C-WEIGHTED SOUND LEVEL OR dBC: A measurement of overall Sound Pressure Level with a frequency response that has essentially no filtering of sound between 50 and 5000 Hz. C-weighted sound levels are a better indicator of the presence of low frequency sound than A-weighted sound levels.

COMPREHENSIVE SOUND LEVEL: A measurement of the overall Sound Pressure Level at a location which includes the effects of all noise sources affecting the location.

DISTANCE DISSIPATION: The geometrical dissipation of sound with distance.

EQUIVALENT CONTINUOUS SOUND LEVEL OR L_{eq}: A single number descriptor commonly used for environmental noise measurements and criteria. It is used to quantify sound which constantly varies over time, such as that commonly occurring in outdoor environments. It is defined as the average Sound Pressure Level over a specific time period that has the same acoustic energy as the actual fluctuating Sound Pressure Levels during the same time period. Time periods commonly used for L_{eq} measurements and criteria are the daytime (07:00 - 22:00 hrs) and nighttime (22:00 - 07:00 hrs) periods.

FREE SOUND FIELD (FREE FIELD): A sound field in which the effects of obstacles or boundaries on propagating sound are negligible.

FREQUENCY: The number of wave oscillations per second (hertz) of an acoustic pressure wave propagating through the air. The same as the pitch, or highness or lowness of a sound.

GROUND ATTENUATION: The effect of sound absorption by the ground separating the source and receiver.

INCREASE IN SOUND LEVEL: The perceived increase in loudness of a sound does not correspond directly to numerical increases in dBA values. Typically, an increase of less than 3 dBA is barely noticeable, an increase of 5 dBA is noticeable, an increase of 10 dBA is perceived as a doubling in apparent loudness, and an increase of 20 dBA is perceived as a four-fold increase in apparent loudness.

NARROW-BAND: A segment of the frequency spectrum which spans a few hertz or tenths of hertz.

NARROW-BAND SOUND PRESSURE LEVEL: The total Sound Pressure Level of sound components in a specific narrow-band frequency segment. Narrow-band Sound Pressure Levels are used to identify the presence of tonal components in a sound.

OCTAVE: The interval in frequency between two sounds having a frequency ratio of two.

OCTAVE BAND: A segment of the frequency spectrum which spans one octave.

OCTAVE BAND SOUND PRESSURE LEVEL: The total sound pressure level of sound components in a specific octave band.

PINK NOISE: A broadband noise characterized by a spectrum that uniformly decreases by 3 dB/octave with increasing octave band frequency. This noise is characterized by a "hushing" sound.

SOUND LEVEL CONTRIBUTION: The contribution of noise from one or more sources to the overall sound level from all sources affecting a particular location.

SOUND POWER LEVEL: A measurement of the acoustic energy of a sound source, which utilizes a logarithmic scale and which is normally calculated from Sound Pressure Level measurements near the source.

SOUND PRESSURE LEVEL: A physical measurement of sound, which utilizes a logarithmic scale and which quantifies the amplitude or volume of acoustic pressure waves propagating through the air.

SPECTRUM: The quantification of the components of a sound as a function of frequency.

STATISTICAL SOUND LEVEL OR L_n: The proportion of time a sound of interest is present at a specific level. Statistical sound levels are expressed as L_n values, which is the sound level exceeded N percent of the time.

THIRD-OCTAVE: The interval in frequency between two sounds having a ratio of 2 to the one-third power, or approximately 1.26.

THIRD-OCTAVE BAND: A segment of the frequency spectrum which spans one-third octave.

THIRD-OCTAVE BAND SOUND PRESSURE LEVEL: The total sound pressure level of sound components in a specific one-third octave band.

URBAN HUM: The more or less steady, continuous background noise in or near an urban area caused by distant road traffic and urban activity.

APPENDIX 2

2017 Regional Noise Model Annual Field Validation Monitoring Report

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2017 Environmental Noise Survey

For The

Regional Noise Model Annual Field Validation Monitoring

Prepared for:

Northeast Capital Industrial Association

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Executive Summary

aci Acoustical Consultants Inc., of Edmonton AB, was retained by the Northeast Capital Industrial Association (NCIA) to conduct an environmental noise survey within Alberta's Industrial Heartland (AIH). The purpose of the study was to conduct a single 48-hour noise monitoring at eleven (11) pre-specified locations within the AIH. An additional noise monitoring, spanning two (2) 48-hour periods, was conducted at an 12th monitoring location (referred to as Location 12) as an independent control/reference point. The noise monitoring was conducted in support of the NCIA's Regional Noise Management Plan. In addition, the results from these noise monitoring will be used to validate the Regional Noise Level Assessment Model (the Regional Noise Model). All noise monitoring procedures and equipment used was in accordance with the requirements of the Alberta Energy Regulator (AER) Directive 038 on Noise Control. Site work was conducted for aci in July and August, 2016 by P. Froment, B.Sc., P.L.(Eng.).

As part of the study, a total of thirteen (13) 48-hour noise monitorings were conducted throughout the Alberta's Industrial Heartland. It was found that the isolated L_{eq}Night[1] broadband and 1/3 octave band L_{eq} sound levels, from at least one (1) over-night period, were similar to those from previous measurements.

The noise levels at most locations consisted of low frequency components with occasional mid/high frequency components that could be attributed to the nearest facility relative to each individual noise monitoring location. Despite the noise being relatively low in frequency, none of the sites indicated any low frequency tonal components. The noise from train passages was again prevalent at all locations and tended to dominate the noise climate as they passed through, particularly when there were train whistles. Despite having unfavourable weather conditions, the isolated noise levels were relatively consistent to previous years.

[1] The term L_{eq} represents the energy equivalent sound level. This is a measure of the equivalent sound level for a specified period of time accounting for fluctuations.

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1.0 Introduction

aci Acoustical Consultants Inc., of Edmonton AB, was retained by the Northeast Capital Industrial Association (NCIA) to conduct an environmental noise survey within Alberta's Industrial Heartland (AIH). The purpose of the study was to conduct a single 48-hour noise monitoring at eleven (11) pre-specified locations within the AIH. An additional noise monitoring, spanning two (2) 48-hour periods, was conducted at an 12th monitoring location (referred to as Location 12) as an independent control/reference point. The noise monitoring was conducted in support of the NCIA's Regional Noise Management Plan. In addition, the results from these noise monitoring's will be used to validate the Regional Noise Level Assessment Model (the Regional Noise Model). All noise monitoring procedures and equipment used was in accordance with the requirements of the Alberta Energy Regulator (AER) Directive 038 on Noise Control. Site work was conducted for aci in July, 2017 by P. Froment, B.Sc., P.L.(Eng.).

2.0 Location Description

Alberta's Industrial Heartland (AIH) is located northeast of Edmonton, AB and extends into five different municipalities as indicated in Figure 1. This includes 533 km^2 within the City of Fort Saskatchewan and the Counties of Lamont, Strathcona and Sturgeon, in addition to 49 km^2 in the City of Edmonton's "Edmonton Energy and Technology Park". The area has 40+ companies in various sectors that include producing and processing oil, gas and petrochemicals in addition to advanced manufacturing.

Topographically, the AIH does have some varying elevation changes however in general it can be considered relatively flat with no substantial hills. Areas with more significant changes in elevation are found adjacent to the North Saskatchewan River (the River) which divides the AIH from the southwest to the northeast (excluding the AIH area within the City of Edmonton's limits). The vegetation varies from open grain fields to thick dense vegetation. Due to the relative distance from the noise monitoring locations to the nearby facilities (with the exception of Noise Monitor Location 12) and the relatively low frequency nature of the industrial noise, the level of vegetative sound absorption is considered negligible to low.

3.0 Measurement Methods

As part of the study, a total of thirteen (13) 48-hour noise monitoring's were conducted at 12 locations[1] throughout the AIH, as indicated in Figure 2.

All noise monitoring locations were identical to those conducted during the 2016 Noise Survey apart from Noise Monitor Locations 1 & 3. The noise monitor at Location #1 was relocated approximately 160 m east to improve the safety of setup and takedown. This location maintains the sight lines to the facilities to the north. It is anticipated that this location will remain the same for future noise monitoring.

Noise Monitor #3 was relocated approximately 120 m north of the previous location due to new construction at the previous site. This new location maintains sight lines to the facilities to the south and west. It is aci's intention to use this location going forward, however this could change based on the new construction in the area.

The noise monitoring was conducted collecting broadband A-weighted and C-weighted as well as 1/3 octave band sound levels and were conducted during "typical" operations at all facilities[2]. In particular, the chosen noise monitoring periods avoided any major shut-downs or outages that could adversely affect the "typical" noise levels (either louder or quieter) from a given facility. In addition, the monitoring's were conducted under summer conditions (i.e. no snow cover) trying to avoid times of precipitation and high wind-speeds. Each noise monitoring was accompanied by a 48-hour digital audio recording for more detailed post process analysis. Three (3) local weather monitoring stations were also used for the two (2) 48-hour time monitoring periods. The weather monitors obtained the wind speed, wind direction, temperature, relative humidity, barometric pressure and rain fall data in 15-second sampling periods. Lastly, it should be noted that all measurements were performed in accordance with the methods described in the AER Directive 038 on Noise Control.

[1] Once again, it should be noted that two (2) 48-hour monitoring were conducted at Monitoring Location 12.
[2] This was verified by all the various company representatives.

4.0 Noise Monitoring Location Description

In addition to Table 1, which provides the UTM coordinates and the start and end times for each noise monitoring, a brief discussion of each noise monitoring location can be found below. All noise measurement instrumentation was calibrated at the start of the measurements and then checked afterwards to ensure that there had been no significant calibration drift over the duration of the measurements. Refer to Appendix I for a detailed description of the measurement equipment used and for all calibration records.

Table 1. Noise Monitoring Locations with Start and End Times[1]

Monitoring Location	UTM Coordinates (Approximate) [2]		Start Time	End Time
	Easting (m)	Northing (m)		
1C	355210	5954157	7/27/17 10:20	7/29/17 10:20
2	358256	5957216	7/27/17 09:45	7/29/17 09:45
3B	358361	5959283	7/27/17 09:20	7/29/17 09:20
4C	361665	5960870	7/27/17 09:00	7/29/17 09:00
5	361777	5964711	7/29/17 15:00	7/31/17 15:00
6	364322	5967894	7/27/17 08:30	7/29/17 08:30
7	N/A			
8a	358897	5965430	7/29/17 12:00	7/31/17 12:00
9	355872	5957574	7/29/17 12:30	7/31/17 12:30
10	355925	5955818	7/27/17 10:05	7/29/17 10:05
11	358430	5963804	7/29/17 13:00	7/31/17 13:00
12b (1st 48-hour)	368223	5963070	7/27/17 08:00	7/29/17 08:00
12b (2nd 48-hour)			7/29/17 08:00	7/31/17 14:00
13	358667	5970180	7/29/17 13:00	7/31/17 13:00

4.1. Noise Monitor Location 1

The noise monitor at Location 1 was located approximately 10 m south of 100 Avenue, 175 m west of 114 Street and approximately 370 m northwest of Highway 15 as indicated in Figure 2 and Figure 3. This put the noise monitor approximately 410 m southwest of the Sherritt International Corporation facility. This is the southernmost noise monitoring location found within the AIH. At this location, there was direct line-of-sight to 100 Avenue, Mel Martin's Transfer Facility and the Sherritt International Corporation facility. There was no significant vegetation between the noise monitor and the facilities to the north.

[1] The letters accompanying the noise monitoring location refers to their location.
[2] The UTM Coordinates have been updated to reflect the modified 2016 noise monitor locations.

4.2. Noise Monitor Location 2

The noise monitor at Location 2 was located approximately 90 m southeast of 125 Street and approximately 1.0 km north of Highway 15 as indicated in Figure 2 and Figure 4. This put the noise monitor approximately 120 m west of the Dow yard, 170 m north of the Dow rail yard and approximately 850 m east-southeast of the Keyera Facility. At this location, there was direct line-of-sight to Dow's main site to the east and to the rail yard to the south. There was no significant vegetation between the noise monitor and the aforementioned facilities.

4.3. Noise Monitor Location 3

The noise monitor at Location 3 was located approximately 10 m east of 125 Street, 275 m south of the CN Rail line 55 m east of the north entrance to the Plains Midstream Facility and approximately 125 m north of the entrance to the Petrogas northern entrance as indicated in Figure 2 and Figure 5. This put the noise monitor approximately 230 m northwest of the Petrogas facility and approximately 380 m east of major equipment at the Plains Midstream Facility. At this location, there was direct line-of-sight to the Plains Midstream Facility but not to the Petrogas site. There was no significant vegetation between the noise monitor and the facilities.

4.4. Noise Monitor Location 4

The noise monitor at Location 4 was located approximately 1.2 km south of the south fence line of the Shell Scotford site and approximately 1.6 km east of Range Road 220 (130 Street) as indicated in Figure 2 and Figure 6. This put the noise monitor at 490 m south of the entrance to the electrical substation to the northwest. At this location, there was direct line-of-sight to the Shell Scotford site but not to the electrical substation to the northwest. There was no significant vegetation between the noise monitor and the Shell Scotford facility.

4.5. Noise Monitor Location 5

The noise monitor at Location 5 was located approximately 200 m north of Township Road 560A and 5 m east of Range Road 215 as indicated in Figure 1 and Figure 7. This put the noise monitor approximately 300 m north of the north fence line for the Shell Scotford facility and approximately 135 m west of an industrial yard to the east. At this location, there was direct line-of-sight to the Shell Scotford site but not the industrial yard (due to the topography of the area). There was no significant vegetation between the noise monitor and the Shell Scotford facility.

4.6. Noise Monitor Location 6

The noise monitor at Location 6 was located approximately 1.0 km north of Township Road 562 and 3 m east of Range Road 213A as indicated in Figure 1 and Figure 8. This put the noise monitor approximately 1.6 km east of the Agrium Redwater facility. Due to favorable topography between the noise monitor and Agrium there was direct line-of-sight to the Agrium site through a small row of deciduous trees across the road. There was no significant vegetation between the noise monitor and the Agrium facility. Note also that a weather monitor was placed at this location, adjacent to the noise monitor for the duration of the noise monitoring periods.

4.7. Noise Monitor Location 8

The noise monitor at Location 8 was located approximately 1.6 km south of Highway 643 (eastbound) and 365 m east of Range Road 221 as indicated in Figure 2 and Figure 9. This put the noise monitor approximately 30 m north of the northern fence line for the Pembina/Williams facility. At this location, there was direct line-of-sight to the Pembina/Williams site through a thin row of deciduous trees. There was no significant vegetation between the noise monitor and the aforementioned facilities.

4.8. Noise Monitor Location 9

The noise monitor at Location 9 was located approximately 5 m southwest of the intersection of Lamoureux Drive and Godbout Avenue as indicated in Figure 2 and Figure 10. This put the noise monitor approximately 1.2 km northwest of the major structures at the Dow facility and approximately 1.3 km west of the Keyera facility. Due to favorable topography, there was direct line-of-sight to the facilities across the River through a thin row of deciduous trees[1]. Despite the thin row of trees there was no significant vegetation between the noise monitor and the aforementioned facilities.

4.9. Noise Monitor Location 10

The noise monitor at Location 10 was located approximately 30 m west of 119 Street and 12 m north of the access road to the Agrium Fort Saskatchewan facility as indicated in Figure 2 and Figure 11. This put the noise monitor approximately 750 m northeast of the major structures at the Agrium facility and approximately 180 m west of the west fence-line of the Dow facility. There was direct line-of-sight to the Dow facility but not to the Agrium facility (due to the topography of the area). There was no significant vegetation between the noise monitor and the aforementioned facilities. Note also that a weather monitor was placed at this location, adjacent to the noise monitor for the duration of the noise monitoring periods.

[1] This was observable during the night-time period.

4.10. Noise Monitor Location 11

The noise monitor at Location 11 was located approximately 3 m northwest of the intersection of Range Road 221 and Township Road 560 as indicated in Figure 2 and Figure 12. This put the noise monitor approximately 1.7 km southwest of the major structures at the Pembina/Williams facility and approximately 330 m west of the Pembina/Williams rail yard. At this location, there was direct line-of-sight to the Pembina/Williams facility but not to the rail yard (due to the topography of the area). It should also be noted that a new satellite office was found directly east of this location. Apart from minimal vehicle traffic, this site did not have any new noise sources that would contribute to the noise climate of the area. There was no significant vegetation between the noise monitor and the facilities.

4.11. Noise Monitor Location 12

The noise monitor at Location 12 was the independent control/reference point. It was located approximately 15 m east of Range Road 211 and 450 m south of Township Road 560 as indicated in Figure 2 and Figure 13. This placed the noise monitor approximately 1.6 km west of Highway 830 and approximately 2.7 km north of Highway 15. At this location, there was direct line-of-sight to the west of the AIH region. The noise monitor was bordered on all sides by a combination of open grassy fields. Due to the distance from the noise monitor to the existing major facilities within the AIH, the vegetative absorption between the noise monitor and these facilities would be considered significant. Note also that a weather monitor was placed at this location for the duration of the noise monitoring periods.

4.12. Noise Monitor Location 13

The noise monitor at Location 13 was located approximately 3 m east of Range Road 221 and 100 m south of Township Road 564 as indicated in Figure 2 and Figure 14. This put the noise monitor approximately 1.1 km northwest of the lay down yard for the NWR facility and is the north easternmost noise monitoring location found within the AIH. At this location, there was no direct line-of-sight to any facilities. There was moderate vegetation between the noise monitor and the aforementioned facilities.

5.0 Equivalent Sound Level & Statistical Descriptors

Environmental noise levels from industry are commonly described in terms of equivalent sound levels or L_{eq}. This is the level of a steady sound having the same acoustic energy, over a given time period, as the fluctuating sound. The concept is that the same amount of annoyance occurs from a sound having a high level for a short period of time as from a sound at a lower level for a longer period of time. In addition, this energy averaged sound level is often A-weighted to account for the reduced sensitivity of average human hearing to low frequency sounds and/or C-weighted to allow for more low frequency noise to be considered. These L_{eq} in dBA/dBC, which are the most common environmental noise measure, are often given for day-time (07:00 to 22:00) L_{eq}Day and night-time (22:00 to 07:00) L_{eq}Night while other criteria use the entire 24-hour period as L_{eq}24.

Another method of conveying long term noise levels utilizes statistical descriptors. These are calculated from a cumulative distribution of the sound levels over the entire measurement duration and then determining the sound level at xx % of the time. These descriptors can be used to provide a more detailed analysis of the varying noise climate.

For purposes of this study, the following equivalent sound levels and statistical descriptors will be presented and discussed:

L_{eq}Day - Measured over the day-time (07:00 – 22:00)

L_{eq}Night - Measured over the night-time (22:00 – 07:00)

L_{10}
- Sound level that was exceeded only 10% of the time.
- Good measure of intermittent or intrusive noise

L_{50}
- Sound level that was exceeded 50% of the time (arithmetic average)
- Good to compare to L_{eq} to determine steadiness of noise

L_{90}
- sound level that was exceeded 90% of the time
- Good indicator of typical "ambient" noise levels

For further information, refer to Appendix II for a description of the acoustical terminology and Appendix III for a list of common noise sources and their associated noise levels.

6.0 Results and Discussion

6.1. Environmental Noise Monitoring

The results of the thirteen (13) 48-hour noise monitoring's can be found in Table 2[1] and are presented in Figures 15 – 105. The figures include the 15-second broadband dBA and dBC L_{eq} sound levels[2], 1-hour dBA and dBC, L_{90}, L_{50}, L_{10} sound levels[3] and the 1/3 octave band L_{eq} sound levels[3] for each noise monitoring location. Table 2 provides results of each of the three daytime periods in addition to the isolated and non-isolated values for the two night-time periods. The isolation analysis for the night-time periods was performed in accordance with Section 4.3.2 of the AER Directive 038. A list of all non-typical noise events removed from each of the thirteen noise monitoring's can be found in Appendix IV. Each event that was removed has been dated with its corresponding time period as well as the rationale for its removal. A detailed discussion of the results for each monitoring location can be found below.

Table 2. L_{eq} 24-Hour Results[4]

Noise Monitoring Location	1st Daytime Period	1st Night-time Period (Non-Isolated)	1st Night-time Period (Isolated)	2nd Daytime Period	2nd Night-time Period (Non-isolated)	2nd Night-time Period (Isolated)	3rd Daytime Period
	L_{eq}Day (dBA)	L_{eq}Night (dBA)		L_{eq}Day (dBA)	L_{eq}Night (dBA)		L_{eq}Day (dBA)
1C	59.3	57.0	49.1	58.1	52.8	47.1	52.1
2	53.4	51.5	49.0	59.9	49.7	47.2	49.2
3B	60.8	51.8	50.9	70.0	53.3	51.2	61.3
4C	61.4	52.7	51.7	48.4	44.9	44.0	45.5
5	52.1	54.5	54.0	50.0	50.5	48.7	63.5
6	67.5	50.3	49.5	65.2	63.5	46.5	49.7
7							
8a	57.2	56.1	52.7	58.0	53.4	46.9	57.5
9	48.9	48.1	47.6	48.3	50.5	39.2	56.8
10	60.8	52.2	48.6	59.2	52.9	50.4	58.2
11	52.2	45.9	44.8	45.2	49.3	44.4	51.2
12b (1st 48-hour)	51.8	47.0	35.7	49.0	48.4	34.8	41.0
12b (2nd 48-hour)	44.9	47.2	37.3	47.5	47.8	33.0	50.1
13	45.5	44.7	43.3	40.1	35.8	25.7	47.5

[1] The results of each location will be discussed individually.
[2] The data provided in the 15-second L_{eq} traces shows the 24-hour time period with the isolated night-time results, after removal of non-typical noise levels. This was done to indicate the relative steadiness of the noise levels and to make it easier to view the night-time data.
[3] Isolated and Non-isolated values are presented.
[4] The letters accompanying the noise monitoring location refers to their location.

6.1.1. Noise Monitoring Location 1C

The results of the noise monitoring conducted at Location 1 are provided in Table 2 and in Figures 15 - 21 The isolated L_{eq}Night values from Table 2 and the traces found in Figures 15 – 18 indicate relatively consistent noise levels for the two night-time periods. The slightly elevated noise levels during the July 28, 2017 night-time period were subjectively apparent during the site visit and are consistent with the weather conditions during that time.

The 1/3 octave band L_{eq} sound levels found in Figures 21 are relatively broadband with a decrease in the higher frequencies (1.25 kHz and above) and an elevated peak in the 25 Hz band, which is consistent with the 2015 & 2016 Noise Surveys.

Based on the results and subjective observations from previous years and when considering the weather conditions, the isolated values are representative of the typical noise climate of this area.

6.1.2. Noise Monitoring Location 2

The results of the noise monitoring conducted at Location 2 are provided in Table 2 and in Figures 22 - 28. The isolated L_{eq}Night traces found in Figures 22 – 23 indicate that a significant amount of data was isolated from the measured (i.e. raw) data. As noted in Appendix IV, the "non-typical" incidents included a storm that occurred during the July 28, 2017 night-time in addition to the rail line to the south. The removal of data due to the rail yard is consistent with previous years.

The isolated 1/3 octave figures indicate relatively broadband noise levels, particularly in the mid-frequency bands, with elevated noise levels in the lower (below 100 Hz) frequency bands. This is consistent with the 2015 & 2016 Noise Survey.

Based on the results and subjective observations from previous years, particularly those from 2015 & 2016, the isolated values are representative of the typical noise climate of this area.

6.1.3. Noise Monitoring Location 3B

The results of the noise monitoring conducted at Location 3 are provided in Table 2 and in Figures 29 - 35. The isolated L_{eq}Night values indicate very consistent values between the two night-time periods however the traces found in Figures 29 – 30 indicate varying noise levels throughout both night-time periods[1]. Specifically, from 01:09 – 02:30 on July 28, 2017 and from 03:00 – 06:00 on July 29, 2017. When examining the 1/3 octave band spectral data there is a significant increase in the noise levels within the 100 Hz centre frequency band. This tonal low-frequency noise was observed during the site visit and was confirmed in the audio recording as well. The source of the low frequency noise was not known.

Apart from the 100 Hz centre frequency band, the 1/3 octave band spectral data the typical traces of elevated noise levels in the lower frequency bands that gradually decrease as the frequency increases.

Based on the results and subjective observations, the isolated values are representative of the typical noise climate of this area and are consistent with the changes made to the area within the past year.

6.1.4. Noise Monitoring Location 4C

The results of the noise monitoring conducted at Location 4 are provided in Table 2 and in Figures 36 - 42. The isolated L_{eq}Night values from Table 2 and the traces found in Figures 36 – 39 indicate varying noise levels for both night-time periods. In reviewing the weather conditions, found in Appendix V, there were no parameters (wind speed, wind direction, etc.) that would account for the variance in noise levels between the two nights. However, it should be noted that this variation in noise level has occurred in previous measurement years at this location. In addition, subjective observations made in previous years have indicated that this location is highly influenced by small variations in meteorological conditions. Therefore, it is possible, that the variation can be attributed to small fluctuations in the weather conditions or possibly on the facilities' operations between the two nights.

As illustrated in Figure 36, the noise climate for the July 27 – 28, 2017 overnight period has less variations in the noise levels. This is also consistent with subjective observations made on-site during this night-time period. The 1/3 octave band spectral data is consistent between both noise monitoring periods with slightly lower levels for the July 28 – 29, 2017 overnight period. Based on the results and subjective observations from previous years and when considering the weather conditions, the isolated values are representative of the typical noise climate of this area.

[1] It should be noted that the data was completely removed between 05:16 – 07:00 on August 4 due to the number of vehicle passages (several per minute) and birds chirping during that time period.

6.1.5. Noise Monitoring Location 5

The results of the noise monitoring conducted at Location 5 are provided in Table 2 and in Figures 43 - 49. Figures 43 – 46 indicate relatively consistent isolated 15-second L_{eq} traces throughout both night-time periods. This is further confirmed in Figures 47 – 48 where there are minimal differences between the L_{10}, L_{50} and L_{90} values which indicates that noise levels were relatively steady and are reflective of typical noise levels. Despite, the consistency of the traces there is still a variance of 5.3 dBA between the two night-time periods. Similarly to Noise Monitoring Location 4, there were no specific weather parameters (wind speed, wind direction, etc.), found in Appendix V, that would account for the variance in noise levels between the two nights. When considering the location of Monitor Location 5 relative to the nearest facility it is anticipated that the variance in noise levels between the two night-time periods could be attributed to the operations of the nearby facility.

The 1/3 octave band spectral data is consistent between both noise monitoring periods with slightly lower levels for the July 30 – 31, 2017 overnight period. Based on comparisons between these results and those the 2016 Noise Survey, the isolated values from the July 29 – 30, 2017 overnight period are more representative of the typical noise climate of this area.

6.1.6. Noise Monitoring Location 6

The results of the noise monitoring conducted at Location 6 are provided in Table 2 and in Figures 50 - 56. The isolated L_{eq}Night values from Table 2 and the traces found in Figures 50 – 53 indicate relatively consistent noise levels for the July 27 – 28, 2017 night-time period. The variance in the July 28 – 29, 2017 night-time period is more pronounced in the figures. The isolated L_{eq}Night values are consistent with those from the 2016, 2015 and 2014 Noise Survey's in which the noise levels vary from 45.9 to 49.5 dBA.

The noise was subjectively broadband across all frequencies which is consistent with the 1/3 octave band L_{eq} traces and with the results from the 2016 Noise Survey.

6.1.7. Noise Monitoring Location 7

As previously mentioned this noise monitoring location will no longer be used as a noise monitoring location due to the NWR refinery.

6.1.8. Noise Monitoring Location 8A

The results of the noise monitoring conducted at Location 8 are provided in Table 2 and in Figures 57 - 63. The isolated L_{eq}Night values and the traces found in Figures 57 – 60 indicate varying noise levels between the two night-time periods. Specifically, there is a difference of 5.8 dBA between the two night-time periods. The variance in noise level can be attributed to the weather conditions between the two nights. The wind during the July 30 – 31, 2017 night-time period was from the southwest before shifting from the north-northwest, thus causing upwind conditions from the noise monitor to the facility to the southeast.

The 1/3 octave band spectral data is consistent between both noise monitoring periods with lower levels for the July 30 – 31, 2017 overnight period. Based on comparisons of the weather between the two night-time periods, the isolated values from the July 29 – 30, 2017 overnight period are more representative of worst-case conditions of the noise climate of this area.

6.1.9. Noise Monitoring Location 9

The results of the noise monitoring conducted at Location 9 are provided in Table 2 and in Figures 64 - 70. The isolated L_{eq}Night values and the traces found in Figures 64 – 67 indicate varying noise levels between the two night-time periods. Specifically, there is a difference of 8.5 dBA between the two night-time periods. The variance in noise level can be attributed to the weather conditions between the two nights. The wind during the July 29 – 30, 2017 night-time period was predominantly from the east thus causing downwind conditions from the noise monitor to the facilities to the east. This relatively large reduction in noise level between nights was also observed for Noise Monitor 8.

The 1/3 octave band spectral data is consistent between both noise monitoring periods with lower levels for the July 30 – 31, 2017 overnight period. Based on comparisons between these results and those from previous years, the isolated values from July 29 – 30, 2017 overnight period are more representative of worst-case conditions of the noise climate of this area.

6.1.10. Noise Monitoring Location 10

The results of the noise monitoring conducted at Location 10 are provided in Table 2 and in Figures 71 - 77. The isolated L_{eq}Night values indicate relatively consistent noise levels between the two nights. However, it should be noted that, due to the weather conditions during the July 28 – 29, 2017 overnight period, a relatively large amount of data from isolated. Despite this, the isolated noise climate is relatively consistent which is confirmed in Figures 75 – 77 where there is very little difference between the isolated L_{10}, L_{50} and L_{90} and 1/3 octave band L_{eq} values which indicates that noise levels were relatively steady and are reflective of typical noise levels.

Similarly to previous years, it was noted that not one site dominated the noise climate of the area. Instead noise was distinctly audible from each the various surrounding facilities and was more prominent when any specific facility was upwind from the noise monitoring location.

Based on the results and subjective observations from previous years and when considering the weather conditions, the isolated values of both night-time periods are representative of the typical noise climate of this area.

6.1.11. Noise Monitoring Location 11

The results of the noise monitoring conducted at Location 11 are provided in Table 2 and in Figures 78 - 84. The isolated L_{eq}Night values from Table 2 indicate relatively consistent values between the two nights however the traces found in Figures 78 - 81 indicate varying noise levels for both night-time periods. Despite this, the isolated noise climate is relatively consistent when comparing the 1/3 octave band L_{eq} sound levels in Figure 84.

The general trace of the 1/3 octave band L_{eq} sound levels indicate elevated noise levels in the lower frequency bands that gradually decrease as the frequency increases. This is consistent with the 2016 Noise Survey.

6.1.12. Noise Monitoring Location 12

The results of the noise monitoring conducted at Location 12 are provided in Table 2 and in Figures 85 - 98. As previously mentioned, this location was the independent control/reference point. Therefore, the results from this location span two (2) 48-hour monitoring periods.

Similarly to 2016, all night-time periods show a significant difference between the non-isolated L_{eq}Night noise levels in comparison to the isolated L_{eq}Night noise levels. This can be attributed to this location being relatively far any major facility[1], therefore most instances of vehicular traffic on Range Road 211 or rail activity along the nearby CP rail line dominate the noise climate. As indicated in all figures this was similar for all night-time periods.

In the absence of the vehicular or rail activity the 1/3 octave band L_{eq} sound levels indicate a similar trace to the other monitoring locations with elevated noise levels in the lower frequency bands (20 Hz – 80 Hz) that gradually decrease as the frequency increases.

6.1.13. Noise Monitoring Location 13

The results of the noise monitoring conducted at Location 13 are provided in Table 2 and in Figures 99 - 105. The isolated L_{eq}Night values from Table 2 and the traces found in Figures 99 – 102 indicate a significant variation in the noise levels for both night-time periods (17.6 dBA). The variance in noise level can be attributed to the wind conditions and possibly to the operations of the nearby sites. The wind during the July 29 – 30, 2017 night-time period was predominantly from the east thus causing downwind/crosswind conditions from the noise monitor to the facilities to the east/southeast. This relatively large reduction in noise level between nights was also observed for Noise Monitor 8 and 9.

As anticipated, the 1/3 octave band spectral data is not consistent between the two noise monitoring periods. Again, this would indicate that the operations of the nearby facilities varied significantly between night-time periods.

[1] This location is approximately 2.3 km northeast of the ATCO Natural Gas Salt Cavern Storage Site.

6.2. 2017 General Subjective Observations and Notes from Site Visits and Data Analysis

- The weather conditions during the 2017 summer were not as favourable as in previous years for noise monitoring.
- Despite the unfavourable weather conditions, the isolated noise levels and 1/3 octave band L_{eq} sound levels were relatively consistent to previous years.
- The noise arriving at most monitor locations consisted primarily of low frequency components that gradually decreased in noise level as the frequency increased.
- None of the sites indicated any specific low frequency tonal components.
- The noise from train passages was prevalent at all locations and tended to dominate the noise climate as they passed through, particularly when there were train whistles. Similarly to 2016, the train passages were not subjectively observed during the site visits in comparison to previous years, however the isolation analysis indicated a similar number of rail passages when compared to 2016 & 2015.
- The influence of meteorological conditions (wind speed and direction) was illustrated at certain locations (R8, R11 and R13). Specifically, the shift from a receiving point upwind condition to a downwind condition.

6.3. Night-time Weather Conditions

As previously mentioned, 3 local weather monitoring stations were used throughout all noise monitoring periods to obtain the wind speed, wind direction, temperature, relative humidity, barometric pressure and rain fall data in 1-minute sampling periods. All weather data are presented in Appendix V[1]. A brief discussion of each night-time period can be found below. The wind speeds during certain night-time periods were in excess of the limits of AER Directive 038. However, through the use of the audio files and the 1/3 octave band L_{eq} sound levels, all instances of high wind speeds that influenced the noise monitoring results were isolated (i.e. removed). Therefore, the results found within Table 2 are considered in compliance with AER Directive 038.

6.3.1. July 27 – 28, 2017

Weather Monitor near Noise Monitor Location 6

The wind conditions during the night-time period were considered high to moderate (above 15 km/hr to between 5 - 14 km/hr, respectively). The wind was initially from the northwest, before shifting to the southwest for the remainder of the night-time period. The temperature ranged from 12°C to 15°C and the relative humidity ranged from approximately 80% - 90%. The barometric pressure was consistent and relatively flat at approximately 94 kPa. Lastly, there was light rainfall from 22:00 – 23:00.

Weather Monitor near Noise Monitor Location 10

Apart from 22:00 – 23:00 the wind conditions during the night-time period were considered moderate (primarily below 10 km/hr). The wind was initially from the northwest, before shifting to the southwest for the remainder of the night-time period. The temperature ranged from 12°C to 16°C and the relative humidity ranged from approximately 75% - 87%. The barometric pressure was consistent and relatively flat at approximately 94 kPa. Lastly, there was light rainfall from 22:00 – 23:00.

Weather Monitor near Noise Monitor Location 12

The wind conditions during the night-time period were considered high to moderate (above 15 km/hr to between 5 - 14 km/hr, respectively). The wind was initially from the northwest, before shifting to the southwest for the remainder of the night-time period. The temperature ranged from 10°C to 14°C and the relative humidity ranged from approximately 80% - 92%. The barometric pressure was consistent and relatively flat at approximately 95kPa. There was light to moderate rainfall from 22:00 – 00:00.

[1] Rainfall was only presented for the night-time period (for all noise monitoring periods) as only the night-time period was isolated.

6.3.2. July 28 – 29, 2017

Weather Monitor near Noise Monitor Location 6

The wind conditions during the night-time period were primarily calm (below 5 km/hr) however there were later periods of time in which the wind increased to above 10 km/hr. The wind direction varied[1] at the beginning of the night-time period before predominantly coming from the south. The temperature ranged from 14°C to 19°C and the relative humidity ranged from approximately 63% - 91%. The barometric pressure was consistent and relatively flat at approximately 95 kPa. Lastly, there was light rainfall from 02:40 – 03:20.

Weather Monitor near Noise Monitor Location 10

The wind conditions during the night-time period were primarily calm (below 5 km/hr) however there were later periods of time in which the wind increased to above 10 km/hr. The wind direction varied[1] at the beginning of the night-time period before predominantly coming from the south. The temperature ranged from 14°C to 20°C and the relative humidity ranged from approximately 62% - 89%. The barometric pressure was consistent and relatively flat at approximately 94 kPa. Lastly, there was more heavy rainfall from 02:20 – 03:15. Again, it should be noted that data was isolated from time periods in which the wind and rain caused noise on the microphone.

Weather Monitor near Noise Monitor Location 12

The wind conditions during the night-time period were primarily calm (below 5 km/hr) however after 02:00, the wind speed had greater variations (from 2 km to just below 25 km/hr). The wind direction was predominantly coming from the south (from southwest to southeast). The temperature ranged from 13°C to 17°C and the relative humidity ranged from approximately 81% - 92%. The barometric pressure was consistent and relatively flat at approximately 95kPa. Lastly, there was moderate rainfall from 02:40 – 03:35.

[1] The wind direction fluctuates more greatly when wind speeds are below 5 km/hr and are essentially calm. In these instances, the wind direction has a minimal influence of the propagation of the sound.

6.3.3. July 29 – 30, 2017

Weather Monitor near Noise Monitor Location 6

The wind conditions during the start of night-time period were considered moderate (primarily between 5 - 10 km/hr) and from the east. The temperature ranged from 15°C to 20°C and the relative humidity ranged from approximately 76% - 89%. The barometric pressure was consistent and relatively flat at approximately 94 kPa. Lastly, there was no precipitation.

Weather Monitor near Noise Monitor Location 10

The wind conditions during the start of night-time period were considered moderate (primarily between 5 - 10 km/hr) and primarily from the east. The temperature ranged from 16°C to 21°C and the relative humidity ranged from approximately 70% - 85%. The barometric pressure was consistent and relatively flat at approximately 94 kPa. Lastly, there was no precipitation.

Weather Monitor near Noise Monitor Location 12

The wind conditions during the start of night-time period were considered calm to moderate (primarily between 2 - 10 km/hr) and primarily from the east-northeast. The temperature ranged from 14°C to 18°C and the relative humidity ranged from approximately 76% - 91%. The barometric pressure was consistent and relatively flat at approximately 94kPa. Lastly, there was no precipitation.

6.3.4. July 30 – 31, 2017

Weather Monitor near Noise Monitor Location 6

The wind conditions were considered moderate (primarily between 5 - 10 km/hr) and predominantly from the west-northwest for the night-time period. The temperature ranged from 12°C to 17°C and the relative humidity ranged from approximately 77% - 90%. The barometric pressure was consistent and relatively flat at approximately 94 kPa. Lastly, there was no precipitation.

Weather Monitor near Noise Monitor Location 10

The wind conditions were considered moderate (primarily between 5 - 10 km/hr) and predominantly from the southwest for the night-time period. The temperature ranged from 13°C to 18°C and the relative humidity ranged from approximately 67% - 84%. The barometric pressure was consistent and relatively flat at approximately 95 kPa. Lastly, there was no precipitation.

Weather Monitor near Noise Monitor Location 12

The wind conditions were considered calm to moderate (primarily between 2 - 10 km/hr). The wind was initially from the south-southwest before shifting to the north-northwest at 03:20. The temperature ranged from 12°C to 16°C and the relative humidity ranged from approximately 71% - 92%. The barometric pressure was consistent and relatively flat at approximately 95kPa. Lastly, there was no precipitation.

7.0 Conclusion

As part of the study, a total of thirteen (13) 48-hour noise monitorings were conducted throughout the Alberta's Industrial Heartland. It was found that the isolated L_{eq}Night broadband and 1/3 octave band L_{eq} sound levels, from at least one (1) over-night period, were similar to those from previous measurements.

The noise levels at most locations consisted of low frequency components with occasional mid/high frequency components that could be attributed to the nearest facility relative to each individual noise monitoring location. Despite the noise being relatively low in frequency, none of the sites indicated any low frequency tonal components. The noise from train passages was again prevalent at all locations and tended to dominate the noise climate as they passed through, particularly when there were train whistles. Despite having unfavourable weather conditions, the isolated noise levels were relatively consistent to previous years.

8.0 References

- *Environmental Noise Survey for the Regional Noise Model Annual Field Validation Monitoring,* prepared for the NCIA by aci Acoustical Consultants Inc., December 3, 2015.
- Alberta Energy Regulator (AER), *Directive 038 on Noise Control, 2007*, Calgary, Alberta
- International Organization for Standardization (ISO), *Standard 1996-1, Acoustics – Description, measurement and assessment of environmental noise – Part 1: Basic quantities and assessment procedures, 2003*, Geneva Switzerland.
- International Organization for Standardization (ISO), *Standard 9613-1, Acoustics – Attenuation of sound during propagation outdoors – Part 1: Calculation of absorption of sound by the atmosphere, 1993*, Geneva Switzerland.
- International Organization for Standardization (ISO), *Standard 9613-2, Acoustics – Attenuation of sound during propagation outdoors – Part 2: General method of calculation, 1996*, Geneva Switzerland.

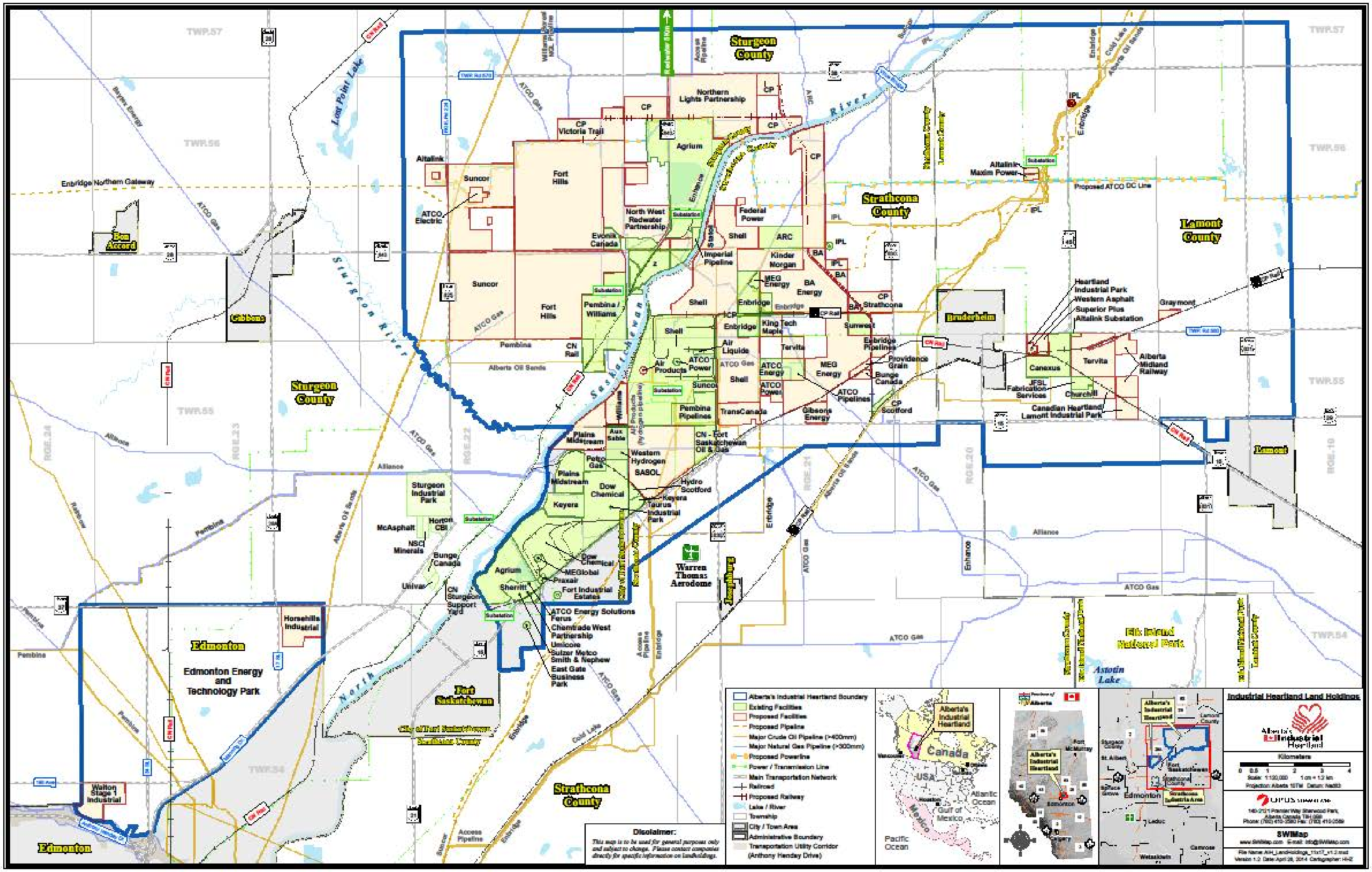

Figure 1. Study Area

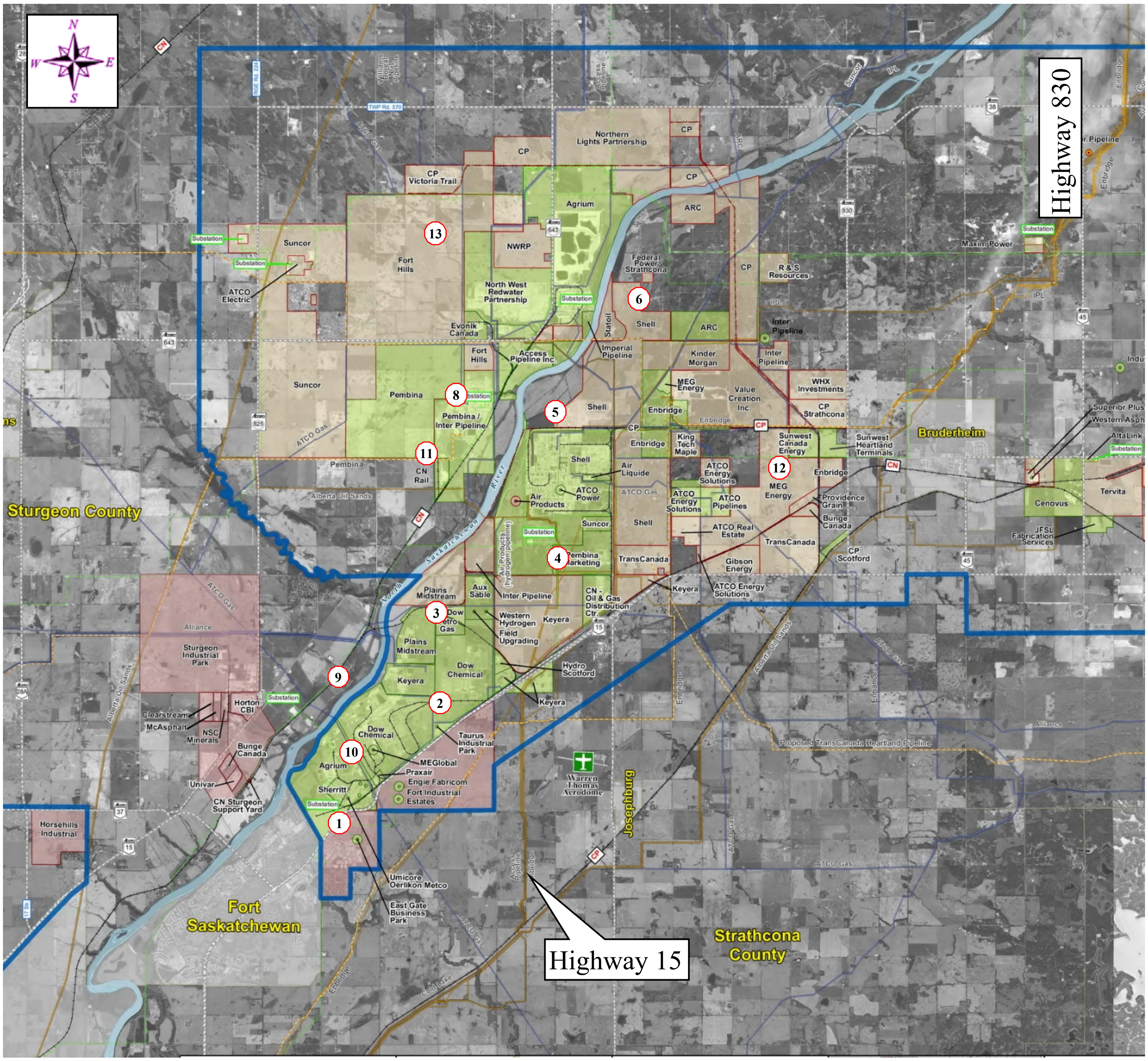

Figure 2. 2017 Study Area (With Noise Monitoring Locations)

Figure 3. Noise Monitor #1

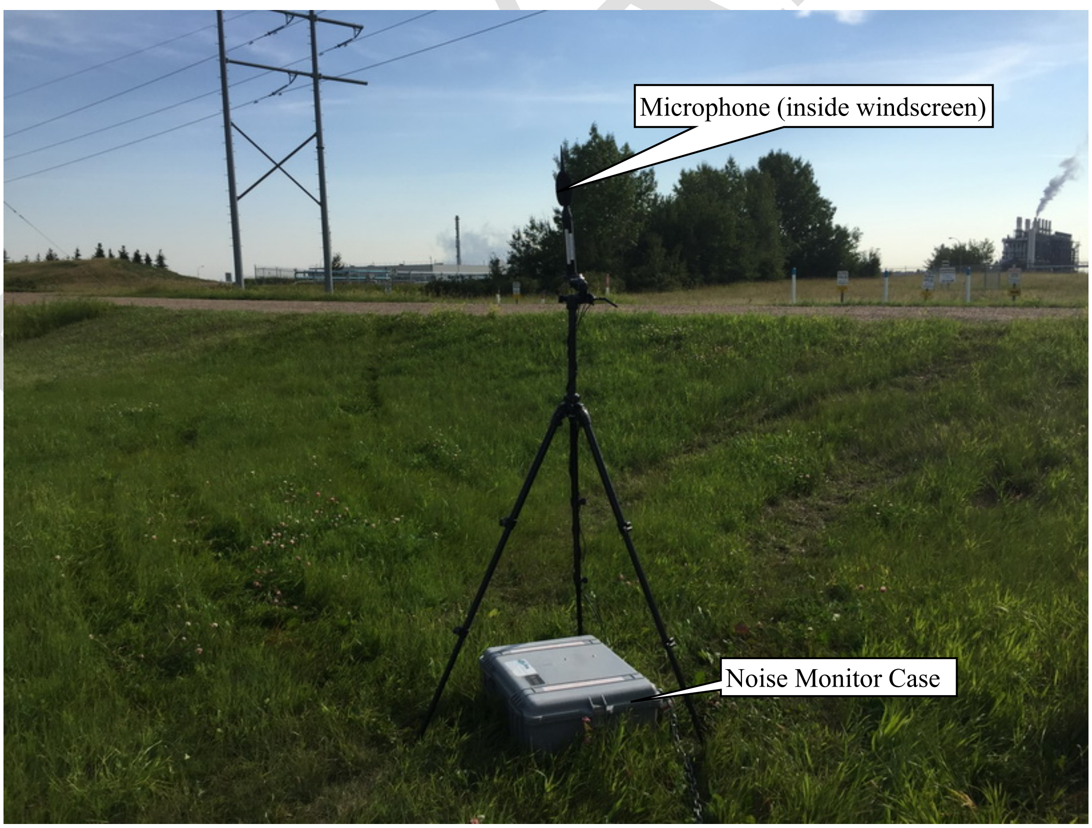

Figure 4. Noise Monitor #2

Figure 5. Noise Monitor #3

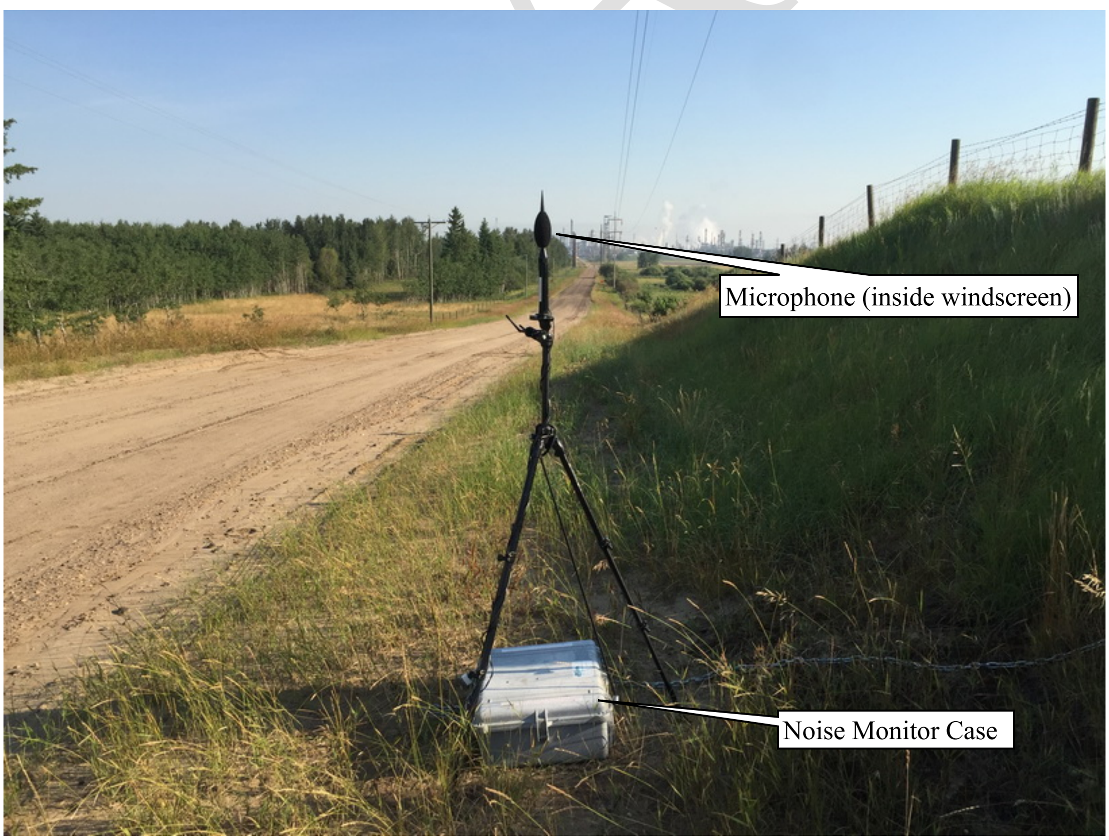

Figure 6. Noise Monitor #4

Figure 7. Noise Monitor #5

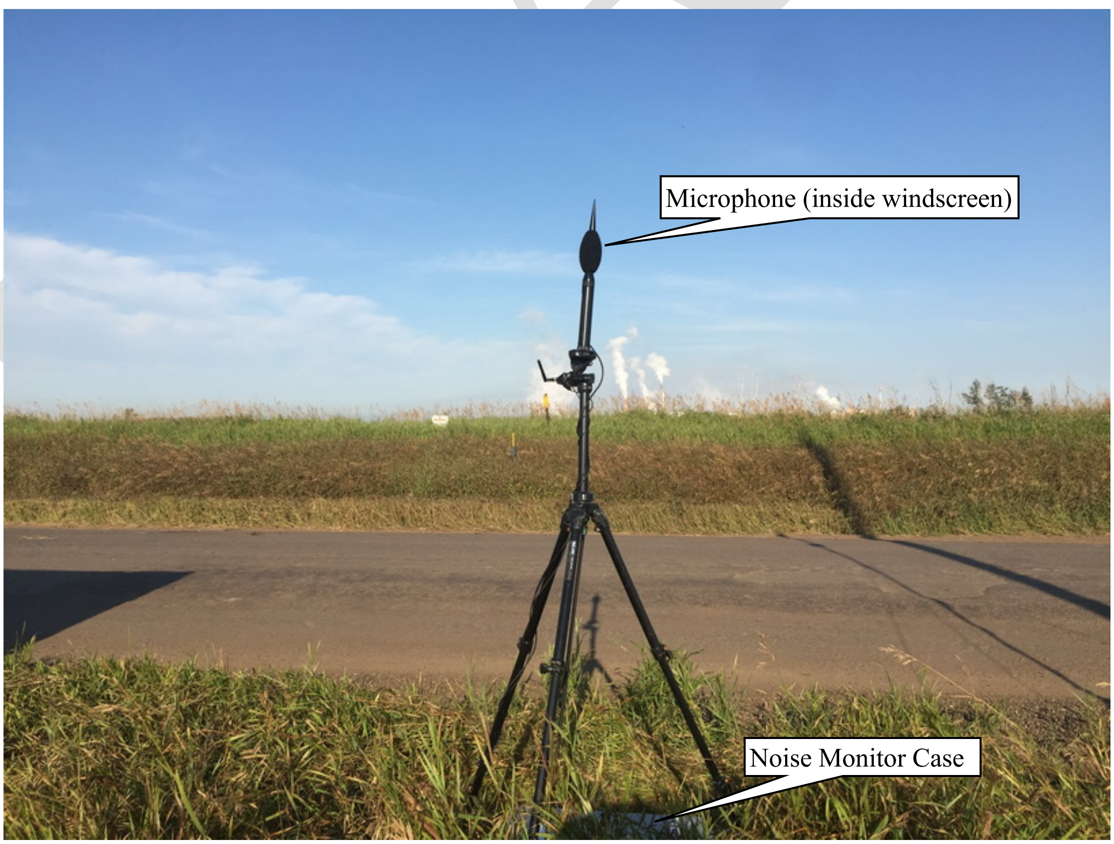

Figure 8. Noise Monitor #6

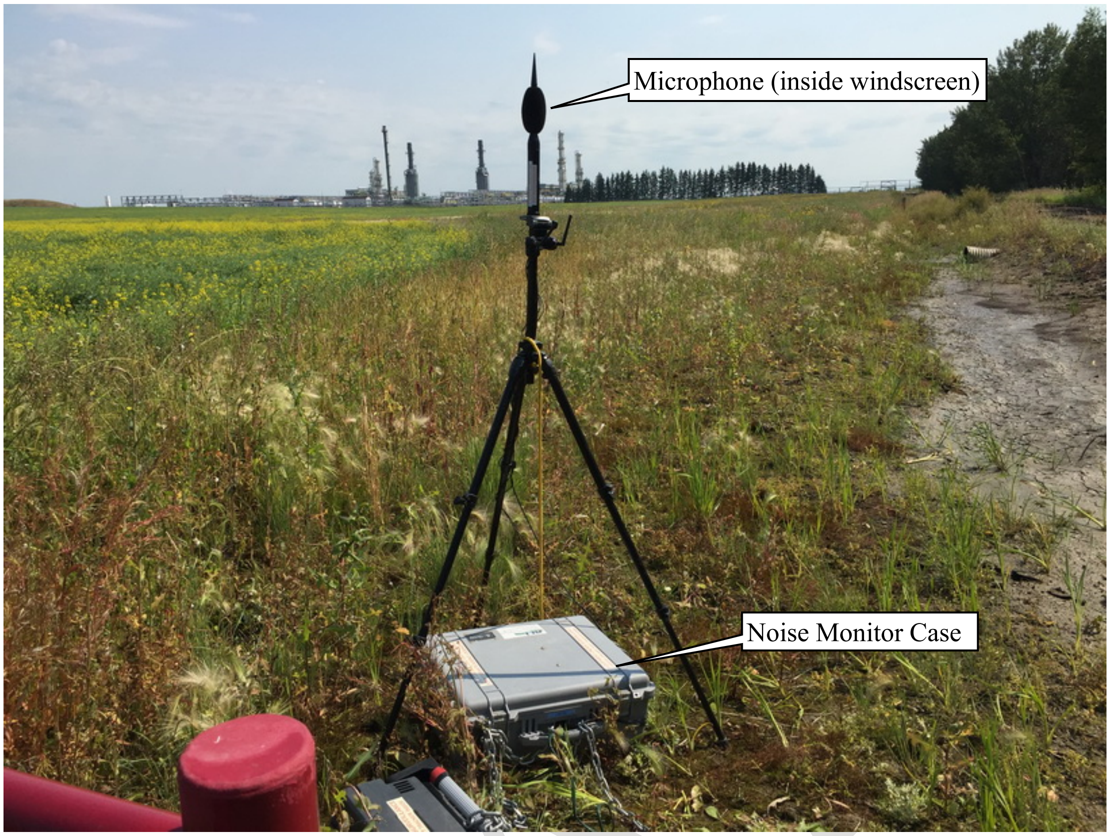

Figure 9. Noise Monitor #8

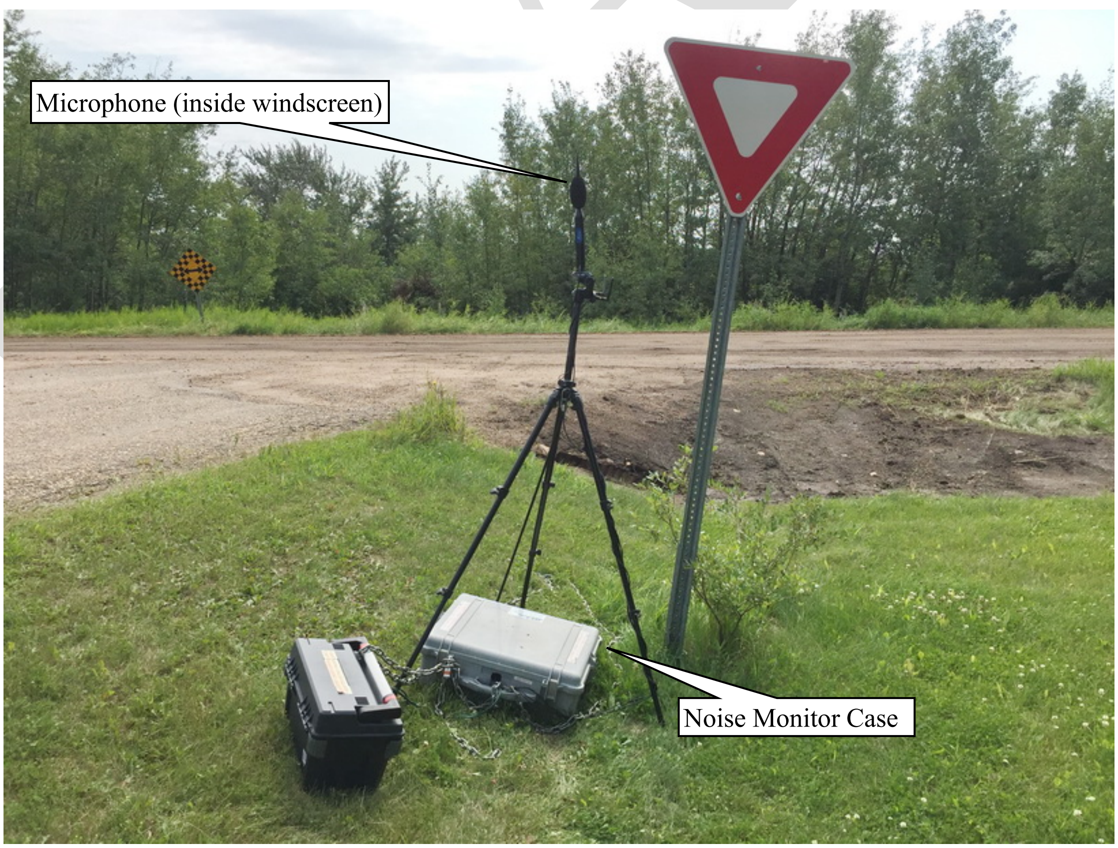

Figure 10. Noise Monitor #9

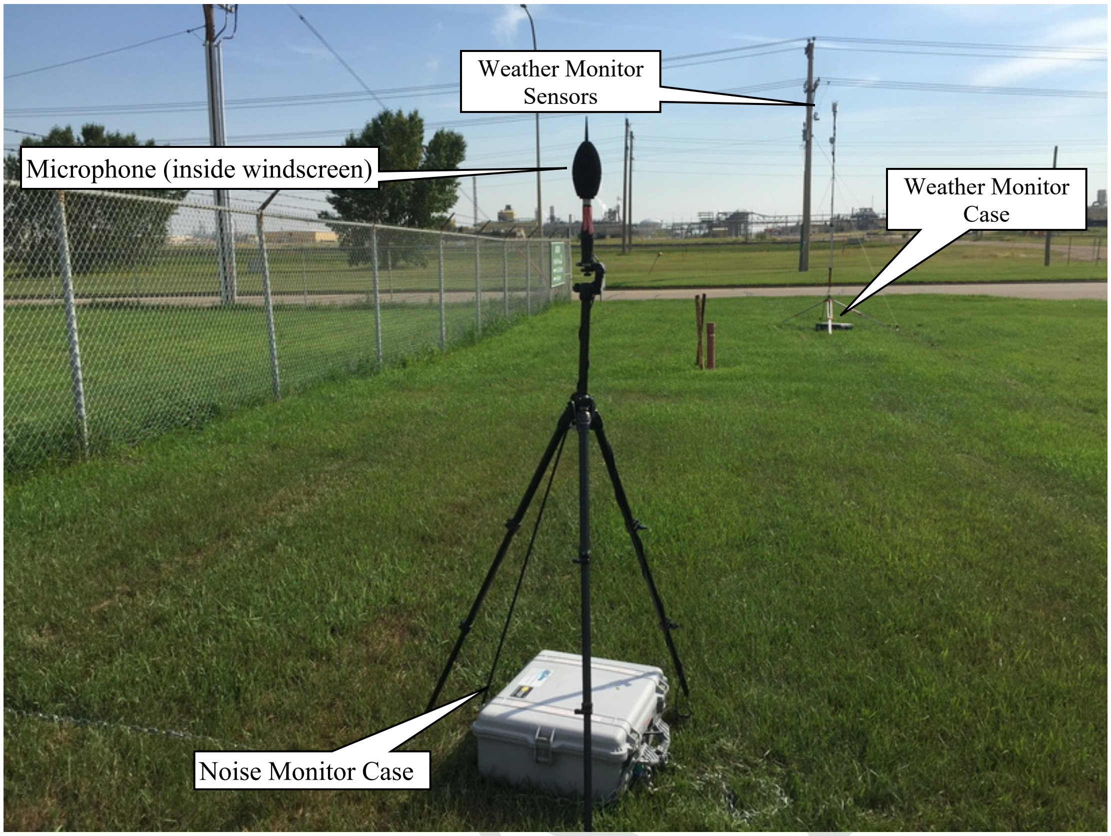

Figure 11. Noise Monitor #10 (With Weather Monitor)

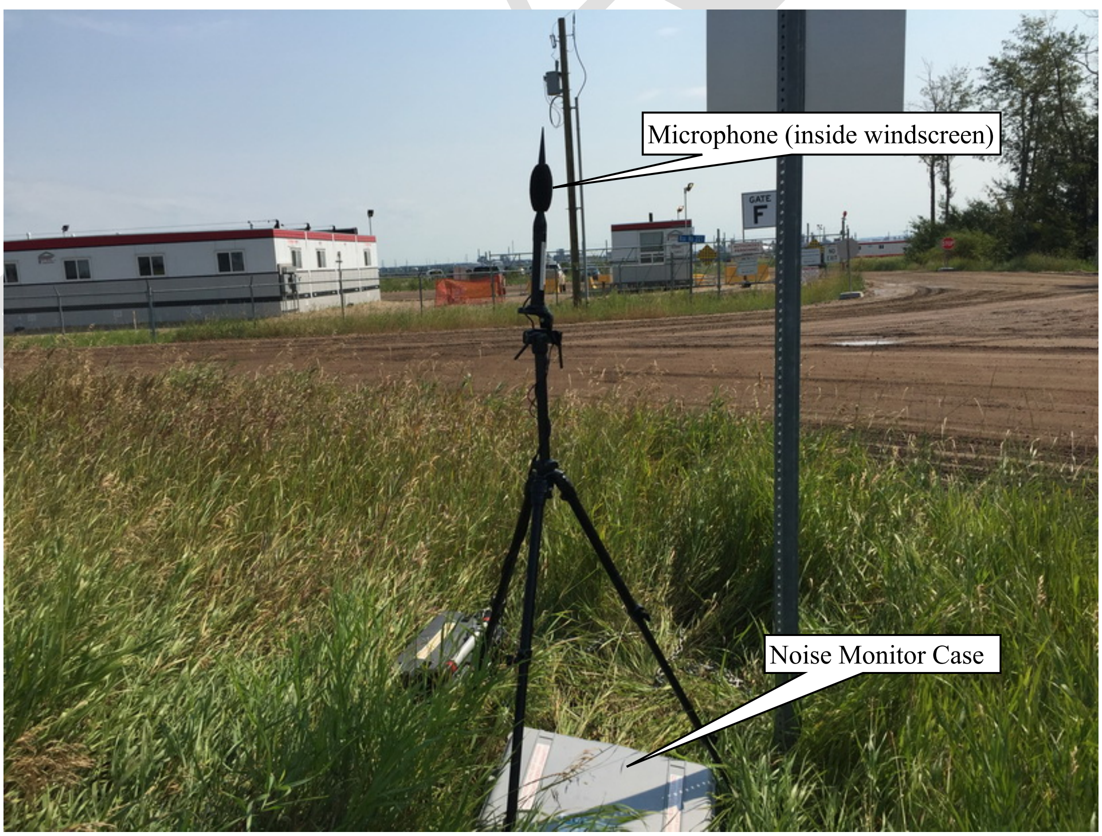

Figure 12. Noise Monitor #11

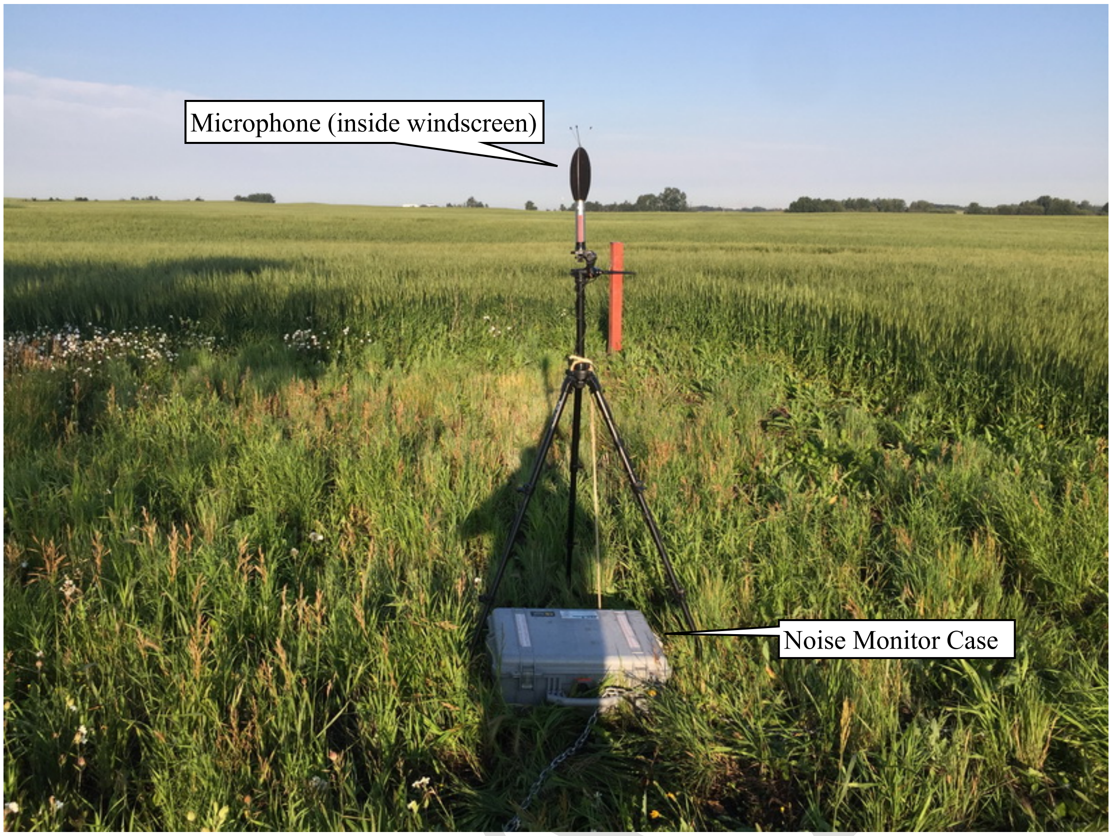

Figure 13. Noise Monitor #12

Figure 14. Noise Monitor #13

Noise Monitor #1

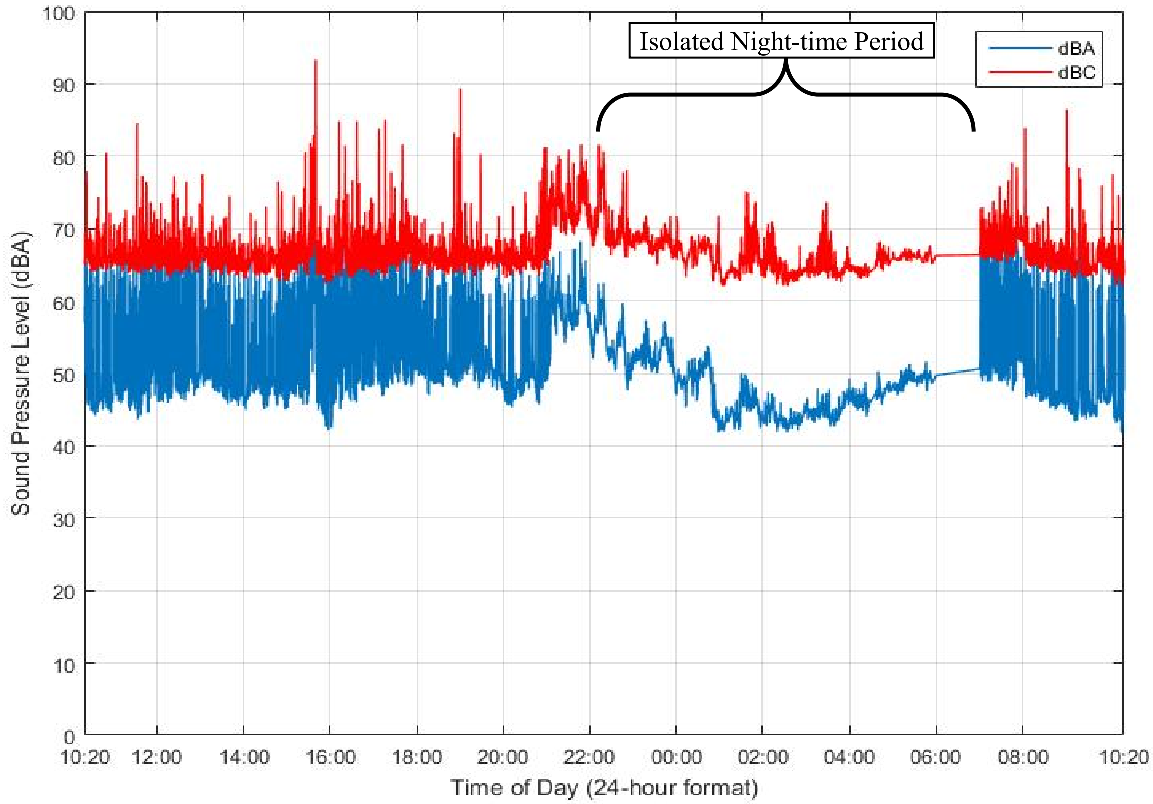

Figure 15. Noise Monitor #1, 15-Second L_{eq} Sound Levels (July 27 - 28, 2017)

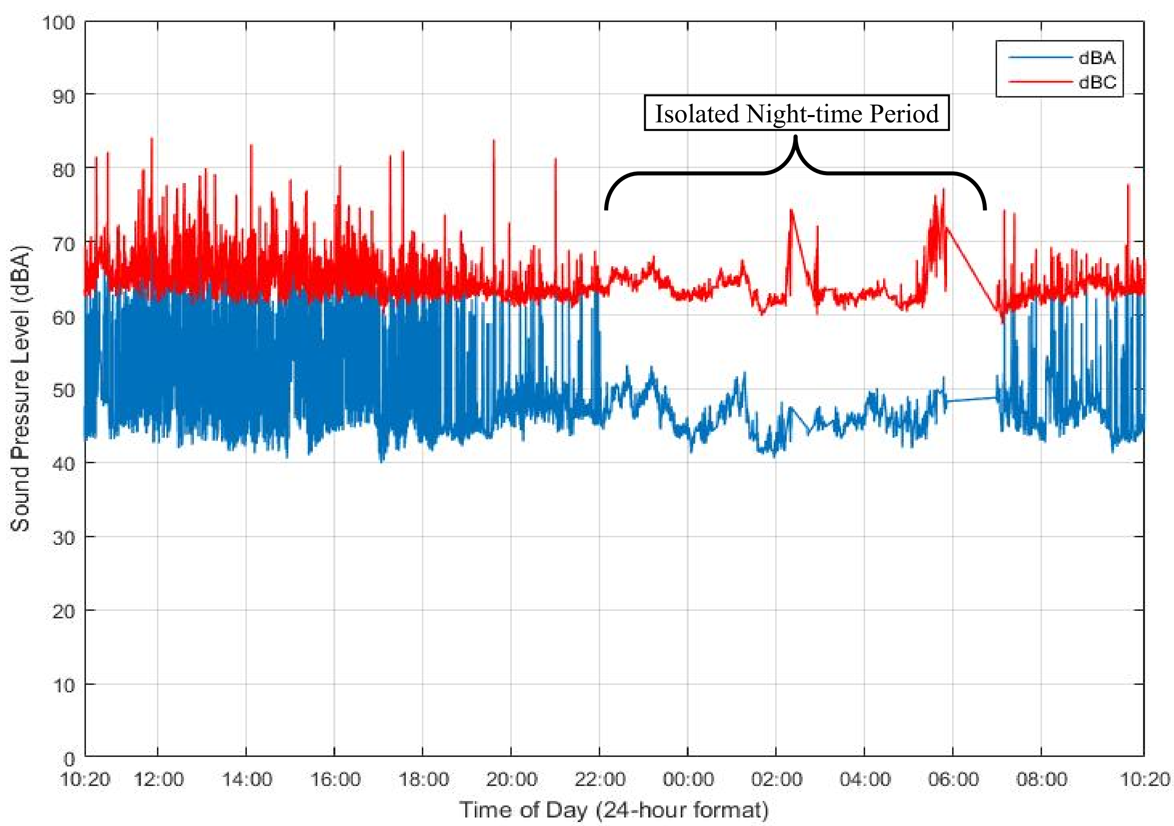

Figure 16. Noise Monitor #1, 15-Second L_{eq} Sound Levels (July 28 - 29, 2017)

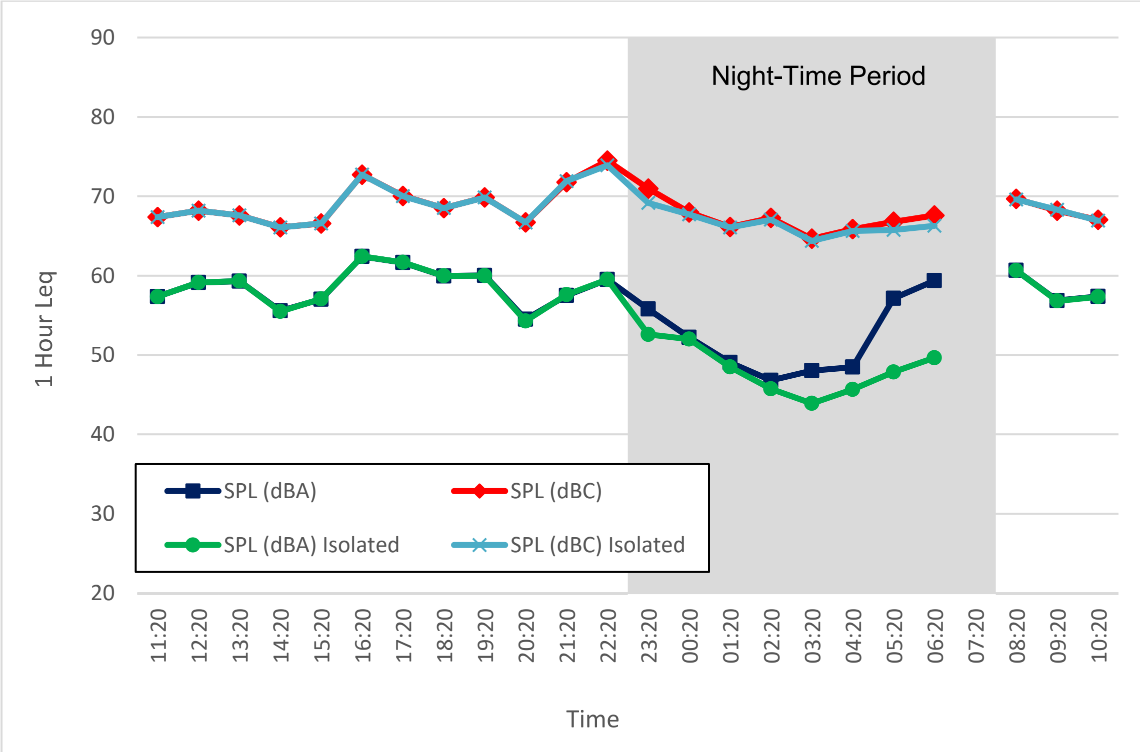

Figure 17. Noise Monitor #1, 1-Hour L_{eq} Sound Levels (July 27 - 28, 2017)[1]

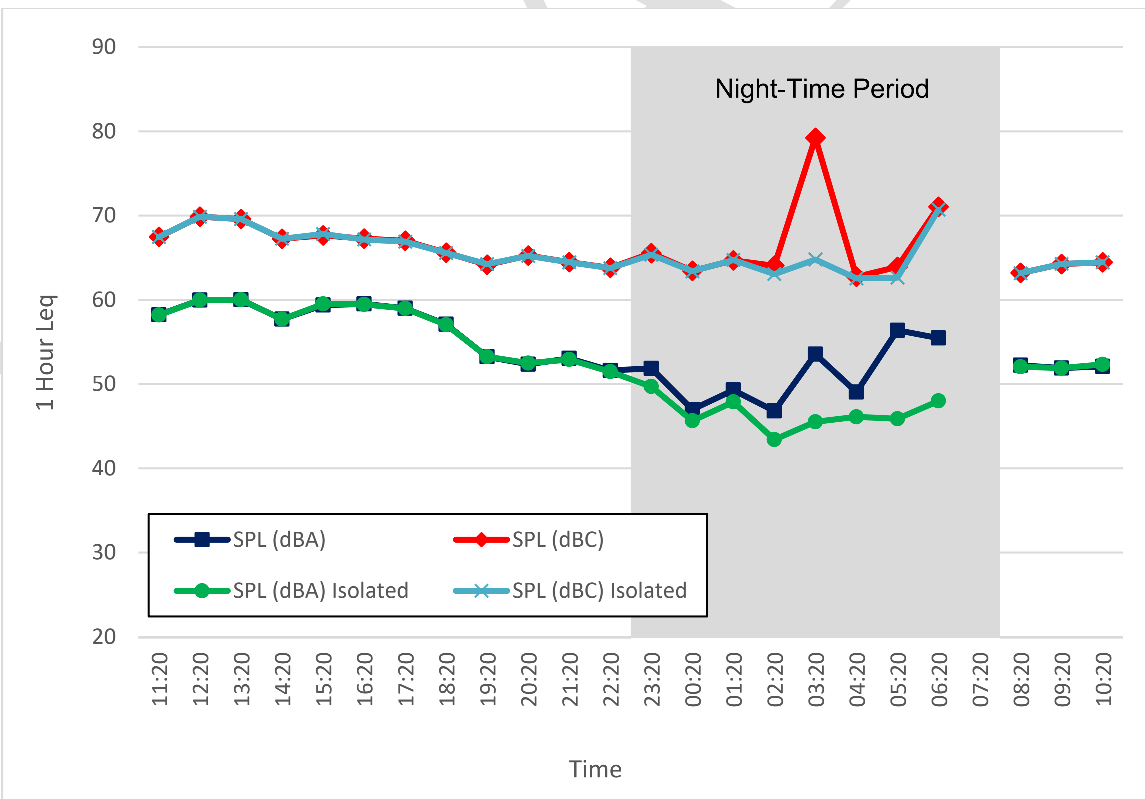

Figure 18. Noise Monitor #1, 1-Hour L_{eq} Sound Levels (July 28 - 29, 2017)[1]

[1] Again, it should be noted that data from 06:00 to 07:00 was entirely removed due to traffic along the adjacent road.

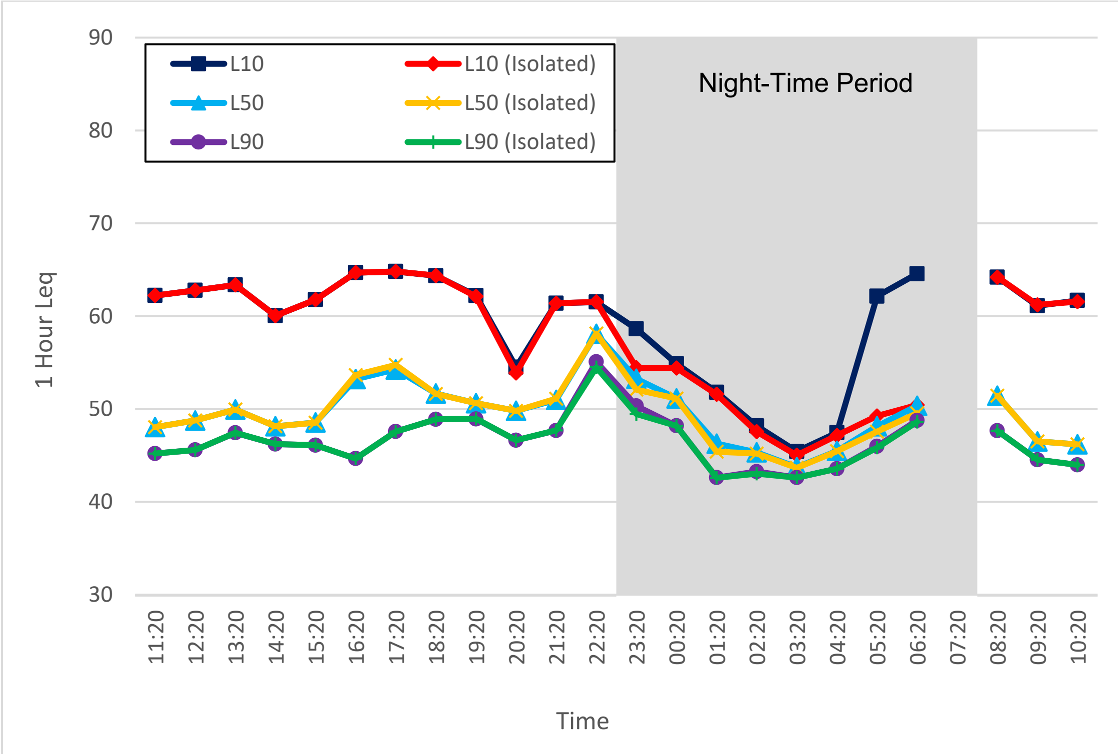

Figure 19. Noise Monitor #1, 1-Hour L_{10}, L_{50}, L_{90} L_{eq} Sound Levels (July 27 - 28, 2017) [1]

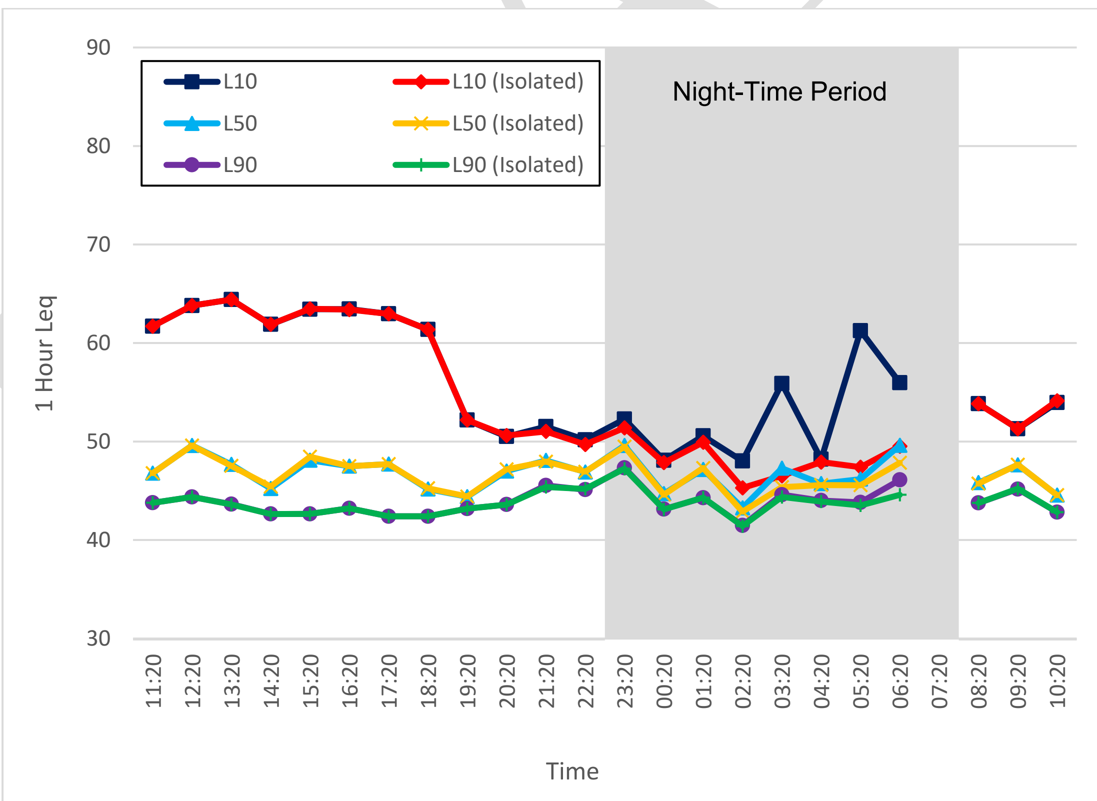

Figure 20. Noise Monitor #1, 1-Hour L_{10}, L_{50}, L_{90} L_{eq} Sound Levels (July 28 - 29, 2017) [1]

[1] Again, it should be noted that data from 06:00 to 07:00 was entirely removed due to traffic along the adjacent road.

Noise Monitor #1

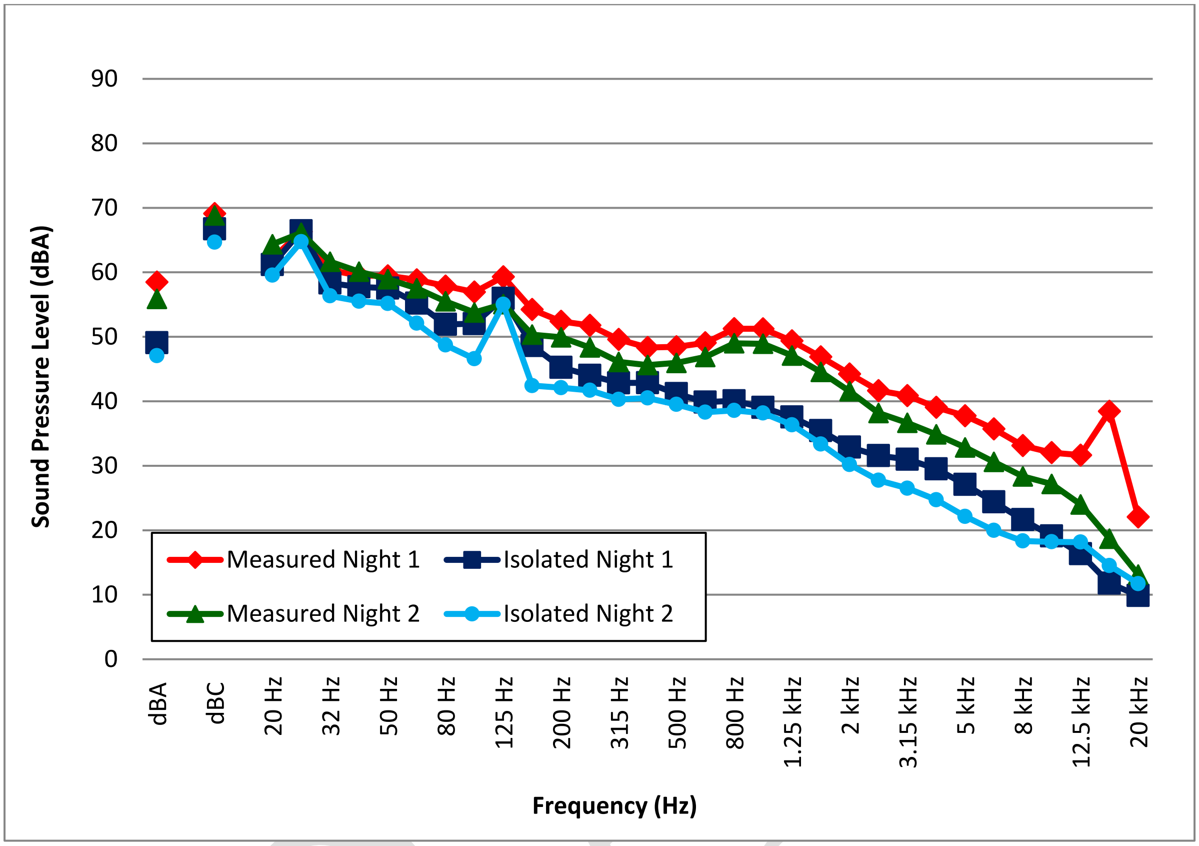

Figure 21. Noise Monitor #1, 1/3 Octave L_{eq} Sound Levels (July 27 - 29, 2017)

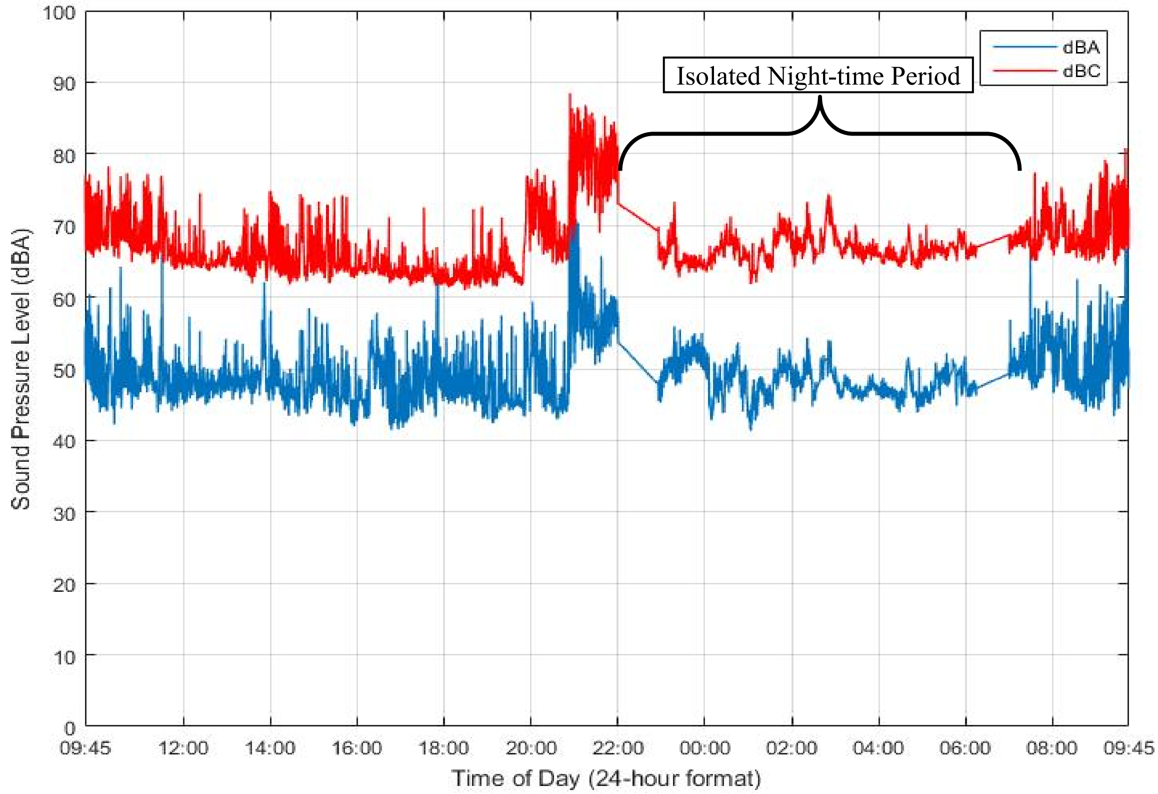

Figure 22. Noise Monitor #2, 15-Second L_{eq} Sound Levels (July 27 - 28, 2017)

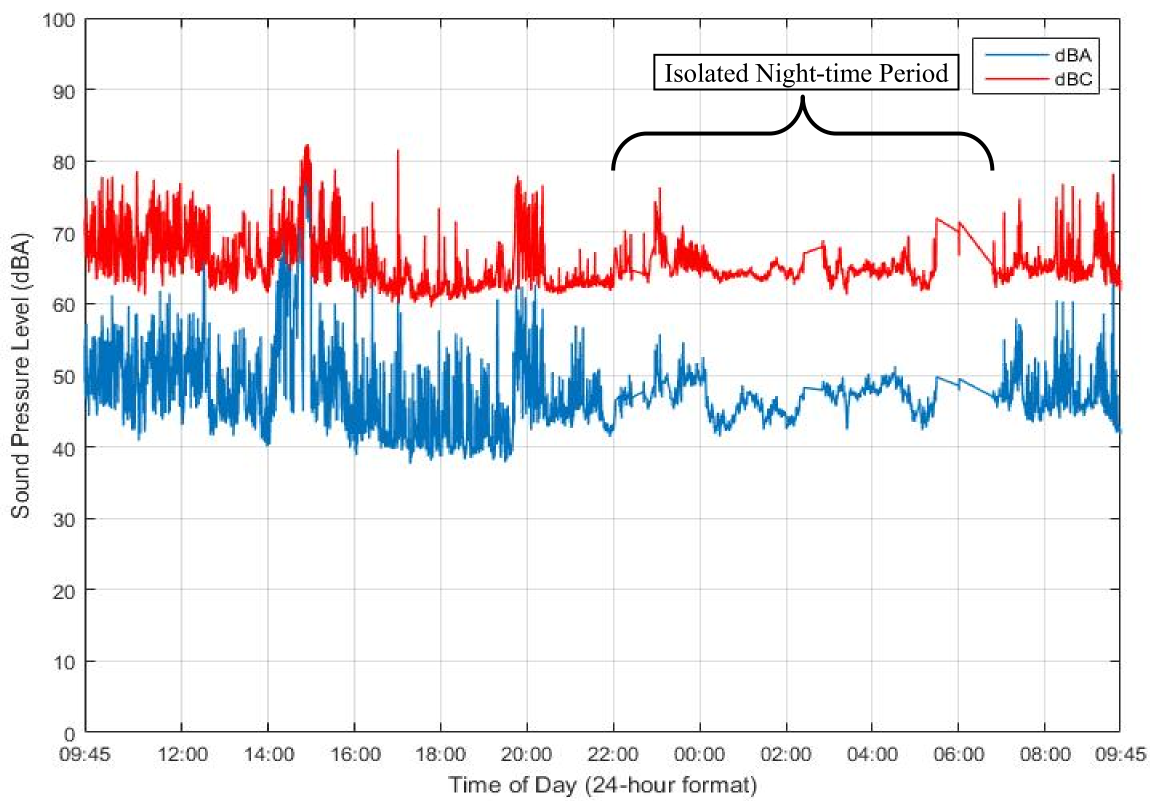

Figure 23. Noise Monitor #2, 15-Second L_{eq} Sound Levels (July 28 - 29, 2017)

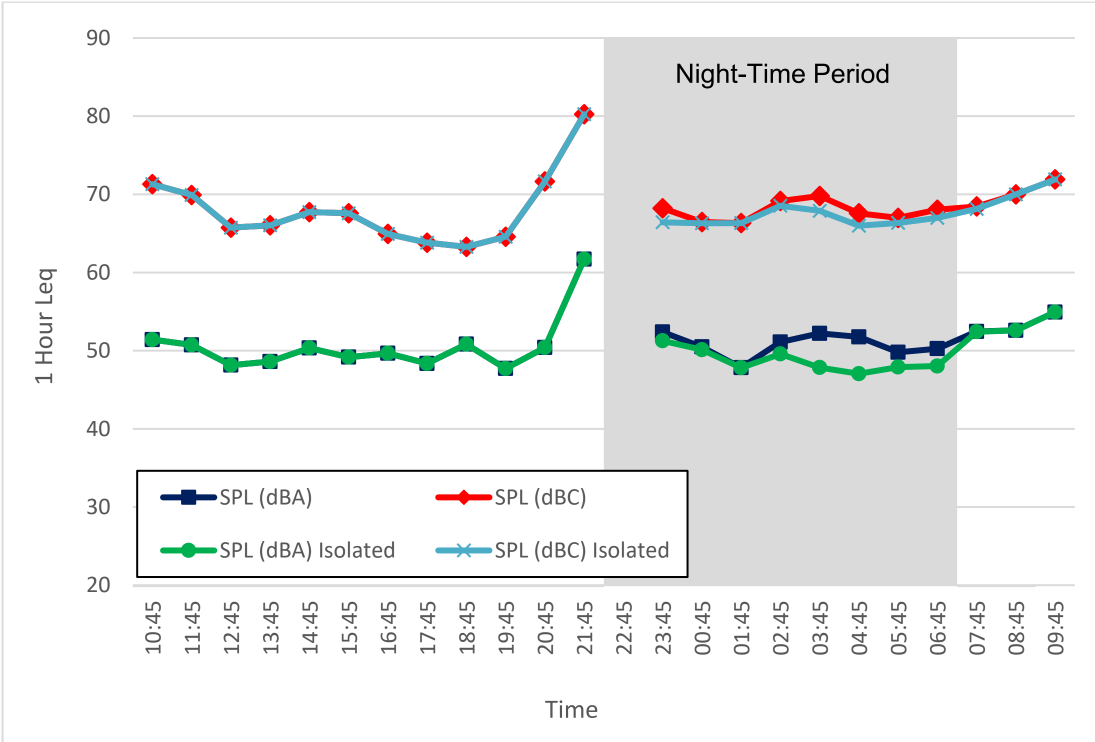

Figure 24. Noise Monitor #2, 1-Hour L_{eq} Sound Levels (July 27 - 28, 2017) [1]

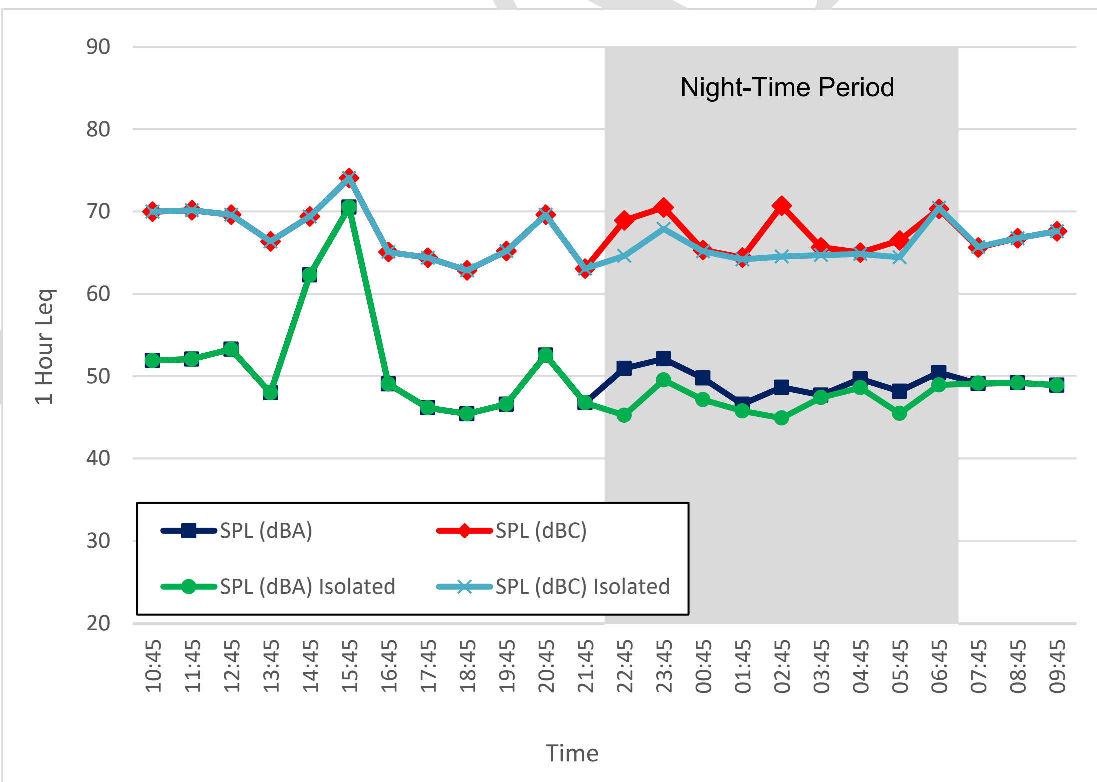

Figure 25. Noise Monitor #2, 1-Hour L_{eq} Sound Levels (July 28 - 29, 2017)

[1] Data from 22:00 to 22:55 was entirely removed due to the influence of a storm in the nearby area.

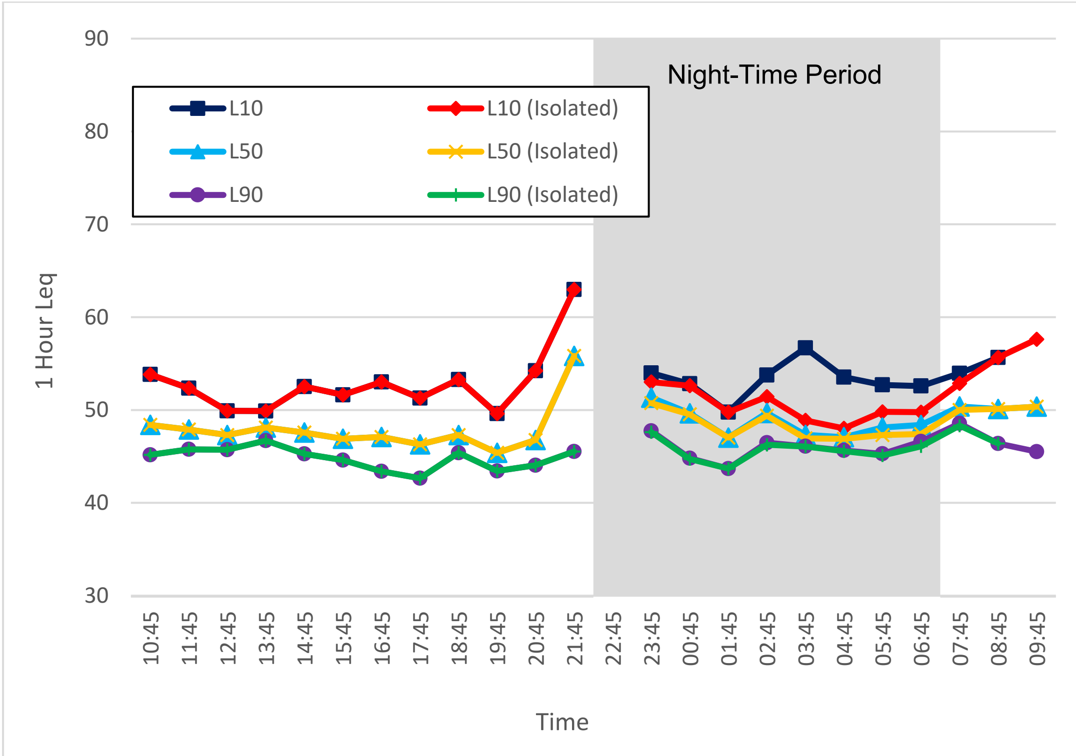

Figure 26. Noise Monitor #2, 1-Hour L_{10}, L_{50}, L_{90} L_{eq} Sound Levels (July 27 - 28, 2017) [1]

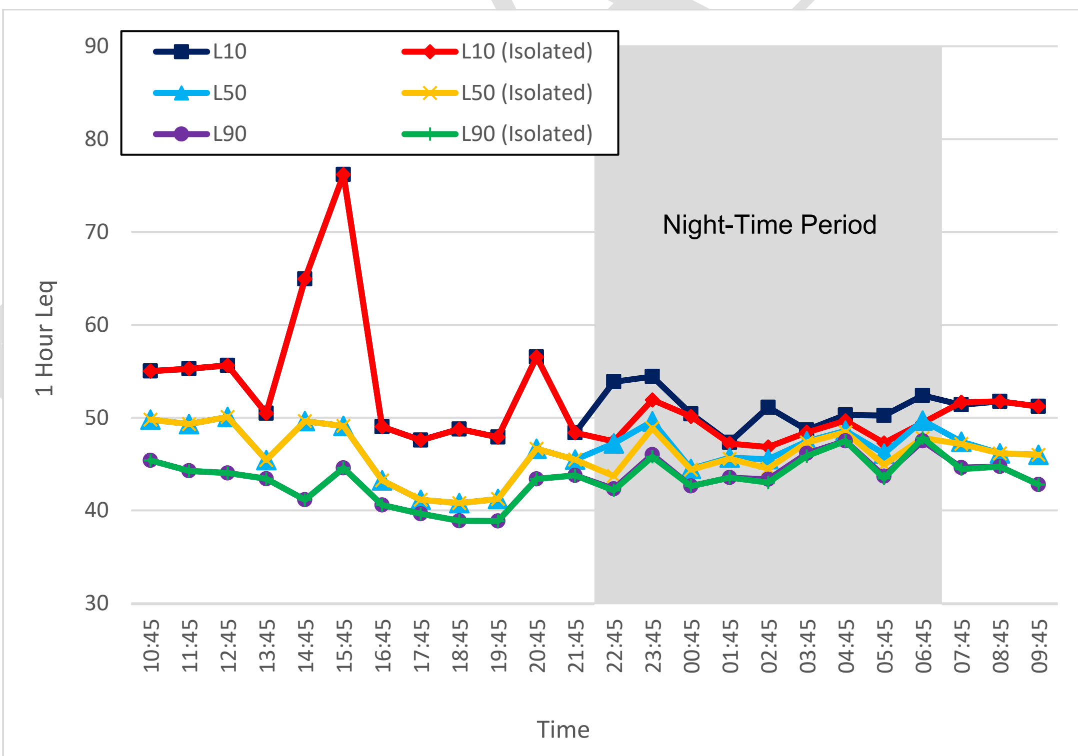

Figure 27. Noise Monitor #2, 1-Hour L_{10}, L_{50}, L_{90} L_{eq} Sound Levels (July 28 - 29, 2017)

[1] Data from 22:00 to 22:55 was entirely removed due to the influence of a storm in the nearby area.

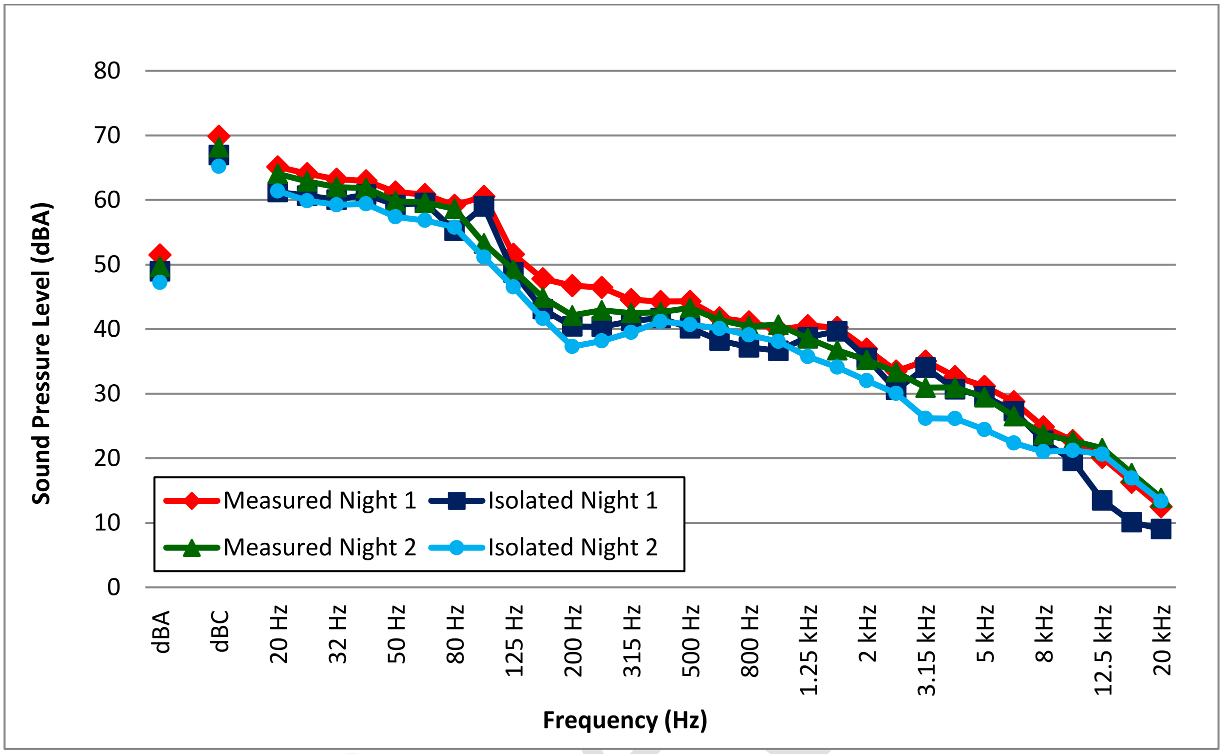

Figure 28. Noise Monitor #2, 1/3 Octave L_{eq} Sound Levels (July 27 - 29, 2017)

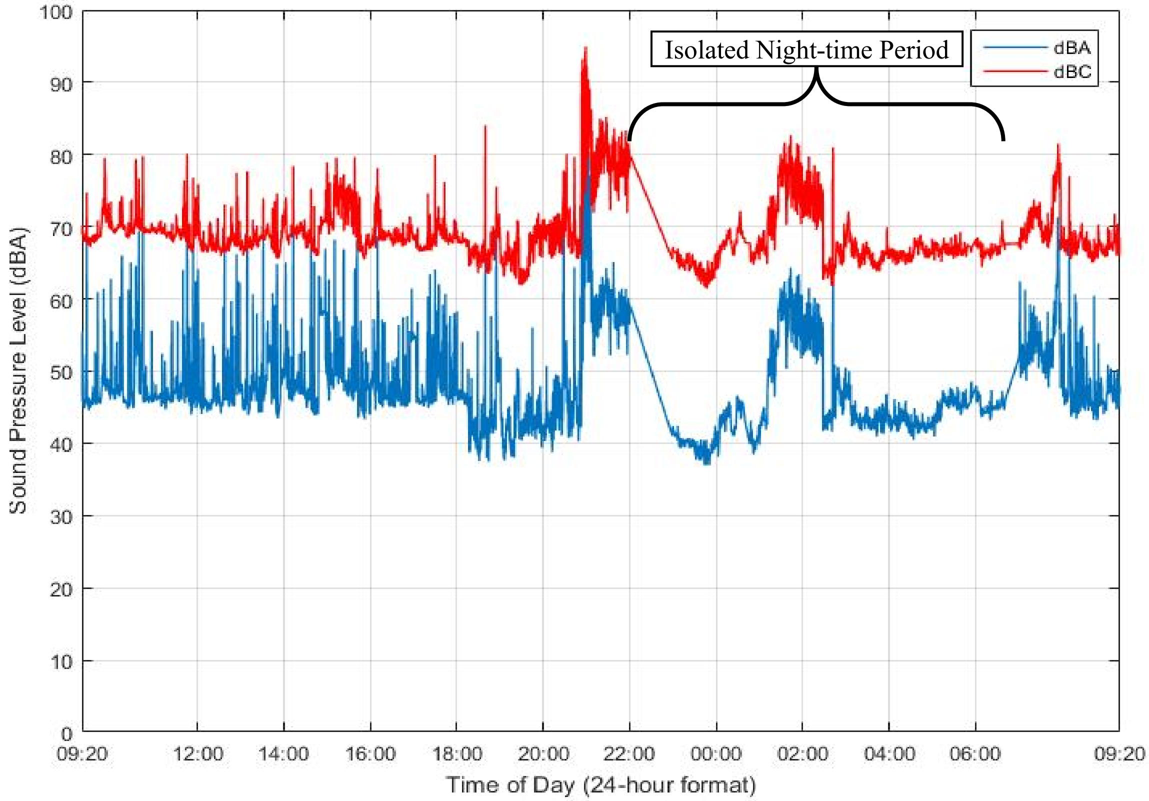

Figure 29. Noise Monitor #3, 15-Second L_{eq} Sound Levels (July 27 - 28, 2017)

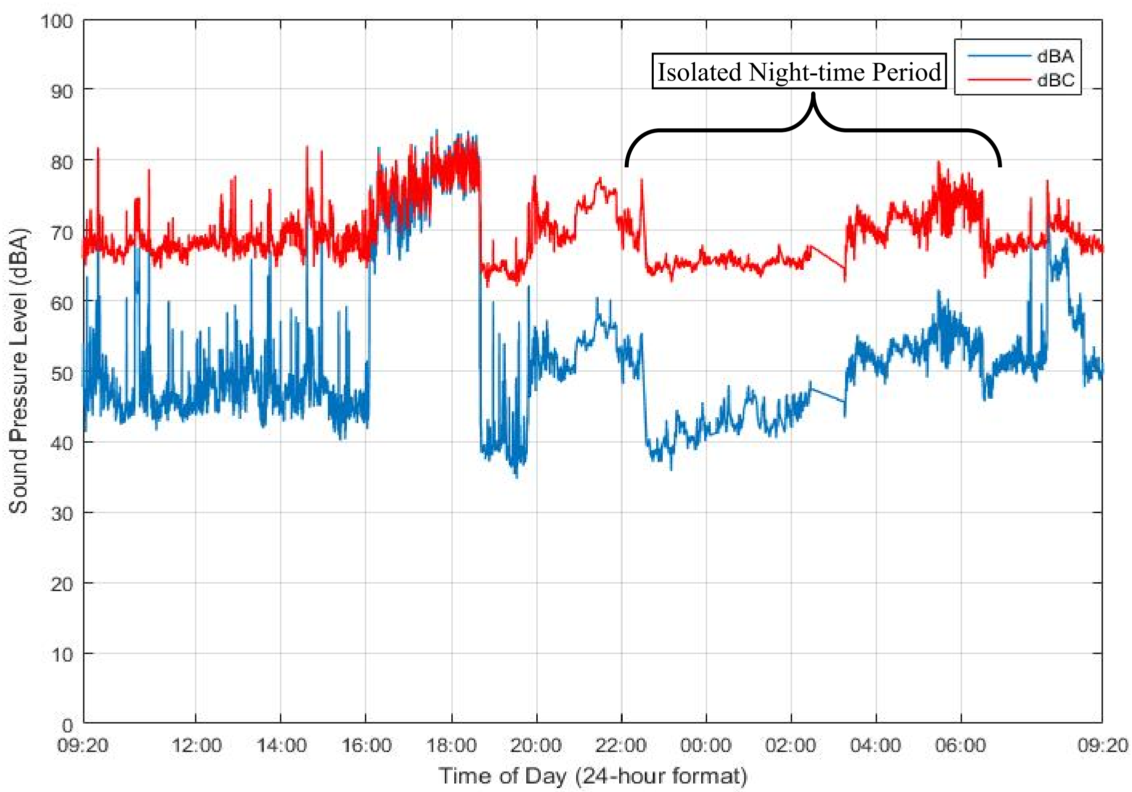

Figure 30. Noise Monitor #3, 15-Second L_{eq} Sound Levels (July 28 - 29, 2017)

Noise Monitor #3

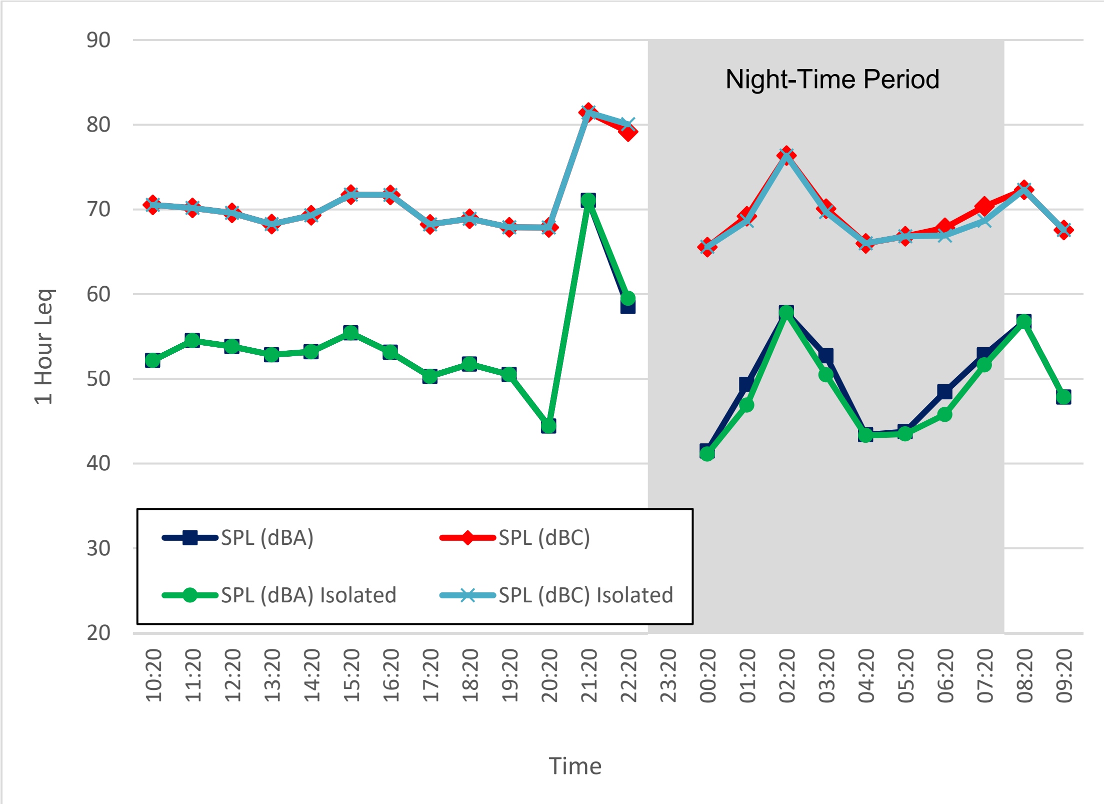

Figure 31. Noise Monitor #3, 1-Hour L_{eq} Sound Levels (July 27 - 28, 2017)[1]

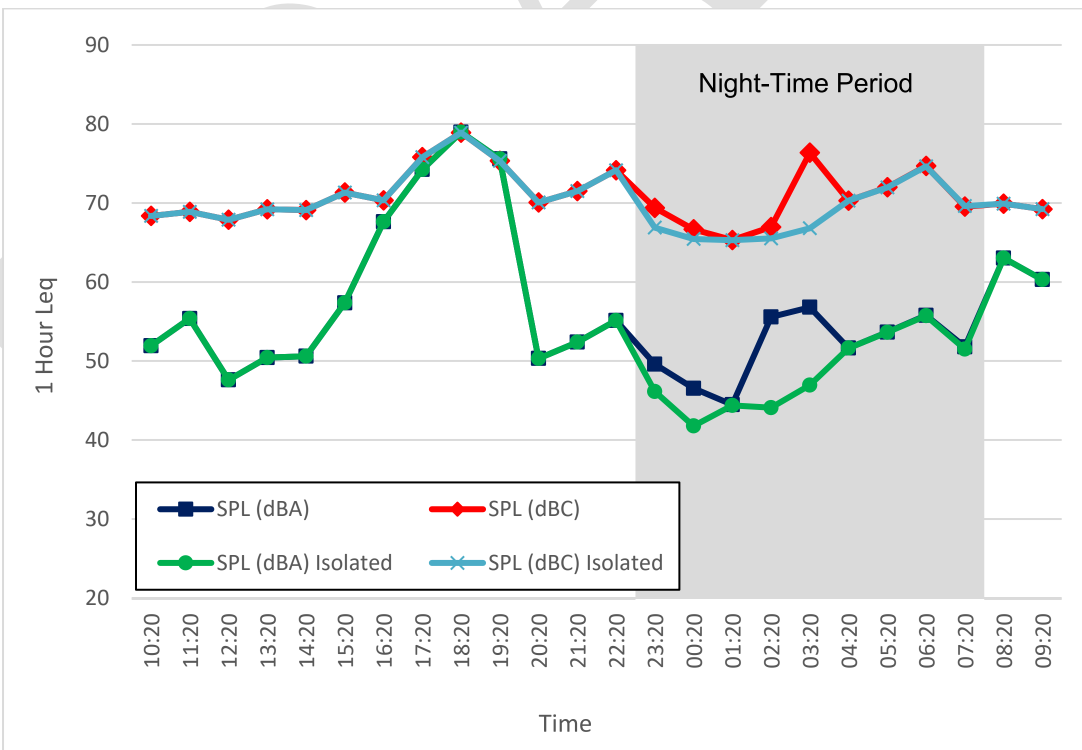

Figure 32. Noise Monitor #3, 1-Hour L_{eq} Sound Levels (July 28 - 29, 2017)

[1] Data from 22:00 to 22:59 was entirely removed due to the influence of a storm in the nearby area.

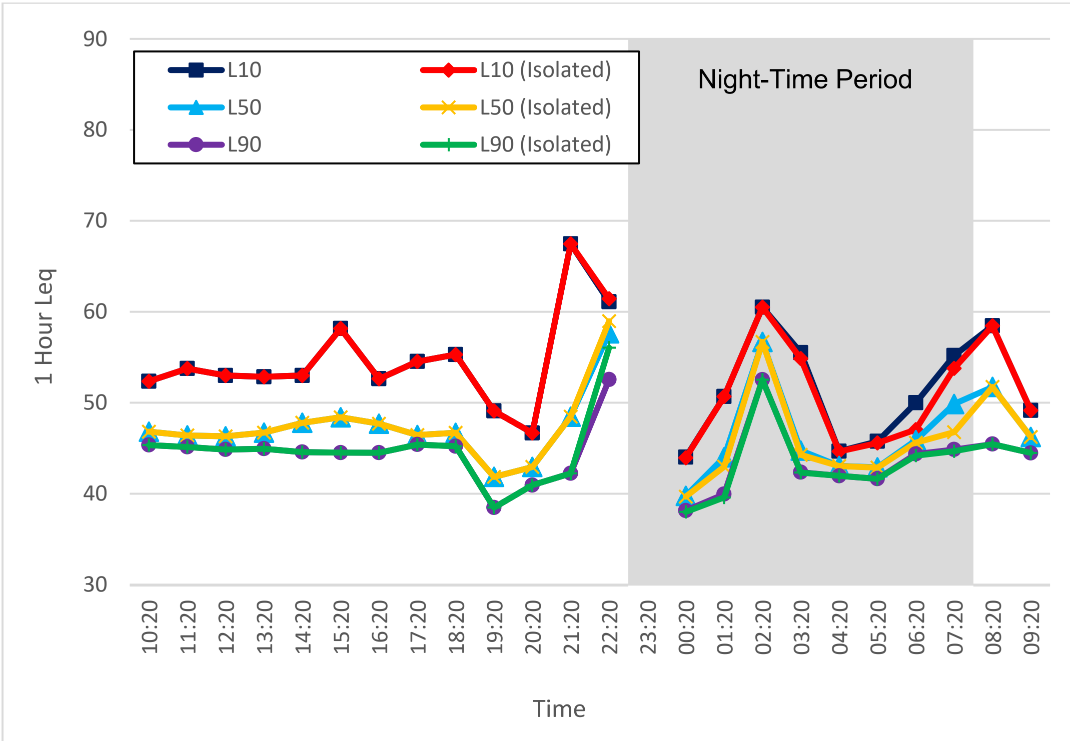

Figure 33. Noise Monitor #3, 1-Hour L_{10}, L_{50}, L_{90} L_{eq} Sound Levels (July 27 - 28, 2017)[1]

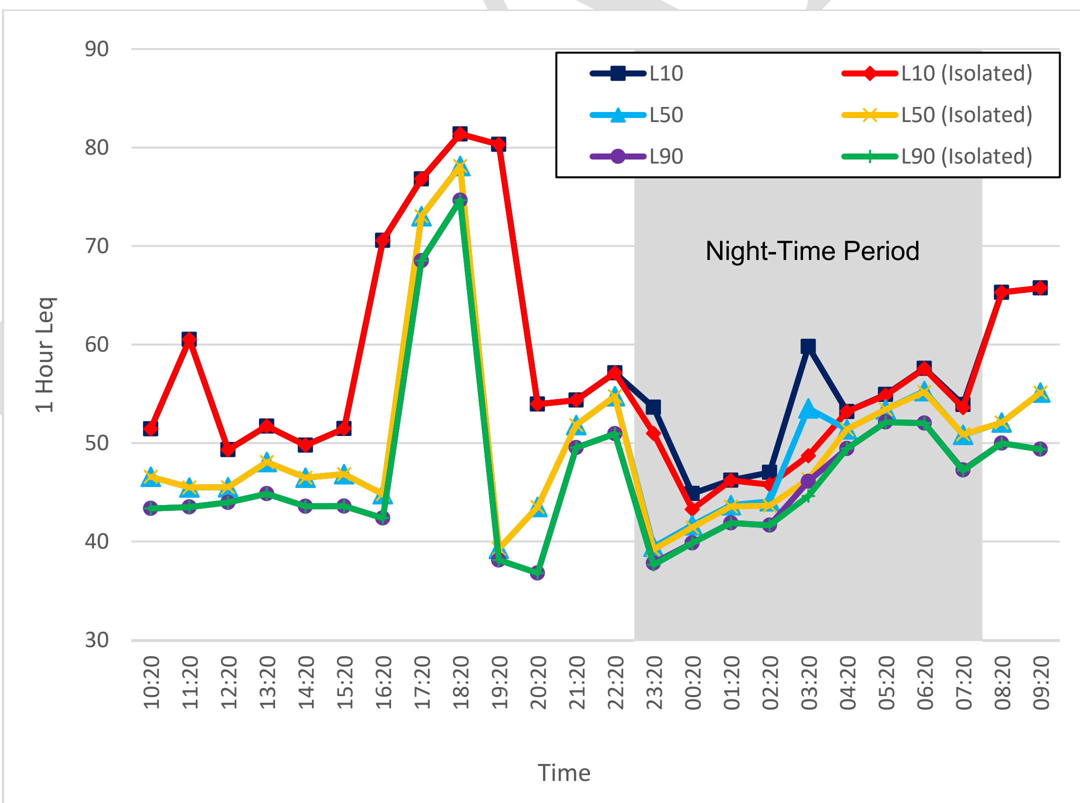

Figure 34. Noise Monitor #3, 1-Hour L_{10}, L_{50}, L_{90} L_{eq} Sound Levels (July 28 - 29, 2017)

[1] Data from 22:00 to 22:59 was entirely removed due to the influence of a storm in the nearby area.

Noise Monitor #3

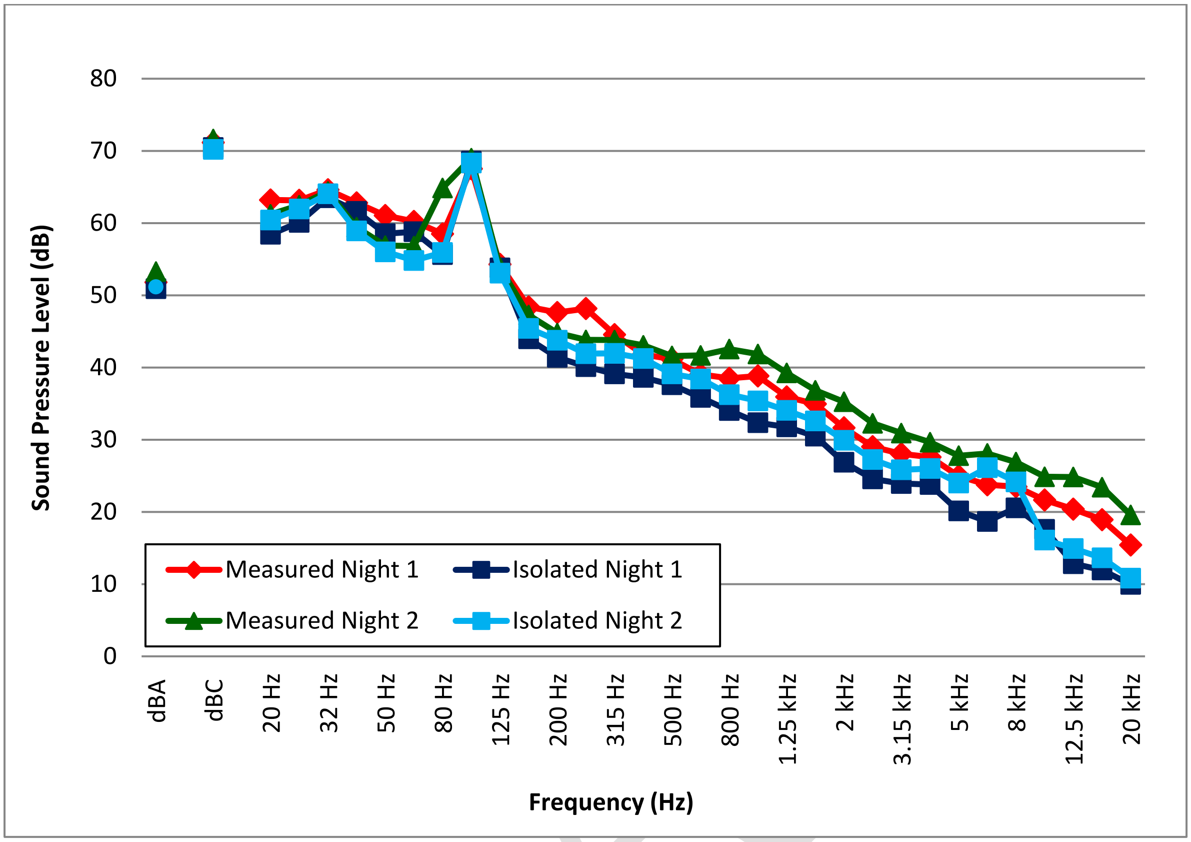

Figure 35. Noise Monitor #3, 1/3 Octave L_{eq} Sound Levels (July 27 - 29, 2017)

Noise Monitor #4

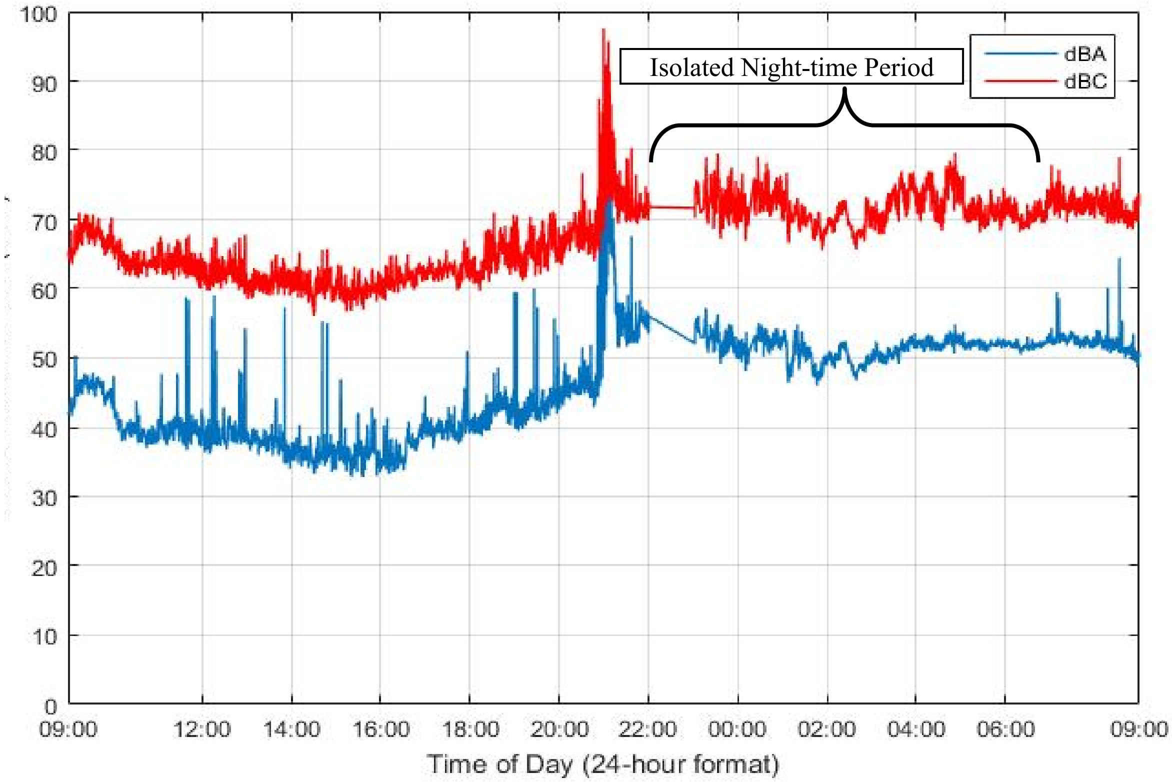

Figure 36. Noise Monitor #4, 15-Second L_{eq} Sound Levels (July 27 - 28, 2017)

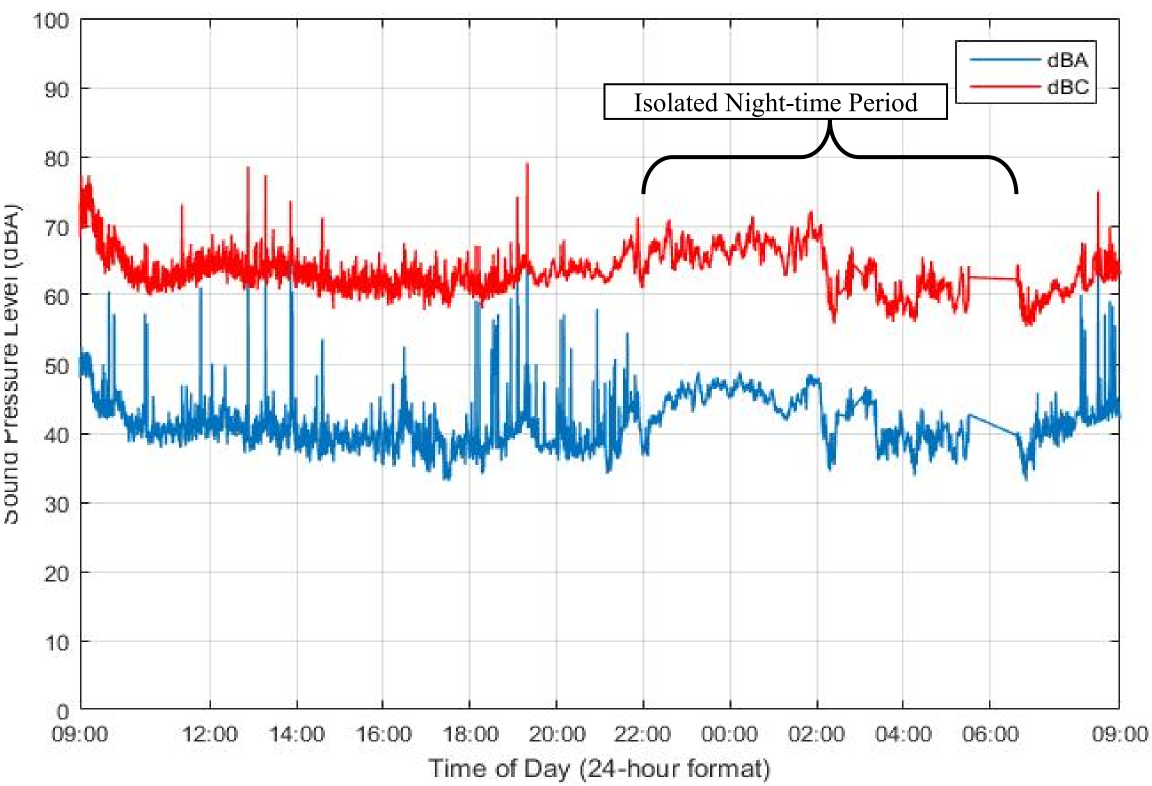

Figure 37. Noise Monitor #4, 15-Second L_{eq} Sound Levels (July 28 - 29, 2017)

Noise Monitor #4

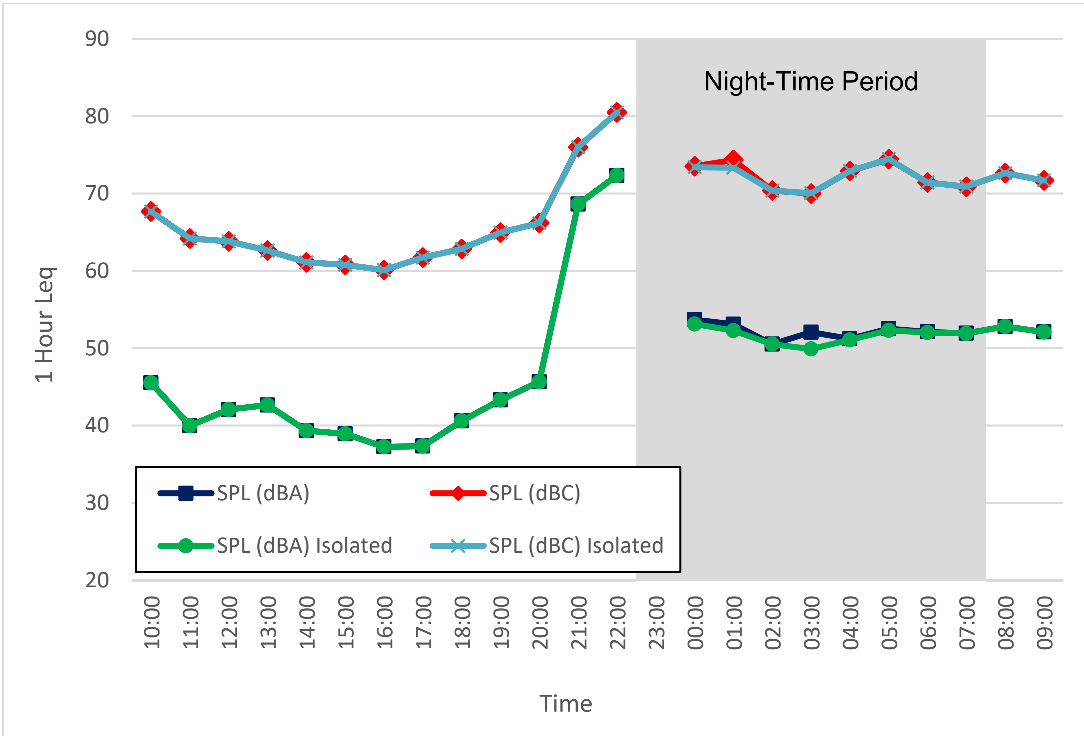

Figure 38. Noise Monitor #4, 1-Hour L_{eq} Sound Levels (July 27 - 28, 2017) [1]

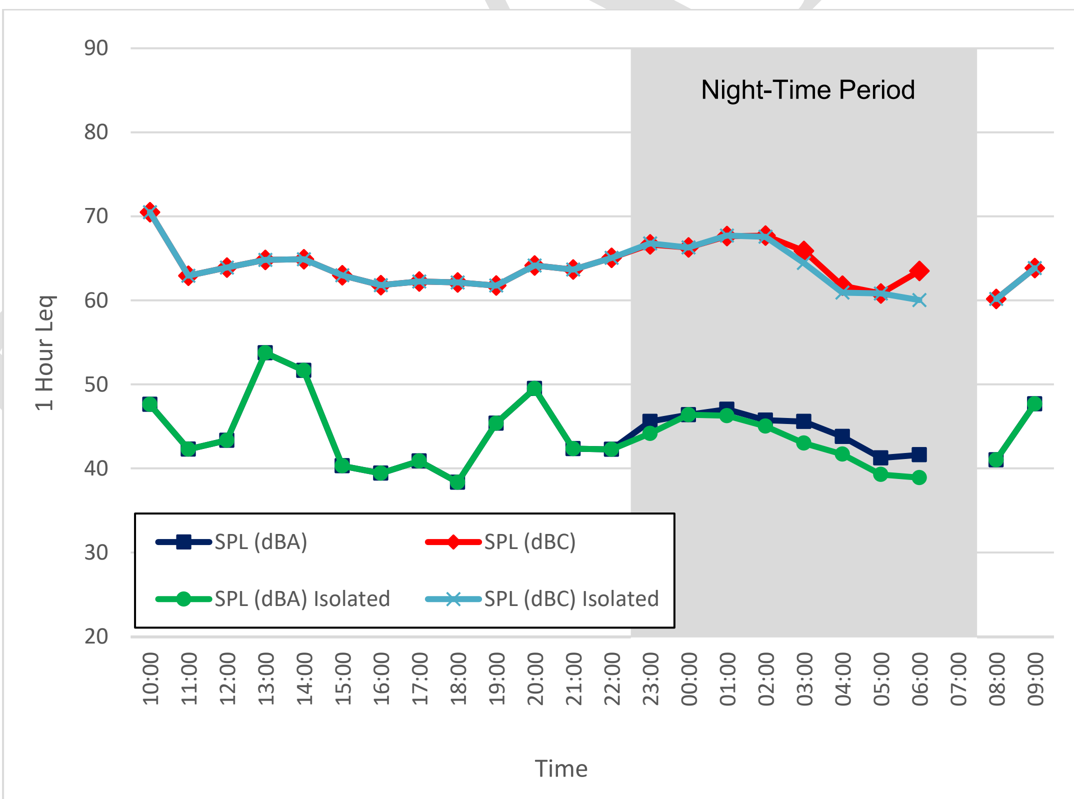

Figure 39. Noise Monitor #4, 1-Hour L_{eq} Sound Levels (July 28 - 29, 2017) [2]

[1] Data from 22:00 to 22:59 was entirely removed due to the influence of a storm in the nearby area.
[2] Data from 05:30 to 06:37 was entirely removed due to the influence of a storm in the nearby area.

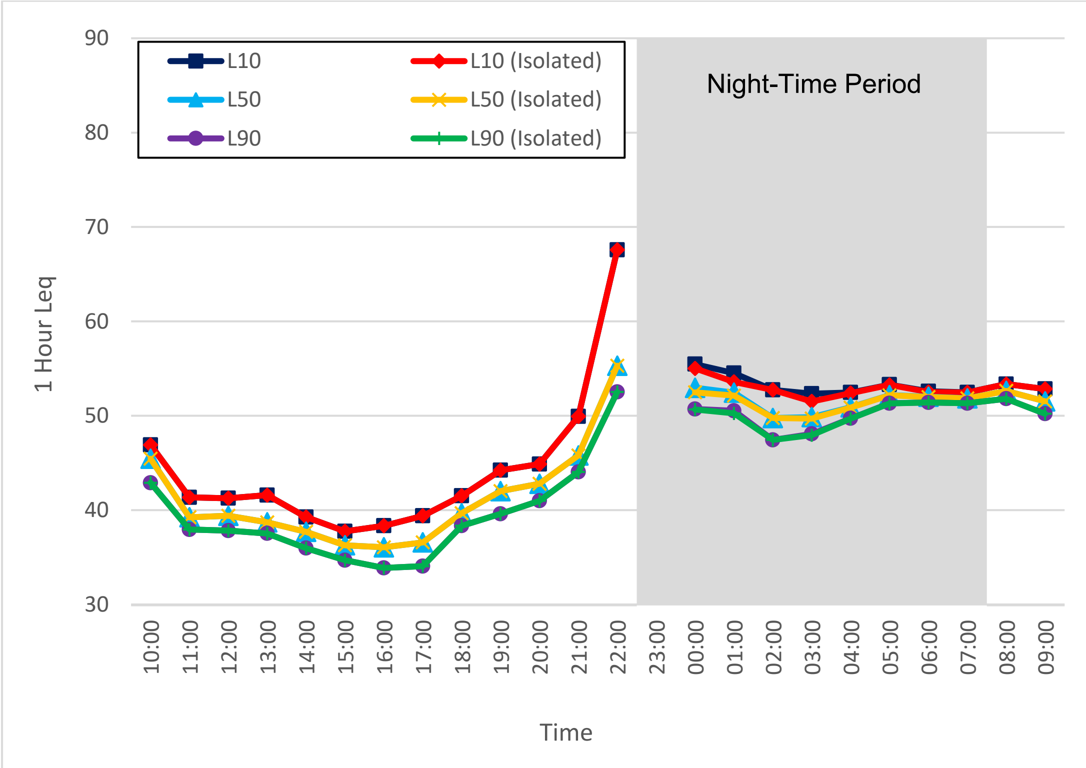

Figure 40. Noise Monitor #4, 1-Hour L_{10}, L_{50}, L_{90} L_{eq} Sound Levels (July 27 - 28, 2017)[1]

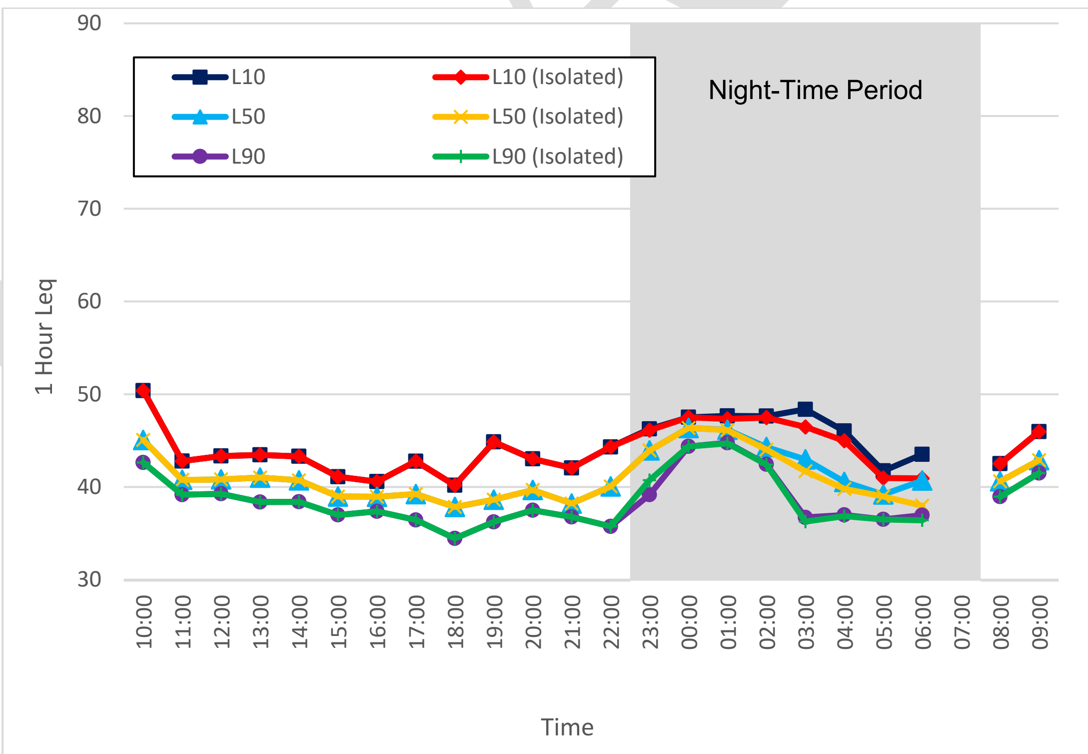

Figure 41. Noise Monitor #4, 1-Hour L_{10}, L_{50}, L_{90} L_{eq} Sound Levels (July 28 - 29, 2017) [2]

[1] Data from 22:00 to 22:59 was entirely removed due to the influence of a storm in the nearby area.
[2] Data from 05:30 to 06:37 was entirely removed due to the influence of a storm in the nearby area.

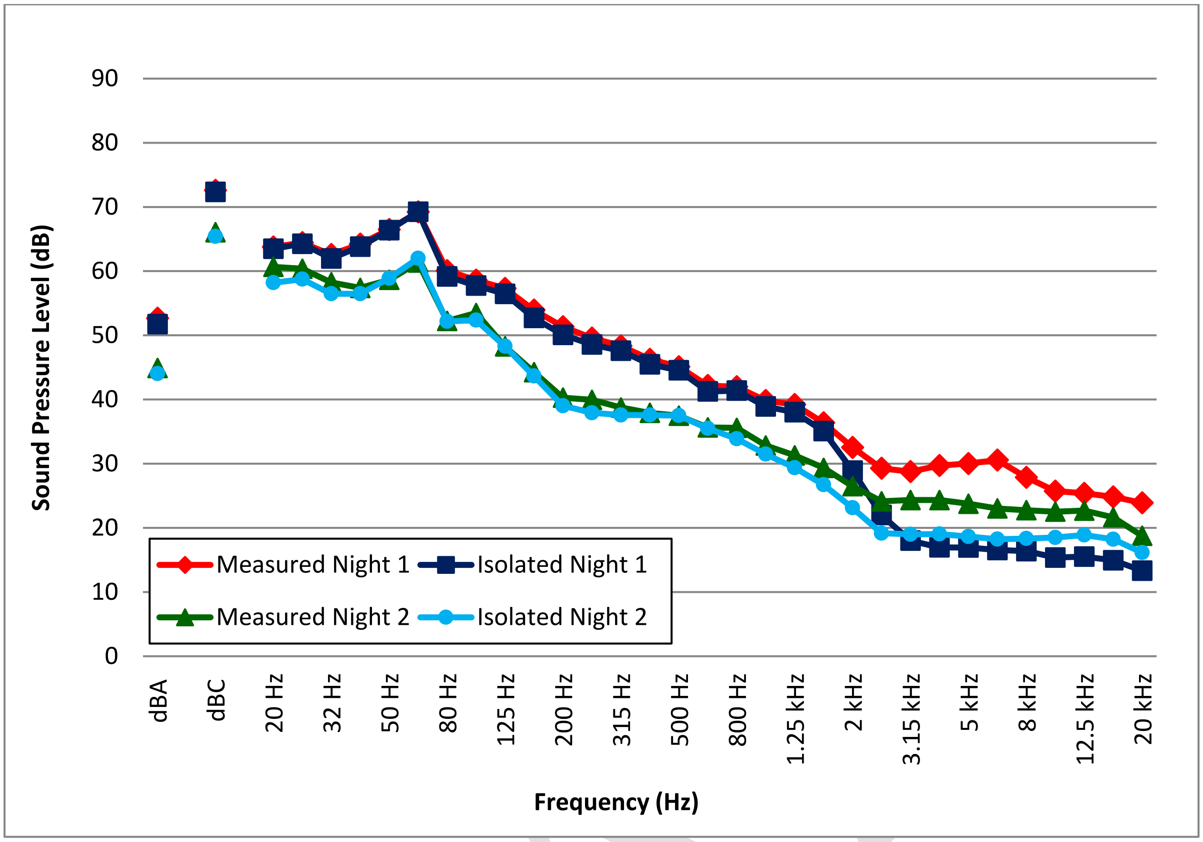

Figure 42. Noise Monitor #4, 1/3 Octave L_{eq} Sound Levels (July 27 - 29, 2017)

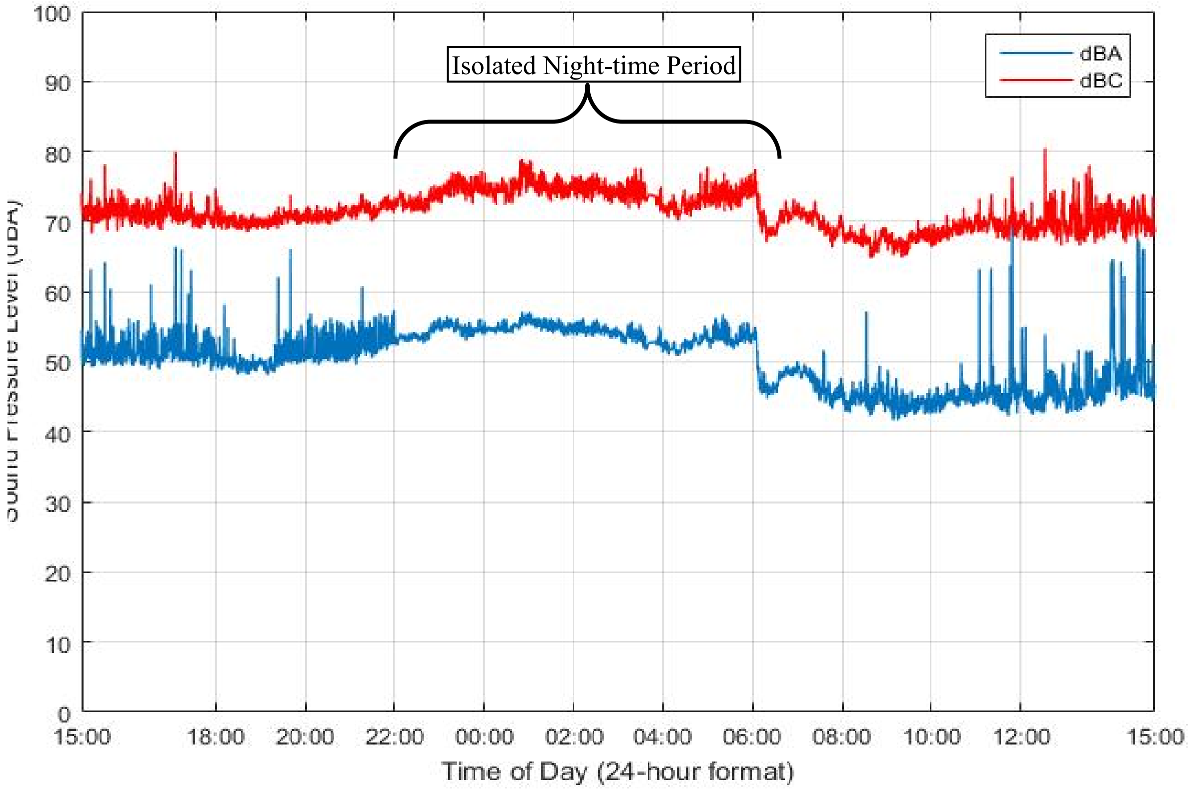

Figure 43. Noise Monitor #5, 15-Second L_{eq} Sound Levels (July 29 - 30, 2017)

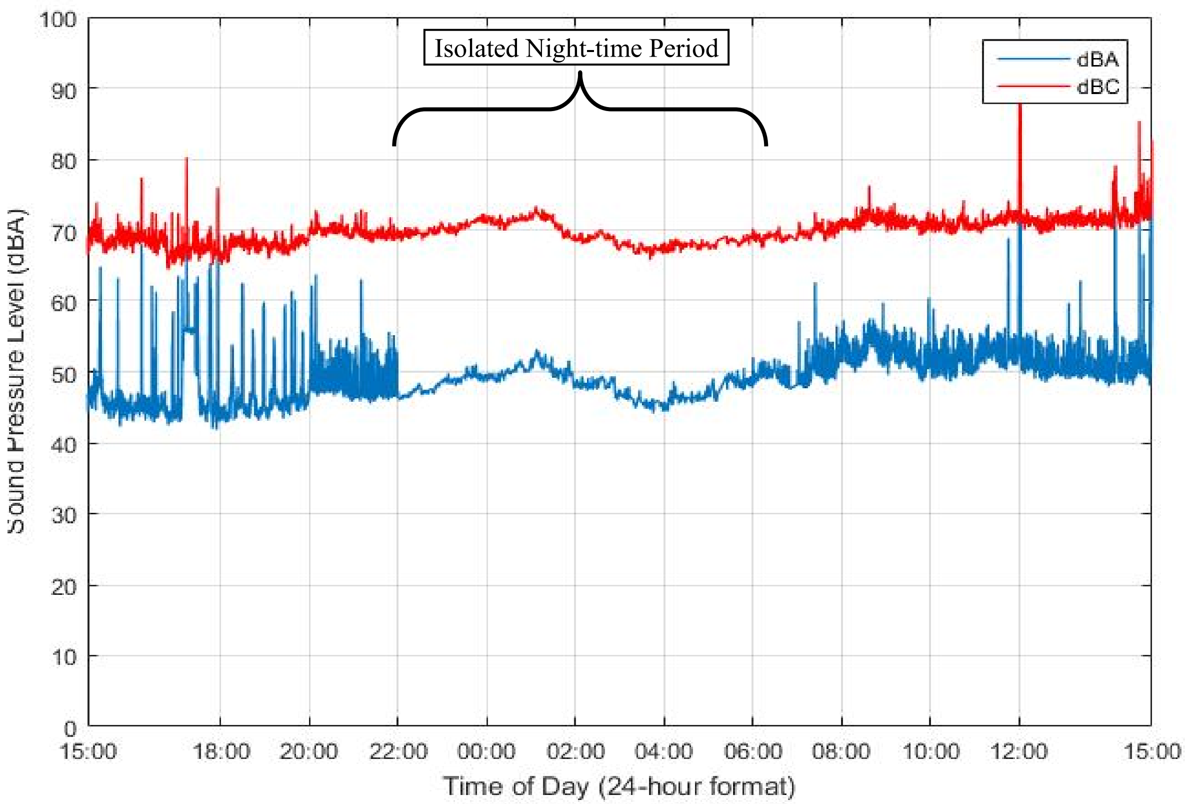

Figure 44. Noise Monitor #5, 15-Second L_{eq} Sound Levels (July 30 - 31, 2017)

Noise Monitor #5

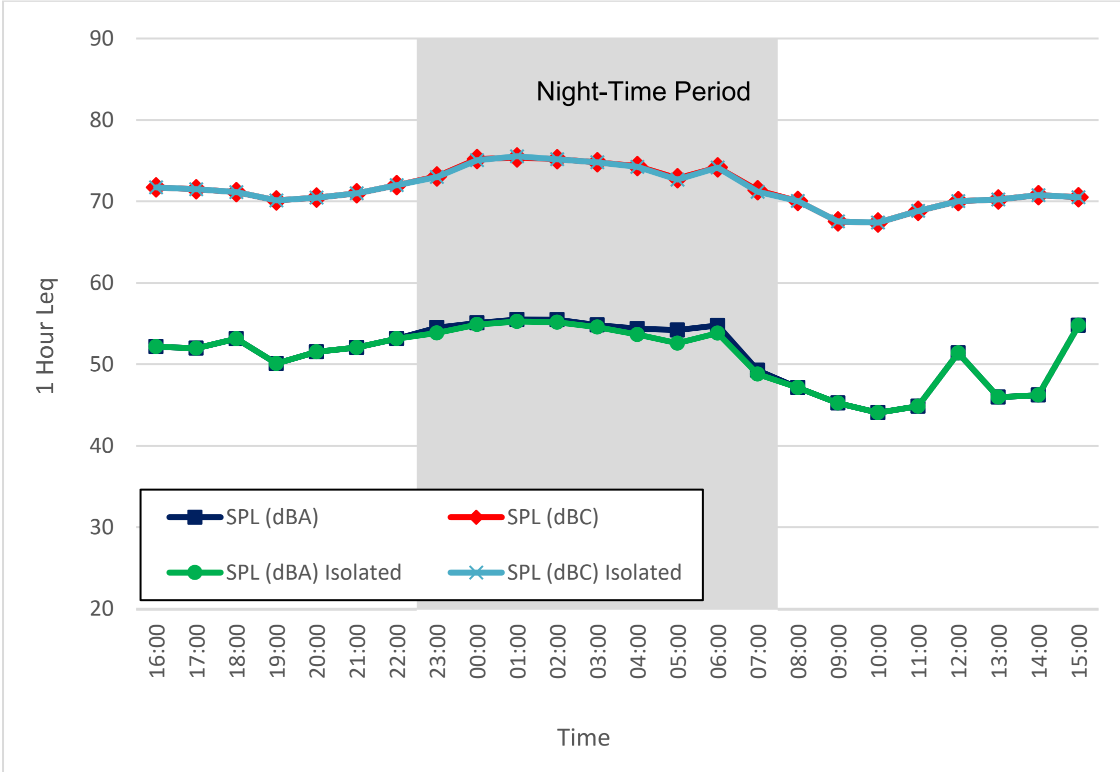

Figure 45. Noise Monitor #5, 1-Hour L_{eq} Sound Levels (July 29 - 30, 2017)

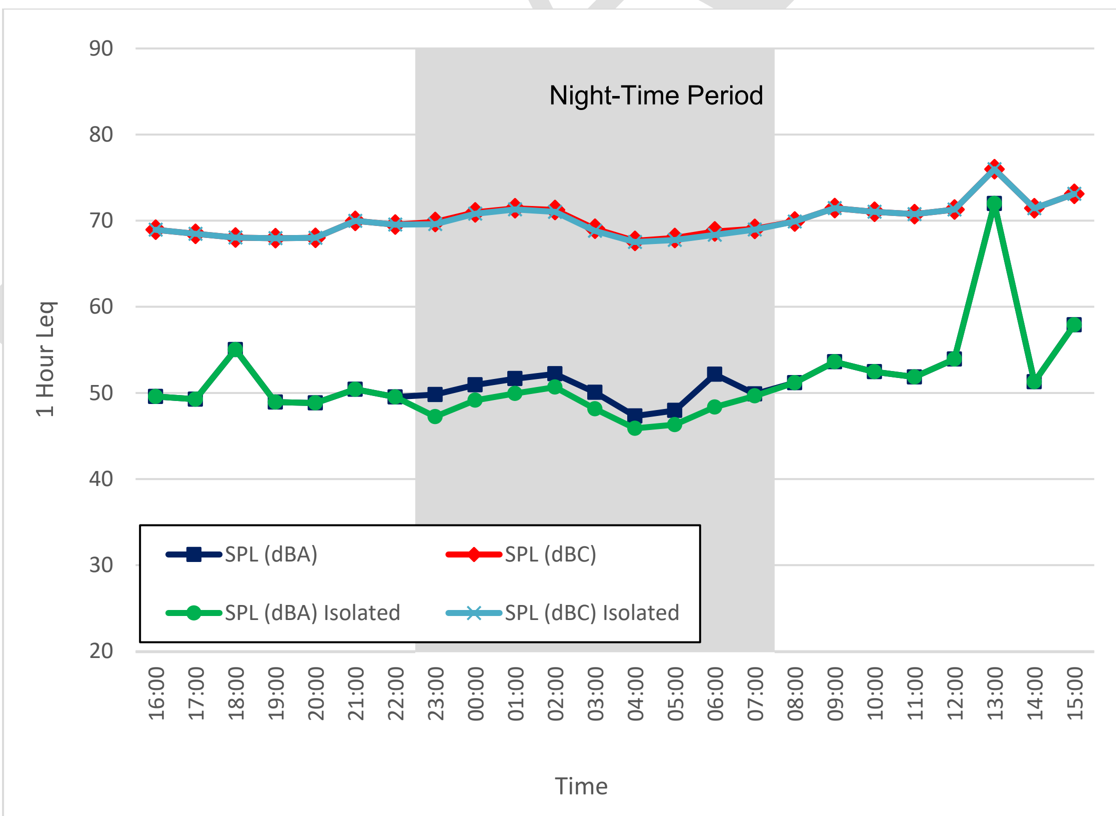

Figure 46. Noise Monitor #5, 1-Hour L_{eq} Sound Levels (July 30 - 31, 2017)

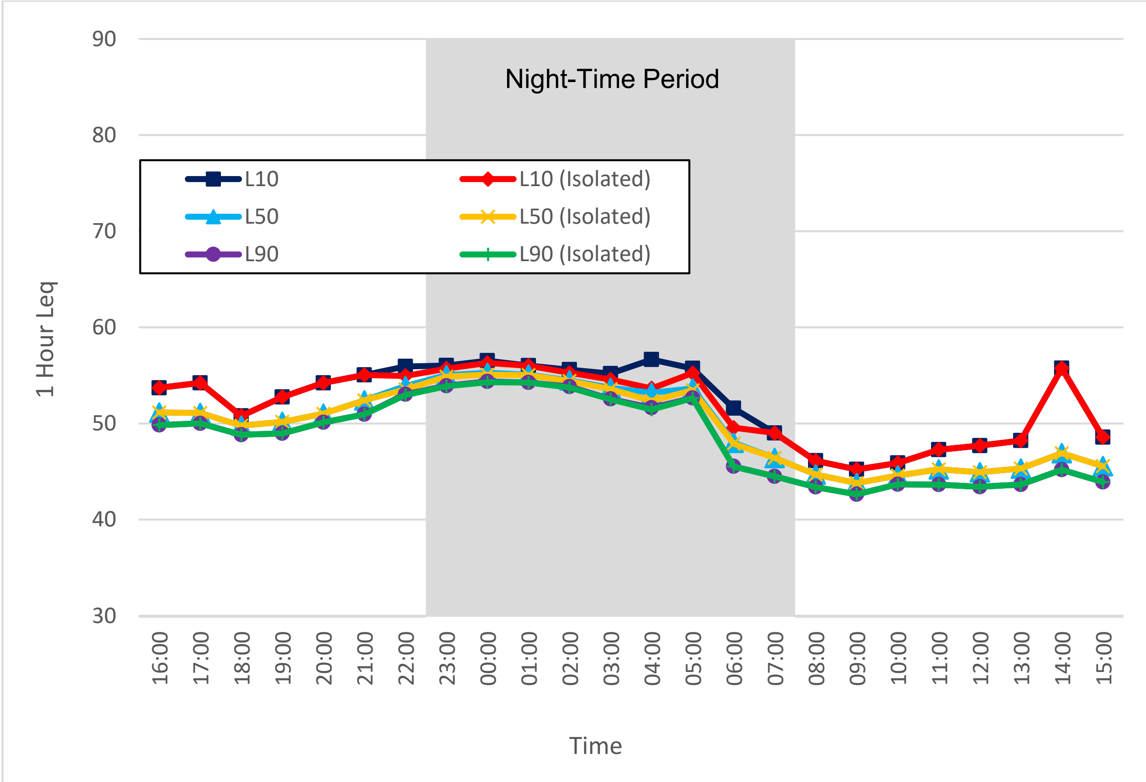

Figure 47. Noise Monitor #5, 1-Hour L_{10}, L_{50}, L_{90} L_{eq} Sound Levels (July 29 - 30, 2017)

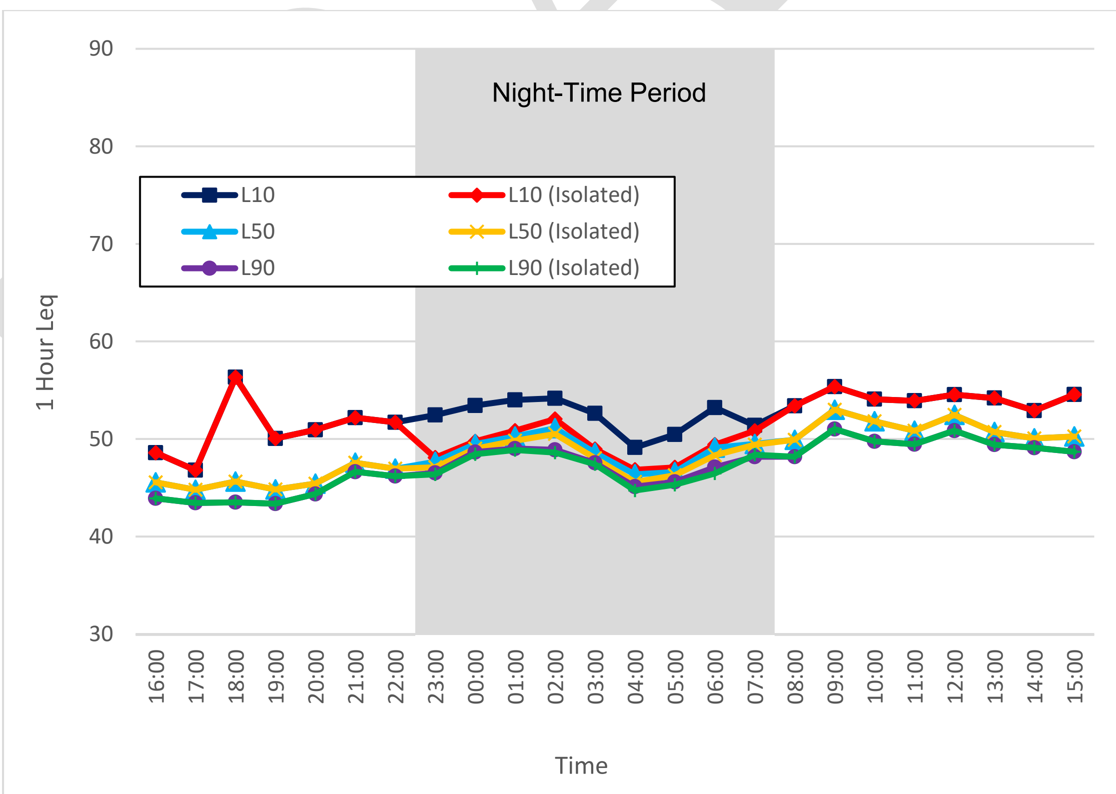

Figure 48. Noise Monitor #5, 1-Hour L_{10}, L_{50}, L_{90} L_{eq} Sound Levels (July 30 - 31, 2017)

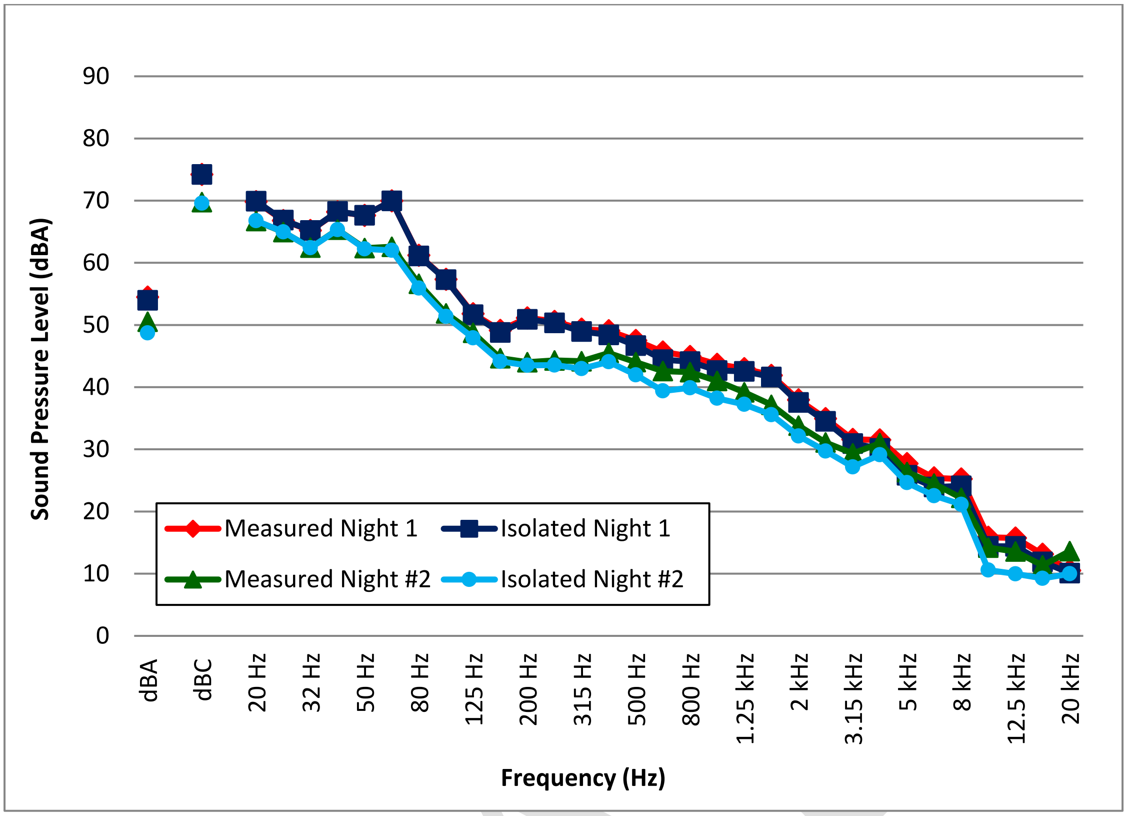

Figure 49. Noise Monitor #5, 1/3 Octave L_{eq} Sound Levels (July 29 - 31, 2017)

Noise Monitor #6

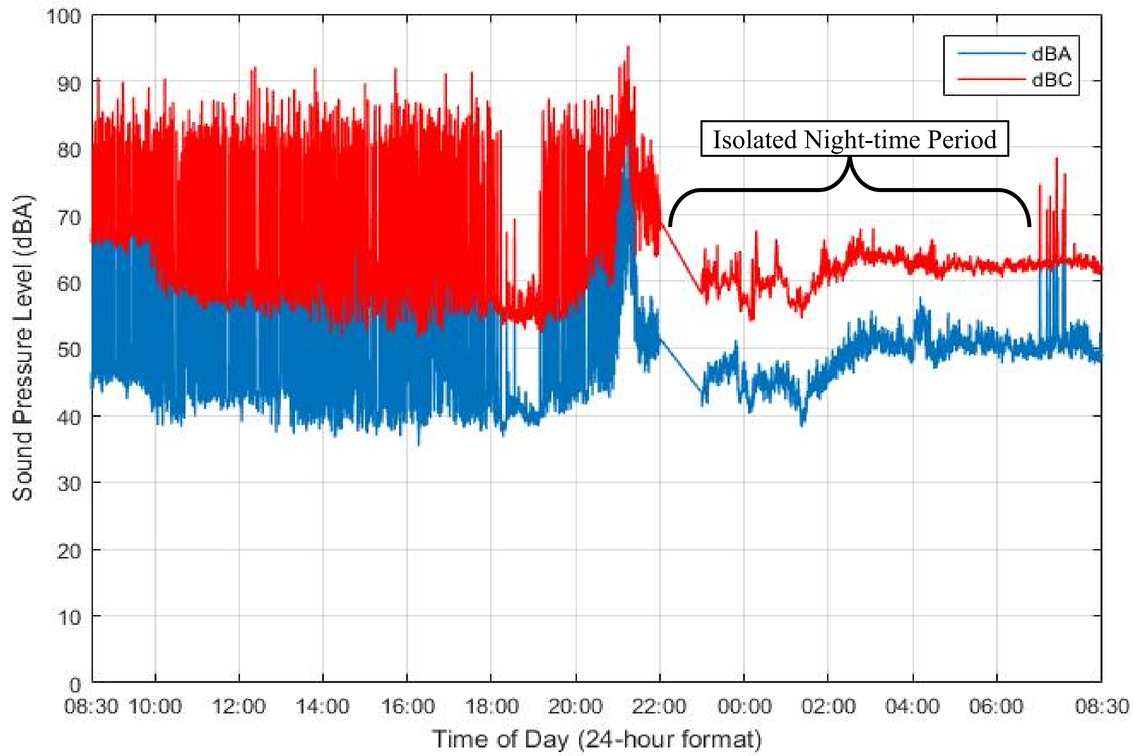

Figure 50. Noise Monitor #6, 15-Second L_{eq} Sound Levels (July 27 - 28, 2017)

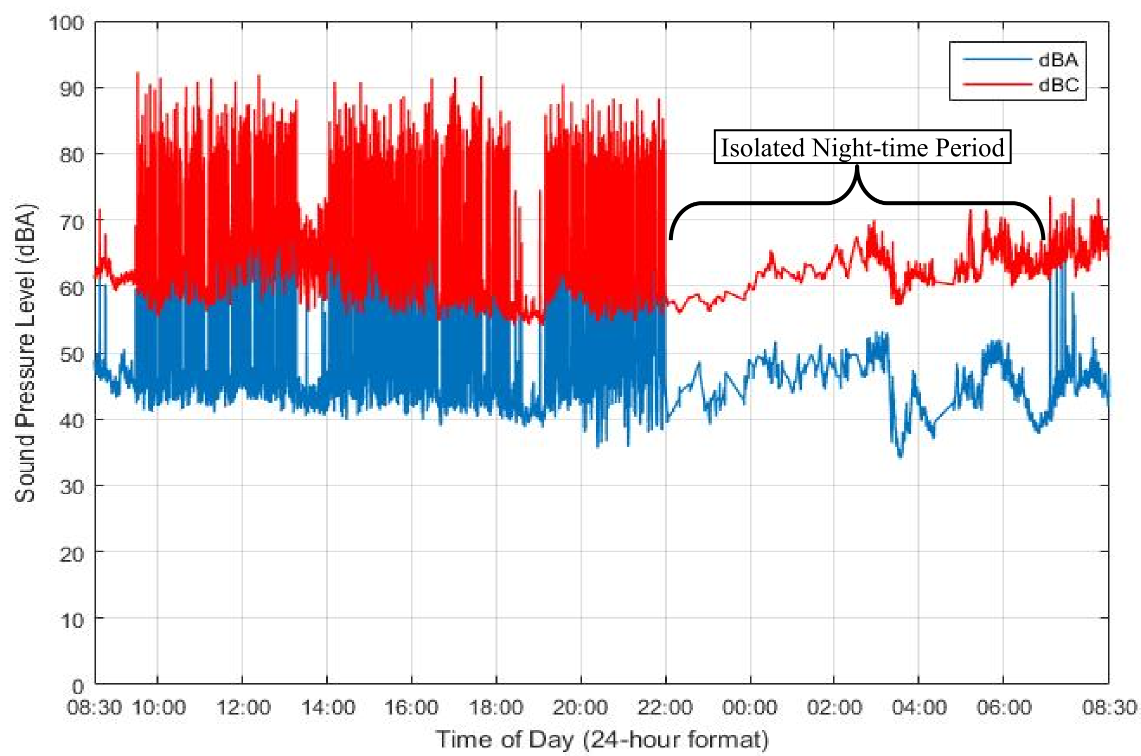

Figure 51. Noise Monitor #6, 15-Second L_{eq} Sound Levels (July 28 - 29, 2017)

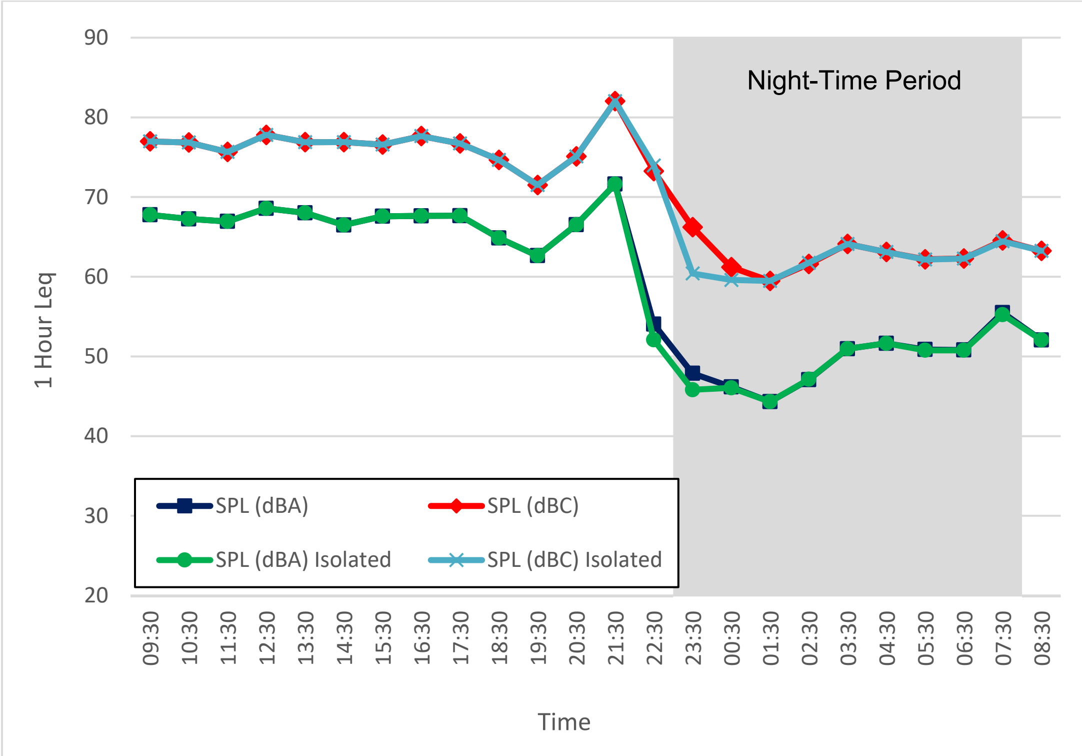

Figure 52. Noise Monitor #6, 1-Hour L_{eq} Sound Levels (July 27 - 28, 2017)[1]

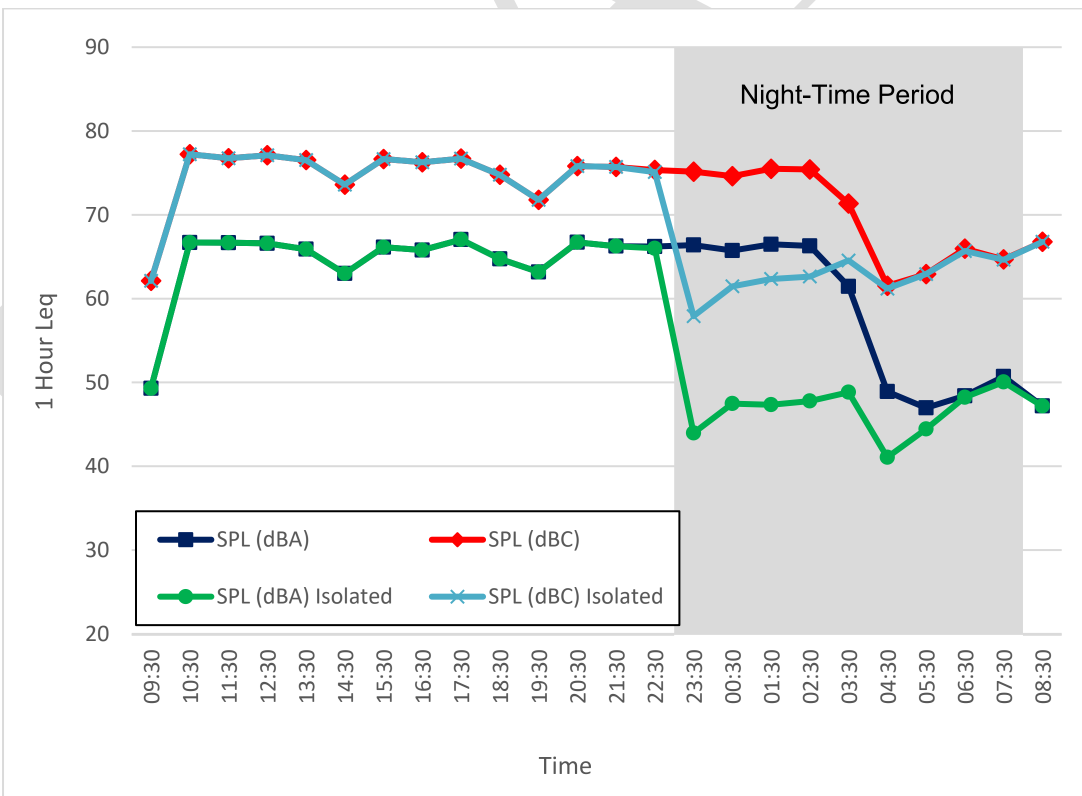

Figure 53. Noise Monitor #6, 1-Hour L_{eq} Sound Levels (July 27 - 28, 2017)

[1] Data from 22:00 to 22:59 was entirely removed due to the influence of a storm in the nearby area.

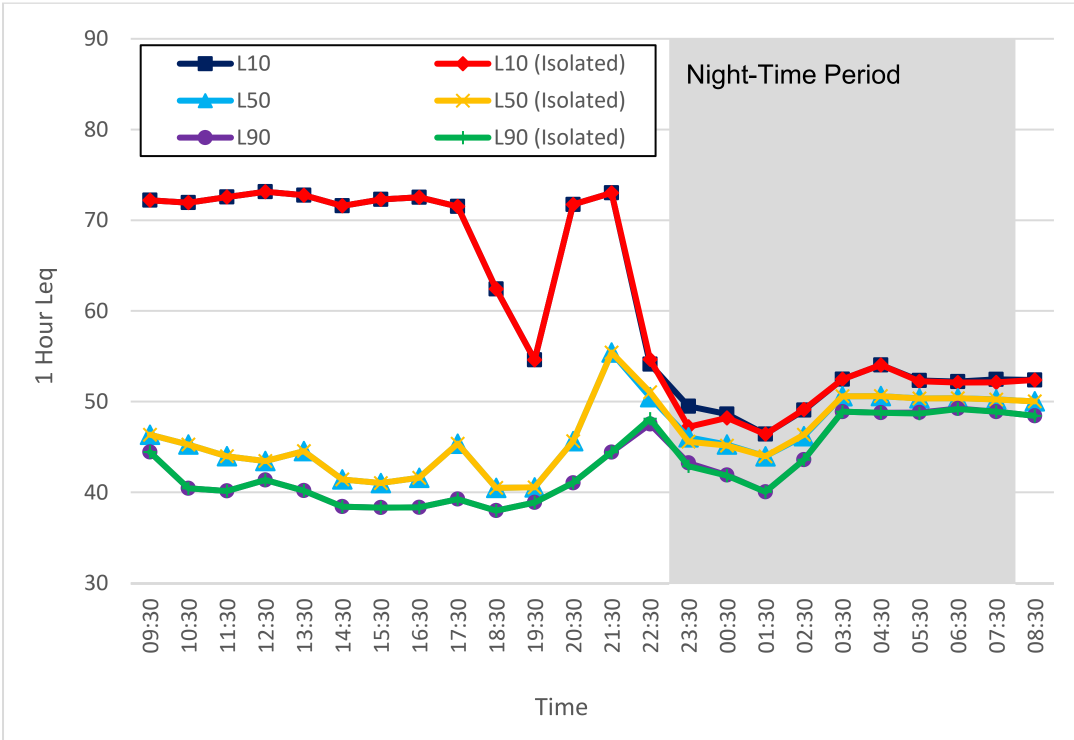

Figure 54. Noise Monitor #6, 1-Hour L_{10}, L_{50}, L_{90} L_{eq} Sound Levels (July 27 - 28, 2017)[1]

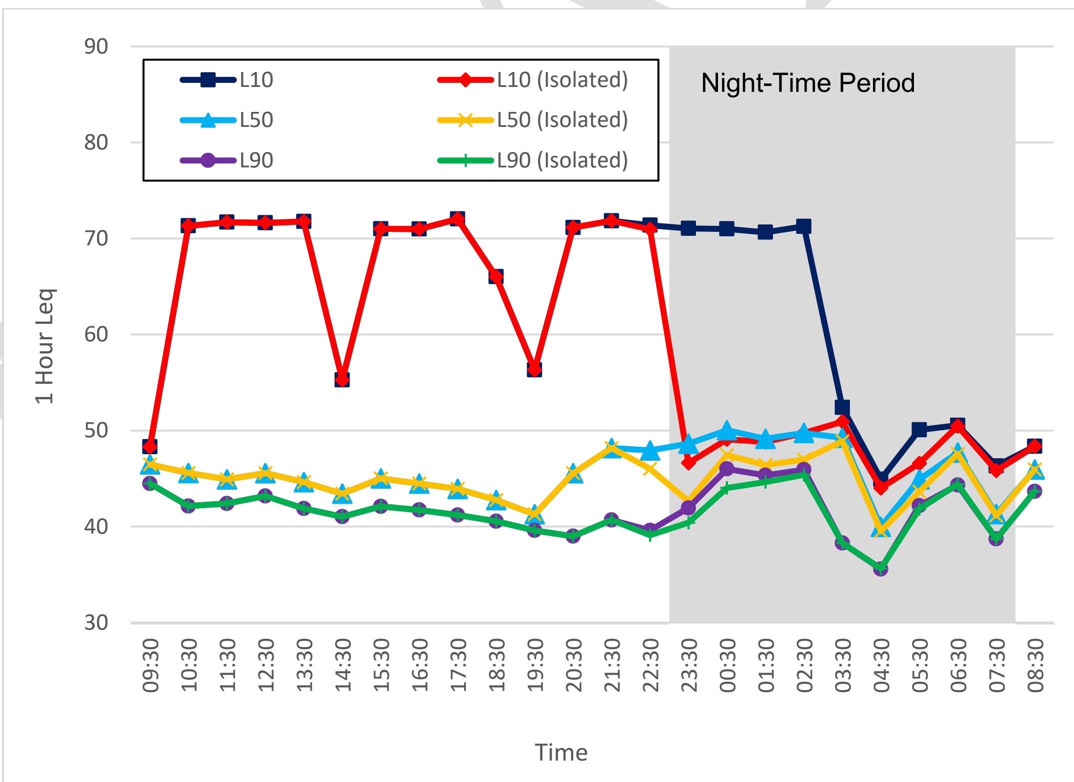

Figure 55. Noise Monitor #6, 1-Hour L_{10}, L_{50}, L_{90} L_{eq} Sound Levels (July 28 - 29, 2017)

[1] Data from 22:00 to 22:59 was entirely removed due to the influence of a storm in the nearby area.

Noise Monitor #6

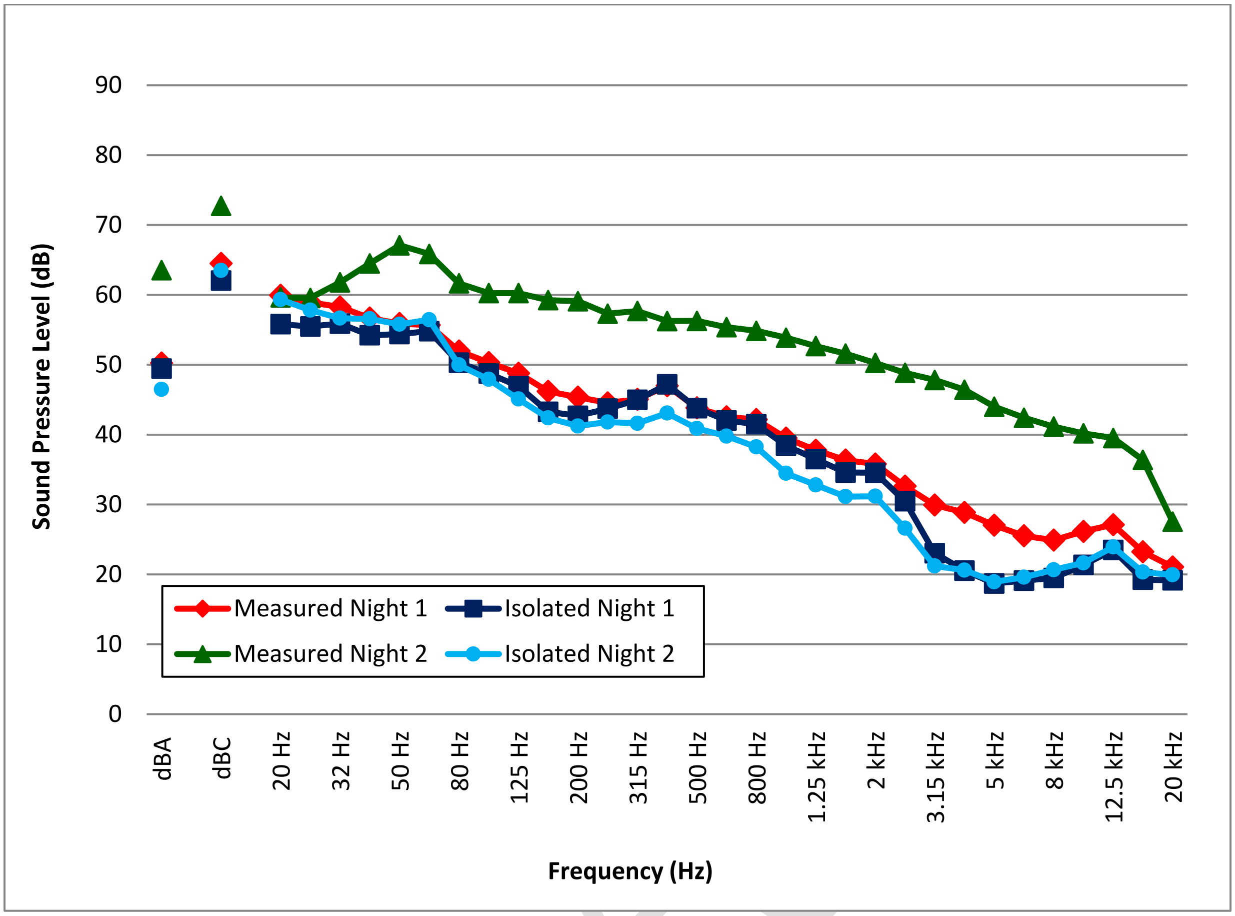

Figure 56. Noise Monitor #6, 1/3 Octave L_{eq} Sound Levels (July 27 - 29, 2017)

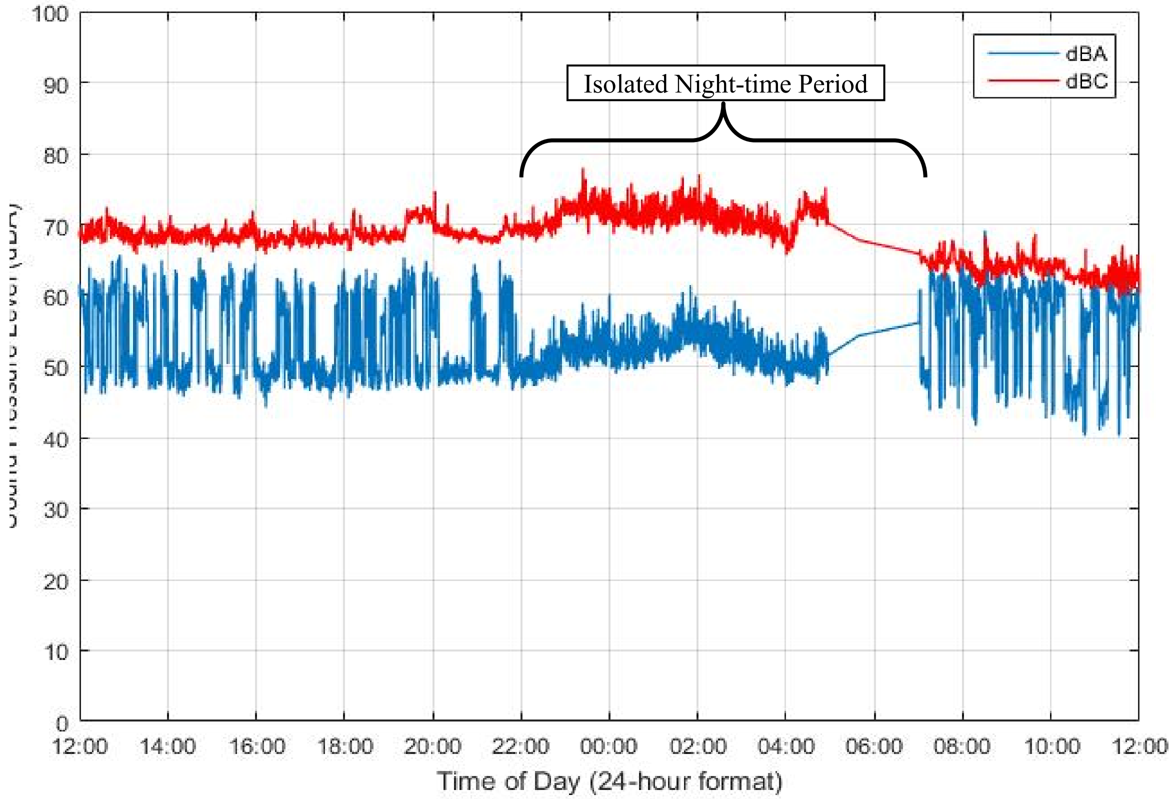

Figure 57. Noise Monitor #8, 15-Second L_{eq} Sound Levels (July 29 - 30, 2017)

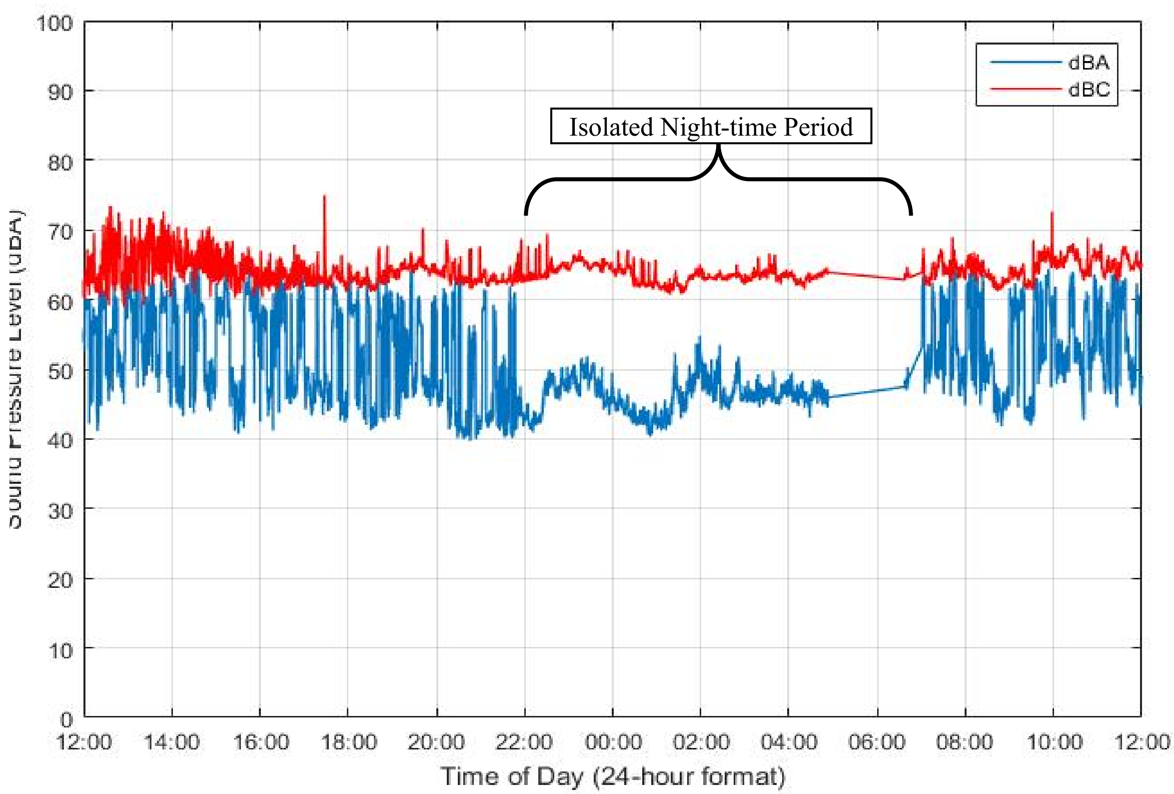

Figure 58. Noise Monitor #8, 15-Second L_{eq} Sound Levels (July 30 - 31, 2017)

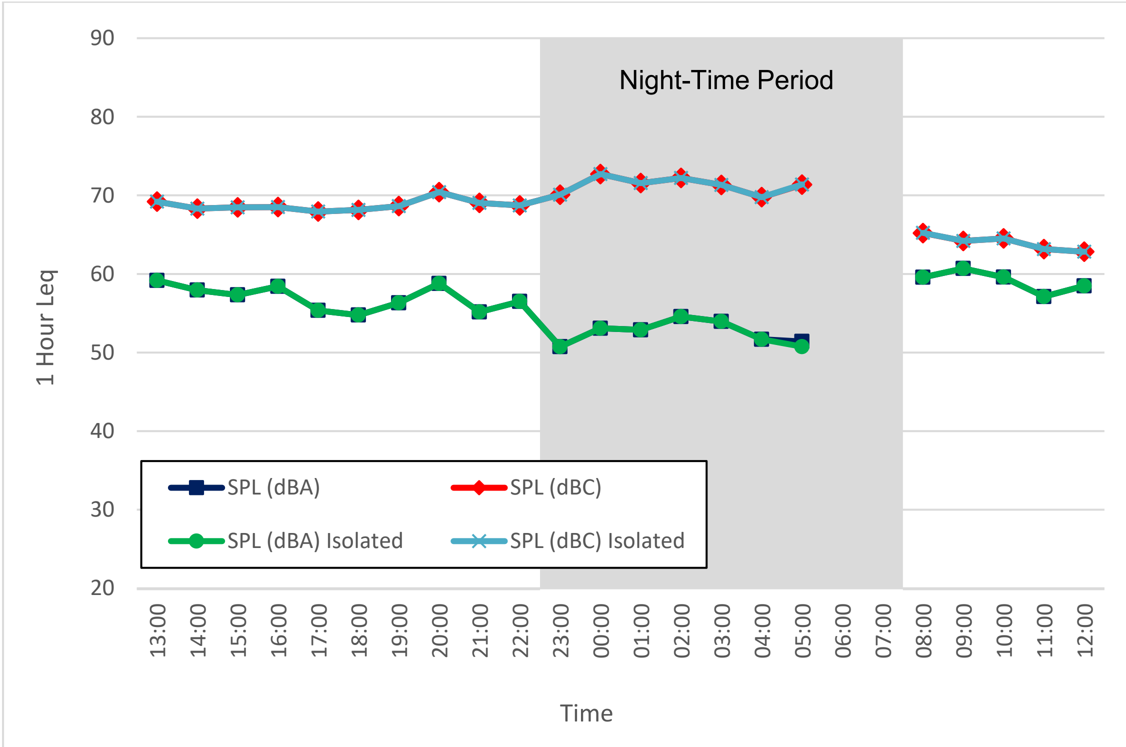

Figure 59. Noise Monitor #8, 1-Hour L_{eq} Sound Levels (July 29 - 30, 2017)[1]

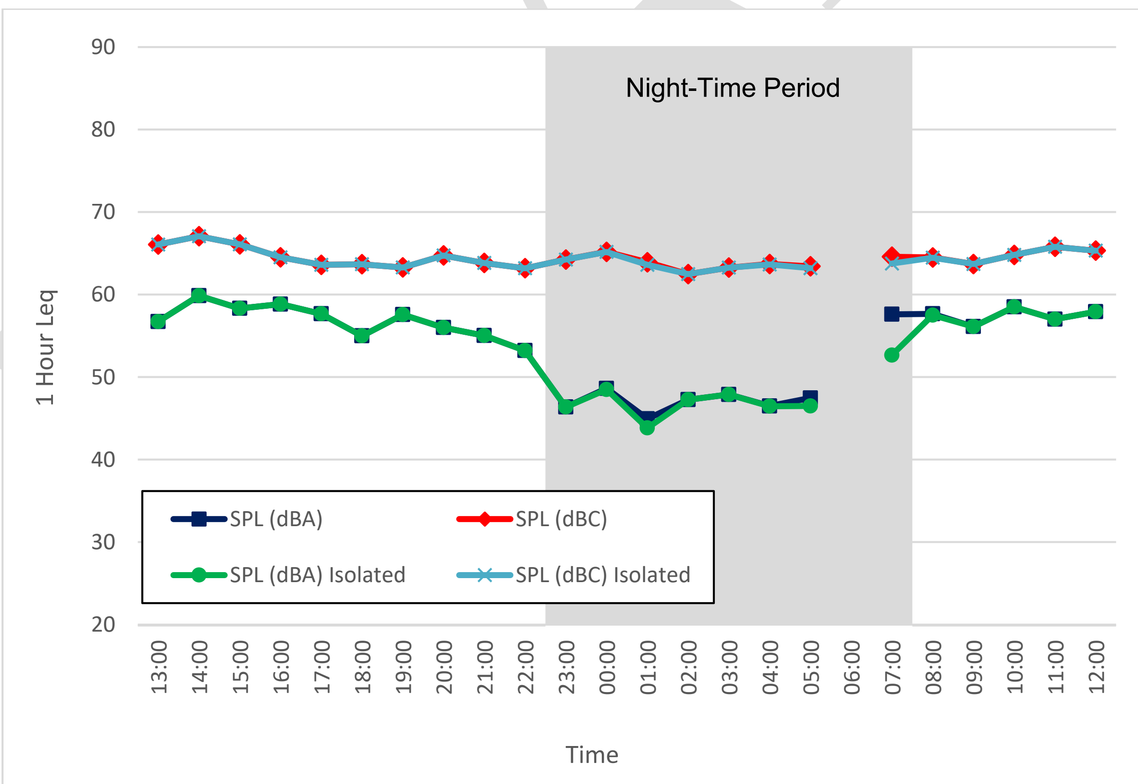

Figure 60. Noise Monitor #8, 1-Hour L_{eq} Sound Levels (July 30 - 31, 2017)[2]

[1] Data from 04:58 to 07:00 was entirely removed due to contributions from birds (morning chorus).
[2] Data from 04:53 to 07:00 was almost entirely removed due to contributions from birds (morning chorus).

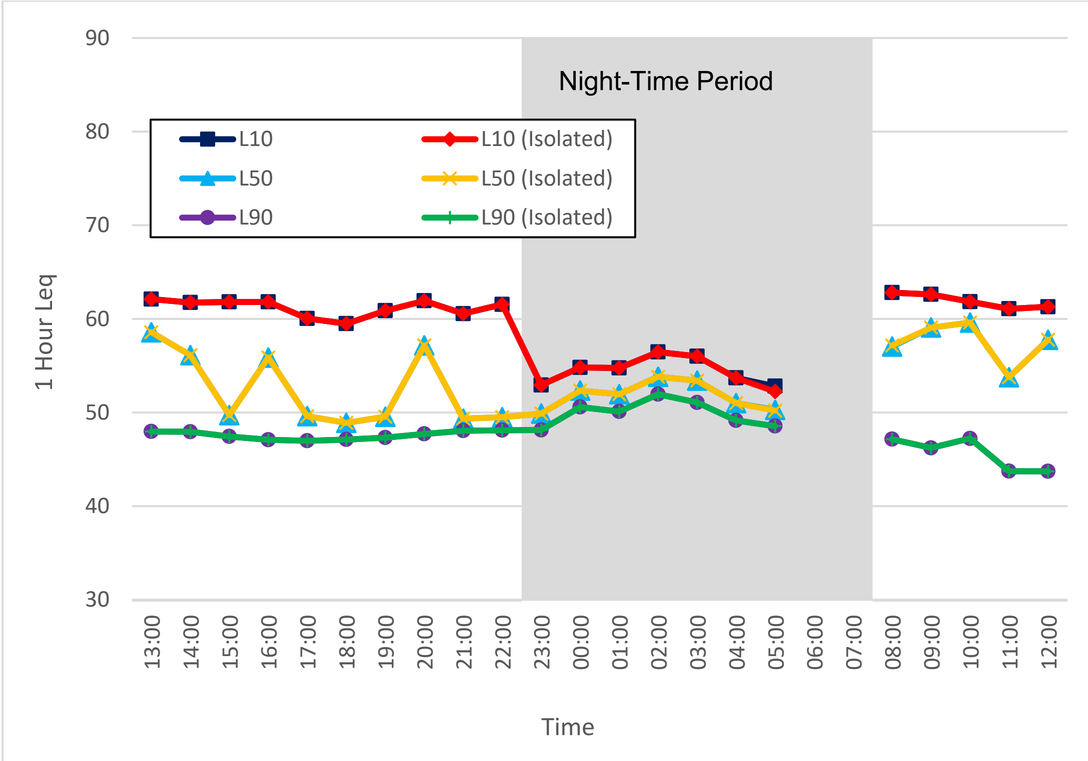

Figure 61. Noise Monitor #8, 1-Hour L_{10}, L_{50}, L_{90} L_{eq} Sound Levels (July 29 - 30, 2017)[1]

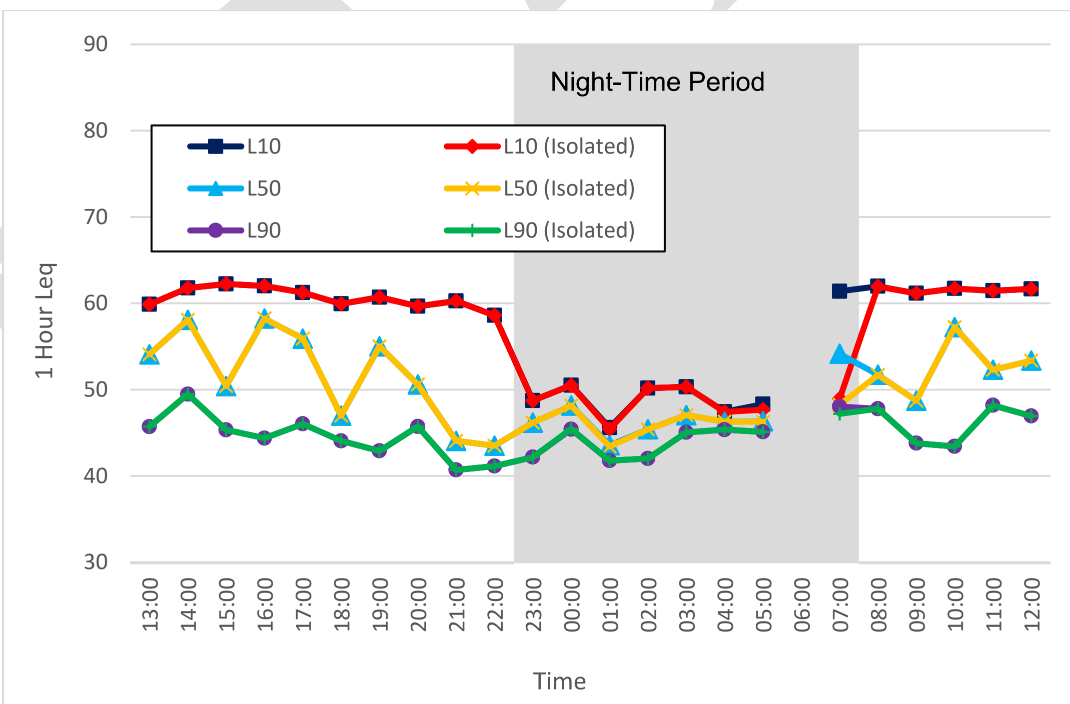

Figure 62. Noise Monitor #8, 1-Hour L_{10}, L_{50}, L_{90} L_{eq} Sound Levels (July 30 - 31, 2017)[2]

[1] Data from 04:58 to 07:00 was entirely removed due to contributions from birds (morning chorus).
[2] Data from 04:53 to 07:00 was almost entirely removed due to contributions from birds (morning chorus).

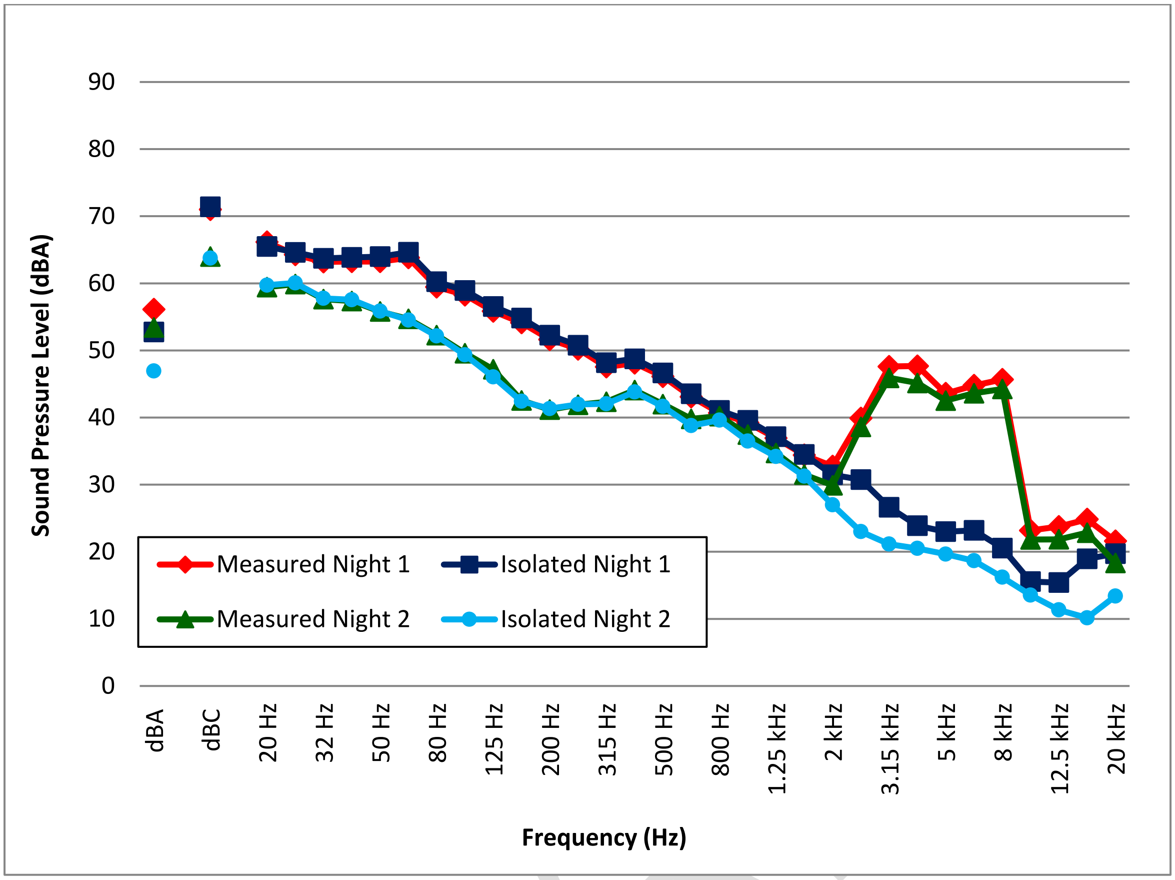

Figure 63. Noise Monitor #8, 1/3 Octave L_{eq} Sound Levels (July 29 - 31, 2017)

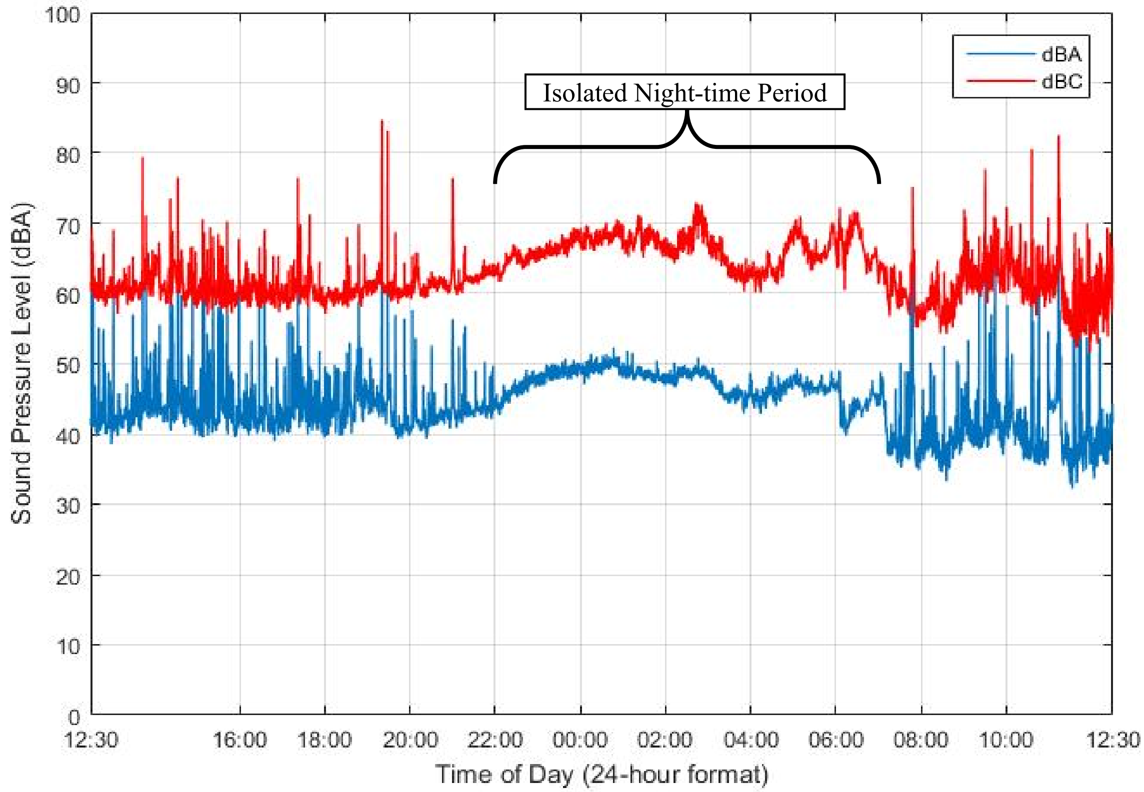

Figure 64. Noise Monitor #9, 15-Second L_{eq} Sound Levels (July 29 - 30, 2017)

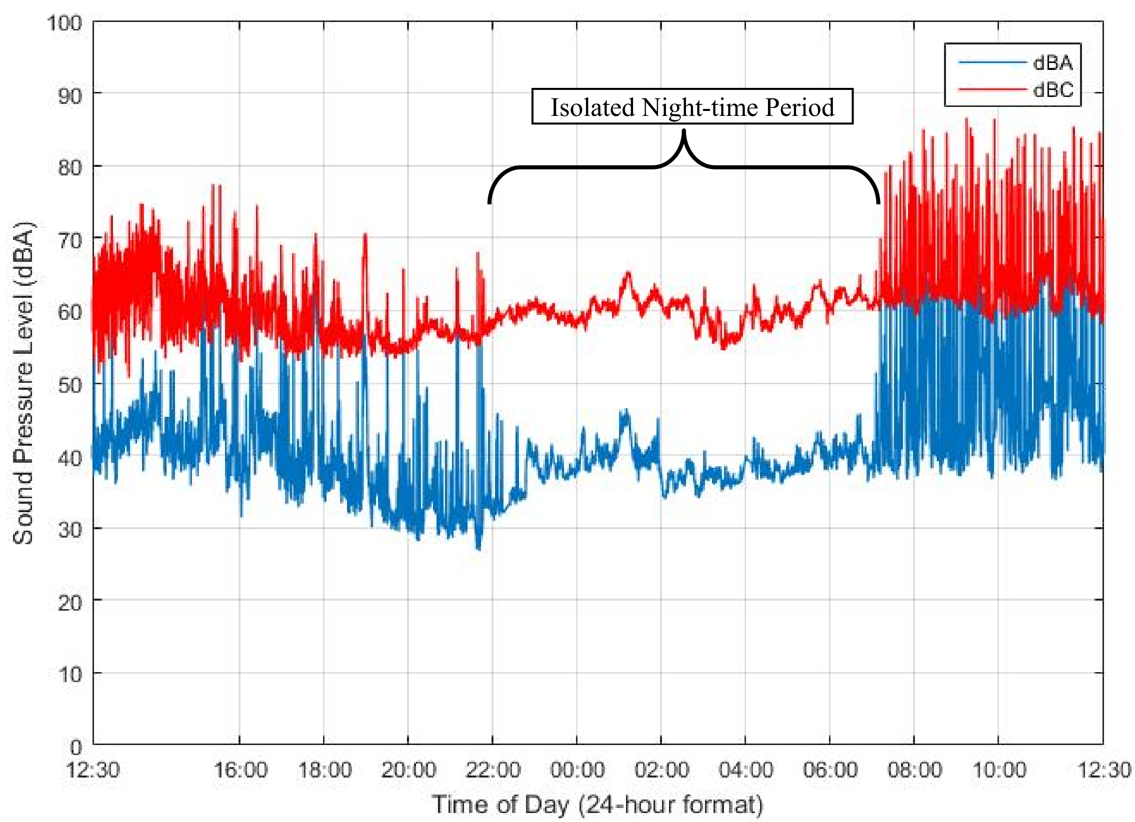

Figure 65. Noise Monitor #9, 15-Second L_{eq} Sound Levels (July 30 - 31, 2017)

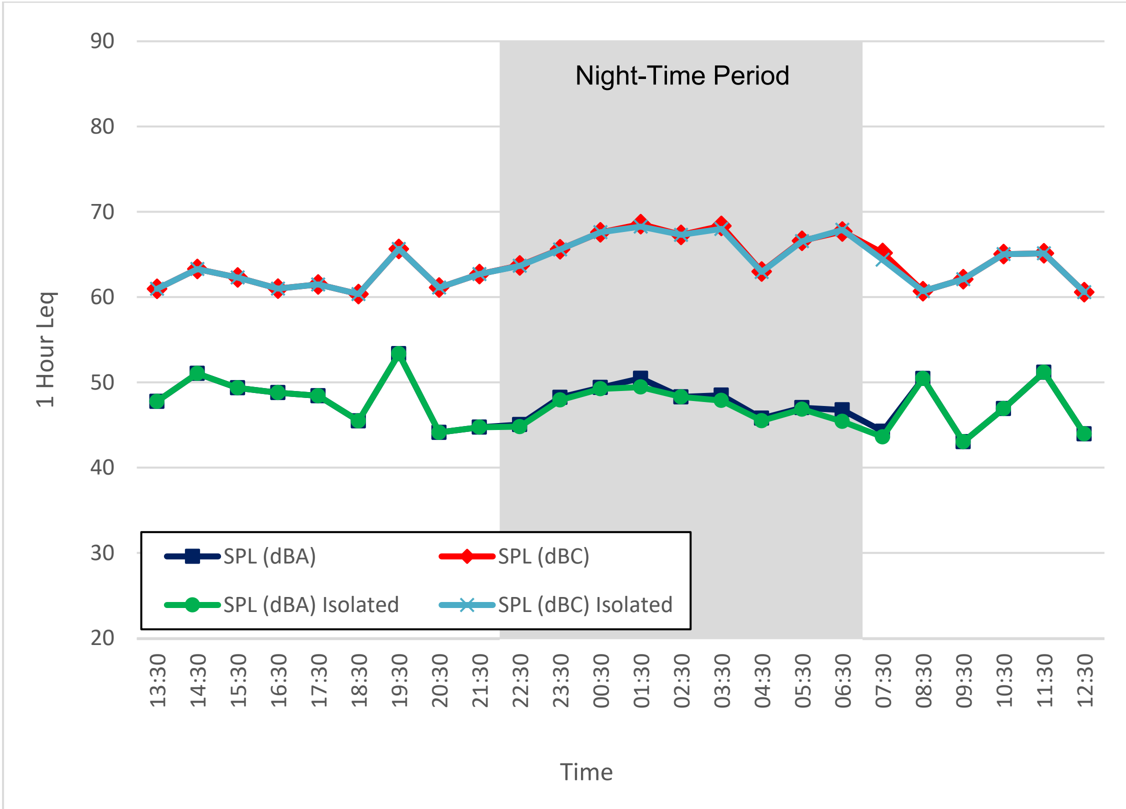

Figure 66. Noise Monitor #9, 1-Hour L_{eq} Sound Levels (July 29 - 30, 2017)

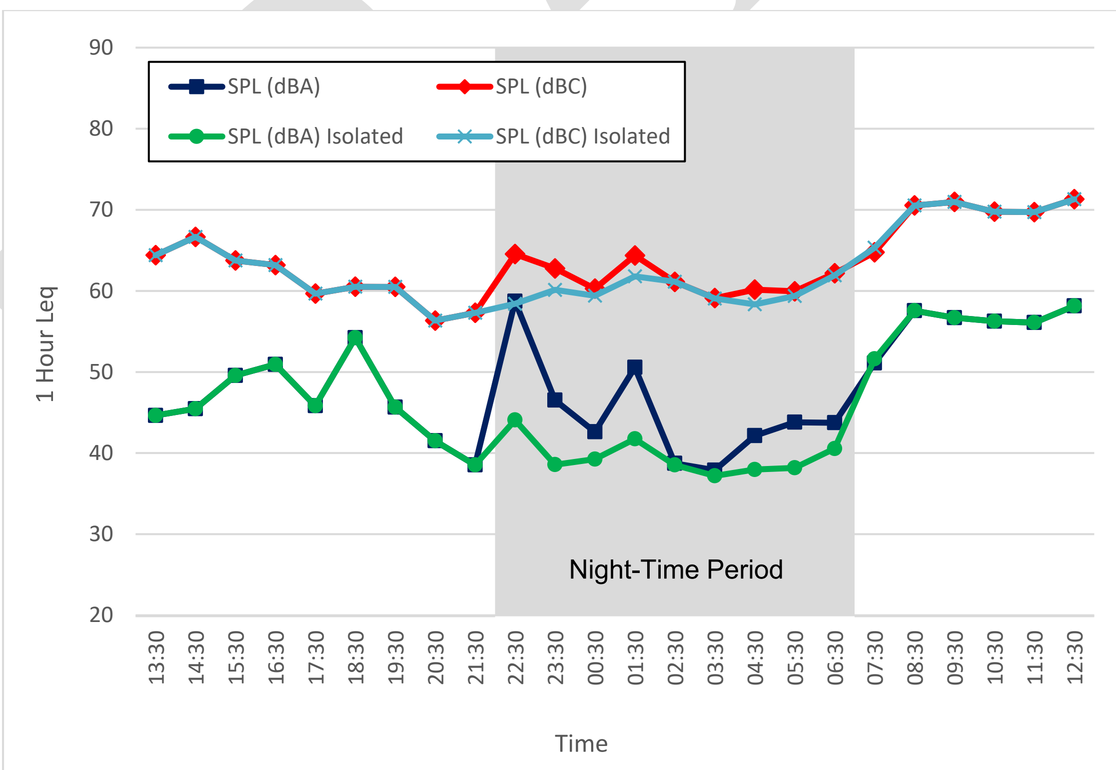

Figure 67. Noise Monitor #9, 1-Hour L_{eq} Sound Levels (July 30 - 31, 2017)

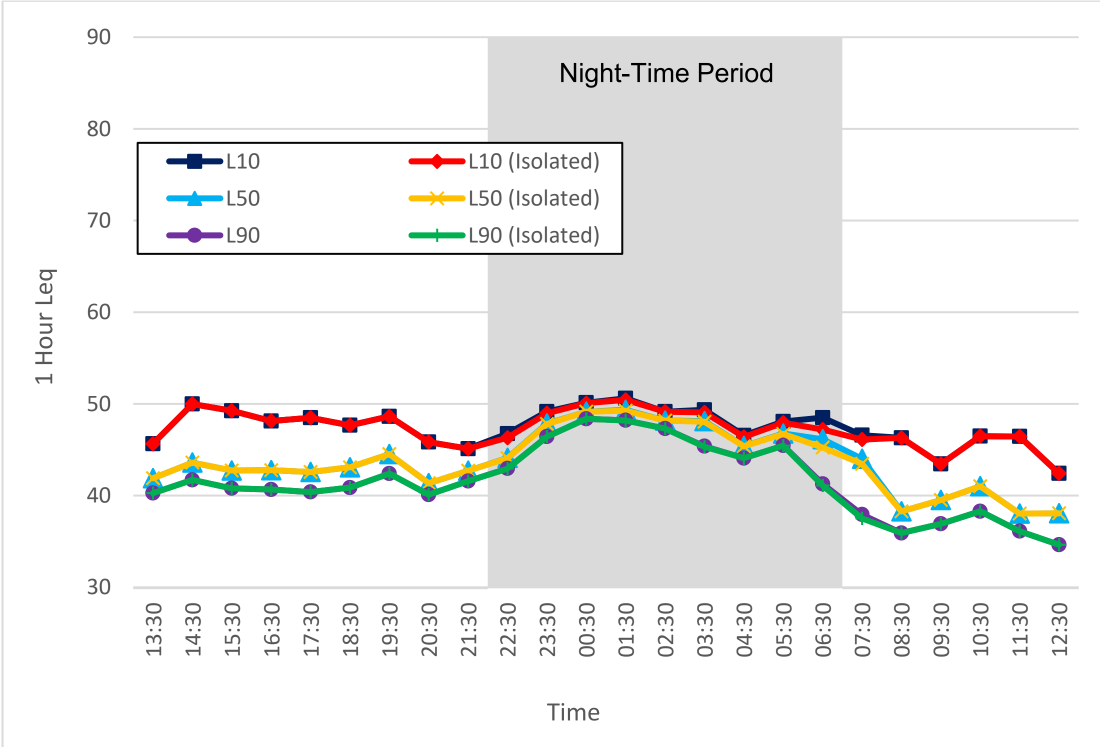

Figure 68. Noise Monitor #9, 1-Hour L_{10}, L_{50}, L_{90} L_{eq} Sound Levels (July 29 - 30, 2017)

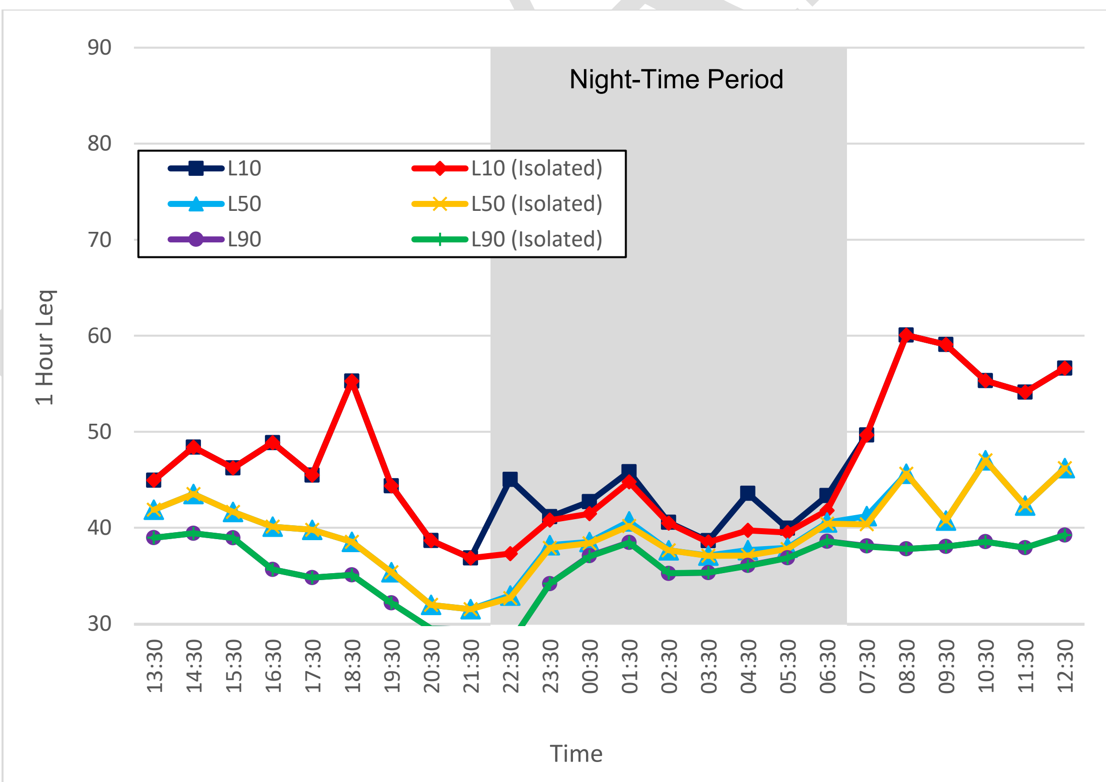

Figure 69. Noise Monitor #9, 1-Hour L_{10}, L_{50}, L_{90} L_{eq} Sound Levels (July 30 - 31, 2017)

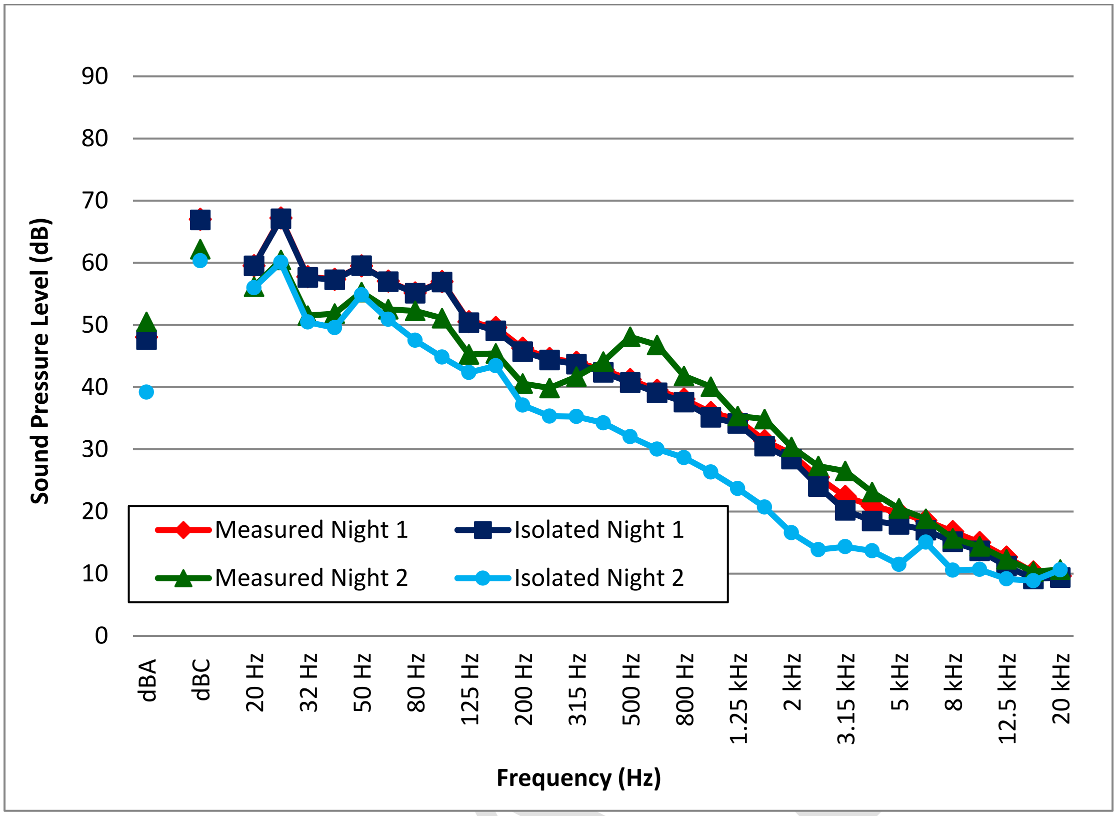

Figure 70. Noise Monitor #9, 1/3 Octave L_{eq} Sound Levels (July 29 - 31, 2017)

Noise Monitor #9

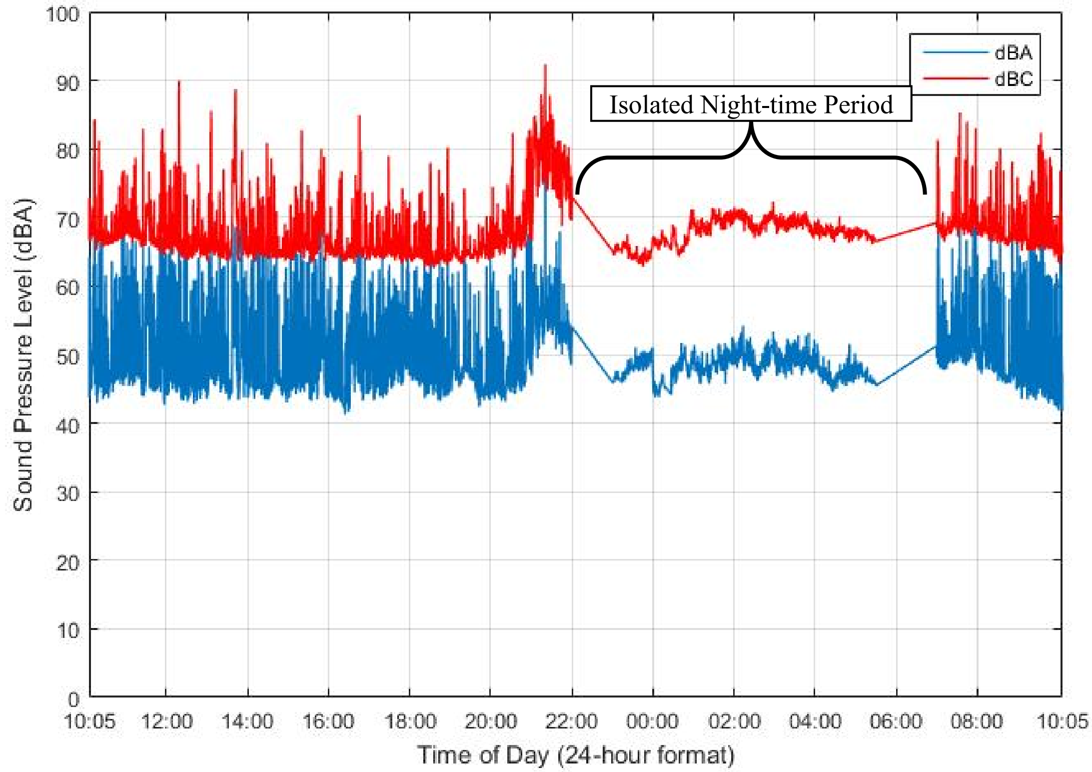

Figure 71. Noise Monitor #10, 15-Second L_{eq} Sound Levels (July 27 - 28, 2017)

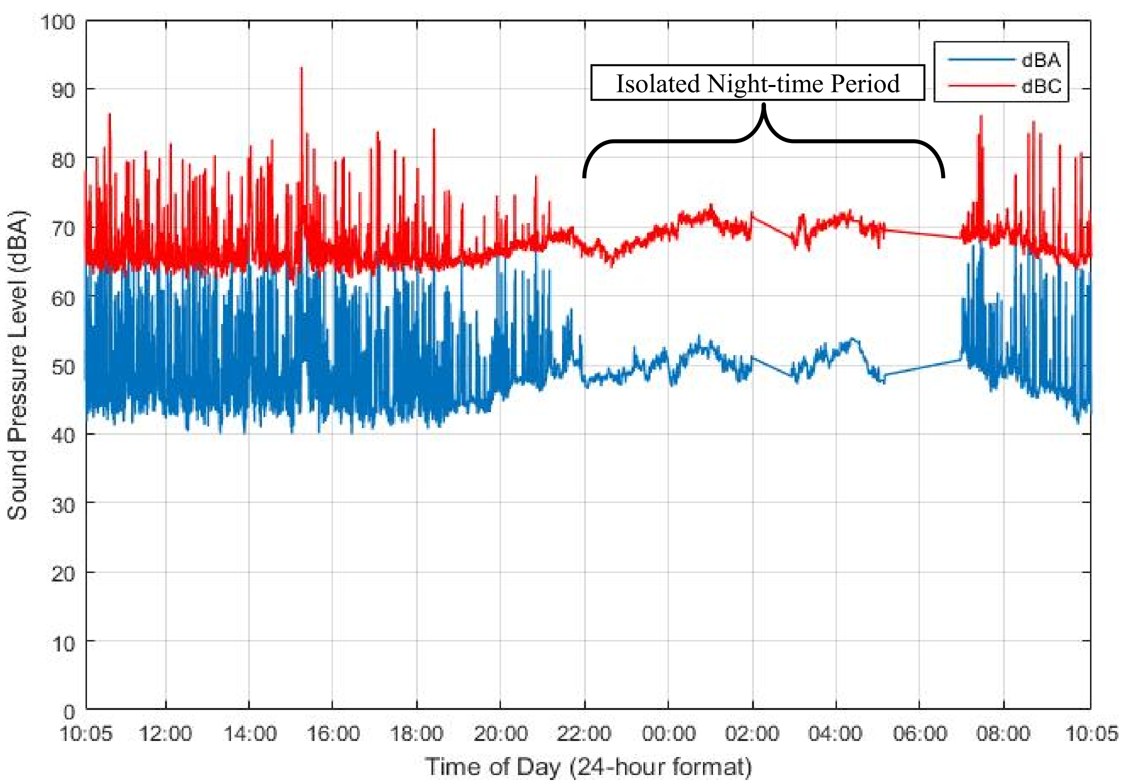

Figure 72. Noise Monitor #10, 15-Second L_{eq} Sound Levels (July 28 - 29, 2017)

Noise Monitor #10

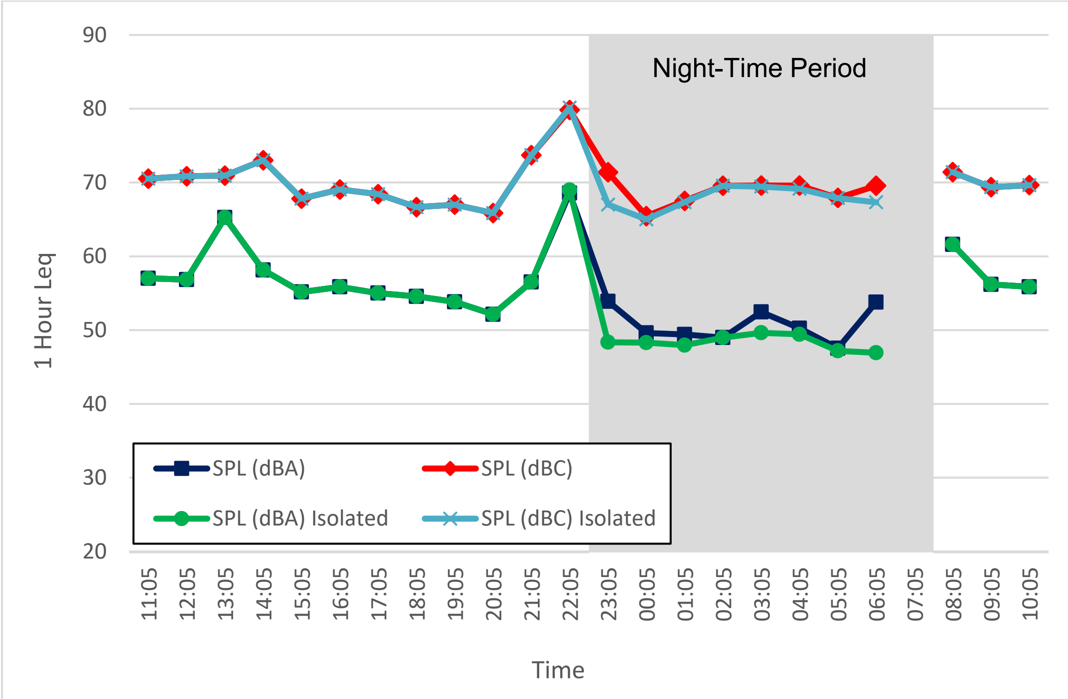

Figure 73. Noise Monitor #10, 1-Hour L_{eq} Sound Levels (July 27 - 28, 2017)[1,2]

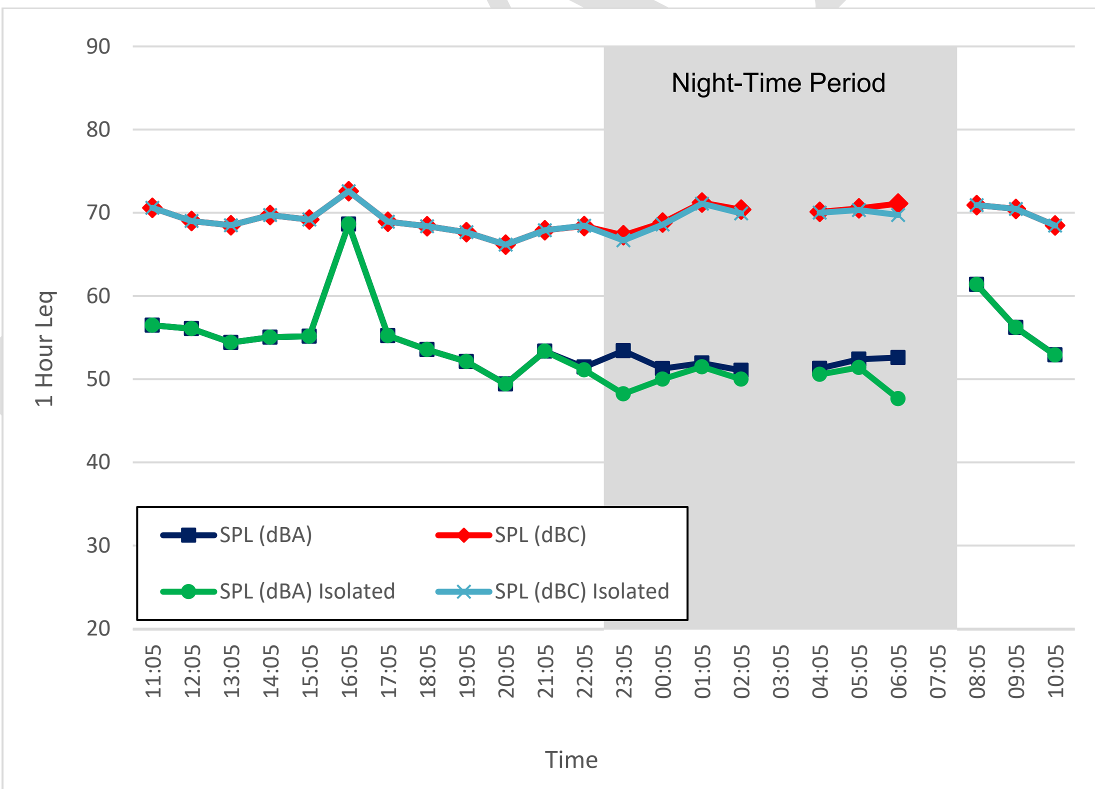

Figure 74. Noise Monitor #10, 1-Hour L_{eq} Sound Levels (July 28 - 29, 2017)[3]

[1] Data from 22:00 to 22:59 was entirely removed due to the influence of a storm in the nearby area.
[2] Data from 05:30 to 07:00 was entirely removed due to traffic along the adjacent road.
[3] Data from 05:10 to 07:00 was entirely removed due to traffic along the adjacent road.

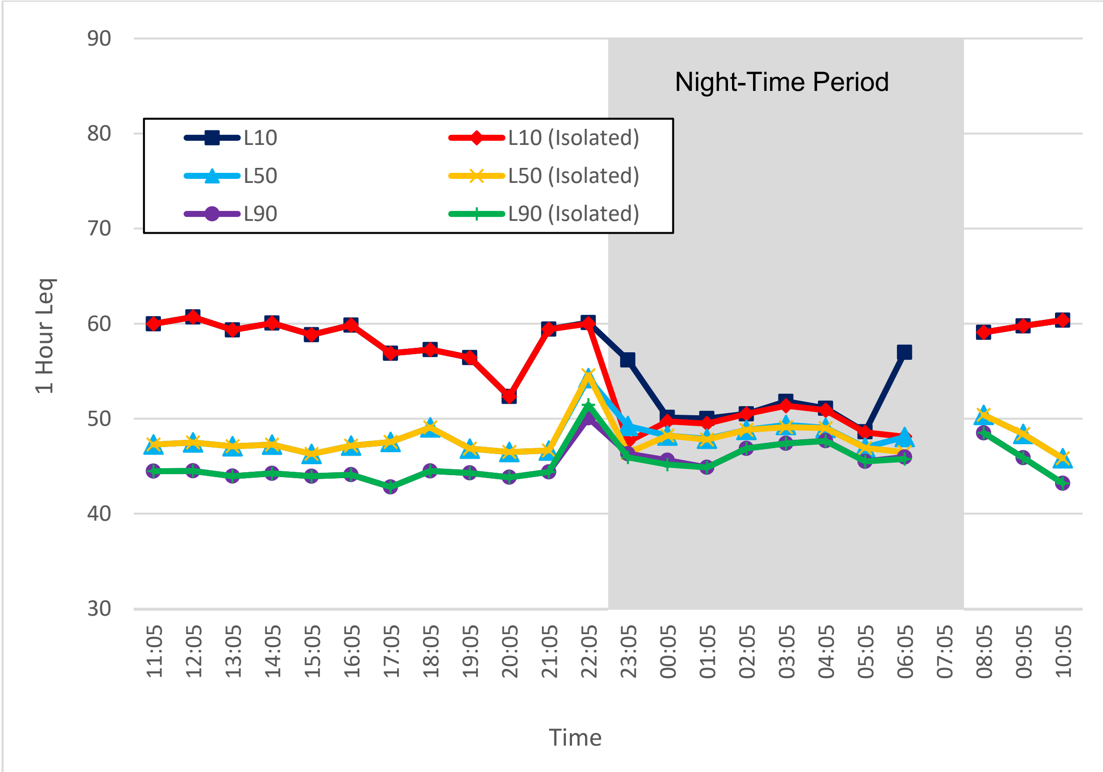

Figure 75. Noise Monitor #10, 1-Hour L_{10}, L_{50}, L_{90} L_{eq} Sound Levels (July 27 - 28, 2017)[1,2]

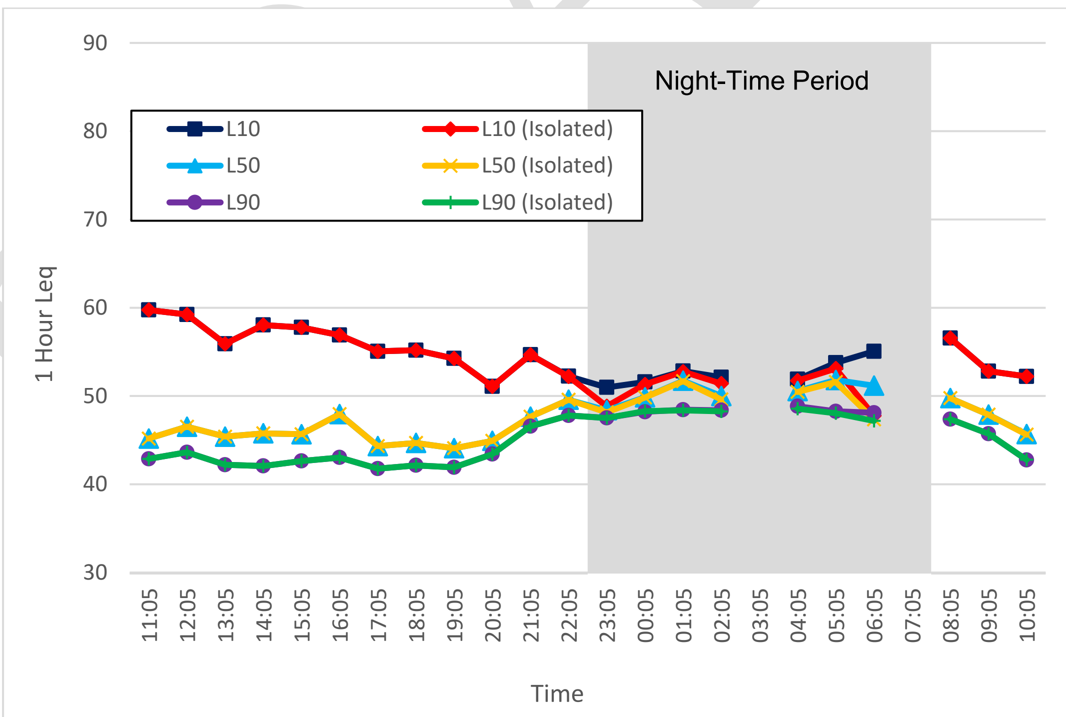

Figure 76. Noise Monitor #10, 1-Hour L_{10}, L_{50}, L_{90} L_{eq} Sound Levels (July 28 - 29, 2017)[3]

[1] Data from 22:00 to 22:59 was entirely removed due to the influence of a storm in the nearby area.
[2] Data from 05:30 to 07:00 was entirely removed due to traffic along the adjacent road.
[3] Data from 05:10 to 07:00 was entirely removed due to traffic along the adjacent road.

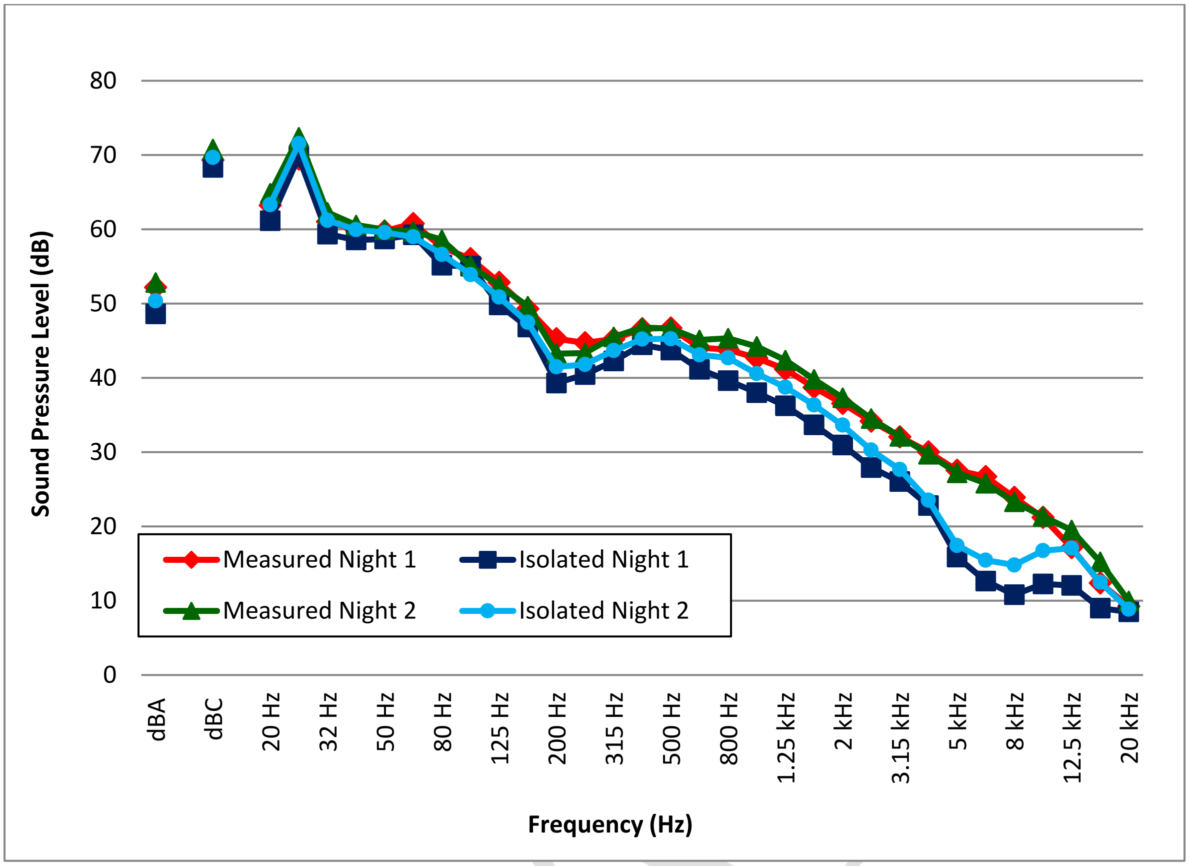

Figure 77. Noise Monitor #10, 1/3 Octave L_{eq} Sound Levels (July 27 - 29, 2017)

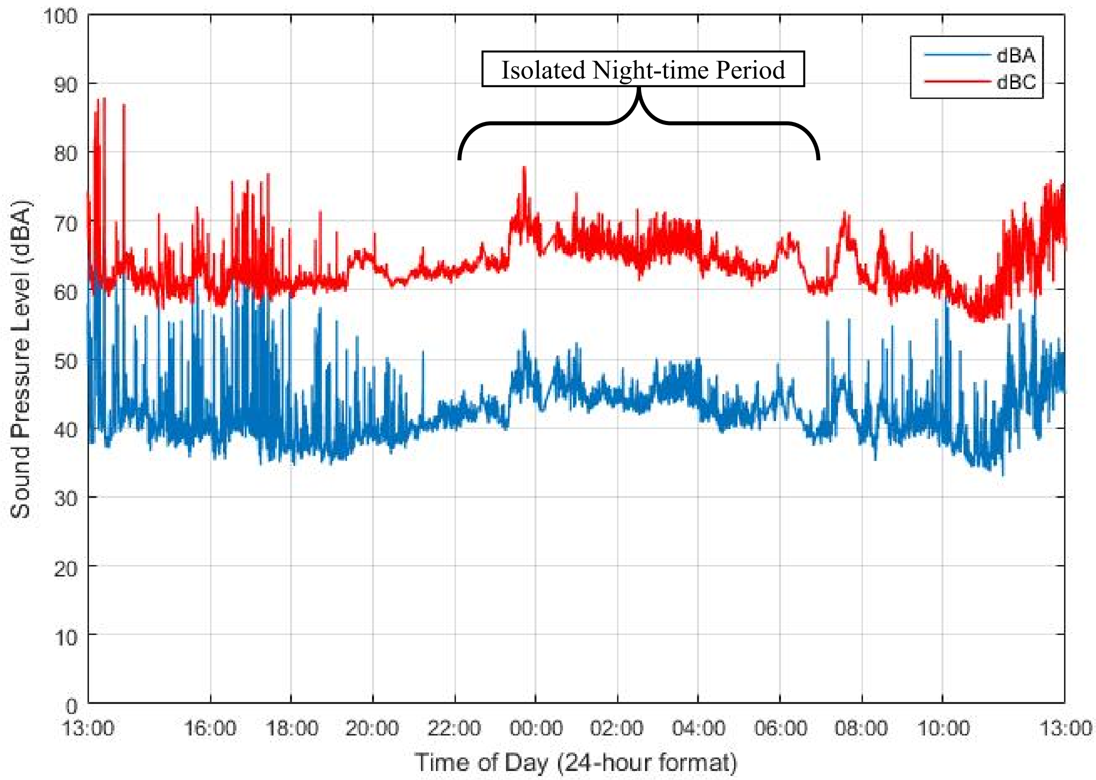

Figure 78. Noise Monitor #11, 15-Second L_{eq} Sound Levels (July 29 - 30, 2017)

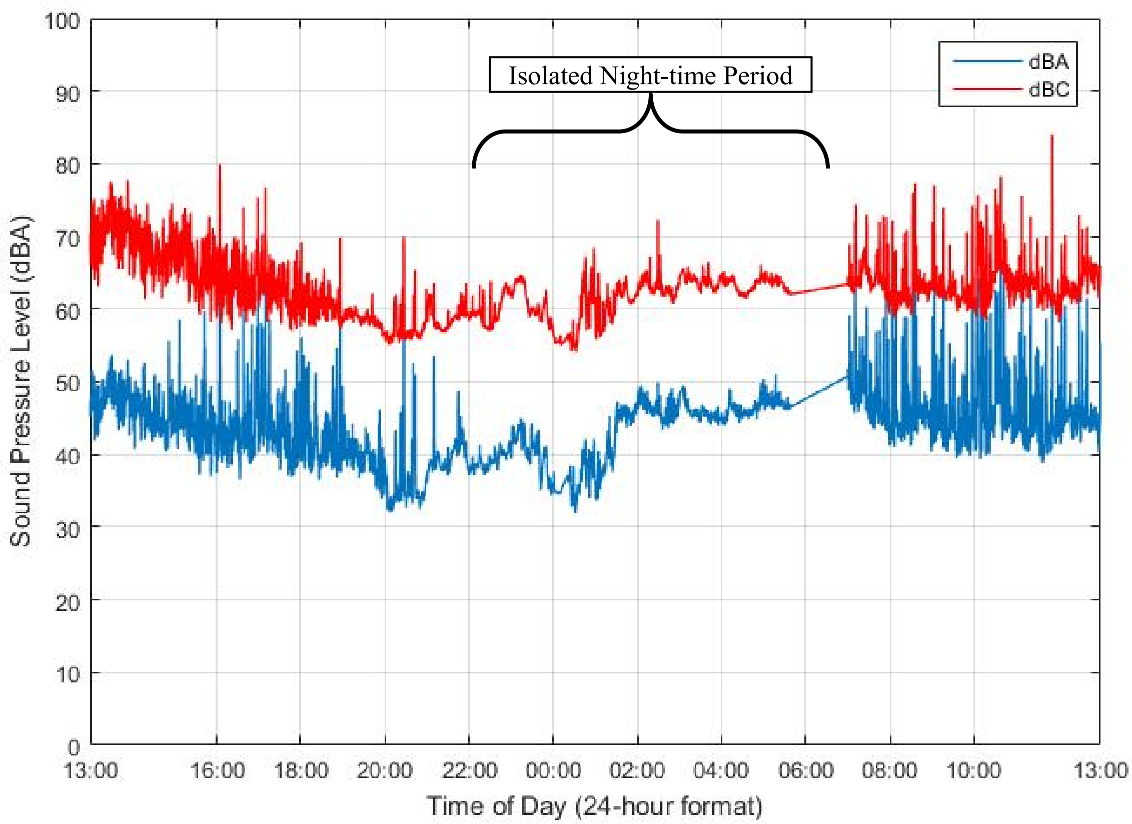

Figure 79. Noise Monitor #11, 15-Second L_{eq} Sound Levels (July 30 - 31, 2017)

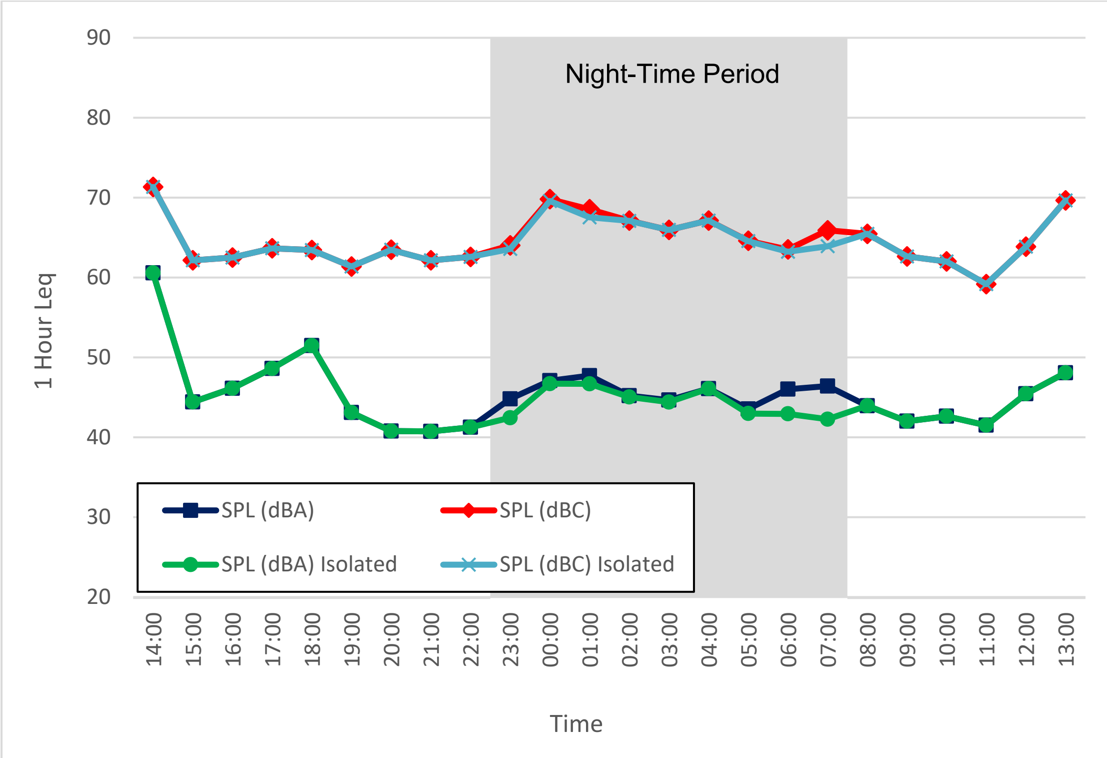

Figure 80. Noise Monitor #11, 1-Hour L_{eq} Sound Levels (July 29 - 30, 2017)

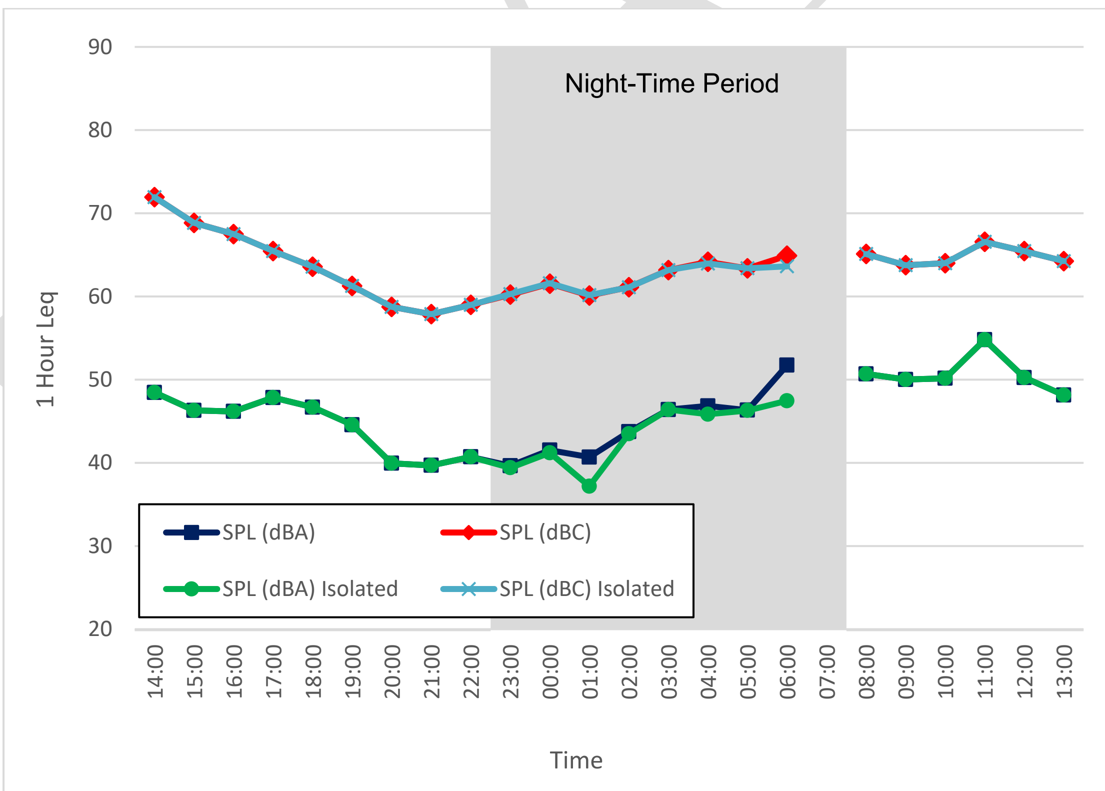

Figure 81. Noise Monitor #11, 1-Hour L_{eq} Sound Levels (July 30 - 31, 2017)[1]

[1] Data from 05:38 to 07:00 was entirely removed due to traffic along the adjacent road.

Noise Monitor #11

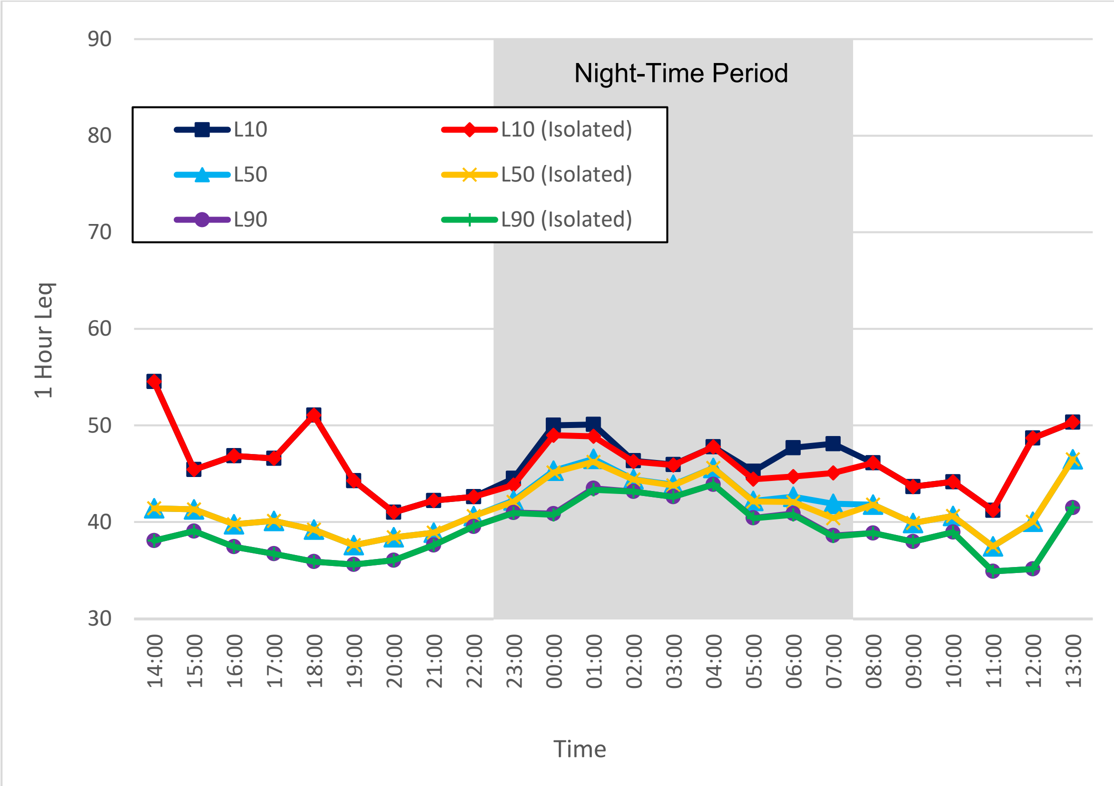

Figure 82. Noise Monitor #11, 1-Hour L_{10}, L_{50}, L_{90} L_{eq} Sound Levels (July 29 - 30, 2017)

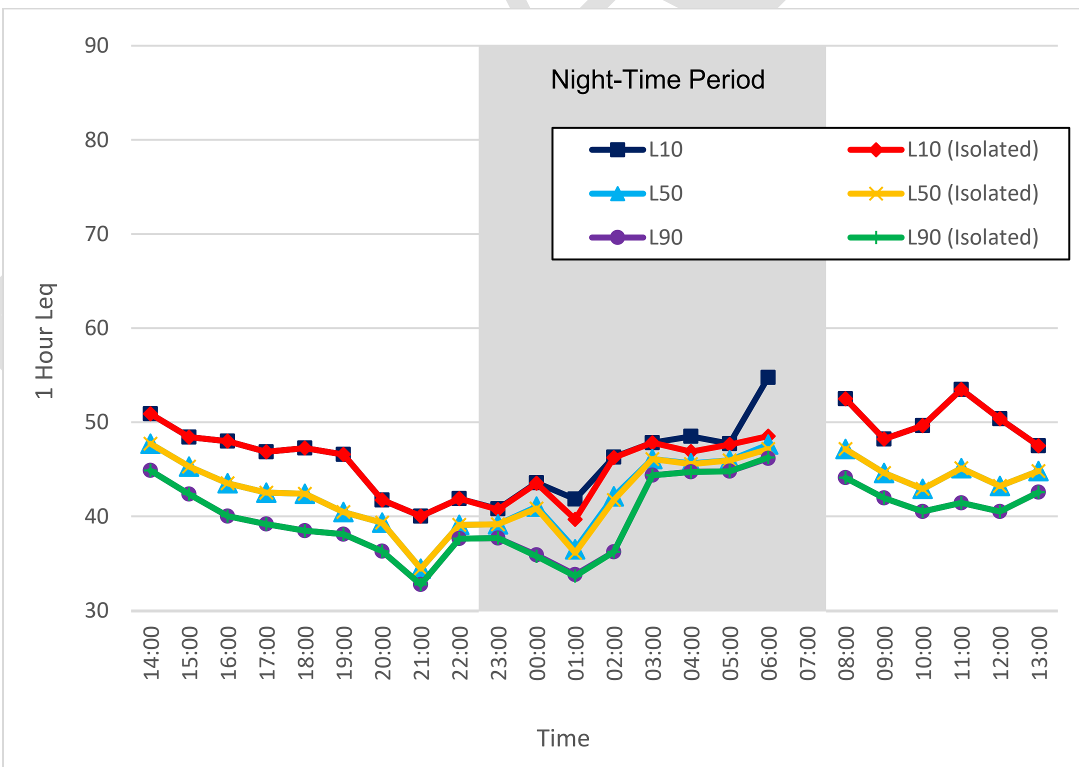

Figure 83. Noise Monitor #11, 1-Hour L_{10}, L_{50}, L_{90} L_{eq} Sound Levels (July 30 - 31, 2017) [1]

[1] Data from 05:38 to 07:00 was entirely removed due to traffic along the adjacent road.

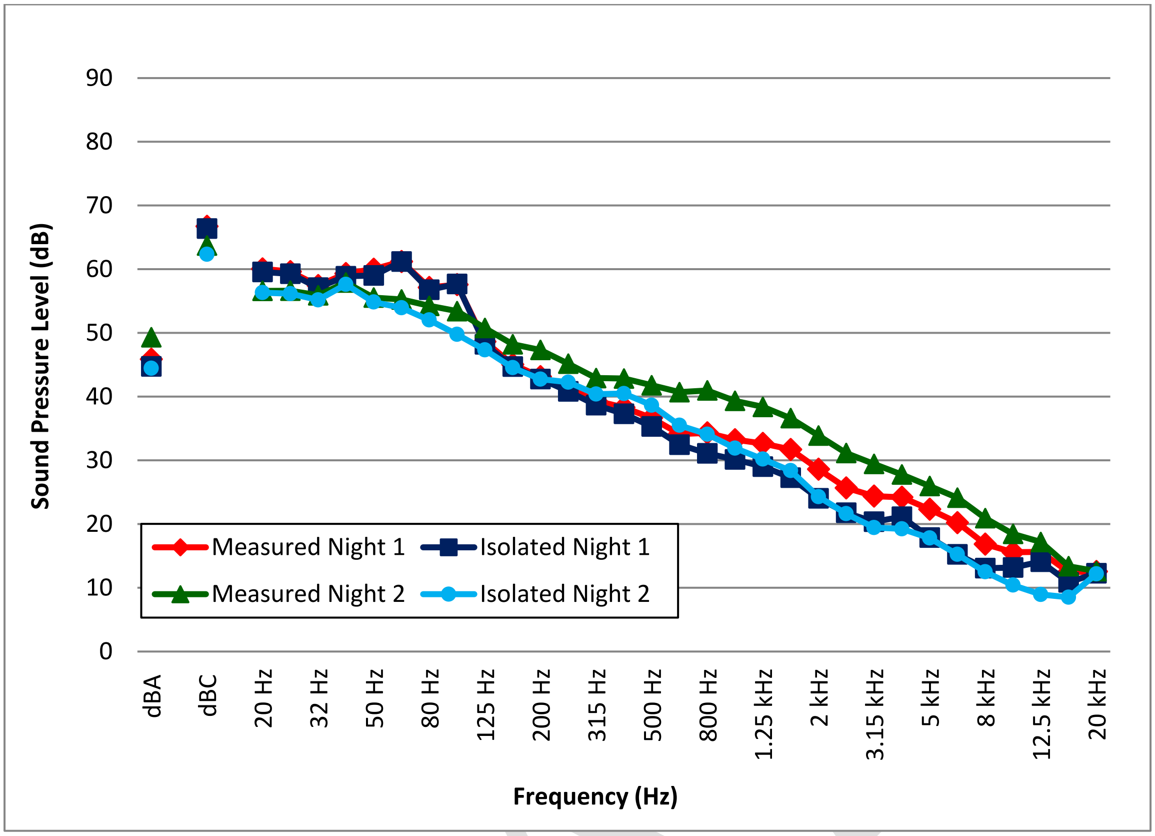

Figure 84. Noise Monitor #11, 1/3 Octave L_{eq} Sound Levels (July 29 - 31, 2017)

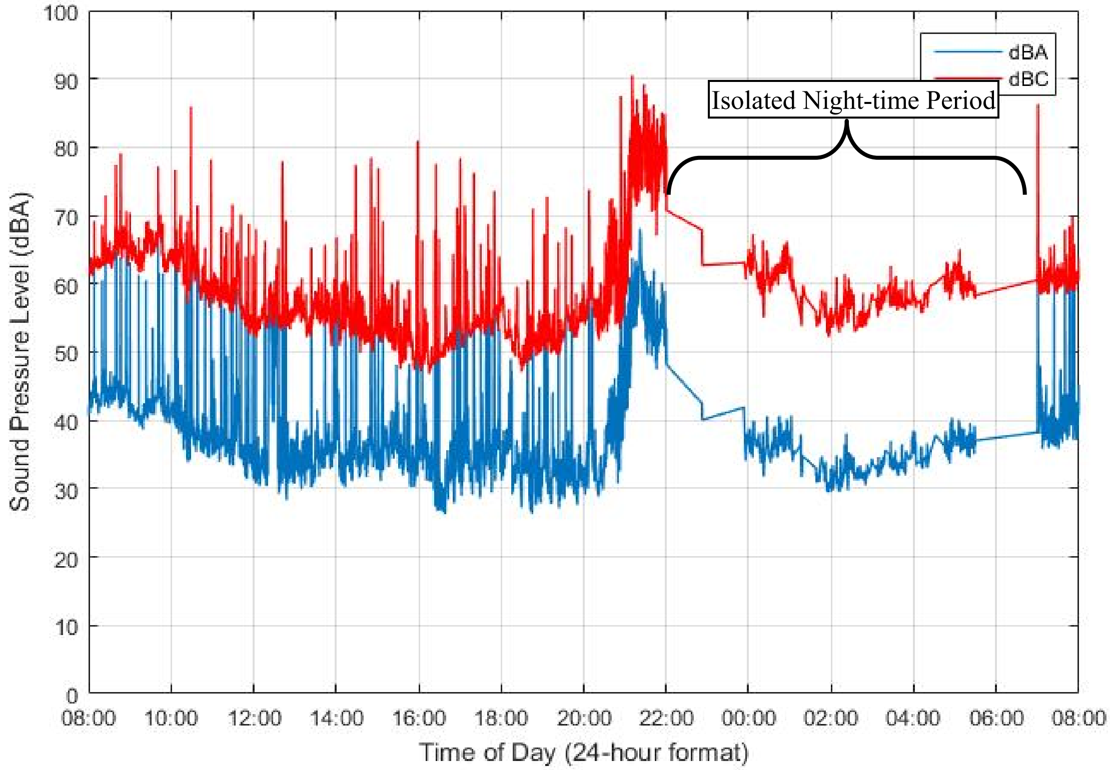

Figure 85. Noise Monitor #12, 15-Second L_{eq} Sound Levels (July 27 - 28, 2017)

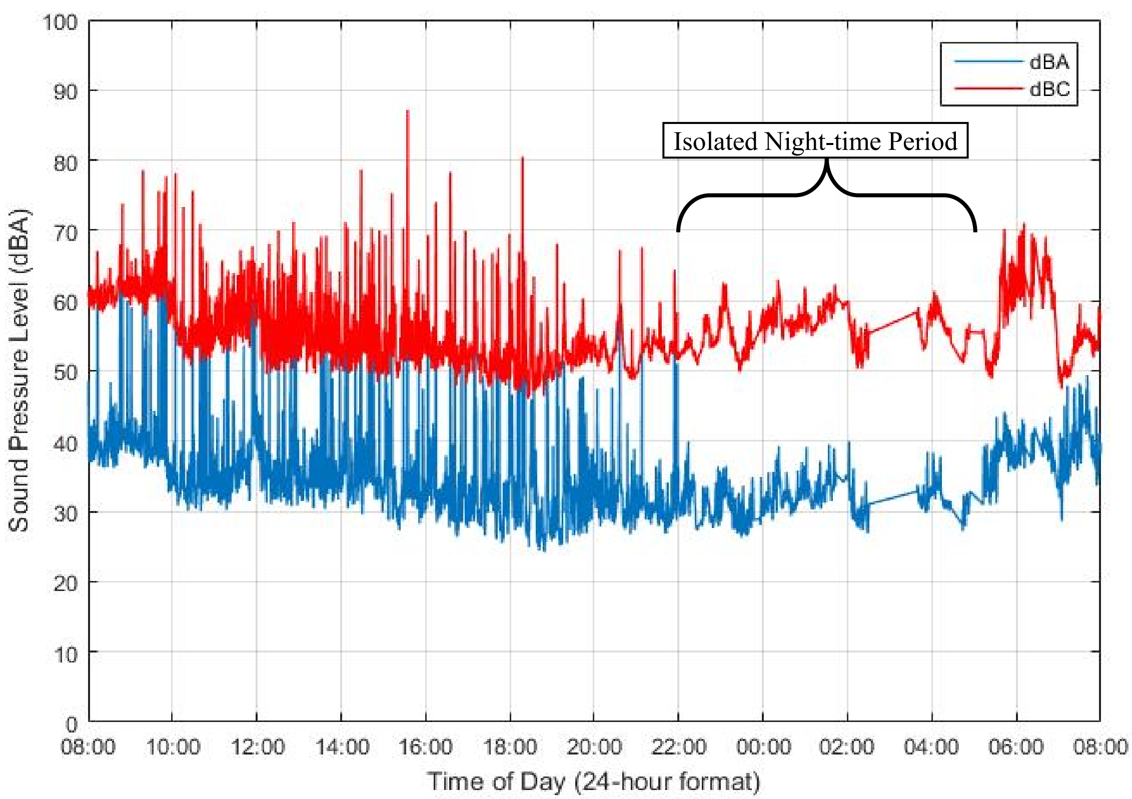

Figure 86. Noise Monitor #12, 15-Second L_{eq} Sound Levels (July 28 - 29, 2017)

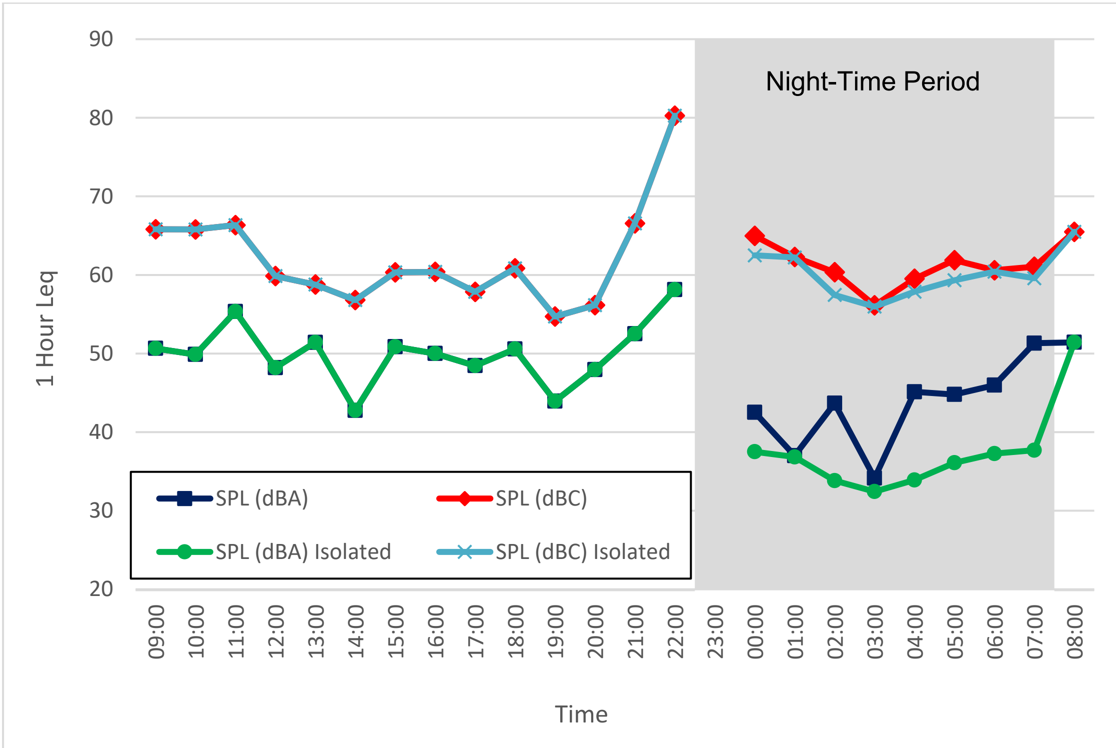

Figure 87. Noise Monitor #12, 1-Hour L_{eq} Sound Levels (July 27 - 28, 2017) [1,2]

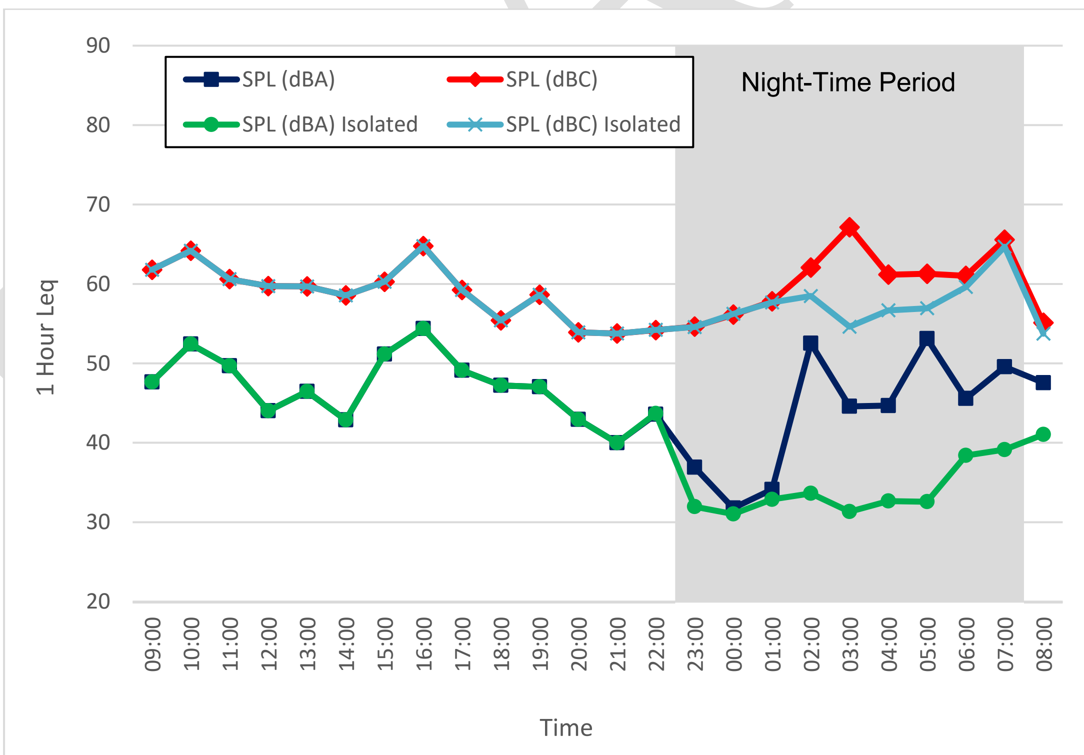

Figure 88. Noise Monitor #12, 1-Hour L_{eq} Sound Levels (July 28 - 29, 2017) [3]

[1] Data from 22:00 to 23:54 was entirely removed due to the influence of a storm in the nearby area.
[2] Data from 05:30 to 07:00 was entirely removed due to traffic along the adjacent road.
[3] Data from 02:31 to 07:00 was entirely removed due to excessive winds.

Noise Monitor #12 - Period 1

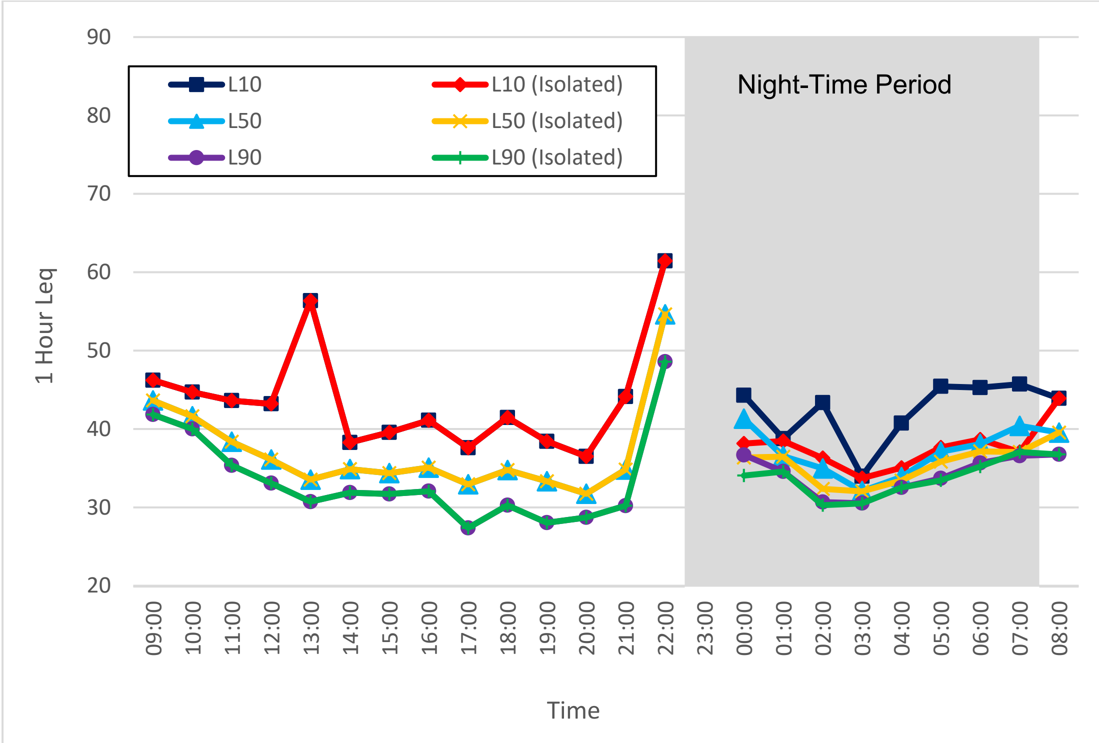

Figure 89. Noise Monitor #12, 1-Hour L_{10}, L_{50}, L_{90} L_{eq} Sound Levels (July 27 - 28, 2017) [1,2]

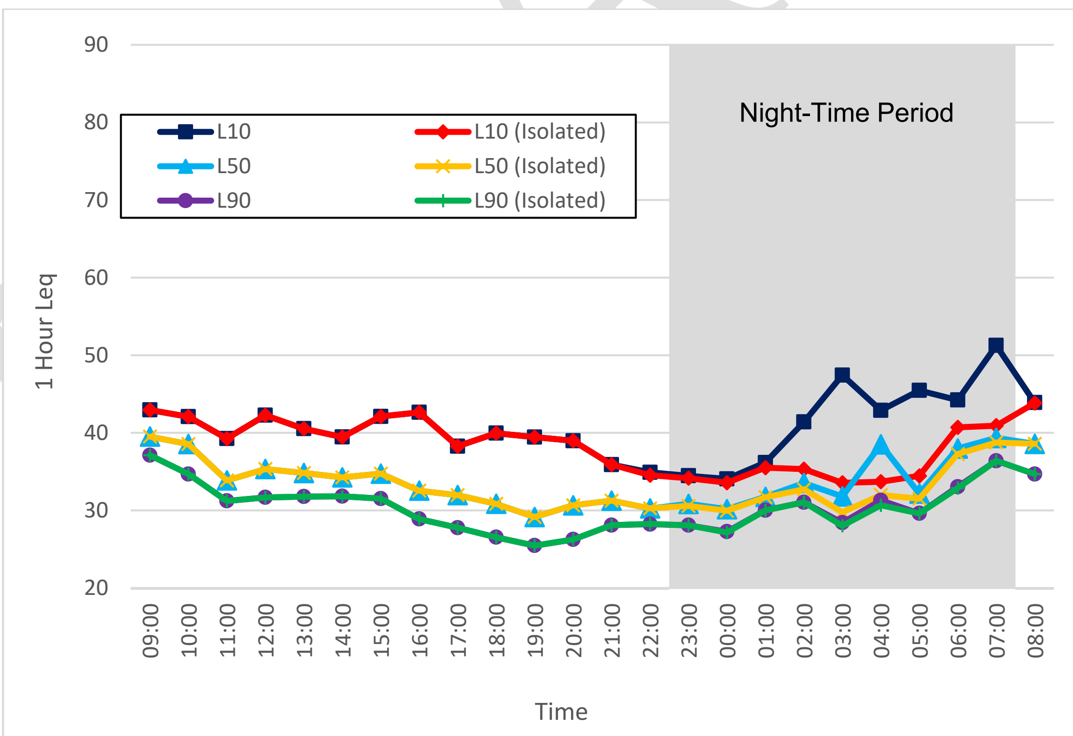

Figure 90. Noise Monitor #12, 1-Hour L_{10}, L_{50}, L_{90} L_{eq} Sound Levels (July 28 - 29, 2017) [3]

[1] Data from 22:00 to 23:54 was entirely removed due to the influence of a storm in the nearby area.
[2] Data from 05:30 to 07:00 was entirely removed due to traffic along the adjacent road.
[3] Data from 02:31 to 07:00 was entirely removed due to excessive winds.

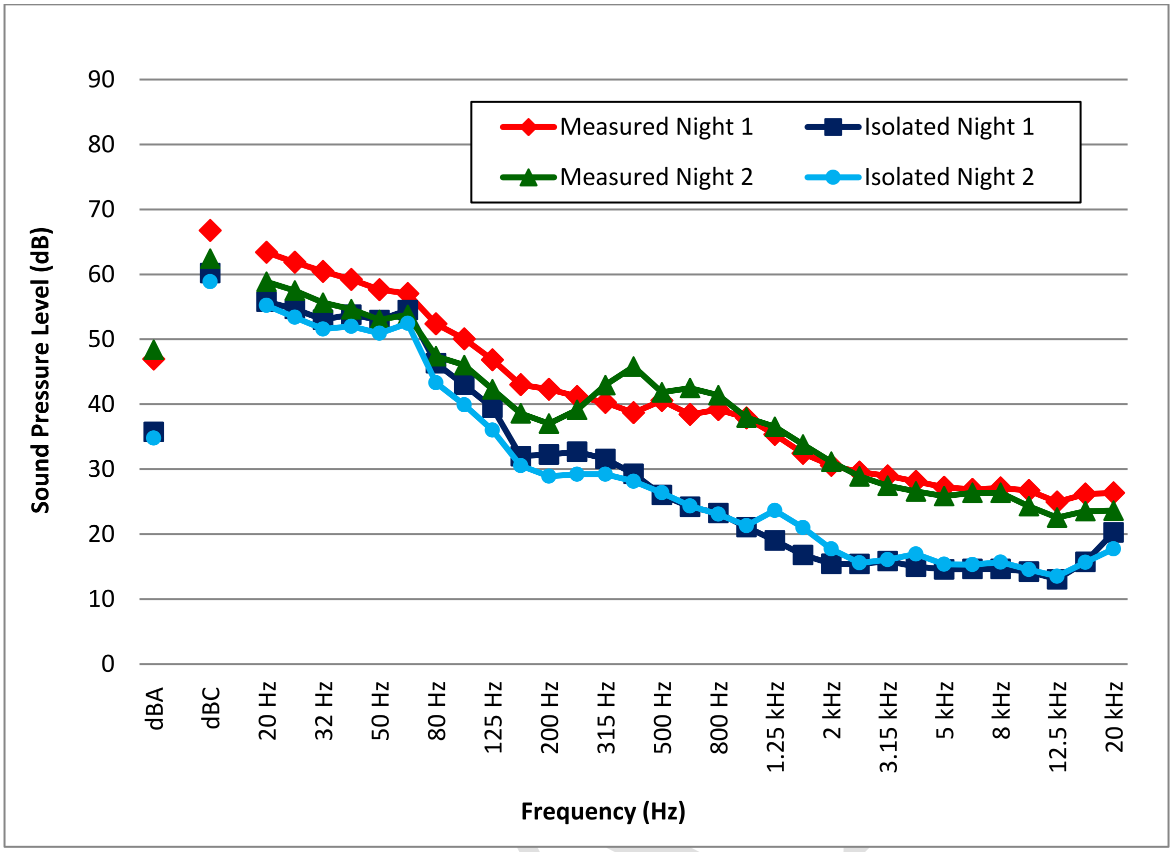

Figure 91. Noise Monitor #12, 1/3 Octave L_{eq} Sound Levels (July 27 - 29, 2017)

Noise Monitor #12 - Period 2

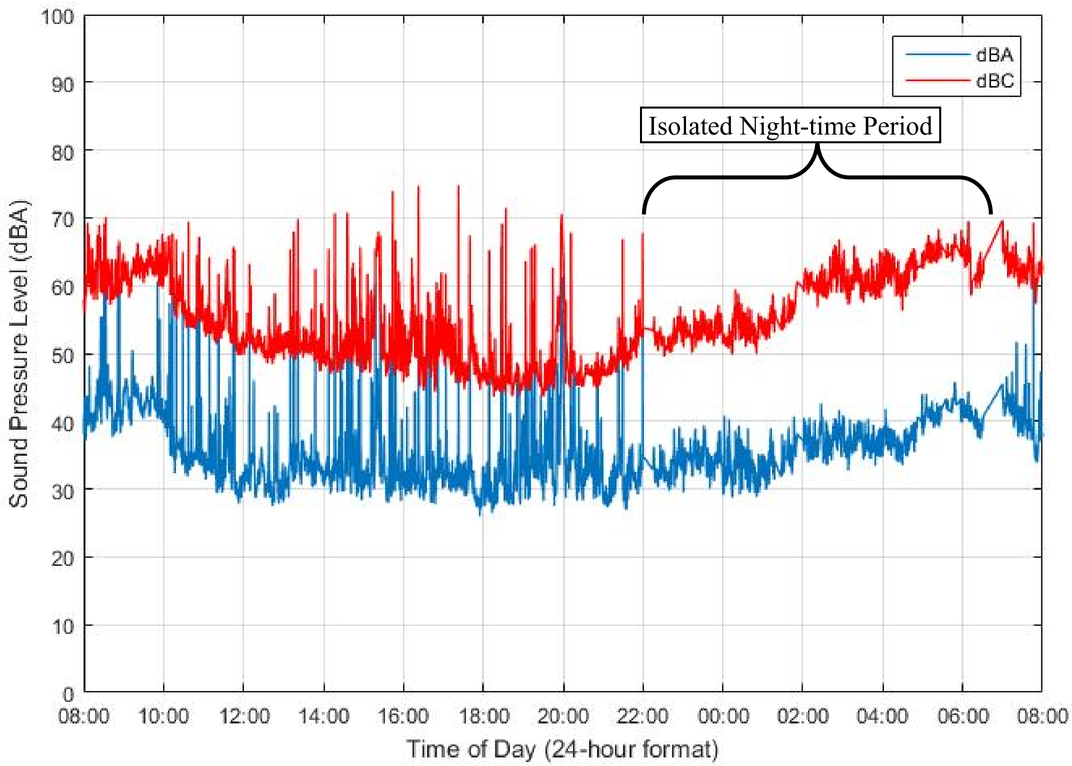

Figure 92. Noise Monitor #12, 15-Second L_{eq} Sound Levels (July 29 - 30, 2017)

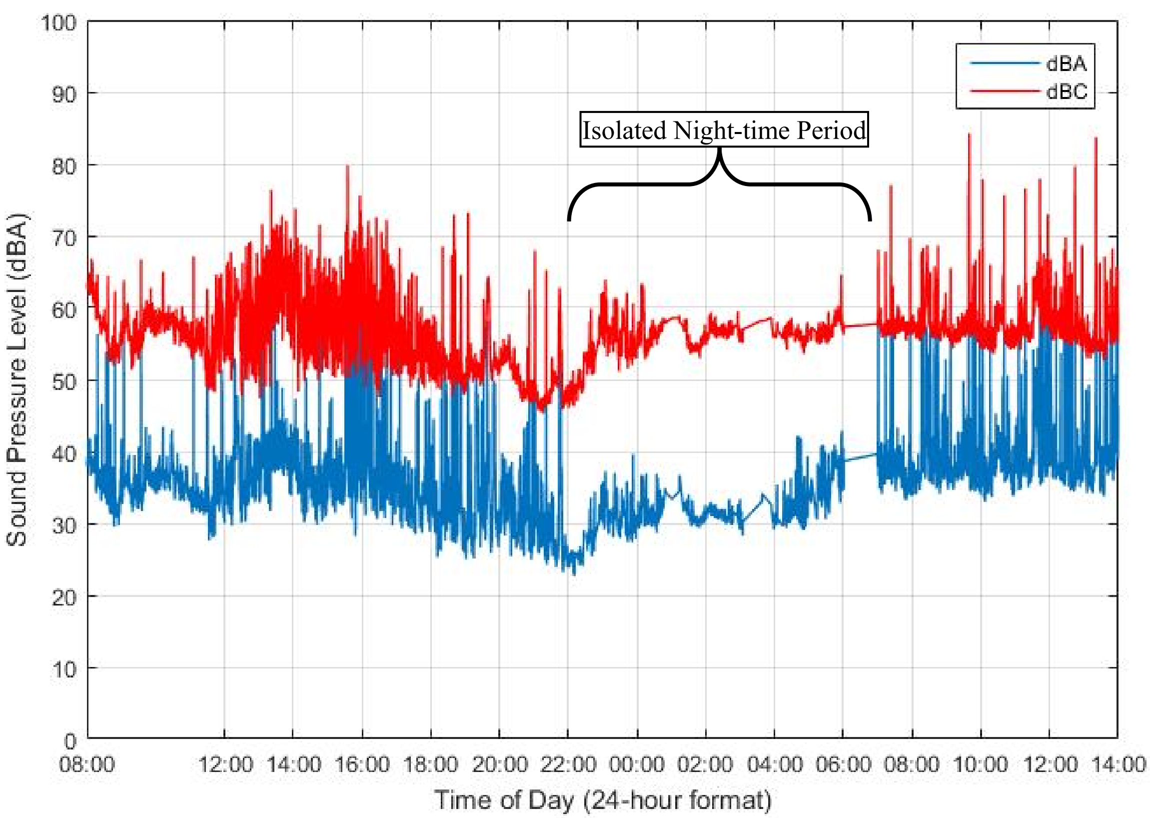

Figure 93. Noise Monitor #12, 15-Second L_{eq} Sound Levels (July 30 - 31, 2017)

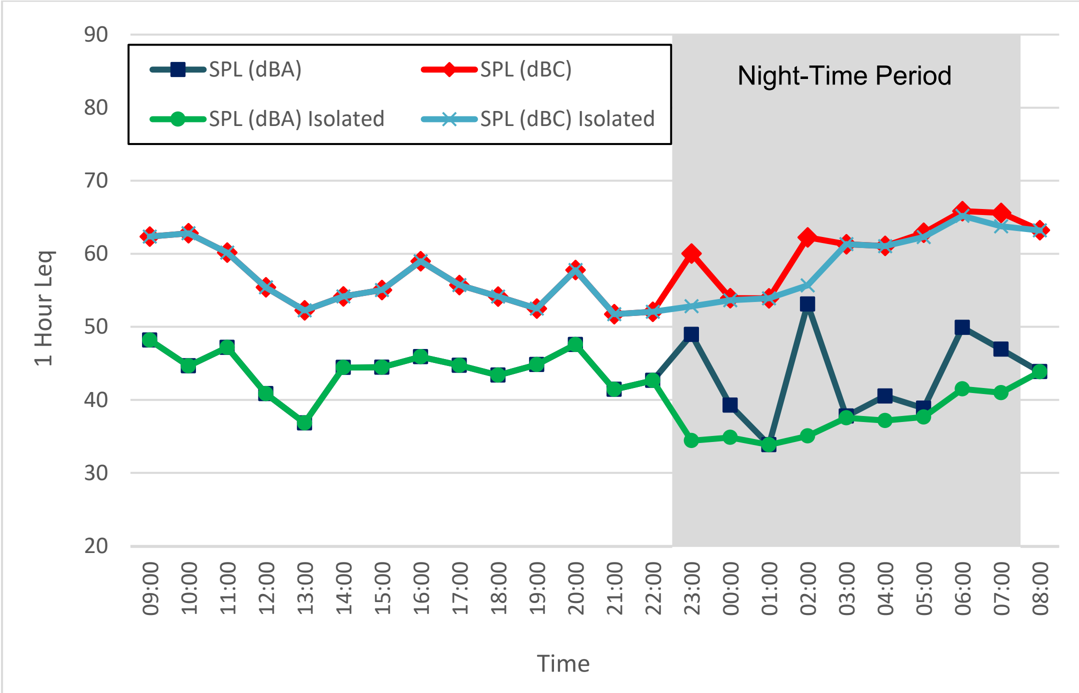

Figure 94. Noise Monitor #12, 1-Hour L_{eq} Sound Levels (July 29 - 30, 2017)

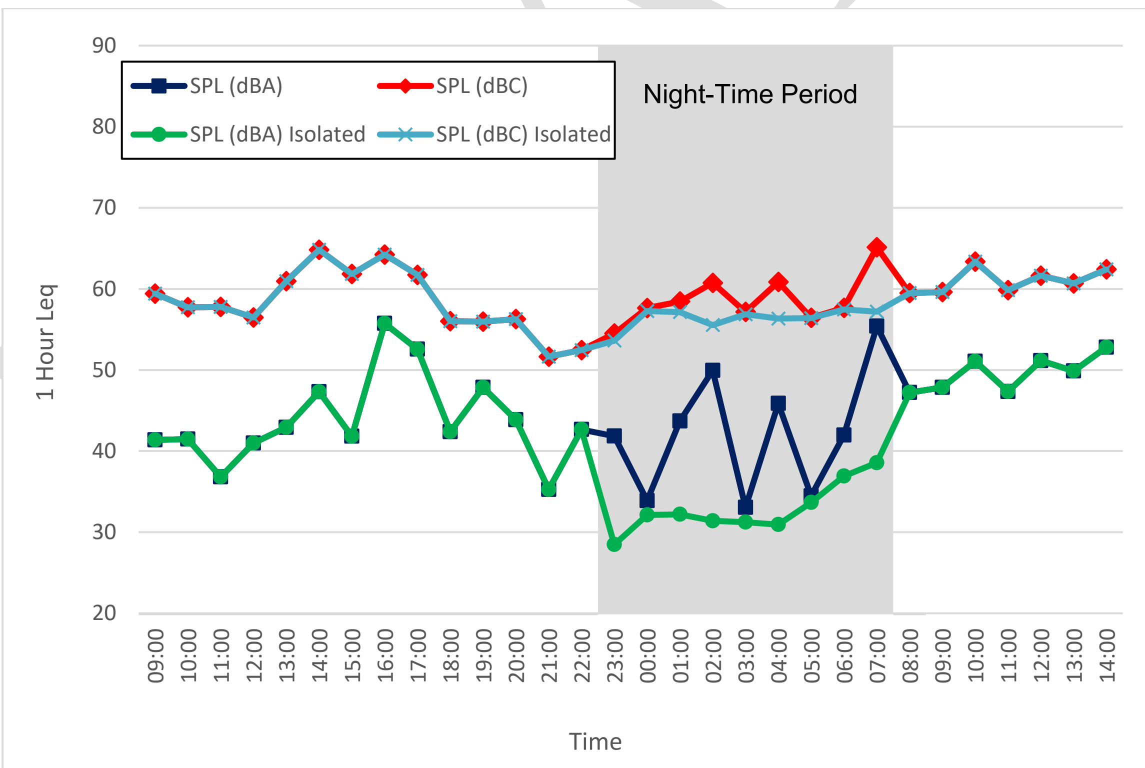

Figure 95. Noise Monitor #12, 1-Hour L_{eq} Sound Levels (July 30 - 31, 2017) [1]

[1] Data from 06:00 to 07:00 was entirely removed due to traffic along the adjacent road.

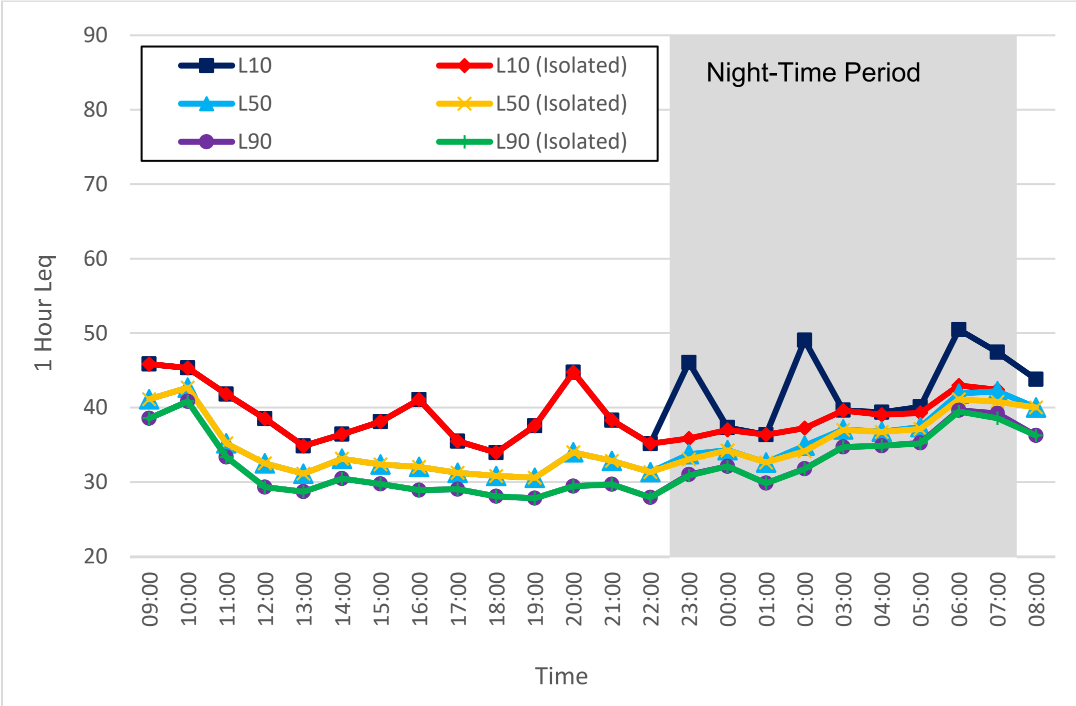

Figure 96. Noise Monitor #12, 1-Hour L_{10}, L_{50}, L_{90} L_{eq} Sound Levels (July 29 - 30, 2017)

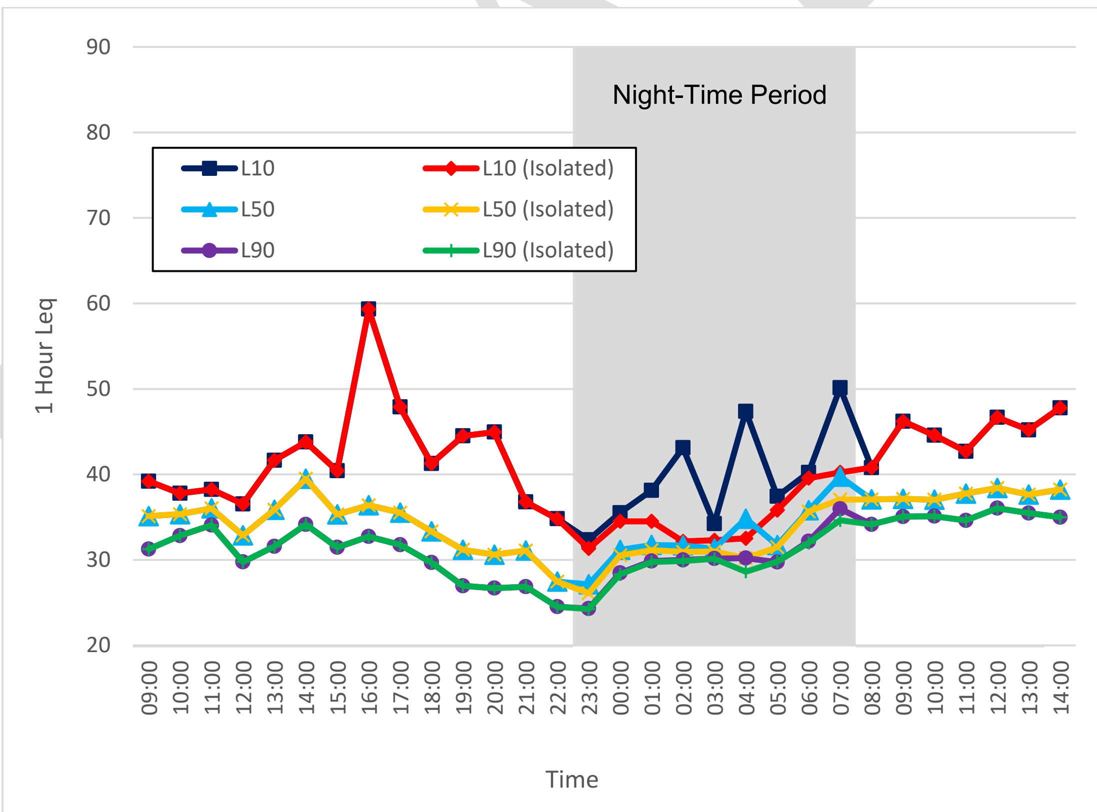

Figure 97. Noise Monitor #12, 1-Hour L_{10}, L_{50}, L_{90} L_{eq} Sound Levels (July 30 - 31, 2017) [1]

[1] Data from 06:00 to 07:00 was entirely removed due to traffic along the adjacent road.

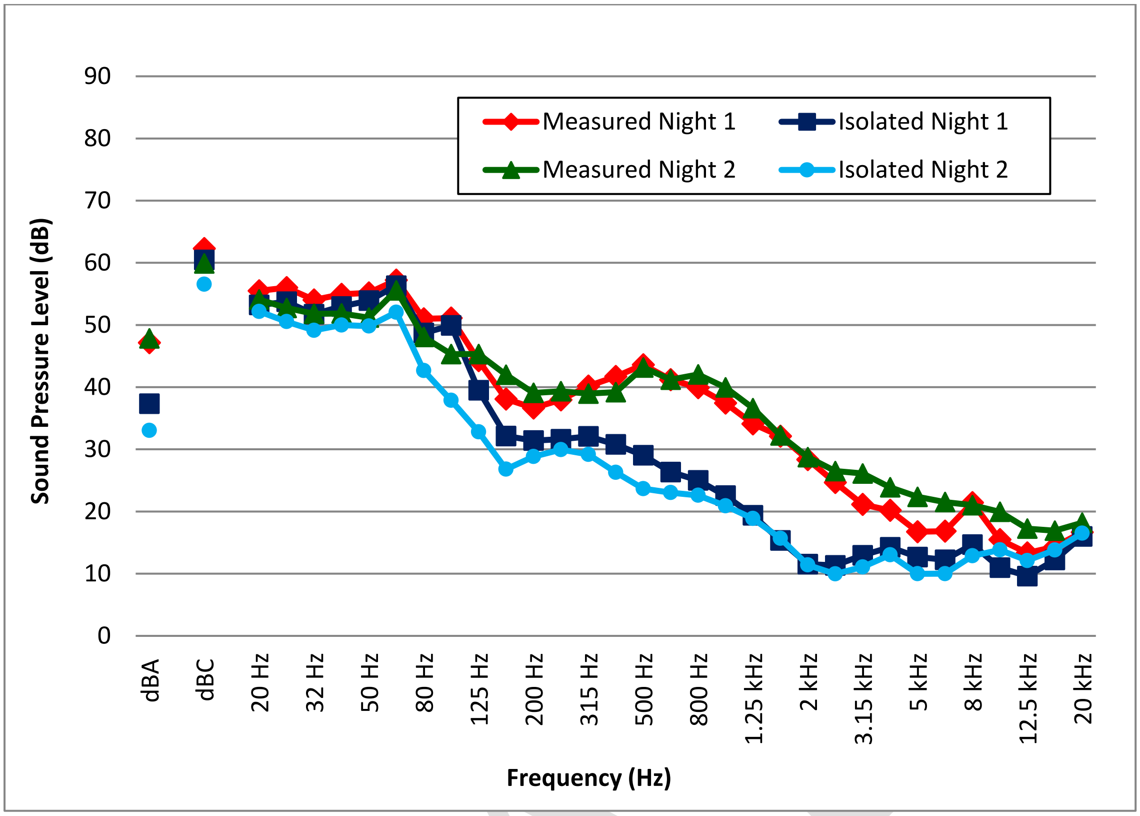

Figure 98. Noise Monitor #12, 1/3 Octave L_{eq} Sound Levels (July 29 - 31, 2017)

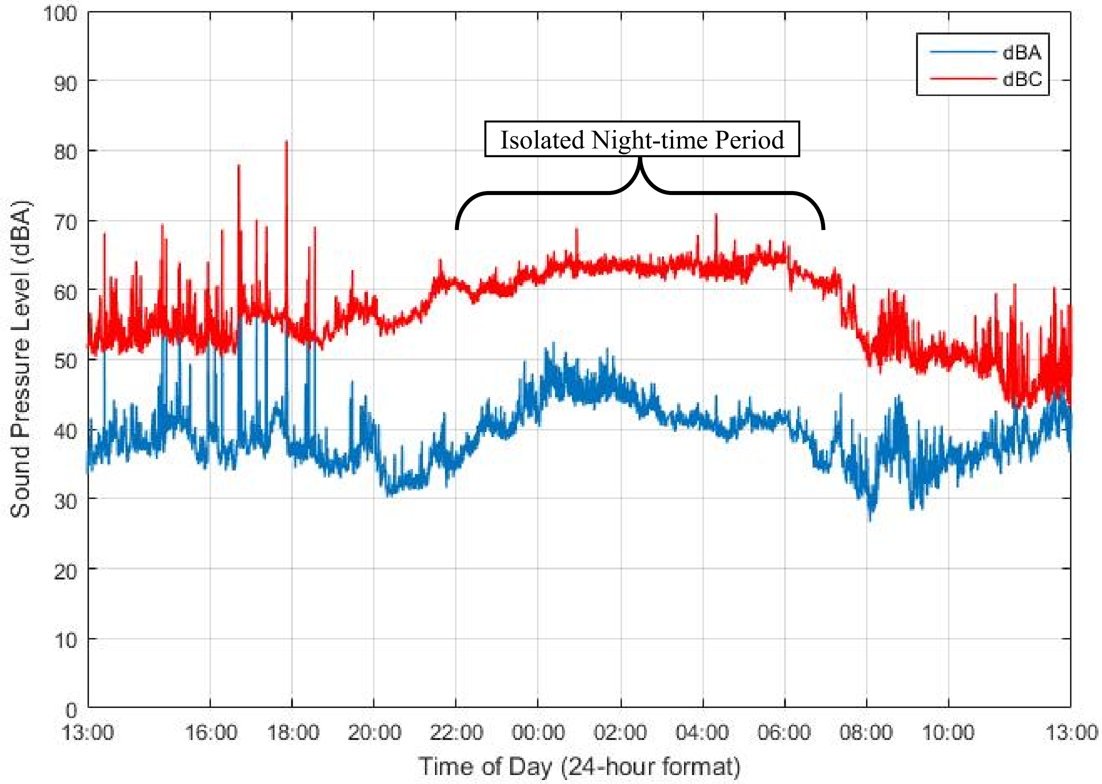

Figure 99. Noise Monitor #13, 15-Second L_{eq} Sound Levels (July 29 - 30, 2017)

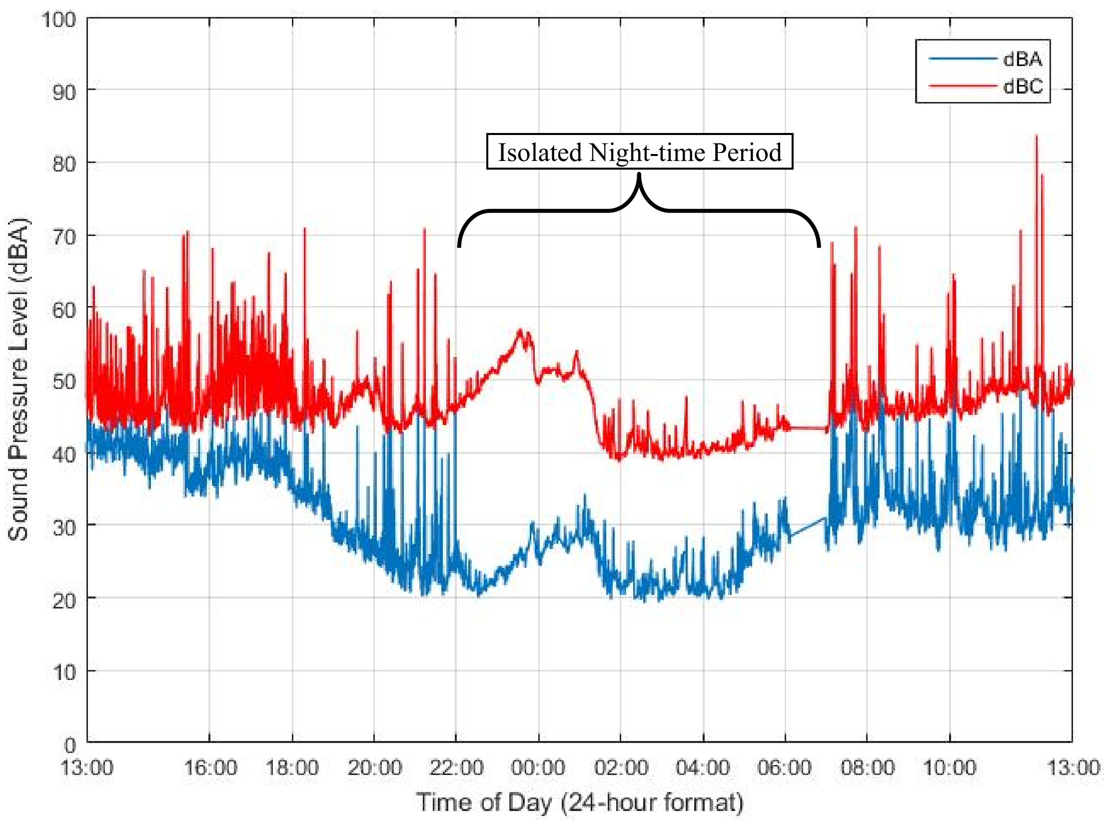

Figure 100. Noise Monitor #13, 15-Second L_{eq} Sound Levels (July 30 - 31, 2017)

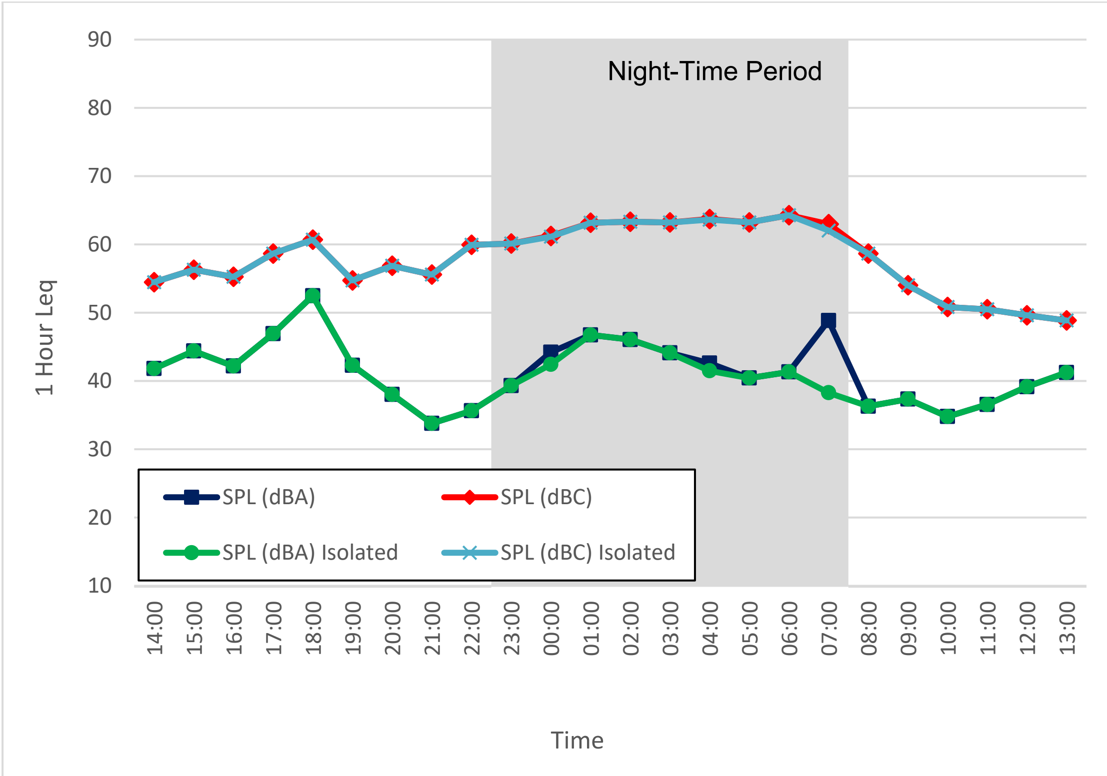

Figure 101. Noise Monitor #13, 1-Hour L_{eq} Sound Levels (July 29 - 30, 2017)

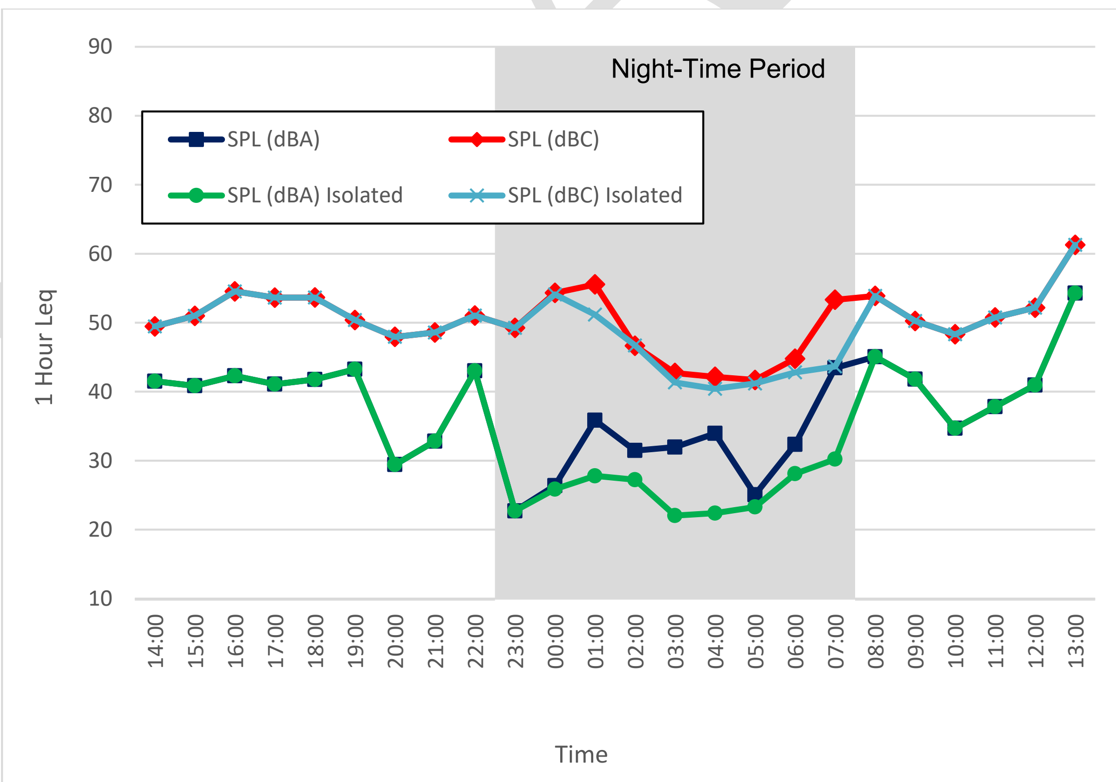

Figure 102. Noise Monitor #13, 1-Hour L_{eq} Sound Levels (July 30 - 31, 2017)

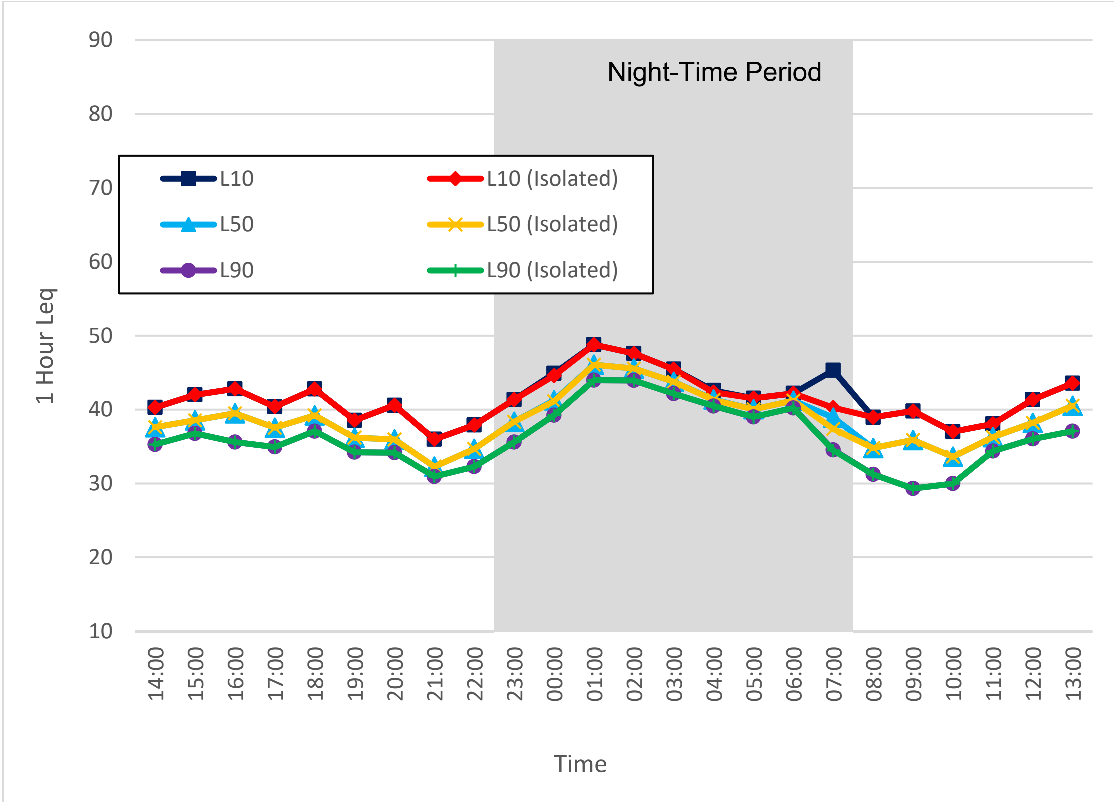

Figure 103. Noise Monitor #13, 1-Hour L_{10}, L_{50}, L_{90} L_{eq} Sound Levels (July 29 - 30, 2017)

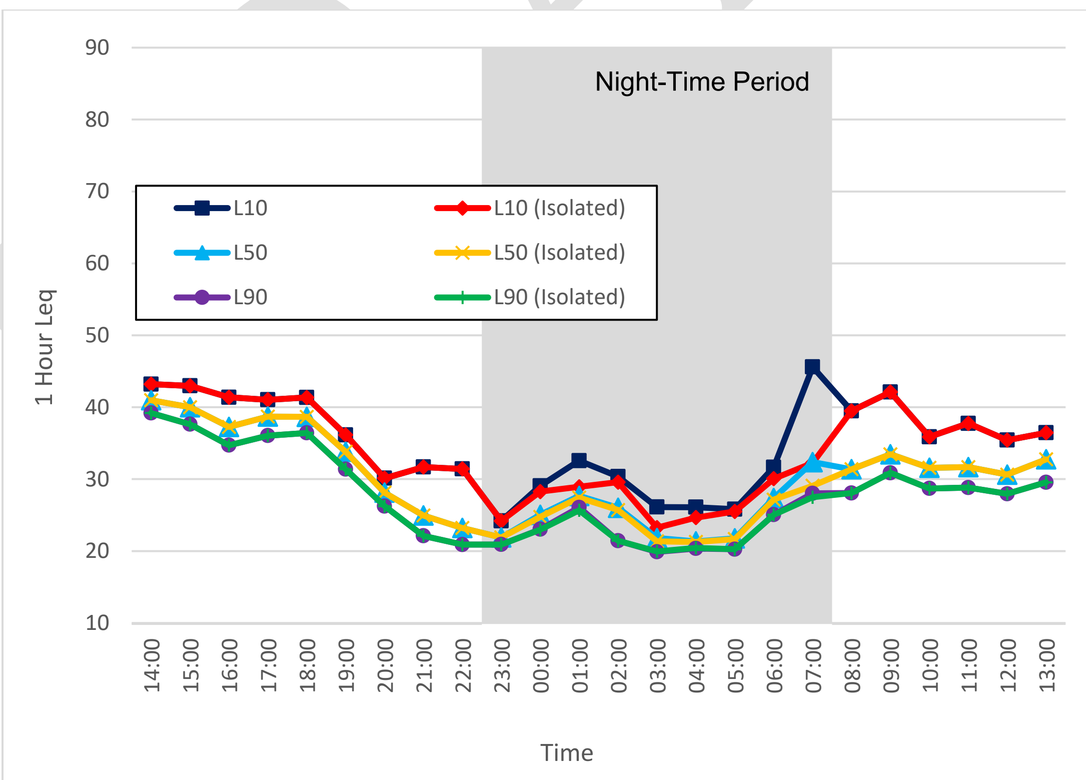

Figure 104. Noise Monitor #13, 1-Hour L_{10}, L_{50}, L_{90} L_{eq} Sound Levels (July 30 - 31, 2017)

Noise Monitor #13

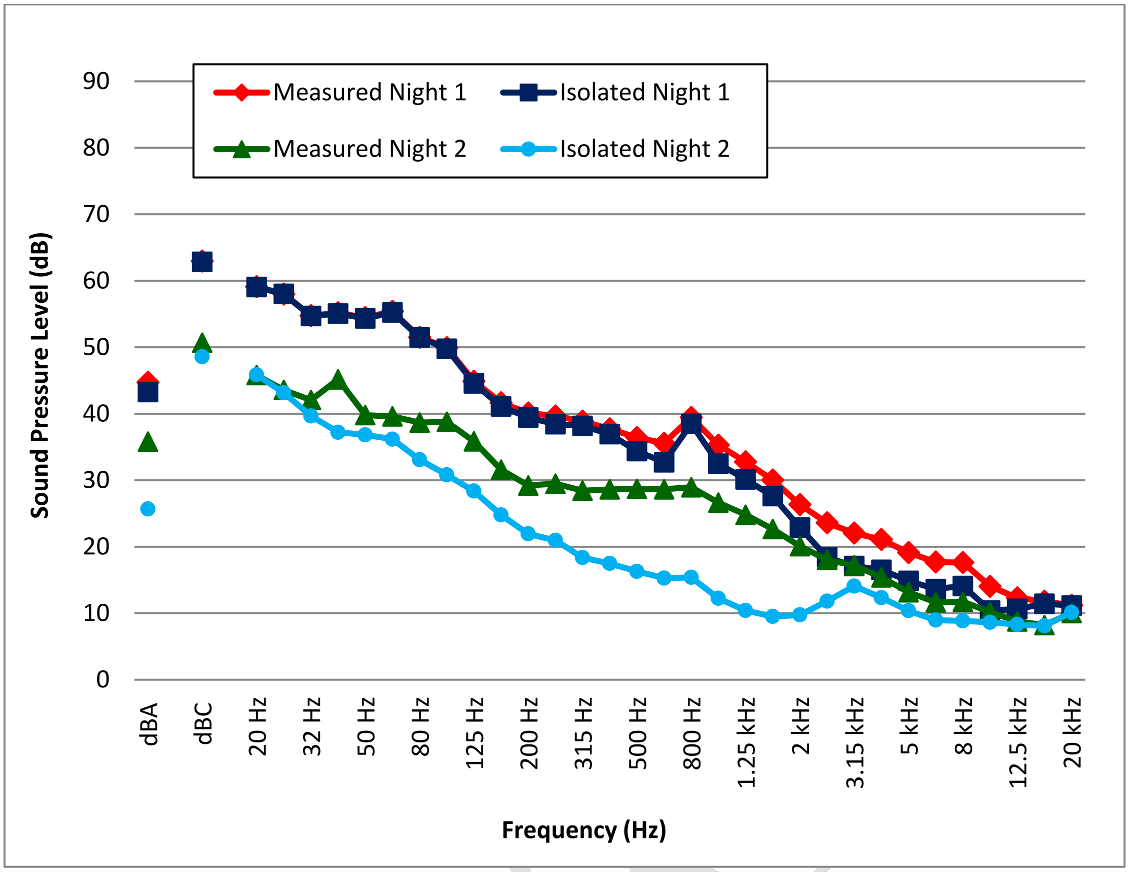

Figure 105. Noise Monitor #13, 1/3 Octave L_{eq} Sound Levels (July 29 - 31, 2017)

Appendix I MEASUREMENT EQUIPMENT USED

Noise Monitors

The environmental noise monitoring equipment used consisted of Brüel and Kjær Type 2250/2270 Precision Integrating Sound Level Meters enclosed in environmental cases with tripods, weather protective microphone hoods, and (in some cases) external batteries. The systems acquired data in 15-second L_{eq} samples using 1/3 octave band frequency analysis and overall A-weighted and C-weighted sound levels. The sound level meters conform to Type 1, ANSI S1.4, ANSI S1.43, IEC 61672-1, IEC 60651, IEC 60804 and DIN 45657. The 1/3 octave filters conform to S1.11 – Type 0-C, and IEC 61260 – Class 0. The calibrator conforms to IEC 942 and ANSI S1.40. The sound level meters, pre-amplifiers and microphones were certified on May 09, 2017 / January 19, 2017 / January 19, 2017 / November 11, 2016 / November 10, 2016 / November 11, 2016 / April 29, 20164 / May 09, 2017 and the calibrator (type B&K 4231) was certified on September 13, 2017 by a NIST NVLAP Accredited Calibration Laboratory for all requirements of ISO 17025: 1999 and relevant requirements of ISO 9002:1994, ISO 9001:2000 and ANSI/NCSL Z540: 1994 Part 1. All measurement methods and instrumentation conform to the requirements of the AER Directive 038. Simultaneous digital audio was recorded directly on the sound level meter using a 8 kHz sample rate for more detailed post-processing analysis. Refer to the next section in the Appendix for a detailed description of the various acoustical descriptive terms used.

Weather Monitors

Each weather monitoring system used for the study consisted of an Orion Weather Station 9510-A-1 with a WXT520 Self-Aspirating Radiation Shield Sensor Unit, a Weather MicroServer 9590 Data-logger, and a Lightning Arrestor. The Data-logger and batteries were located in a grounded, weather protective case. The Sensor Unit was mounted on a sturdy survey tripod (with supporting guy-wires) at approximately 5.0 m above ground. The system was set up to record data in 1-minute samples obtaining the wind-speed, peak wind-speed, and wind-direction in a rolling 2-minute average as well as the 1-minute temperature, relative humidity, barometric pressure, rain rate and total rain accumulation.

Record of Calibration Results

Description	Date	Time	Pre / Post	Calibration Level	Calibrator Model	Serial Number
Monitor #1	July 27, 2017	10:20	Pre	93.9 dBA	B&K 4231	2478139
Monitor #1	July 29, 2017	10:30	Post	93.8 dBA	B&K 4231	2478139
Monitor #2	July 27, 2017	09:45	Pre	93.9 dBA	B&K 4231	2478139
Monitor #2	July 29, 2017	09:50	Post	93.8 dBA	B&K 4231	2478139
Monitor #3	July 27, 2017	09:20	Pre	93.9 dBA	B&K 4231	2478139
Monitor #3	July 29, 2017	09:35	Post	93.8 dBA	B&K 4231	2478139
Monitor #4	July 27, 2017	09:00	Pre	93.9 dBA	B&K 4231	2478139
Monitor #4	July 29, 2017	09:20	Post	93.8 dBA	B&K 4231	2478139
Monitor #5	July 28, 2017	14:20	Pre	93.9 dBA	B&K 4231	2478139
Monitor #5	July 31, 2017	15:20	Post	93.8 dBA	B&K 4231	2478139
Monitor #6	July 27, 2017	08:30	Pre	93.9 dBA	B&K 4231	2478139
Monitor #6	July 29, 2017	08:40	Post	93.9 dBA	B&K 4231	2478139
Monitor #8	July 29, 2017	11:45	Pre	93.9 dBA	B&K 4231	2478139
Monitor #8	July 31, 2017	13:40	Post	93.8 dBA	B&K 4231	2478139
Monitor #9	July 29, 2017	12:30	Pre	93.9 dBA	B&K 4231	2478139
Monitor #9	July 31, 2017	12:45	Post	93.8 dBA	B&K 4231	2478139
Monitor #10	July 27, 2017	10:05	Pre	93.9 dBA	B&K 4231	2478139
Monitor #10	July 29, 2017	10:10	Post	93.9 dBA	B&K 4231	2478139
Monitor #11	July 29, 2017	12:00	Pre	93.9 dBA	B&K 4231	2478139
Monitor #11	July 31, 2017	13:30	Post	93.8 dBA	B&K 4231	2478139
Monitor #12	July 27, 2017	08:35	Pre	93.9 dBA	B&K 4231	2478139
Monitor #12	July 31, 2017	12:15	Post	93.9 dBA	B&K 4231	2478139
Monitor #13	July 29, 2017	11:30	Pre	93.9 dBA	B&K 4231	2478139
Monitor #13	July 31, 2017	14:00	Post	93.8 dBA	B&K 4231	2478139

B&K 4231 Calibrator Calibration Certificate

Scantek, Inc.
CALIBRATION LABORATORY
ISO 17025: 2005, ANSI/NCSL Z540:1994 Part 1
ACCREDITED by NVLAP (an ILAC MRA signatory)

NVLAP®
NVLAP Lab Code: 200625-0

Calibration Certificate No.34409

Instrument: **Acoustical Calibrator**
Model: **4231**
Manufacturer: **Brüel and Kjær**
Serial number: **2478139**
Class (IEC 60942): **1**
Barometer type:
Barometer s/n:

Date Calibrated: **8/17/2015** *Cal Due:*

Status:	Received	Sent
In tolerance:	X	X
Out of tolerance:		
See comments:		

Contains non-accredited tests: __Yes _X_ No

Customer: **Acoustical Consultants Inc.**
Tel/Fax: **780-414-6373 / -6376**
Address: **5031 - 210 Street**
Edmonton, Alberta
Canada T6M 0A8

Tested in accordance with the following procedures and standards:
Calibration of Acoustical Calibrators, Scantek Inc., Rev. 1/16/2015

Instrumentation used for calibration: Nor-1504 Norsonic Test System:

Instrument - Manufacturer	Description	S/N	Cal. Date	Traceability evidence Cal. Lab / Accreditation	Cal. Due
483B-Norsonic	SME Cal Unit	31052	Oct 7, 2014	Scantek, Inc./ NVLAP	Oct 7, 2015
DS-360-SRS	Function Generator	33584	Sep 30, 2013	ACR Env./ A2LA	Sep 30, 2015
34401A-Agilent Technologies	Digital Voltmeter	US36120731	Oct 1, 2014	ACR Env. / A2LA	Oct 1, 2015
HM30-Thommen	Meteo Station	1040170/39633	Oct 3, 2014	ACR Env./ A2LA	Oct 3, 2015
8903-HP	Audio Analyzer	2514A05691	Dec 12, 2013	ACR Env. / A2LA	Dec 12, 2016
PC Program 1018 Norsonic	Calibration software	v.6.1T	Validated Nov 2014	Scantek, Inc.	-
4134-Brüel&Kjær	Microphone	906763	Oct 15, 2013	NPL-UK / UKAS	Oct 15, 2015
1203-Norsonic	Preamplifier	14052	Aug 22, 2014	Scantek, Inc./ NVLAP	Aug 22, 2015

Instrumentation and test results are traceable to SI (International System of Units) through standards maintained by NIST (USA) and NPL (UK)

Calibrated by:	Valentin Buzduga	Authorized signatory:	Mariana Buzduga
Signature		Signature	
Date	8/17/2015	Date	8/17/2015

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B&K 2250 Unit #1 SLM Calibration Certificate

Scantek, Inc.
CALIBRATION LABORATORY
ISO 17025: 2005, ANSI/NCSL Z540:1994 Part 1
ACCREDITED by NVLAP (an ILAC MRA signatory)

NVLAP® CALIBRATION
NVLAP Lab Code: 200625-0

Calibration Certificate No.38467

Instrument: **Sound Level Meter**
Model: **2250**
Manufacturer: **Brüel and Kjær**
Serial number: **2488495**
Tested with: **Microphone 4189 s/n 2471133**
Preamplifier ZC0032 s/n 3271
Type (class): **1**
Customer: **ACI Acoustical Consultants Inc.**
Tel/Fax: **780-414-6373 / 780-414-6376**

Date Calibrated: **5/9/2017** *Cal Due:*

Status:	**Received**	**Sent**
In tolerance:	X	X
Out of tolerance:		
See comments:		

Contains non-accredited tests: __Yes X No
Calibration service: __ Basic X Standard
Address: **5031 - 210 Street**
Edmonton, Alberta
CANADA T6M 0A8

Tested in accordance with the following procedures and standards:
Calibration of Sound Level Meters, Scantek Inc., Rev. 6/26/2015
SLM & Dosimeters – Acoustical Tests, Scantek Inc., Rev. 7/6/2011

Instrumentation used for calibration: Nor-1504 Norsonic Test System:

Instrument - Manufacturer	Description	S/N	Cal. Date	Traceability evidence Cal. Lab / Accreditation	Cal. Due
483B-Norsonic	SME Cal Unit	31061	Jul 27, 2016	Scantek, Inc./ NVLAP	Jul 27, 2017
DS-360-SRS	Function Generator	88077	Sep 15, 2016	ACR Env./ A2LA	Sep 15, 2018
34401A-Agilent Technologies	Digital Voltmeter	MY47011118	Sep 15, 2016	ACR Env./ A2LA	Sep 15, 2017
HM30-Thommen	Meteo Station	1040170/39633	Nov 1, 2016	ACR Env./ A2LA	Nov 1, 2017
PC Program 1019 Norsonic	Calibration software	v.6.1T	Validated Nov 2014	Scantek, Inc.	-
1251-Norsonic	Calibrator	30878	Nov 10, 2016	Scantek, Inc./ NVLAP	Nov 10, 2017

Instrumentation and test results are traceable to SI (International System of Units) through standards maintained by NIST (USA) and NPL (UK).

Environmental conditions:

Temperature (°C)	Barometric pressure (kPa)	Relative Humidity (%)
23.0	100.11	41.8

Calibrated by:	Jeremy Gotwalt	**Authorized signatory:**	Steven E. Marshall
Signature	[signature]	Signature	[signature]
Date	5/9/17	Date	5/9/2017

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B&K 2250 Unit #1 Microphone Calibration Certificate

Scantek, Inc.
CALIBRATION LABORATORY
ISO 17025: 2005, ANSI/NCSL Z540:1994 Part 1
ACCREDITED by NVLAP (an ILAC MRA signatory)

NVLAP®
CALIBRATION
NVLAP Lab Code: 200625-0

Calibration Certificate No.38468

Instrument:	**Microphone**
Model:	**4189**
Manufacturer:	**Brüel & Kjær**
Serial number:	**2471133**
Composed of:	

Date Calibrated: **5/8/2017** *Cal Due:*

Status:	**Received**	**Sent**
In tolerance:	X	X
Out of tolerance:		
See comments:		

Contains non-accredited tests: __Yes _X_ No

Customer: **ACI Acoustical Consultants Inc.**
Tel/Fax: **780-414-6373/780-414-6376**
Address: **5031 - 210 Street**
Edmonton, Alberta
CANADA T6M 0A8

Tested in accordance with the following procedures and standards:
Calibration of Measurement Microphones, Scantek, Inc., Rev. 2/25/2015

Instrumentation used for calibration: N-1504 Norsonic Test System:

Instrument - Manufacturer	Description	S/N	Cal. Date	Traceability evidence Cal. Lab / Accreditation	Cal. Due
483B-Norsonic	SME Cal Unit	31061	Jul 27, 2016	Scantek, Inc./ NVLAP	Jul 27, 2017
DS-360-SRS	Function Generator	88077	Sep 15, 2016	ACR Env./ A2LA	Sep 15, 2018
34401A-Agilent Technologies	Digital Voltmeter	MY47011118	Sep 15, 2016	ACR Env./ A2LA	Sep 15, 2017
HM30-Thommen	Meteo Station	1040170/39633	Nov 1, 2016	ACR Env./ A2LA	Nov 1, 2017
PC Program 1017 Norsonic	Calibration software	v.6.1T	Validated Nov 2014	Scantek, Inc.	-
1253-Norsonic	Calibrator	28326	Nov 10, 2016	Scantek, Inc./ NVLAP	Nov 10, 2017
1203-Norsonic	Preamplifier	92268	Oct 17, 2016	Scantek, Inc./ NVLAP	Oct 17, 2017
4180-Brüel&Kjær	Microphone	2246115	Oct 26, 2015	NPL-UK / UKAS	Oct 26, 2017

Instrumentation and test results are traceable to SI - BIPM through standards maintained by NPL (UK) and NIST (USA)

Calibrated by:	Jeremy Gotwalt	**Authorized signatory:**	Steven E. Marshall
Signature	[signature]	Signature	[signature]
Date	5/8/17	Date	5/9/2017

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B&K 2270 Unit #2 SLM Calibration Certificate

Scantek, Inc.
CALIBRATION LABORATORY
ISO 17025: 2005, ANSI/NCSL Z540:1994 Part 1
ACCREDITED by NVLAP (an ILAC MRA signatory)

NVLAP® CALIBRATION
NVLAP Lab Code: 200625-0

Calibration Certificate No.37710

Instrument:	**Sound Level Meter**
Model:	**2270**
Manufacturer:	**Brüel and Kjær**
Serial number:	**3002718**
Tested with:	**Microphone 4189 s/n 2850742** **Preamplifier ZC0032 s/n 18754**
Type (class):	**1**
Customer:	**ACI Acoustical Consultants Inc.**
Tel/Fax:	**780-414-6373 / -6376**

Date Calibrated: **1/19/2017** *Cal Due:*

Status:	**Received**	**Sent**
In tolerance:	X	X
Out of tolerance:		
See comments:		

Contains non-accredited tests: __**Yes** X **No**
Calibration service: __ **Basic** X **Standard**
Address: **5031 - 210 Street**
Edmonton, Alberta, CANADA
T6M 0A8

Tested in accordance with the following procedures and standards:
Calibration of Sound Level Meters, Scantek Inc., Rev. 6/26/2015
SLM & Dosimeters – Acoustical Tests, Scantek Inc., Rev. 7/6/2011

Instrumentation used for calibration: Nor-1504 Norsonic Test System:

Instrument - Manufacturer	Description	S/N	Cal. Date	Traceability evidence Cal. Lab / Accreditation	Cal. Due
483B-Norsonic	SME Cal Unit	31061	Jul 27, 2016	Scantek, Inc./ NVLAP	Jul 27, 2017
DS-360-SRS	Function Generator	88077	Sep 15, 2016	ACR Env./ A2LA	Sep 15, 2018
34401A-Agilent Technologies	Digital Voltmeter	MY47011118	Sep 15, 2016	ACR Env./ A2LA	Sep 15, 2017
HM30-Thommen	Meteo Station	1040170/39633	Nov 1, 2016	ACR Env./ A2LA	Nov 1, 2017
PC Program 1019 Norsonic	Calibration software	v.6.1T	Validated Nov 2014	Scantek, Inc.	-
1251-Norsonic	Calibrator	30878	Nov 10, 2016	Scantek, Inc./ NVLAP	Nov 10, 2017

Instrumentation and test results are traceable to SI (International System of Units) through standards maintained by NIST (USA) and NPL (UK).

Environmental conditions:

Temperature (°C)	Barometric pressure (kPa)	Relative Humidity (%)
22.8	100.31	40.2

Calibrated by:	Jeremy Gotwalt	**Authorized signatory:**	Steven E. Marshall
Signature	[signature]	Signature	[signature]
Date	1/19/17	Date	1/20/2017

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B&K 2270 Unit #2 Microphone Calibration Certificate

Scantek, Inc.
CALIBRATION LABORATORY
ISO 17025: 2005, ANSI/NCSL Z540:1994 Part 1
ACCREDITED by NVLAP (an ILAC MRA signatory)

NVLAP®
CALIBRATION
NVLAP Lab Code: 200625-0

Calibration Certificate No.37711

Instrument:	**Microphone**	*Date Calibrated:* **1/18/2017** *Cal Due:*		
Model:	**4189**	*Status:*	**Received**	**Sent**
Manufacturer:	**Brüel & Kjær**	*In tolerance:*	X	X
Serial number:	**2850742**	*Out of tolerance:*		
Composed of:		*See comments:*		

Contains non-accredited tests: __Yes _X_ No

Customer: **ACI Acoustical Consultants Inc.**
Tel/Fax: **780-414-6373/-6376**
Address: **5031 - 210 Street, Edmonton, Alberta, CANADA T6M 0A8**

Tested in accordance with the following procedures and standards:
Calibration of Measurement Microphones, Scantek, Inc., Rev. 2/25/2015

Instrumentation used for calibration: N-1504 Norsonic Test System:

Instrument - Manufacturer	Description	S/N	Cal. Date	Traceability evidence Cal. Lab / Accreditation	Cal. Due
483B-Norsonic	SME Cal Unit	31061	Jul 27, 2016	Scantek, Inc./ NVLAP	Jul 27, 2017
DS-360-SRS	Function Generator	88077	Sep 15, 2016	ACR Env./ A2LA	Sep 15, 2018
34401A-Agilent Technologies	Digital Voltmeter	MY47011118	Sep 15, 2016	ACR Env./ A2LA	Sep 15, 2017
HM30-Thommen	Meteo Station	1040170/39633	Nov 1, 2016	ACR Env./ A2LA	Nov 1, 2017
PC Program 1017 Norsonic	Calibration software	v.6.1T	Validated Nov 2014	Scantek, Inc.	-
1253-Norsonic	Calibrator	22909	Nov 10, 2016	Scantek, Inc./ NVLAP	Nov 10, 2017
1203-Norsonic	Preamplifier	92268	Oct 17, 2016	Scantek, Inc./ NVLAP	Oct 17, 2017
4180-Brüel&Kjær	Microphone	2246115	Oct 26, 2015	NPL-UK / UKAS	Oct 26, 2017

Instrumentation and test results are traceable to SI - BIPM through standards maintained by NPL (UK) and NIST (USA)

Calibrated by:	Jeremy Gotwalt	**Authorized signatory:**	Steven E. Marshall
Signature	[signature]	Signature	[signature]
Date	1/18/17	Date	1/20/2017

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B&K 2270 Unit #3 SLM Calibration Certificates

Scantek, Inc.
CALIBRATION LABORATORY
ISO 17025: 2005, ANSI/NCSL Z540:1994 Part 1
ACCREDITED by NVLAP (an ILAC MRA signatory)

NVLAP® CALIBRATION
NVLAP Lab Code: 200625-0

Calibration Certificate No.37708

Instrument: **Sound Level Meter**
Model: **2270**
Manufacturer: **Brüel and Kjær**
Serial number: **3002730**
Tested with: **Microphone 4189 s/n 2850741**
Preamplifier ZC0032 s/n 18750
Type (class): **1**
Customer: **ACI Acoustical Consultants Inc.**
Tel/Fax: **780-414-6373 / -6376**

Date Calibrated: **1/19/2017** *Cal Due:*

Status:	Received	Sent
In tolerance:	X	X
Out of tolerance:		
See comments:		

Contains non-accredited tests: __Yes _X_ No
Calibration service: __ Basic _X_ Standard
Address: **5031 - 210 Street**
Edmonton, Alberta, CANADA
T6M 0A8

Tested in accordance with the following procedures and standards:
Calibration of Sound Level Meters, Scantek Inc., Rev. 6/26/2015
SLM & Dosimeters – Acoustical Tests, Scantek Inc., Rev. 7/6/2011

Instrumentation used for calibration: Nor-1504 Norsonic Test System:

Instrument - Manufacturer	Description	S/N	Cal. Date	Traceability evidence Cal. Lab / Accreditation	Cal. Due
483B-Norsonic	SME Cal Unit	31061	Jul 27, 2016	Scantek, Inc./ NVLAP	Jul 27, 2017
DS-360-SRS	Function Generator	88077	Sep 15, 2016	ACR Env./ A2LA	Sep 15, 2018
34401A-Agilent Technologies	Digital Voltmeter	MY47011118	Sep 15, 2016	ACR Env./ A2LA	Sep 15, 2017
HM30-Thommen	Meteo Station	1040170/39633	Nov 1, 2016	ACR Env./ A2LA	Nov 1, 2017
PC Program 1019 Norsonic	Calibration software	v.6.1T	Validated Nov 2014	Scantek, Inc.	-
1251-Norsonic	Calibrator	30878	Nov 10, 2016	Scantek, Inc./ NVLAP	Nov 10, 2017

Instrumentation and test results are traceable to SI (International System of Units) through standards maintained by NIST (USA) and NPL (UK).

Environmental conditions:

Temperature (°C)	Barometric pressure (kPa)	Relative Humidity (%)
23.3	100.34	42.3

Calibrated by:	Jeremy Gotwalt	**Authorized signatory:**	Steven E. Marshall
Signature	[signature]	Signature	[signature]
Date	1/19/17	Date	1/20/2017

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B&K 2270 Unit #3 Microphone Calibration Certificates

Scantek, Inc.
CALIBRATION LABORATORY
ISO 17025: 2005, ANSI/NCSL Z540:1994 Part 1
ACCREDITED by NVLAP (an ILAC MRA signatory)

NVLAP®
CALIBRATION
NVLAP Lab Code: 200625-0

Calibration Certificate No.37709

Instrument:	**Microphone**	*Date Calibrated:* **1/18/2017** *Cal Due:*		
Model:	**4189**	*Status:*	**Received**	**Sent**
Manufacturer:	**Brüel & Kjær**	*In tolerance:*	X	X
Serial number:	**2850741**	*Out of tolerance:*		
Composed of:		*See comments:*		
		Contains non-accredited tests: __Yes _X_ No		
Customer:	**ACI Acoustical Consultants Inc.**	*Address:*	**5031 - 210 Street Edmonton, Alberta, CANADA T6M 0A8**	
Tel/Fax:	**780-414-6373/-6376**			

Tested in accordance with the following procedures and standards:
Calibration of Measurement Microphones, Scantek, Inc., Rev. 2/25/2015

Instrumentation used for calibration: N-1504 Norsonic Test System:

Instrument - Manufacturer	Description	S/N	Cal. Date	Traceability evidence Cal. Lab / Accreditation	Cal. Due
483B-Norsonic	SME Cal Unit	31061	Jul 27, 2016	Scantek, Inc./ NVLAP	Jul 27, 2017
DS-360-SRS	Function Generator	88077	Sep 15, 2016	ACR Env./ A2LA	Sep 15, 2018
34401A-Agilent Technologies	Digital Voltmeter	MY47011118	Sep 15, 2016	ACR Env./ A2LA	Sep 15, 2017
HM30-Thommen	Meteo Station	1040170/39633	Nov 1, 2016	ACR Env./ A2LA	Nov 1, 2017
PC Program 1017 Norsonic	Calibration software	v.6.1T	Validated Nov 2014	Scantek, Inc.	-
1253-Norsonic	Calibrator	22909	Nov 10, 2016	Scantek, Inc./ NVLAP	Nov 10, 2017
1203-Norsonic	Preamplifier	92268	Oct 17, 2016	Scantek, Inc./ NVLAP	Oct 17, 2017
4180-Brüel&Kjær	Microphone	2246115	Oct 26, 2015	NPL-UK / UKAS	Oct 26, 2017

Instrumentation and test results are traceable to SI - BIPM through standards maintained by NPL (UK) and NIST (USA)

Calibrated by:	Jeremy Gotwalt	**Authorized signatory:**	Steven E. Marshall
Signature	[signature]	Signature	[signature]
Date	1/18/17	Date	1/20/2017

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B&K 2270 Unit #4 SLM Calibration Certificate

Scantek, Inc.
CALIBRATION LABORATORY
ISO 17025: 2005, ANSI/NCSL Z540:1994 Part 1
ACCREDITED by NVLAP (an ILAC MRA signatory)

NVLAP®
CALIBRATION
NVLAP Lab Code: 200625-0

Calibration Certificate No.37319

Instrument: **Sound Level Meter**
Model: **2270**
Manufacturer: **Brüel and Kjær**
Serial number: **2644639**
Tested with: **Microphone 4189 s/n 2643219**
Preamplifier ZC0032 s/n 8255
Type (class): **1**
Customer: **ACI Acoustical Consultants Inc.**
Tel/Fax: **780-414-6373 / -6376**

Date Calibrated: **11/14/2016** *Cal Due:*

Status:	Received	Sent
In tolerance:	X	X
Out of tolerance:		
See comments:		

Contains non-accredited tests: __Yes X No
Calibration service: __ Basic X Standard
Address: **5031 - 210 Street**
Edmonton, Alberta, CANADA
T6M 0A8

Tested in accordance with the following procedures and standards:
Calibration of Sound Level Meters, Scantek Inc., Rev. 6/26/2015
SLM & Dosimeters – Acoustical Tests, Scantek Inc., Rev. 7/6/2011

Instrumentation used for calibration: Nor-1504 Norsonic Test System:

Instrument - Manufacturer	Description	S/N	Cal. Date	Traceability evidence Cal. Lab / Accreditation	Cal. Due
483B-Norsonic	SME Cal Unit	31061	Jul 27, 2016	Scantek, Inc./ NVLAP	Jul 27, 2017
DS-360-SRS	Function Generator	88077	Sep 15, 2016	ACR Env./ A2LA	Sep 15, 2018
34401A-Agilent Technologies	Digital Voltmeter	MY47011118	Sep 15, 2016	ACR Env./ A2LA	Sep 15, 2017
HM30-Thommen	Meteo Station	1040170/39633	Nov 1, 2016	ACR Env./ A2LA	Nov 1, 2017
PC Program 1019 Norsonic	Calibration software	v.6.1T	Validated Nov 2014	Scantek, Inc.	-
1251-Norsonic	Calibrator	30878	Nov 10, 2016	Scantek, Inc./ NVLAP	Nov 10, 2017

Instrumentation and test results are traceable to SI (International System of Units) through standards maintained by NIST (USA) and NPL (UK).

Environmental conditions:

Temperature (°C)	Barometric pressure (kPa)	Relative Humidity (%)
21.5	100.29	38.8

Calibrated by:	Jeremy Gotwalt	**Authorized signatory:**	Valentin Buzduga
Signature	[signature]	Signature	[signature]
Date	11/14/16	Date	11/14/2016

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B&K 2270 Unit #4 Microphone Calibration Certificate

Scantek, Inc.
CALIBRATION LABORATORY

ISO 17025: 2005, ANSI/NCSL Z540:1994 Part 1
ACCREDITED by NVLAP (an ILAC MRA signatory)

NVLAP®
CALIBRATION
NVLAP Lab Code: 200625-0

Calibration Certificate No.37320

Instrument: **Microphone**
Model: **4189**
Manufacturer: **Brüel & Kjær**
Serial number: **2643219**
Composed of:

Date Calibrated: **11/10/2016** *Cal Due:*

Status:	**Received**	**Sent**
In tolerance:	X	X
Out of tolerance:		
See comments:		

Contains non-accredited tests: __Yes _X_ No

Customer: **ACI Acoustical Consultants Inc.**
Tel/Fax: **780-414-6373/-6376**
Address: **5031 - 210 Street, Edmonton, Alberta, CANADA T6M 0A8**

Tested in accordance with the following procedures and standards:
Calibration of Measurement Microphones, Scantek, Inc., Rev. 2/25/2015

Instrumentation used for calibration: N-1504 Norsonic Test System:

Instrument - Manufacturer	Description	S/N	Cal. Date	Traceability evidence Cal. Lab / Accreditation	Cal. Due
483B-Norsonic	SME Cal Unit	31061	Jul 27, 2016	Scantek, Inc./ NVLAP	Jul 27, 2017
DS-360-SRS	Function Generator	88077	Sep 15, 2016	ACR Env./ A2LA	Sep 15, 2018
34401A-Agilent Technologies	Digital Voltmeter	MY47011118	Sep 15, 2016	ACR Env./ A2LA	Sep 15, 2017
HM30-Thommen	Meteo Station	1040170/39633	Nov 1, 2016	ACR Env./ A2LA	Nov 1, 2017
PC Program 1017 Norsonic	Calibration software	v.6.1T	Validated Nov 2014	Scantek, Inc.	-
1253-Norsonic	Calibrator	28326	Nov 10, 2015	Scantek, Inc./ NVLAP	Nov 10, 2016
1203-Norsonic	Preamplifier	92268	Oct 17, 2016	Scantek, Inc./ NVLAP	Oct 17, 2017
4180-Brüel&Kjær	Microphone	2246115	Oct 26, 2015	NPL-UK / UKAS	Oct 26, 2017

Instrumentation and test results are traceable to SI - BIPM through standards maintained by NPL (UK) and NIST (USA)

Calibrated by:	Jeremy Gotwalt	**Authorized signatory:**	Valentin Buzduga
Signature		Signature	
Date	11/10/16	Date	11/14/2016

Calibration Certificates or Test Reports shall not be reproduced, except in full, without written approval of the laboratory.
This Calibration Certificate or Test Reports shall not be used to claim product certification, approval or endorsement by NVLAP, NIST, or any agency of the federal government.
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B&K 2250 Unit #5 SLM Calibration Certificate

Scantek, Inc.
CALIBRATION LABORATORY
ISO 17025: 2005, ANSI/NCSL Z540:1994 Part 1
ACCREDITED by NVLAP (an ILAC MRA signatory)

NVLAP® CALIBRATION
NVLAP Lab Code: 200625-0

Calibration Certificate No.37315

Instrument: **Sound Level Meter**
Model: **2250**
Manufacturer: **Brüel and Kjær**
Serial number: **2722894**
Tested with: **Microphone 4189 s/n 2719777**
Preamplifier ZC0032 s/n 13895
Type (class): **1**
Customer: **ACI Acoustical Consultants Inc.**
Tel/Fax: **780-414-6373 / -6376**

Date Calibrated: **11/11/2016** *Cal Due:*

Status:	Received	Sent
In tolerance:	X	X
Out of tolerance:		
See comments:		

Contains non-accredited tests: __Yes X No
Calibration service: __ Basic X Standard
Address: **5031 - 210 Street**
Edmonton, Alberta, CANADA
T6M 0A8

Tested in accordance with the following procedures and standards:
Calibration of Sound Level Meters, Scantek Inc., Rev. 6/26/2015
SLM & Dosimeters – Acoustical Tests, Scantek Inc., Rev. 7/6/2011

Instrumentation used for calibration: Nor-1504 Norsonic Test System:

Instrument - Manufacturer	Description	S/N	Cal. Date	Traceability evidence Cal. Lab / Accreditation	Cal. Due
483B-Norsonic	SME Cal Unit	31061	Jul 27, 2016	Scantek, Inc./ NVLAP	Jul 27, 2017
DS-360-SRS	Function Generator	88077	Sep 15, 2016	ACR Env./ A2LA	Sep 15, 2018
34401A-Agilent Technologies	Digital Voltmeter	MY47011118	Sep 15, 2016	ACR Env./ A2LA	Sep 15, 2017
HM30-Thommen	Meteo Station	1040170/39633	Nov 1, 2016	ACR Env./ A2LA	Nov 1, 2017
PC Program 1019 Norsonic	Calibration software	v.6.1T	Validated Nov 2014	Scantek, Inc.	-
1251-Norsonic	Calibrator	30878	Nov 10, 2016	Scantek, Inc./ NVLAP	Nov 10, 2017

Instrumentation and test results are traceable to SI (International System of Units) through standards maintained by NIST (USA) and NPL (UK).

Environmental conditions:

Temperature (°C)	Barometric pressure (kPa)	Relative Humidity (%)
23.6	99.58	30.5

Calibrated by:	Jeremy Gotwalt	**Authorized signatory:**	Valentin Buzduga
Signature	[signature]	Signature	[signature]
Date	11/11/16	Date	11/14/2016

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B&K 2250 Unit #5 Microphone Calibration Certificate

Scantek, Inc.
CALIBRATION LABORATORY

ISO 17025: 2005, ANSI/NCSL Z540:1994 Part 1
ACCREDITED by NVLAP (an ILAC MRA signatory)

NVLAP®
CALIBRATION
NVLAP Lab Code: 200625-0

Calibration Certificate No.37316

Instrument: **Microphone**
Model: **4189**
Manufacturer: **Brüel & Kjær**
Serial number: **2719777**
Composed of:

Date Calibrated: **11/10/2016** *Cal Due:*

Status:	Received	Sent
In tolerance:	X	X
Out of tolerance:		
See comments:		

Contains non-accredited tests: __Yes _X_ No

Customer: **ACI Acoustical Consultants Inc.**
Tel/Fax: **780-414-6373/-6376**
Address: **5031 - 210 Street, Edmonton, Alberta, CANADA T6M 0A8**

Tested in accordance with the following procedures and standards:
Calibration of Measurement Microphones, Scantek, Inc., Rev. 2/25/2015

Instrumentation used for calibration: N-1504 Norsonic Test System:

Instrument - Manufacturer	Description	S/N	Cal. Date	Traceability evidence Cal. Lab / Accreditation	Cal. Due
483B-Norsonic	SME Cal Unit	31061	Jul 27, 2016	Scantek, Inc./ NVLAP	Jul 27, 2017
DS-360-SRS	Function Generator	88077	Sep 15, 2016	ACR Env./ A2LA	Sep 15, 2018
34401A-Agilent Technologies	Digital Voltmeter	MY47011118	Sep 15, 2016	ACR Env./ A2LA	Sep 15, 2017
HM30-Thommen	Meteo Station	1040170/39633	Nov 1, 2016	ACR Env./ A2LA	Nov 1, 2017
PC Program 1017 Norsonic	Calibration software	v.6.1T	Validated Nov 2014	Scantek, Inc.	-
1253-Norsonic	Calibrator	28326	Nov 10, 2015	Scantek, Inc./ NVLAP	Nov 10, 2016
1203-Norsonic	Preamplifier	92268	Oct 17, 2016	Scantek, Inc./ NVLAP	Oct 17, 2017
4180-Brüel&Kjær	Microphone	2246115	Oct 26, 2015	NPL-UK / UKAS	Oct 26, 2017

Instrumentation and test results are traceable to SI - BIPM through standards maintained by NPL (UK) and NIST (USA)

Calibrated by:	Jeremy Gotwalt	**Authorized signatory:**	Valentin Buzduga
Signature	[signature]	Signature	[signature]
Date	11/10/16	Date	11/14/2016

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B&K 2250 Unit #6 SLM Calibration Certificate

Scantek, Inc.
CALIBRATION LABORATORY
ISO 17025: 2005, ANSI/NCSL Z540:1994 Part 1
ACCREDITED by NVLAP (an ILAC MRA signatory)

NVLAP® CALIBRATION
NVLAP Lab Code: 200625-0

Calibration Certificate No.37313

Instrument:	**Sound Level Meter**	*Date Calibrated:*	**11/10/2016** *Cal Due:*
Model:	**2250**	*Status:*	**Received** / **Sent**
Manufacturer:	**Brüel and Kjær**	*In tolerance:*	X / X
Serial number:	**2661161**	*Out of tolerance:*	
Tested with:	**Microphone 4189 s/n 2650730** **Preamplifier ZC0032 s/n 9935**	*See comments:*	
		Contains non-accredited tests:	__Yes _X_ No
Type (class):	**1**	*Calibration service:*	__ Basic _X_ Standard
Customer:	**ACI Acoustical Consultants Inc.**	*Address:*	**5031 - 210 Street Edmonton, Alberta, CANADA T6M 0A8**
Tel/Fax:	**780-414-6373 / -6376**		

Tested in accordance with the following procedures and standards:
Calibration of Sound Level Meters, Scantek Inc., Rev. 6/26/2015
SLM & Dosimeters – Acoustical Tests, Scantek Inc., Rev. 7/6/2011

Instrumentation used for calibration: Nor-1504 Norsonic Test System:

Instrument - Manufacturer	Description	S/N	Cal. Date	Traceability evidence Cal. Lab / Accreditation	Cal. Due
483B-Norsonic	SME Cal Unit	31061	Jul 27, 2016	Scantek, Inc./ NVLAP	Jul 27, 2017
DS-360-SRS	Function Generator	88077	Sep 15, 2016	ACR Env./ A2LA	Sep 15, 2018
34401A-Agilent Technologies	Digital Voltmeter	MY47011118	Sep 15, 2016	ACR Env./ A2LA	Sep 15, 2017
HM30-Thommen	Meteo Station	1040170/39633	Nov 1, 2016	ACR Env./ A2LA	Nov 1, 2017
PC Program 1019 Norsonic	Calibration software	v.6.1T	Validated Nov 2014	Scantek, Inc.	-
1251-Norsonic	Calibrator	30878	Nov 10, 2016	Scantek, Inc./ NVLAP	Nov 10, 2017

Instrumentation and test results are traceable to SI (International System of Units) through standards maintained by NIST (USA) and NPL (UK).

Environmental conditions:

Temperature (°C)	Barometric pressure (kPa)	Relative Humidity (%)
22.1	100.26	38.2

Calibrated by:	Jeremy Gotwalt	**Authorized signatory:**	Valentin Buzduga
Signature	[signature]	Signature	[signature]
Date	11/10/16	Date	11/14/2016

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B&K 2250 Unit #6 Microphone Calibration Certificate

Scantek, Inc.
CALIBRATION LABORATORY
ISO 17025: 2005, ANSI/NCSL Z540:1994 Part 1
ACCREDITED by NVLAP (an ILAC MRA signatory)

NVLAP®
CALIBRATION
NVLAP Lab Code: 200625-0

Calibration Certificate No.37314

Instrument: **Microphone**
Model: **4189**
Manufacturer: **Brüel & Kjær**
Serial number: **2650730**
Composed of:

Date Calibrated: **11/10/2016** *Cal Due:*

Status:	**Received**	**Sent**
In tolerance:	X	X
Out of tolerance:		
See comments:		

Contains non-accredited tests: __Yes _X_ No

Customer: **ACI Acoustical Consultants Inc.**
Tel/Fax: **780-414-6373/-6376**
Address: **5031 - 210 Street**
Edmonton, Alberta, CANADA
T6M 0A8

Tested in accordance with the following procedures and standards:
Calibration of Measurement Microphones, Scantek, Inc., Rev. 2/25/2015

Instrumentation used for calibration: N-1504 Norsonic Test System:

Instrument - Manufacturer	Description	S/N	Cal. Date	Traceability evidence Cal. Lab / Accreditation	Cal. Due
483B-Norsonic	SME Cal Unit	31061	Jul 27, 2016	Scantek, Inc./ NVLAP	Jul 27, 2017
DS-360-SRS	Function Generator	88077	Sep 15, 2016	ACR Env./ A2LA	Sep 15, 2018
34401A-Agilent Technologies	Digital Voltmeter	MY47011118	Sep 15, 2016	ACR Env./ A2LA	Sep 15, 2017
HM30-Thommen	Meteo Station	1040170/39633	Nov 1, 2016	ACR Env./ A2LA	Nov 1, 2017
PC Program 1017 Norsonic	Calibration software	v.6.1T	Validated Nov 2014	Scantek, Inc.	-
1253-Norsonic	Calibrator	28326	Nov 10, 2015	Scantek, Inc./ NVLAP	Nov 10, 2016
1203-Norsonic	Preamplifier	92268	Oct 17, 2016	Scantek, Inc./ NVLAP	Oct 17, 2017
4180-Brüel&Kjær	Microphone	2246115	Oct 26, 2015	NPL-UK / UKAS	Oct 26, 2017

Instrumentation and test results are traceable to SI - BIPM through standards maintained by NPL (UK) and NIST (USA)

Calibrated by:	Jeremy Gotwalt	**Authorized signatory:**	Valentin Buzduga
Signature	[signature]	Signature	[signature]
Date	11/10/16	Date	11/14/2016

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B&K 4231 Unit #6 Calibrator Calibration Certificate

Scantek, Inc.
CALIBRATION LABORATORY
ISO 17025: 2005, ANSI/NCSL Z540:1994 Part 1
ACCREDITED by NVLAP (an ILAC MRA signatory)

NVLAP®
CALIBRATION
NVLAP Lab Code: 200625-0

Calibration Certificate No.37705

Instrument: **Acoustical Calibrator**
Model: **4231**
Manufacturer: **Brüel and Kjær**
Serial number: **2656414**
Class (IEC 60942): **1**
Barometer type:
Barometer s/n:

Date Calibrated: **1/18/2017** *Cal Due:*

Status:	Received	Sent
In tolerance:	X	X
Out of tolerance:		
See comments:		

Contains non-accredited tests: __Yes _X_ No

Customer: **ACI Acoustical Consultants Inc.**
Tel/Fax: **780-414-6373 / -6376**
Address: **5031 - 210 Street, Edmonton, Alberta, CANADA T6M 0A8**

Tested in accordance with the following procedures and standards:
Calibration of Acoustical Calibrators, Scantek Inc., Rev. 10/1/2010

Instrumentation used for calibration: Nor-1504 Norsonic Test System:

Instrument - Manufacturer	Description	S/N	Cal. Date	Traceability evidence Cal. Lab / Accreditation	Cal. Due
483B-Norsonic	SME Cal Unit	31061	Jul 27, 2016	Scantek, Inc./ NVLAP	Jul 27, 2017
DS-360-SRS	Function Generator	88077	Sep 15, 2016	ACR Env./ A2LA	Sep 15, 2018
34401A-Agilent Technologies	Digital Voltmeter	MY47011118	Sep 15, 2016	ACR Env./ A2LA	Sep 15, 2017
HM30-Thommen	Meteo Station	1040170/39633	Nov 1, 2016	ACR Env./ A2LA	Nov 1, 2017
140-Norsonic	Real Time Analyzer	1403978	Mar 17, 2016	Scantek, Inc. / NVLAP	Mar 17, 2017
PC Program 1018 Norsonic	Calibration software	v.6.1T	Validated Nov 2014	Scantek, Inc.	-
4192-Brüel&Kjær	Microphone	2854675	Nov 11, 2016	Scantek, Inc. / NVLAP	Nov 11, 2017
1203-Norsonic	Preamplifier	92268	Oct 17, 2016	Scantek, Inc./ NVLAP	Oct 17, 2017

Instrumentation and test results are traceable to SI (International System of Units) through standards maintained by NIST (USA) and NPL (UK)

Calibrated by:	Jeremy Gotwalt	**Authorized signatory:**	Steven E. Marshall
Signature	[signature]	Signature	Steven E Marshall
Date	1/18/17	Date	1/20/2017

Calibration Certificates or Test Reports shall not be reproduced, except in full, without written approval of the laboratory.
This Calibration Certificate or Test Reports shall not be used to claim product certification, approval or endorsement by NVLAP, NIST, or any agency of the federal government.
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B&K 2250 Unit #7 SLM Calibration Certificate

Scantek, Inc.
CALIBRATION LABORATORY

ISO 17025: 2005, ANSI/NCSL Z540:1994 Part 1
ACCREDITED by NVLAP (an ILAC MRA signatory)

NVLAP® CALIBRATION
NVLAP Lab Code: 200625-0

Calibration Certificate No.37317

Instrument:	**Sound Level Meter**	*Date Calibrated:* **11/11/2016** *Cal Due:*	
Model:	**2250**	*Status:*	**Received** / **Sent**
Manufacturer:	**Brüel and Kjær**	*In tolerance:*	**X** / **X**
Serial number:	**2722859**	*Out of tolerance:*	
Tested with:	**Microphone 4189 s/n 2710791** **Preamplifier ZC0032 s/n 13398**	*See comments:*	
		Contains non-accredited tests: __Yes X No	
Type (class):	**1**	*Calibration service:* __ Basic X Standard	
Customer:	**ACI Acoustical Consultants Inc.**	*Address:*	**5031 - 210 Street** **Edmonton, Alberta, CANADA** **T6M 0A8**
Tel/Fax:	**780-414-6373 / -6376**		

Tested in accordance with the following procedures and standards:
Calibration of Sound Level Meters, Scantek Inc., Rev. 6/26/2015
SLM & Dosimeters – Acoustical Tests, Scantek Inc., Rev. 7/6/2011

Instrumentation used for calibration: Nor-1504 Norsonic Test System:

Instrument - Manufacturer	Description	S/N	Cal. Date	Traceability evidence Cal. Lab / Accreditation	Cal. Due
483B-Norsonic	SME Cal Unit	31061	Jul 27, 2016	Scantek, Inc./ NVLAP	Jul 27, 2017
DS-360-SRS	Function Generator	88077	Sep 15, 2016	ACR Env./ A2LA	Sep 15, 2018
34401A-Agilent Technologies	Digital Voltmeter	MY47011118	Sep 15, 2016	ACR Env./ A2LA	Sep 15, 2017
HM30-Thommen	Meteo Station	1040170/39633	Nov 1, 2016	ACR Env./ A2LA	Nov 1, 2017
PC Program 1019 Norsonic	Calibration software	v.6.1T	Validated Nov 2014	Scantek, Inc.	-
1251-Norsonic	Calibrator	30878	Nov 10, 2016	Scantek, Inc./ NVLAP	Nov 10, 2017

Instrumentation and test results are traceable to SI (International System of Units) through standards maintained by NIST (USA) and NPL (UK).

Environmental conditions:

Temperature (°C)	Barometric pressure (kPa)	Relative Humidity (%)
22.9	99.83	33.4

Calibrated by:	Jeremy Gotwalt	**Authorized signatory:**	Valentin Buzduga
Signature	[signature]	Signature	[signature]
Date	11/11/16	Date	11/14/2016

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B&K 2250 Unit #7 Microphone Calibration Certificate

Scantek, Inc.
CALIBRATION LABORATORY
ISO 17025: 2005, ANSI/NCSL Z540:1994 Part 1
ACCREDITED by NVLAP (an ILAC MRA signatory)

NVLAP®
CALIBRATION
NVLAP Lab Code: 200625-0

Calibration Certificate No.37318

Instrument: **Microphone**
Model: **4189**
Manufacturer: **Brüel & Kjær**
Serial number: **2710791**
Composed of:

Date Calibrated: **11/10/2016** *Cal Due:*

Status:	**Received**	**Sent**
In tolerance:	X	X
Out of tolerance:		
See comments:		

Contains non-accredited tests: __Yes _X_ No

Customer: **ACI Acoustical Consultants Inc.**
Tel/Fax: **780-414-6373/-6376**
Address: **5031 - 210 Street**
Edmonton, Alberta, CANADA
T6M 0A8

Tested in accordance with the following procedures and standards:
Calibration of Measurement Microphones, Scantek, Inc., Rev. 2/25/2015

Instrumentation used for calibration: N-1504 Norsonic Test System:

Instrument - Manufacturer	Description	S/N	Cal. Date	Traceability evidence Cal. Lab / Accreditation	Cal. Due
483B-Norsonic	SME Cal Unit	31061	Jul 27, 2016	Scantek, Inc./ NVLAP	Jul 27, 2017
DS-360-SRS	Function Generator	88077	Sep 15, 2016	ACR Env./ A2LA	Sep 15, 2018
34401A-Agilent Technologies	Digital Voltmeter	MY47011118	Sep 15, 2016	ACR Env./ A2LA	Sep 15, 2017
HM30-Thommen	Meteo Station	1040170/39633	Nov 1, 2016	ACR Env./ A2LA	Nov 1, 2017
PC Program 1017 Norsonic	Calibration software	v.6.1T	Validated Nov 2014	Scantek, Inc.	-
1253-Norsonic	Calibrator	28326	Nov 10, 2015	Scantek, Inc./ NVLAP	Nov 10, 2016
1203-Norsonic	Preamplifier	92268	Oct 17, 2016	Scantek, Inc./ NVLAP	Oct 17, 2017
4180-Brüel&Kjær	Microphone	2246115	Oct 26, 2015	NPL-UK / UKAS	Oct 26, 2017

Instrumentation and test results are traceable to SI - BIPM through standards maintained by NPL (UK) and NIST (USA)

Calibrated by:	Jeremy Gotwalt	**Authorized signatory:**	Valentin Buzduga
Signature	[signature]	Signature	[signature]
Date	11/10/16	Date	11/14/2016

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B&K 2250 Unit #9 SLM Calibration Certificate

Scantek, Inc.
CALIBRATION LABORATORY

ISO 17025: 2005, ANSI/NCSL Z540:1994 Part 1
ACCREDITED by NVLAP (an ILAC MRA signatory)

NVLAP®
NVLAP Lab Code: 200625-0

Calibration Certificate No.36134

Instrument:	**Sound Level Meter**	*Date Calibrated:* **4/29/2016** *Cal Due:*		
Model:	**2250**	*Status:*	**Received**	**Sent**
Manufacturer:	**Brüel and Kjær**	*In tolerance:*	**X**	**X**
Serial number:	**3006198**	*Out of tolerance:*		
Tested with:	**Microphone 4189 s/n 2906926**	*See comments:*		
	Preamplifier ZC0032 s/n 19467	*Contains non-accredited tests:* __Yes **X** No		
Type (class):	**1**	*Calibration service:* __ Basic **X** Standard		
Customer:	**Acoustical Consultants Inc.**	*Address:* **5031 210 Street, Edmonton, Alberta, Canada T6M 0A8**		
Tel/Fax:	**780-414-6373 /**			

Tested in accordance with the following procedures and standards:
Calibration of Sound Level Meters, Scantek Inc., Rev. 6/26/2015
SLM & Dosimeters – Acoustical Tests, Scantek Inc., Rev. 7/6/2011

Instrumentation used for calibration: Nor-1504 Norsonic Test System:

Instrument - Manufacturer	Description	S/N	Cal. Date	Traceability evidence Cal. Lab / Accreditation	Cal. Due
483B-Norsonic	SME Cal Unit	31061	Jul 20, 2015	Scantek, Inc./ NVLAP	Jul 20, 2016
DS-360-SRS	Function Generator	88077	Sep 9, 2014	ACR Env./ A2LA	Sep 9, 2016
34401A-Agilent Technologies	Digital Voltmeter	MY47011118	Sep 24, 2015	ACR Env./ A2LA	Sep 24, 2016
HM30-Thommen	Meteo Station	1040170/39633	Oct 23, 2015	ACR Env./ A2LA	Oct 23, 2016
PC Program 1019 Norsonic	Calibration software	v.6.1T	Validated Nov 2014	Scantek, Inc.	-
1251-Norsonic	Calibrator	30878	Nov 10, 2015	Scantek, Inc./ NVLAP	Nov 10, 2016

Instrumentation and test results are traceable to SI (International System of Units) through standards maintained by NIST (USA) and NPL (UK).

Environmental conditions:

Temperature (°C)	Barometric pressure (kPa)	Relative Humidity (%)
22.6	100.23	37.2

Calibrated by:	Jeremy Gotwalt	**Authorized signatory:**	Valentin Buzduga
Signature	[signature]	Signature	[signature]
Date	4/29/16	Date	5/04/2016

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B&K 2250 Unit #9 Microphone Calibration Certificate

Scantek, Inc.
CALIBRATION LABORATORY
ISO 17025: 2005, ANSI/NCSL Z540:1994 Part 1
ACCREDITED by NVLAP (an ILAC MRA signatory)

NVLAP®
NVLAP Lab Code: 200625-0

Calibration Certificate No.36135

Instrument:	**Microphone**	*Date Calibrated:*	**4/28/2016** *Cal Due:*		
Model:	**4189**	*Status:*		**Received**	**Sent**
Manufacturer:	**Brüel & Kjær**	*In tolerance:*		X	X
Serial number:	**2906926**	*Out of tolerance:*			
Composed of:		*See comments:*			
		Contains non-accredited tests: __Yes _X_ No			
Customer:	**Acoustical Consultants Inc.**	*Address:*	**5031 210 Street**		
Tel/Fax:	**780-414-6373/**		**Edmonton, Alberta, Canada T6M 0A8**		

Tested in accordance with the following procedures and standards:
Calibration of Measurement Microphones, Scantek, Inc., Rev. 2/25/2015

Instrumentation used for calibration: N-1504 Norsonic Test System:

Instrument - Manufacturer	Description	S/N	Cal. Date	Traceability evidence Cal. Lab / Accreditation	Cal. Due
483B-Norsonic	SME Cal Unit	31061	Jul 20, 2015	Scantek, Inc./ NVLAP	Jul 20, 2016
DS-360-SRS	Function Generator	88077	Sep 9, 2014	ACR Env./ A2LA	Sep 9, 2016
34401A-Agilent Technologies	Digital Voltmeter	MY47011118	Sep 24, 2015	ACR Env./ A2LA	Sep 24, 2016
HM30-Thommen	Meteo Station	1040170/39633	Oct 23, 2015	ACR Env./ A2LA	Oct 23, 2016
PC Program 1017 Norsonic	Calibration software	v.6.1T	Validated Nov 2014	Scantek, Inc.	-
1253-Norsonic	Calibrator	22909	Nov 10, 2015	Scantek, Inc./ NVLAP	Nov 10, 2016
1203-Norsonic	Preamplifier	92268	Oct 14, 2015	Scantek, Inc./ NVLAP	Oct 14, 2016
4180-Brüel&Kjær	Microphone	2246115	Oct 26, 2015	NPL-UK / UKAS	Oct 26, 2017

Instrumentation and test results are traceable to SI - BIPM through standards maintained by NPL (UK) and NIST (USA)

Calibrated by:	Jeremy Gotwalt	**Authorized signatory:**	Valentin Buzduga
Signature	[signature]	Signature	[signature]
Date	4/28/16	Date	5/04/2016

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B&K 2250 Unit #10 SLM Calibration Certificate

Scantek, Inc.
CALIBRATION LABORATORY
ISO 17025: 2005, ANSI/NCSL Z540:1994 Part 1
ACCREDITED by NVLAP (an ILAC MRA signatory)

NVLAP CALIBRATION
NVLAP Lab Code: 200625-0

Calibration Certificate No.38469

Instrument: **Sound Level Meter**
Model: **2250**
Manufacturer: **Brüel and Kjær**
Serial number: **3007542**
Tested with: **Microphone 4189 s/n 2978664**
Preamplifier ZC0032 s/n 22379
Type (class): **1**
Customer: **ACI Acoustical Consultants Inc.**
Tel/Fax: **780-414-6373 / 780-414-6376**

Date Calibrated: **5/9/2017** *Cal Due:*

Status:	Received	Sent
In tolerance:	X	X
Out of tolerance:		
See comments:		

Contains non-accredited tests: __Yes _X_ No
Calibration service: ___ Basic _X_ Standard
Address: **5031 - 210 Street**
Edmonton, Alberta
CANADA T6M 0A8

Tested in accordance with the following procedures and standards:
Calibration of Sound Level Meters, Scantek Inc., Rev. 6/26/2015
SLM & Dosimeters – Acoustical Tests, Scantek Inc., Rev. 7/6/2011

Instrumentation used for calibration: Nor-1504 Norsonic Test System:

Instrument - Manufacturer	Description	S/N	Cal. Date	Traceability evidence Cal. Lab / Accreditation	Cal. Due
483B-Norsonic	SME Cal Unit	31061	Jul 27, 2016	Scantek, Inc./ NVLAP	Jul 27, 2017
DS-360-SRS	Function Generator	88077	Sep 15, 2016	ACR Env./ A2LA	Sep 15, 2018
34401A-Agilent Technologies	Digital Voltmeter	MY47011118	Sep 15, 2016	ACR Env./ A2LA	Sep 15, 2017
HM30-Thommen	Meteo Station	1040170/39633	Nov 1, 2016	ACR Env./ A2LA	Nov 1, 2017
PC Program 1019 Norsonic	Calibration software	v.6.1T	Validated Nov 2014	Scantek, Inc.	-
1251-Norsonic	Calibrator	30878	Nov 10, 2016	Scantek, Inc./ NVLAP	Nov 10, 2017

Instrumentation and test results are traceable to SI (International System of Units) through standards maintained by NIST (USA) and NPL (UK).

Environmental conditions:

Temperature (°C)	Barometric pressure (kPa)	Relative Humidity (%)
22.5	100.05	43.4

Calibrated by:	Jeremy Gotwalt	**Authorized signatory:**	Steven E. Marshall
Signature	[signature]	Signature	[signature]
Date		Date	5/9/2017

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B&K 2250 Unit #10 Microphone Calibration Certificate

Scantek, Inc.
CALIBRATION LABORATORY

ISO 17025: 2005, ANSI/NCSL Z540:1994 Part 1
ACCREDITED by NVLAP (an ILAC MRA signatory)

NVLAP®
CALIBRATION
NVLAP Lab Code: 200625-0

Calibration Certificate No.38470

Instrument:	**Microphone**	*Date Calibrated:* **5/8/2017**	*Cal Due:*	
Model:	**4189**	*Status:*	**Received**	**Sent**
Manufacturer:	**Brüel & Kjær**	*In tolerance:*	X	X
Serial number:	**2978664**	*Out of tolerance:*		
Composed of:		*See comments:*		
		Contains non-accredited tests: __Yes _X_ No		
Customer:	**ACI Acoustical Consultants Inc.**	*Address:*	**5031 - 210 Street Edmonton, Alberta CANADA T6M 0A8**	
Tel/Fax:	**780-414-6373/780-414-6376**			

Tested in accordance with the following procedures and standards:
Calibration of Measurement Microphones, Scantek, Inc., Rev. 2/25/2015

Instrumentation used for calibration: N-1504 Norsonic Test System:

Instrument - Manufacturer	Description	S/N	Cal. Date	Traceability evidence Cal. Lab / Accreditation	Cal. Due
483B-Norsonic	SME Cal Unit	31061	Jul 27, 2016	Scantek, Inc./ NVLAP	Jul 27, 2017
DS-360-SRS	Function Generator	88077	Sep 15, 2016	ACR Env./ A2LA	Sep 15, 2018
34401A-Agilent Technologies	Digital Voltmeter	MY47011118	Sep 15, 2016	ACR Env./ A2LA	Sep 15, 2017
HM30-Thommen	Meteo Station	1040170/39633	Nov 1, 2016	ACR Env./ A2LA	Nov 1, 2017
PC Program 1017 Norsonic	Calibration software	v.6.1T	Validated Nov 2014	Scantek, Inc.	-
1253-Norsonic	Calibrator	28326	Nov 10, 2016	Scantek, Inc./ NVLAP	Nov 10, 2017
1203-Norsonic	Preamplifier	92268	Oct 17, 2016	Scantek, Inc./ NVLAP	Oct 17, 2017
4180-Brüel&Kjær	Microphone	2246115	Oct 26, 2015	NPL-UK / UKAS	Oct 26, 2017

Instrumentation and test results are traceable to SI - BIPM through standards maintained by NPL (UK) and NIST (USA)

Calibrated by:	Jeremy Gotwalt	**Authorized signatory:**	Steven E. Marshall
Signature	[signature]	Signature	[signature]
Date	5/8/17	Date	5/9/2017

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This Calibration Certificate or Test Reports shall not be used to claim product certification, approval or endorsement by NVLAP, NIST, or any agency of the federal government.
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Appendix II THE ASSESSMENT OF ENVIRONMENTAL NOISE (GENERAL)

Sound Pressure Level

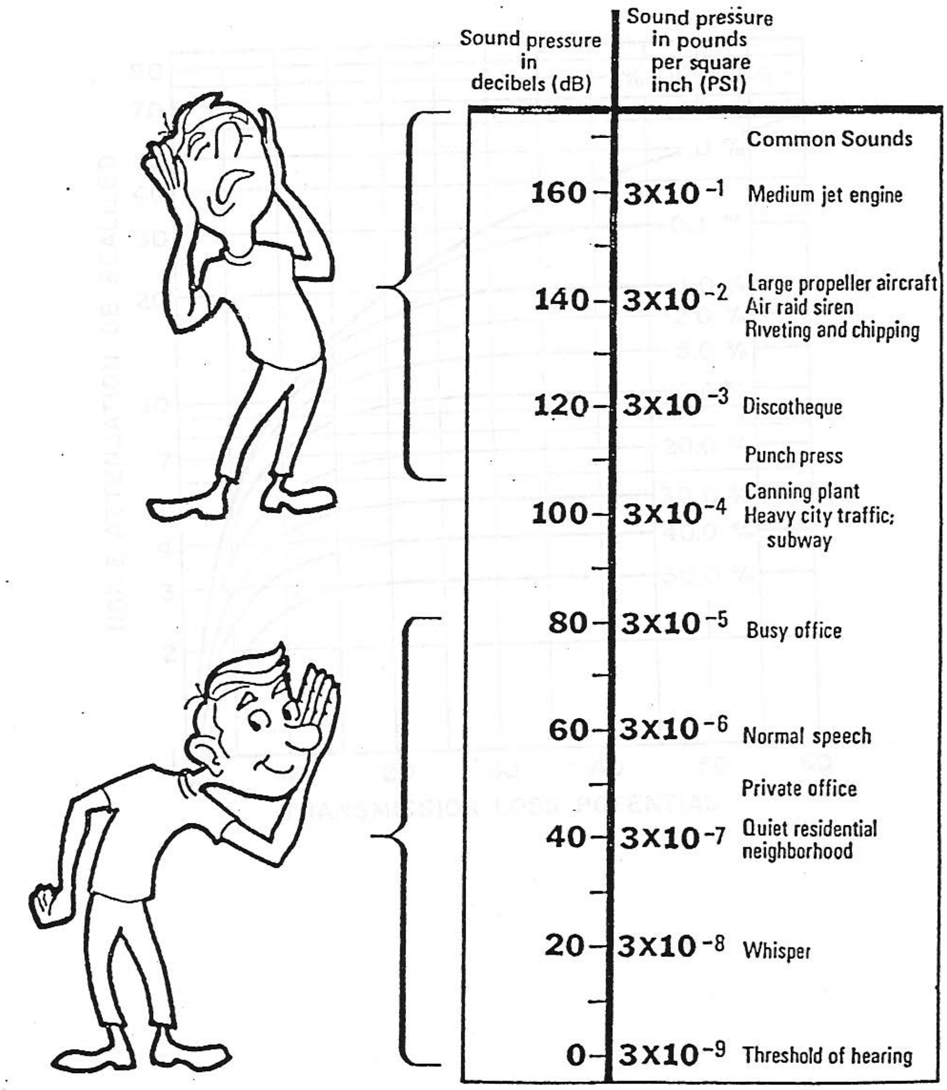
Sound pressure is initially measured in Pascal's (Pa). Humans can hear several orders of magnitude in sound pressure levels, so a more convenient scale is used. This scale is known as the decibel (dB) scale, named after Alexander Graham Bell (telephone guy). It is a base 10 logarithmic scale. When we measure pressure we typically measure the RMS sound pressure.

$$SPL = 10\log_{10}\left[\frac{P_{RMS}^2}{P_{ref}^2}\right] = 20\log_{10}\left[\frac{P_{RMS}}{P_{ref}}\right]$$

Where: SPL = Sound Pressure Level in dB
P_{RMS} = Root Mean Square measured pressure (Pa)
P_{ref} = Reference sound pressure level ($P_{ref} = 2x10^{-5}$ Pa = 20 μPa)

This reference sound pressure level is an internationally agreed upon value. It represents the threshold of human hearing for "typical" people based on numerous testing. It is possible to have a threshold which is lower than 20 μPa which will result in negative dB levels. As such, zero dB does not mean there is no sound!

In general, a difference of 1 – 2 dB is the threshold for humans to notice that there has been a change in sound level. A difference of 3 dB (factor of 2 in acoustical energy) is perceptible and a change of 5 dB is strongly perceptible. A change of 10 dB is typically considered a factor of 2. This is quite remarkable when considering that 10 dB is 10-times the acoustical energy!


Sound pressure in decibels (dB)
Sound pressure in pounds per square inch (PSI)
Common Sounds
160 3X10 -1 Medium jet engine
140 3X10 -2 Large propeller aircraft
Air raid siren
Riveting and chipping
120 3X10 -3 Discotheque
Punch press
Canning plant
100 3X10 -4 Heavy city traffic; subway
80 3X10 -5 Busy office
60 3X10 -6 Normal speech
Private office
40 3X10 -7 Quiet residential neighborhood
20 3X10 -8 Whisper
0 3X10 -9 Threshold of hearing

Frequency

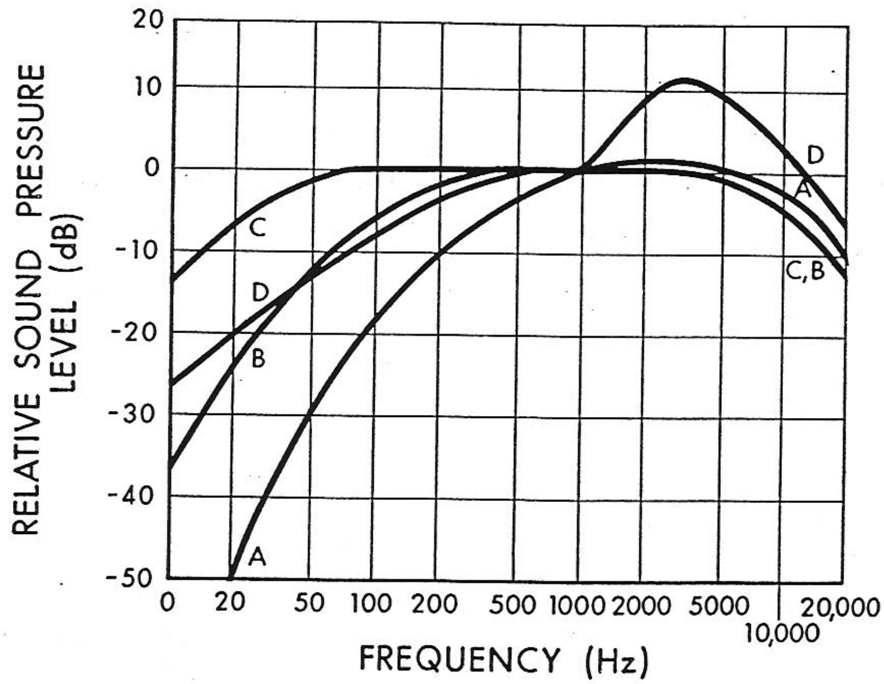
The range of frequencies audible to the human ear ranges from approximately 20 Hz to 20 kHz. Within this range, the human ear does not hear equally at all frequencies. It is not very sensitive to low frequency sounds, is very sensitive to mid frequency sounds and is slightly less sensitive to high frequency sounds. Due to the large frequency range of human hearing, the entire spectrum is often divided into 31 bands, each known as a 1/3 octave band.

The internationally agreed upon center frequencies and upper and lower band limits for the 1/1 (whole octave) and 1/3 octave bands are as follows:

Lower Band Limit	Whole Octave Center Frequency	Upper Band Limit
11	**16**	22
22	**31.5**	44
44	**63**	88
88	**125**	177
177	**250**	355
355	**500**	710
710	**1000**	1420
1420	**2000**	2840
2840	**4000**	5680
5680	**8000**	11360
11360	**16000**	22720

Lower Band Limit	1/3 Octave Center Frequency	Upper Band Limit
14.1	**16**	17.8
17.8	**20**	22.4
22.4	**25**	28.2
28.2	**31.5**	35.5
35.5	**40**	44.7
44.7	**50**	56.2
56.2	**63**	70.8
70.8	**80**	89.1
89.1	**100**	112
112	**125**	141
141	**160**	178
178	**200**	224
224	**250**	282
282	**315**	355
355	**400**	447
447	**500**	562
562	**630**	708
708	**800**	891
891	**1000**	1122
1122	**1250**	1413
1413	**1600**	1778
1778	**2000**	2239
2239	**2500**	2818
2818	**3150**	3548
3548	**4000**	4467
4467	**5000**	5623
5623	**6300**	7079
7079	**8000**	8913
8913	**10000**	11220
11220	**12500**	14130
14130	**16000**	17780
17780	**20000**	22390

Human hearing is most sensitive at approximately 3500 Hz which corresponds to the ¼ wavelength of the ear canal (approximately 2.5 cm). Because of this range of sensitivity to various frequencies, we typically apply various weighting networks to the broadband measured sound to more appropriately account for the way humans hear. By default, the most common weighting network used is the so-called "A-weighting". It can be seen in the figure that the low frequency sounds are reduced significantly with the A-weighting.



Combination of Sounds

When combining multiple sound sources the general equation is:

$$\Sigma SPL_n = 10\log_{10}\left[\sum_{i=1}^{n} 10^{\frac{SPL_i}{10}}\right]$$

Examples:

- Two sources of 50 dB each add together to result in 53 dB.
- Three sources of 50 dB each add together to result in 55 dB.
- Ten sources of 50 dB each add together to result in 60 dB.
- One source of 50 dB added to another source of 40 dB results in 50.4 dB

It can be seen that, if multiple similar sources exist, removing or reducing only one source will have little effect.

Sound Level Measurements

Over the years a number of methods for measuring and describing environmental noise have been developed. The most widely used and accepted is the concept of the Energy Equivalent Sound Level (L_{eq}) which was developed in the US (1970's) to characterize noise levels near US Air-force bases. This is the level of a steady state sound which, for a given period of time, would contain the same energy as the time varying sound. The concept is that the same amount of annoyance occurs from a sound having a high level for a short period of time as from a sound at a lower level for a longer period of time.

The L_{eq} is defined as:

$$L_{eq} = 10\log_{10}\left[\frac{1}{T}\int_0^T 10^{\frac{dB}{10}}\,dT\right] = 10\log_{10}\left[\frac{1}{T}\int_0^T \frac{P^2}{P_{ref}^2}\,dT\right]$$

We must specify the time period over which to measure the sound. i.e. 1-second, 10-seconds, 15-seconds, 1-minute, 1-day, etc. **An L_{eq} is meaningless if there is no time period associated**.

In general there a few very common L_{eq} sample durations which are used in describing environmental noise measurements. These include:

- $L_{eq}24$ - Measured over a 24-hour period
- $L_{eq}Night$ - Measured over the night-time (typically 22:00 – 07:00)
- $L_{eq}Day$ - Measured over the day-time (typically 07:00 – 22:00)
- L_{DN} - Same as $L_{eq}24$ with a 10 dB penalty added to the night-time

Statistical Descriptor

Another method of conveying long term noise levels utilizes statistical descriptors. These are calculated from a cumulative distribution of the sound levels over the entire measurement duration and then determining the sound level at xx % of the time.

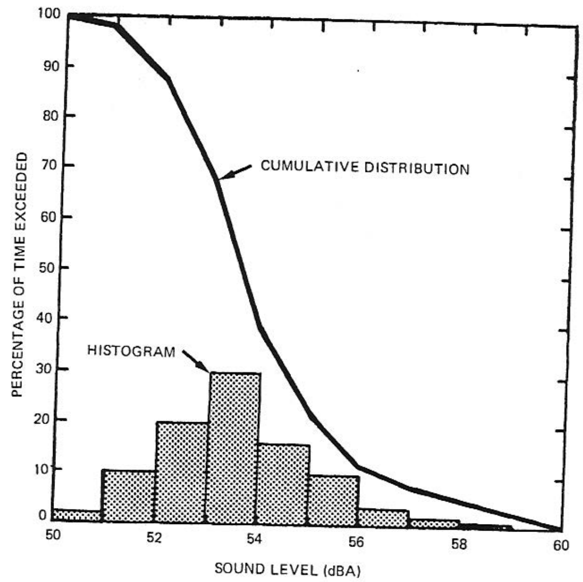


Figure 16.6 Statistically processed community noise showing histogram and cumulative distribution of A weighted sound levels.

Industrial Noise Control, Lewis Bell, Marcel Dekker, Inc. 1994

The most common statistical descriptors are:

L_{min} - minimum sound level measured
L_{01} - sound level that was exceeded only 1% of the time
L_{10} - sound level that was exceeded only 10% of the time.
- Good measure of intermittent or intrusive noise
- Good measure of Traffic Noise

L_{50} - sound level that was exceeded 50% of the time (arithmetic average)
- Good to compare to L_{eq} to determine steadiness of noise

L_{90} - sound level that was exceeded 90% of the time
- Good indicator of typical "ambient" noise levels

L_{99} - sound level that was exceeded 99% of the time
L_{max} - maximum sound level measured

These descriptors can be used to provide a more detailed analysis of the varying noise climate:

- If there is a large difference between the L_{eq} and the L_{50} (L_{eq} can never be any lower than the L_{50}) then it can be surmised that one or more short duration, high level sound(s) occurred during the time period.
- If the gap between the L_{10} and L_{90} is relatively small (less than 15 – 20 dBA) then it can be surmised that the noise climate was relatively steady.

Sound Propagation

In order to understand sound propagation, the nature of the source must first be discussed. In general, there are three types of sources. These are known as 'point', 'line', and 'area'. This discussion will concentrate on point and line sources since area sources are much more complex and can usually be approximated by point sources at large distances.

Point Source

As sound radiates from a point source, it dissipates through geometric spreading. The basic relationship between the sound levels at two distances from a point source is:

$$\therefore SPL_1 - SPL_2 = 20\log_{10}\left(\frac{r_2}{r_1}\right)$$

Where: SPL_1 = sound pressure level at location 1, SPL_2 = sound pressure level at location 2
r_1 = distance from source to location 1, r_2 = distance from source to location 2

Thus, the reduction in sound pressure level for a point source radiating in a free field is **6 dB per doubling of distance**. This relationship is independent of reflectivity factors provided they are always present. Note that this only considers geometric spreading and does not take into account atmospheric effects. Point sources still have some physical dimension associated with them, and typically do not radiate sound equally in all directions in all frequencies. The directionality of a source is also highly dependent on frequency. As frequency increases, directionality increases.

Examples (note no atmospheric absorption):

- A point source measuring 50 dB at 100m will be 44 dB at 200m.
- A point source measuring 50 dB at 100m will be 40.5 dB at 300m.
- A point source measuring 50 dB at 100m will be 38 dB at 400m.
- A point source measuring 50 dB at 100m will be 30 dB at 1000m.

Line Source

A line source is similar to a point source in that it dissipates through geometric spreading. The difference is that a line source is equivalent to a long line of many point sources. The basic relationship between the sound levels at two distances from a line source is:

$$SPL_1 - SPL_2 = 10\log_{10}\left(\frac{r_2}{r_1}\right)$$

The difference from the point source is that the '20' term in front of the 'log' is now only 10. Thus, the reduction in sound pressure level for a line source radiating in a free field is **3 dB per doubling of distance**.

Examples (note no atmospheric absorption):

- A line source measuring 50 dB at 100m will be 47 dB at 200m.
- A line source measuring 50 dB at 100m will be 45 dB at 300m.
- A line source measuring 50 dB at 100m will be 44 dB at 400m.
- A line source measuring 50 dB at 100m will be 40 dB at 1000m.

Atmospheric Absorption

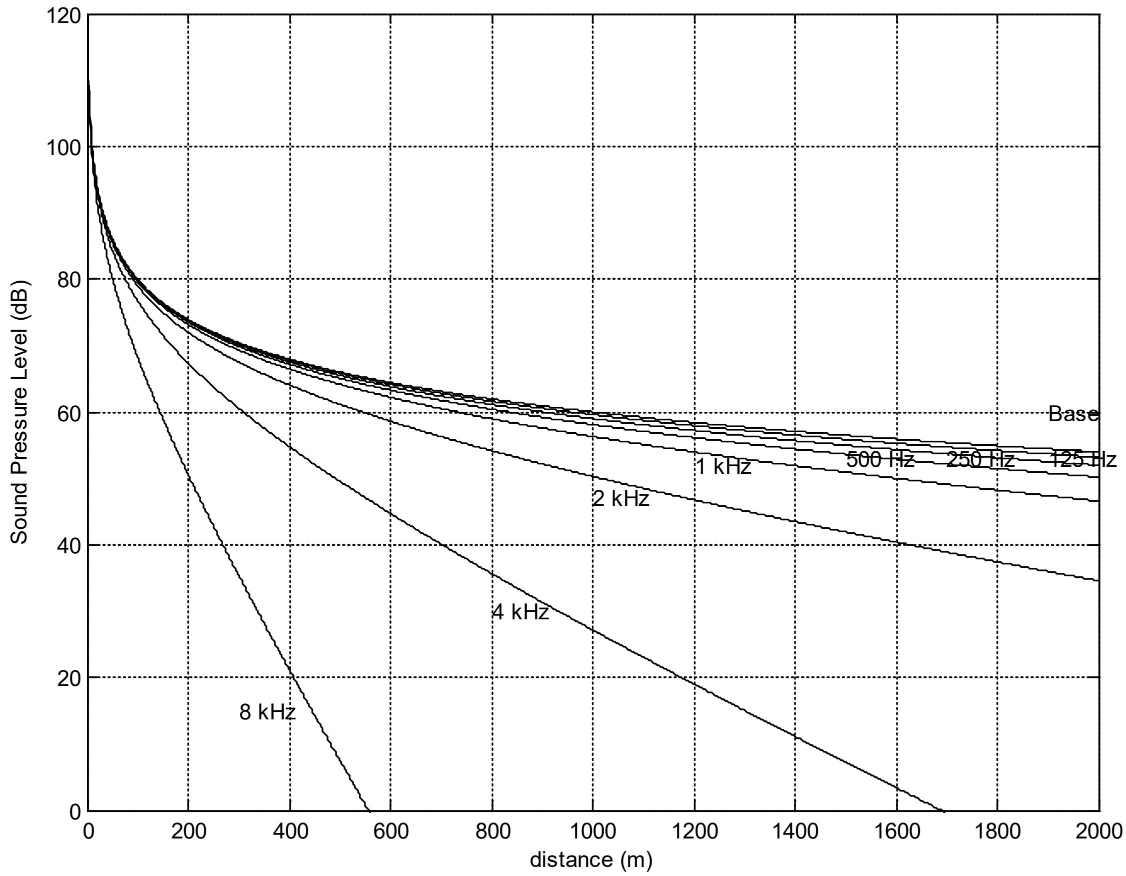
As sound transmits through a medium, there is an attenuation (or dissipation of acoustic energy) which can be attributed to three mechanisms:

1) **Viscous Effects** - Dissipation of acoustic energy due to fluid friction which results in thermodynamically irreversible propagation of sound.
2) **Heat Conduction Effects** - Heat transfer between high and low temperature regions in the wave which result in non-adiabatic propagation of the sound.
3) **Inter Molecular Energy Interchanges** - Molecular energy relaxation effects which result in a time lag between changes in translational kinetic energy and the energy associated with rotation and vibration of the molecules.

The following table illustrates the attenuation coefficient of sound at standard pressure (101.325 kPa) in units of dB/100m.

Temperature	Relative Humidity	Frequency (Hz)					
ºC	(%)	125	250	500	1000	2000	4000
30	20	0.06	0.18	0.37	0.64	1.40	4.40
	50	0.03	0.10	0.33	0.75	1.30	2.50
	90	0.02	0.06	0.24	0.70	1.50	2.60
20	20	0.07	0.15	0.27	0.62	1.90	6.70
	50	0.04	0.12	0.28	0.50	1.00	2.80
	90	0.02	0.08	0.26	0.56	0.99	2.10
10	20	0.06	0.11	0.29	0.94	3.20	9.00
	50	0.04	0.11	0.20	0.41	1.20	4.20
	90	0.03	0.10	0.21	0.38	0.81	2.50
0	20	0.05	0.15	0.50	1.60	3.70	5.70
	50	0.04	0.08	0.19	0.60	2.10	6.70
	90	0.03	0.08	0.15	0.36	1.10	4.10

- As frequency increases, absorption tends to increase
- As Relative Humidity increases, absorption tends to decrease
- There is no direct relationship between absorption and temperature
- **The net result of atmospheric absorption is to modify the sound propagation of a point source from 6 dB/doubling-of-distance to approximately 7 – 8 dB/doubling-of-distance (based on anecdotal experience)**



Atmospheric Absorption at 10°C and 70% RH

Meteorological Effects

There are many meteorological factors which can affect how sound propagates over large distances. These various phenomena must be considered when trying to determine the relative impact of a noise source either after installation or during the design stage.

Wind
- Can greatly alter the noise climate away from a source depending on direction
- Sound levels downwind from a source can be increased due to refraction of sound back down towards the surface. This is due to the generally higher velocities as altitude increases.
- Sound levels upwind from a source can be decreased due to a "bending" of the sound away from the earth's surface.
- Sound level differences of ±10dB are possible depending on severity of wind and distance from source.
- Sound levels crosswind are generally not disturbed by an appreciable amount
- Wind tends to generate its own noise, however, and can provide a high degree of masking relative to a noise source of particular interest.

Temperature
- Temperature effects can be similar to wind effects
- Typically, the temperature is warmer at ground level than it is at higher elevations.
- If there is a very large difference between the ground temperature (very warm) and the air aloft (only a few hundred meters) then the transmitted sound refracts upward due to the changing speed of sound.
- If the air aloft is warmer than the ground temperature (known as an *inversion*) the resulting higher speed of sound aloft tends to refract the transmitted sound back down towards the ground. This essentially works on Snell's law of reflection and refraction.
- Temperature inversions typically happen early in the morning and are most common over large bodies of water or across river valleys.
- Sound level differences of ±10dB are possible depending on gradient of temperature and distance from source.

Rain
- Rain does not affect sound propagation by an appreciable amount unless it is very heavy
- The larger concern is the noise generated by the rain itself. A heavy rain striking the ground can cause a significant amount of highly broadband noise. The amount of noise generated is difficult to predict.
- Rain can also affect the output of various noise sources such as vehicle traffic.

Summary
- In general, these wind and temperature effects are difficult to predict
- Empirical models (based on measured data) have been generated to attempt to account for these effects.
- Environmental noise measurements must be conducted with these effects in mind. Sometimes it is desired to have completely calm conditions, other times a "worst case" of downwind noise levels are desired.

Topographical Effects

Similar to the various atmospheric effects outlined in the previous section, the effect of various geographical and vegetative factors must also be considered when examining the propagation of noise over large distances.

Topography

- One of the most important factors in sound propagation.
- Can provide a natural barrier between source and receiver (i.e. if berm or hill in between).
- Can provide a natural amplifier between source and receiver (i.e. large valley in between or hard reflective surface in between).
- Must look at location of topographical features relative to source and receiver to determine importance (i.e. small berm 1km away from source and 1km away from receiver will make negligible impact).

Grass

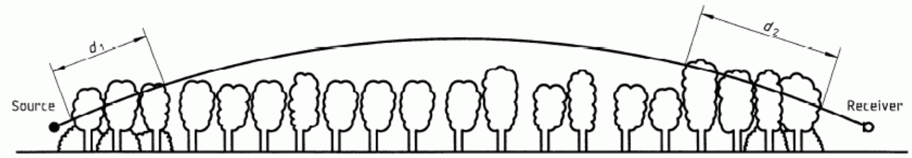
- Can be an effective absorber due to large area covered
- Only effective at low height above ground. Does not affect sound transmitted direct from source to receiver if there is line of sight.
- Typically less absorption than atmospheric absorption when there is line of sight.
- Approximate rule of thumb based on empirical data is:

$$A_g = 18\log_{10}(f) - 31 \qquad (dB/100m)$$

Where: A_g is the absorption amount

Trees

- Provide absorption due to foliage
- Deciduous trees are essentially ineffective in the winter
- Absorption depends heavily on density and height of trees
- No data found on absorption of various kinds of trees
- Large spans of trees are required to obtain even minor amounts of sound reduction
- In many cases, trees can provide an effective visual barrier, even if the noise attenuation is negligible.



NOTE — $d_f = d_1 + d_2$

For calculating d_1 and d_2, the curved path radius may be assumed to be 5 km.

Figure A.1 — Attenuation due to propagation through foliage increases linearly with propagation distance d_f through the foliage

Table A.1 — Attenuation of an octave band of noise due to propagation a distance d_f through dense foliage

Propagation distance d_f m	Nominal midband frequency Hz							
	63	125	250	500	1 000	2 000	4 000	8 000
$10 \leq d_f \leq 20$	Attenuation, dB: 0	0	1	1	1	1	2	3
$20 \leq d_f \leq 200$	Attenuation, dB/m: 0,02	0,03	0,04	0,05	0,06	0,08	0,09	0,12

Tree/Foliage attenuation from ISO 9613-2:1996

Bodies of Water

- Large bodies of water can provide the opposite effect to grass and trees.
- Reflections caused by small incidence angles (grazing) can result in larger sound levels at great distances (increased reflectivity, Q).
- Typically air temperatures are warmer high aloft since air temperatures near water surface tend to be more constant. Result is a high probability of temperature inversion.
- Sound levels can “carry” much further.

Snow

- Covers the ground for approximately 1/2 of the year in northern climates.
- Can act as an absorber or reflector (and varying degrees in between).
- Freshly fallen snow can be quite absorptive.
- Snow which has been sitting for a while and hard packed due to wind can be quite reflective.
- Falling snow can be more absorptive than rain, but does not tend to produce its own noise.
- Snow can cover grass which might have provided some means of absorption.
- Typically sound propagates with less impedance in winter due to hard snow on ground and no foliage on trees/shrubs.

Appendix III SOUND LEVELS OF FAMILIAR NOISE SOURCES

Used with Permission Obtained from the Alberta Energy Regulator (AER) Directive 038 (February 2007)

Source[1]	**Sound Level (dBA)**
Bedroom of a country home	30
Soft whisper at 1.5 m	30
Quiet office or living room	40
Moderate rainfall	50
Inside average urban home	50
Quiet street	50
Normal conversation at 1 m	60
Noisy office	60
Noisy restaurant	70
Highway traffic at 15 m	75
Loud singing at 1 m	75
Tractor at 15 m	78-95
Busy traffic intersection	80
Electric typewriter	80
Bus or heavy truck at 15 m	88-94
Jackhammer	88-98
Loud shout	90
Freight train at 15 m	95
Modified motorcycle	95
Jet taking off at 600 m	100
Amplified rock music	110
Jet taking off at 60 m	120
Air-raid siren	130

[1] Cottrell, Tom, 1980, *Noise in Alberta*, Table 1, p.8, ECA80 - 16/1B4 (Edmonton: Environment Council of Alberta).

SOUND LEVELS GENERATED BY COMMON APPLIANCES

Used with Permission Obtained from the Alberta Energy Regulator (AER) Directive 038 (February 2007)

Source[1]	**Sound level at 3 feet (dBA)**
Freezer	38-45
Refrigerator	34-53
Electric heater	47
Hair clipper	50
Electric toothbrush	48-57
Humidifier	41-54
Clothes dryer	51-65
Air conditioner	50-67
Electric shaver	47-68
Water faucet	62
Hair dryer	58-64
Clothes washer	48-73
Dishwasher	59-71
Electric can opener	60-70
Food mixer	59-75
Electric knife	65-75
Electric knife sharpener	72
Sewing machine	70-74
Vacuum cleaner	65-80
Food blender	65-85
Coffee mill	75-79
Food waste disposer	69-90
Edger and trimmer	81
Home shop tools	64-95
Hedge clippers	85
Electric lawn mower	80-90

[1] Reif, Z. F., and Vermeulen, P. J., 1979, "Noise from domestic appliances, construction, and industry," Table 1, p.166, in Jones, H. W., ed., *Noise in the Human Environment*, vol. 2, ECA79-SP/1 (Edmonton: Environment Council of Alberta).

Appendix IV DATA REMOVAL

Data Removal Noise Monitoring Location #1

Start Time	End Time	Duration (min)	Reason
7/27/17 22:06	7/27/17 22:21	14.6	Excessive Wind Noise
7/27/17 22:23	7/27/17 22:24	0.9	Thunder
7/27/17 22:25	7/27/17 22:25	0.9	Thunder
7/27/17 22:27	7/27/17 22:27	0.9	Thunder
7/27/17 22:30	7/27/17 22:30	0.1	Thunder
7/27/17 22:30	7/27/17 22:31	0.9	Thunder
7/27/17 22:36	7/27/17 22:37	1.1	Thunder
7/27/17 22:37	7/27/17 22:49	11.9	Excessive Wind Noise
7/27/17 22:49	7/27/17 22:50	0.9	Thunder
7/27/17 22:54	7/27/17 22:55	0.9	Thunder
7/27/17 22:58	7/27/17 22:59	1.1	Loud Vehicle Passby
7/27/17 23:00	7/27/17 23:01	1.6	Loud Vehicle Passby
7/27/17 23:03	7/27/17 23:04	0.9	Thunder
7/27/17 23:05	7/27/17 23:05	0.9	Loud Vehicle Passby
7/27/17 23:09	7/27/17 23:10	1.4	Loud Vehicle Passby
7/27/17 23:10	7/27/17 23:11	0.9	Loud Vehicle Passby
7/27/17 23:14	7/27/17 23:14	0.9	Loud Vehicle Passby
7/27/17 23:40	7/27/17 23:41	1.1	Train Passby
7/27/17 23:59	7/28/17 00:00	0.6	Excessive Wind Noise
7/28/17 00:14	7/28/17 00:15	1.1	Loud Vehicle Passby
7/28/17 00:19	7/28/17 00:19	0.1	Train Passby
7/28/17 00:19	7/28/17 00:20	0.6	Train Passby
7/28/17 00:22	7/28/17 00:22	0.6	Excessive Bird Noise
7/28/17 00:41	7/28/17 00:42	0.9	Loud Vehicle Passby
7/28/17 00:53	7/28/17 00:54	0.9	Loud Vehicle Passby
7/28/17 00:56	7/28/17 00:56	0.6	Excessive Wind Noise
7/28/17 01:30	7/28/17 01:31	0.4	Loud Vehicle Passby
7/28/17 01:47	7/28/17 01:48	0.9	Excessive Wind Noise
7/28/17 01:51	7/28/17 01:51	0.9	Loud Vehicle Passby
7/28/17 01:55	7/28/17 01:56	1.6	Loud Vehicle Passby
7/28/17 01:59	7/28/17 02:00	0.9	Site Visit
7/28/17 02:53	7/28/17 02:55	2.1	Loud Vehicle Passby
7/28/17 02:56	7/28/17 02:57	1.4	Train Passby
7/28/17 02:59	7/28/17 03:00	1.1	Train Passby
7/28/17 03:05	7/28/17 03:06	1.1	Train Passby
7/28/17 03:07	7/28/17 03:07	0.9	Loud Vehicle Passby
7/28/17 03:28	7/28/17 03:29	0.6	Excessive Wind Noise
7/28/17 03:54	7/28/17 03:55	1.1	Loud Vehicle Passby
7/28/17 04:01	7/28/17 04:01	0.9	Loud Vehicle Passby

Data Removal Noise Monitoring Location #1 Cont.

Start Time	End Time	Duration (min)	Reason
7/28/17 04:17	7/28/17 04:18	0.9	Loud Vehicle Passby
7/28/17 04:22	7/28/17 04:23	1.6	Loud Vehicle Passby
7/28/17 04:27	7/28/17 04:35	8.1	Loud Vehicle Passby
7/28/17 04:36	7/28/17 04:37	1.1	Loud Vehicle Passby
7/28/17 04:41	7/28/17 04:42	1.4	Loud Vehicle Passby
7/28/17 04:47	7/28/17 04:47	0.6	Loud Vehicle Passby
7/28/17 04:49	7/28/17 04:52	3.6	Loud Vehicle Passby
7/28/17 04:55	7/28/17 04:57	2.4	Loud Vehicle Passby
7/28/17 04:57	7/28/17 05:00	2.9	Loud Vehicle Passby
7/28/17 05:02	7/28/17 05:05	2.4	Loud Vehicle Passby
7/28/17 05:07	7/28/17 05:08	0.9	Loud Vehicle Passby
7/28/17 05:13	7/28/17 05:13	0.6	Loud Vehicle Passby
7/28/17 05:17	7/28/17 05:17	0.9	Loud Vehicle Passby
7/28/17 05:20	7/28/17 05:20	0.6	Loud Vehicle Passby
7/28/17 05:26	7/28/17 05:28	2.1	Loud Vehicle Passby
7/28/17 05:29	7/28/17 05:33	3.6	Loud Vehicle Passby
7/28/17 05:34	7/28/17 05:35	1.4	Loud Vehicle Passby
7/28/17 05:36	7/28/17 05:37	1.1	Loud Vehicle Passby
7/28/17 05:38	7/28/17 05:39	0.9	Loud Vehicle Passby
7/28/17 05:40	7/28/17 05:43	2.9	Loud Vehicle Passby
7/28/17 05:44	7/28/17 05:44	0.6	Loud Vehicle Passby
7/28/17 05:47	7/28/17 05:48	0.9	Loud Vehicle Passby
7/28/17 05:49	7/28/17 05:51	1.6	Loud Vehicle Passby
7/28/17 05:51	7/28/17 05:53	2.1	Loud Vehicle Passby
7/28/17 05:54	7/28/17 05:59	4.9	Loud Vehicle Passby
7/28/17 05:59	7/28/17 07:00	60.4	Morning Rush Hour
7/28/17 22:02	7/28/17 22:03	0.9	Loud Vehicle Passby
7/28/17 22:13	7/28/17 22:14	1.1	Loud Vehicle Passby
7/28/17 22:17	7/28/17 22:17	0.6	Loud Vehicle Passby
7/28/17 22:22	7/28/17 22:24	1.6	Train Passby
7/28/17 22:27	7/28/17 22:27	0.9	Loud Vehicle Passby
7/28/17 22:39	7/28/17 22:41	1.4	Loud Vehicle Passby
7/28/17 22:51	7/28/17 22:52	0.6	Loud Vehicle Passby
7/28/17 22:53	7/28/17 22:54	0.9	Loud Vehicle Passby
7/28/17 22:55	7/28/17 22:56	0.9	Loud Vehicle Passby
7/28/17 22:59	7/28/17 23:00	0.9	Loud Vehicle Passby
7/28/17 23:01	7/28/17 23:02	0.6	Loud Vehicle Passby
7/28/17 23:05	7/28/17 23:05	0.9	Loud Vehicle Passby
7/28/17 23:46	7/28/17 23:47	1.1	Loud Vehicle Passby

Data Removal Noise Monitoring Location #1 Cont.

Start Time	End Time	Duration (min)	Reason
7/29/17 00:06	7/29/17 00:07	0.9	Loud Vehicle Passby
7/29/17 00:08	7/29/17 00:09	1.1	Loud Vehicle Passby
7/29/17 00:12	7/29/17 00:13	1.4	Loud Vehicle Passby
7/29/17 00:25	7/29/17 00:26	1.4	Loud Vehicle Passby
7/29/17 00:33	7/29/17 00:35	2.6	Loud Vehicle Passby
7/29/17 00:36	7/29/17 00:38	2.1	Train Passby
7/29/17 00:38	7/29/17 00:39	0.9	Loud Vehicle Passby
7/29/17 01:20	7/29/17 01:22	2.6	Train Passby
7/29/17 01:24	7/29/17 01:24	0.1	Train Passby
7/29/17 01:24	7/29/17 01:24	0.1	Train Passby
7/29/17 01:24	7/29/17 01:26	2.1	Train Passby
7/29/17 01:35	7/29/17 01:36	1.1	Loud Vehicle Passby
7/29/17 01:41	7/29/17 01:42	0.9	Loud Vehicle Passby
7/29/17 01:43	7/29/17 01:44	0.9	Loud Vehicle Passby
7/29/17 01:45	7/29/17 01:47	2.1	Loud Vehicle Passby
7/29/17 01:54	7/29/17 01:54	0.1	Loud Vehicle Passby
7/29/17 01:54	7/29/17 01:55	1.1	Loud Vehicle Passby
7/29/17 02:05	7/29/17 02:06	1.1	Loud Vehicle Passby
7/29/17 02:12	7/29/17 02:13	0.9	Excessive Wind Noise
7/29/17 02:14	7/29/17 02:14	0.1	Excessive Wind Noise
7/29/17 02:14	7/29/17 02:17	3.1	Excessive Wind Noise
7/29/17 02:20	7/29/17 02:42	21.6	Excessive Wind Noise
7/29/17 02:43	7/29/17 02:51	8.4	Excessive Wind Noise
7/29/17 03:07	7/29/17 03:16	9.9	Excessive Wind Noise
7/29/17 03:43	7/29/17 03:44	1.9	Loud Vehicle Passby
7/29/17 04:02	7/29/17 04:04	1.9	Loud Vehicle Passby
7/29/17 04:14	7/29/17 04:15	1.1	Loud Vehicle Passby
7/29/17 04:17	7/29/17 04:19	1.6	Loud Vehicle Passby
7/29/17 04:23	7/29/17 04:25	2.4	Loud Vehicle Passby
7/29/17 04:26	7/29/17 04:28	1.9	Loud Vehicle Passby
7/29/17 04:30	7/29/17 04:31	1.6	Loud Vehicle Passby
7/29/17 04:32	7/29/17 04:36	3.6	Loud Vehicle Passby
7/29/17 04:37	7/29/17 04:38	1.6	Loud Vehicle Passby
7/29/17 04:40	7/29/17 04:40	0.9	Loud Vehicle Passby
7/29/17 04:41	7/29/17 04:42	1.1	Loud Vehicle Passby
7/29/17 04:44	7/29/17 04:44	0.9	Loud Vehicle Passby
7/29/17 04:45	7/29/17 04:48	3.1	Loud Vehicle Passby
7/29/17 04:51	7/29/17 04:52	0.9	Loud Vehicle Passby
7/29/17 04:53	7/29/17 04:55	2.4	Loud Vehicle Passby

Data Removal Noise Monitoring Location #1 Cont.

Start Time	End Time	Duration (min)	Reason
7/29/17 05:02	7/29/17 05:02	0.6	Loud Vehicle Passby
7/29/17 05:04	7/29/17 05:06	2.4	Loud Vehicle Passby
7/29/17 05:14	7/29/17 05:15	1.1	Loud Vehicle Passby
7/29/17 05:15	7/29/17 05:16	0.9	Loud Vehicle Passby
7/29/17 05:18	7/29/17 05:19	0.6	Loud Vehicle Passby
7/29/17 05:21	7/29/17 05:22	0.9	Loud Vehicle Passby
7/29/17 05:23	7/29/17 05:24	0.9	Loud Vehicle Passby
7/29/17 05:25	7/29/17 05:26	1.4	Loud Vehicle Passby
7/29/17 05:27	7/29/17 05:28	0.9	Loud Vehicle Passby
7/29/17 05:30	7/29/17 05:31	1.4	Loud Vehicle Passby
7/29/17 05:32	7/29/17 05:33	0.9	Loud Vehicle Passby
7/29/17 05:38	7/29/17 05:39	1.6	Loud Vehicle Passby
7/29/17 05:39	7/29/17 05:40	1.1	Excessive Wind Noise
7/29/17 05:41	7/29/17 05:42	1.4	Loud Vehicle Passby
7/29/17 05:43	7/29/17 05:44	1.1	Loud Vehicle Passby
7/29/17 05:44	7/29/17 05:45	1.4	Excessive Wind Noise
7/29/17 05:51	7/29/17 06:58	67.1	Excessive Wind Noise
	Total Night #1	**172**	
	Total Night #2	**192**	
	Total Data	**364**	

Data Removal Noise Monitoring Location #2

Start Time	End Time	Duration (min)	Reason
7/27/17 22:00	7/27/17 22:55	55.1	Excessive Wind Noise
7/27/17 23:00	7/27/17 23:01	0.8	Thunder
7/27/17 23:03	7/27/17 23:04	0.8	Thunder
7/27/17 23:09	7/27/17 23:09	0.6	Thunder
7/27/17 23:10	7/27/17 23:10	0.1	Thunder
7/27/17 23:10	7/27/17 23:11	0.8	Thunder
7/27/17 23:13	7/27/17 23:15	2.1	Equipment on-site
7/28/17 00:19	7/28/17 00:20	1.3	Loud Vehicle Passby
7/28/17 00:23	7/28/17 00:24	0.6	Train Passby
7/28/17 00:31	7/28/17 00:32	1.1	Train Passby
7/28/17 00:43	7/28/17 00:44	0.8	Train Passby
7/28/17 02:10	7/28/17 02:11	0.8	Monitor Check
7/28/17 02:12	7/28/17 02:13	0.3	Train Passby
7/28/17 02:16	7/28/17 02:17	0.6	Train Passby
7/28/17 02:19	7/28/17 02:19	0.8	Train Passby
7/28/17 02:34	7/28/17 02:39	5.1	Rail Activity
7/28/17 02:40	7/28/17 02:42	2.3	Rail Activity
7/28/17 02:44	7/28/17 02:48	4.1	Rail Yard Activity
7/28/17 02:49	7/28/17 02:50	0.8	Train Passby
7/28/17 02:54	7/28/17 02:58	4.6	Rail Activity
7/28/17 03:00	7/28/17 03:03	3.3	Rail Yard Activity
7/28/17 03:08	7/28/17 03:08	0.8	Train Passby
7/28/17 03:45	7/28/17 03:45	0.6	Train Passby
7/28/17 03:52	7/28/17 03:53	1.1	Loud Vehicle Passby
7/28/17 03:58	7/28/17 03:59	0.8	Train Passby
7/28/17 04:10	7/28/17 04:10	0.3	Train Passby
7/28/17 04:19	7/28/17 04:20	0.6	Train Passby
7/28/17 04:21	7/28/17 04:21	0.8	Train Passby
7/28/17 04:22	7/28/17 04:23	1.1	Train Passby
7/28/17 04:35	7/28/17 04:36	1.1	Train Passby
7/28/17 04:38	7/28/17 04:40	2.6	Rail Yard Activity
7/28/17 04:41	7/28/17 04:45	3.6	Rail Yard Activity
7/28/17 04:47	7/28/17 04:51	3.8	Rail Yard Activity
7/28/17 04:55	7/28/17 04:55	0.1	Train Passby
7/28/17 05:03	7/28/17 05:04	0.8	Rail Yard Activity
7/28/17 05:12	7/28/17 05:13	0.8	Loud Vehicle Passby
7/28/17 05:15	7/28/17 05:16	0.8	Loud Vehicle Passby
7/28/17 05:19	7/28/17 05:20	1.3	Loud Vehicle Passby
7/28/17 05:22	7/28/17 05:23	1.1	Loud Vehicle Passby
7/28/17 05:38	7/28/17 05:38	0.3	Excessive Bird Noise

Data Removal Noise Monitoring Location #2 Cont.

Start Time	End Time	Duration (min)	Reason
7/28/17 05:38	7/28/17 05:41	3.1	Excessive Bird Noise
7/28/17 05:43	7/28/17 05:45	2.3	Excessive Bird Noise
7/28/17 05:48	7/28/17 05:50	1.8	Train Passby
7/28/17 05:50	7/28/17 05:51	0.8	Excessive Bird Noise
7/28/17 05:52	7/28/17 05:52	0.6	Excessive Bird Noise
7/28/17 05:55	7/28/17 05:55	0.6	Train Passby
7/28/17 05:56	7/28/17 05:57	0.8	Loud Vehicle Passby
7/28/17 06:01	7/28/17 06:01	0.3	Loud Vehicle Passby
7/28/17 06:05	7/28/17 06:06	0.6	Excessive Bird Noise
7/28/17 06:10	7/28/17 06:11	0.8	Excessive Bird Noise
7/28/17 06:12	7/28/17 06:13	0.8	Loud Vehicle Passby
7/28/17 06:15	7/28/17 06:59	44.3	Morning Rush/Chorus
7/28/17 22:00	7/28/17 22:00	0.3	Train Passby
7/28/17 22:00	7/28/17 22:01	1.0	Train Passby
7/28/17 22:03	7/28/17 22:05	2.5	Train Passby
7/28/17 22:05	7/28/17 22:07	1.8	Train Passby
7/28/17 22:07	7/28/17 22:08	0.8	Train Passby
7/28/17 22:08	7/28/17 22:09	0.8	Train Passby
7/28/17 22:12	7/28/17 22:14	2.8	Train Passby
7/28/17 22:18	7/28/17 22:22	3.5	Rail Yard Activity
7/28/17 22:26	7/28/17 22:26	0.3	Train Passby
7/28/17 22:26	7/28/17 22:41	15.0	Rail Yard Activity
7/28/17 22:43	7/28/17 22:46	2.5	Rail Yard Activity
7/28/17 22:51	7/28/17 22:55	4.8	Rail Yard Activity
7/28/17 22:56	7/28/17 22:57	1.0	Rail Yard Activity
7/28/17 22:57	7/28/17 22:57	0.5	Train Passby
7/28/17 23:01	7/28/17 23:02	1.8	Rail Yard Activity
7/28/17 23:03	7/28/17 23:04	1.0	Rail Yard Activity
7/28/17 23:06	7/28/17 23:07	1.3	Rail Yard Activity
7/28/17 23:07	7/28/17 23:08	0.3	Rail Yard Activity
7/28/17 23:08	7/28/17 23:12	3.3	Rail Yard Activity
7/28/17 23:12	7/28/17 23:14	2.3	Rail Yard Activity
7/28/17 23:16	7/28/17 23:19	3.3	Rail Yard Activity
7/28/17 23:19	7/28/17 23:20	0.8	Rail Yard Activity
7/28/17 23:20	7/28/17 23:22	1.5	Rail Yard Activity
7/28/17 23:24	7/28/17 23:26	1.8	Rail Yard Activity
7/28/17 23:33	7/28/17 23:34	1.3	Rail Yard Activity
7/28/17 23:59	7/29/17 00:00	1.0	Rail Yard Activity
7/29/17 00:03	7/29/17 00:04	1.0	Rail Yard Activity
7/29/17 00:49	7/29/17 00:50	1.5	Train Passby

Data Removal Noise Monitoring Location #2 Cont.

Start Time	End Time	Duration (min)	Reason
7/29/17 01:13	7/29/17 01:14	1.0	Train Passby
7/29/17 01:27	7/29/17 01:29	1.3	Train Passby
7/29/17 01:44	7/29/17 01:45	1.3	Train Passby
7/29/17 01:48	7/29/17 01:49	1.3	Train Passby
7/29/17 01:53	7/29/17 01:54	1.0	Train Passby
7/29/17 01:55	7/29/17 01:56	1.0	Train Passby
7/29/17 02:09	7/29/17 02:10	1.0	Loud Vehicle Passby
7/29/17 02:20	7/29/17 02:22	2.5	Excessive Wind Noise
7/29/17 02:25	7/29/17 02:51	25.8	Excessive Wind Noise
7/29/17 03:06	7/29/17 03:09	3.0	Loud Vehicle Passby
7/29/17 03:14	7/29/17 03:14	0.3	Loud Vehicle Passby
7/29/17 03:14	7/29/17 03:15	0.8	Loud Vehicle Passby
7/29/17 03:43	7/29/17 03:43	0.3	Train Passby
7/29/17 03:43	7/29/17 03:45	1.8	Train Passby
7/29/17 03:46	7/29/17 03:47	1.0	Train Passby
7/29/17 03:52	7/29/17 03:53	1.5	Train Passby
7/29/17 03:56	7/29/17 03:57	0.8	Train Passby
7/29/17 04:04	7/29/17 04:05	1.0	Train Passby
7/29/17 04:12	7/29/17 04:12	0.8	Train Passby
7/29/17 04:20	7/29/17 04:21	0.8	Train Passby
7/29/17 04:25	7/29/17 04:26	1.0	Train Passby
7/29/17 04:28	7/29/17 04:29	1.3	Train Passby
7/29/17 04:30	7/29/17 04:31	1.3	Train Passby
7/29/17 04:42	7/29/17 04:44	1.3	Train Passby
7/29/17 04:44	7/29/17 04:48	4.0	Rail Yard Activity
7/29/17 04:52	7/29/17 04:53	1.0	Rail Yard Activity
7/29/17 05:01	7/29/17 05:03	2.8	Rail Yard Activity
7/29/17 05:03	7/29/17 05:05	1.3	Loud Vehicle Passby
7/29/17 05:19	7/29/17 05:20	1.0	Loud Vehicle Passby
7/29/17 05:23	7/29/17 05:24	1.0	Loud Vehicle Passby
7/29/17 05:29	7/29/17 06:47	78.0	Excessive Wind Noise
7/29/17 06:53	7/29/17 06:56	3.0	Excessive Bird Noise
7/29/17 06:57	7/29/17 06:59	1.8	Excessive Bird Noise
	Total Night #1	**167**	
	Total Night #2	**205**	
	Total Data	**372**	

Data Removal Noise Monitoring Location #3

Start Time	End Time	Duration (min)	Reason
7/27/17 22:00	7/27/17 22:59	58.7	Excessive Wind Noise
7/27/17 23:00	7/27/17 23:02	1.9	Thunder
7/27/17 23:02	7/27/17 23:03	0.9	Thunder
7/27/17 23:03	7/27/17 23:04	1.2	Thunder
7/27/17 23:09	7/27/17 23:10	1.4	Thunder
7/27/17 23:12	7/27/17 23:12	0.7	Thunder
7/27/17 23:15	7/27/17 23:16	1.4	Thunder
7/27/17 23:17	7/27/17 23:18	1.4	Thunder
7/27/17 23:20	7/27/17 23:21	1.7	Thunder
7/27/17 23:23	7/27/17 23:24	1.2	Thunder
7/27/17 23:55	7/27/17 23:57	1.4	Excessive Rain Noise
7/28/17 00:21	7/28/17 00:22	1.4	Train Passby
7/28/17 00:23	7/28/17 00:24	1.2	Train Passby
7/28/17 00:25	7/28/17 00:26	0.9	Train Passby
7/28/17 00:27	7/28/17 00:28	0.9	Train Passby
7/28/17 00:31	7/28/17 00:33	1.9	Train Passby
7/28/17 00:36	7/28/17 00:39	2.7	Train Passby
7/28/17 00:40	7/28/17 00:46	6.7	Train Passby
7/28/17 00:47	7/28/17 00:47	0.4	Train Passby
7/28/17 02:46	7/28/17 02:47	1.2	Train Passby
7/28/17 02:49	7/28/17 02:50	1.2	Train Passby
7/28/17 02:53	7/28/17 02:54	0.9	Train Passby
7/28/17 03:00	7/28/17 03:01	1.4	Train Passby
7/28/17 03:01	7/28/17 03:03	1.7	Train Passby
7/28/17 03:45	7/28/17 03:46	0.7	Train Passby
7/28/17 04:45	7/28/17 04:45	0.2	Excessive Bird Noise
7/28/17 04:56	7/28/17 04:57	1.2	Train Passby
7/28/17 04:58	7/28/17 04:58	0.2	Excessive Bird Noise
7/28/17 04:58	7/28/17 04:58	0.4	Excessive Bird Noise
7/28/17 05:11	7/28/17 05:11	0.7	Train Passby
7/28/17 05:13	7/28/17 05:14	0.9	Loud Vehicle Passby
7/28/17 05:33	7/28/17 05:34	0.9	Loud Vehicle Passby
7/28/17 05:37	7/28/17 05:38	0.7	Loud Vehicle Passby
7/28/17 05:41	7/28/17 05:41	0.7	Loud Vehicle Passby
7/28/17 05:45	7/28/17 05:45	0.7	Loud Vehicle Passby
7/28/17 05:49	7/28/17 05:53	4.2	Train Passby
7/28/17 05:55	7/28/17 06:00	5.7	Train Passby
7/28/17 06:04	7/28/17 06:05	1.7	Excessive Bird Noise
7/28/17 06:12	7/28/17 06:14	2.4	Excessive Bird Noise
7/28/17 06:15	7/28/17 06:17	2.2	Excessive Bird Noise

Data Removal Noise Monitoring Location #3 Cont.

Start Time	End Time	Duration (min)	Reason
7/28/17 06:20	7/28/17 06:21	0.7	Loud Vehicle Passby
7/28/17 06:24	7/28/17 06:25	1.7	Loud Vehicle Passby
7/28/17 06:26	7/28/17 06:27	1.2	Excessive Bird Noise
7/28/17 06:41	7/28/17 06:59	18.7	Train Passby
7/28/17 22:29	7/28/17 22:35	6.4	Loud Vehicle Passby
7/28/17 22:57	7/28/17 23:01	3.7	Loud Vehicle Passby
7/28/17 23:11	7/28/17 23:12	0.9	High Frequency Noise ???
7/29/17 00:03	7/29/17 00:04	1.4	Train Passby
7/29/17 00:05	7/29/17 00:13	7.9	Train Passby
7/29/17 00:13	7/29/17 00:14	0.9	Train Passby
7/29/17 00:41	7/29/17 00:43	2.4	High Frequency Noise ???
7/29/17 00:58	7/29/17 00:59	0.7	Train Passby
7/29/17 01:28	7/29/17 01:29	1.2	Train Passby
7/29/17 01:34	7/29/17 01:35	1.9	Train Passby
7/29/17 01:43	7/29/17 01:50	7.4	Train Passby
7/29/17 02:12	7/29/17 02:12	0.7	Train Passby
7/29/17 02:27	7/29/17 03:14	47.2	Excessive Wind Noise
7/29/17 04:50	7/29/17 04:50	0.9	Loud Vehicle Passby
7/29/17 05:54	7/29/17 05:56	1.4	Loud Vehicle Passby
7/29/17 06:34	7/29/17 06:35	1.9	Train Passby
7/29/17 06:36	7/29/17 06:37	1.2	Loud Vehicle Passby
7/29/17 06:47	7/29/17 06:48	1.4	Loud Vehicle Passby
	Total Night #1	**140**	
	Total Night #2	**90**	
	Total Data	**229**	

Data Removal Noise Monitoring Location #4

Start Time	End Time	Duration (min)	Reason
7/27/17 22:01	7/27/17 23:01	60.9	Excessive Rain Noise
7/27/17 23:03	7/27/17 23:04	0.9	Thunder
7/27/17 23:08	7/27/17 23:10	1.4	Thunder
7/27/17 23:10	7/27/17 23:14	4.1	Thunder
7/27/17 23:38	7/27/17 23:39	1.4	Loud Vehicle Passby
7/27/17 23:41	7/27/17 23:41	0.4	Loud Vehicle Passby
7/28/17 00:07	7/28/17 00:08	0.9	Announcement
7/28/17 00:15	7/28/17 00:22	7.1	Train Passby
7/28/17 00:26	7/28/17 00:26	0.6	Loud Vehicle Passby
7/28/17 00:29	7/28/17 00:30	1.1	Loud Vehicle Passby
7/28/17 00:49	7/28/17 00:50	0.6	Loud Vehicle Passby
7/28/17 00:53	7/28/17 00:54	0.6	Loud Vehicle Passby
7/28/17 02:09	7/28/17 02:10	0.9	Loud Vehicle Passby
7/28/17 02:12	7/28/17 02:13	0.9	Loud Vehicle Passby
7/28/17 02:25	7/28/17 02:28	2.4	Loud Vehicle Passby
7/28/17 02:29	7/28/17 02:29	0.6	Loud Vehicle Passby
7/28/17 02:31	7/28/17 02:33	2.1	Monitor Check
7/28/17 02:35	7/28/17 02:35	0.9	Loud Vehicle Passby
7/28/17 02:40	7/28/17 02:42	1.6	Loud Vehicle Passby
7/28/17 02:45	7/28/17 02:45	0.9	Loud Vehicle Passby
7/28/17 02:57	7/28/17 02:58	0.6	Loud Vehicle Passby
7/28/17 03:00	7/28/17 03:01	0.9	Loud Vehicle Passby
7/28/17 03:02	7/28/17 03:03	0.9	Train Passby
7/28/17 03:23	7/28/17 03:24	0.9	Train Passby
7/28/17 03:55	7/28/17 03:55	0.6	Train Passby
7/28/17 04:03	7/28/17 04:04	0.9	Loud Vehicle Passby
7/28/17 04:12	7/28/17 04:13	0.6	Loud Vehicle Passby
7/28/17 04:20	7/28/17 04:21	0.6	Loud Vehicle Passby
7/28/17 05:32	7/28/17 05:33	0.4	Excessive Bird Noise
7/28/17 05:33	7/28/17 05:34	0.6	Excessive Bird Noise
7/28/17 05:36	7/28/17 05:36	0.6	Excessive Bird Noise
7/28/17 05:43	7/28/17 05:46	2.4	Excessive Bird Noise
7/28/17 06:25	7/28/17 06:27	1.6	Train Passby
7/28/17 22:00	7/28/17 22:00	0.9	Train Passby
7/28/17 22:04	7/28/17 22:06	2.4	Wildlife
7/28/17 22:10	7/28/17 22:11	1.1	Wildlife
7/28/17 22:16	7/28/17 22:16	0.6	Wildlife
7/28/17 22:22	7/28/17 22:23	1.4	Loud Vehicle Passby
7/28/17 22:26	7/28/17 22:27	1.6	Monitor Check
7/29/17 00:05	7/29/17 00:06	1.1	Wildlife

Data Removal Noise Monitoring Location #4 Cont.

Start Time	End Time	Duration (min)	Reason
7/29/17 00:07	7/29/17 00:08	0.9	Wildlife
7/29/17 00:43	7/29/17 00:43	0.6	Wildlife
7/29/17 00:45	7/29/17 00:46	1.1	Wildlife
7/29/17 01:35	7/29/17 01:37	1.4	Loud Vehicle Passby
7/29/17 01:39	7/29/17 01:40	1.1	Loud Vehicle Passby
7/29/17 01:53	7/29/17 01:54	1.9	Train Passby
7/29/17 02:06	7/29/17 02:07	0.6	Train Passby
7/29/17 02:30	7/29/17 02:39	9.1	Excessive Wind Noise
7/29/17 02:51	7/29/17 03:03	12.6	Excessive Rain Noise
7/29/17 03:16	7/29/17 03:19	3.4	Excessive Rain Noise
7/29/17 03:20	7/29/17 03:21	1.4	Loud Vehicle Passby
7/29/17 03:34	7/29/17 03:35	1.6	Loud Vehicle Passby
7/29/17 03:50	7/29/17 03:51	1.1	Train Passby
7/29/17 03:52	7/29/17 03:54	1.4	Train Passby
7/29/17 04:00	7/29/17 04:01	1.1	Train Passby
7/29/17 04:02	7/29/17 04:05	3.9	Train Passby
7/29/17 04:56	7/29/17 04:59	3.1	Train Passby
7/29/17 05:15	7/29/17 05:17	2.4	Train Passby
7/29/17 05:18	7/29/17 05:19	1.4	Train Passby
7/29/17 05:20	7/29/17 05:22	1.6	Train Passby
7/29/17 05:31	7/29/17 06:37	66.4	Excessive Wind Noise
7/29/17 06:51	7/29/17 06:52	1.1	Loud Vehicle Passby
	Total Night #1	**101**	
	Total Night #2	**128**	
	Total Data	**229**	

Data Removal Noise Monitoring Location #5

Start Time	End Time	Duration (min)	Reason
7/29/17 22:00	7/29/17 22:01	1.0	Loud Vehicle Passby
7/29/17 22:04	7/29/17 22:04	0.8	Loud Vehicle Passby
7/29/17 22:06	7/29/17 22:06	0.5	Loud Vehicle Passby
7/29/17 22:08	7/29/17 22:09	0.8	Loud Vehicle Passby
7/29/17 22:09	7/29/17 22:09	0.8	Loud Vehicle Passby
7/29/17 22:10	7/29/17 22:11	0.8	Loud Vehicle Passby
7/29/17 22:12	7/29/17 22:12	0.5	Loud Vehicle Passby
7/29/17 22:14	7/29/17 22:15	1.0	Loud Vehicle Passby
7/29/17 22:17	7/29/17 22:17	0.8	Loud Vehicle Passby
7/29/17 22:18	7/29/17 22:19	0.8	Loud Vehicle Passby
7/29/17 22:20	7/29/17 22:20	0.3	Loud Vehicle Passby
7/29/17 22:20	7/29/17 22:20	0.5	Loud Vehicle Passby
7/29/17 22:23	7/29/17 22:24	1.0	Loud Vehicle Passby
7/29/17 22:25	7/29/17 22:26	0.8	Loud Vehicle Passby
7/29/17 22:28	7/29/17 22:29	1.0	Loud Vehicle Passby
7/29/17 22:29	7/29/17 22:30	0.8	Loud Vehicle Passby
7/29/17 22:31	7/29/17 22:31	0.5	Loud Vehicle Passby
7/29/17 22:34	7/29/17 22:35	1.0	Loud Vehicle Passby
7/29/17 22:37	7/29/17 22:38	0.5	Loud Vehicle Passby
7/29/17 22:43	7/29/17 22:44	1.0	Loud Vehicle Passby
7/29/17 22:47	7/29/17 22:48	0.8	Loud Vehicle Passby
7/29/17 22:50	7/29/17 22:51	1.0	Loud Vehicle Passby
7/29/17 22:54	7/29/17 22:56	1.5	Loud Vehicle Passby
7/29/17 23:02	7/29/17 23:03	1.3	Loud Vehicle Passby
7/29/17 23:13	7/29/17 23:14	1.0	Loud Vehicle Passby
7/29/17 23:18	7/29/17 23:18	0.5	Loud Vehicle Passby
7/29/17 23:19	7/29/17 23:20	0.8	Loud Vehicle Passby
7/29/17 23:20	7/29/17 23:21	1.0	Loud Vehicle Passby
7/29/17 23:26	7/29/17 23:27	1.3	Loud Vehicle Passby
7/29/17 23:45	7/29/17 23:46	1.3	Loud Vehicle Passby
7/29/17 23:47	7/29/17 23:48	0.8	Loud Vehicle Passby
7/29/17 23:49	7/29/17 23:51	2.0	Loud Vehicle Passby
7/29/17 23:53	7/29/17 23:54	0.8	Loud Vehicle Passby
7/29/17 23:56	7/29/17 23:57	1.0	Loud Vehicle Passby
7/29/17 23:58	7/29/17 23:59	1.3	Loud Vehicle Passby
7/30/17 00:02	7/30/17 00:03	1.3	Loud Vehicle Passby
7/30/17 00:03	7/30/17 00:05	1.5	Loud Vehicle Passby
7/30/17 00:06	7/30/17 00:07	1.0	Loud Vehicle Passby
7/30/17 00:08	7/30/17 00:09	1.0	Loud Vehicle Passby
7/30/17 00:11	7/30/17 00:11	0.8	Loud Vehicle Passby

Data Removal Noise Monitoring Location #5 Cont

Start Time	End Time	Duration (min)	Reason
7/30/17 00:12	7/30/17 00:13	1.0	Loud Vehicle Passby
7/30/17 00:13	7/30/17 00:14	1.3	Loud Vehicle Passby
7/30/17 00:17	7/30/17 00:17	0.5	Loud Vehicle Passby
7/30/17 00:20	7/30/17 00:21	1.0	Loud Vehicle Passby
7/30/17 00:21	7/30/17 00:23	1.8	Loud Vehicle Passby
7/30/17 00:23	7/30/17 00:24	1.0	Loud Vehicle Passby
7/30/17 00:26	7/30/17 00:27	1.0	Loud Vehicle Passby
7/30/17 00:31	7/30/17 00:33	1.5	Loud Vehicle Passby
7/30/17 00:34	7/30/17 00:35	0.8	Loud Vehicle Passby
7/30/17 00:36	7/30/17 00:37	1.0	Loud Vehicle Passby
7/30/17 00:40	7/30/17 00:41	0.8	Loud Vehicle Passby
7/30/17 00:41	7/30/17 00:42	1.0	Loud Vehicle Passby
7/30/17 00:43	7/30/17 00:44	0.8	Loud Vehicle Passby
7/30/17 00:44	7/30/17 00:46	1.3	Loud Vehicle Passby
7/30/17 01:10	7/30/17 01:11	1.0	Loud Vehicle Passby
7/30/17 01:56	7/30/17 01:57	1.3	Loud Vehicle Passby
7/30/17 02:22	7/30/17 02:22	0.8	Loud Vehicle Passby
7/30/17 02:35	7/30/17 02:36	0.8	Loud Vehicle Passby
7/30/17 02:37	7/30/17 02:38	1.5	Train Passby
7/30/17 02:38	7/30/17 02:40	1.3	Loud Vehicle Passby
7/30/17 02:41	7/30/17 02:42	1.0	Train Passby
7/30/17 02:45	7/30/17 02:46	1.0	Loud Vehicle Passby
7/30/17 02:54	7/30/17 02:55	0.8	Loud Vehicle Passby
7/30/17 03:02	7/30/17 03:03	0.8	Loud Vehicle Passby
7/30/17 03:37	7/30/17 03:41	4.0	Train Passby
7/30/17 03:41	7/30/17 03:48	7.0	Train Passby
7/30/17 03:48	7/30/17 03:49	0.3	Train Passby
7/30/17 03:49	7/30/17 03:50	1.0	Train Passby
7/30/17 03:51	7/30/17 03:51	0.3	Loud Vehicle Passby
7/30/17 03:51	7/30/17 03:52	1.0	Loud Vehicle Passby
7/30/17 03:53	7/30/17 03:53	0.3	Loud Vehicle Passby
7/30/17 03:58	7/30/17 03:59	1.0	Loud Vehicle Passby
7/30/17 04:01	7/30/17 04:02	1.3	Loud Vehicle Passby
7/30/17 04:03	7/30/17 04:05	1.5	Loud Vehicle Passby
7/30/17 04:08	7/30/17 04:09	1.0	Loud Vehicle Passby
7/30/17 04:09	7/30/17 04:10	1.3	Loud Vehicle Passby
7/30/17 04:11	7/30/17 04:13	1.5	Loud Vehicle Passby
7/30/17 04:13	7/30/17 04:14	0.8	Loud Vehicle Passby
7/30/17 04:14	7/30/17 04:15	1.0	Loud Vehicle Passby
7/30/17 04:16	7/30/17 04:17	0.8	Loud Vehicle Passby

Data Removal Noise Monitoring Location #5 Cont

Start Time	End Time	Duration (min)	Reason
7/30/17 04:18	7/30/17 04:19	1.0	Loud Vehicle Passby
7/30/17 04:19	7/30/17 04:20	0.8	Loud Vehicle Passby
7/30/17 04:21	7/30/17 04:23	1.8	Loud Vehicle Passby
7/30/17 04:23	7/30/17 04:24	1.0	Loud Vehicle Passby
7/30/17 04:25	7/30/17 04:26	1.8	Loud Vehicle Passby
7/30/17 04:27	7/30/17 04:27	0.8	Loud Vehicle Passby
7/30/17 04:30	7/30/17 04:31	1.3	Loud Vehicle Passby
7/30/17 04:32	7/30/17 04:34	1.3	Loud Vehicle Passby
7/30/17 04:35	7/30/17 04:36	0.8	Loud Vehicle Passby
7/30/17 04:38	7/30/17 04:39	0.8	Loud Vehicle Passby
7/30/17 04:40	7/30/17 04:42	2.0	Loud Vehicle Passby
7/30/17 04:43	7/30/17 04:43	0.5	Loud Vehicle Passby
7/30/17 04:44	7/30/17 04:46	2.5	Loud Vehicle Passby
7/30/17 04:46	7/30/17 04:47	0.5	Loud Vehicle Passby
7/30/17 04:47	7/30/17 04:48	1.0	Loud Vehicle Passby
7/30/17 04:48	7/30/17 04:50	1.3	Loud Vehicle Passby
7/30/17 04:50	7/30/17 04:52	2.0	Loud Vehicle Passby
7/30/17 04:52	7/30/17 04:54	1.3	Loud Vehicle Passby
7/30/17 04:54	7/30/17 04:55	0.5	Loud Vehicle Passby
7/30/17 04:56	7/30/17 04:57	0.5	Loud Vehicle Passby
7/30/17 05:01	7/30/17 05:01	0.3	Loud Vehicle Passby
7/30/17 05:01	7/30/17 05:02	1.0	Loud Vehicle Passby
7/30/17 05:03	7/30/17 05:03	0.3	Loud Vehicle Passby
7/30/17 05:03	7/30/17 05:05	1.3	Loud Vehicle Passby
7/30/17 05:13	7/30/17 05:15	1.5	Loud Vehicle Passby
7/30/17 05:23	7/30/17 05:24	1.0	Loud Vehicle Passby
7/30/17 05:32	7/30/17 05:33	0.8	Loud Vehicle Passby
7/30/17 05:34	7/30/17 05:35	1.0	Loud Vehicle Passby
7/30/17 05:35	7/30/17 05:37	1.3	Loud Vehicle Passby
7/30/17 05:38	7/30/17 05:39	1.3	Loud Vehicle Passby
7/30/17 05:39	7/30/17 05:40	0.8	Loud Vehicle Passby
7/30/17 05:41	7/30/17 05:42	1.3	Loud Vehicle Passby
7/30/17 05:50	7/30/17 05:53	2.3	Loud Vehicle Passby
7/30/17 05:59	7/30/17 06:01	2.5	Loud Vehicle Passby
7/30/17 06:16	7/30/17 06:18	1.5	Loud Vehicle Passby
7/30/17 06:28	7/30/17 06:29	1.3	Loud Vehicle Passby
7/30/17 06:50	7/30/17 06:50	0.8	Loud Vehicle Passby
7/30/17 06:54	7/30/17 06:55	0.8	Loud Vehicle Passby
7/30/17 22:00	7/30/17 22:01	1.0	Loud Vehicle Passby
7/30/17 22:02	7/30/17 22:04	1.5	Loud Vehicle Passby

Data Removal Noise Monitoring Location #5 Cont

Start Time	End Time	Duration (min)	Reason
7/30/17 22:05	7/30/17 22:06	1.0	Loud Vehicle Passby
7/30/17 22:08	7/30/17 22:09	0.8	Loud Vehicle Passby
7/30/17 22:09	7/30/17 22:10	1.0	Loud Vehicle Passby
7/30/17 22:11	7/30/17 22:12	1.3	Loud Vehicle Passby
7/30/17 22:15	7/30/17 22:16	1.0	Loud Vehicle Passby
7/30/17 22:17	7/30/17 22:17	0.8	Loud Vehicle Passby
7/30/17 22:19	7/30/17 22:21	1.5	Loud Vehicle Passby
7/30/17 22:21	7/30/17 22:22	1.0	Loud Vehicle Passby
7/30/17 22:23	7/30/17 22:26	2.5	Loud Vehicle Passby
7/30/17 22:27	7/30/17 22:29	1.8	Loud Vehicle Passby
7/30/17 22:29	7/30/17 22:30	1.3	Loud Vehicle Passby
7/30/17 22:31	7/30/17 22:32	1.0	Loud Vehicle Passby
7/30/17 22:33	7/30/17 22:34	0.8	Loud Vehicle Passby
7/30/17 22:34	7/30/17 22:35	1.0	Loud Vehicle Passby
7/30/17 22:37	7/30/17 22:39	1.8	Loud Vehicle Passby
7/30/17 22:42	7/30/17 22:43	1.0	Loud Vehicle Passby
7/30/17 22:43	7/30/17 22:44	1.0	Loud Vehicle Passby
7/30/17 22:44	7/30/17 22:45	0.8	Loud Vehicle Passby
7/30/17 22:49	7/30/17 22:50	0.8	Loud Vehicle Passby
7/30/17 22:51	7/30/17 22:52	0.8	Loud Vehicle Passby
7/30/17 22:54	7/30/17 22:55	1.3	Loud Vehicle Passby
7/30/17 22:58	7/30/17 22:58	0.3	Loud Vehicle Passby
7/30/17 22:58	7/30/17 22:58	0.5	Loud Vehicle Passby
7/30/17 22:58	7/30/17 23:00	1.3	Loud Vehicle Passby
7/30/17 23:00	7/30/17 23:01	0.8	Loud Vehicle Passby
7/30/17 23:01	7/30/17 23:02	1.0	Loud Vehicle Passby
7/30/17 23:02	7/30/17 23:03	0.8	Loud Vehicle Passby
7/30/17 23:03	7/30/17 23:05	1.5	Loud Vehicle Passby
7/30/17 23:05	7/30/17 23:06	1.0	Loud Vehicle Passby
7/30/17 23:08	7/30/17 23:09	0.8	Loud Vehicle Passby
7/30/17 23:10	7/30/17 23:11	1.3	Loud Vehicle Passby
7/30/17 23:12	7/30/17 23:13	0.8	Loud Vehicle Passby
7/30/17 23:14	7/30/17 23:15	1.8	Loud Vehicle Passby
7/30/17 23:16	7/30/17 23:17	0.8	Loud Vehicle Passby
7/30/17 23:20	7/30/17 23:20	0.3	Loud Vehicle Passby
7/30/17 23:20	7/30/17 23:21	1.0	Loud Vehicle Passby
7/30/17 23:27	7/30/17 23:30	3.8	Loud Vehicle Passby
7/30/17 23:31	7/30/17 23:32	0.8	Loud Vehicle Passby
7/30/17 23:32	7/30/17 23:33	0.3	Loud Vehicle Passby
7/30/17 23:33	7/30/17 23:33	0.5	Loud Vehicle Passby

Data Removal Noise Monitoring Location #5 Cont

Start Time	End Time	Duration (min)	Reason
7/30/17 23:35	7/30/17 23:35	0.3	Loud Vehicle Passby
7/30/17 23:35	7/30/17 23:39	4.0	Train Passby
7/30/17 23:41	7/30/17 23:42	1.0	Loud Vehicle Passby
7/30/17 23:42	7/30/17 23:43	1.0	Loud Vehicle Passby
7/30/17 23:43	7/30/17 23:45	1.3	Loud Vehicle Passby
7/30/17 23:45	7/30/17 23:46	0.3	Loud Vehicle Passby
7/30/17 23:46	7/30/17 23:46	0.3	Loud Vehicle Passby
7/30/17 23:46	7/30/17 23:46	0.3	Loud Vehicle Passby
7/30/17 23:47	7/30/17 23:47	0.3	Loud Vehicle Passby
7/30/17 23:47	7/30/17 23:49	1.8	Loud Vehicle Passby
7/30/17 23:52	7/30/17 23:53	0.8	Loud Vehicle Passby
7/30/17 23:58	7/30/17 23:59	1.0	Loud Vehicle Passby
7/31/17 00:00	7/31/17 00:01	0.8	Loud Vehicle Passby
7/31/17 00:03	7/31/17 00:05	2.0	Loud Vehicle Passby
7/31/17 00:07	7/31/17 00:08	1.0	Loud Vehicle Passby
7/31/17 00:09	7/31/17 00:12	3.0	Loud Vehicle Passby
7/31/17 00:16	7/31/17 00:17	1.3	Loud Vehicle Passby
7/31/17 00:18	7/31/17 00:19	1.3	Loud Vehicle Passby
7/31/17 00:20	7/31/17 00:21	1.0	Loud Vehicle Passby
7/31/17 00:24	7/31/17 00:25	1.0	Loud Vehicle Passby
7/31/17 00:26	7/31/17 00:29	2.8	Loud Vehicle Passby
7/31/17 00:32	7/31/17 00:35	3.0	Loud Vehicle Passby
7/31/17 00:37	7/31/17 00:39	1.3	Loud Vehicle Passby
7/31/17 00:41	7/31/17 00:43	2.0	Loud Vehicle Passby
7/31/17 00:43	7/31/17 00:45	2.0	Loud Vehicle Passby
7/31/17 00:47	7/31/17 00:50	2.3	Loud Vehicle Passby
7/31/17 00:54	7/31/17 00:58	4.0	Loud Vehicle Passby
7/31/17 01:00	7/31/17 01:00	0.8	Loud Vehicle Passby
7/31/17 01:01	7/31/17 01:02	1.0	Loud Vehicle Passby
7/31/17 01:03	7/31/17 01:04	1.0	Loud Vehicle Passby
7/31/17 01:05	7/31/17 01:06	1.8	Loud Vehicle Passby
7/31/17 01:08	7/31/17 01:09	1.0	Loud Vehicle Passby
7/31/17 01:11	7/31/17 01:13	2.0	Loud Vehicle Passby
7/31/17 01:17	7/31/17 01:19	2.0	Loud Vehicle Passby
7/31/17 01:20	7/31/17 01:22	1.5	Loud Vehicle Passby
7/31/17 01:22	7/31/17 01:25	3.0	Loud Vehicle Passby
7/31/17 01:26	7/31/17 01:28	1.3	Loud Vehicle Passby
7/31/17 01:30	7/31/17 01:32	2.0	Loud Vehicle Passby
7/31/17 01:33	7/31/17 01:35	2.3	Loud Vehicle Passby
7/31/17 01:36	7/31/17 01:37	1.0	Loud Vehicle Passby

Data Removal Noise Monitoring Location #5 Cont

Start Time	End Time	Duration (min)	Reason
7/31/17 01:38	7/31/17 01:40	1.8	Loud Vehicle Passby
7/31/17 01:40	7/31/17 01:43	2.3	Loud Vehicle Passby
7/31/17 01:44	7/31/17 01:45	1.0	Loud Vehicle Passby
7/31/17 01:48	7/31/17 01:49	1.0	Loud Vehicle Passby
7/31/17 01:52	7/31/17 01:54	1.3	Loud Vehicle Passby
7/31/17 01:54	7/31/17 01:54	0.3	Aircraft Flyover
7/31/17 01:54	7/31/17 01:55	1.0	Loud Vehicle Passby
7/31/17 01:55	7/31/17 01:55	0.3	Loud Vehicle Passby
7/31/17 01:55	7/31/17 01:56	0.3	Loud Vehicle Passby
7/31/17 01:56	7/31/17 01:57	1.3	Loud Vehicle Passby
7/31/17 01:58	7/31/17 01:59	0.8	Loud Vehicle Passby
7/31/17 02:02	7/31/17 02:05	2.8	Loud Vehicle Passby
7/31/17 02:06	7/31/17 02:08	2.0	Loud Vehicle Passby
7/31/17 02:09	7/31/17 02:10	1.3	Loud Vehicle Passby
7/31/17 02:10	7/31/17 02:11	0.8	Loud Vehicle Passby
7/31/17 02:12	7/31/17 02:14	2.0	Loud Vehicle Passby
7/31/17 02:19	7/31/17 02:21	2.3	Loud Vehicle Passby
7/31/17 02:24	7/31/17 02:27	3.3	Loud Vehicle Passby
7/31/17 02:29	7/31/17 02:30	1.0	Loud Vehicle Passby
7/31/17 02:31	7/31/17 02:32	1.3	Loud Vehicle Passby
7/31/17 02:33	7/31/17 02:36	3.0	Loud Vehicle Passby
7/31/17 02:36	7/31/17 02:39	3.0	Loud Vehicle Passby
7/31/17 02:40	7/31/17 02:43	2.8	Loud Vehicle Passby
7/31/17 02:46	7/31/17 02:48	2.0	Loud Vehicle Passby
7/31/17 02:48	7/31/17 02:52	3.3	Loud Vehicle Passby
7/31/17 02:55	7/31/17 02:55	0.3	Loud Vehicle Passby
7/31/17 02:55	7/31/17 02:56	1.0	Loud Vehicle Passby
7/31/17 02:57	7/31/17 02:57	0.3	Loud Vehicle Passby
7/31/17 02:57	7/31/17 02:59	2.3	Loud Vehicle Passby
7/31/17 02:59	7/31/17 03:01	1.5	Loud Vehicle Passby
7/31/17 03:01	7/31/17 03:03	1.5	Loud Vehicle Passby
7/31/17 03:03	7/31/17 03:04	1.0	Loud Vehicle Passby
7/31/17 03:06	7/31/17 03:07	1.3	Loud Vehicle Passby
7/31/17 03:10	7/31/17 03:10	0.3	Loud Vehicle Passby
7/31/17 03:10	7/31/17 03:11	1.0	Loud Vehicle Passby
7/31/17 03:13	7/31/17 03:15	1.8	Loud Vehicle Passby
7/31/17 03:15	7/31/17 03:16	1.8	Loud Vehicle Passby
7/31/17 03:17	7/31/17 03:18	1.8	Loud Vehicle Passby
7/31/17 03:19	7/31/17 03:21	2.3	Loud Vehicle Passby
7/31/17 03:22	7/31/17 03:25	3.0	Loud Vehicle Passby

Data Removal Noise Monitoring Location #5 Cont

Start Time	End Time	Duration (min)	Reason
7/31/17 03:25	7/31/17 03:26	1.3	Loud Vehicle Passby
7/31/17 03:28	7/31/17 03:31	3.0	Loud Vehicle Passby
7/31/17 03:31	7/31/17 03:33	1.8	Loud Vehicle Passby
7/31/17 03:36	7/31/17 03:37	1.3	Loud Vehicle Passby
7/31/17 03:37	7/31/17 03:40	2.8	Loud Vehicle Passby
7/31/17 03:42	7/31/17 03:44	2.3	Loud Vehicle Passby
7/31/17 03:46	7/31/17 03:51	4.5	Loud Vehicle Passby
7/31/17 03:52	7/31/17 03:54	2.5	Loud Vehicle Passby
7/31/17 04:00	7/31/17 04:01	1.3	Loud Vehicle Passby
7/31/17 04:03	7/31/17 04:04	1.5	Loud Vehicle Passby
7/31/17 04:06	7/31/17 04:08	1.8	Loud Vehicle Passby
7/31/17 04:10	7/31/17 04:10	0.3	Loud Vehicle Passby
7/31/17 04:10	7/31/17 04:11	0.8	Loud Vehicle Passby
7/31/17 04:13	7/31/17 04:15	1.5	Loud Vehicle Passby
7/31/17 04:16	7/31/17 04:17	1.0	Loud Vehicle Passby
7/31/17 04:18	7/31/17 04:19	1.0	Loud Vehicle Passby
7/31/17 04:20	7/31/17 04:21	1.0	Loud Vehicle Passby
7/31/17 04:22	7/31/17 04:23	1.3	Loud Vehicle Passby
7/31/17 04:24	7/31/17 04:25	1.3	Loud Vehicle Passby
7/31/17 04:26	7/31/17 04:27	0.8	Loud Vehicle Passby
7/31/17 04:31	7/31/17 04:35	4.3	Loud Vehicle Passby
7/31/17 04:39	7/31/17 04:43	4.8	Loud Vehicle Passby
7/31/17 04:45	7/31/17 04:46	1.0	Loud Vehicle Passby
7/31/17 04:47	7/31/17 04:48	0.8	Loud Vehicle Passby
7/31/17 04:54	7/31/17 04:56	2.3	Loud Vehicle Passby
7/31/17 04:57	7/31/17 04:59	1.5	Loud Vehicle Passby
7/31/17 05:00	7/31/17 05:01	1.3	Loud Vehicle Passby
7/31/17 05:01	7/31/17 05:04	2.3	Loud Vehicle Passby
7/31/17 05:04	7/31/17 05:06	1.8	Loud Vehicle Passby
7/31/17 05:06	7/31/17 05:07	0.3	Loud Vehicle Passby
7/31/17 05:07	7/31/17 05:07	0.8	Loud Vehicle Passby
7/31/17 05:12	7/31/17 05:13	1.8	Loud Vehicle Passby
7/31/17 05:13	7/31/17 05:24	10.8	Excessive Bird Noise
7/31/17 05:25	7/31/17 05:26	0.3	Loud Vehicle Passby
7/31/17 05:26	7/31/17 05:26	0.8	Loud Vehicle Passby
7/31/17 05:28	7/31/17 05:30	2.0	Loud Vehicle Passby
7/31/17 05:30	7/31/17 05:32	2.0	Excessive Bird Noise
7/31/17 05:33	7/31/17 05:34	1.3	Loud Vehicle Passby
7/31/17 05:35	7/31/17 05:36	1.3	Loud Vehicle Passby
7/31/17 05:36	7/31/17 05:39	2.5	Loud Vehicle Passby

Data Removal Noise Monitoring Location #5 Cont

Start Time	End Time	Duration (min)	Reason
7/31/17 05:44	7/31/17 05:45	1.3	Loud Vehicle Passby
7/31/17 05:50	7/31/17 05:52	2.3	Loud Vehicle Passby
7/31/17 05:56	7/31/17 05:57	1.3	Loud Vehicle Passby
7/31/17 05:59	7/31/17 05:59	0.3	Loud Vehicle Passby
7/31/17 06:00	7/31/17 06:00	0.3	Loud Vehicle Passby
7/31/17 06:11	7/31/17 06:11	0.3	Loud Vehicle Passby
7/31/17 06:24	7/31/17 06:25	1.0	Loud Vehicle Passby
7/31/17 06:26	7/31/17 06:28	2.5	Loud Vehicle Passby
7/31/17 06:29	7/31/17 06:31	2.0	Loud Vehicle Passby
7/31/17 06:50	7/31/17 06:59	9.5	Excessive Bird Noise
	Total Night #1	**128**	
	Total Night #2	**265**	
	Total Data	**393**	

Data Removal Noise Monitoring Location #6

Start Time	End Time	Duration (min)	Reason
7/27/17 22:00	7/27/17 22:59	58.6	Excessive Rain Noise
7/27/17 23:01	7/27/17 23:01	0.6	Thunder
7/27/17 23:03	7/27/17 23:04	0.6	Train Passby
7/28/17 00:05	7/28/17 00:06	1.1	Train Passby
7/28/17 00:17	7/28/17 00:19	1.9	Excessive Wind Noise
7/28/17 00:26	7/28/17 00:27	0.9	Loud Vehicle Passby
7/28/17 01:30	7/28/17 01:30	0.6	Train Passby
7/28/17 01:31	7/28/17 01:31	0.1	Train Passby
7/28/17 01:34	7/28/17 01:34	0.9	Train Passby
7/28/17 01:35	7/28/17 01:35	0.6	Train Passby
7/28/17 01:39	7/28/17 01:40	0.6	Train Passby
7/28/17 01:45	7/28/17 01:46	1.6	Train Passby
7/28/17 02:04	7/28/17 02:05	1.6	Loud Vehicle Passby
7/28/17 04:30	7/28/17 04:30	0.6	Train Passby
7/28/17 04:41	7/28/17 04:41	0.4	Train Passby
7/28/17 04:56	7/28/17 04:57	0.9	Loud Vehicle Passby
7/28/17 05:57	7/28/17 05:58	0.9	Train Passby
7/28/17 06:32	7/28/17 06:33	1.4	Loud Vehicle Passby
7/28/17 06:50	7/28/17 06:51	1.4	Loud Vehicle Passby
7/28/17 06:55	7/28/17 06:56	0.9	Loud Vehicle Passby
7/28/17 22:00	7/28/17 22:01	1.9	Loud Vehicle Passby
7/28/17 22:04	7/28/17 22:06	1.9	Loud Vehicle Passby
7/28/17 22:06	7/28/17 22:08	2.4	Loud Vehicle Passby
7/28/17 22:08	7/28/17 22:10	1.6	Loud Vehicle Passby
7/28/17 22:11	7/28/17 22:19	7.9	Loud Vehicle Passby
7/28/17 22:20	7/28/17 22:34	13.6	Loud Vehicle Passby
7/28/17 22:35	7/28/17 22:43	7.9	Loud Vehicle Passby
7/28/17 22:43	7/28/17 22:45	2.6	Loud Vehicle Passby
7/28/17 22:46	7/28/17 22:48	1.9	Loud Vehicle Passby
7/28/17 22:49	7/28/17 22:55	6.1	Loud Vehicle Passby
7/28/17 22:56	7/28/17 23:00	4.1	Loud Vehicle Passby
7/28/17 23:00	7/28/17 23:02	2.1	Loud Vehicle Passby
7/28/17 23:04	7/28/17 23:10	5.6	Loud Vehicle Passby
7/28/17 23:13	7/28/17 23:16	3.1	Loud Vehicle Passby
7/28/17 23:18	7/28/17 23:21	3.1	Loud Vehicle Passby
7/28/17 23:22	7/28/17 23:22	0.1	Loud Vehicle Passby
7/28/17 23:22	7/28/17 23:24	1.9	Loud Vehicle Passby
7/28/17 23:25	7/28/17 23:30	4.9	Loud Vehicle Passby
7/28/17 23:30	7/28/17 23:30	0.1	Loud Vehicle Passby
7/28/17 23:30	7/28/17 23:51	20.6	Loud Vehicle Passby

Data Removal Noise Monitoring Location #6 cont.

Start Time	End Time	Duration (min)	Reason
7/28/17 23:55	7/28/17 23:56	1.9	Loud Vehicle Passby
7/28/17 23:58	7/29/17 00:04	5.9	Loud Vehicle Passby
7/29/17 00:05	7/29/17 00:10	4.9	Loud Vehicle Passby
7/29/17 00:11	7/29/17 00:12	1.6	Loud Vehicle Passby
7/29/17 00:12	7/29/17 00:14	2.1	Loud Vehicle Passby
7/29/17 00:15	7/29/17 00:15	0.1	Loud Vehicle Passby
7/29/17 00:15	7/29/17 00:15	0.1	Loud Vehicle Passby
7/29/17 00:15	7/29/17 00:16	1.1	Loud Vehicle Passby
7/29/17 00:17	7/29/17 00:19	1.9	Loud Vehicle Passby
7/29/17 00:21	7/29/17 00:22	1.6	Loud Vehicle Passby
7/29/17 00:24	7/29/17 00:26	2.6	Loud Vehicle Passby
7/29/17 00:32	7/29/17 00:35	3.1	Loud Vehicle Passby
7/29/17 00:37	7/29/17 00:39	1.6	Loud Vehicle Passby
7/29/17 00:41	7/29/17 00:44	3.1	Loud Vehicle Passby
7/29/17 00:46	7/29/17 00:53	6.9	Loud Vehicle Passby
7/29/17 00:53	7/29/17 00:59	6.1	Loud Vehicle Passby
7/29/17 01:00	7/29/17 01:02	1.6	Loud Vehicle Passby
7/29/17 01:02	7/29/17 01:05	2.4	Loud Vehicle Passby
7/29/17 01:05	7/29/17 01:07	2.1	Loud Vehicle Passby
7/29/17 01:12	7/29/17 01:15	2.9	Loud Vehicle Passby
7/29/17 01:16	7/29/17 01:17	1.4	Loud Vehicle Passby
7/29/17 01:19	7/29/17 01:24	5.4	Loud Vehicle Passby
7/29/17 01:24	7/29/17 01:27	2.6	Loud Vehicle Passby
7/29/17 01:27	7/29/17 01:32	4.9	Loud Vehicle Passby
7/29/17 01:34	7/29/17 01:35	1.4	Loud Vehicle Passby
7/29/17 01:36	7/29/17 01:37	1.6	Loud Vehicle Passby
7/29/17 01:38	7/29/17 01:39	1.6	Loud Vehicle Passby
7/29/17 01:47	7/29/17 01:50	3.4	Loud Vehicle Passby
7/29/17 01:52	7/29/17 01:53	1.1	Loud Vehicle Passby
7/29/17 01:53	7/29/17 01:58	4.4	Loud Vehicle Passby
7/29/17 01:59	7/29/17 02:00	1.4	Loud Vehicle Passby
7/29/17 02:00	7/29/17 02:00	0.1	Loud Vehicle Passby
7/29/17 02:00	7/29/17 02:02	2.1	Loud Vehicle Passby
7/29/17 02:03	7/29/17 02:07	4.4	Loud Vehicle Passby
7/29/17 02:10	7/29/17 02:13	2.9	Loud Vehicle Passby
7/29/17 02:16	7/29/17 02:18	1.9	Loud Vehicle Passby
7/29/17 02:19	7/29/17 02:21	2.4	Loud Vehicle Passby
7/29/17 02:22	7/29/17 02:24	1.6	Loud Vehicle Passby
7/29/17 02:24	7/29/17 02:27	2.9	Loud Vehicle Passby
7/29/17 02:27	7/29/17 02:31	3.9	Loud Vehicle Passby

Data Removal Noise Monitoring Location #6 cont.

Start Time	End Time	Duration (min)	Reason
7/29/17 02:31	7/29/17 02:37	5.9	Loud Vehicle Passby
7/29/17 02:38	7/29/17 02:39	1.6	Loud Vehicle Passby
7/29/17 02:40	7/29/17 02:42	2.1	Loud Vehicle Passby
7/29/17 02:42	7/29/17 02:44	1.6	Loud Vehicle Passby
7/29/17 03:22	7/29/17 03:22	0.1	Excessive Wind Noise
7/29/17 03:33	7/29/17 03:35	1.9	Loud Vehicle Passby
7/29/17 04:22	7/29/17 04:48	26.4	Excessive Wind Noise
7/29/17 05:01	7/29/17 05:01	0.6	Train Passby
7/29/17 05:10	7/29/17 05:12	2.6	Train Passby
7/29/17 05:16	7/29/17 05:17	1.4	Train Passby
7/29/17 05:24	7/29/17 05:25	0.9	Train Passby
7/29/17 05:32	7/29/17 05:34	1.6	Train Passby
7/29/17 05:53	7/29/17 05:54	1.1	Excessive Wind Noise
7/29/17 06:23	7/29/17 06:23	0.1	Excessive Wind Noise
7/29/17 06:24	7/29/17 06:24	0.4	Excessive Wind Noise
7/29/17 06:28	7/29/17 06:28	0.6	Excessive Wind Noise
7/29/17 06:29	7/29/17 06:30	0.6	Excessive Wind Noise
7/29/17 06:38	7/29/17 06:39	1.1	Loud Vehicle Passby
7/29/17 06:41	7/29/17 06:41	0.4	Train Passby
7/29/17 06:43	7/29/17 06:43	0.6	Loud Vehicle Passby
7/29/17 06:46	7/29/17 06:47	1.4	Loud Vehicle Passby
7/29/17 06:59	7/29/17 06:59	0.9	Loud Vehicle Passby
	Total Night #1	**76**	
	Total Night #2	**253**	
	Total Data	**330**	

Data Removal Noise Monitoring Location #8

Start Time	End Time	Duration (min)	Reason
7/30/17 04:58	7/30/17 06:59	121.9	Morning Chorus
7/30/17 23:50	7/30/17 23:51	1.3	Train Passby
7/30/17 23:53	7/30/17 23:55	1.8	Train Passby
7/31/17 00:19	7/31/17 00:19	0.8	Monitor Check
7/31/17 00:21	7/31/17 00:23	1.5	Monitor Check
7/31/17 00:25	7/31/17 00:27	1.3	Monitor Check
7/31/17 03:39	7/31/17 03:40	0.3	Loud Vehicle Passby
7/31/17 03:40	7/31/17 03:42	1.8	Loud Vehicle Passby
7/31/17 04:29	7/31/17 04:31	1.3	Loud Vehicle Passby
7/31/17 04:34	7/31/17 04:36	1.5	Loud Vehicle Passby
7/31/17 04:53	7/31/17 06:37	104.0	Morning Chorus
7/31/17 06:43	7/31/17 06:55	12.3	Excessive Bird Noise
7/31/17 06:55	7/31/17 07:01	5.3	Excessive Bird Noise
	Total Night #1	**122**	
	Total Night #2	**133**	
	Total Data	**255**	

Data Removal Noise Monitoring Location #9

Start Time	End Time	Duration (min)	Reason
7/29/17 22:07	7/29/17 22:08	1.2	Loud Vehicle Passby
7/29/17 22:13	7/29/17 22:13	0.7	Loud Vehicle Passby
7/29/17 22:20	7/29/17 22:21	1.2	Loud Vehicle Passby
7/29/17 22:40	7/29/17 22:41	0.7	Loud Bang
7/29/17 23:10	7/29/17 23:11	0.7	Loud Vehicle Passby
7/29/17 23:24	7/29/17 23:25	0.9	Loud Vehicle Passby
7/29/17 23:31	7/29/17 23:32	1.2	Train Passby
7/29/17 23:35	7/29/17 23:36	0.9	Train Passby
7/30/17 00:41	7/30/17 00:41	0.7	Loud Vehicle Passby
7/30/17 00:42	7/30/17 00:43	0.4	Loud Vehicle Passby
7/30/17 00:44	7/30/17 00:45	0.9	Loud Vehicle Passby
7/30/17 00:55	7/30/17 00:56	1.2	Loud Vehicle Passby
7/30/17 02:42	7/30/17 02:44	2.2	Monitor Check
7/30/17 02:47	7/30/17 02:48	0.9	Monitor Check
7/30/17 03:13	7/30/17 03:13	0.2	Loud Vehicle Passby
7/30/17 03:13	7/30/17 03:14	0.9	Loud Vehicle Passby
7/30/17 04:17	7/30/17 04:18	0.7	Train Passby
7/30/17 04:26	7/30/17 04:27	0.9	Train Passby
7/30/17 04:27	7/30/17 04:27	0.2	Train Passby
7/30/17 04:28	7/30/17 04:28	0.9	Train Passby
7/30/17 05:10	7/30/17 05:10	0.2	Train Passby
7/30/17 05:11	7/30/17 05:12	1.2	Train Passby
7/30/17 05:29	7/30/17 05:30	1.2	Excessive Bird Noise
7/30/17 05:31	7/30/17 05:31	0.9	Excessive Bird Noise
7/30/17 05:38	7/30/17 05:39	1.4	Train Passby
7/30/17 05:40	7/30/17 05:43	2.4	Train Passby
7/30/17 05:46	7/30/17 05:46	0.4	Excessive Bird Noise
7/30/17 05:47	7/30/17 05:48	1.9	Loud Vehicle Passby
7/30/17 05:49	7/30/17 05:49	0.4	Train Passby
7/30/17 05:50	7/30/17 05:50	0.2	Loud Vehicle Passby
7/30/17 05:51	7/30/17 05:51	0.7	Loud Vehicle Passby
7/30/17 06:34	7/30/17 06:35	1.4	Loud Vehicle Passby
7/30/17 06:36	7/30/17 06:42	5.4	Loud Vehicle Passby
7/30/17 06:46	7/30/17 06:47	1.7	Loud Vehicle Passby
7/30/17 06:52	7/30/17 06:55	2.9	Loud Vehicle Passby
7/30/17 22:02	7/30/17 22:02	0.5	Dog Barking
7/30/17 22:14	7/30/17 22:24	9.5	Train Passby
7/30/17 22:30	7/30/17 22:30	0.3	Loud Vehicle Passby
7/30/17 22:30	7/30/17 22:30	0.3	Loud Vehicle Passby
7/30/17 22:30	7/30/17 22:31	0.8	Loud Vehicle Passby

Data Removal Noise Monitoring Location #9 Cont.

Start Time	End Time	Duration (min)	Reason
7/30/17 22:48	7/30/17 22:50	2.0	Loud Vehicle Passby
7/30/17 23:27	7/30/17 23:29	1.5	Loud Vehicle Passby
7/30/17 23:30	7/30/17 23:31	1.0	Train Passby
7/30/17 23:33	7/30/17 23:34	0.8	Train Passby
7/30/17 23:37	7/30/17 23:39	2.0	Loud Vehicle Passby
7/30/17 23:43	7/30/17 23:45	1.8	Aircraft Flyover
7/30/17 23:53	7/30/17 23:55	2.0	Loud Vehicle Passby
7/30/17 23:59	7/31/17 00:00	1.0	Loud Vehicle Passby
7/31/17 00:03	7/31/17 00:05	2.3	Monitor Check
7/31/17 00:34	7/31/17 00:35	1.5	Loud Vehicle Passby
7/31/17 00:38	7/31/17 00:39	1.3	Loud Vehicle Passby
7/31/17 00:40	7/31/17 00:41	1.0	Loud Vehicle Passby
7/31/17 00:58	7/31/17 01:00	1.8	Loud Vehicle Passby
7/31/17 01:12	7/31/17 01:14	1.3	Train Passby
7/31/17 01:14	7/31/17 01:19	5.3	Loud Vehicle Passby
7/31/17 02:02	7/31/17 02:05	2.5	Loud Vehicle Passby
7/31/17 02:30	7/31/17 02:31	1.3	Loud Vehicle Passby
7/31/17 02:47	7/31/17 02:48	1.5	Aircraft Flyover
7/31/17 03:49	7/31/17 03:50	1.3	Loud Vehicle Passby
7/31/17 03:55	7/31/17 03:57	2.5	Train Passby
7/31/17 03:57	7/31/17 03:59	2.0	Train Passby
7/31/17 04:01	7/31/17 04:08	6.5	Train Passby
7/31/17 04:08	7/31/17 04:10	1.5	Train Passby
7/31/17 04:47	7/31/17 04:47	0.8	Loud Vehicle Passby
7/31/17 04:55	7/31/17 04:56	1.0	Loud Vehicle Passby
7/31/17 04:58	7/31/17 05:00	2.3	Loud Vehicle Passby
7/31/17 05:08	7/31/17 05:08	0.3	Loud Vehicle Passby
7/31/17 05:08	7/31/17 05:09	1.3	Loud Vehicle Passby
7/31/17 05:32	7/31/17 05:34	2.0	Loud Vehicle Passby
7/31/17 05:35	7/31/17 05:36	1.8	Loud Vehicle Passby
7/31/17 05:39	7/31/17 05:39	0.3	Loud Vehicle Passby
7/31/17 05:39	7/31/17 05:39	0.3	Loud Vehicle Passby
7/31/17 05:39	7/31/17 05:40	0.3	Loud Vehicle Passby
7/31/17 05:40	7/31/17 05:41	1.0	Loud Vehicle Passby
7/31/17 05:42	7/31/17 05:45	3.0	Loud Vehicle Passby
7/31/17 05:57	7/31/17 05:58	1.3	Loud Vehicle Passby
7/31/17 05:59	7/31/17 06:00	0.8	Loud Vehicle Passby
7/31/17 06:00	7/31/17 06:02	1.3	Loud Vehicle Passby
7/31/17 06:16	7/31/17 06:16	0.3	Loud Vehicle Passby
7/31/17 06:16	7/31/17 06:17	0.3	Loud Vehicle Passby

Data Removal Noise Monitoring Location #9 Cont.

Start Time	End Time	Duration (min)	Reason
7/31/17 06:17	7/31/17 06:18	1.3	Loud Vehicle Passby
7/31/17 06:26	7/31/17 06:27	1.5	Loud Vehicle Passby
7/31/17 06:31	7/31/17 06:33	1.5	Loud Vehicle Passby
7/31/17 06:35	7/31/17 06:36	0.8	Loud Vehicle Passby
7/31/17 06:40	7/31/17 06:41	1.0	Loud Vehicle Passby
7/31/17 06:44	7/31/17 06:45	1.3	Loud Vehicle Passby
7/31/17 06:46	7/31/17 06:49	3.3	Loud Vehicle Passby
7/31/17 06:51	7/31/17 06:53	2.3	Loud Vehicle Passby
7/31/17 06:54	7/31/17 06:57	2.5	Loud Vehicle Passby
7/31/17 06:57	7/31/17 07:00	2.8	Loud Vehicle Passby
	Total Night #1	**40**	
	Total Night #2	**131**	
	Total Data	**170**	

Data Removal Noise Monitoring Location #10

Start Time	End Time	Duration (min)	Reason
7/27/17 22:00	7/27/17 23:00	59.8	Excessive Rain Noise
7/27/17 23:00	7/27/17 23:02	1.8	Thunder
7/27/17 23:03	7/27/17 23:04	1.3	Thunder
7/27/17 23:09	7/27/17 23:12	3.3	Thunder
7/27/17 23:14	7/27/17 23:15	1.0	Train Passby
7/27/17 23:17	7/27/17 23:18	1.0	Thunder
7/27/17 23:20	7/27/17 23:21	1.0	Thunder
7/27/17 23:28	7/27/17 23:29	1.0	Loud Vehicle Passby
7/28/17 00:15	7/28/17 00:16	1.0	Loud Vehicle Passby
7/28/17 00:18	7/28/17 00:26	7.5	Train Passby
7/28/17 02:49	7/28/17 02:50	0.8	Train Passby
7/28/17 02:53	7/28/17 02:54	1.3	Train Passby
7/28/17 02:55	7/28/17 02:57	1.8	Train Passby
7/28/17 03:11	7/28/17 03:12	1.0	Train Passby
7/28/17 03:48	7/28/17 03:49	1.0	Loud Vehicle Passby
7/28/17 04:37	7/28/17 04:38	1.5	Loud Vehicle Passby
7/28/17 05:05	7/28/17 05:06	0.8	Loud Vehicle Passby
7/28/17 05:10	7/28/17 05:14	4.0	Loud Vehicle Passby
7/28/17 05:17	7/28/17 05:20	3.0	Loud Vehicle Passby
7/28/17 05:22	7/28/17 05:23	1.0	Loud Vehicle Passby
7/28/17 05:28	7/28/17 05:29	1.0	Loud Vehicle Passby
7/28/17 05:30	7/28/17 06:59	89.0	Morning Rush
7/28/17 21:50	7/28/17 21:51	1.3	Loud Vehicle Passby
7/28/17 22:03	7/28/17 22:04	1.8	Loud Vehicle Passby
7/28/17 22:06	7/28/17 22:07	1.5	Loud Vehicle Passby
7/28/17 22:12	7/28/17 22:12	0.0	Loud Vehicle Passby
7/28/17 22:12	7/28/17 22:14	1.5	Loud Vehicle Passby
7/28/17 22:27	7/28/17 22:28	1.5	Loud Vehicle Passby
7/28/17 22:32	7/28/17 22:33	1.0	Loud Vehicle Passby
7/28/17 22:34	7/28/17 22:34	0.0	Loud Vehicle Passby
7/28/17 22:35	7/28/17 22:37	2.8	Loud Vehicle Passby
7/28/17 22:39	7/28/17 22:40	1.3	Loud Vehicle Passby
7/28/17 22:42	7/28/17 22:42	0.0	Loud Vehicle Passby
7/28/17 22:42	7/28/17 22:44	1.8	Loud Vehicle Passby
7/28/17 22:49	7/28/17 22:50	1.0	Loud Vehicle Passby
7/28/17 22:51	7/28/17 22:52	1.3	Loud Vehicle Passby
7/28/17 22:54	7/28/17 22:55	0.8	Loud Vehicle Passby
7/28/17 22:56	7/28/17 22:57	1.0	Loud Vehicle Passby
7/28/17 23:00	7/28/17 23:01	1.5	Loud Vehicle Passby
7/28/17 23:07	7/28/17 23:09	1.8	Loud Vehicle Passby

Data Removal Noise Monitoring Location #10 Cont.

Start Time	End Time	Duration (min)	Reason
7/28/17 23:22	7/28/17 23:24	1.5	Loud Vehicle Passby
7/28/17 23:42	7/28/17 23:43	1.0	Loud Vehicle Passby
7/28/17 23:57	7/28/17 23:57	0.0	Loud Vehicle Passby
7/28/17 23:57	7/28/17 23:58	1.0	Loud Vehicle Passby
7/29/17 00:02	7/29/17 00:02	0.0	Loud Vehicle Passby
7/29/17 00:02	7/29/17 00:04	2.3	Loud Vehicle Passby
7/29/17 00:35	7/29/17 00:36	0.8	Loud Vehicle Passby
7/29/17 00:52	7/29/17 00:54	2.0	Loud Vehicle Passby
7/29/17 01:17	7/29/17 01:18	0.8	Loud Vehicle Passby
7/29/17 01:21	7/29/17 01:22	0.5	Loud Vehicle Passby
7/29/17 01:24	7/29/17 01:26	1.8	Train Passby
7/29/17 01:27	7/29/17 01:28	1.3	Train Passby
7/29/17 01:59	7/29/17 02:00	0.8	Excessive Wind Noise
7/29/17 02:00	7/29/17 02:56	55.3	Excessive Wind Noise
7/29/17 03:02	7/29/17 03:04	1.3	Loud Vehicle Passby
7/29/17 03:08	7/29/17 03:10	1.5	Loud Vehicle Passby
7/29/17 03:36	7/29/17 03:37	1.5	Loud Vehicle Passby
7/29/17 03:46	7/29/17 03:47	1.3	Loud Vehicle Passby
7/29/17 03:48	7/29/17 03:49	1.3	Loud Vehicle Passby
7/29/17 03:51	7/29/17 03:54	2.5	Loud Vehicle Passby
7/29/17 04:04	7/29/17 04:06	2.0	Loud Vehicle Passby
7/29/17 04:20	7/29/17 04:23	2.5	Train Passby
7/29/17 04:24	7/29/17 04:33	9.0	Loud Vehicle Passby
7/29/17 04:45	7/29/17 04:47	2.0	Loud Vehicle Passby
7/29/17 04:48	7/29/17 04:50	2.3	Loud Vehicle Passby
7/29/17 04:55	7/29/17 04:57	1.5	Loud Vehicle Passby
7/29/17 05:02	7/29/17 05:07	4.8	Loud Vehicle Passby
7/29/17 05:10	7/29/17 06:58	108.5	Morning Traffic
7/29/17 06:59	7/29/17 07:00	1.3	Loud Vehicle Passby
	Total Night #1	**185**	
	Total Night #2	**233**	
	Total Data	**418**	

Data Removal Noise Monitoring Location #11

Start Time	End Time	Duration (min)	Reason
7/29/17 22:34	7/29/17 22:35	1.0	Loud Vehicle Passby
7/29/17 22:35	7/29/17 22:37	2.2	Loud Vehicle Passby
7/29/17 22:42	7/29/17 22:46	4.7	Train Passby
7/29/17 23:05	7/29/17 23:07	3.0	Site Activity
7/29/17 23:23	7/29/17 23:24	1.7	Site Activity
7/29/17 23:44	7/29/17 23:45	1.0	Train Passby
7/29/17 23:53	7/29/17 23:56	3.5	Train Passby
7/30/17 00:08	7/30/17 00:12	4.5	Train Passby
7/30/17 00:14	7/30/17 00:26	12.7	Site Activity
7/30/17 00:27	7/30/17 00:29	2.0	Train Passby
7/30/17 00:44	7/30/17 00:44	0.2	Train Passby
7/30/17 00:44	7/30/17 00:45	1.7	Train Passby
7/30/17 00:48	7/30/17 00:48	0.2	Train Passby
7/30/17 00:49	7/30/17 00:50	1.7	Train Passby
7/30/17 01:42	7/30/17 01:42	0.2	Loud Vehicle Passby
7/30/17 01:43	7/30/17 01:43	0.2	Train Passby
7/30/17 01:43	7/30/17 01:44	1.7	Loud Vehicle Passby
7/30/17 02:49	7/30/17 02:50	1.2	Loud Vehicle Passby
7/30/17 02:55	7/30/17 02:55	0.2	Loud Vehicle Passby
7/30/17 02:55	7/30/17 02:57	2.0	Loud Vehicle Passby
7/30/17 04:47	7/30/17 04:49	1.7	Loud Vehicle Passby
7/30/17 04:56	7/30/17 04:58	2.0	Loud Vehicle Passby
7/30/17 05:07	7/30/17 05:09	1.5	Loud Vehicle Passby
7/30/17 05:21	7/30/17 05:23	2.5	Excessive Bird Noise
7/30/17 05:31	7/30/17 05:34	3.5	Loud Vehicle Passby
7/30/17 05:38	7/30/17 05:40	1.7	Loud Vehicle Passby
7/30/17 05:41	7/30/17 05:47	6.2	Loud Vehicle Passby
7/30/17 05:52	7/30/17 05:53	1.2	Excessive Bird Noise
7/30/17 05:57	7/30/17 06:00	2.7	Loud Vehicle Passby
7/30/17 06:03	7/30/17 06:08	5.2	Excessive Wind Noise
7/30/17 06:15	7/30/17 06:17	1.7	Loud Vehicle Passby
7/30/17 06:17	7/30/17 06:18	1.0	Excessive Bird Noise
7/30/17 06:19	7/30/17 06:25	6.0	Excessive Bird Noise
7/30/17 06:26	7/30/17 06:28	2.2	Excessive Bird Noise
7/30/17 06:31	7/30/17 06:34	3.5	Excessive Bird Noise
7/30/17 06:36	7/30/17 06:38	2.7	Excessive Bird Noise
7/30/17 06:51	7/30/17 06:53	2.2	Excessive Bird Noise
7/30/17 06:56	7/30/17 06:57	1.5	Excessive Bird Noise
7/30/17 22:11	7/30/17 22:12	1.0	Monitor Check
7/30/17 22:25	7/30/17 22:27	1.5	Loud Vehicle Passby

Data Removal Noise Monitoring Location #11 Cont.

Start Time	End Time	Duration (min)	Reason
7/30/17 23:42	7/30/17 23:43	1.2	Train Passby
7/30/17 23:44	7/30/17 23:47	2.7	Train Passby
7/30/17 23:50	7/30/17 23:50	0.7	Train Passby
7/31/17 00:03	7/31/17 00:07	4.0	Loud Vehicle Passby
7/31/17 00:11	7/31/17 00:15	4.2	Loud Vehicle Passby
7/31/17 00:16	7/31/17 00:20	4.5	Site Activity
7/31/17 00:47	7/31/17 00:49	2.0	Loud Vehicle Passby
7/31/17 01:46	7/31/17 01:47	1.7	Loud Vehicle Passby
7/31/17 03:00	7/31/17 03:05	5.7	Train Passby
7/31/17 03:16	7/31/17 03:16	0.2	Loud Vehicle Passby
7/31/17 03:17	7/31/17 03:19	2.2	Loud Vehicle Passby
7/31/17 03:46	7/31/17 03:47	1.2	Loud Vehicle Passby
7/31/17 04:30	7/31/17 04:31	1.2	Loud Vehicle Passby
7/31/17 05:04	7/31/17 05:05	1.7	Loud Vehicle Passby
7/31/17 05:08	7/31/17 05:10	2.7	Loud Vehicle Passby
7/31/17 05:24	7/31/17 05:27	3.2	Loud Vehicle Passby
7/31/17 05:38	7/31/17 06:59	81.7	Morning Rush/Chorus
	Total Night #1	**94**	
	Total Night #2	**123**	
	Total Data	**217**	

Data Removal Noise Monitoring Location #12

Start Time	End Time	Duration (min)	Reason
7/27/17 22:00	7/27/17 23:54	113.9	Excessive Wind Noise
7/27/17 23:57	7/27/17 23:58	1.2	Loud Vehicle Passby
7/28/17 00:08	7/28/17 00:09	1.7	Loud Vehicle Passby
7/28/17 01:05	7/28/17 01:05	0.2	Train Passby
7/28/17 01:06	7/28/17 01:15	9.2	Train Passby
7/28/17 01:19	7/28/17 01:22	3.2	Loud Vehicle Passby
7/28/17 01:22	7/28/17 01:22	0.2	Train Passby
7/28/17 01:22	7/28/17 01:37	14.7	Train Passby
7/28/17 01:47	7/28/17 01:50	2.9	Aircraft Flyover
7/28/17 02:55	7/28/17 02:58	3.4	Loud Vehicle Passby
7/28/17 03:00	7/28/17 03:05	4.7	Monitor Check
7/28/17 03:18	7/28/17 03:24	6.2	Train Passby
7/28/17 03:40	7/28/17 03:41	1.7	Loud Vehicle Passby
7/28/17 03:50	7/28/17 03:51	1.2	Train Passby
7/28/17 03:51	7/28/17 03:52	0.9	Train Passby
7/28/17 03:53	7/28/17 03:54	1.2	Train Passby
7/28/17 03:54	7/28/17 03:55	1.4	Train Passby
7/28/17 03:57	7/28/17 03:58	1.2	Train Passby
7/28/17 04:04	7/28/17 04:09	5.2	Train Passby
7/28/17 04:13	7/28/17 04:14	1.2	Train Passby
7/28/17 04:15	7/28/17 04:18	2.7	Train Passby
7/28/17 04:21	7/28/17 04:23	2.9	Train Passby
7/28/17 04:24	7/28/17 04:31	7.7	Train Passby
7/28/17 04:32	7/28/17 04:44	12.4	Train Passby
7/28/17 04:51	7/28/17 04:52	1.4	Excessive Bird Noise
7/28/17 04:59	7/28/17 05:01	2.4	Loud Vehicle Passby
7/28/17 05:02	7/28/17 05:03	1.2	Excessive Bird Noise
7/28/17 05:13	7/28/17 05:16	2.7	Excessive Bird Noise
7/28/17 05:25	7/28/17 05:26	1.7	Loud Vehicle Passby
7/28/17 05:30	7/28/17 06:59	89.7	Morning Rush/ Chorus
7/28/17 21:46	7/28/17 21:47	1.7	Loud Vehicle Passby
7/28/17 22:03	7/28/17 22:05	2.7	Loud Vehicle Passby
7/28/17 22:27	7/28/17 22:32	5.4	Train Passby
7/28/17 22:49	7/28/17 22:50	1.7	Goose
7/28/17 23:46	7/28/17 23:54	8.2	Loud Vehicle Passby
7/29/17 00:15	7/29/17 00:17	2.7	Train Passby
7/29/17 00:33	7/29/17 00:36	2.7	Aircraft Flyover
7/29/17 01:04	7/29/17 01:06	2.2	Loud Vehicle Passby
7/29/17 01:44	7/29/17 01:53	9.2	Train Passby
7/29/17 01:53	7/29/17 01:57	3.4	Train Passby

Data Removal Noise Monitoring Location #12 Cont.

Start Time	End Time	Duration (min)	Reason
7/29/17 01:57	7/29/17 02:00	3.2	Train Passby
7/29/17 02:31	7/29/17 03:24	53.9	Excessive Wind Noise
7/29/17 03:25	7/29/17 03:38	13.7	Train Passby
7/29/17 03:50	7/29/17 03:52	1.7	Loud Vehicle Passby
7/29/17 04:27	7/29/17 04:43	15.7	Train Passby
7/29/17 04:54	7/29/17 05:12	18.2	Train Passby
7/29/17 05:39	7/29/17 05:41	2.7	Loud Vehicle Passby
7/29/17 06:12	7/29/17 06:20	8.2	Train Passby
7/29/17 06:26	7/29/17 06:36	10.2	Train Passby
7/29/17 06:54	7/29/17 06:57	2.7	Loud Vehicle Passby
7/29/17 06:58	7/29/17 07:00	2.7	Loud Vehicle Passby
7/29/17 22:00	7/29/17 22:14	13.9	Train Passby
7/29/17 22:33	7/29/17 22:35	2.2	Aircraft Flyover
7/29/17 22:43	7/29/17 22:45	2.4	Loud Vehicle Passby
7/29/17 23:06	7/29/17 23:08	2.2	Loud Vehicle Passby
7/30/17 01:19	7/30/17 01:27	8.4	Train Passby
7/30/17 01:34	7/30/17 01:36	2.4	Loud Vehicle Passby
7/30/17 01:36	7/30/17 01:37	0.7	Loud Vehicle Passby
7/30/17 01:50	7/30/17 01:51	1.4	Train Passby
7/30/17 01:51	7/30/17 02:00	9.2	Train Passby
7/30/17 03:28	7/30/17 03:28	0.2	Loud Vehicle Passby
7/30/17 03:29	7/30/17 03:30	1.4	Loud Vehicle Passby
7/30/17 03:33	7/30/17 03:34	1.4	Loud Vehicle Passby
7/30/17 04:52	7/30/17 04:55	3.4	Excessive Bird Noise
7/30/17 04:55	7/30/17 04:58	2.9	Excessive Bird Noise
7/30/17 05:03	7/30/17 05:04	1.7	Loud Vehicle Passby
7/30/17 05:27	7/30/17 05:35	7.9	Train Passby
7/30/17 05:38	7/30/17 05:41	3.2	Excessive Bird Noise
7/30/17 05:44	7/30/17 05:47	3.2	Excessive Bird Noise
7/30/17 05:50	7/30/17 05:56	6.2	Train Passby
7/30/17 06:13	7/30/17 06:13	0.2	Excessive Wind Noise
7/30/17 06:14	7/30/17 06:18	4.4	Excessive Wind Noise
7/30/17 06:21	7/30/17 06:22	1.4	Loud Vehicle Passby
7/30/17 06:28	7/30/17 06:29	1.2	Loud Vehicle Passby
7/30/17 06:31	7/30/17 06:59	28.2	Morning Chorus
7/30/17 22:05	7/30/17 22:07	1.9	Loud Vehicle Passby
7/30/17 22:12	7/30/17 22:14	1.9	Loud Vehicle Passby
7/30/17 22:15	7/30/17 22:17	1.7	Loud Vehicle Passby
7/30/17 22:27	7/30/17 22:32	4.4	Loud Vehicle Passby

Data Removal Noise Monitoring Location #12 Cont.

Start Time	End Time	Duration (min)	Reason
7/30/17 22:47	7/30/17 22:52	5.4	Train Passby
7/30/17 23:12	7/30/17 23:12	0.2	Loud Vehicle Passby
7/30/17 23:12	7/30/17 23:15	3.4	Loud Vehicle Passby
7/30/17 23:36	7/30/17 23:38	2.4	Aircraft Flyover
7/30/17 23:44	7/30/17 23:46	1.9	Aircraft Flyover
7/30/17 23:54	7/30/17 23:56	1.4	Aircraft Flyover
7/30/17 23:58	7/30/17 23:59	0.9	Loud Vehicle Passby
7/31/17 00:27	7/31/17 00:30	2.7	Aircraft Flyover
7/31/17 00:43	7/31/17 00:44	1.4	Train Passby
7/31/17 00:46	7/31/17 00:48	2.7	Train Passby
7/31/17 00:49	7/31/17 00:51	2.2	Train Passby
7/31/17 00:52	7/31/17 00:52	0.2	Train Passby
7/31/17 00:52	7/31/17 01:00	8.4	Train Passby
7/31/17 01:01	7/31/17 01:13	12.4	Train Passby
7/31/17 01:14	7/31/17 01:20	6.2	Train Passby
7/31/17 01:23	7/31/17 01:26	3.2	Train Passby
7/31/17 01:41	7/31/17 01:43	2.4	Train Passby
7/31/17 01:45	7/31/17 01:47	2.2	Train Passby
7/31/17 01:50	7/31/17 01:51	1.7	Train Passby
7/31/17 02:01	7/31/17 02:04	2.9	Loud Vehicle Passby
7/31/17 02:13	7/31/17 02:13	0.2	Loud Vehicle Passby
7/31/17 02:13	7/31/17 02:15	2.2	Loud Vehicle Passby
7/31/17 02:23	7/31/17 02:24	1.9	Loud Vehicle Passby
7/31/17 02:26	7/31/17 02:28	2.2	Loud Vehicle Passby
7/31/17 02:48	7/31/17 02:55	6.9	Train Passby
7/31/17 03:05	7/31/17 03:22	17.7	Train Passby
7/31/17 03:23	7/31/17 03:26	3.7	Train Passby
7/31/17 03:26	7/31/17 03:37	11.2	Train Passby
7/31/17 03:38	7/31/17 03:54	15.9	Train Passby
7/31/17 03:55	7/31/17 03:55	0.2	Train Passby
7/31/17 03:55	7/31/17 03:57	2.2	Train Passby
7/31/17 03:59	7/31/17 04:02	3.4	Loud Vehicle Passby
7/31/17 04:05	7/31/17 04:14	8.9	Loud Vehicle Passby
7/31/17 04:31	7/31/17 04:34	3.2	Loud Vehicle Passby
7/31/17 04:52	7/31/17 04:54	1.9	Loud Vehicle Passby
7/31/17 04:58	7/31/17 05:03	4.7	Loud Vehicle Passby
7/31/17 05:04	7/31/17 05:11	6.9	Loud Vehicle Passby
7/31/17 05:37	7/31/17 05:37	0.2	Loud Vehicle Passby
7/31/17 05:37	7/31/17 05:39	1.7	Loud Vehicle Passby

Data Removal Noise Monitoring Location #12 Cont.

Start Time	End Time	Duration (min)	Reason
7/31/17 05:48	7/31/17 05:50	2.7	Loud Vehicle Passby
7/31/17 06:01	7/31/17 06:59	58.4	Morning Rush/Chorus
	Total Night #1	**300**	
	Total Night #2	**171**	
	Total Night #3	**110**	
	Total Night #4	**232**	
	Total Data	**812**	

Data Removal Noise Monitoring Location #13

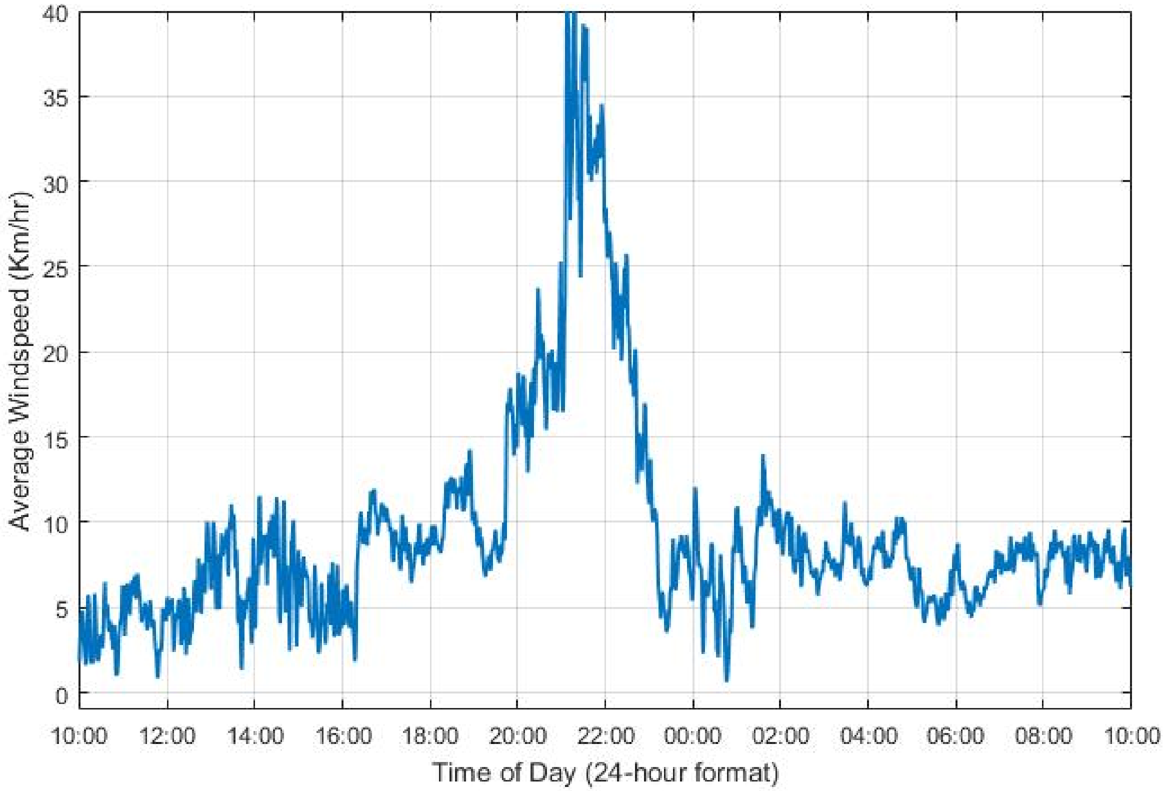
Start Time	End Time	Duration (min)	Reason
7/29/17 23:47	7/29/17 23:48	1.7	Loud Vehicle Passby
7/30/17 03:08	7/30/17 03:10	1.9	Monitor Check
7/30/17 03:10	7/30/17 03:14	3.9	Monitor Check
7/30/17 06:00	7/30/17 06:05	4.7	Loud Vehicle Passby
7/30/17 06:07	7/30/17 06:09	2.4	Loud Vehicle Passby
7/30/17 06:11	7/30/17 06:11	0.9	Loud Vehicle Passby
7/30/17 06:12	7/30/17 06:15	2.4	Loud Vehicle Passby
7/30/17 06:18	7/30/17 06:19	1.2	Loud Vehicle Passby
7/30/17 06:23	7/30/17 06:27	3.9	Loud Vehicle Passby
7/30/17 06:33	7/30/17 06:35	1.4	Loud Vehicle Passby
7/30/17 06:36	7/30/17 06:37	1.7	Loud Vehicle Passby
7/30/17 06:38	7/30/17 06:38	0.2	Loud Vehicle Passby
7/30/17 06:38	7/30/17 06:39	0.9	Loud Vehicle Passby
7/30/17 23:36	7/30/17 23:36	0.2	Loud Vehicle Passby
7/30/17 23:36	7/30/17 23:36	0.2	Loud Vehicle Passby
7/30/17 23:37	7/30/17 23:38	1.9	Loud Vehicle Passby
7/30/17 23:44	7/30/17 23:47	3.2	Loud Vehicle Passby
7/31/17 00:15	7/31/17 00:16	1.7	Coyotes
7/31/17 00:21	7/31/17 00:24	3.4	Loud Vehicle Passby
7/31/17 00:30	7/31/17 00:32	2.7	Monitor Check
7/31/17 00:33	7/31/17 00:36	3.2	Monitor Check
7/31/17 00:47	7/31/17 00:49	2.2	Loud Vehicle Passby
7/31/17 00:53	7/31/17 00:55	2.7	Loud Vehicle Passby
7/31/17 01:30	7/31/17 01:33	3.2	Coyotes
7/31/17 01:40	7/31/17 01:42	1.4	Aircraft Flyover
7/31/17 01:46	7/31/17 01:48	1.9	Aircraft Flyover
7/31/17 02:01	7/31/17 02:04	3.7	Loud Vehicle Passby
7/31/17 02:21	7/31/17 02:24	3.2	Coyotes
7/31/17 02:40	7/31/17 02:44	3.9	Loud Vehicle Passby
7/31/17 02:48	7/31/17 02:51	2.9	Aircraft Flyover
7/31/17 03:24	7/31/17 03:26	2.2	Coyotes
7/31/17 03:32	7/31/17 03:35	3.4	Aircraft Flyover
7/31/17 03:52	7/31/17 03:54	2.2	Coyotes
7/31/17 04:32	7/31/17 04:35	3.2	Aircraft Flyover
7/31/17 04:44	7/31/17 04:46	1.7	Loud Vehicle Passby
7/31/17 05:10	7/31/17 05:11	1.4	Excessive Bird Noise
7/31/17 05:43	7/31/17 05:47	4.4	Loud Vehicle Passby
7/31/17 05:52	7/31/17 05:57	4.7	Loud Vehicle Passby
7/31/17 06:07	7/31/17 06:58	51.4	Morning Chorus

Data Removal Noise Monitoring Location #13 Cont.

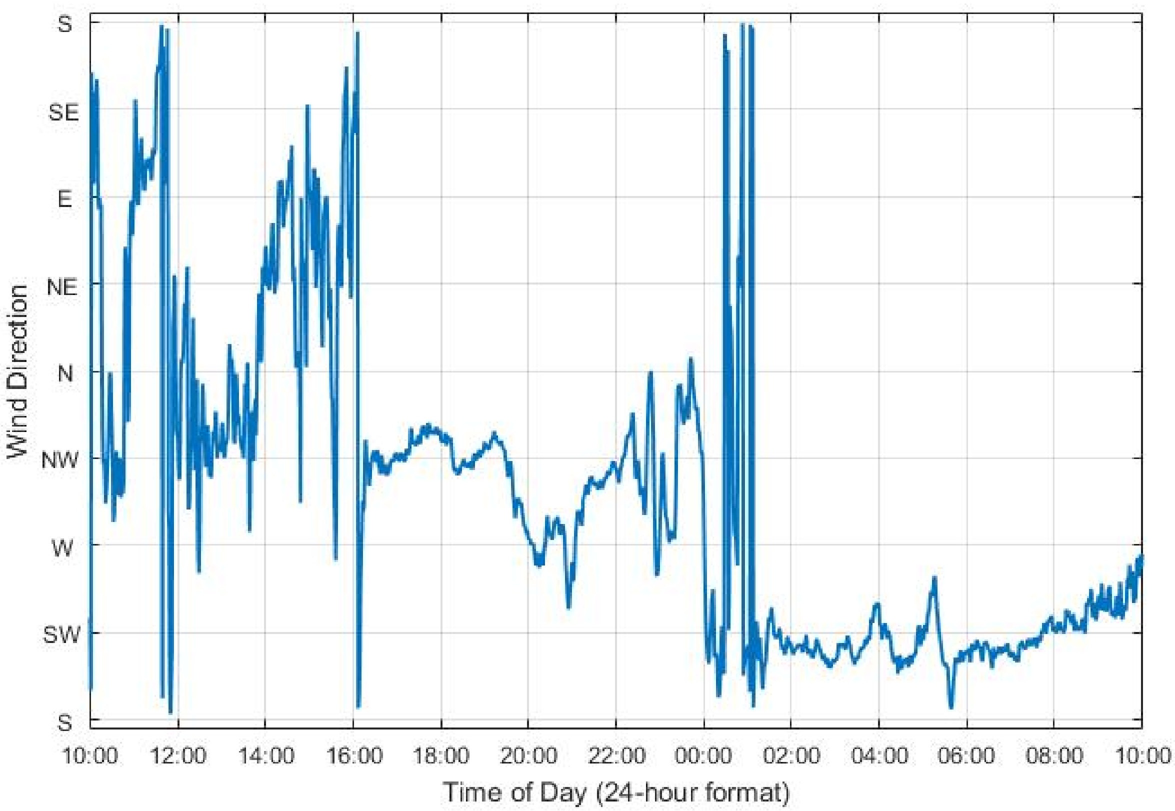
Start Time	End Time	Duration (min)	Reason
	Total Night #1	27	
	Total Night #2	116	
	Total Data	144	

Appendix V WEATHER DATA

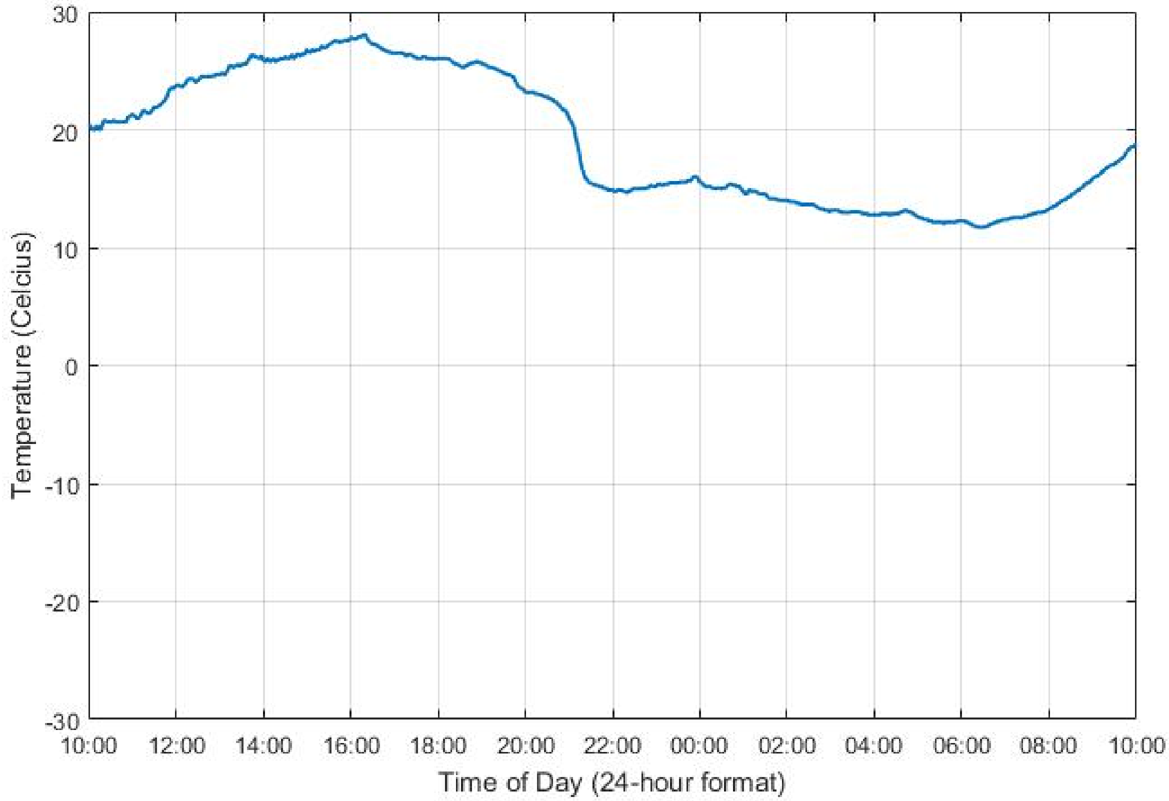
July 27 - 28, 2017 Weather Data



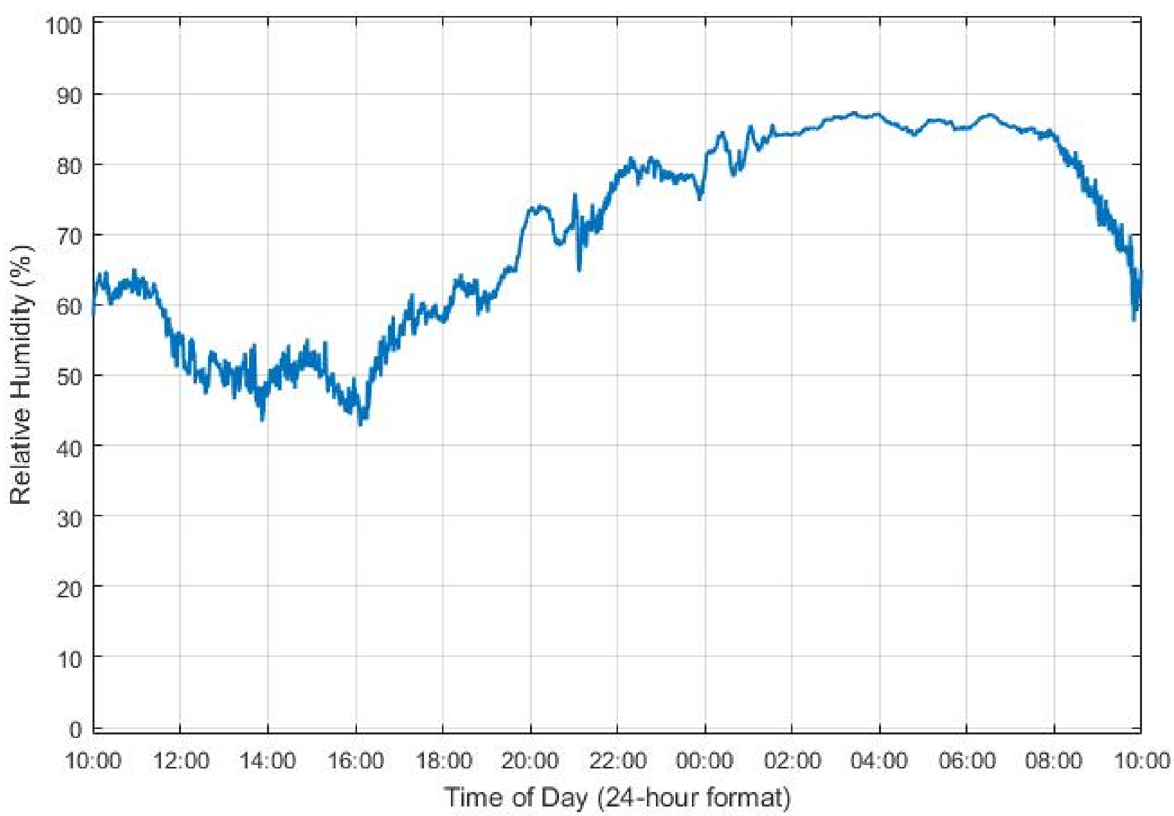
Monitored Wind Speed (July 27 – 28, 2017) at Noise Monitor Location 6



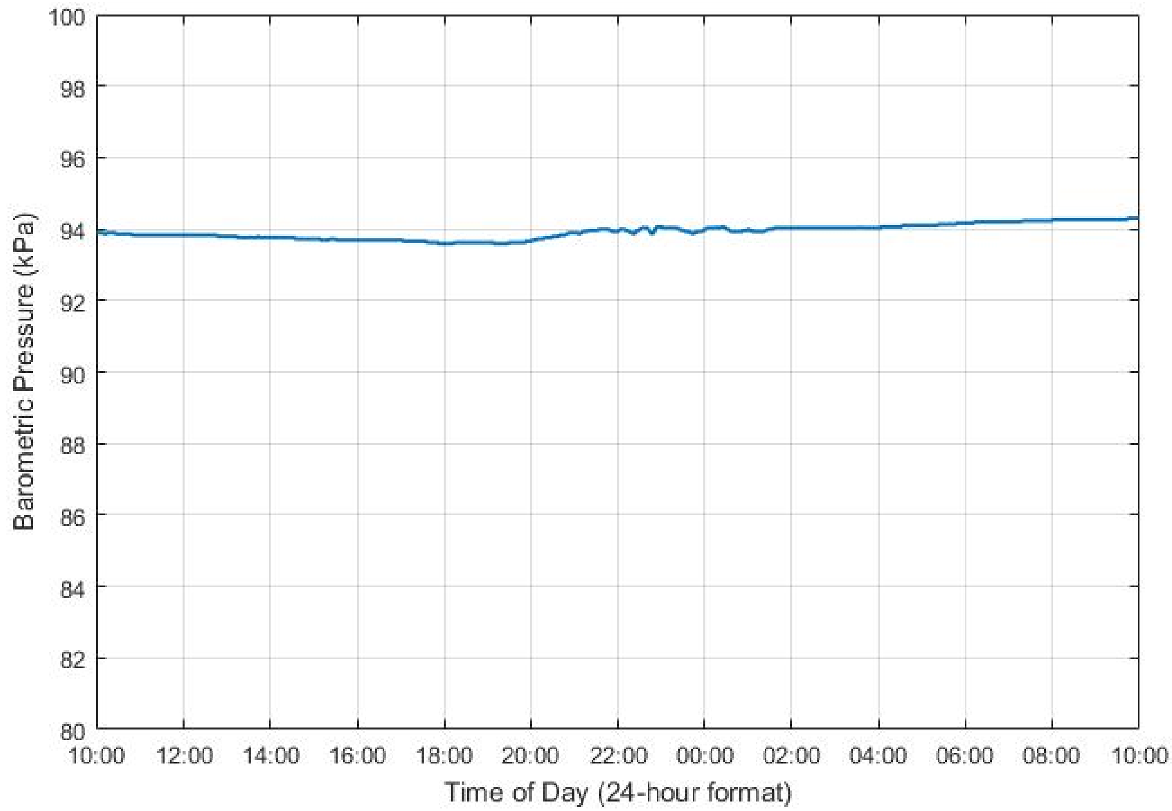
Monitored Wind Direction (July 27 – 28, 2017) at Noise Monitor Location 6



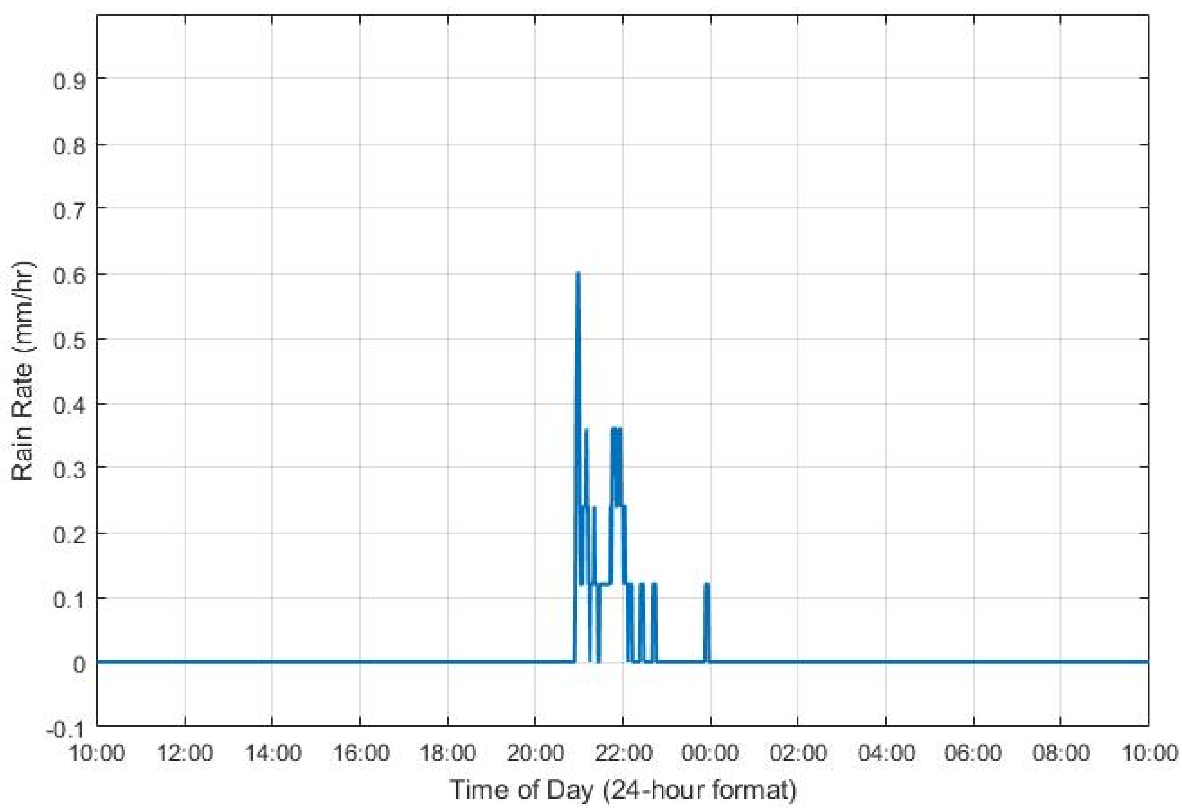
Monitored Temperature (July 27 – 28, 2017) at Noise Monitor Location 6



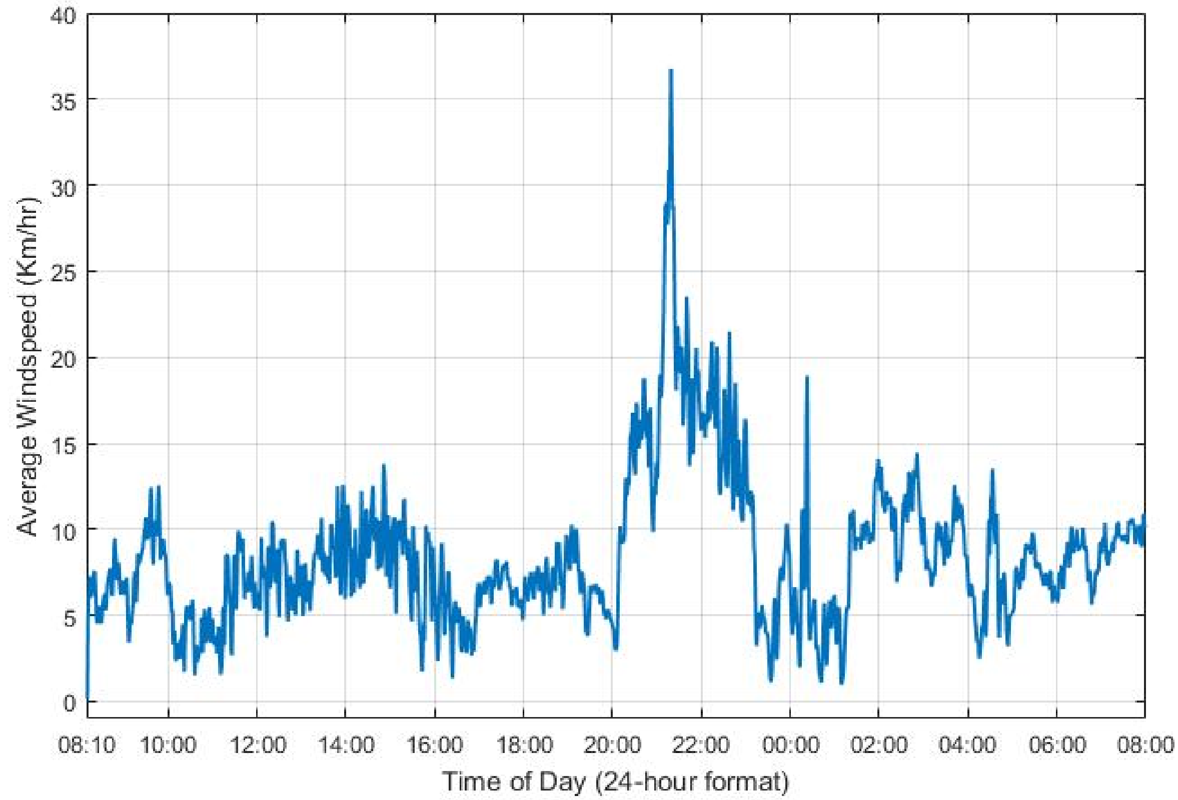
Monitored Humidity (July 27 – 28, 2017) at Noise Monitor Location 6



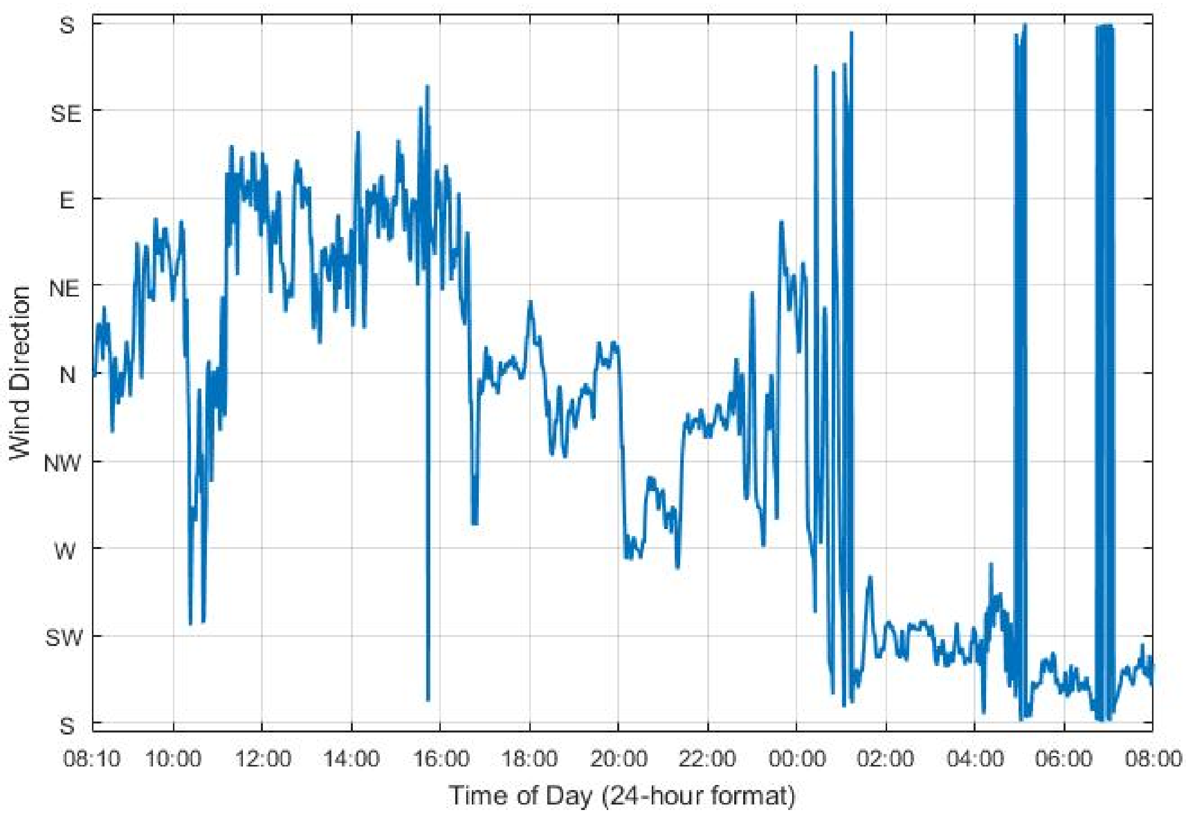
Monitored Barometric Pressure (July 27 – 28, 2017) at Noise Monitor Location 6



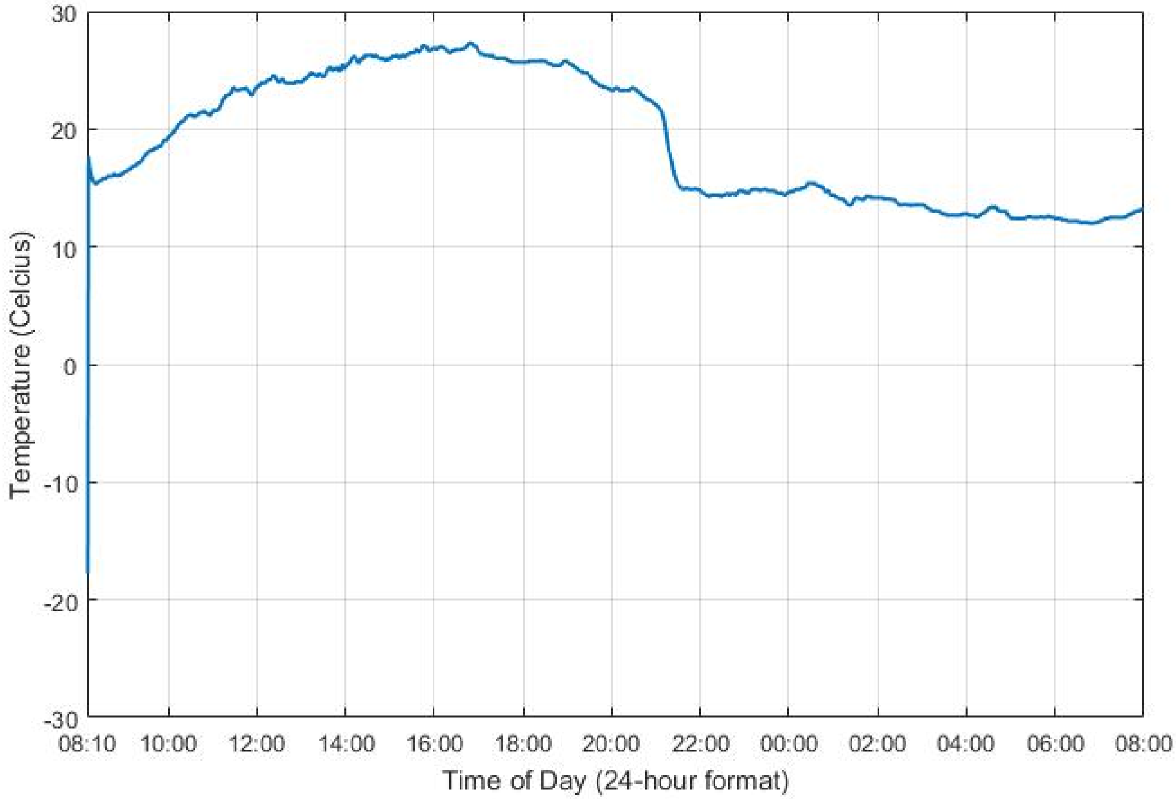
Monitored Rain Rate (July 27 – 28, 2017) at Noise Monitor Location 6



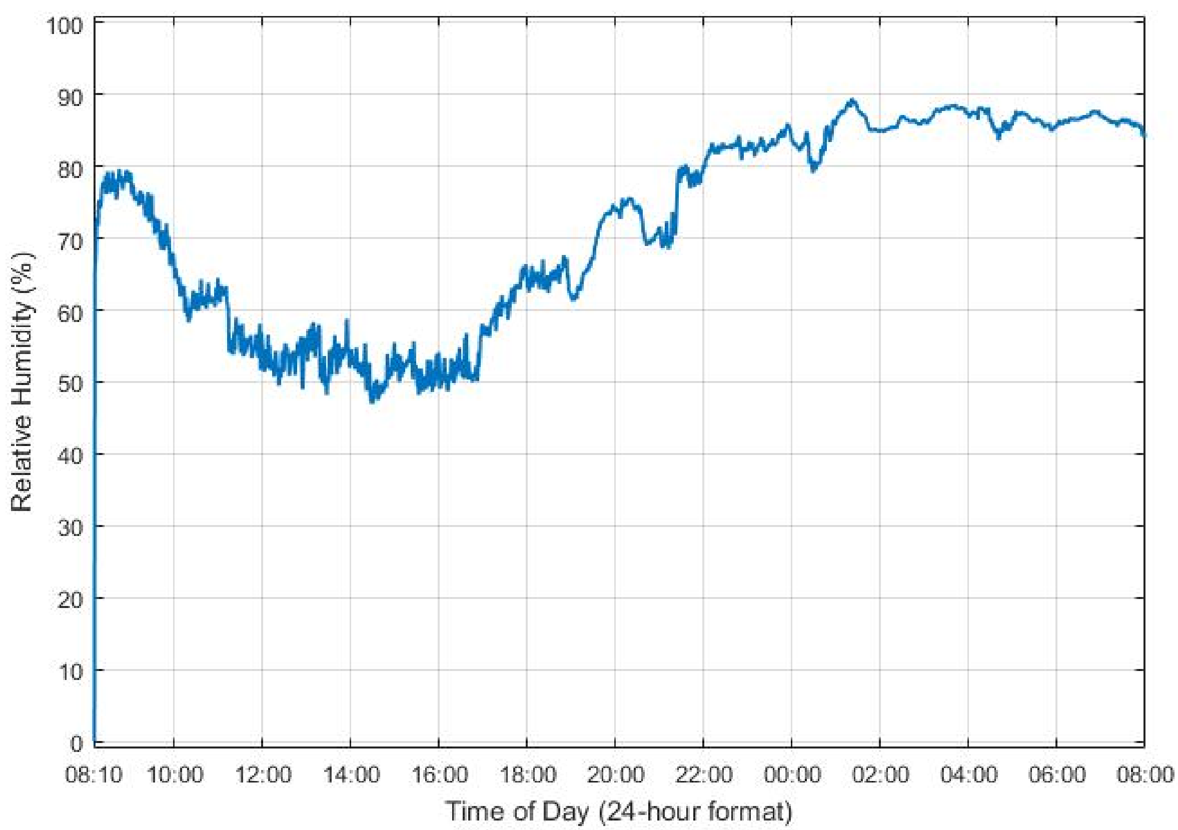
Monitored Wind Speed (July 27 – 28, 2017) at Noise Monitor Location 10



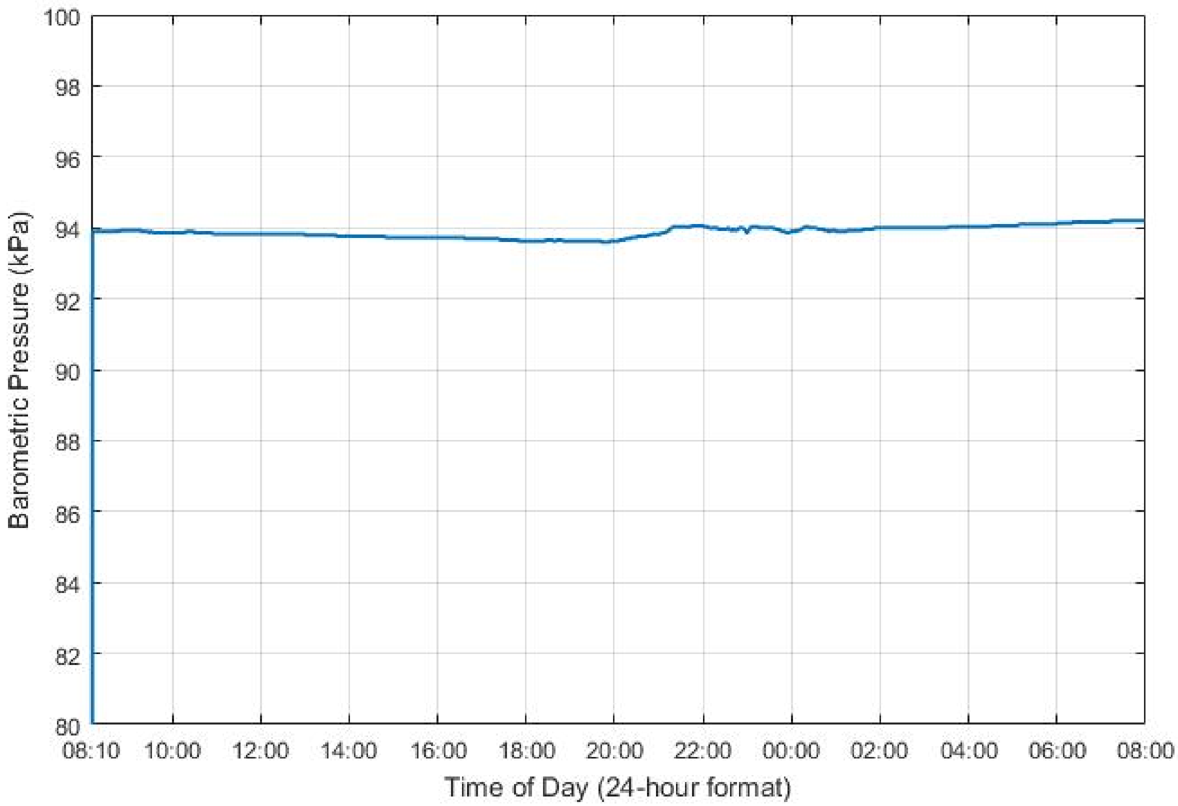
Monitored Wind Direction (July 27 – 28, 2017) at Noise Monitor Location 10



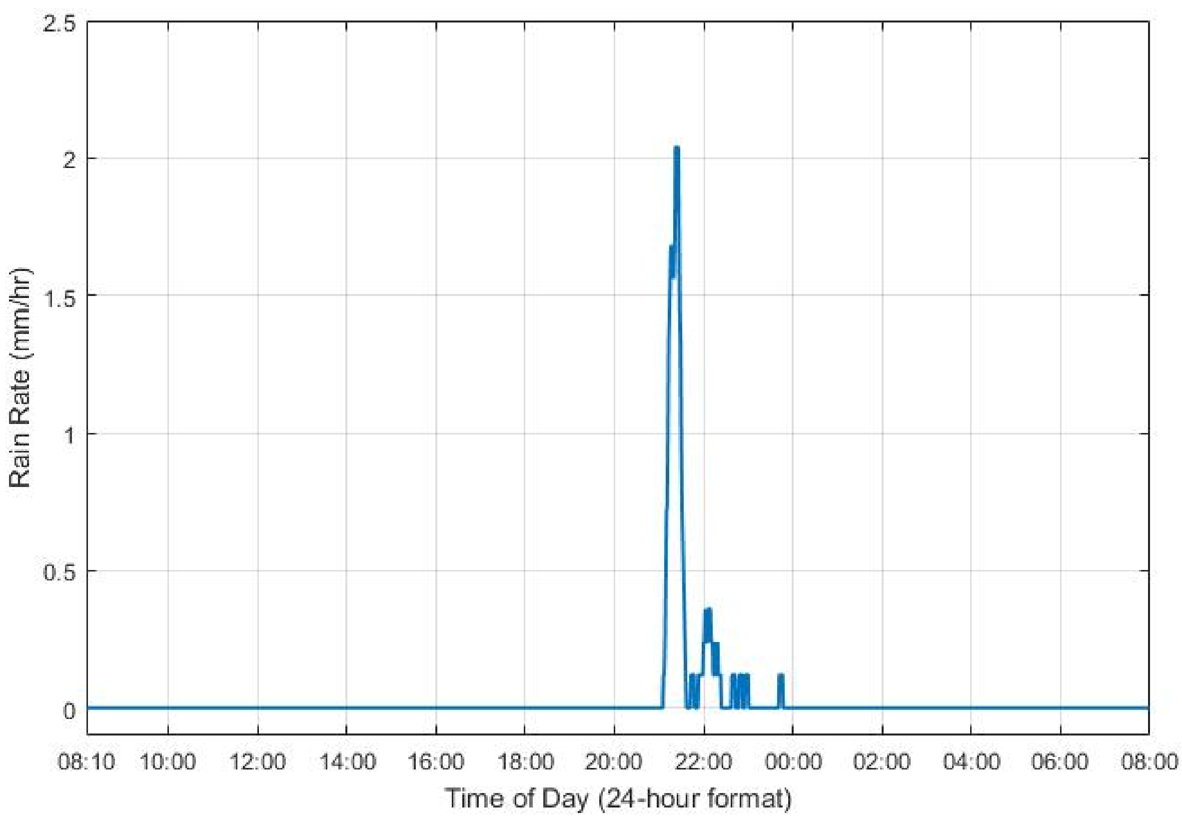
Monitored Temperature (July 27 – 28, 2017) at Noise Monitor Location 10



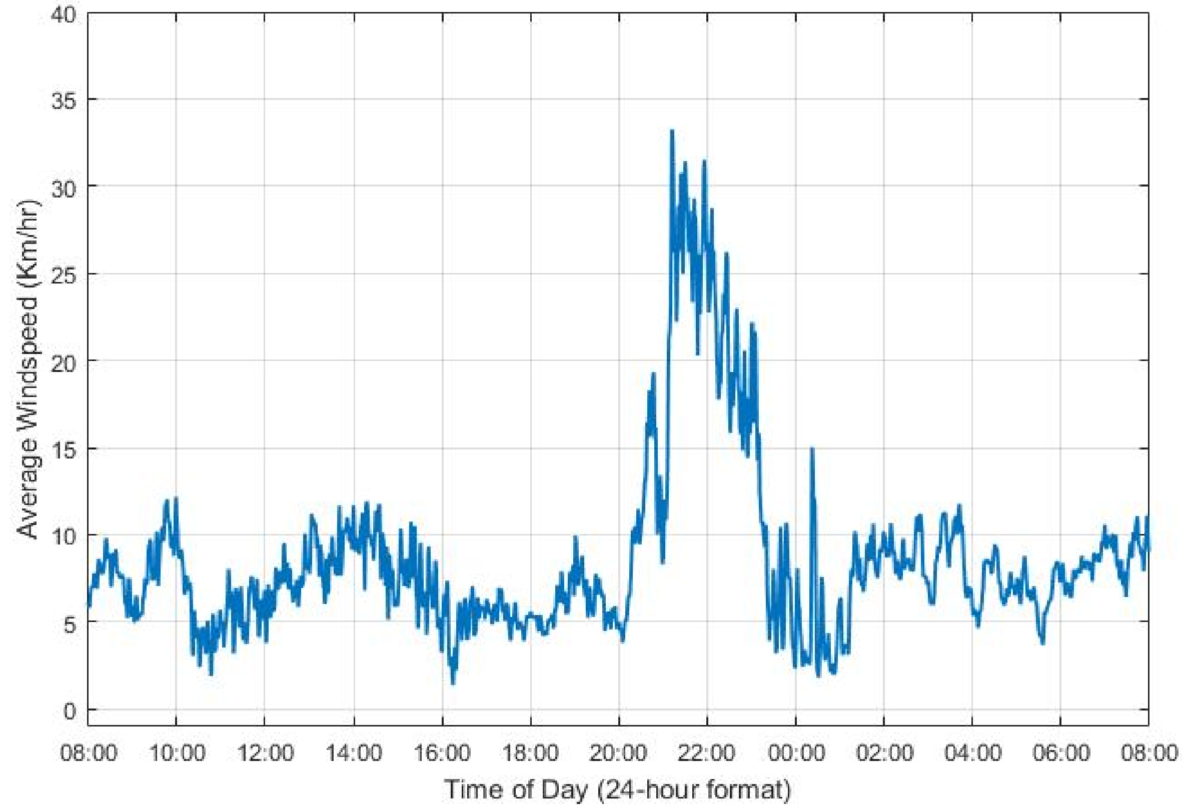
Monitored Humidity (July 27 – 28, 2017) at Noise Monitor Location 10



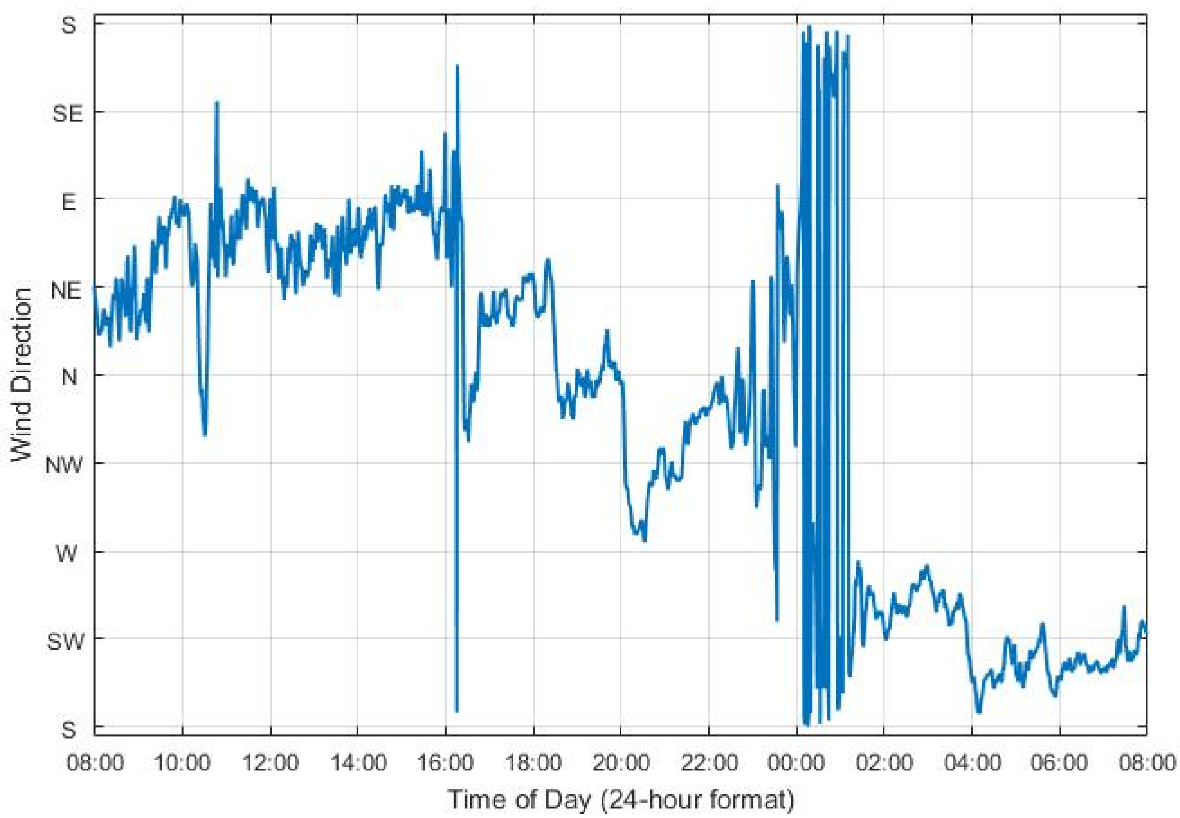
Monitored Barometric Pressure (July 27 – 28, 2017) at Noise Monitor Location 10



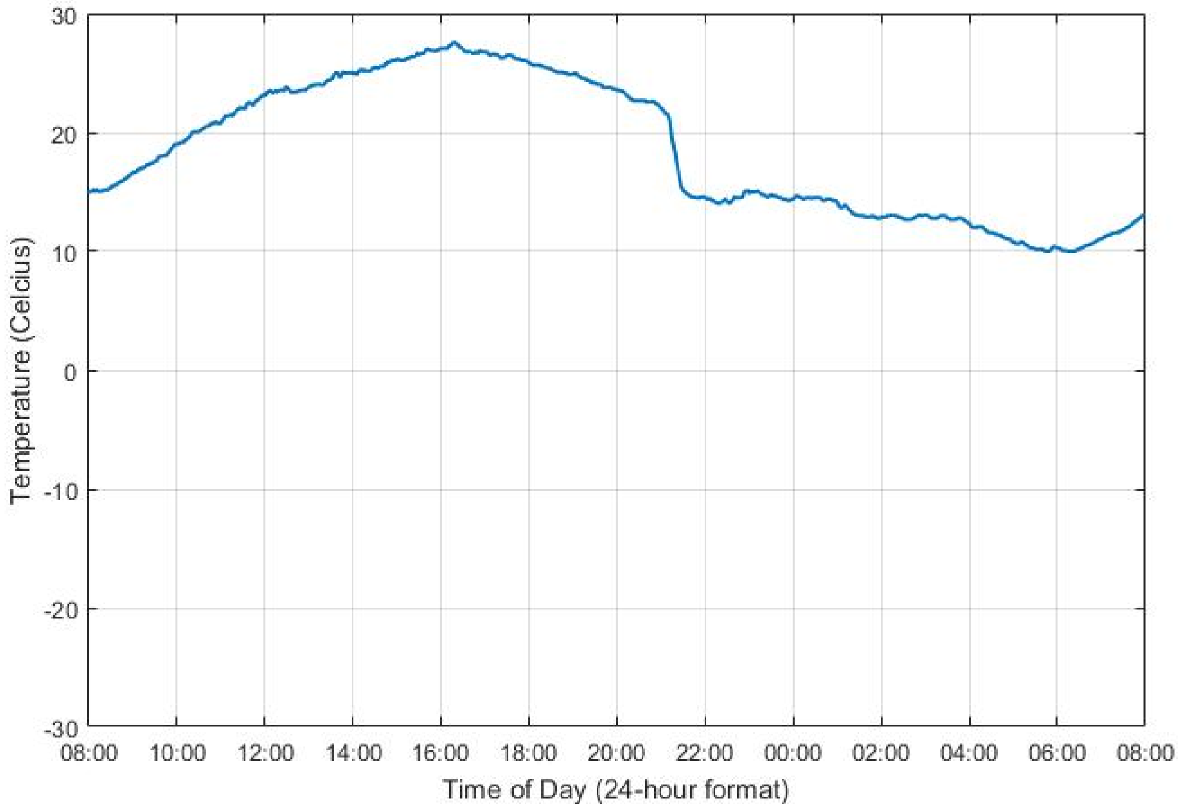
Night-time Monitored Rain Rate (July 27 – 28, 2017) at Noise Monitor Location 10



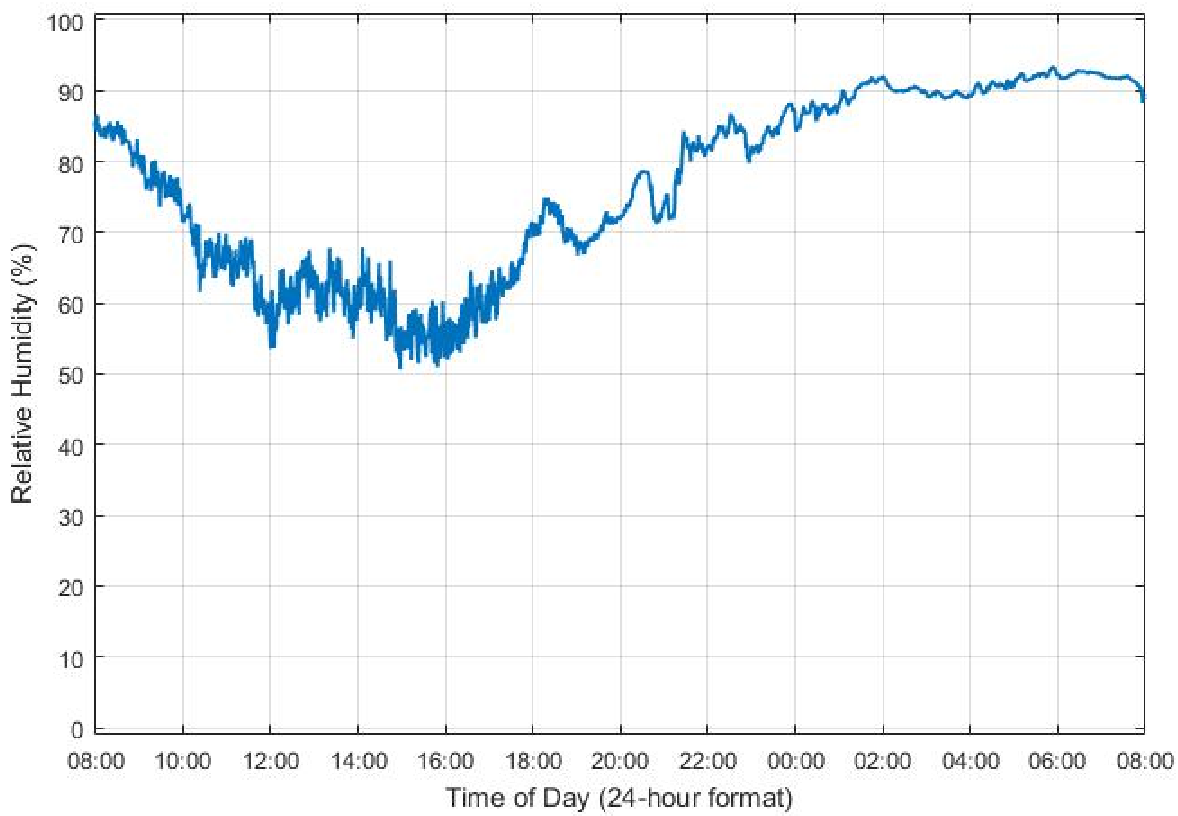
Monitored Wind Speed (July 27 – 28, 2017) at Noise Monitor Location 12



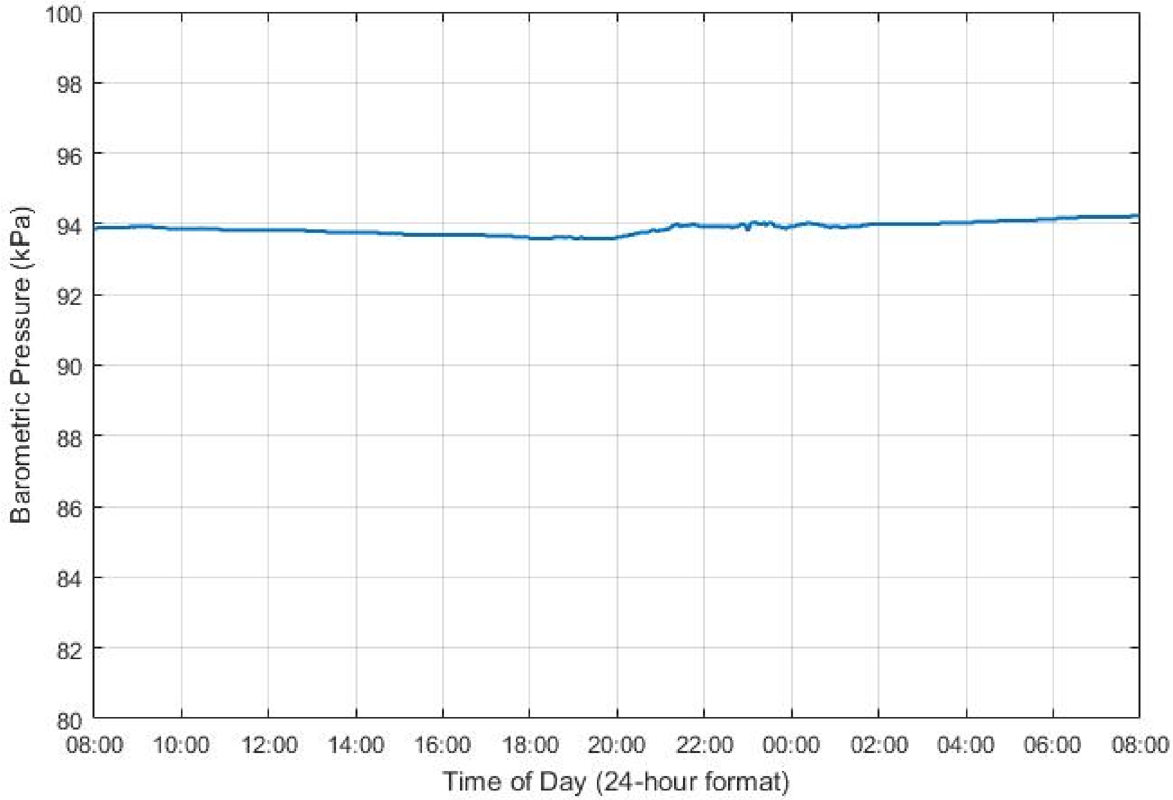
Monitored Wind Direction (July 27 – 28, 2017) at Noise Monitor Location 12



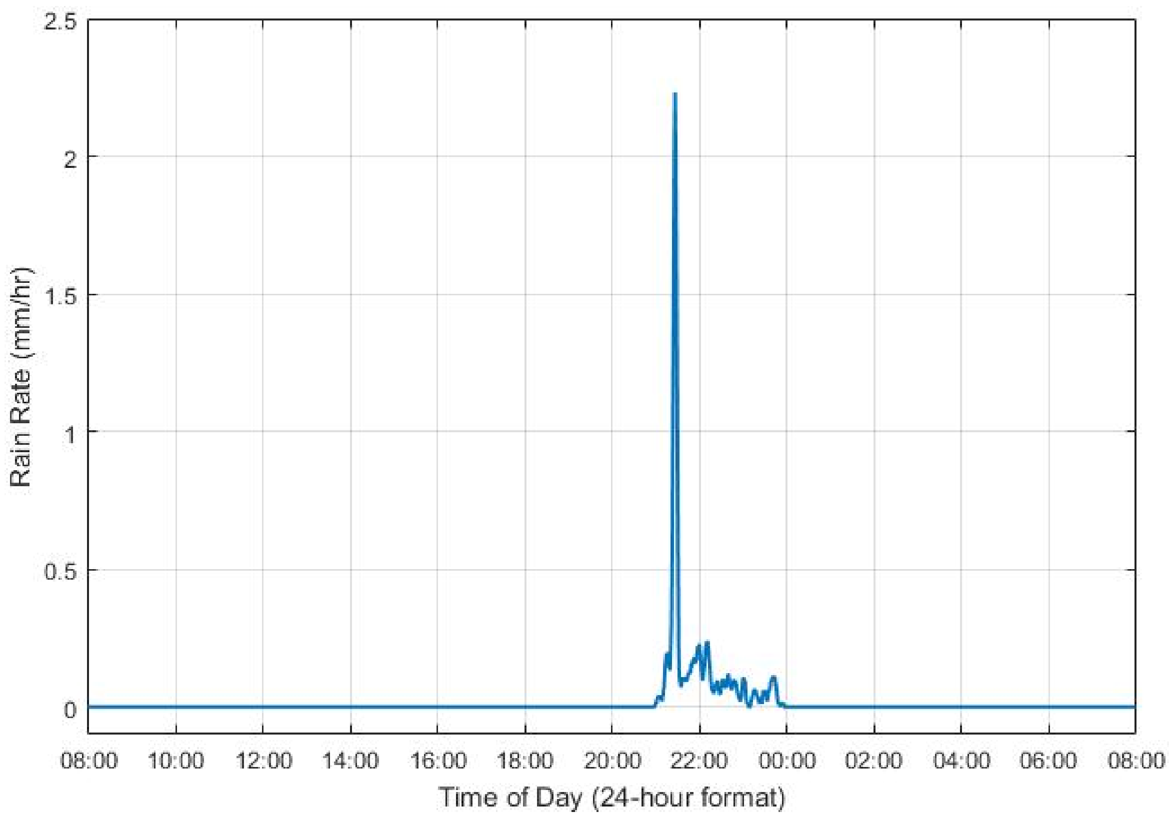
Monitored Temperature (July 27 – 28, 2017) at Noise Monitor Location 12



Monitored Humidity (July 27 – 28, 2017) at Noise Monitor Location 12

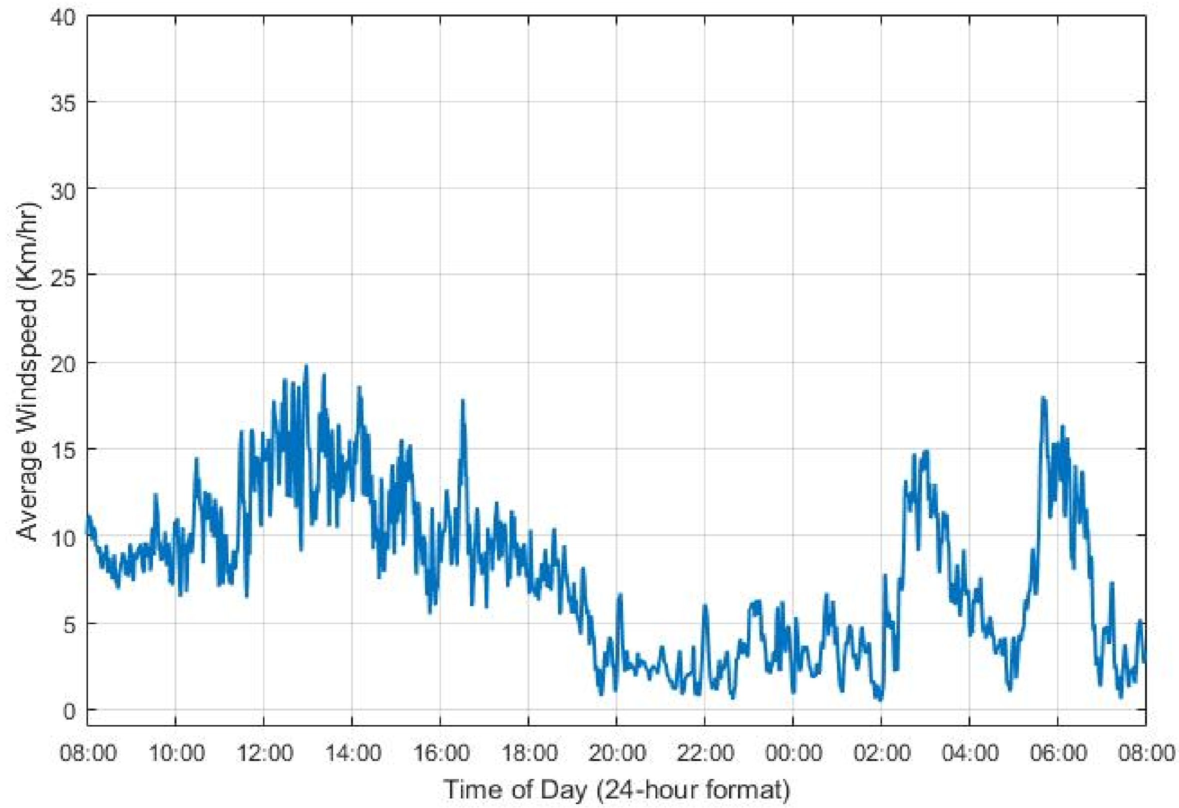


Monitored Barometric Pressure (July 27 – 28, 2017) at Noise Monitor Location 12

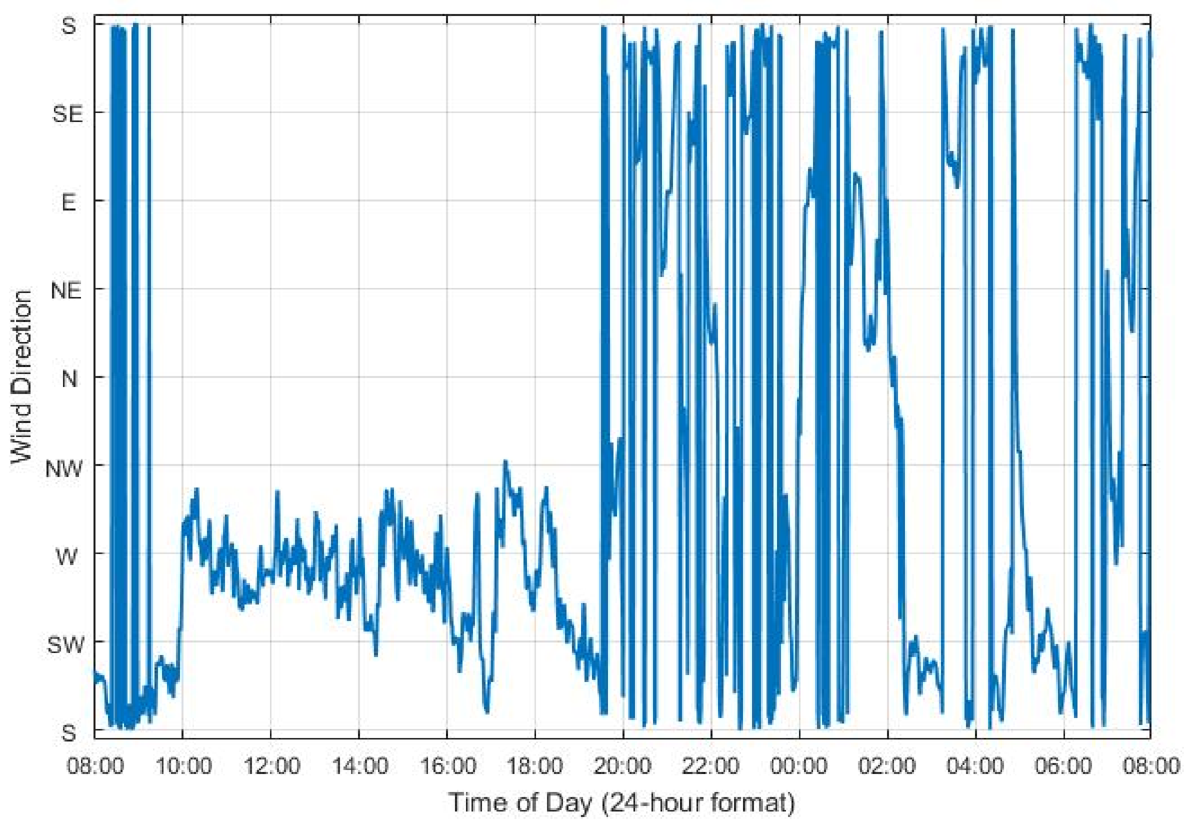


Monitored Rain Rate (July 27 – 28, 2017) at Noise Monitor Location 12

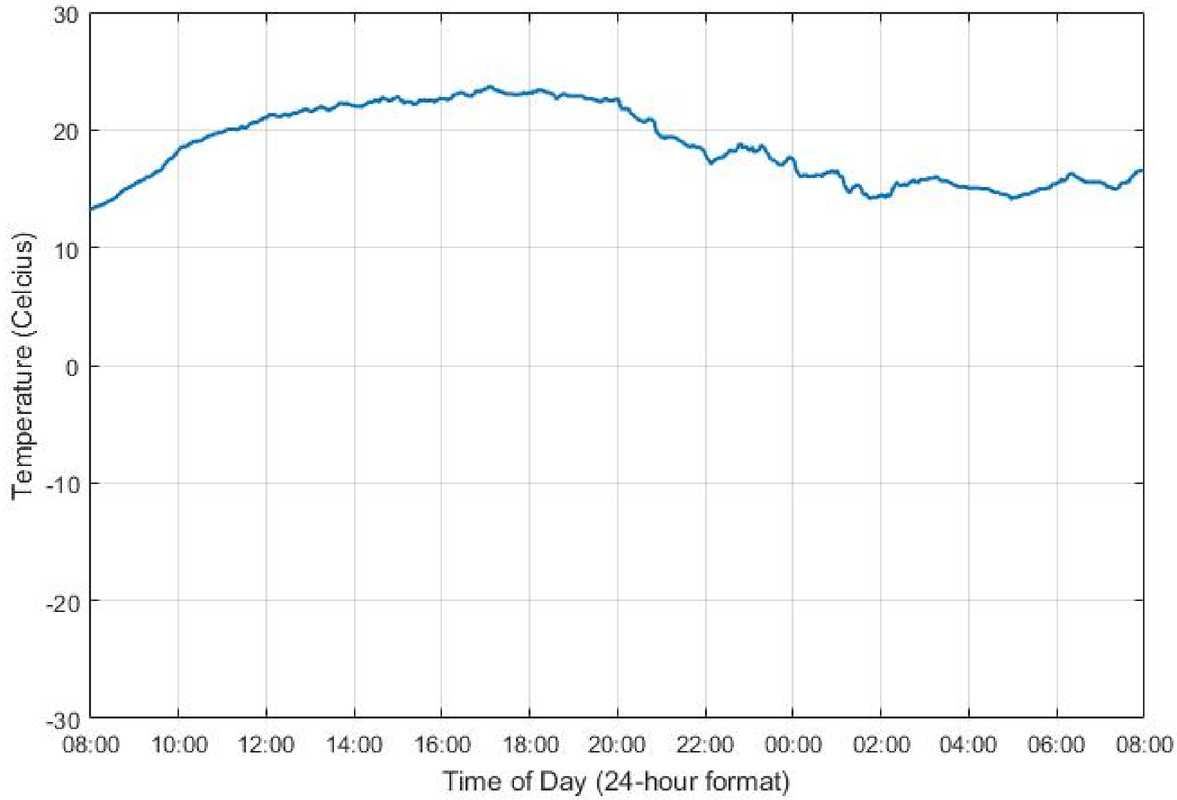
July 28 – 29, 2017 Weather Data



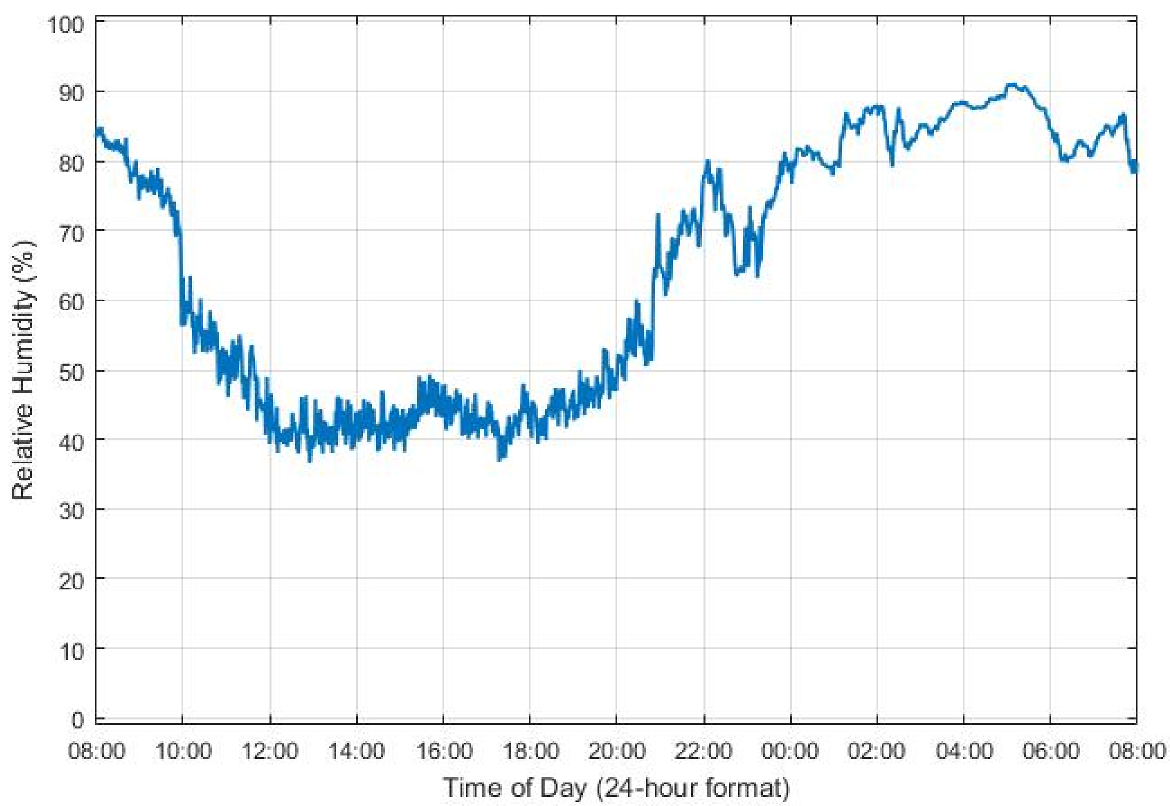
Monitored Wind Speed (July 28 – 29, 2017) at Noise Monitor Location 6



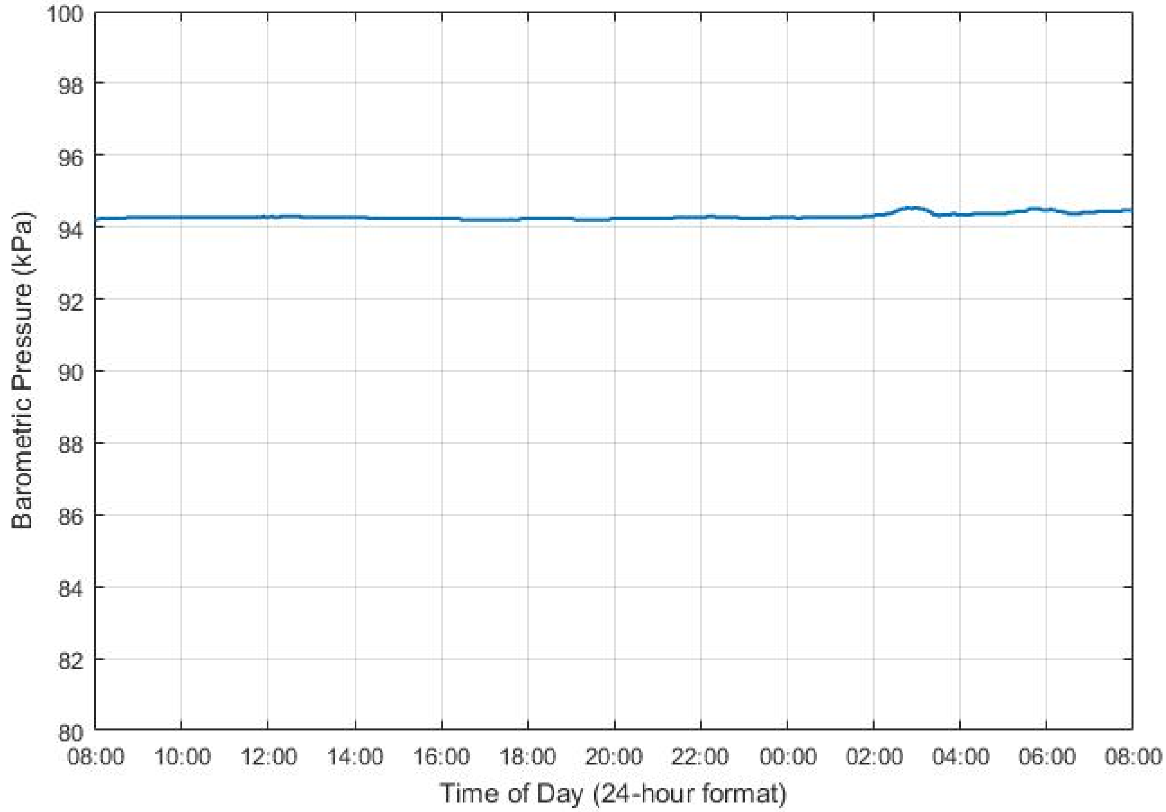
Monitored Wind Direction (July 28 – 29, 2017) at Noise Monitor Location 6



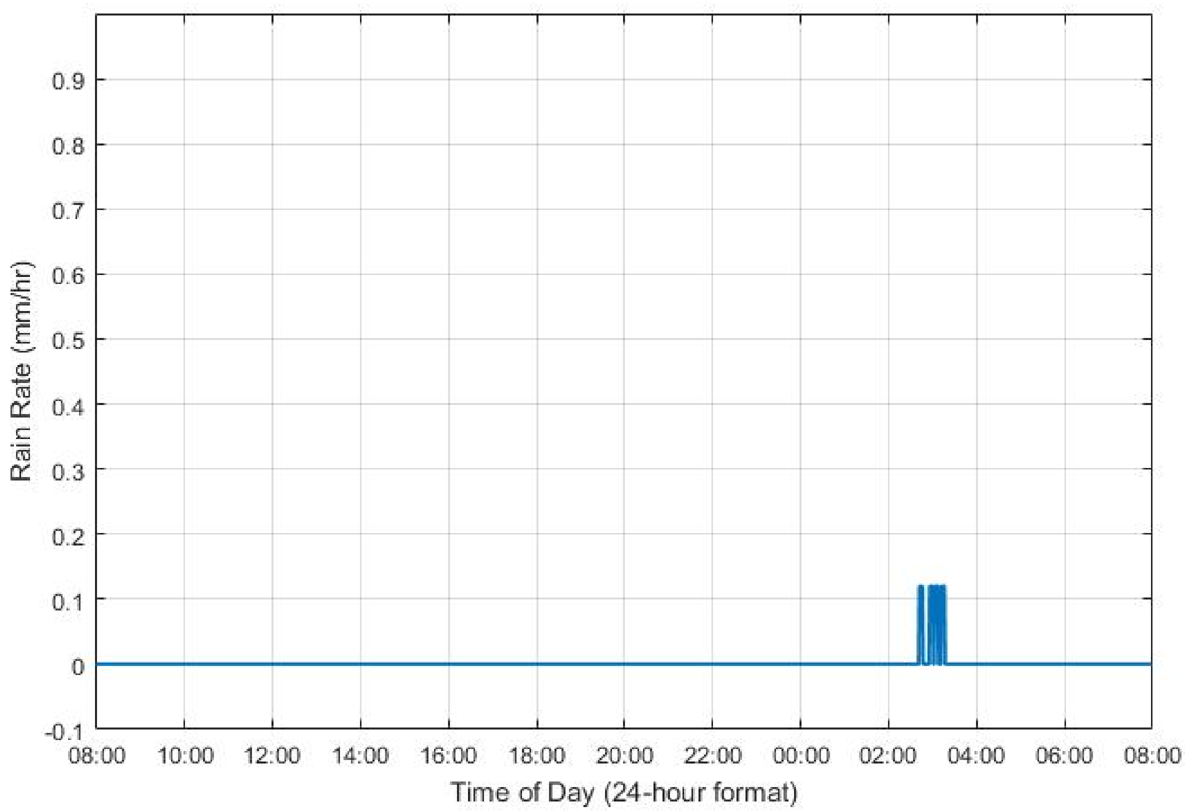
Monitored Temperature (July 28 – 29, 2017) at Noise Monitor Location 6



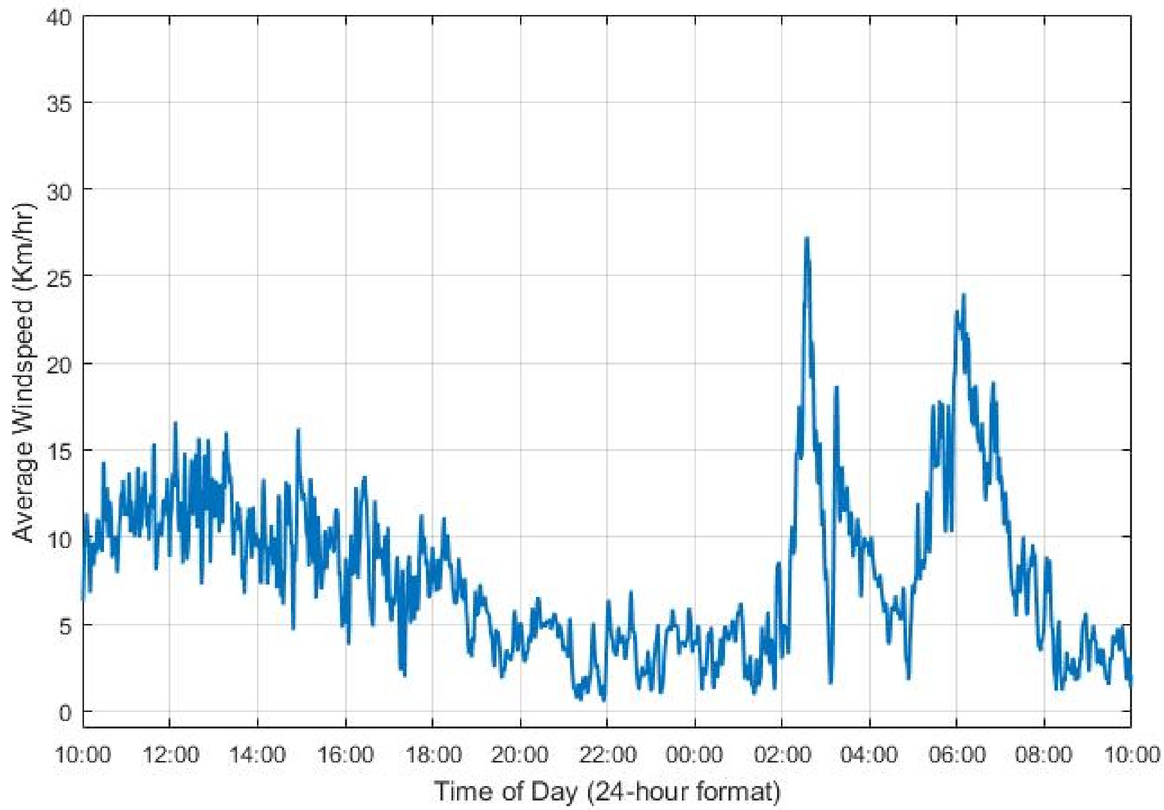
Monitored Humidity (July 28 – 29, 2017) at Noise Monitor Location 6



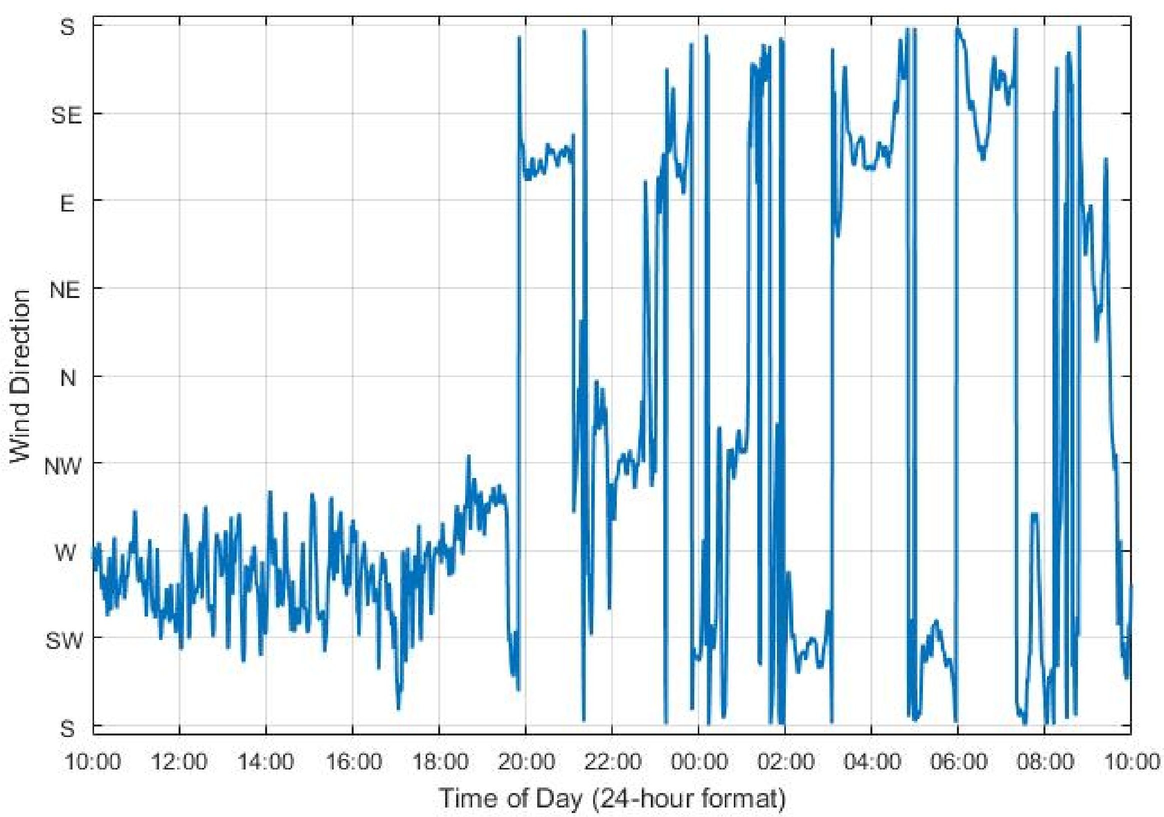
Monitored Barometric Pressure (July 28 – 29, 2017) at Noise Monitor Location 6



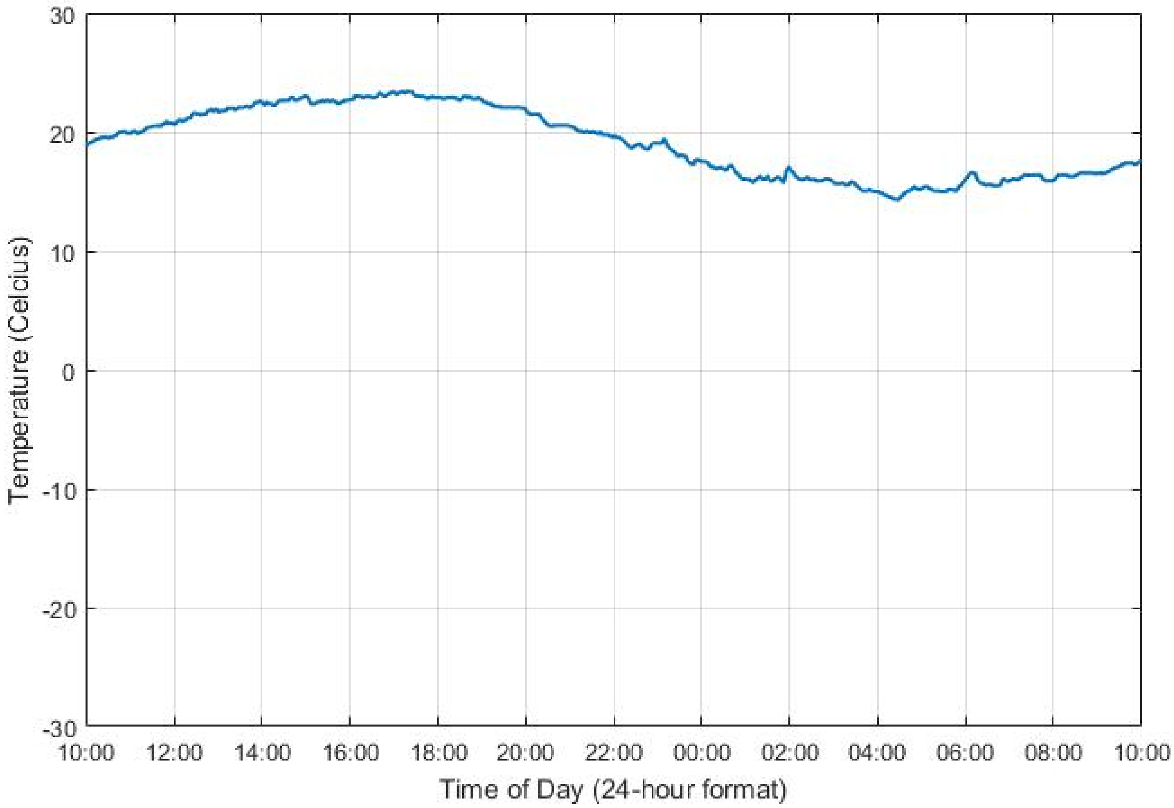
Monitored Rain Rate (July 28 – 29, 2017) at Noise Monitor Location 6



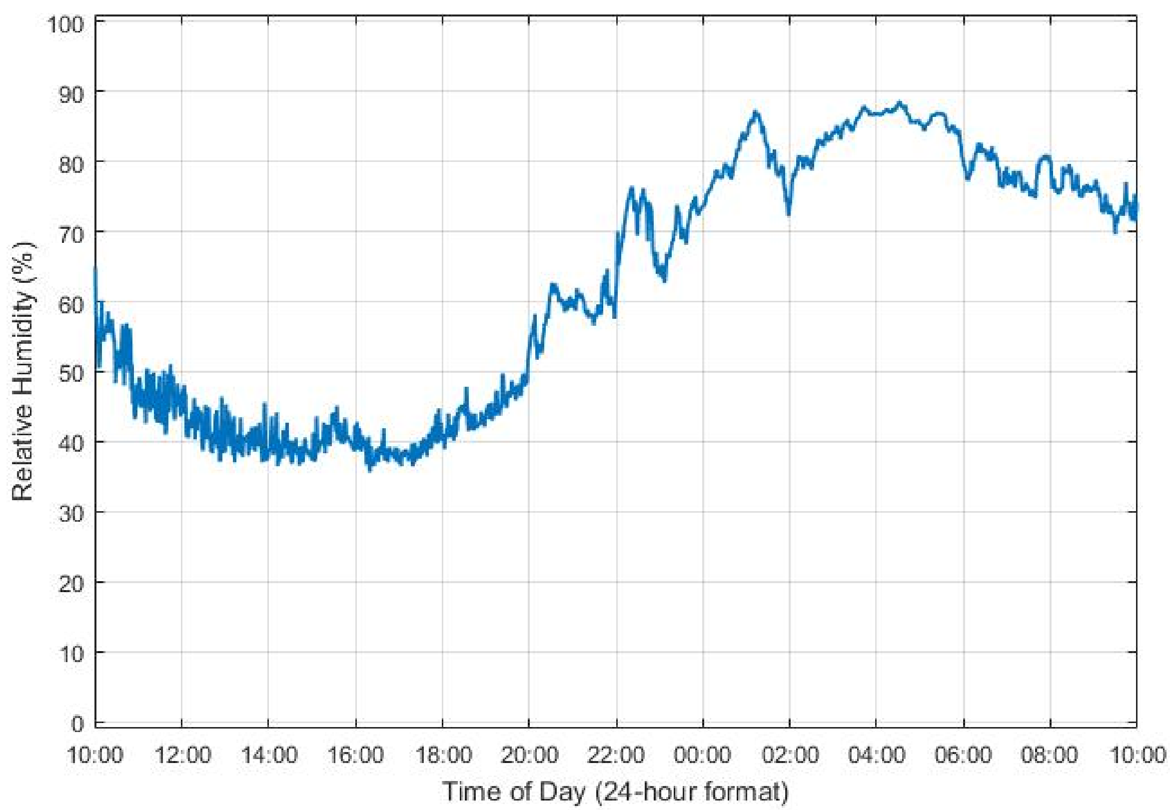
Monitored Wind Speed (July 28 – 29, 2017) at Noise Monitor Location 10



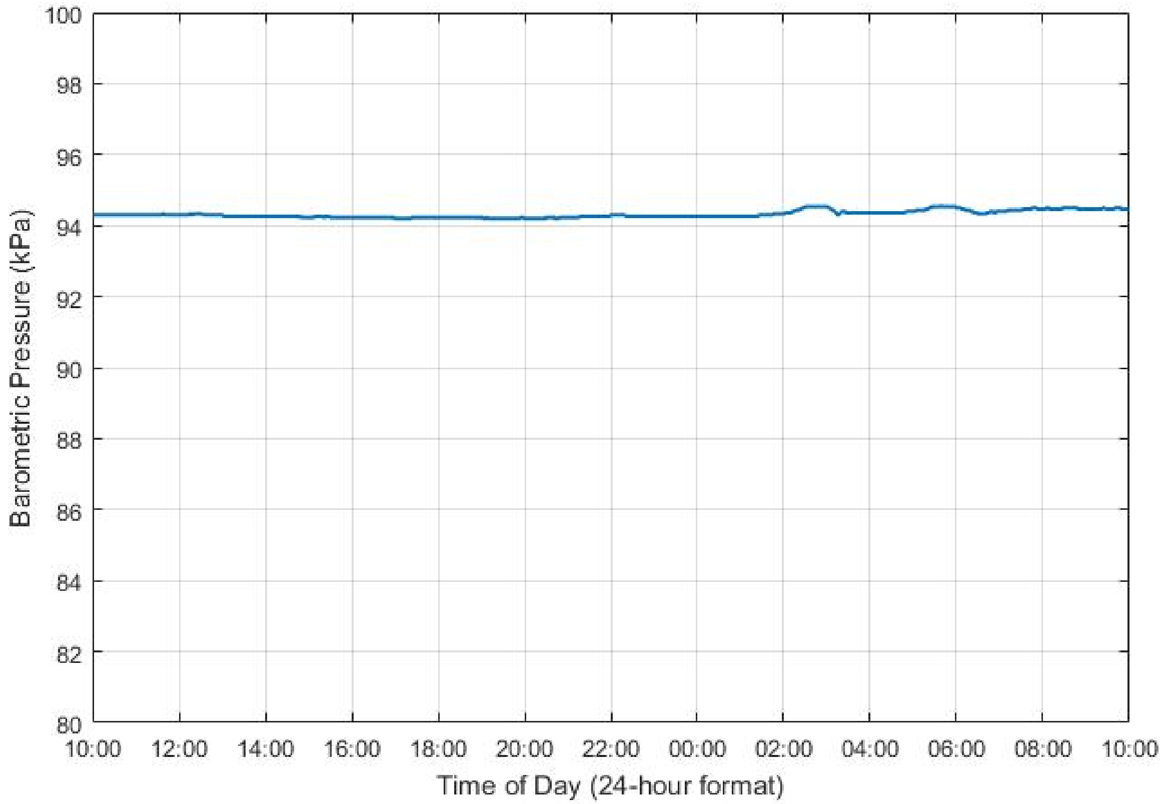
Monitored Wind Direction (July 28 – 29, 2017) at Noise Monitor Location 10



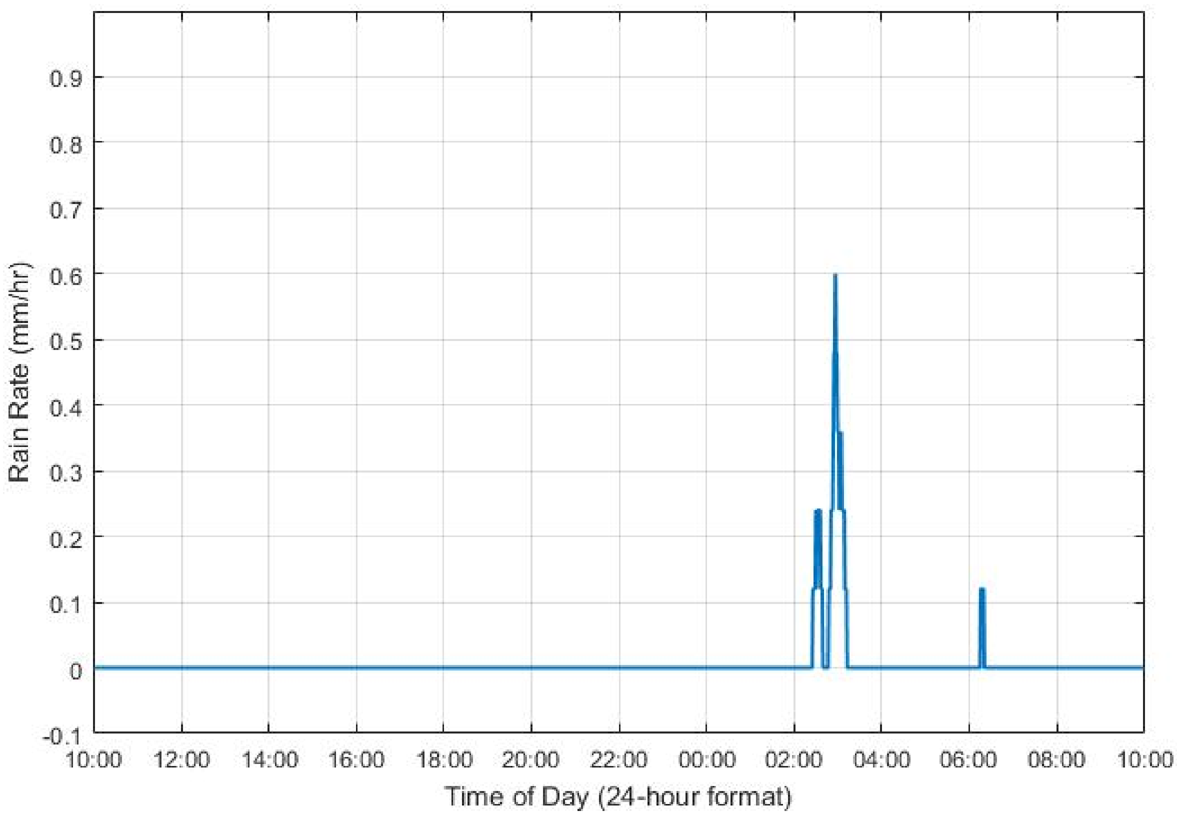
Monitored Temperature (July 28 – 29, 2017) at Noise Monitor Location 10



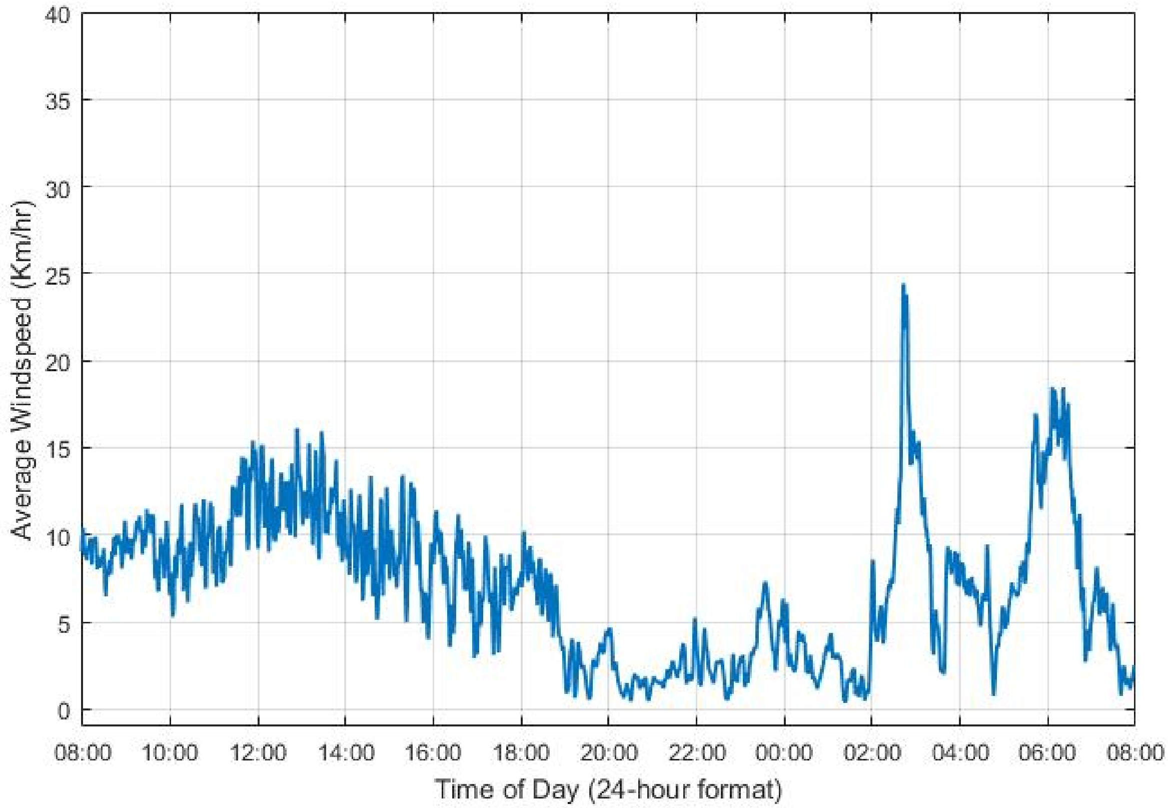
Monitored Humidity (July 28 – 29, 2017) at Noise Monitor Location 10



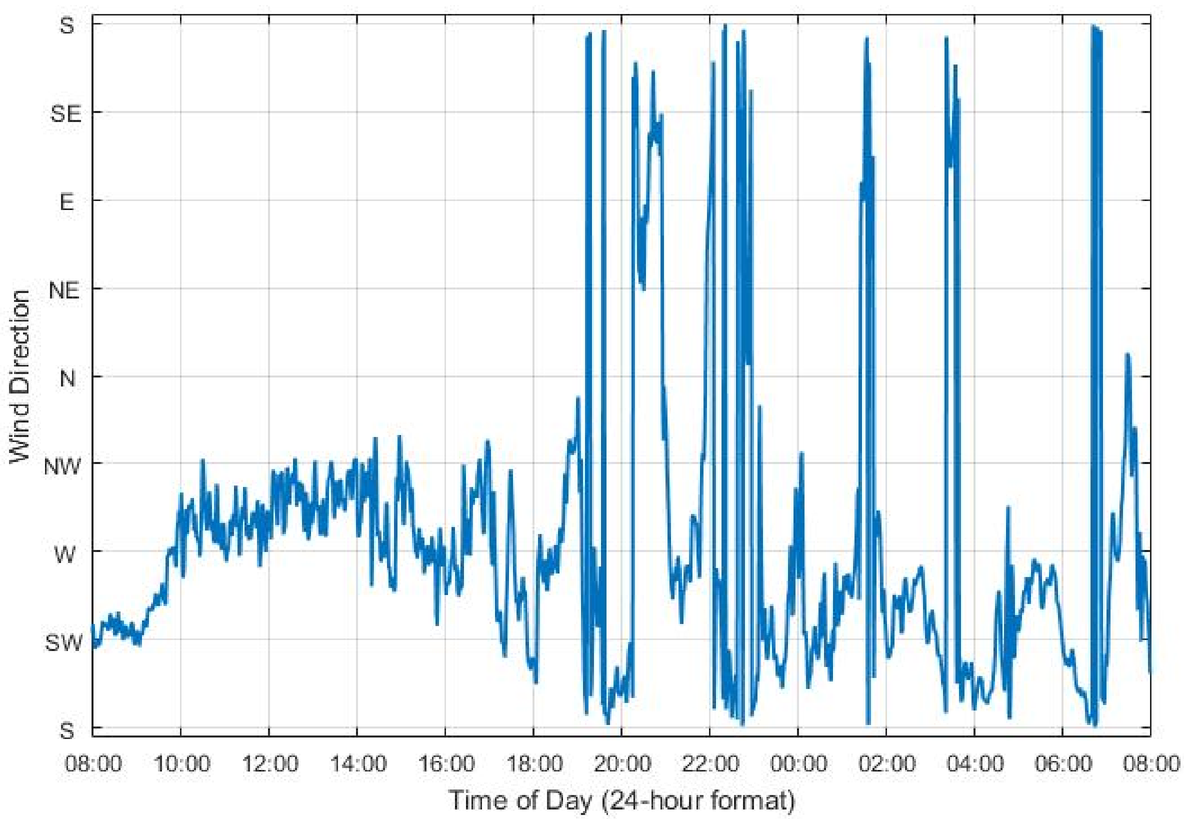
Monitored Barometric Pressure (July 28 – 29, 2017) at Noise Monitor Location 10



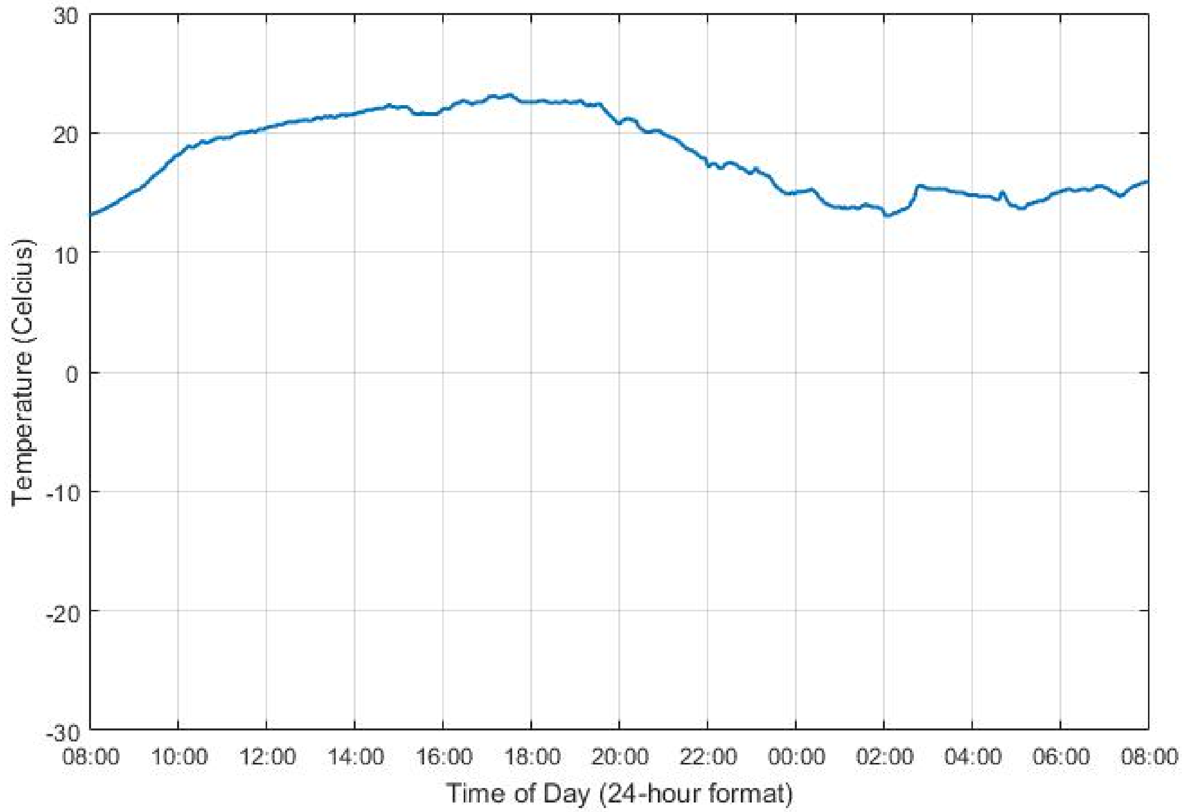
Night-time Monitored Rain Rate (July 28 – 29, 2017) at Noise Monitor Location 10



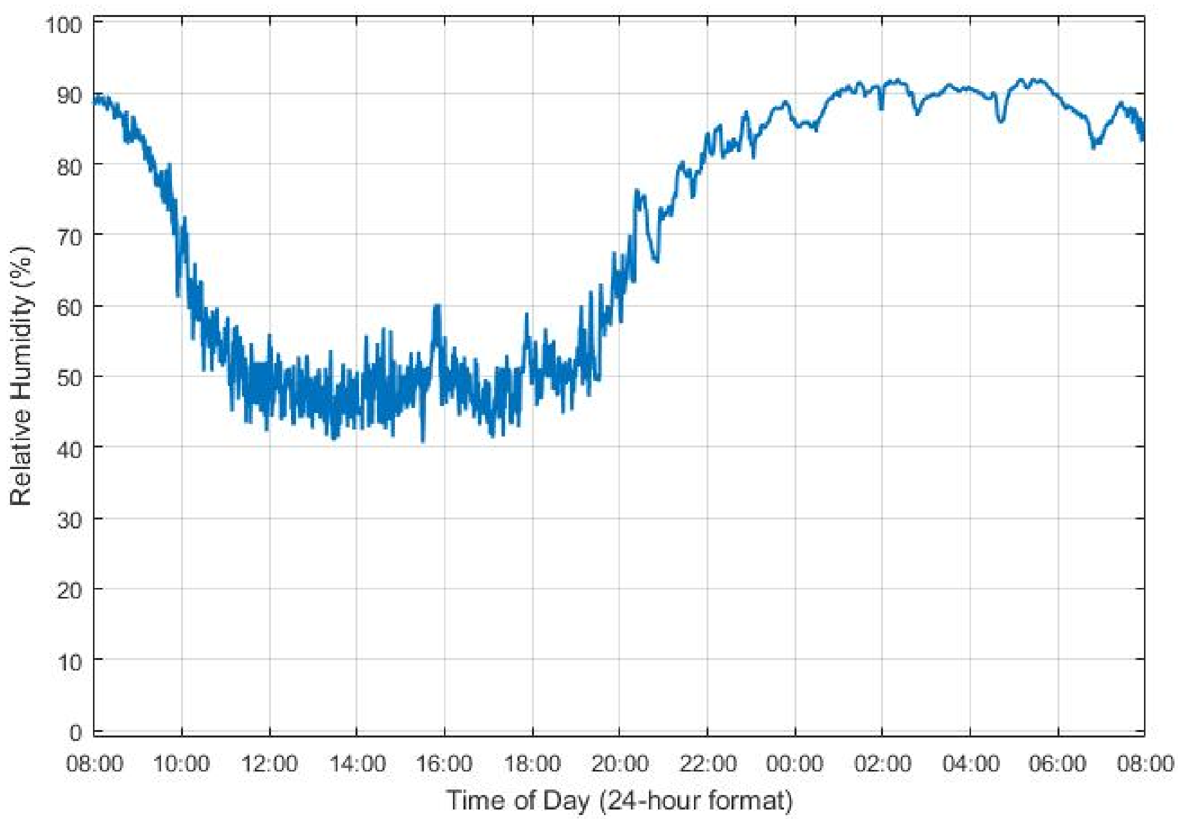
Monitored Wind Speed (July 28 – 29, 2017) at Noise Monitor Location 12



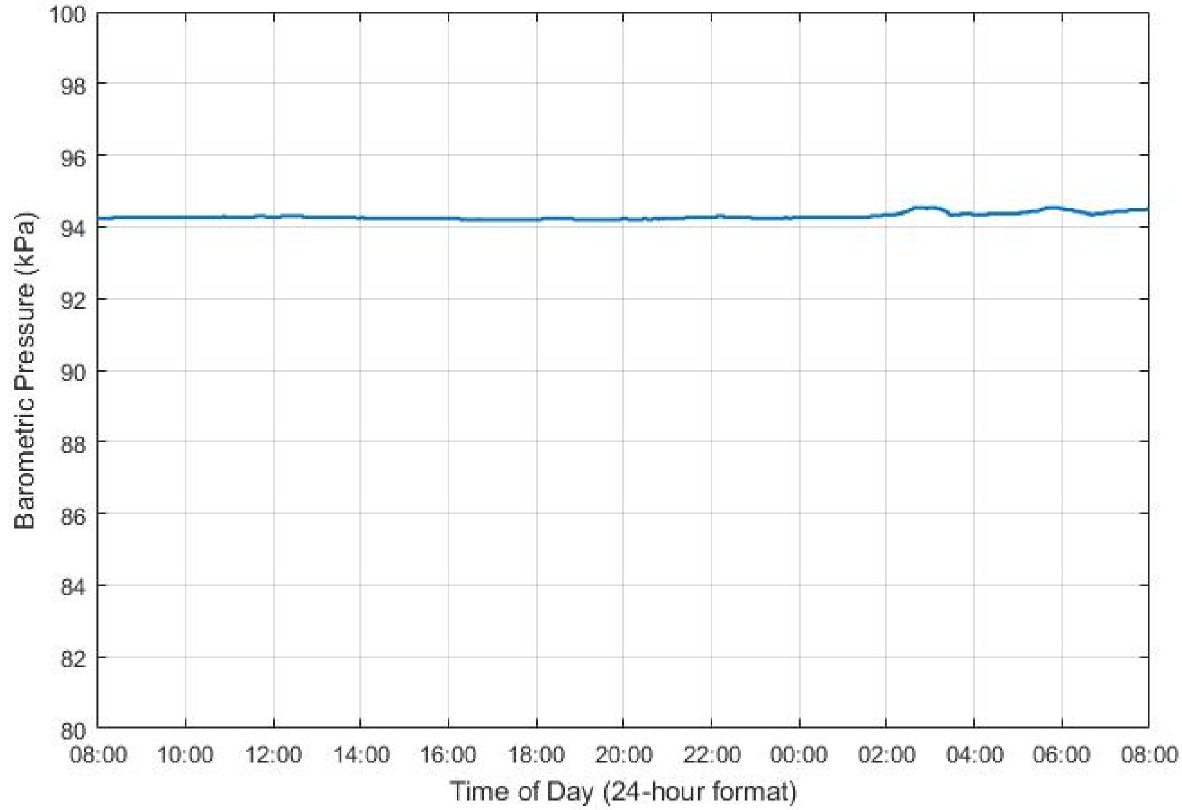
Monitored Wind Direction (July 28 – 29, 2017) at Noise Monitor Location 12



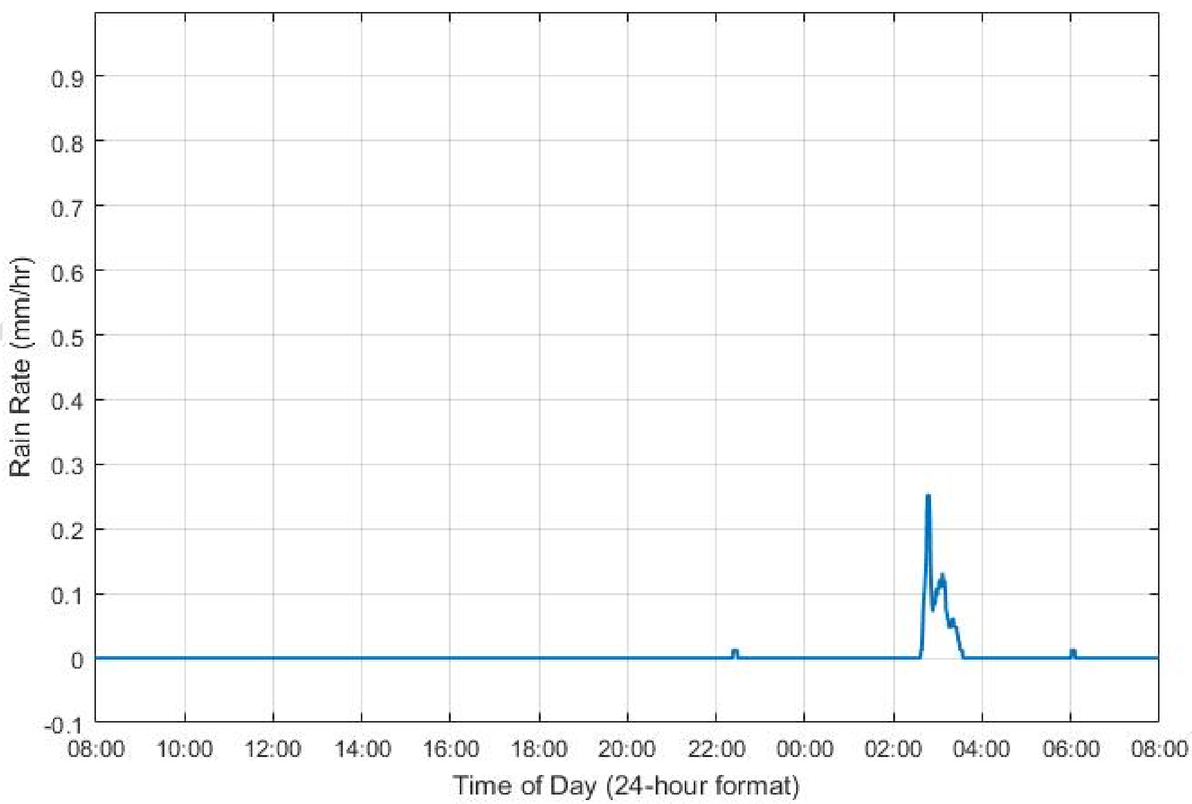
Monitored Temperature (July 28 – 29, 2017) at Noise Monitor Location 12



Monitored Humidity (July 28 – 29, 2017) at Noise Monitor Location 12

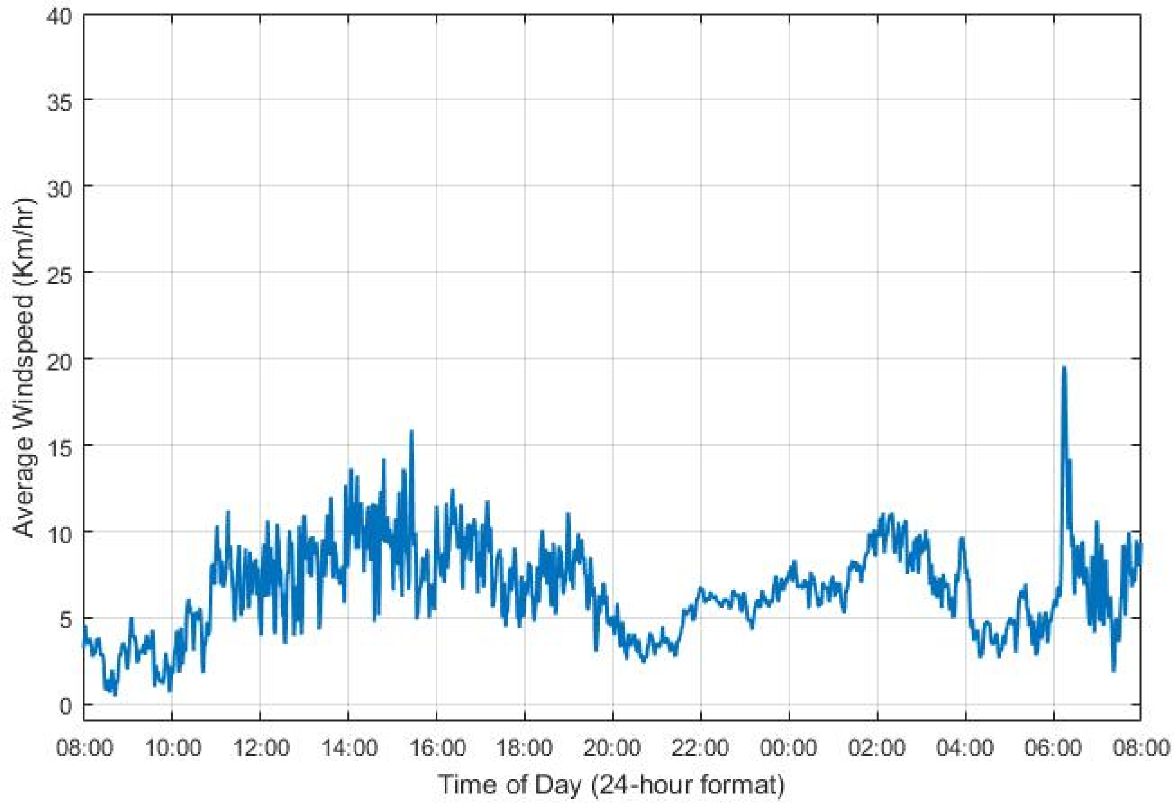


Monitored Barometric Pressure (July 28 – 29, 2017) at Noise Monitor Location 12

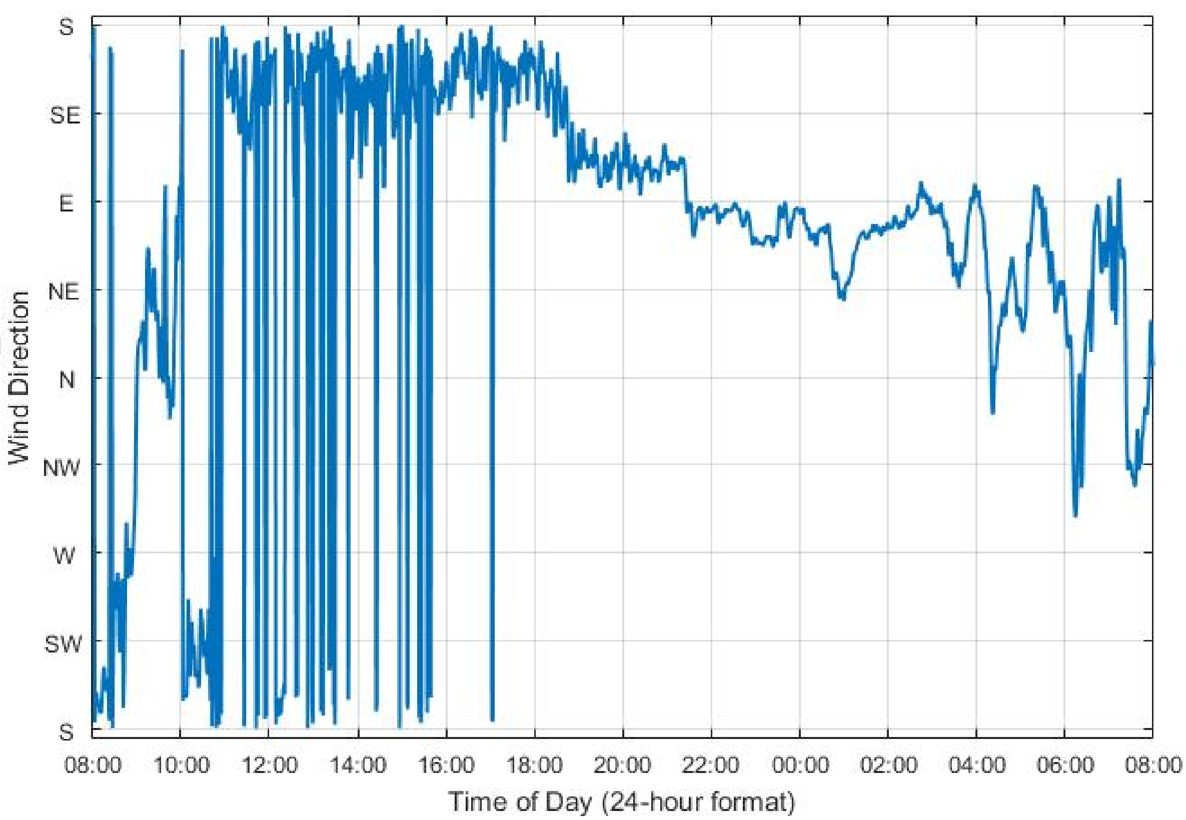


Night-time Monitored Rain Rate (July 28 – 29, 2017) at Noise Monitor Location 12

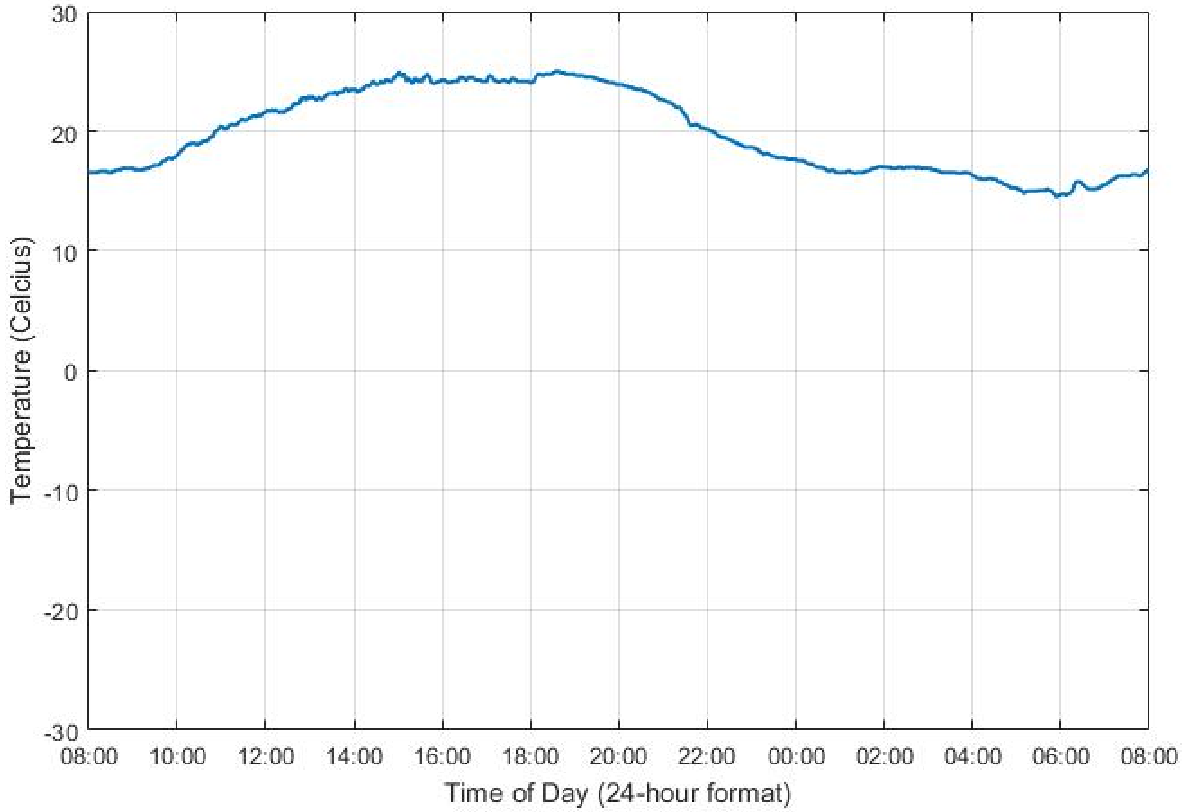
July 29 - 30, 2017 Weather Data



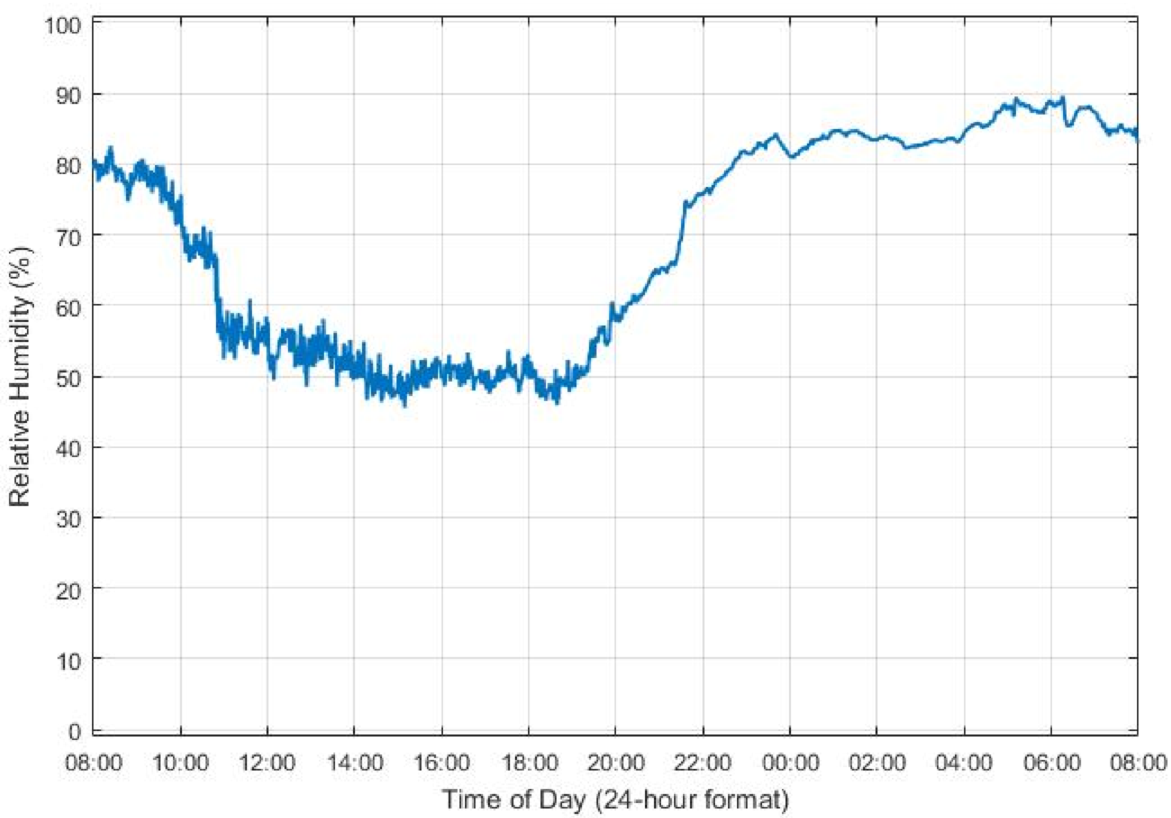
Monitored Wind Speed (July 29 – 30, 2017) at Noise Monitor Location 6



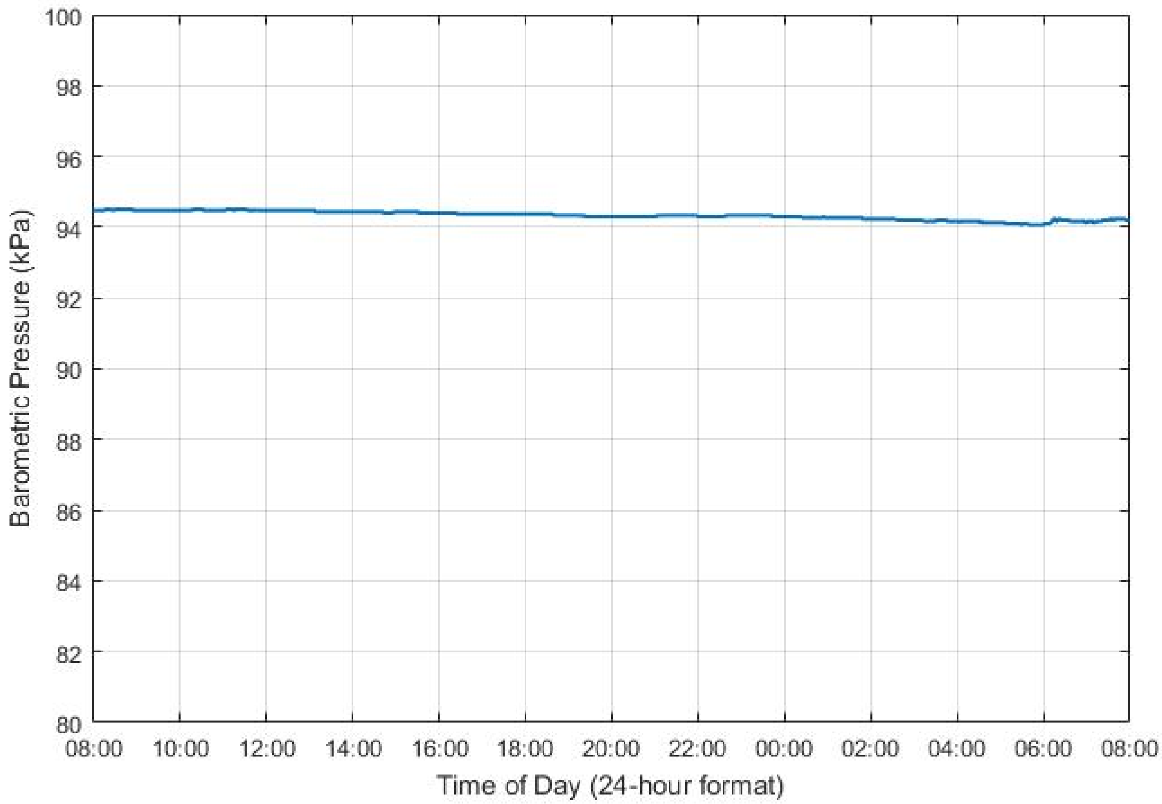
Monitored Wind Direction (July 29 – 30, 2017) at Noise Monitor Location 6



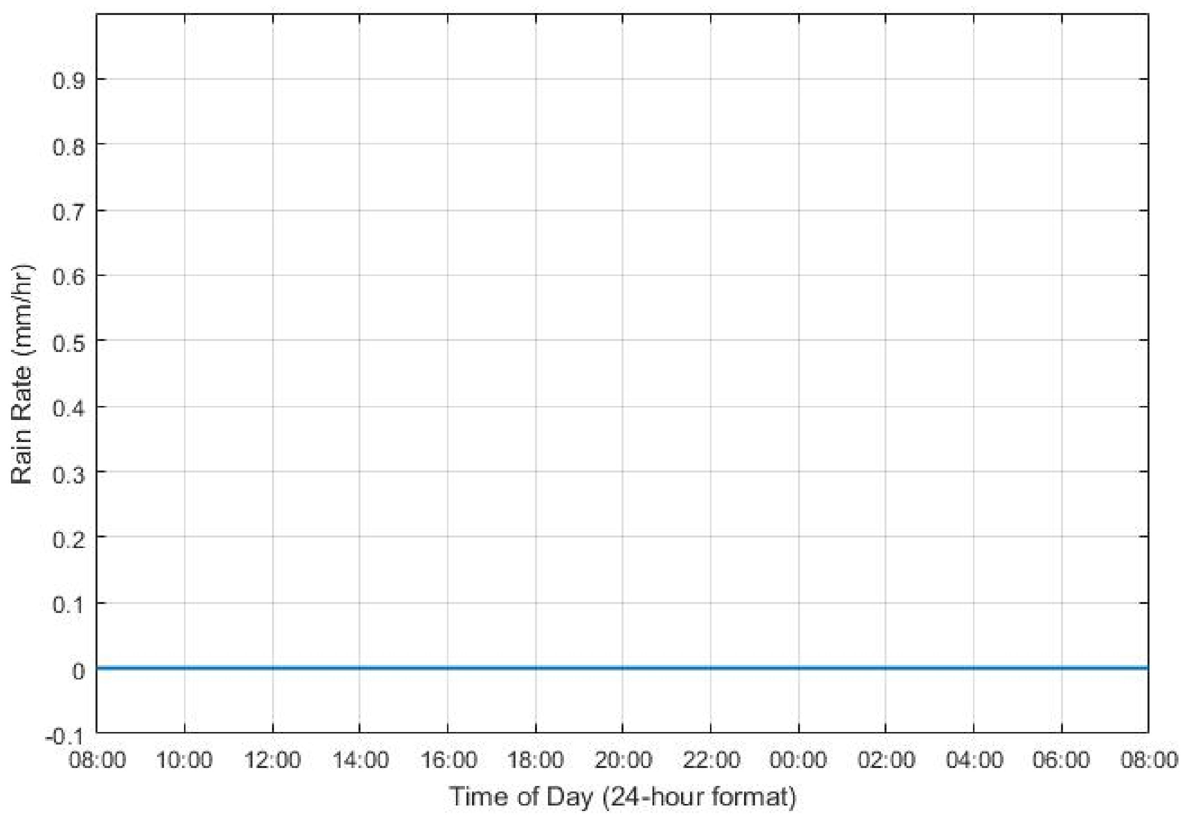
Monitored Temperature (July 29 – 30, 2017) at Noise Monitor Location 6



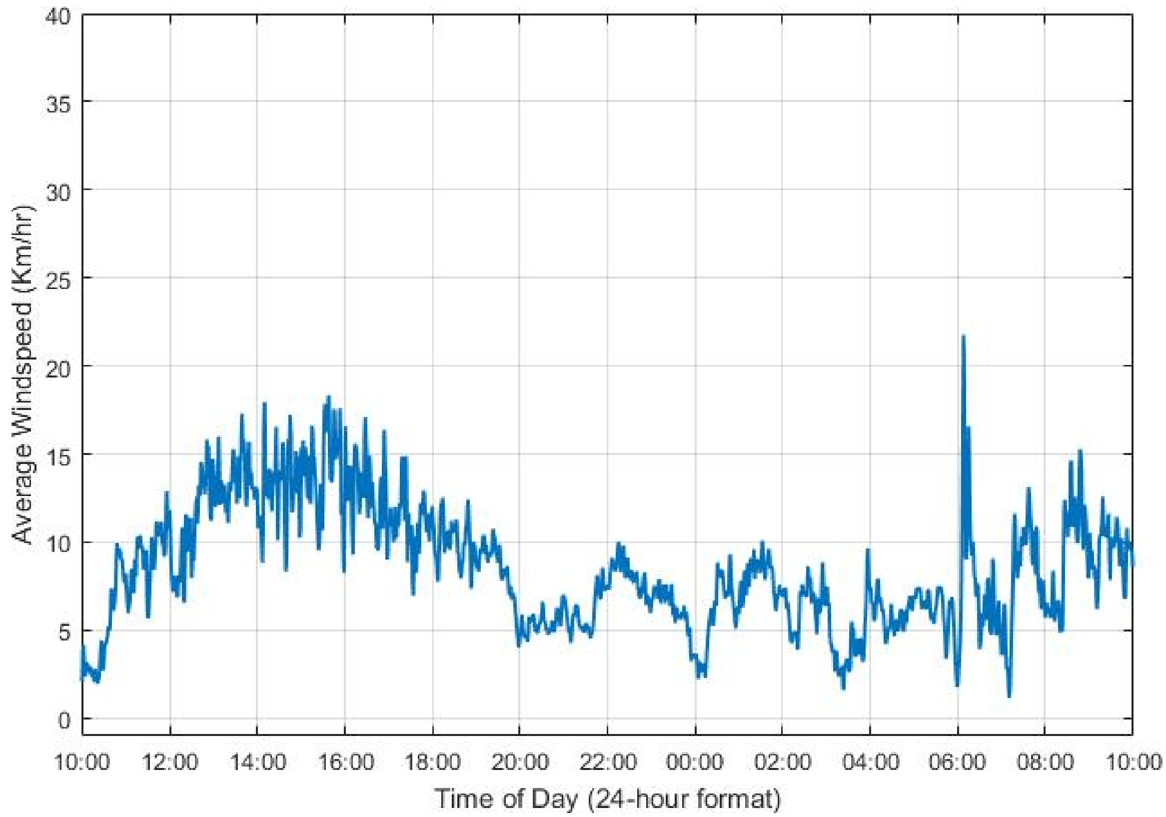
Monitored Humidity (July 29 – 30, 2017) at Noise Monitor Location 6



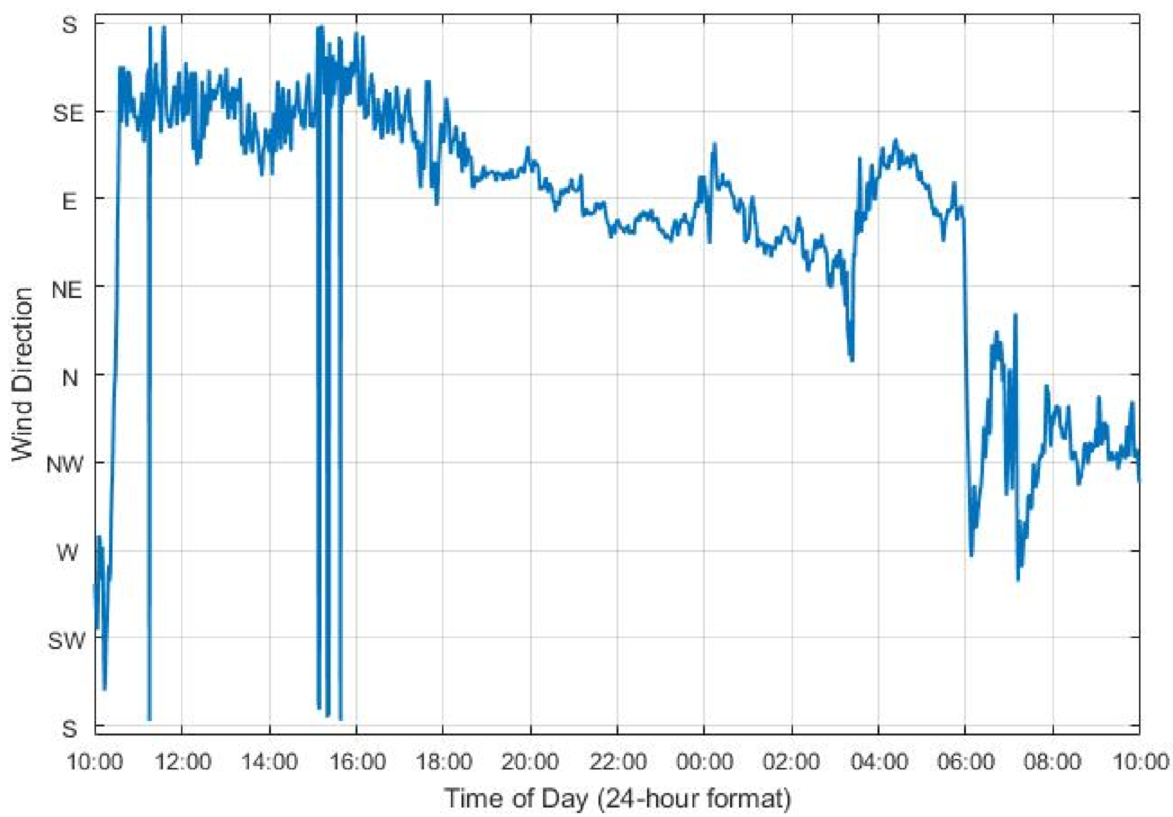
Monitored Barometric Pressure (July 29 – 30, 2017) at Noise Monitor Location 6



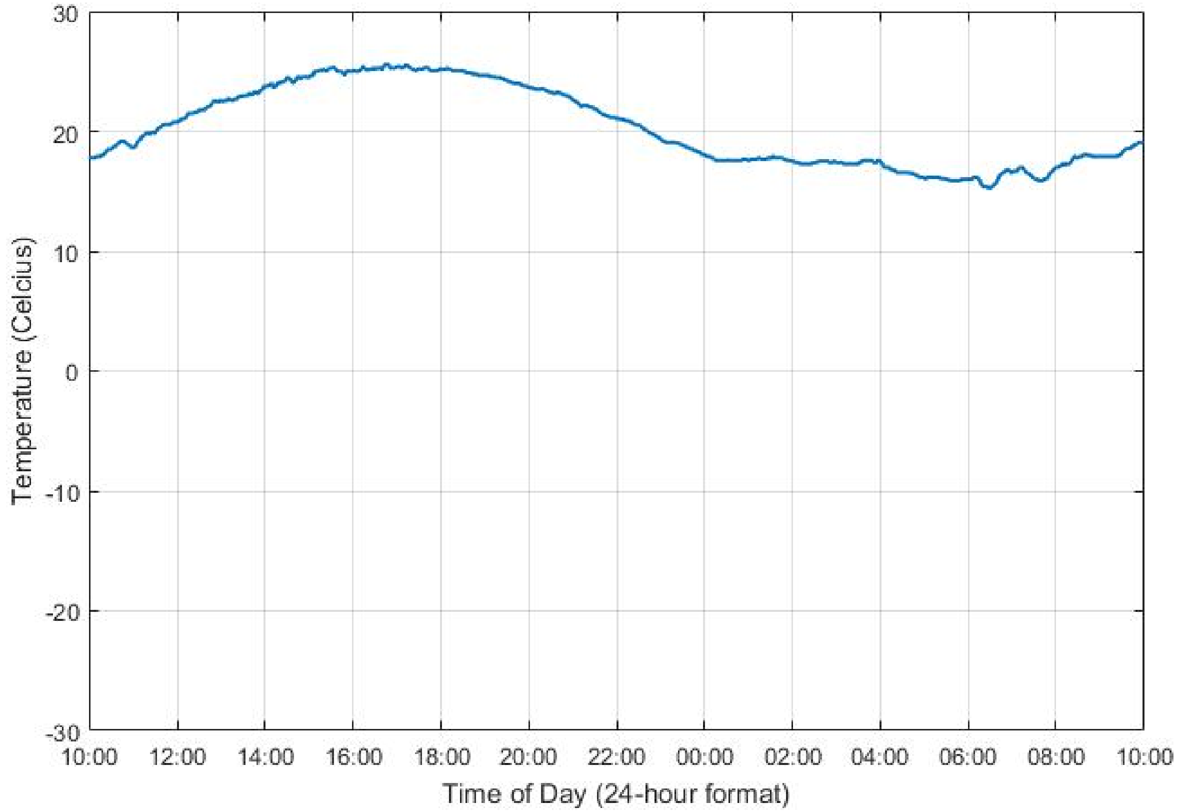
Monitored Rain Rate (July 29 – 30, 2017) at Noise Monitor Location 6



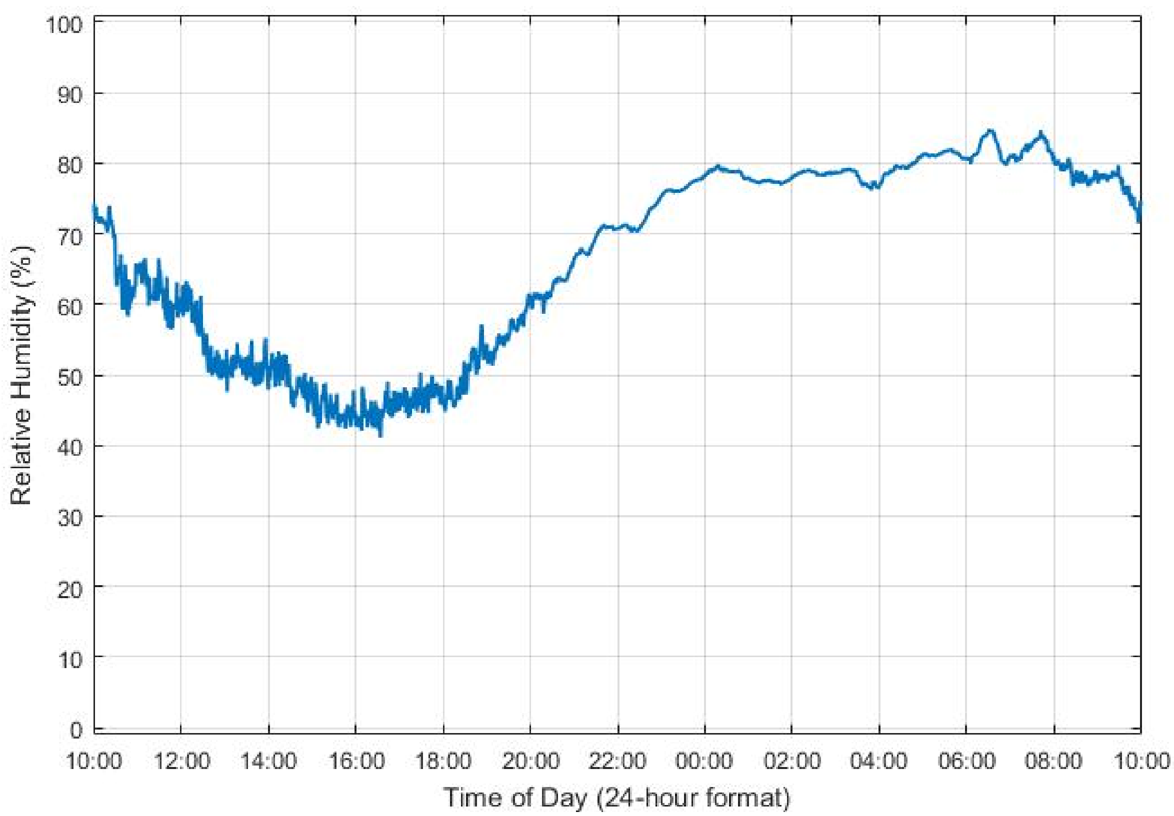
Monitored Wind Speed (July 29 – 30, 2017) at Noise Monitor Location 10



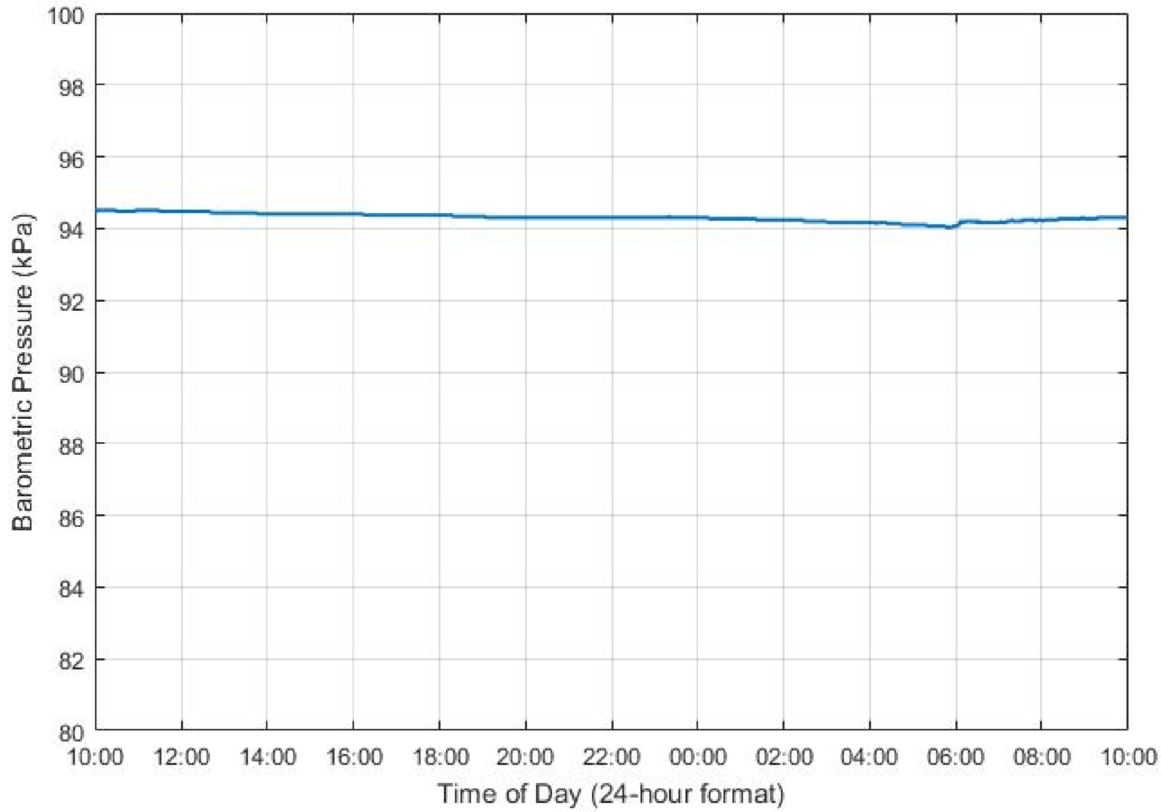
Monitored Wind Direction (July 29 – 30, 2017) at Noise Monitor Location 10



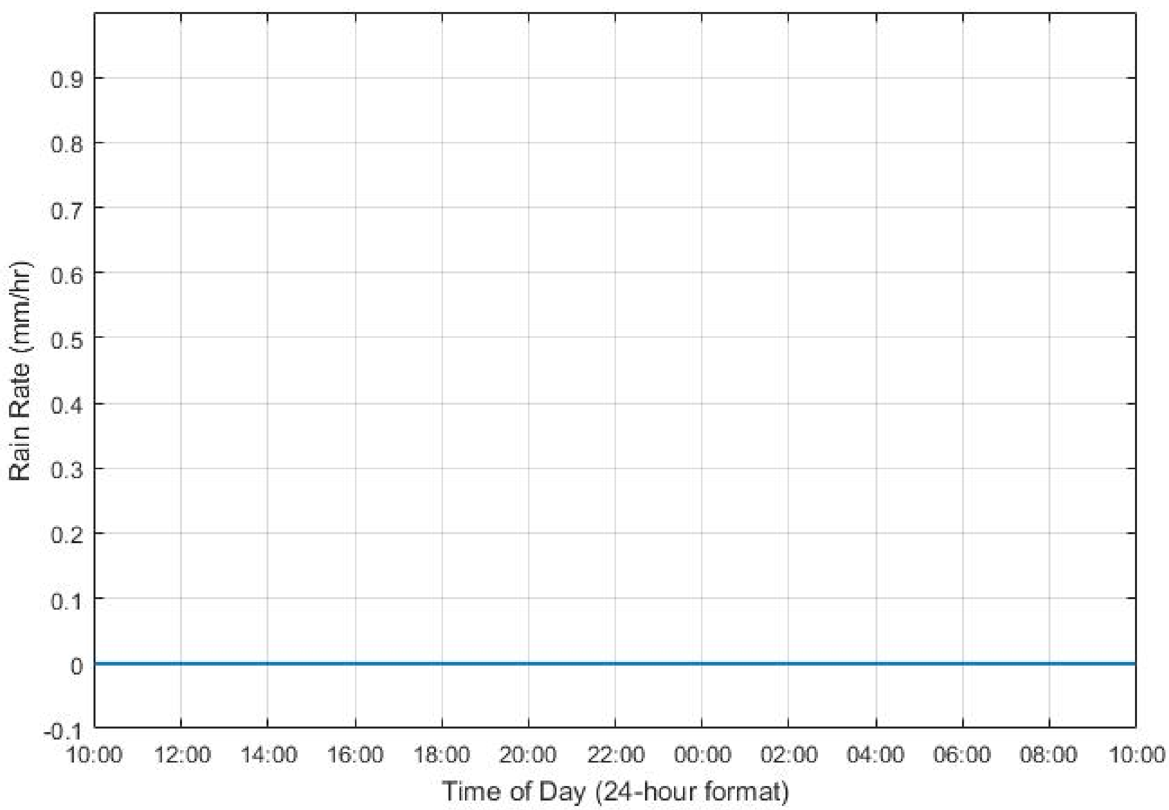
Monitored Temperature (July 29 – 30, 2017) at Noise Monitor Location 10



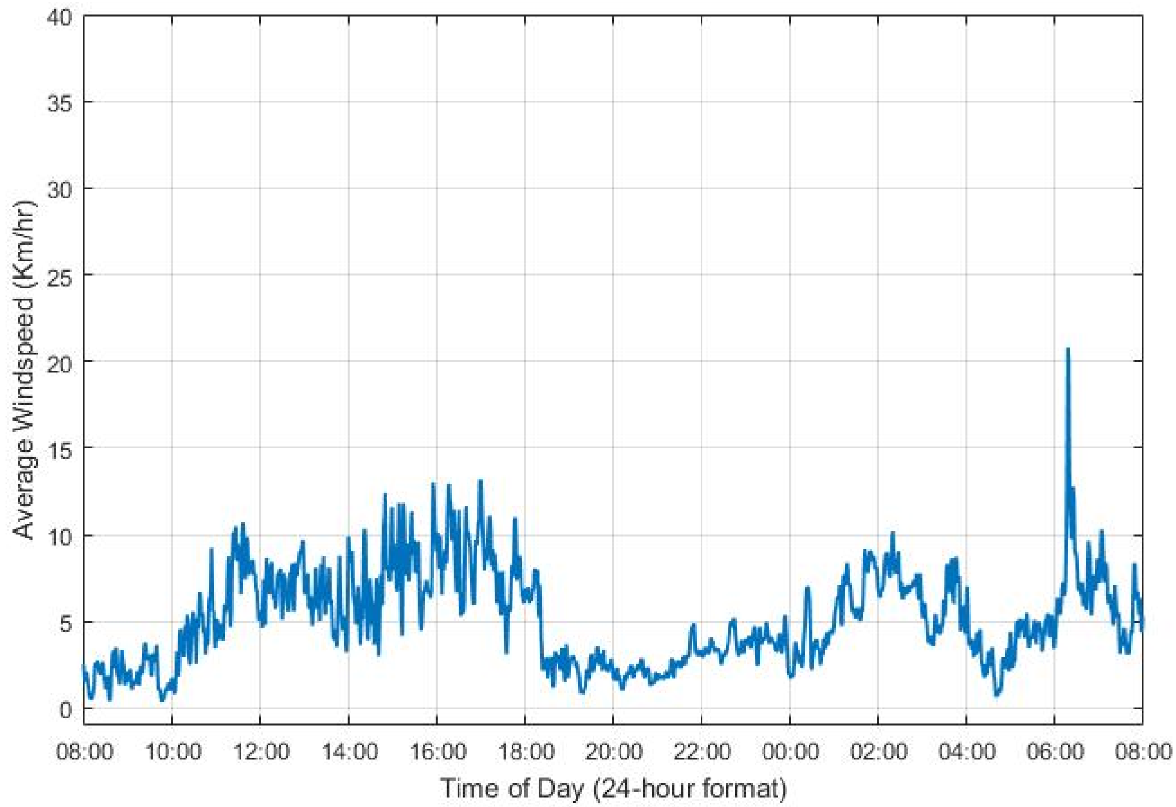
Monitored Humidity (July 29 – 30, 2017) at Noise Monitor Location 10



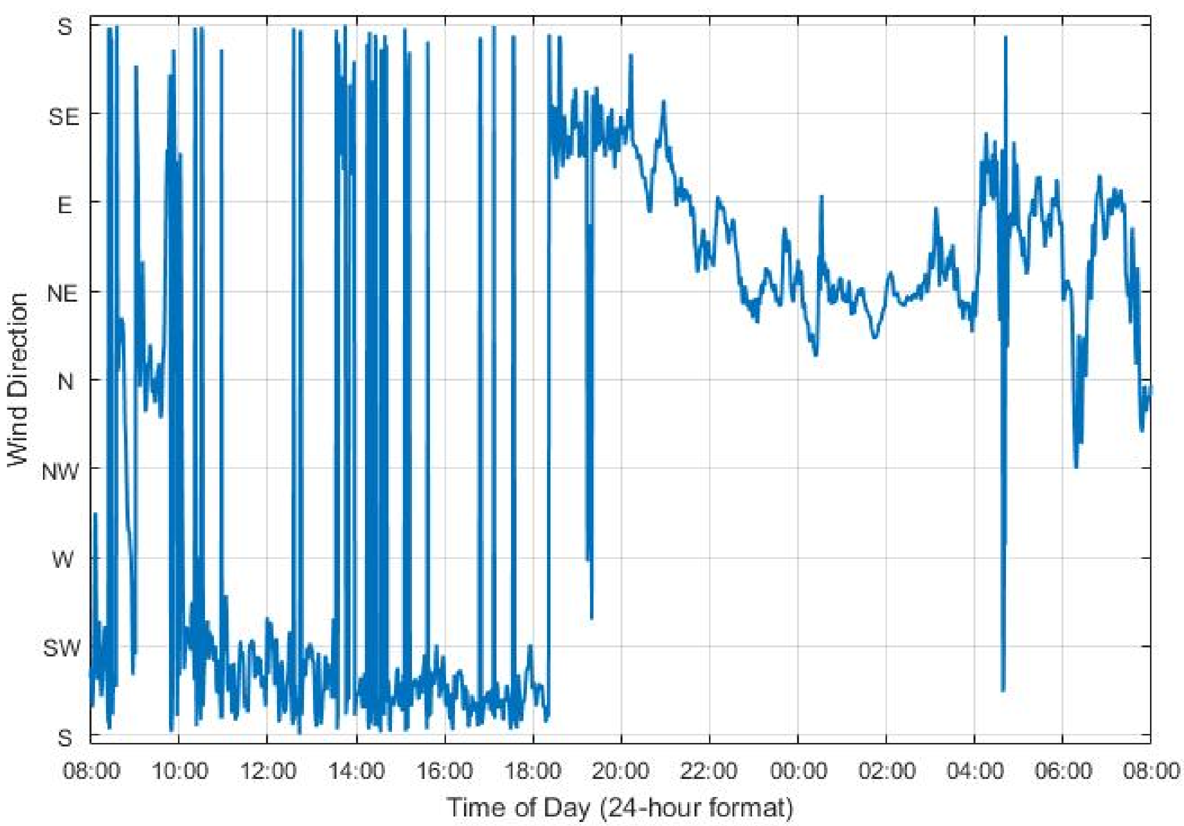
Monitored Barometric Pressure (July 29 – 30, 2017) at Noise Monitor Location 10



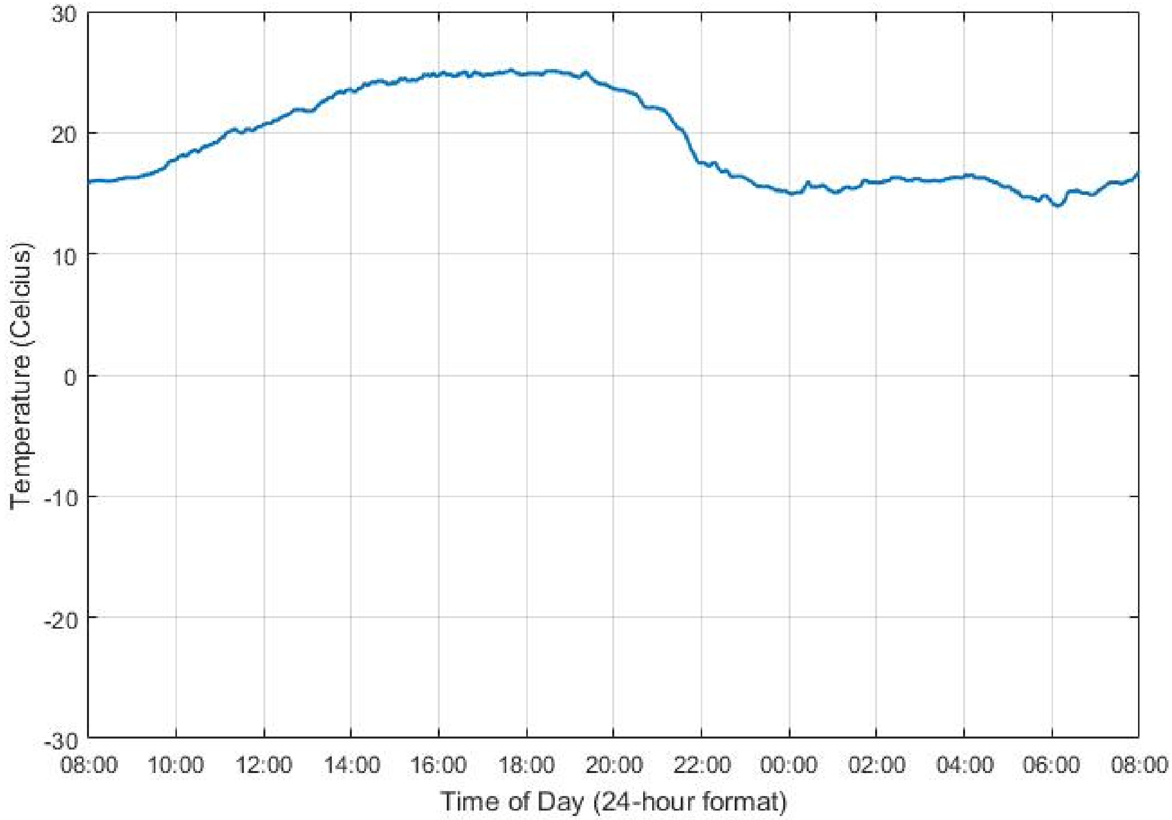
Monitored Rain Rate (July 29 – 30, 2017) at Noise Monitor Location 10



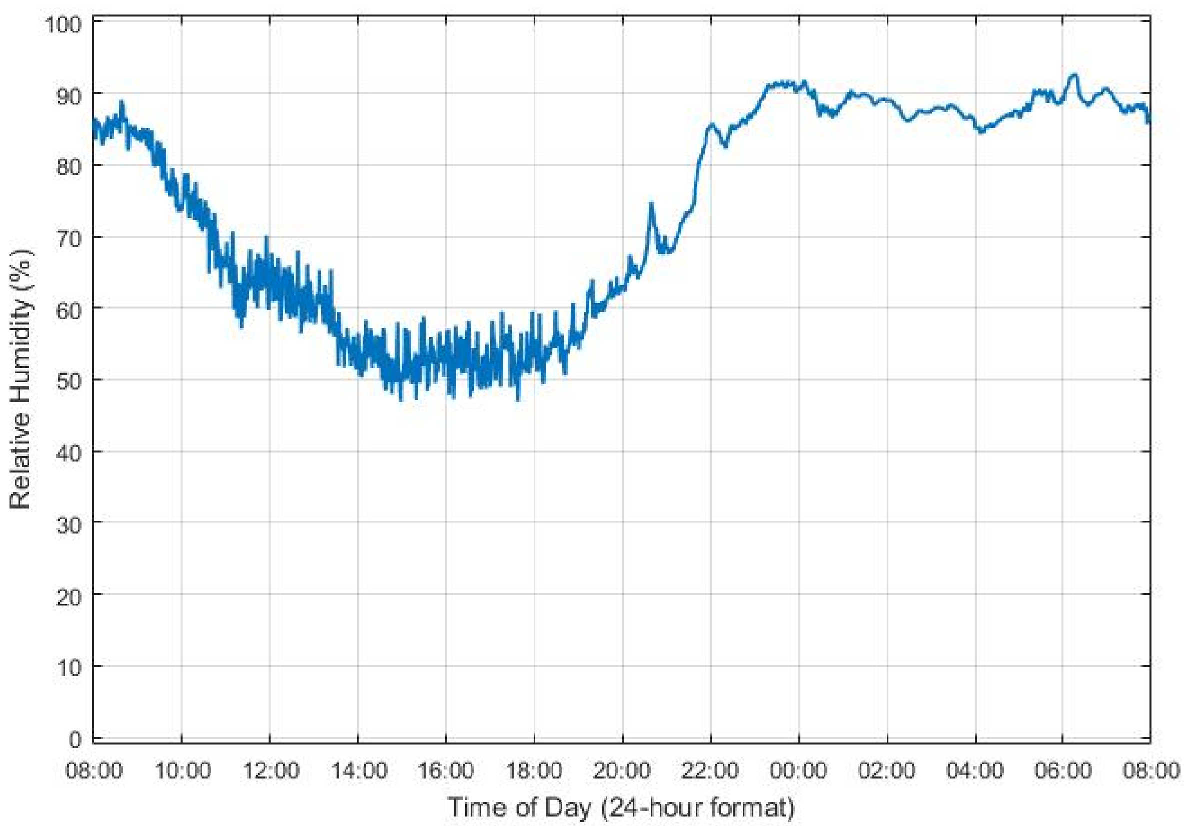
Monitored Wind Speed (July 29 – 30, 2017) at Noise Monitor Location 12



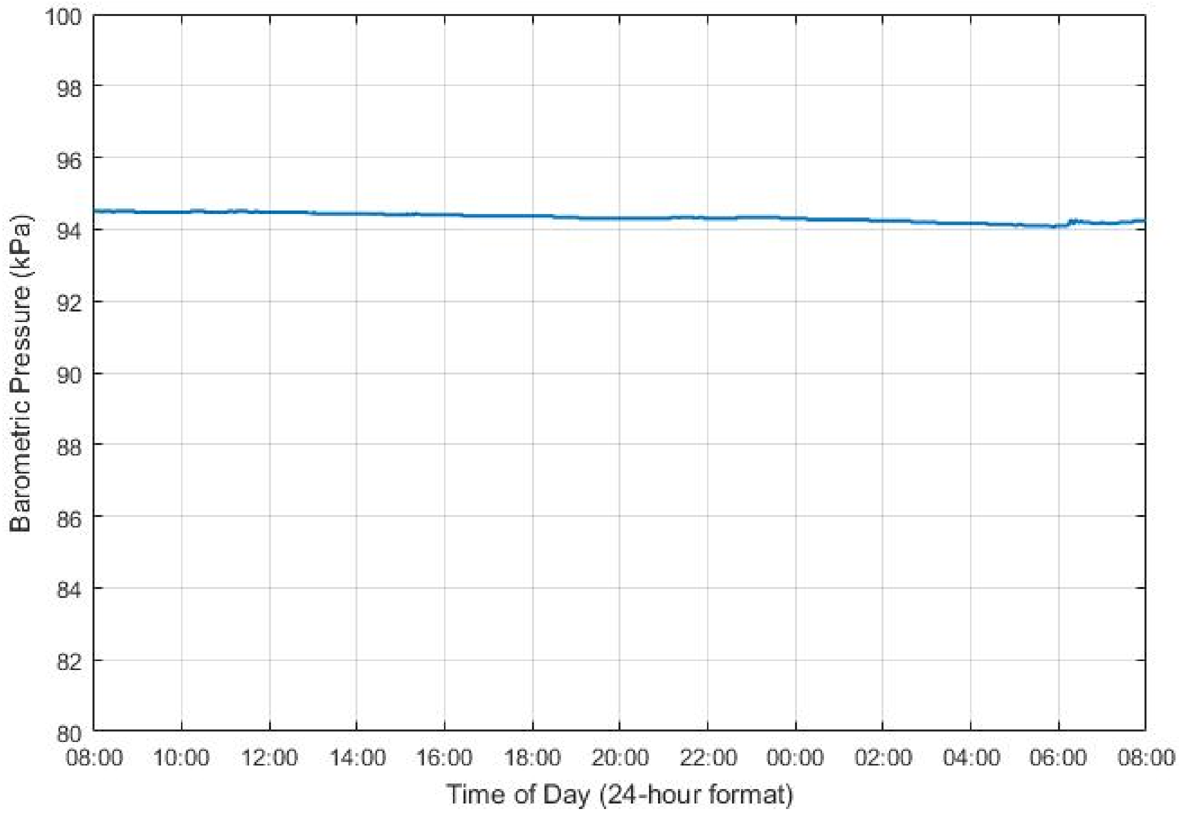
Monitored Wind Direction (July 29 – 30, 2017) at Noise Monitor Location 12



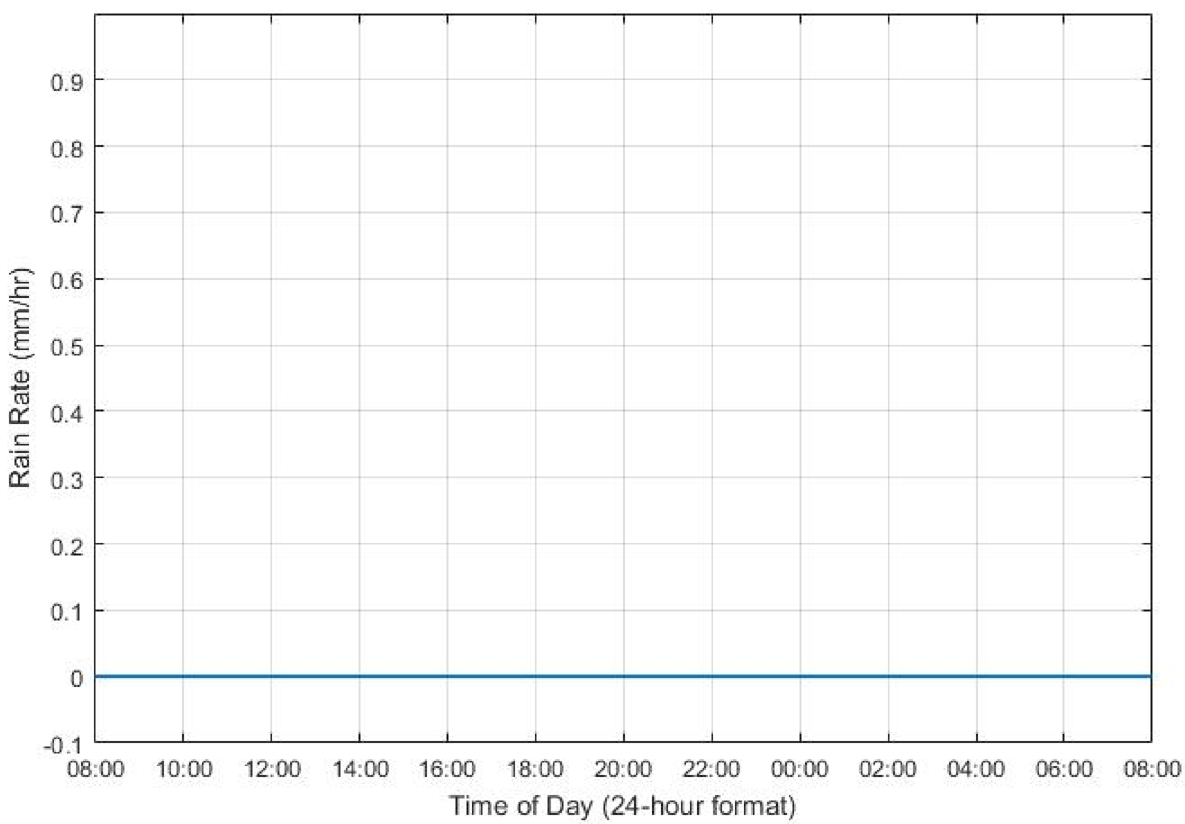
Monitored Temperature (July 29 – 30, 2017) at Noise Monitor Location 12



Monitored Humidity (July 29 – 30, 2017) at Noise Monitor Location 12

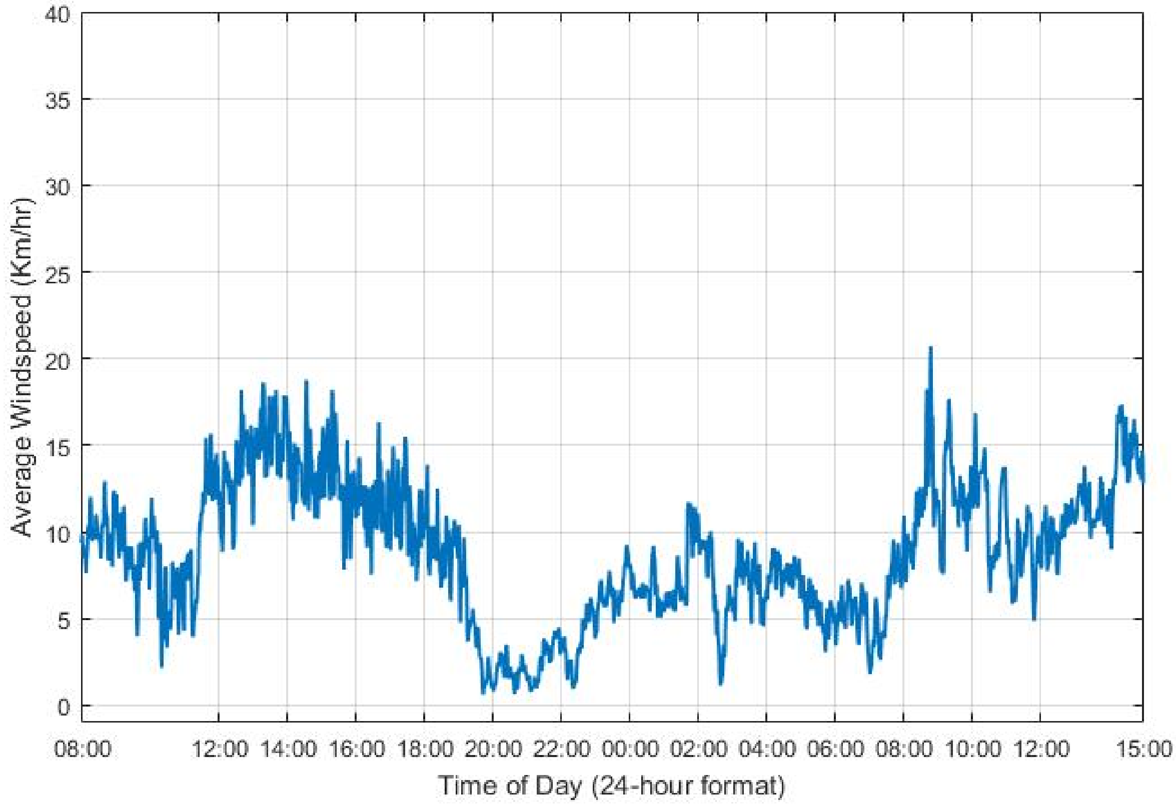


Monitored Barometric Pressure (July 29 – 30, 2017) at Noise Monitor Location 12

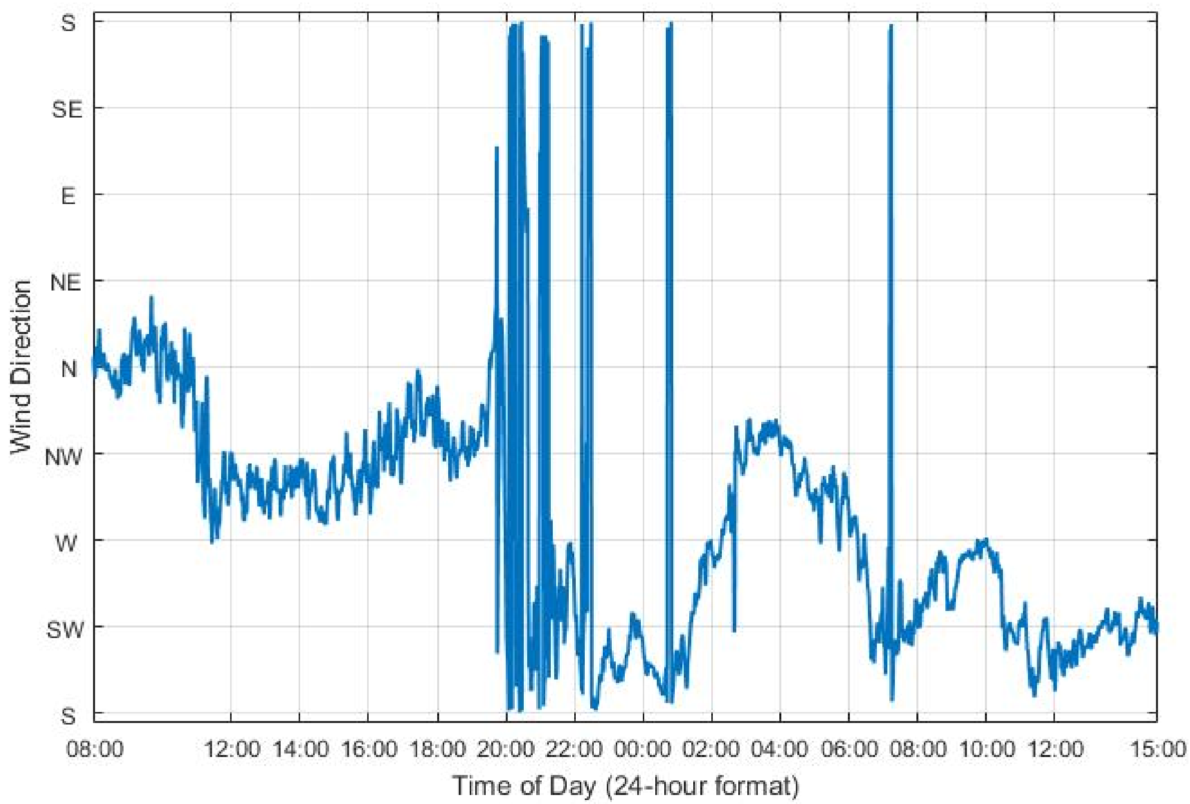


Night-time Monitored Rain Rate (July 29 – 30, 2017) at Noise Monitor Location 12

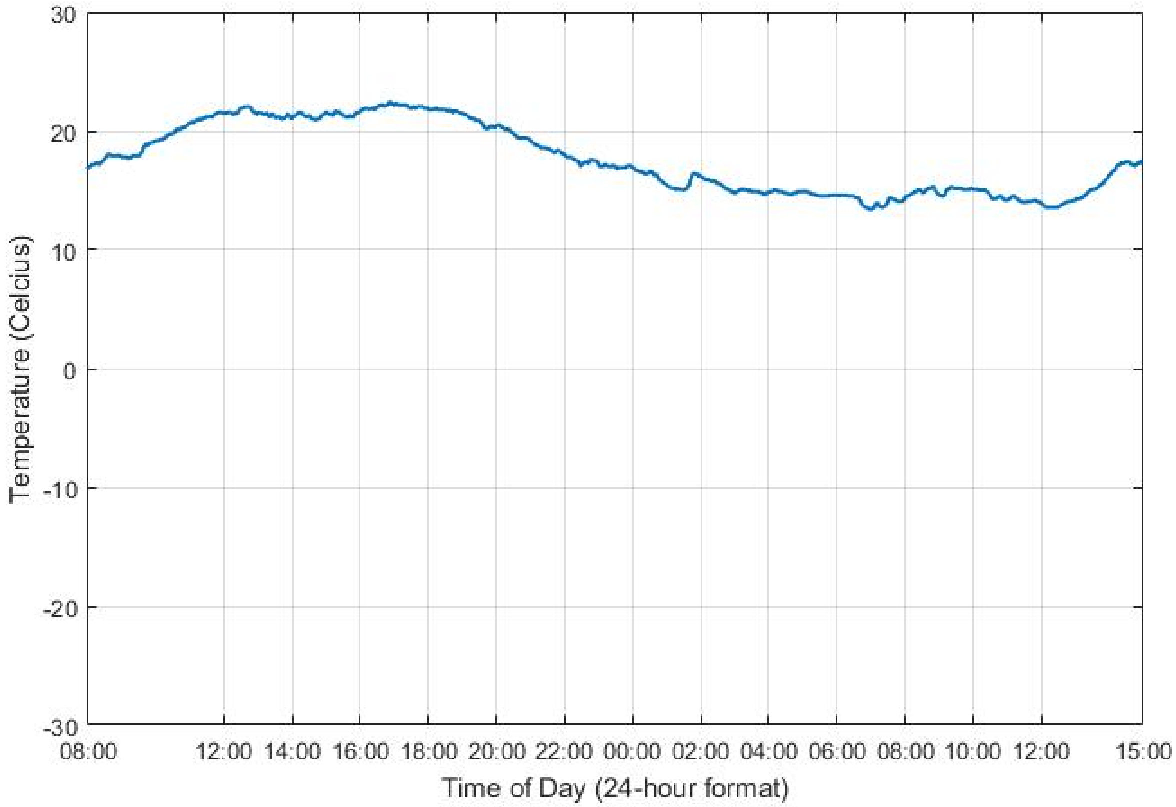
July 30 – 31, 2017 Weather Data



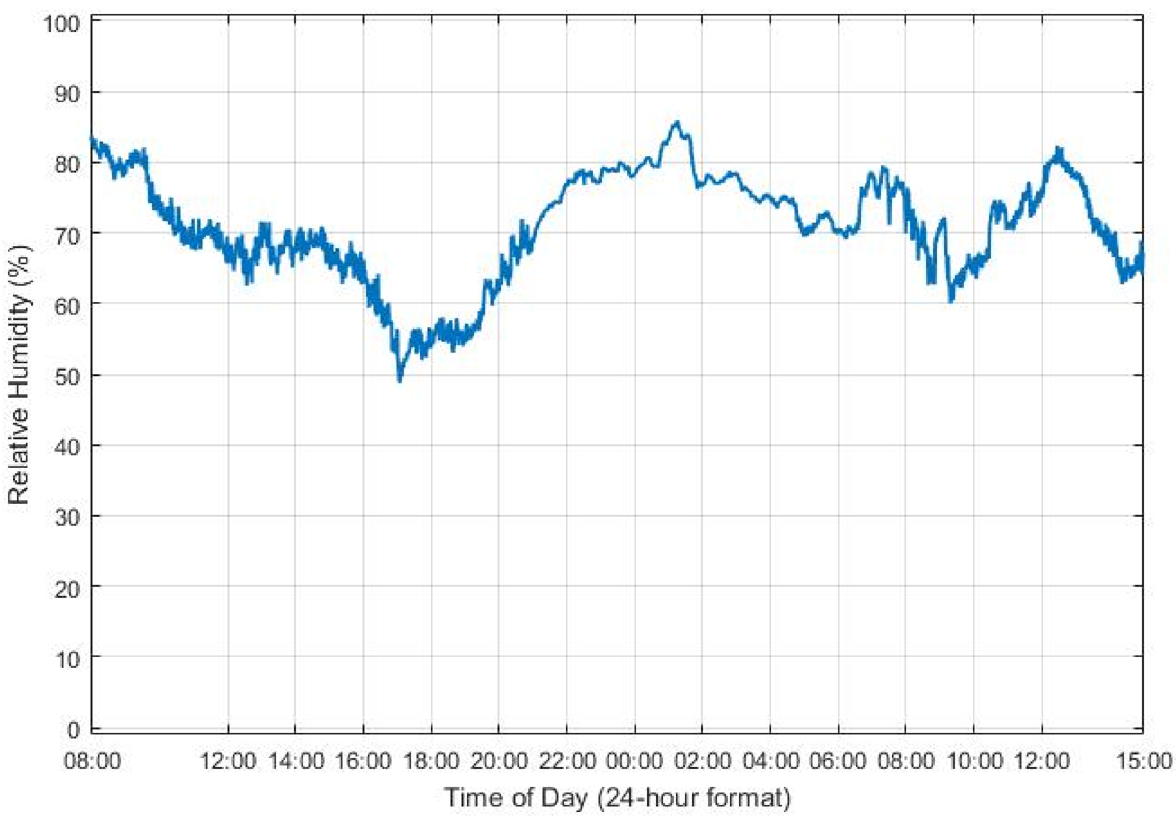
Monitored Wind Speed (July 30 – 31, 2017) at Noise Monitor Location 6



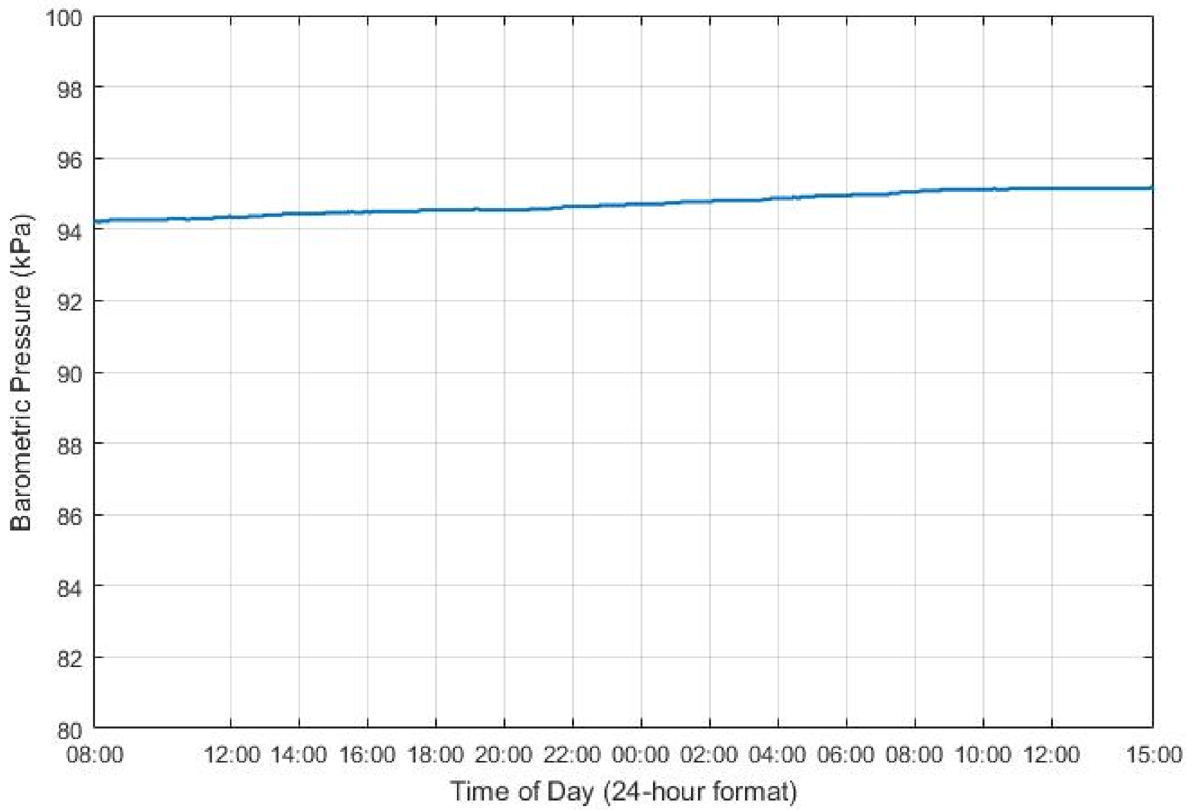
Monitored Wind Direction (July 30 – 31, 2017) at Noise Monitor Location 6



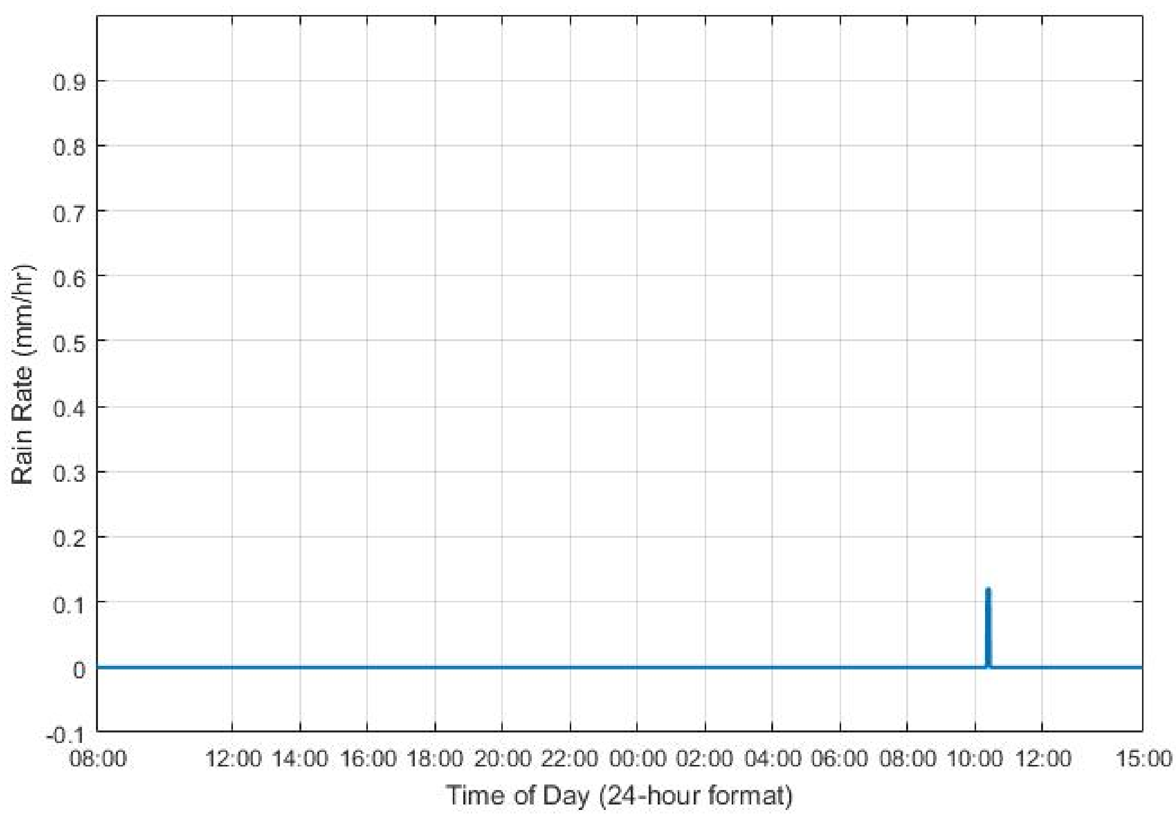
Monitored Temperature (July 30 – 31, 2017) at Noise Monitor Location 6



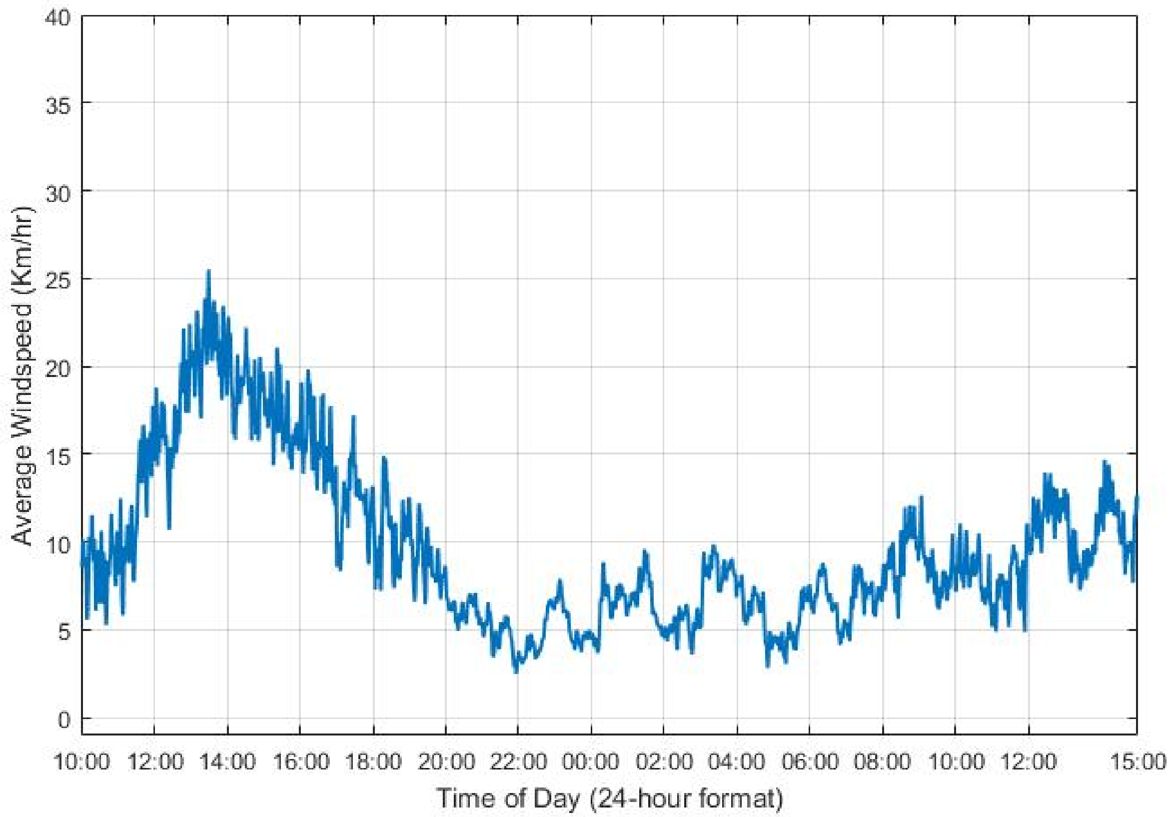
Monitored Humidity (July 30 – 31, 2017) at Noise Monitor Location 6



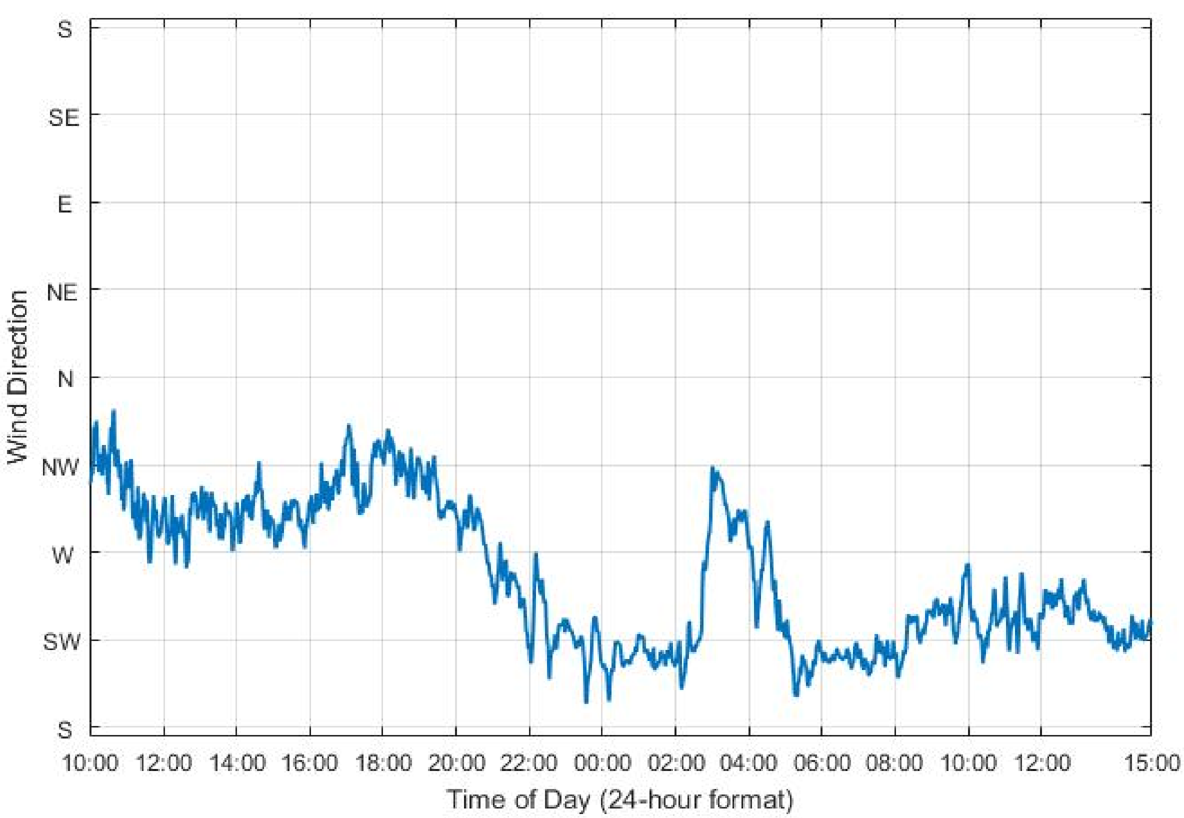
Monitored Barometric Pressure (July 30 – 31, 2017) at Noise Monitor Location 6



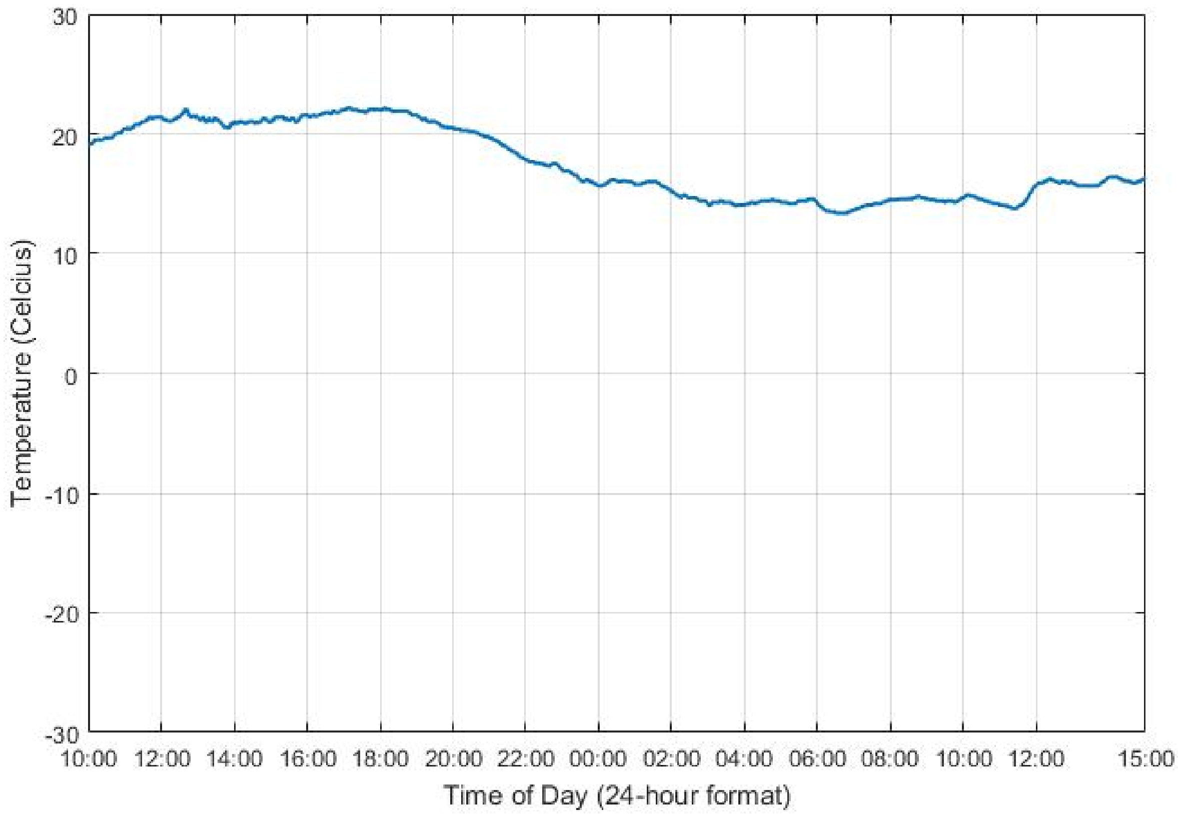
Night-time Monitored Rain Rate (July 30 – 31, 2017) at Noise Monitor Location 6



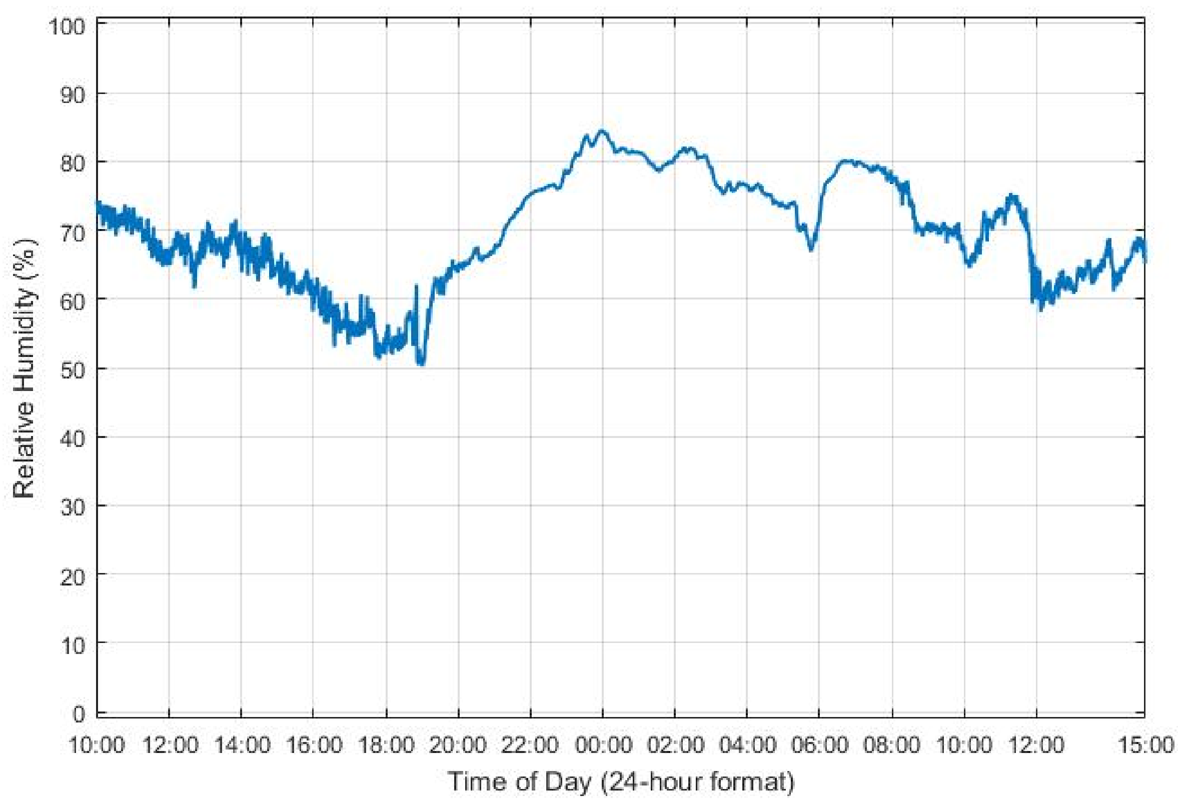
Monitored Wind Speed (July 30 – 31, 2017) at Noise Monitor Location 10



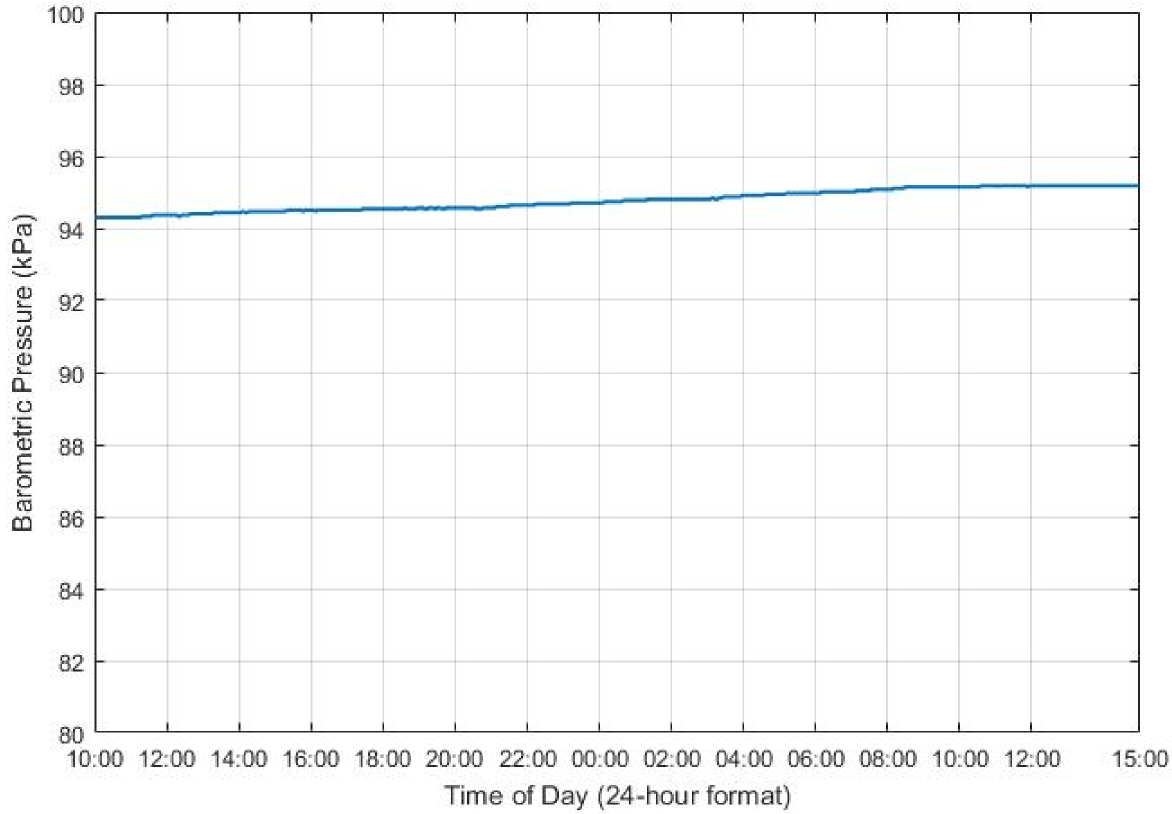
Monitored Wind Direction (July 30 – 31, 2017) at Noise Monitor Location 10



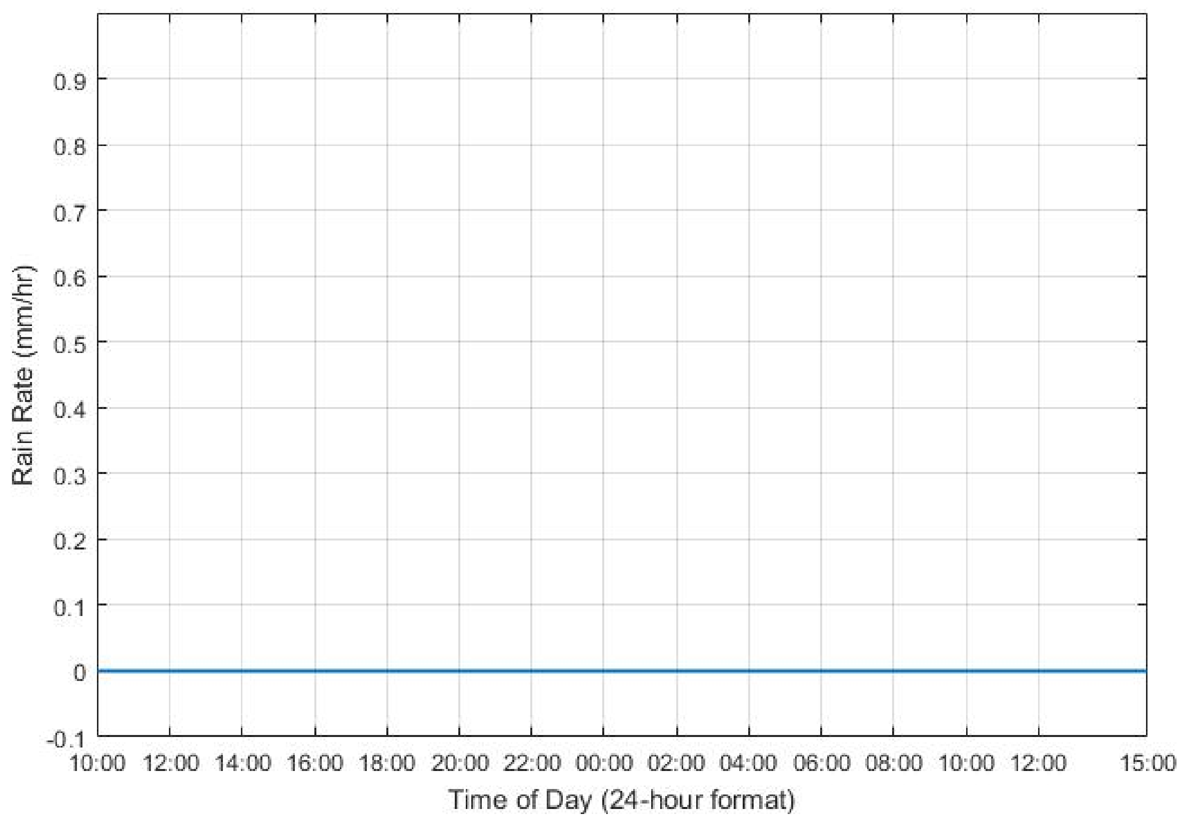
Monitored Temperature (July 30 – 31, 2017) at Noise Monitor Location 10



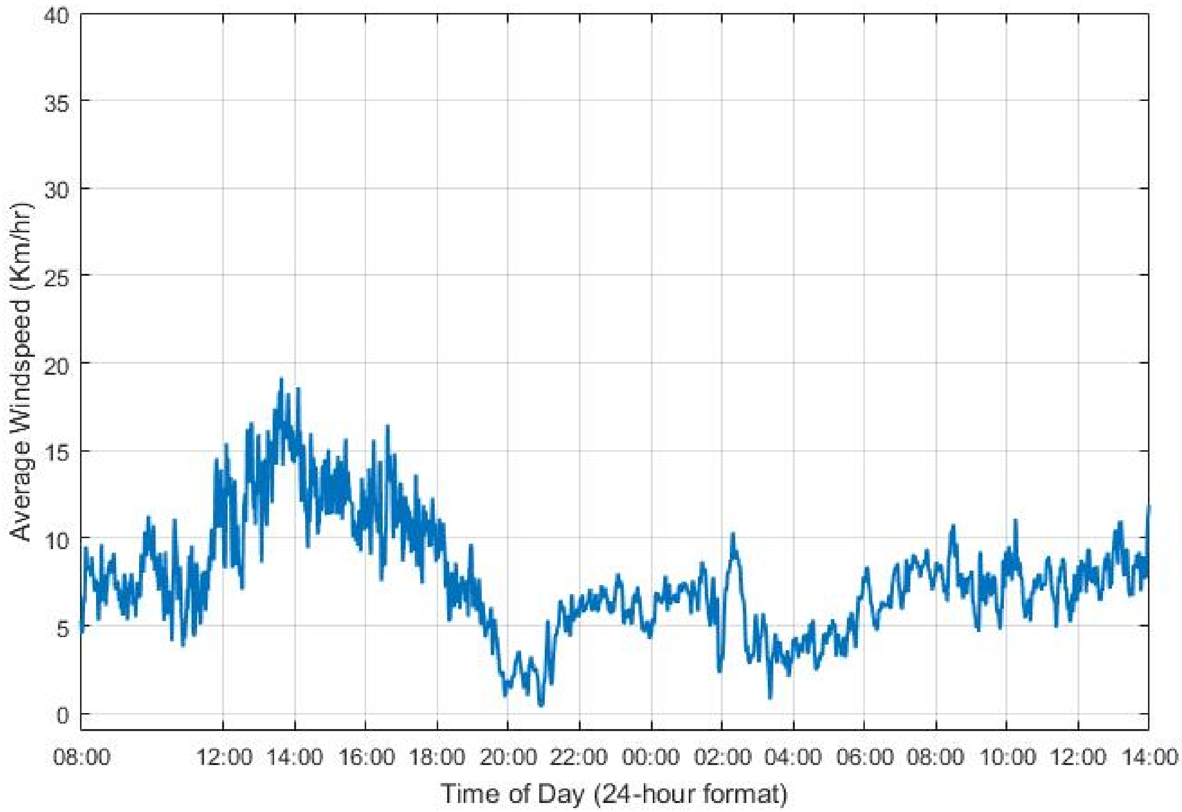
Monitored Humidity (July 30 – 31, 2017) at Noise Monitor Location 10



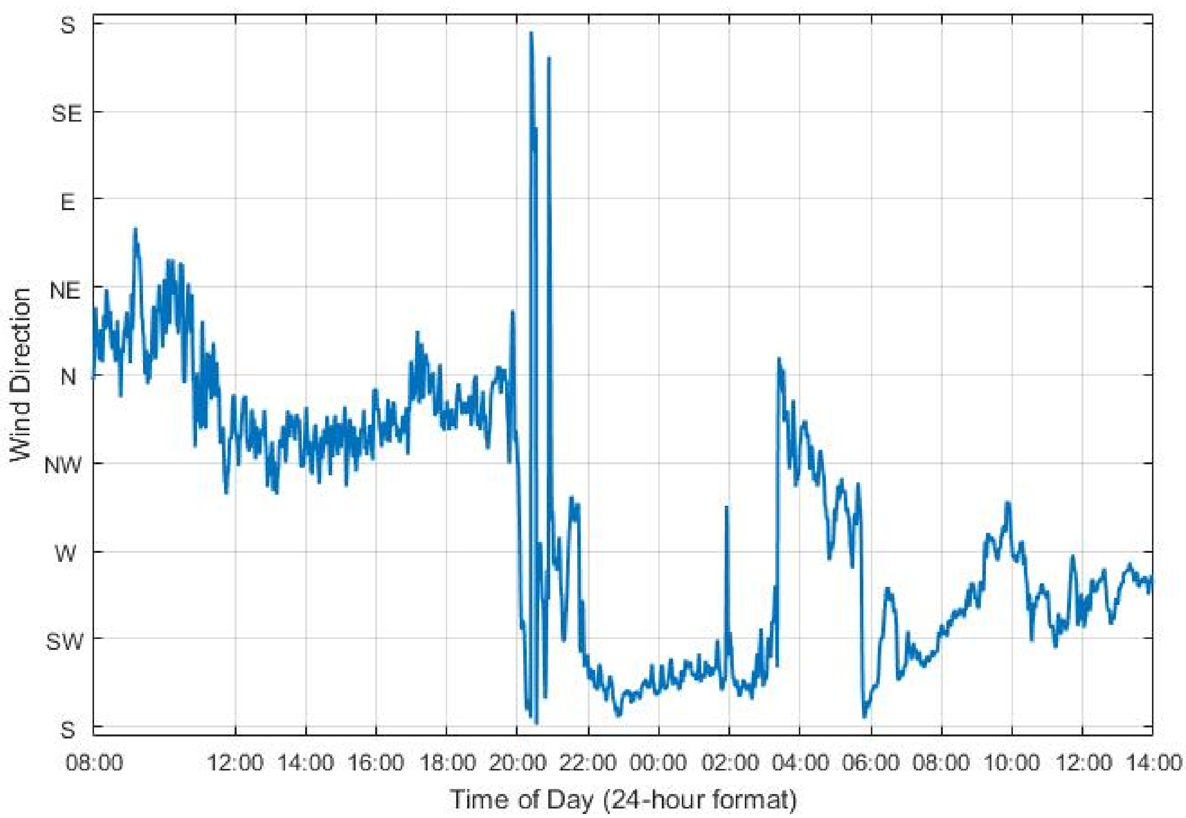
Monitored Barometric Pressure (July 30 – 31, 2017) at Noise Monitor Location 10



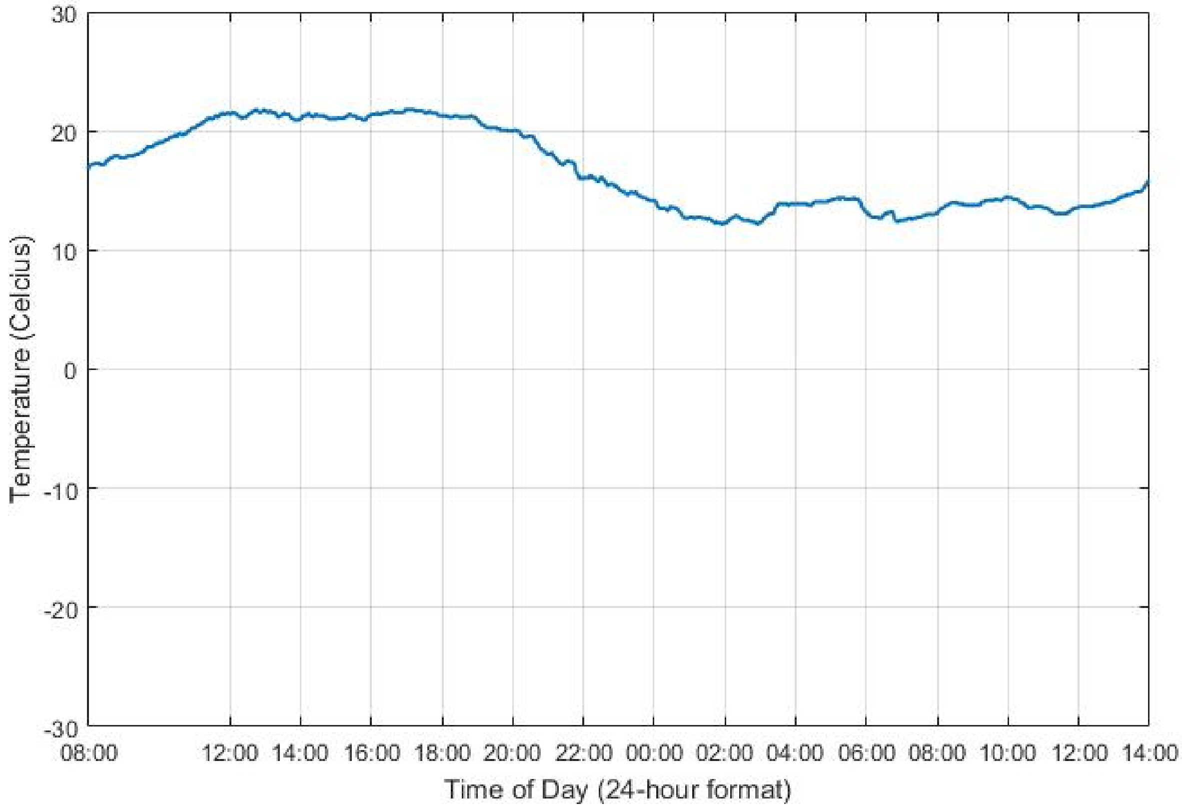
Night-time Monitored Rain Rate (July 30 – 31, 2017) at Noise Monitor Location 10



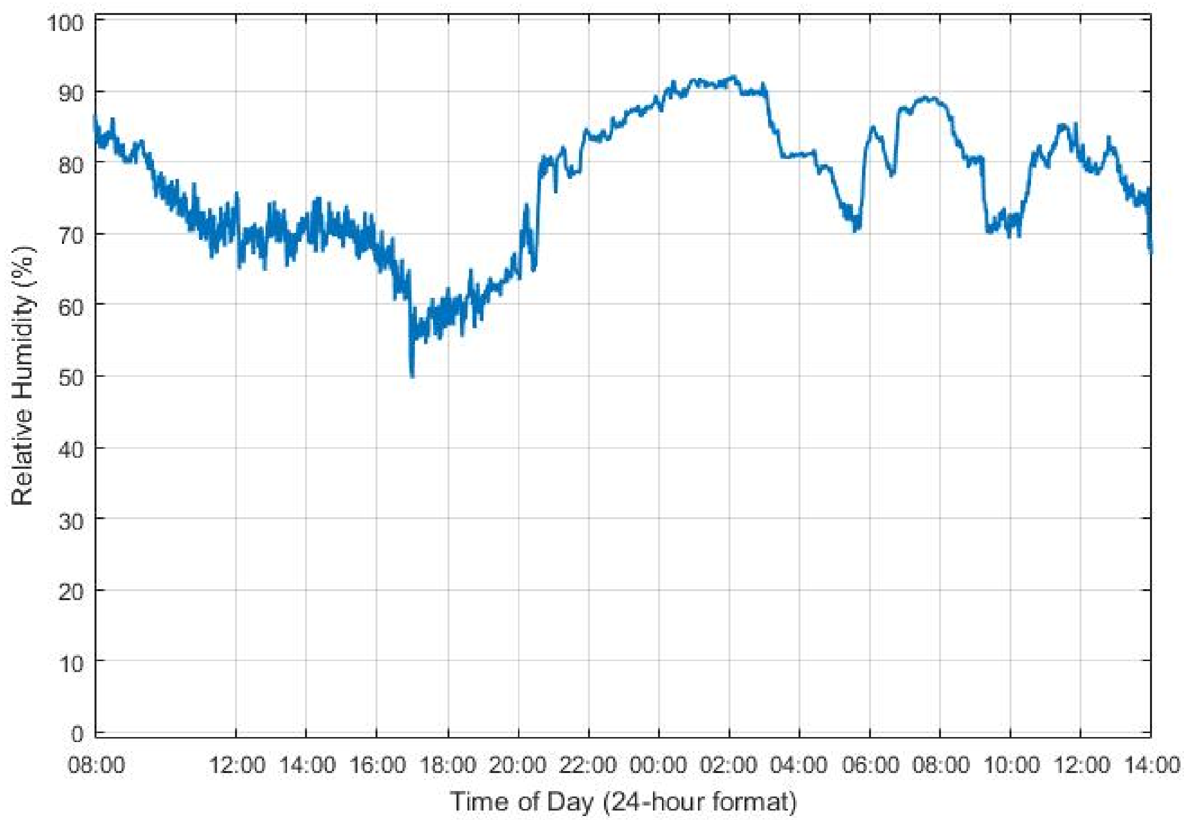
Monitored Wind Speed (July 30 – 31, 2017) at Noise Monitor Location 12



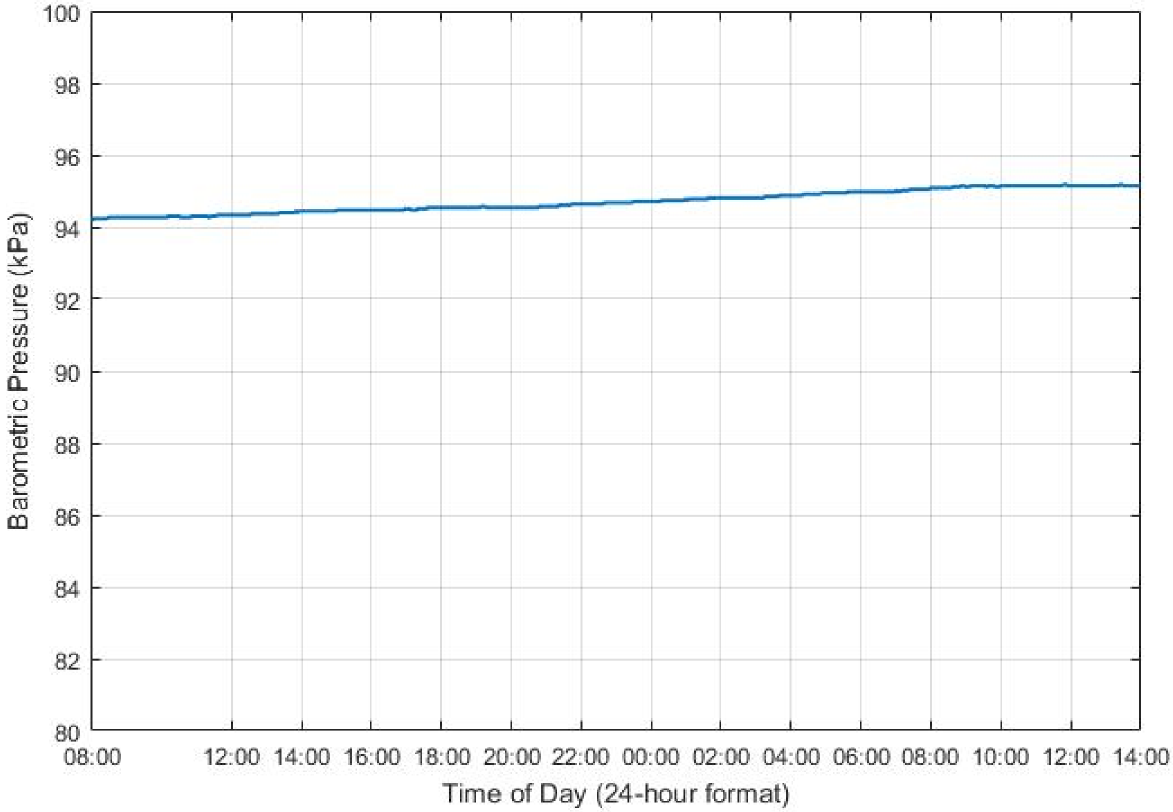
Monitored Wind Direction (July 30 – 31, 2017) at Noise Monitor Location 12



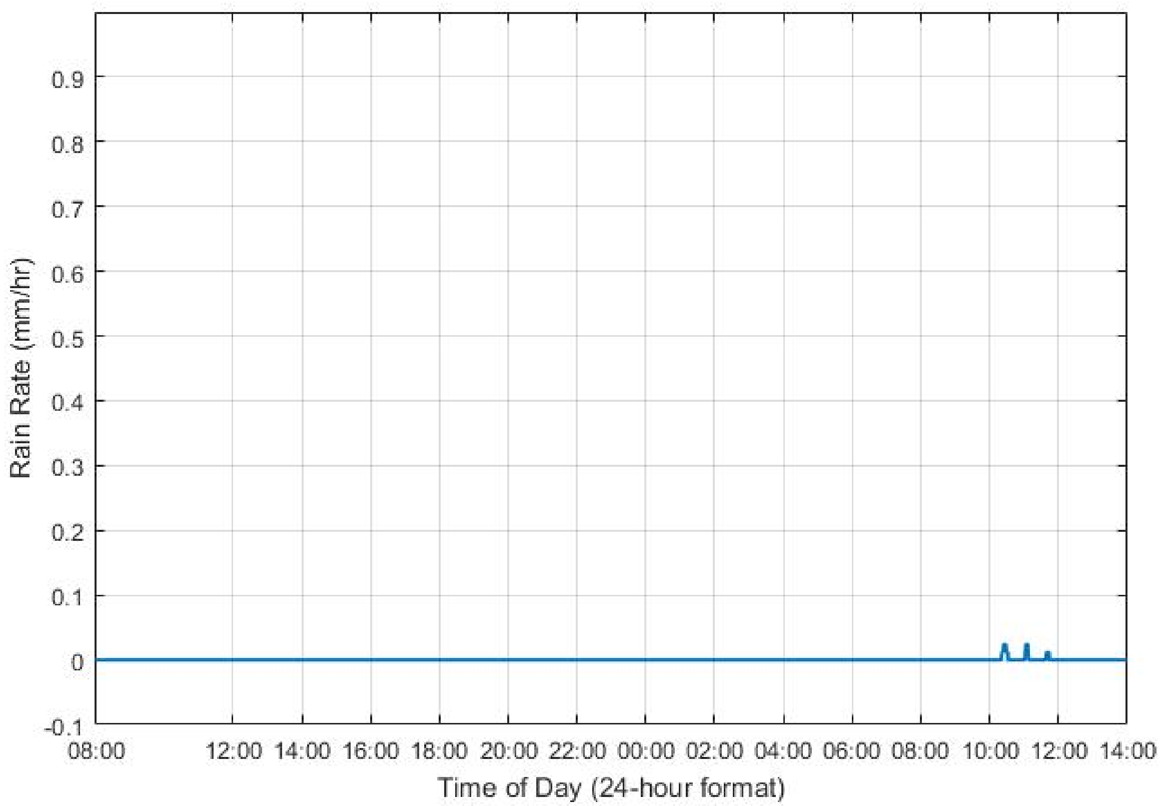
Monitored Temperature (July 30 – 31, 2017) at Noise Monitor Location 12



Monitored Humidity (July 30 – 31, 2017) at Noise Monitor Location 12



Monitored Barometric Pressure (July 30 – 31, 2017) at Noise Monitor Location 12



Monitored Rain Rate (July 30 – 31, 2017) at Noise Monitor Location 12

APPENDIX 3

2018 Regional Noise Model Annual Field Validation Monitoring Report

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2018 Environmental Noise Survey

For The

Regional Noise Model Annual Field Validation Monitoring

Prepared for:

Northeast Capital Industrial Association

Prepared by:
P. Froment, B.Sc., B.Ed., P.L.(Eng.)
aci Acoustical Consultants Inc.
Edmonton, Alberta
APEGA Permit to Practice #P7735

12/13/2018

aci Project #: 17-020
December 13, 2018

Executive Summary

aci Acoustical Consultants Inc., of Edmonton AB, was retained by the Northeast Capital Industrial Association (NCIA) to conduct an environmental noise survey within Alberta's Industrial Heartland (AIH). The purpose of the study was to conduct a single 48-hour noise monitoring at eleven (11) pre-specified locations within the AIH. An additional noise monitoring, spanning two (2) 48-hour periods, was conducted at an 12th monitoring location (referred to as Location 12) as an independent control/reference point. The noise monitoring was conducted in support of the NCIA's Regional Noise Management Plan. In addition, the results from these noise monitoring's will be used to validate the Regional Noise Level Assessment Model (the Regional Noise Model). All noise monitoring procedures and equipment used was in accordance with the requirements of the Alberta Energy Regulator (AER) Directive 038 on Noise Control. Site work was conducted for aci in June and July 2018 by P. Froment, B.Sc., P.L.(Eng.).

As part of the study, a total of thirteen (13) 48-hour noise monitorings were conducted throughout the Alberta's Industrial Heartland. It was found that the isolated L_{eq}Night broadband and 1/3 octave band L_{eq} sound levels were similar to those from previous measurements. In certain cases, due to ideal weather conditions, it would be anticipated that the results from the 2018 noise monitoring are most reflective (in comparison to previous years) of the typical noise climate of their given area.

The noise levels at most locations consisted of low frequency components with occasional mid/high frequency components that could be attributed to the nearest facility relative to each individual noise monitoring location. Despite the noise being relatively low in frequency, none of the sites indicated any low frequency tonal components. The noise from train passages was again prevalent at all locations and tended to dominate the noise climate as they passed through. This was particularly true for locations within proximity to a rail line and for locations further away from any of the large industrial sites.

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1.0 Introduction

aci Acoustical Consultants Inc., of Edmonton AB, was retained by the Northeast Capital Industrial Association (NCIA) to conduct an environmental noise survey within Alberta's Industrial Heartland (AIH). The purpose of the study was to conduct a single 48-hour noise monitoring at eleven (11) pre-specified locations within the AIH. An additional noise monitoring, spanning two (2) 48-hour periods, was conducted at an 12th monitoring location (referred to as Location 12) as an independent control/reference point. The noise monitoring was conducted in support of the NCIA's Regional Noise Management Plan. In addition, the results from these noise monitoring's will be used to validate the Regional Noise Level Assessment Model (the Regional Noise Model). All noise monitoring procedures and equipment used was in accordance with the requirements of the Alberta Energy Regulator (AER) Directive 038 on Noise Control. Site work was conducted for aci in June and July 2018 by P. Froment, B.Sc., P.L.(Eng.).

2.0 Location Description

Alberta's Industrial Heartland (AIH) is located northeast of Edmonton, AB and extends into five different municipalities as indicated in Figure 1. This includes 533 km^2 within the City of Fort Saskatchewan and the Counties of Lamont, Strathcona and Sturgeon, in addition to 49 km^2 in the City of Edmonton's "Edmonton Energy and Technology Park". The area has 40+ companies in various sectors that include producing and processing oil, gas and petrochemicals in addition to advanced manufacturing.

Topographically, the AIH does have some varying elevation changes however in general it can be considered relatively flat with no substantial hills. Areas with more significant changes in elevation are found adjacent to the North Saskatchewan River (the River) which divides the AIH from the southwest to the northeast (excluding the AIH area within the City of Edmonton's limits). The vegetation varies from open grain fields to thick dense vegetation. Due to the relative distance from the noise monitoring locations to the nearby facilities (with the exception of Noise Monitor Location 12) and the relatively low frequency nature of the industrial noise, the level of vegetative sound absorption is considered negligible to low.

3.0 Measurement Methods

As part of the study, a total of thirteen (13) 48-hour noise monitoring's were conducted at 12 locations[1] throughout the AIH, as indicated in Figure 2.

All noise monitoring locations were identical to those conducted during the 2017 Noise Survey. The noise monitoring was conducted collecting broadband A-weighted and C-weighted as well as 1/3 octave band sound levels and were conducted during "typical" operations at all facilities[2]. In particular, the chosen noise monitoring periods avoided any major shut-downs or outages[3] that could adversely affect the "typical" noise levels (either louder or quieter) from a given facility. In addition, the monitoring's were conducted under summer conditions (i.e. no snow cover) trying to avoid times of precipitation and high wind-speeds. Each noise monitoring was accompanied by a 48-hour digital audio recording for more detailed post process analysis.

Three (3) local weather monitoring stations were also used for the two (2) 48-hour time monitoring periods. The weather monitors obtained the wind speed, wind direction, temperature, relative humidity, barometric pressure and rain fall data in 15-second sampling periods. Lastly, it should be noted that all measurements were performed in accordance with the methods described in the AER Directive 038 on Noise Control.

[1] Once again, it should be noted that two (2) 48-hour monitoring were conducted at Monitoring Location 12.
[2] This was verified by all the various company representatives.
[3] This was based on information provided by the various NCIA members.

4.0 Noise Monitoring Location Description

In addition to Table 1, which provides the UTM coordinates and the start and end times for each noise monitoring, a brief discussion of each noise monitoring location can be found below. All noise measurement instrumentation was calibrated at the start of the measurements and then checked afterwards to ensure that there had been no significant calibration drift over the duration of the measurements. Refer to Appendix I for a detailed description of the measurement equipment used and for all calibration records.

Table 1. Noise Monitoring Locations with Start and End Times[1]

Monitoring Location	UTM Coordinates (Approximate) [2]		Start Time	End Time
	Easting (m)	Northing (m)		
1C	355210	5954157	7/24/18 12:00	7/26/18 12:00
2	358256	5957216	6/18/18 14:00	6/20/18 14:00
3B	358361	5959283	6/18/18 13:50	6/20/18 13:50
4C	361665	5960870	7/24/18 13:00	7/26/18 13:00
5	361777	5964711	6/18/18 13:30	6/20/18 13:30
6	364322	5967894	6/18/18 13:10	6/20/18 13:10
7	N/A			
8A	358897	5965430	7/24/18 15:00	7/26/18 15:00
9	355872	5957574	6/18/18 15:00	6/20/18 15:00
10	355925	5955818	6/18/18 14:30	6/20/18 14:30
11	358430	5963804	7/24/18 18:00	7/26/18 18:00
12B (1st 48-hour)	368223	5963070	6/18/18 13:00	6/20/18 13:00
12B (2nd 48-hour)			7/24/18 14:00	7/26/18 14:00
13	358667	5970180	7/24/18 15:00	7/26/18 15:00

4.1. Noise Monitor Location 1

The noise monitor at Location 1 was located approximately 10 m south of 100 Avenue, 175 m west of 114 Street and approximately 370 m northwest of Highway 15 as indicated in Figure 2 and Figure 3. This put the noise monitor approximately 410 m southwest of the Sherritt International Corporation facility. This is the southernmost noise monitoring location found within the AIH. At this location, there was direct line-of-sight to 100 Avenue, Mel Martin's Transfer Facility and the Sherritt International Corporation facility. There was no significant vegetation between the noise monitor and the facilities to the north. Note

[1] The letters accompanying the noise monitoring location refers to their location.
[2] The UTM Coordinates have been updated to reflect the 2018 noise monitor locations.

also that a weather monitor was placed at this location, adjacent to the noise monitor for the duration of the noise monitoring periods.

4.2. Noise Monitor Location 2

The noise monitor at Location 2 was located approximately 90 m southeast of 125 Street and approximately 1.0 km north of Highway 15 as indicated in Figure 2 and Figure 4. This put the noise monitor approximately 120 m west of the Dow yard, 170 m north of the Dow rail yard and approximately 850 m east-southeast of the Keyera Facility. At this location, there was direct line-of-sight to Dow's main site to the east and to the rail yard to the south. There was no significant vegetation between the noise monitor and the aforementioned facilities.

4.3. Noise Monitor Location 3

The noise monitor at Location 3 was located approximately 10 m east of 125 Street, 275 m south of the CN Rail line 55 m east of the north entrance to the Plains Midstream Facility and approximately 125 m north of the entrance to the Petrogas northern entrance as indicated in Figure 2 and Figure 5. This put the noise monitor approximately 230 m northwest of the Petrogas facility and approximately 380 m east of major equipment at the Plains Midstream Facility. At this location, there was direct line-of-sight to the Plains Midstream Facility but not to the Petrogas site. There was no significant vegetation between the noise monitor and the facilities.

4.4. Noise Monitor Location 4

The noise monitor at Location 4 was located approximately 1.2 km south of the south fence line of the Shell Scotford site and approximately 1.6 km east of Range Road 220 (130 Street) as indicated in Figure 2 and Figure 6. This put the noise monitor at 490 m south of the entrance to the electrical substation to the northwest. At this location, there was direct line-of-sight to the Shell Scotford site but not to the electrical substation to the northwest. There was no significant vegetation between the noise monitor and the Shell Scotford facility.

4.5. Noise Monitor Location 5

The noise monitor at Location 5 was located approximately 200 m north of Township Road 560A and 5 m east of Range Road 215 as indicated in Figure 1 and Figure 7. This put the noise monitor approximately 300 m north of the north fence line for the Shell Scotford facility and approximately 135 m west of an industrial yard to the east. At this location, there was direct line-of-sight to the Shell Scotford site but not the industrial yard (due to the topography of the area). There was no significant vegetation between the noise monitor and the Shell Scotford facility.

4.6. Noise Monitor Location 6

The noise monitor at Location 6 was located approximately 1.0 km north of Township Road 562 and 3 m east of Range Road 213A as indicated in Figure 1 and Figure 8. This put the noise monitor approximately 1.6 km east of the Nutrien Redwater facility. Due to favorable topography between the noise monitor and Nutrien there was direct line-of-sight to the Nutrien site through a small row of deciduous trees across the road. There was no significant vegetation between the noise monitor and the Nutrien facility. Note also that a weather monitor was placed at this location, adjacent to the noise monitor for the duration of the noise monitoring periods.

4.7. Noise Monitor Location 8

The noise monitor at Location 8 was located approximately 1.6 km south of Highway 643 (eastbound) and 365 m east of Range Road 221 as indicated in Figure 2 and Figure 9. This put the noise monitor approximately 30 m north of the northern fence line for the Pembina/Williams facility. At this location, there was direct line-of-sight to the Pembina/Williams site through a thin row of deciduous trees. There was no significant vegetation between the noise monitor and the aforementioned facilities.

4.8. Noise Monitor Location 9

The noise monitor at Location 9 was located approximately 5 m southwest of the intersection of Lamoureux Drive and Godbout Avenue as indicated in Figure 2 and Figure 10. This put the noise monitor approximately 1.2 km northwest of the major structures at the Dow facility and approximately 1.3 km west of the Keyera facility. Due to favorable topography, there was direct line-of-sight to the facilities across the River through a thin row of deciduous trees[1]. Despite the thin row of trees there was no significant vegetation between the noise monitor and the aforementioned facilities.

4.9. Noise Monitor Location 10

The noise monitor at Location 10 was located approximately 30 m west of 119 Street and 12 m north of the access road to the Nutrien Fort Saskatchewan facility as indicated in Figure 2 and Figure 11. This put the noise monitor approximately 750 m northeast of the major structures at the Nutrien facility and approximately 180 m west of the west fence-line of the Dow facility. There was direct line-of-sight to the

[1] This was observable during the night-time period.

Dow facility but not to the Nutrien facility (due to the topography of the area). There was no significant vegetation between the noise monitor and the aforementioned facilities. Note also that a weather monitor was placed at this location, adjacent to the noise monitor for the duration of the noise monitoring periods.

4.10. Noise Monitor Location 11

The noise monitor at Location 11 was located approximately 3 m northwest of the intersection of Range Road 221 and Township Road 560 as indicated in Figure 2 and Figure 12. This put the noise monitor approximately 1.7 km southwest of the major structures at the Pembina/Williams facility and approximately 330 m west of the Pembina/Williams rail yard. At this location, there was direct line-of-sight to the Pembina/Williams facility but not to the rail yard (due to the topography of the area). There was no significant vegetation between the noise monitor and the facilities.

4.11. Noise Monitor Location 12

The noise monitor at Location 12 was the independent control/reference point. It was located approximately 15 m east of Range Road 211 and 450 m south of Township Road 560 as indicated in Figure 2 and Figure 13. This placed the noise monitor approximately 1.6 km west of Highway 830 and approximately 2.7 km north of Highway 15. At this location, there was direct line-of-sight to the west of the AIH region. The noise monitor was bordered on all sides by a combination of open grassy fields. Due to the distance from the noise monitor to the existing major facilities within the AIH, the vegetative absorption between the noise monitor and these facilities would be considered significant. Note also that a weather monitor was placed at this location for the duration of the noise monitoring periods.

4.12. Noise Monitor Location 13

The noise monitor at Location 13 was located approximately 3 m east of Range Road 221 and 100 m south of Township Road 564 as indicated in Figure 2 and Figure 14. This put the noise monitor approximately 1.1 km northwest of the lay down yard for the NWR facility and is the north easternmost noise monitoring location found within the AIH. At this location, there was no direct line-of-sight to any facilities. There was moderate vegetation between the noise monitor and the aforementioned facilities.

5.0 Equivalent Sound Level & Statistical Descriptors

Environmental noise levels from industry are commonly described in terms of equivalent sound levels or L_{eq}. This is the level of a steady sound having the same acoustic energy, over a given time period, as the fluctuating sound. The concept is that the same amount of annoyance occurs from a sound having a high level for a short period of time as from a sound at a lower level for a longer period of time. In addition, this energy averaged sound level is often A-weighted to account for the reduced sensitivity of average human hearing to low frequency sounds and/or C-weighted to allow for more low frequency noise to be considered. These L_{eq} in dBA/dBC, which are the most common environmental noise measure, are often given for day-time (07:00 to 22:00) L_{eq}Day and night-time (22:00 to 07:00) L_{eq}Night while other criteria use the entire 24-hour period as L_{eq}24.

Another method of conveying long term noise levels utilizes statistical descriptors. These are calculated from a cumulative distribution of the sound levels over the entire measurement duration and then determining the sound level at xx % of the time. These descriptors can be used to provide a more detailed analysis of the varying noise climate.

For purposes of this study, the following equivalent sound levels and statistical descriptors will be presented and discussed:

L_{eq}Day - Measured over the day-time (07:00 – 22:00)

L_{eq}Night - Measured over the night-time (22:00 – 07:00)

L_{10}
- Sound level that was exceeded only 10% of the time.
- Good measure of intermittent or intrusive noise

L_{50}
- Sound level that was exceeded 50% of the time (arithmetic average)
- Good to compare to L_{eq} to determine steadiness of noise

L_{90}
- sound level that was exceeded 90% of the time
- Good indicator of typical “ambient” noise levels

For further information, refer to Appendix II for a description of the acoustical terminology and Appendix III for a list of common noise sources and their associated noise levels.

6.0 Results and Discussion

6.1. Environmental Noise Monitoring

The results of the thirteen (13) 48-hour noise monitoring's have been provided in Table 2[1] and are presented in Figures 15 – 105. The figures include the 15-second broadband dBA and dBC L_{eq} sound levels[2], 1-hour dBA and dBC, L_{90}, L_{50}, L_{10} sound levels[3] and the 1/3 octave band L_{eq} sound levels[3] for each noise monitoring location. Table 2 provides results of each of the three daytime periods in addition to the isolated and non-isolated values for the two night-time periods. The isolation analysis for the night-time periods was performed in accordance with Section 4.3.2 of the AER Directive 038. A list of all non-typical noise events removed from each of the thirteen (13) noise monitoring's are provided in Appendix IV. Each event removed has been dated with its corresponding time period as well as the rationale for its removal. A detailed discussion of the results for each monitoring location can be found below.

Table 2. L_{eq} 24-Hour Results[4]

Noise Monitoring Location	1st Daytime Period	1st Night-time Period (Non-Isolated)	1st Night-time Period (Isolated)	2nd Daytime Period	2nd Night-time Period (Non-isolated)	2nd Night-time Period (Isolated)	3rd Daytime Period
	L_{eq}Day (dBA)	L_{eq}Night (dBA)		L_{eq}Day (dBA)	L_{eq}Night (dBA)		L_{eq}Day (dBA)
1C	56.7	55.5	50.8	57.1	54.7	46.8	56.3
2	58.5	61.2	49.9	55.0	57.7	50.0	56.9
3B	49.9	51.6	47.5	51.2	53.8	49.6	51.9
4C	51.9	47.6	47.2	42.9	41.5	40.5	45.5
5	55.2	53.2	53.0	53.4	53.2	53.0	51.9
6	40.4	47.9	46.2	58.2	47.9	46.4	58.4
7							
8A	46.8	49.7	49.6	48.9	49.7	49.5	53.6
9	52.9	48.5	46.6	51.8	50.5	47.9	53.1
10	57.8	55.3	52.2	55.9	55.1	53.1	56.6
11	44.8	49.0	45.8	52.8	48.1	43.8	57.7
12B (1st 48-hour)	46.7	43.7	36.0	46.4	46.4	36.6	50.8
12B (2nd 48-hour)	47.8	44.3	28.6	47.5	45.7	31.1	49.4
13	40.1	39.5	36.6	42.2	39.7	37.6	45.8

[1] The results of each location will be discussed individually.
[2] The data provided in the 15-second L_{eq} traces shows the 24-hour time period with the isolated night-time results, after removal of non-typical noise levels. This was done to indicate the relative steadiness of the noise levels and to make it easier to view the night-time data.
[3] Isolated and Non-isolated values are presented.
[4] The letters accompanying the noise monitoring location refers to their location.

6.1.1. Noise Monitoring Location 1C

The results of the noise monitoring conducted at Location 1 are provided in Table 2 and in Figures 15 - 21 The isolated L_{eq}Night values from Table 2 and the traces found in Figures 15 – 18 indicate relatively consistent noise levels at the start of both night-time periods. However, as indicated in Figure 16, there is drop in the noise levels from approximately 01:00 to 03:00 on the morning of July 26, 2018. This could account for the lower noise levels when compared to the previous night. Despite the lower noise levels during the July 25 -26, 2018 night-time period the 1/3 octave band L_{eq} sound levels found in Figures 21 show similar traces. They are both relatively broadband with a decrease in the higher frequencies (1.25 kHz and above) and an elevated peak in the 25 Hz band, which is consistent with the past three noise surveys (2015 – 2017).

When comparing the results and subjective observations from this year to previous years, the isolated values are representative of the typical noise climate of this area.

6.1.2. Noise Monitoring Location 2

The results of the noise monitoring conducted at Location 2 are provided in Table 2 and in Figures 22 - 28. The isolated L_{eq}Night values from Table 2 and the traces found in Figures 22 – 23 indicate very similar and consistent noise levels throughout both night-time periods. As noted in Appendix IV, the “non-typical” incidents included a relatively significant amount of rail activity. The removal of data due to the rail yard is consistent with previous years.

The isolated 1/3 octave figures indicate relatively broadband noise levels, particularly in the mid-frequency bands, with elevated noise levels in the lower (below 125 Hz) frequency bands which is consistent with the past three noise surveys (2015 – 2017).

Based on the results and subjective observations from previous years, the isolated values are representative of the typical noise climate of this area.

6.1.3. Noise Monitoring Location 3B

The results of the noise monitoring conducted at Location 3 are provided in Table 2 and in Figures 29 - 35. The isolated L_{eq}Night values indicate very consistent noise levels and traces between the two night-time periods in Figures 29 – 30 indicate varying noise levels throughout both night-time periods. When examining the 1/3 octave band spectral data there is a significant increase in the noise levels within the

100 Hz centre frequency band. This is more pronounced for the second night-time period and is consistent with values from the 2017 noise survey. This tonal low-frequency noise was observed during the site visit and was confirmed in the audio recording as well. Apart from the 100 Hz centre frequency band, the 1/3 octave band spectral data shows an increase in the 5 kHz – 8kHz centre frequency bands. This was also noted during the site visits and can be attributed to the adjacent facilities.

Based on the results and subjective observations, the isolated values are representative of the typical noise climate of this area and are consistent with the changes made to the area within the past year.

6.1.4. Noise Monitoring Location 4C

The results of the noise monitoring conducted at Location 4 are provided in Table 2 and in Figures 36 - 42. The isolated L_{eq}Night values from Table 2 and the traces found in Figures 36 – 39 indicate very consistent noise levels for the first night-time period while the second night has more varying noise levels. In reviewing the weather conditions, found in Appendix V, there were no parameters (wind speed, wind direction, etc.) that would account for the variance in noise levels between the two nights. However, it should be noted that this variation in noise level has occurred in previous measurement years at this location. In addition, subjective observations made in previous years have indicated that this location is highly influenced by small variations in meteorological conditions. Therefore, it is possible, that the variation can be attributed to small fluctuations in the weather conditions or possibly on the facilities' operations between the two nights.

In comparison to previous years however, the 1/3 octave band spectral data is not as consistent between both overnight periods. This would indicate that there was a change in the operational conditions at the site to the north. Based on the results and subjective observations from previous years the isolated values of the July 24 – 25, 2018 night-time period would be more representative of the typical noise climate of this area.

6.1.5. Noise Monitoring Location 5

The results of the noise monitoring conducted at Location 5 are provided in Table 2 and in Figures 43 - 49. Figures 43 – 46 indicate very consistent isolated 15-second L_{eq} traces throughout both night-time periods. This is further confirmed in Figures 47 – 48 where there are minimal differences between the L_{10}, L_{50} and L_{90} values which indicates that noise levels were relatively steady and are reflective of typical noise levels. In addition, in comparison to the 2017 noise survey, there were significantly less vehicle passages during the 2018 monitoring period. In addition, the 1/3 octave band spectral data is almost identical between both noise monitoring periods.

Based on the results and subjective observations from previous years, the isolated values are representative of the typical noise climate of this area.

6.1.6. Noise Monitoring Location 6

The results of the noise monitoring conducted at Location 6 are provided in Table 2 and in Figures 50 - 56.[1] The isolated L_{eq}Night values from Table 2 and the traces found in Figures 50 – 53 indicate relatively consistent noise levels for both night-time periods. In addition, the 1/3 octave band spectral data is very similar between both noise monitoring periods with noise levels that are relatively broadband across all frequencies.

When comparing the isolated noise levels and the subjective observations from previous years, the isolated values are representative of the typical noise climate of this area.

6.1.7. Noise Monitoring Location 7

As previously mentioned this noise monitoring location will no longer be used as a noise monitoring location due to the NWR refinery.

6.1.8. Noise Monitoring Location 8A

The results of the noise monitoring conducted at Location 8 are provided in Table 2 and in Figures 57 - 63. The traces found in Figures 57 – 60 indicate relatively consistent noise levels for both night-time periods. The isolated L_{eq}Night values and the 1/3 octave band spectral data is almost identical between both noise monitoring periods. This can likely be attributed to ideal weather conditions for this noise monitoring period in addition to consistent operations at the adjacent facilities.

[1] It should be noted that due to an equipment malfunction the day-time data from the initial setup up until 21:55 of June 18, 2018 was lost. However, no data from the night-time periods was lost and therefore the remaining day-time data is more than sufficient in representing typical daytime values.

Based on the similarity of the measured data and on the consistent weather conditions during the noise monitoring, it would be anticipated that the results from the 2018 noise monitoring are most reflective (in comparison to previous years) of the typical noise climate of this area.

6.1.9. Noise Monitoring Location 9

The results of the noise monitoring conducted at Location 9 are provided in Table 2 and in Figures 64 - 70. The isolated L_{eq}Night values and the traces found in Figures 64 – 67 indicate relatively consistent noise levels between the two night-time periods. However, as indicated in Figure 64, the noise levels are during the first night-time period varied more significantly with lower noise levels from 22:00 – 00:00. This could account for the lower noise levels relative to the second night-time period. Despite the lower noise levels during the June 18 - 19, 2018 night-time period the 1/3 octave band L_{eq} sound levels found in Figure 70 shows very similar traces for both nights. They are both relatively broadband with a gradual decrease from the lower frequencies to higher frequencies.

Based on the measured noise levels, subjective observations and the weather conditions during the two night-time periods it would be anticipated that the results from the 2018 noise monitoring are most reflective (in comparison to previous years) of the typical noise climate of this area.

6.1.10. Noise Monitoring Location 10

The results of the noise monitoring conducted at Location 10 are provided in Table 2 and in Figures 71 - 77. The isolated L_{eq}Night values indicate relatively consistent noise levels between the two nights. As noted in Appendix IV, the "non-typical" incidents included a relatively significant amount of vehicle traffic which is consistent with previous years. Similarly to previous years, it was subjectively noted that not one site dominated the noise climate of the area. Instead noise was distinctly audible from each the various surrounding facilities.

The 1/3 octave band L_{eq} sound levels are very consistent with previous years (2015 – 2017) in that the noise levels are relatively broadband from 100 Hz – 2kHz before they decrease as the frequency increases. As a result, the night-time isolated values are representative of the typical noise climate of this area.

6.1.11. Noise Monitoring Location 11

The results of the noise monitoring conducted at Location 11 are provided in Table 2 and in Figures 78 - 84. Similarly to the 2017 noise monitoring period, the isolated L_{eq}Night values from Table 2 indicate relatively consistent values between the two nights however the traces found in Figures 78 - 81 indicate varying noise levels for both night-time periods. Despite this, the isolated noise climate is relatively consistent when comparing the 1/3 octave band L_{eq} sound levels in Figure 84.

As noted in Appendix IV, the "non-typical" incidents included a relatively significant amount activity directly associated with the nearby rail yard. The removal of data due to the rail yard is consistent with previous years.

The general trace of the 1/3 octave band L_{eq} sound levels indicate elevated noise levels in the lower frequency bands that gradually decrease as the frequency increases. This is consistent with previous years (2015 – 2017), thus, the night-time isolated values are representative of the typical noise climate of this area

6.1.12. Noise Monitoring Location 12

The results of the noise monitoring conducted at Location 12 are provided in Table 2 and in Figures 85 - 98. As previously mentioned, this location was the independent control/reference point. Therefore, the results from this location span two (2) 48-hour monitoring periods.

Similarly to previous years (2015 – 2017), all night-time periods show a significant difference between the non-isolated L_{eq}Night noise levels in comparison to the isolated L_{eq}Night noise levels. This can be attributed to this location being relatively far any major facility[1], therefore most instances of vehicular traffic on Range Road 211 or rail activity along the nearby CP rail line dominate the noise climate. In addition, during the four (4) 2018 night-time periods there were significant noise contributions from crickets/frogs and after approximately 04:00, the morning rush (on Highway 211) and the morning chorus (birds chirping). These noise sources totally dominated the noise climate and thus large portions of this time period were removed.

[1] This location is approximately 2.3 km northeast of the ATCO Natural Gas Salt Cavern Storage Site.

In the absence of the vehicular or rail activity the 1/3 octave band L_{eq} sound levels indicate a similar trace to the other monitoring locations with elevated noise levels in the lower frequency bands (50 Hz – 80 Hz) that gradually decrease as the frequency increases.

6.1.13. Noise Monitoring Location 13

The results of the noise monitoring conducted at Location 13 are provided in Table 2 and in Figures 99 - 105. The isolated L_{eq}Night values from Table 2 and the traces found in Figures 99 – 102 indicate small variations between the night-time periods. The primary difference is illustrated in Figure 99 for the first night-time period where the noise levels are relatively low (between 20 – 30 dBA) until approximately 02:00. This variance can most likely be attributed to the operations at the facilities southeast of this site as there was no major change in weather conditions between the two nights.

Unlike the 2017 noise monitoring period, the 1/3 octave band spectral data is very consistent between the two noise monitoring periods. As a result, it would be anticipated that the night-time isolated values are representative of the typical noise climate of this area.

6.2. 2017 General Subjective Observations and Notes from Site Visits and Data Analysis

- The weather conditions during the 2018 summer were much more favorable in comparison to the 2017 monitoring period. As a result, for certain locations, it would be anticipated that the results from the 2018 noise monitoring are most reflective (in comparison to previous years) of the typical noise climate of their given area.
- The isolated noise levels and 1/3 octave band L_{eq} sound levels were relatively consistent to previous years.
- The noise arriving at most monitor locations consisted primarily of low frequency components that gradually decreased in noise level as the frequency increased.
- None of the sites indicated any specific low frequency tonal components.
- The noise from train passages was prevalent at all locations and tended to dominate the noise climate as they passed through, particularly when there were train whistles.
- At two locations, the rail activity (not just passages) dominated the noise climate and were very frequent.
- Similarly to the 2017 noise survey, the train passages were not as subjectively observed during the site visits, however the isolation analysis indicated a similar number of rail passages when compared to previous years (2015 – 2017).

6.3. Night-time Weather Conditions

As previously mentioned, 3 local weather monitoring stations were used throughout all noise monitoring periods to obtain the wind speed, wind direction, temperature, relative humidity, barometric pressure and rain fall data in 1-minute sampling periods. All weather data are presented in Appendix V. A brief discussion of each night-time period can be found below. The wind speeds throughout all night-time periods were below the limits of AER Directive 038. Therefore, the results found within Table 2 are considered in compliance with AER Directive 038.

6.3.1. June 18 – 19, 2018

Weather Monitor near Noise Monitor Location 6

The wind conditions during the night-time period were considered moderate to calm (between 5 – 8 km/hr, respectively). The wind direction varied[1] during the night-time period but was generally from the south. The temperature ranged from 12°C to 22°C and the relative humidity ranged from approximately 40% - 75%. The barometric pressure was consistent and flat at approximately 94 kPa. Lastly, there was no precipitation.

Weather Monitor near Noise Monitor Location 10

The wind conditions during the night-time period were considered moderate to calm (between 1 – 9 km/hr, respectively). The wind direction varied[2] during the night-time period but was generally from the south. The temperature ranged from 12°C to 22°C and the relative humidity ranged from approximately 45% - 83%. The barometric pressure was consistent and flat at approximately 94 kPa. Lastly, there was no precipitation.

Weather Monitor near Noise Monitor Location 12

The wind conditions during the night-time period were considered moderate to calm (primarily between 4 – 9 km/hr, respectively) apart from a short duration in which the wind increased above 10 km/hr. The wind direction varied[2] during the night-time period but was generally from the southwest. The temperature ranged from 11°C to 21°C and the relative humidity ranged from approximately 43% - 81%. The barometric pressure was consistent and flat at approximately 94kPa. Lastly, there was no precipitation.

[1] The wind direction fluctuates more greatly when wind speeds are below 5 km/hr and are essentially calm. In these instances, the wind direction has a minimal influence of the propagation of the sound.

6.3.2. June 19 – 20, 2018

Weather Monitor near Noise Monitor Location 6

In general the weather conditions at this location were similar to the previous night. The wind conditions during the night were considered moderate to calm (between 5 – 8 km/hr, respectively). The wind direction varied[1] during the night-time period but was generally from the south. The temperature ranged from 14°C to 23°C and the relative humidity ranged from approximately 40% - 73%. The barometric pressure was consistent and flat at approximately 94 kPa and there was no precipitation.

Weather Monitor near Noise Monitor Location 10

The wind conditions during the night-time period were considered moderate to calm (between 5 – 8 km/hr, respectively) apart from a short duration in which the wind increased above 10 km/hr. The wind direction varied[1] during the night-time period but was generally from the south. The temperature ranged from 13°C to 23°C and the relative humidity ranged from approximately 41% - 72%. The barometric pressure was consistent and flat at approximately 94 kPa and there was no precipitation.

Weather Monitor near Noise Monitor Location 12

The wind conditions during the night were considered moderate to calm (between 3 – 10 km/hr, respectively). The wind direction varied[1] during the night-time period but was generally from the southwest. The temperature ranged from 12°C to 23°C and the relative humidity ranged from approximately 40% - 78%. The barometric pressure was consistent and flat at approximately 94 kPa and there was no precipitation.

[1] The wind direction fluctuates more greatly when wind speeds are below 5 km/hr and are essentially calm. In these instances, the wind direction has a minimal influence of the propagation of the sound.

6.3.3. July 24 – 25, 2018

Weather Monitor near Noise Monitor Location 1

The wind conditions throughout the night-time period were considered calm (below 5 km/hr). The wind direction varied[1] during the night-time period but was generally from the south. The temperature ranged from 7°C to 15°C and the relative humidity ranged from approximately 60% - 89%. The barometric pressure was consistent and relatively flat at approximately 95 kPa. Lastly, there was no precipitation.

Weather Monitor near Noise Monitor Location 12

The wind conditions during the night-time period were considered moderate to calm (between 2 – 7 km/hr). The wind direction varied[1] during the night-time period but was primarily from the south-southwest. The temperature ranged from 4°C to 14°C and the relative humidity ranged from approximately 68% - 90%. The barometric pressure was consistent and relatively flat at approximately 95 kPa. Lastly, there was no precipitation.

Weather Monitor near Noise Monitor Location 13

The wind conditions during the night-time period were considered calm (below 5 km/hr). The wind direction varied[1] during the night-time period with no dominant direction. The temperature ranged from 4°C to 12°C and the relative humidity ranged from approximately 76% - 93%. The barometric pressure was consistent and relatively flat at approximately 95 kPa. Lastly, there was no precipitation.

[1] The wind direction fluctuates more greatly when wind speeds are below 5 km/hr and are essentially calm. In these instances, the wind direction has a minimal influence of the propagation of the sound.

6.3.4. July 25 – 26, 2018

Weather Monitor near Noise Monitor Location 1

The wind conditions throughout the night-time period were considered calm (primarily below 5 km/hr). The wind direction varied[1] during the night-time period with no dominant direction. The temperature ranged from 9°C to 16°C and the relative humidity ranged from approximately 70% - 89%. The barometric pressure was consistent and relatively flat at approximately 95 kPa. Lastly, there was no precipitation.

Weather Monitor near Noise Monitor Location 12

The wind conditions during the night-time period were considered calm (primarily below 5 km/hr). The wind direction varied[1] during the night-time period but was primarily from the northeast. The temperature ranged from 7°C to 14°C and the relative humidity ranged from approximately 74% - 90%. The barometric pressure was consistent and relatively flat at approximately 95 kPa. Lastly, there was no precipitation.

Weather Monitor near Noise Monitor Location 13

In general the weather conditions at this location were similar to the previous night with very calm wind conditions. The wind direction varied[1] during the night-time period with no dominant direction. The temperature ranged from 6°C to 14°C and the relative humidity ranged from approximately 80% - 92%. The barometric pressure was consistent and flat at approximately 95 kPa and there was no precipitation.

[1] The wind direction fluctuates more greatly when wind speeds are below 5 km/hr and are essentially calm. In these instances, the wind direction has a minimal influence of the propagation of the sound.

7.0 Conclusion

As part of the study, a total of thirteen (13) 48-hour noise monitorings were conducted throughout the Alberta's Industrial Heartland. It was found that the isolated L_{eq}Night broadband and 1/3 octave band L_{eq} sound levels were similar to those from previous measurements. In certain cases, due to ideal weather conditions, it would be anticipated that the results from the 2018 noise monitoring are most reflective (in comparison to previous years) of the typical noise climate of their given area.

The noise levels at most locations consisted of low frequency components with occasional mid/high frequency components that could be attributed to the nearest facility relative to each individual noise monitoring location. Despite the noise being relatively low in frequency, none of the sites indicated any low frequency tonal components. The noise from train passages was again prevalent at all locations and tended to dominate the noise climate as they passed through. This was particularly true for locations within proximity to a rail line and for locations further away from any of the large industrial sites.

8.0 References

- *Environmental Noise Survey for the Regional Noise Model Annual Field Validation Monitoring,* prepared for the NCIA by aci Acoustical Consultants Inc., (2015 – 2017)
- Alberta Energy Regulator (AER), *Directive 038 on Noise Control, 2007*, Calgary, Alberta
- International Organization for Standardization (ISO), *Standard 1996-1, Acoustics – Description, measurement and assessment of environmental noise – Part 1: Basic quantities and assessment procedures, 2003*, Geneva Switzerland.
- International Organization for Standardization (ISO), *Standard 9613-1, Acoustics – Attenuation of sound during propagation outdoors – Part 1: Calculation of absorption of sound by the atmosphere, 1993*, Geneva Switzerland.
- International Organization for Standardization (ISO), *Standard 9613-2, Acoustics – Attenuation of sound during propagation outdoors – Part 2: General method of calculation, 1996*, Geneva Switzerland.

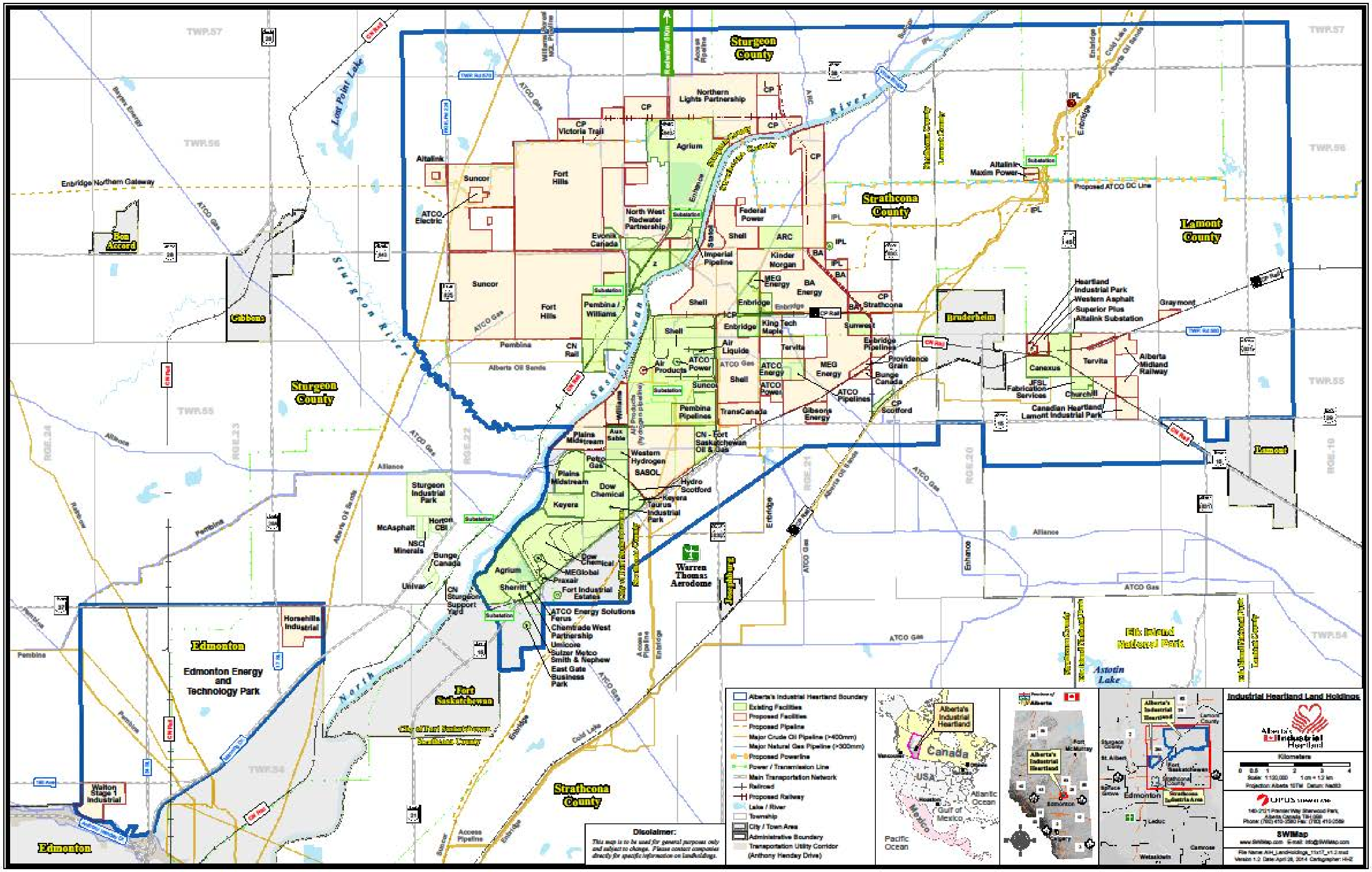

Figure 1. Study Area

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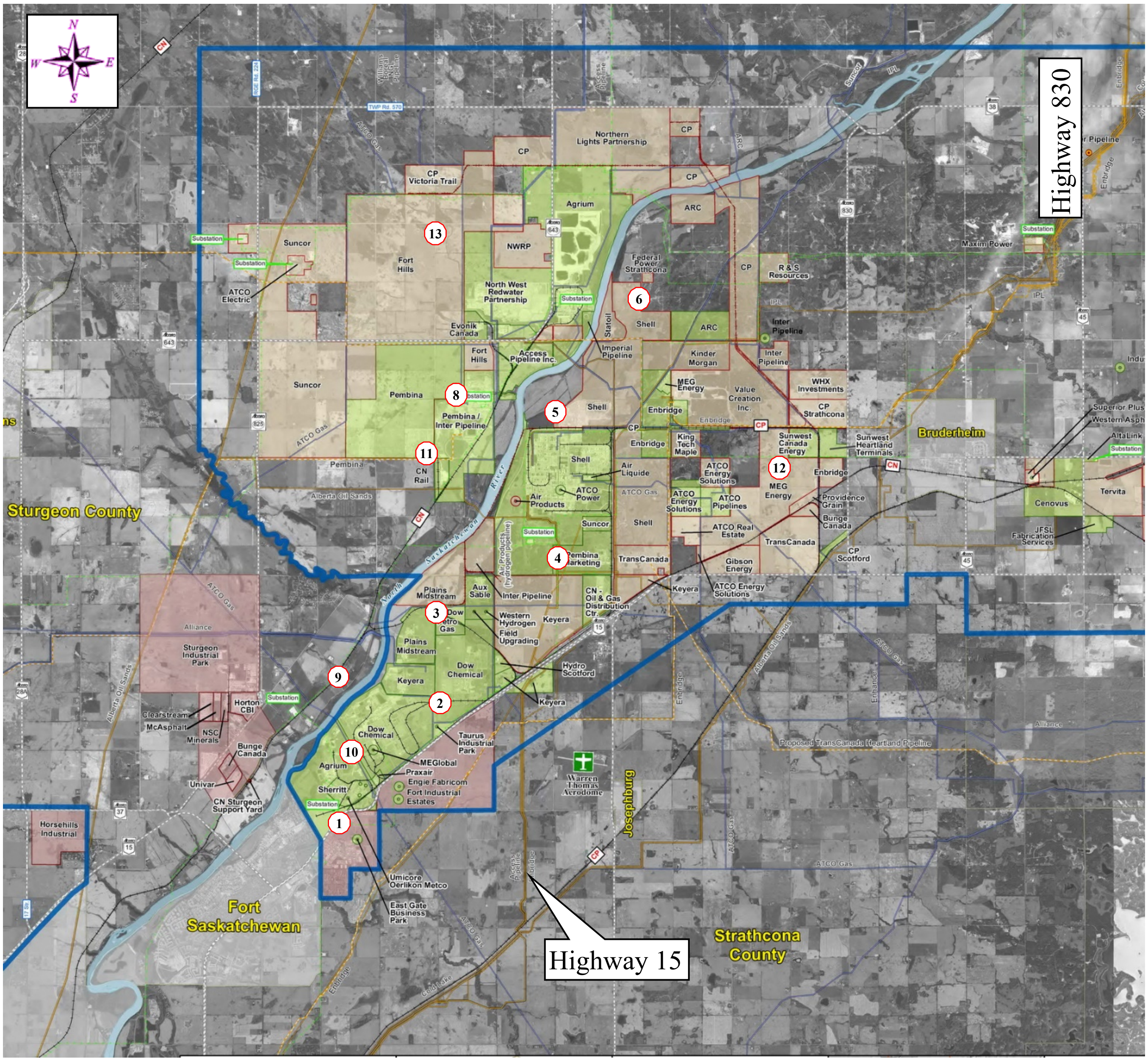

Figure 2. 2017 Study Area (With Noise Monitoring Locations)

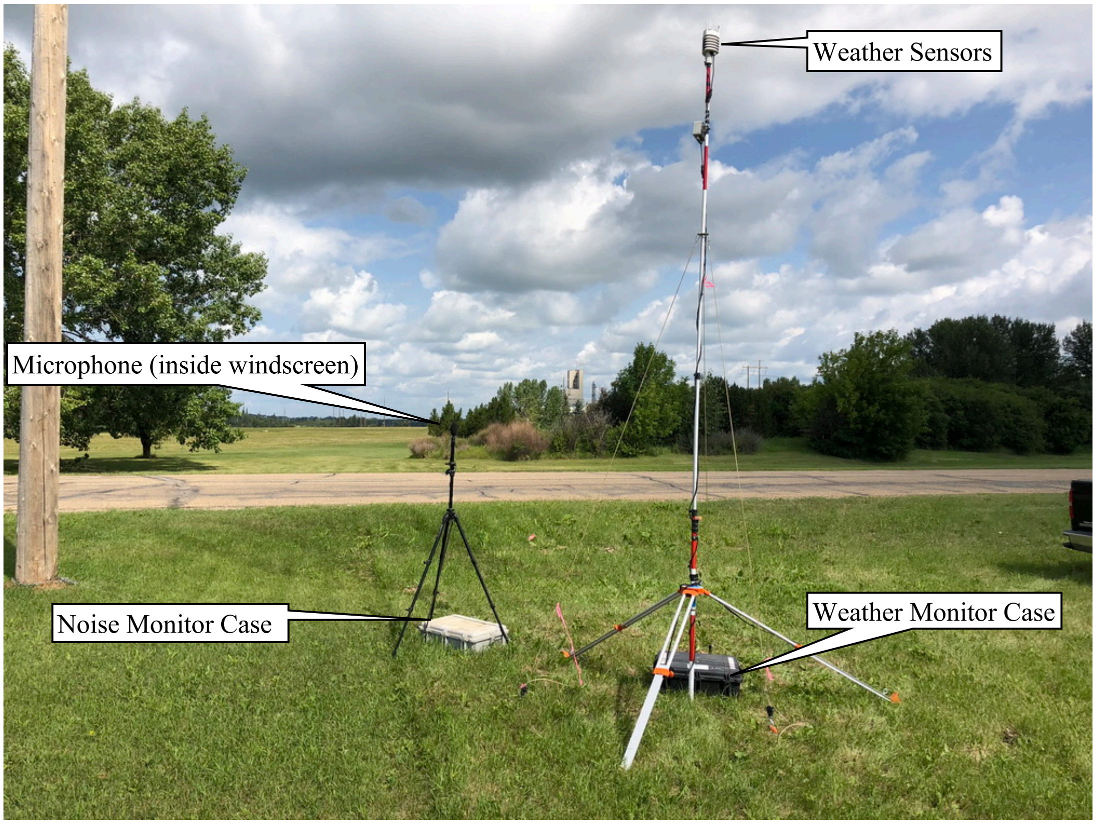

Figure 3. Noise Monitor #1 (With Weather Monitor)

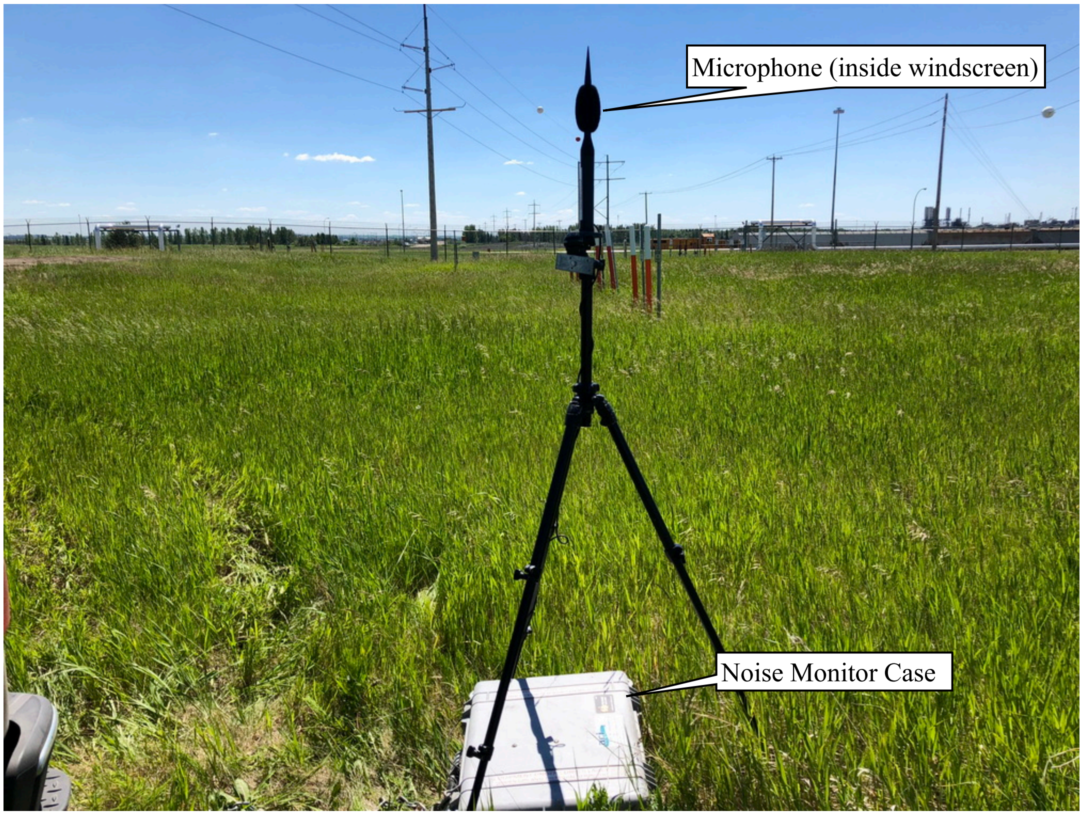

Figure 4. Noise Monitor #2

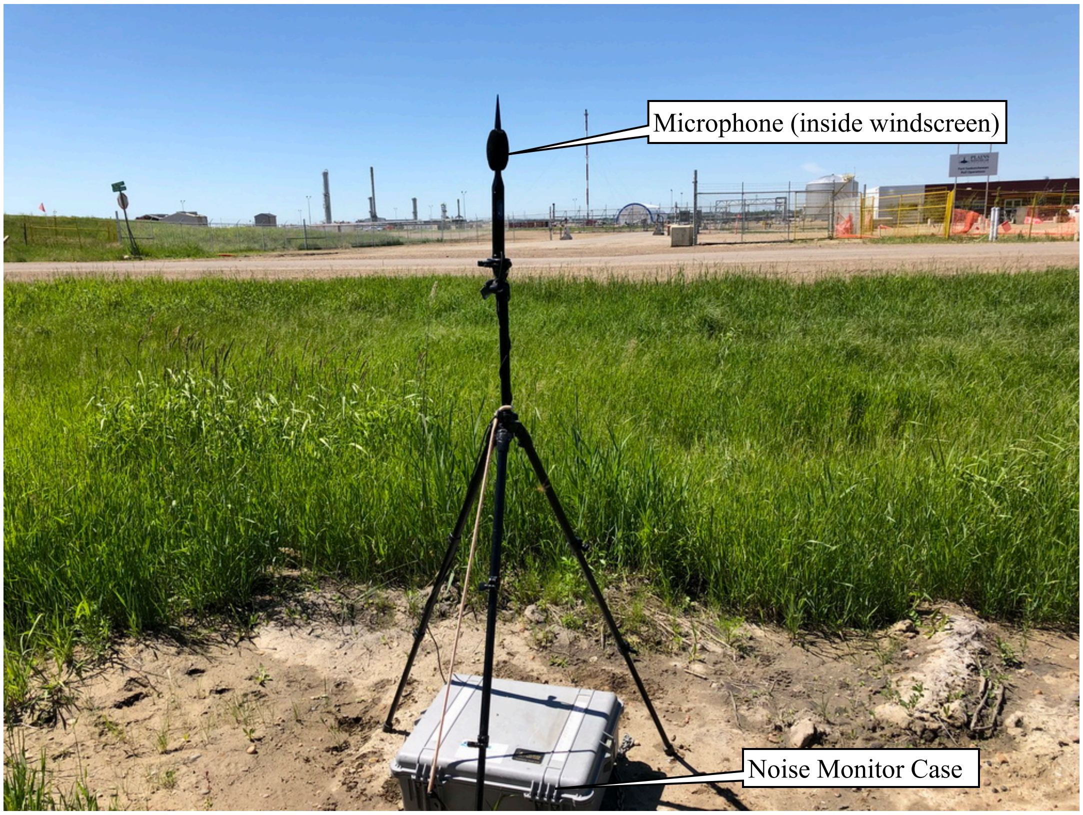

Figure 5. Noise Monitor #3

Figure 6. Noise Monitor #4

Figure 7. Noise Monitor #5

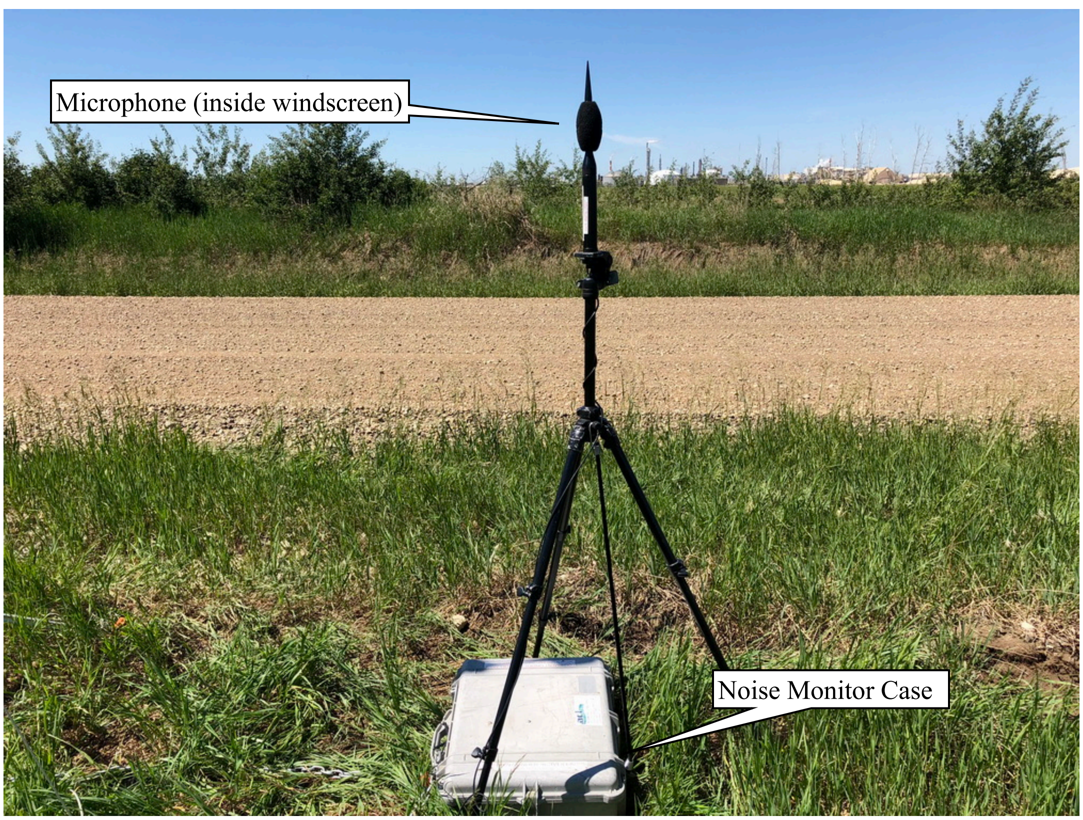

Figure 8. Noise Monitor #6

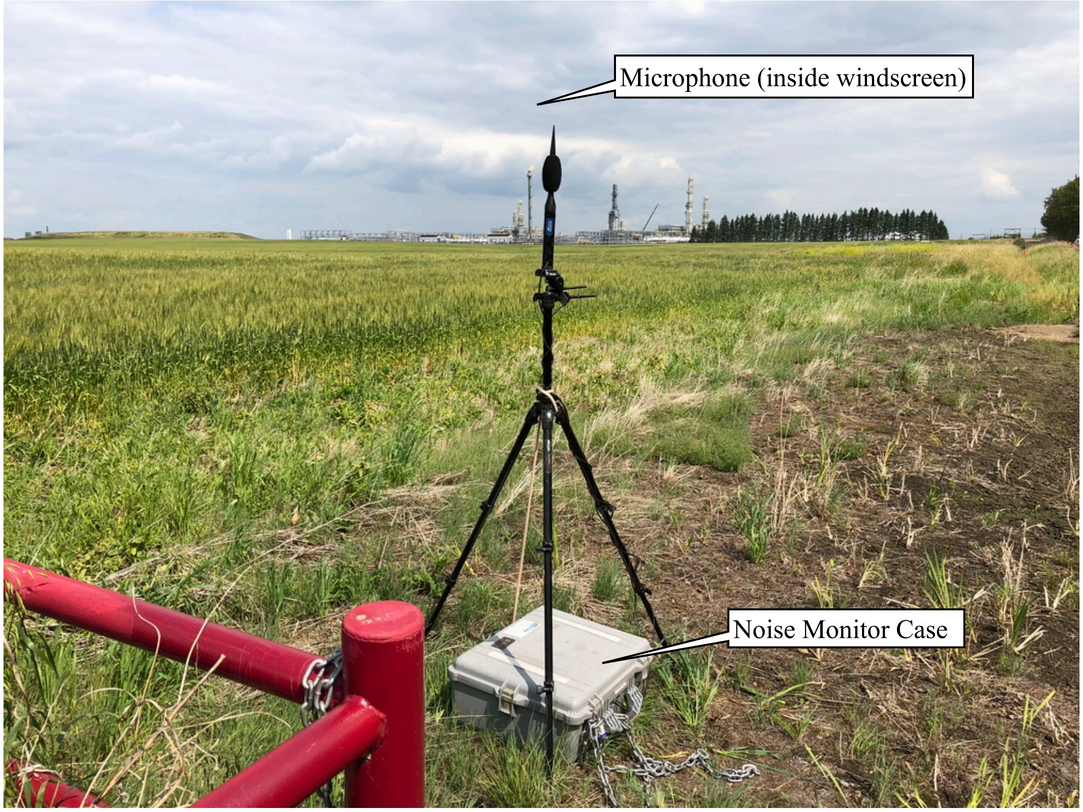

Figure 9. Noise Monitor #8

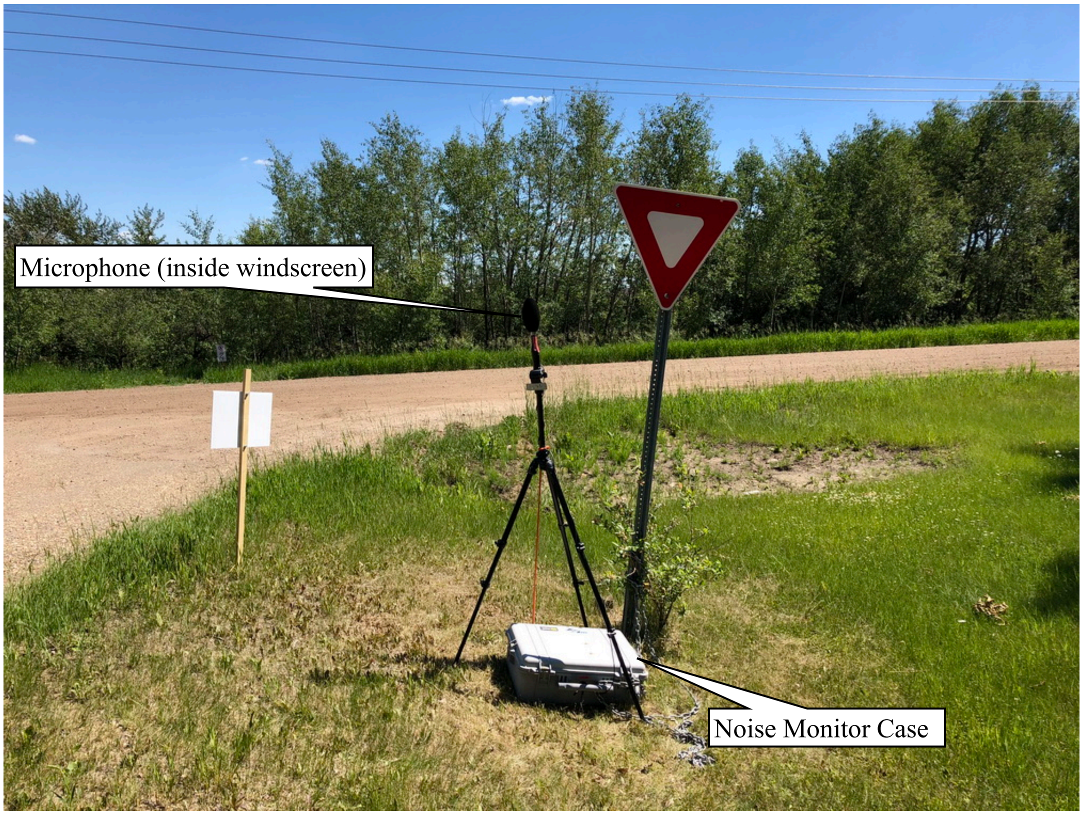

Figure 10. Noise Monitor #9

Figure 11. Noise Monitor #10

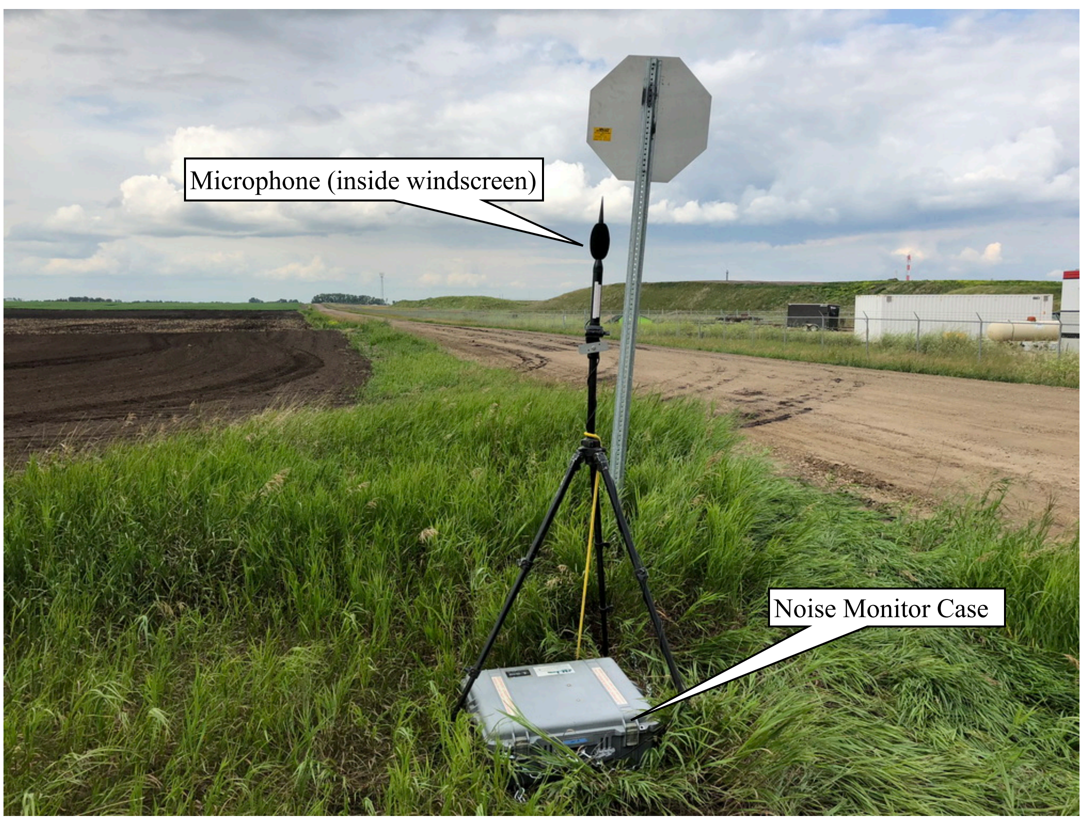

Figure 12. Noise Monitor #11

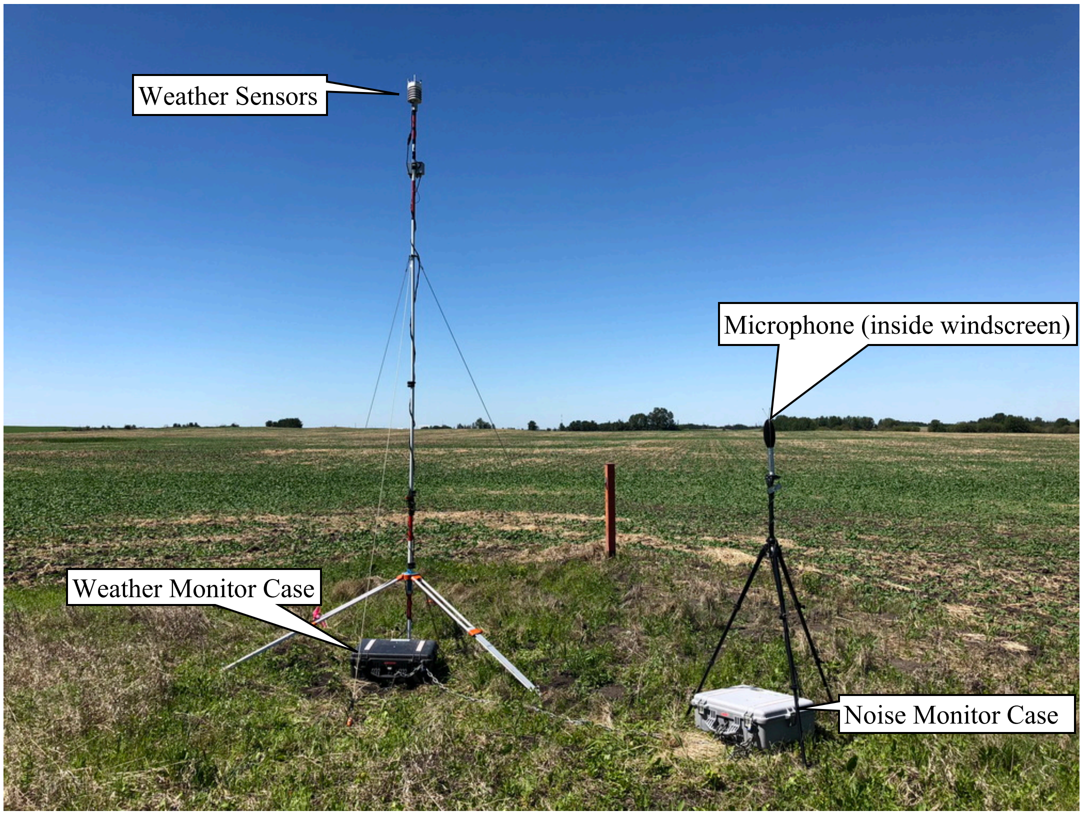

Figure 13. Noise Monitor #12 (Control Site w/ Weather Monitor)

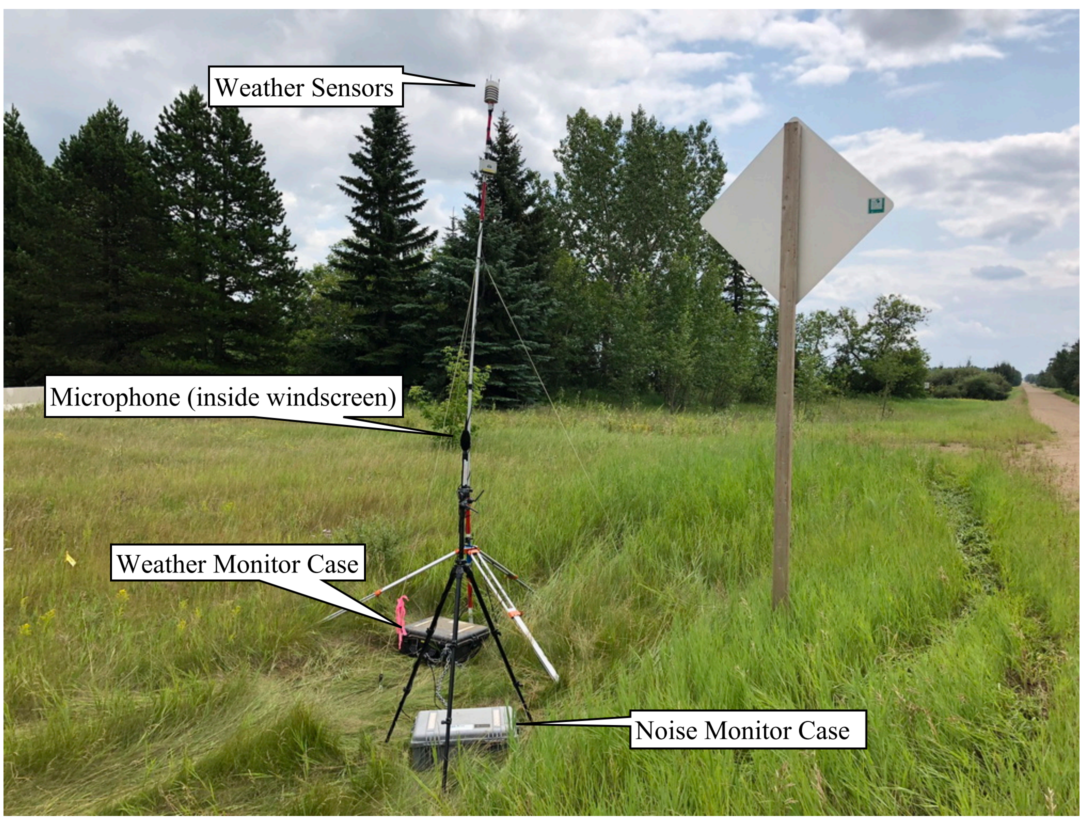

Figure 14. Noise Monitor #13

Noise Monitor #1

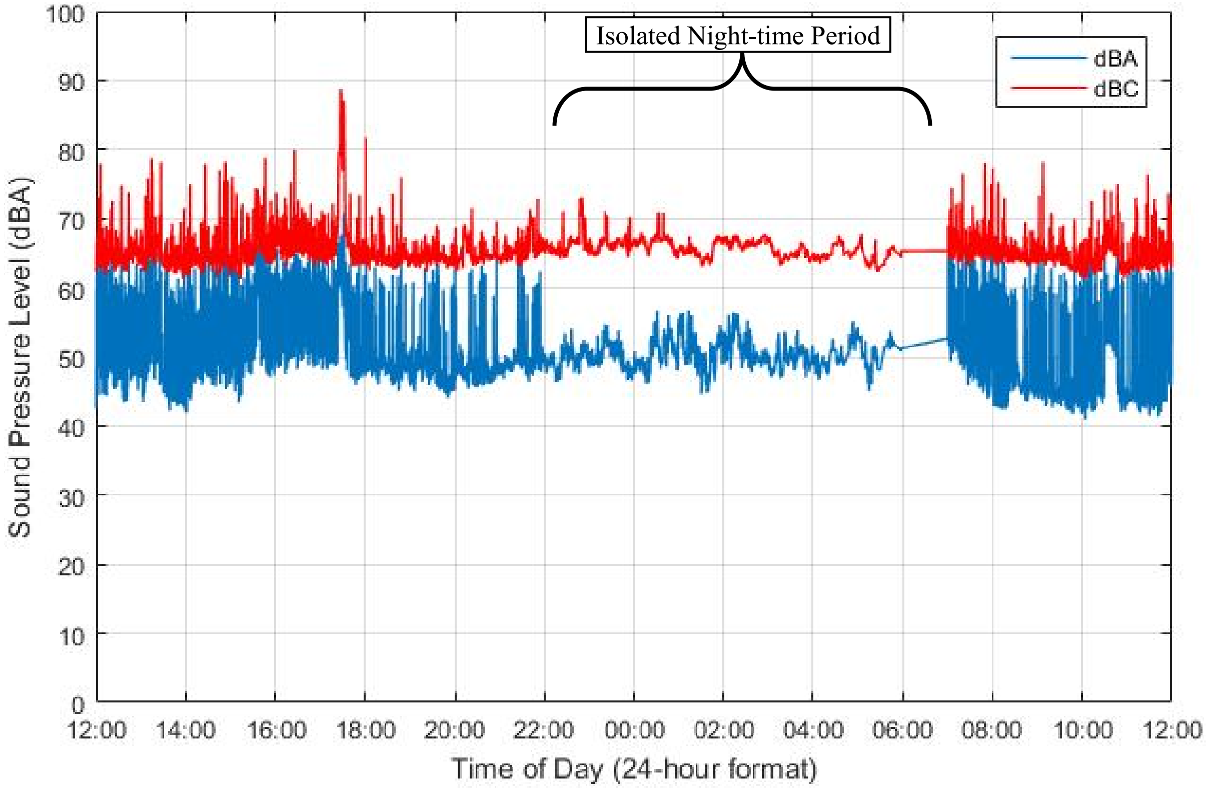

Figure 15. Noise Monitor #1, 15-Second L_{eq} Sound Levels (July 24 - 25, 2018)

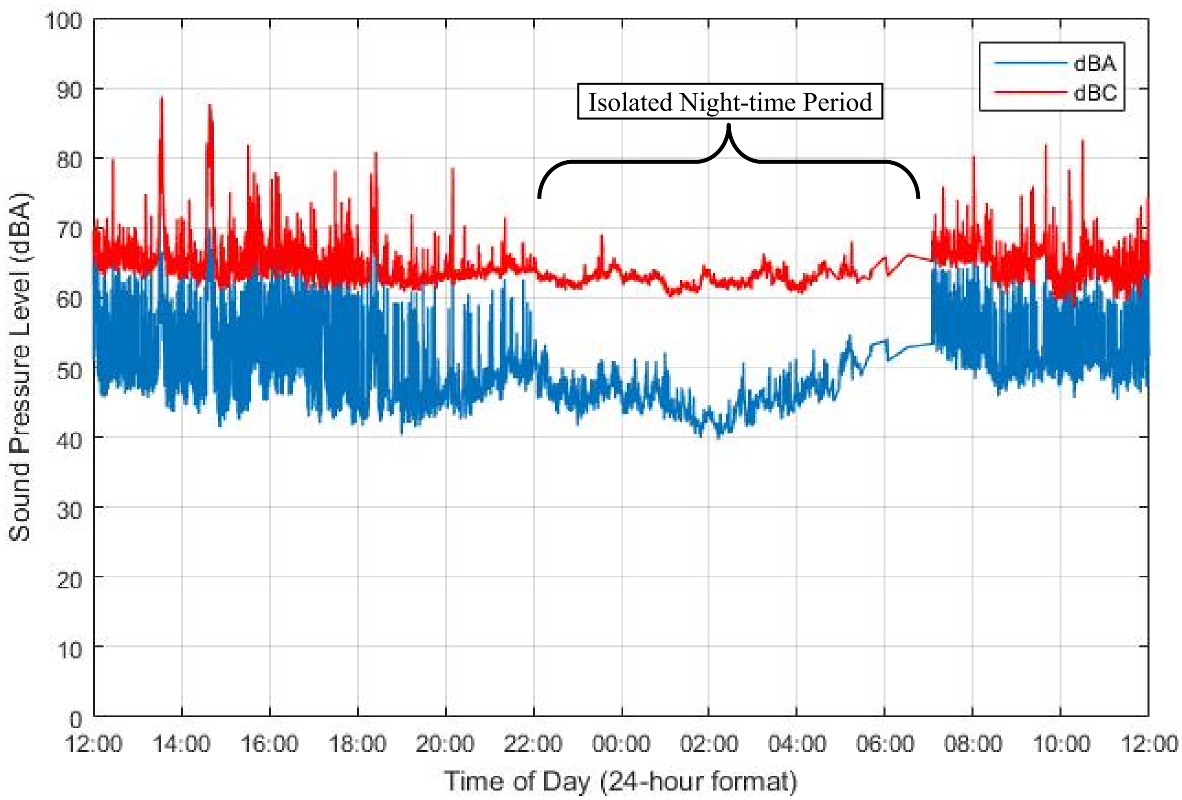

Figure 16. Noise Monitor #1, 15-Second L_{eq} Sound Levels (July 25 - 26, 2018)

Noise Monitor #1

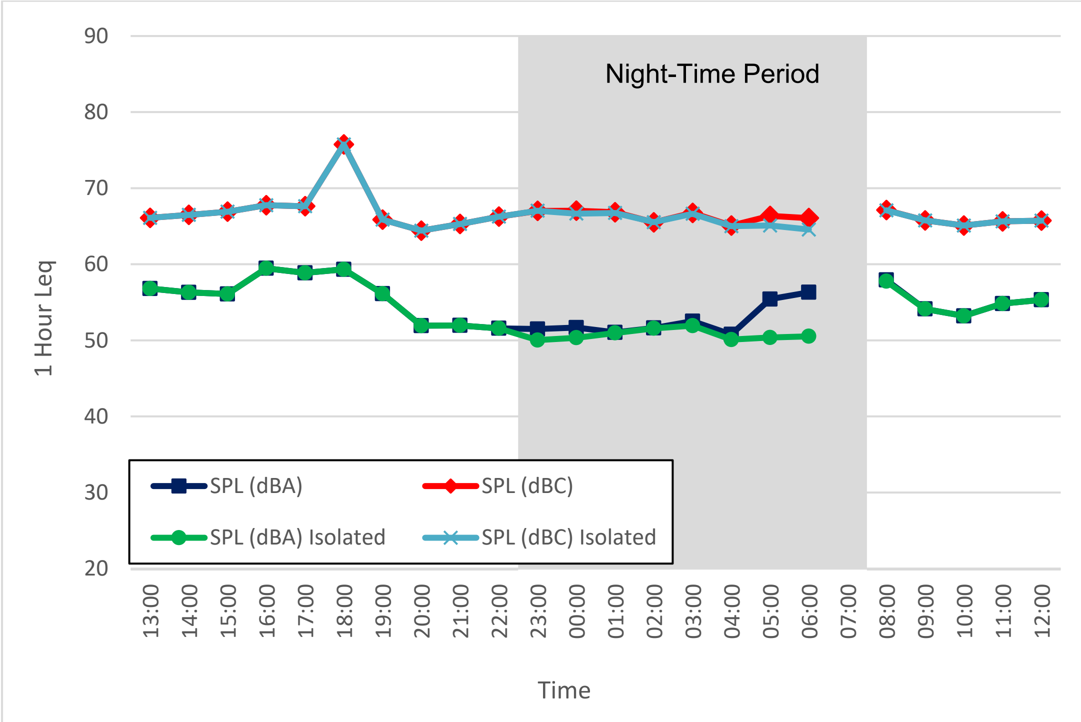

Figure 17. Noise Monitor #1, 1-Hour L_{eq} Sound Levels (July 24 - 25, 2018)[1]

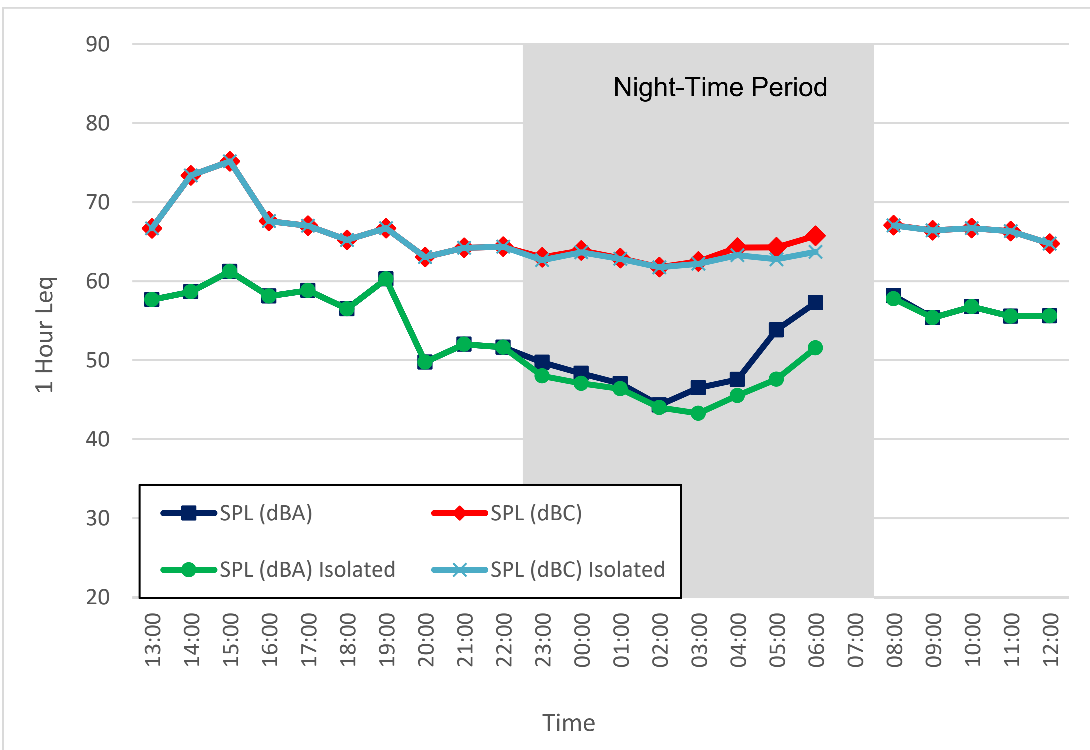

Figure 18. Noise Monitor #1, 1-Hour L_{eq} Sound Levels (July 25 - 26, 2018)[1]

[1] Again, it should be noted that data from 06:00 to 07:00 was entirely removed due to traffic along the adjacent road.

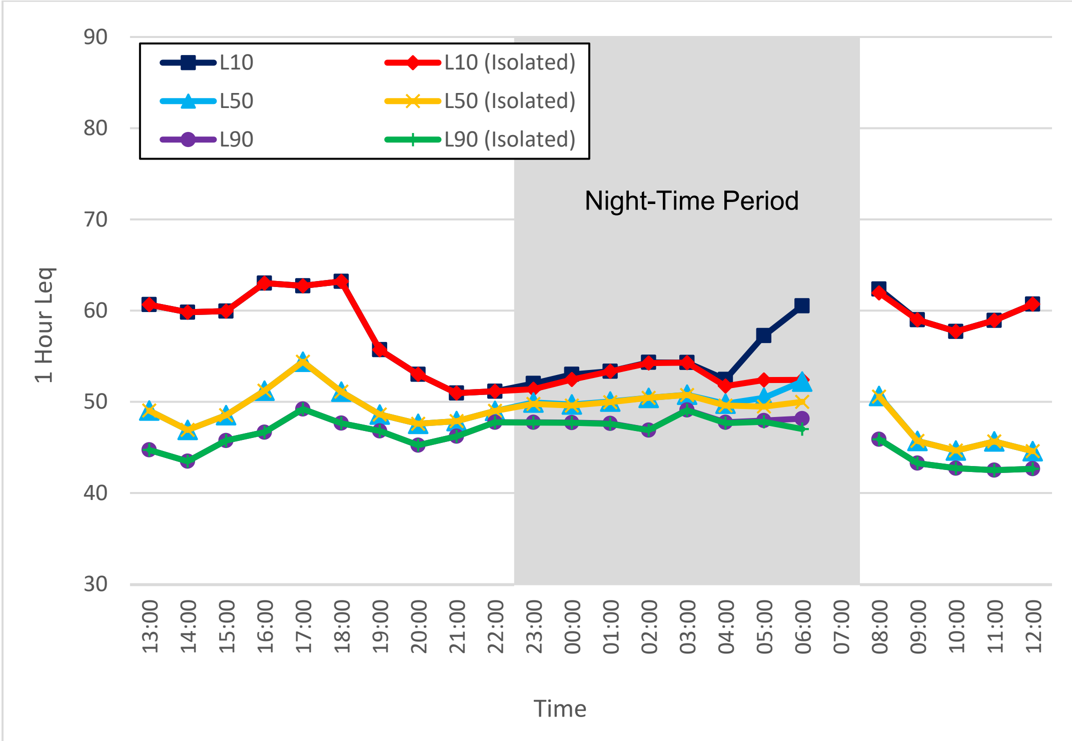

Figure 19. Noise Monitor #1, 1-Hour L_{10}, L_{50}, L_{90} L_{eq} Sound Levels (July 24 - 25, 2018)[1]

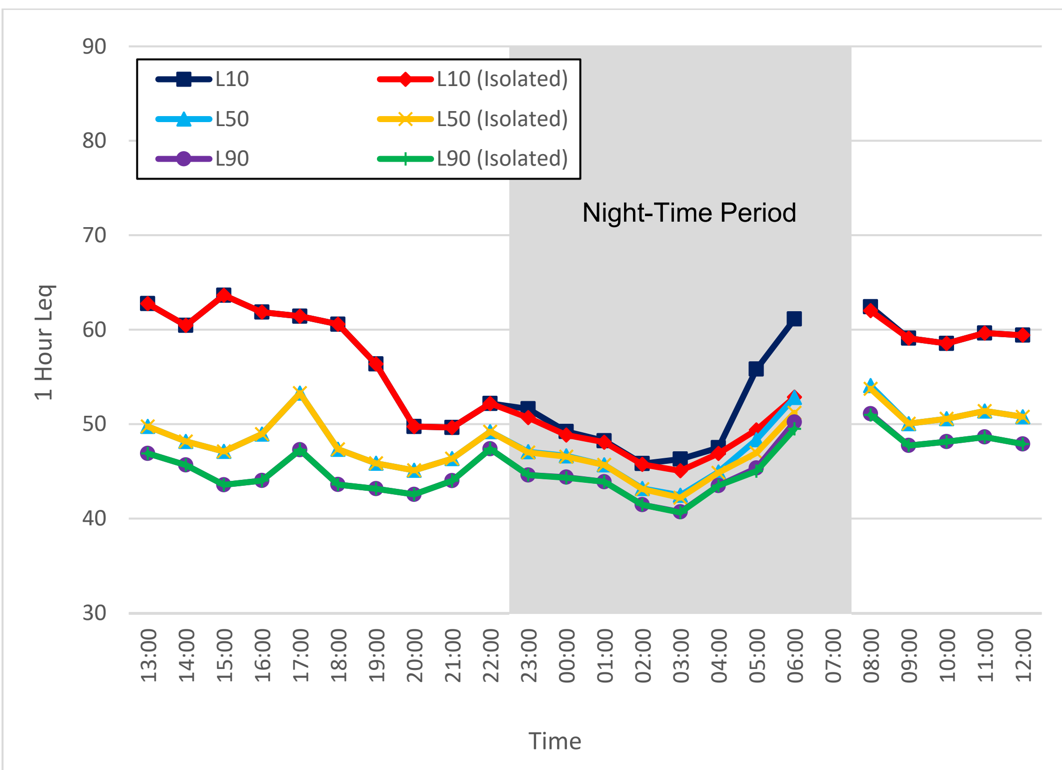

Figure 20. Noise Monitor #1, 1-Hour L_{10}, L_{50}, L_{90} L_{eq} Sound Levels (July 25 - 26, 2018)[1]

[1] Again, it should be noted that data from 06:00 to 07:00 was entirely removed due to traffic along the adjacent road.

Noise Monitor #1

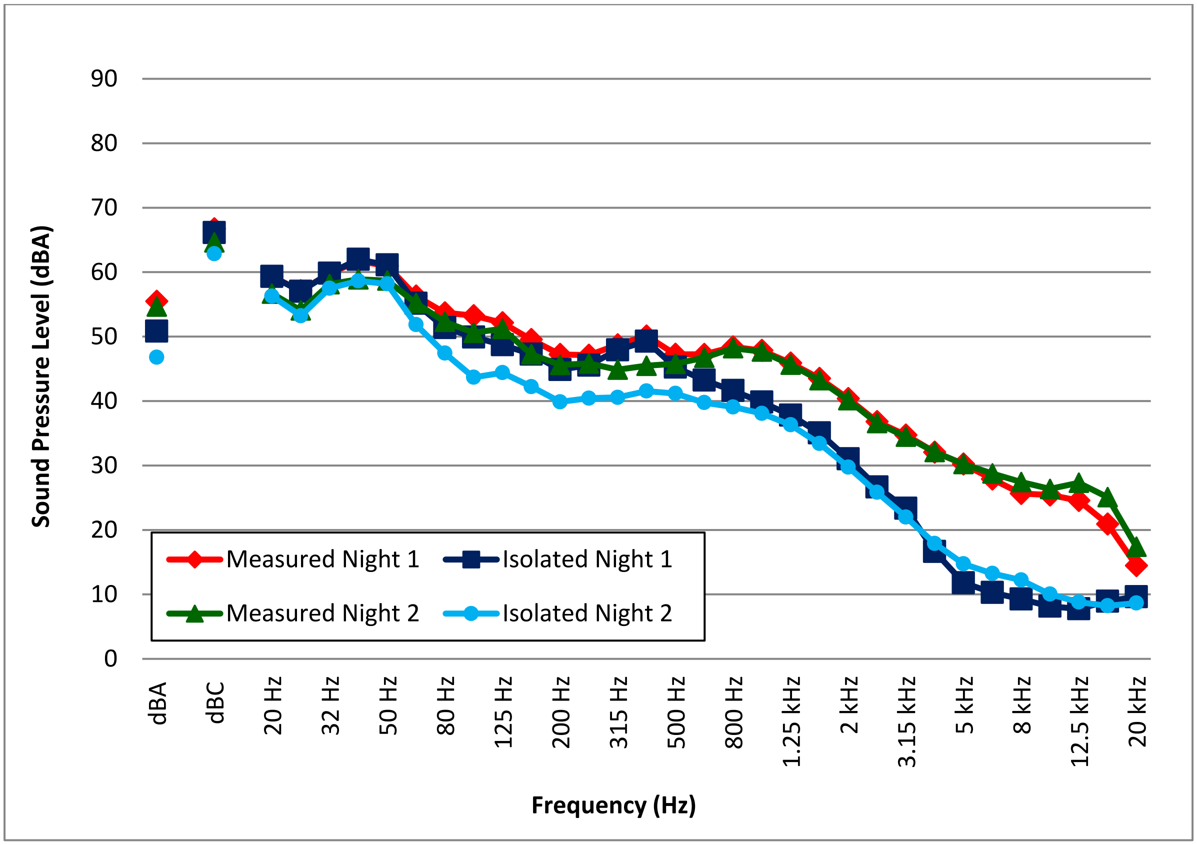

Figure 21. Noise Monitor #1, 1/3 Octave L_{eq} Sound Levels (July 24 - 26, 2018)

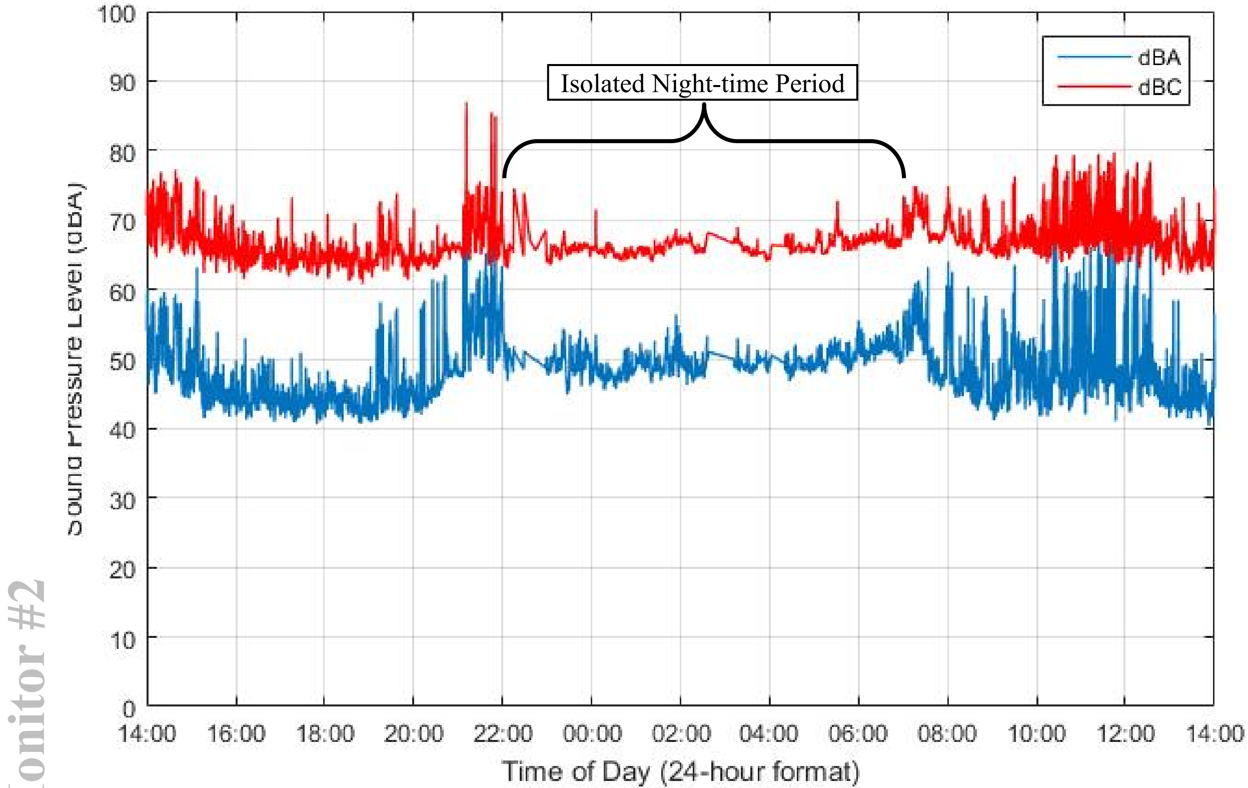

Figure 22. Noise Monitor #2, 15-Second L_{eq} Sound Levels (June 18 - 19, 2018)

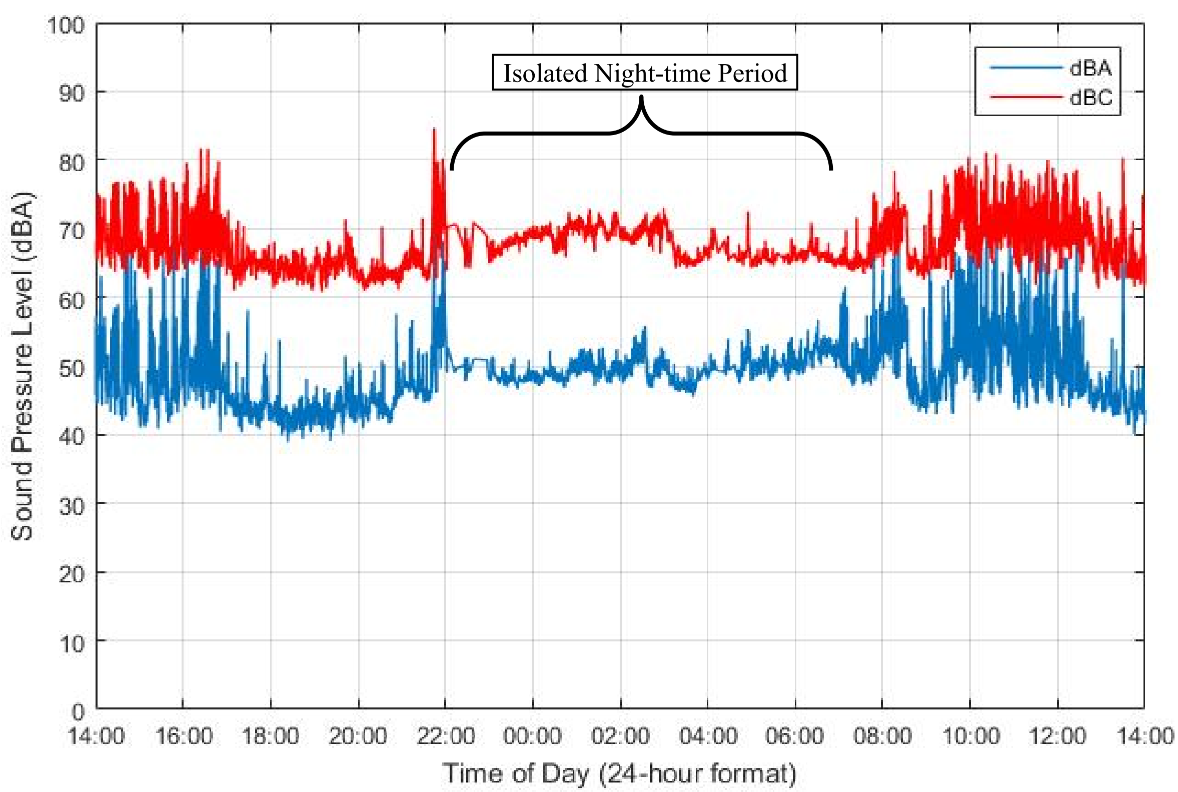

Figure 23. Noise Monitor #2, 15-Second L_{eq} Sound Levels (June 19 - 20, 2018)

Noise Monitor #2

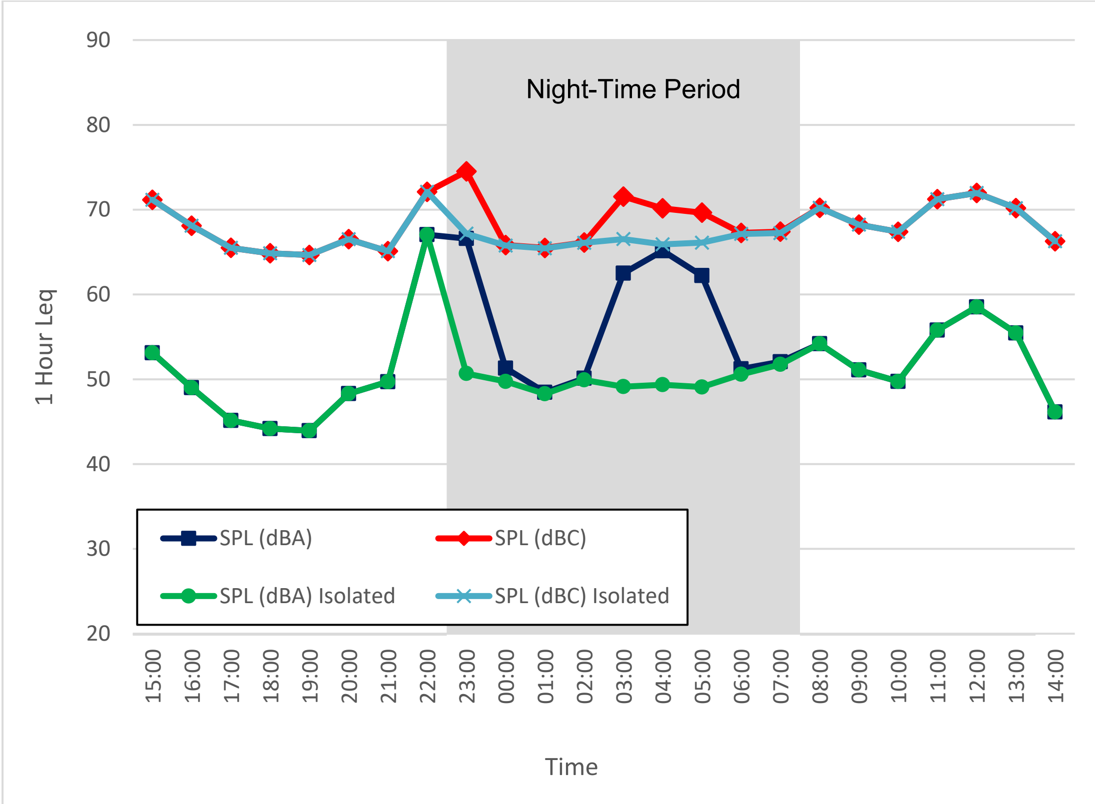

Figure 24. Noise Monitor #2, 1-Hour L_{eq} Sound Levels (June 18 - 19, 2018)

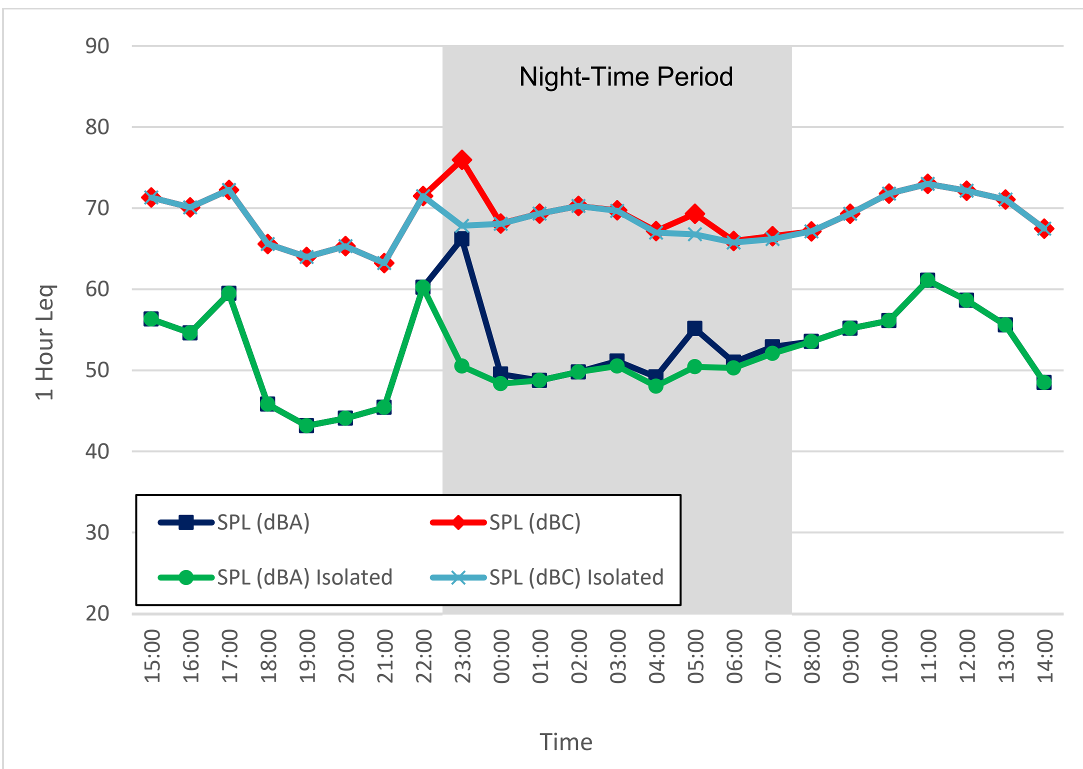

Figure 25. Noise Monitor #2, 1-Hour L_{eq} Sound Levels (June 19 - 20, 2018)

Noise Monitor #2

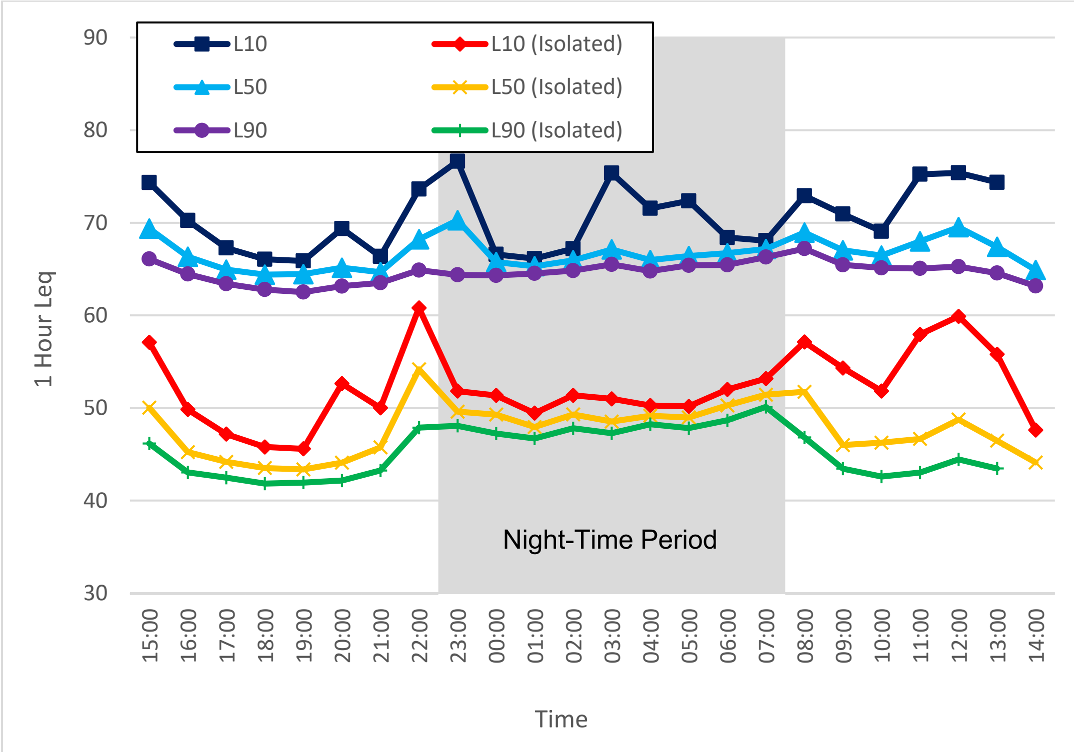

Figure 26. Noise Monitor #2, 1-Hour L_{10}, L_{50}, L_{90} L_{eq} Sound Levels (June 18 - 19, 2018)

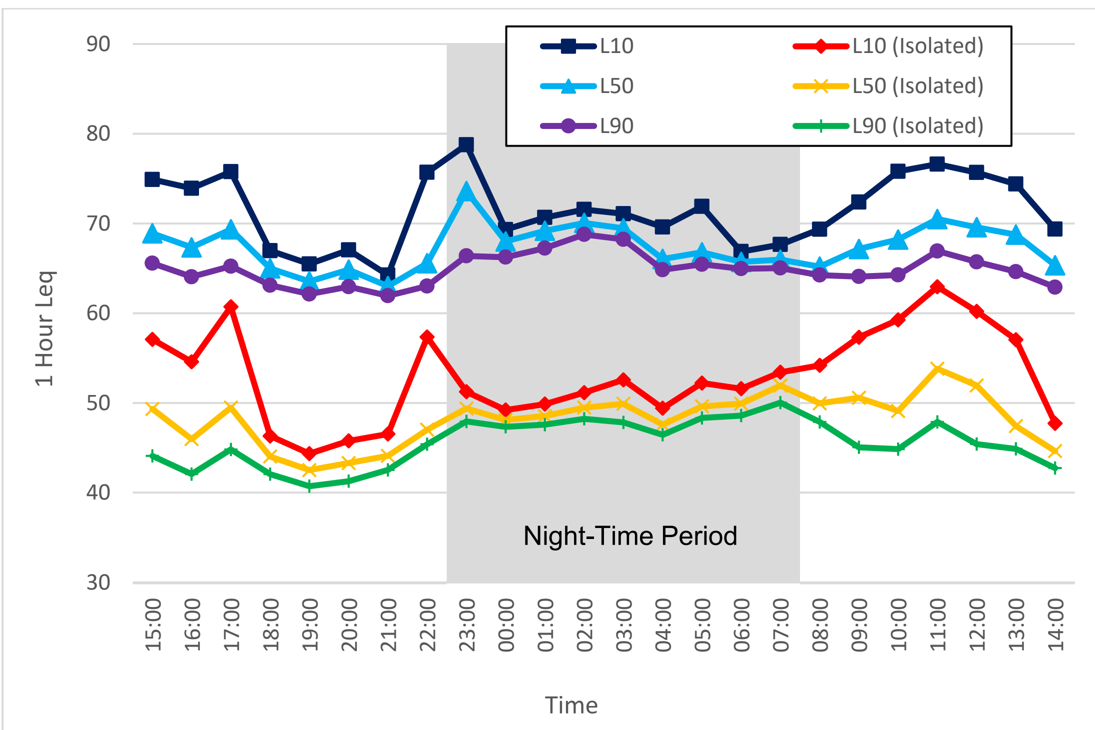

Figure 27. Noise Monitor #2, 1-Hour L_{10}, L_{50}, L_{90} L_{eq} Sound Levels (June 19 - 20, 2018)

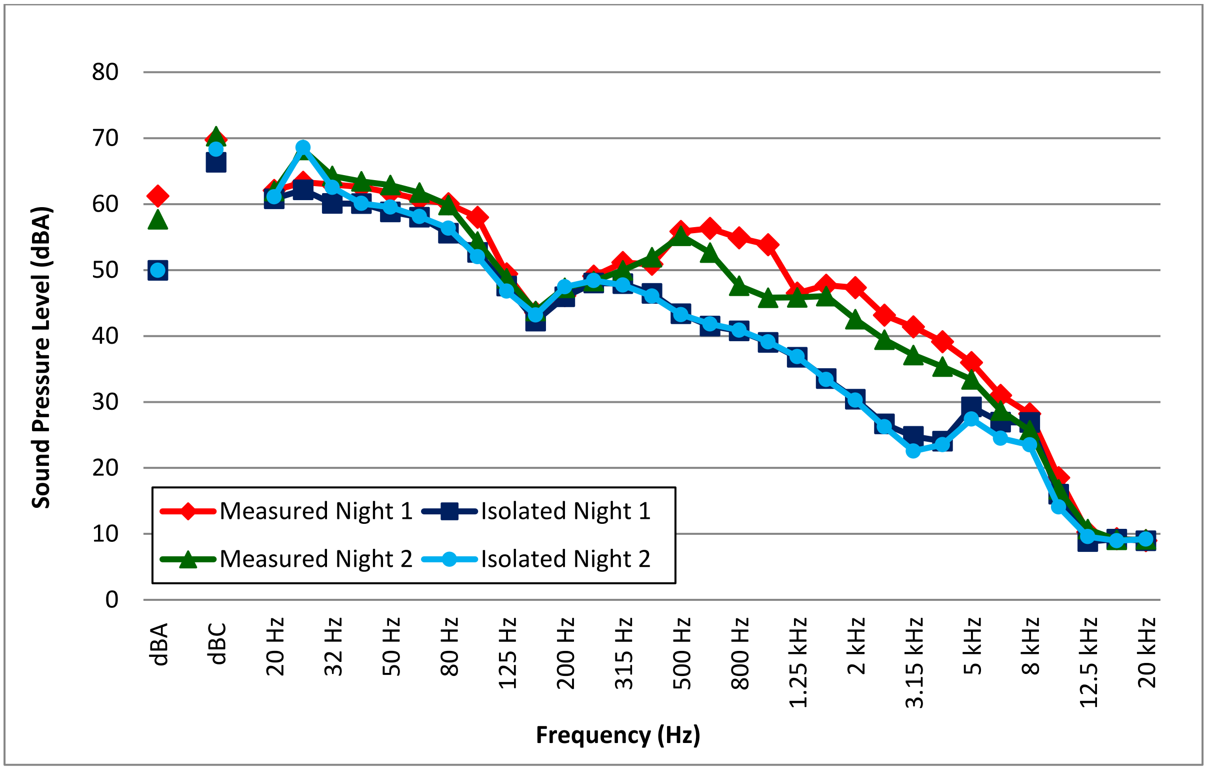

Figure 28. Noise Monitor #2, 1/3 Octave L_{eq} Sound Levels (June 18 – 20, 2018)

Noise Monitor #3

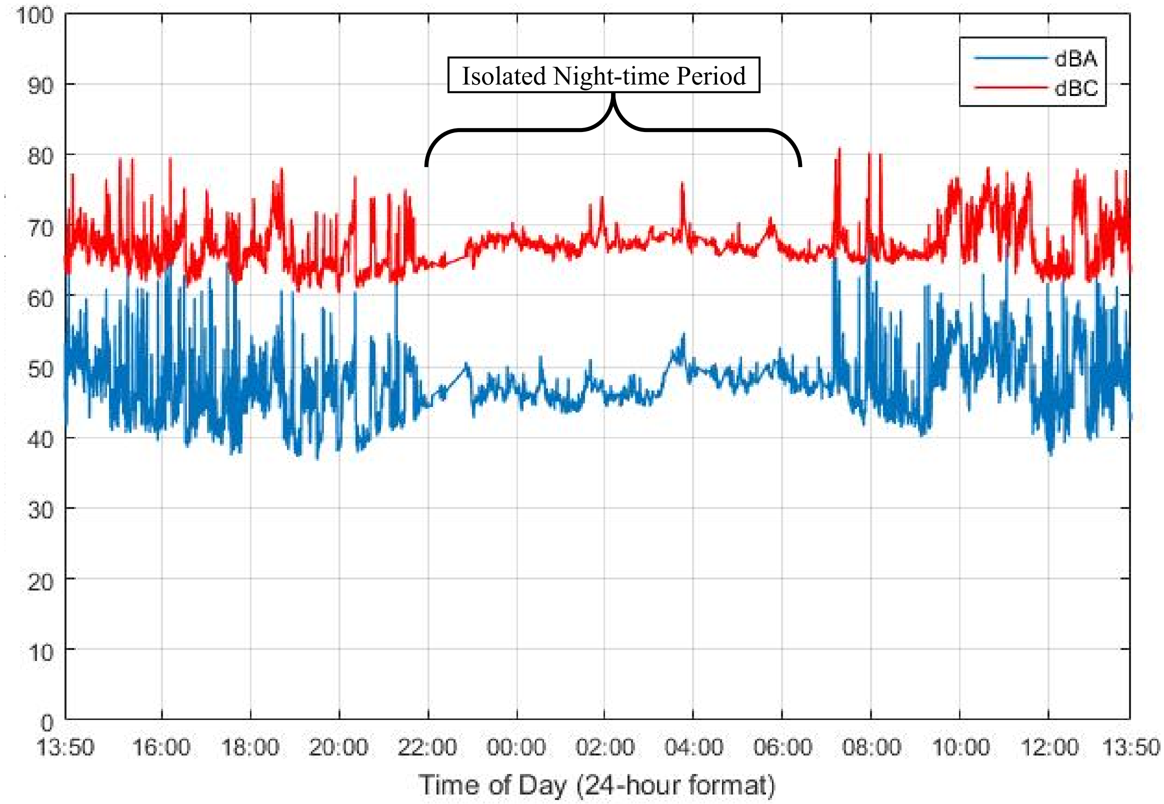

Figure 29. Noise Monitor #3, 15-Second L_{eq} Sound Levels (June 18 - 19, 2018)

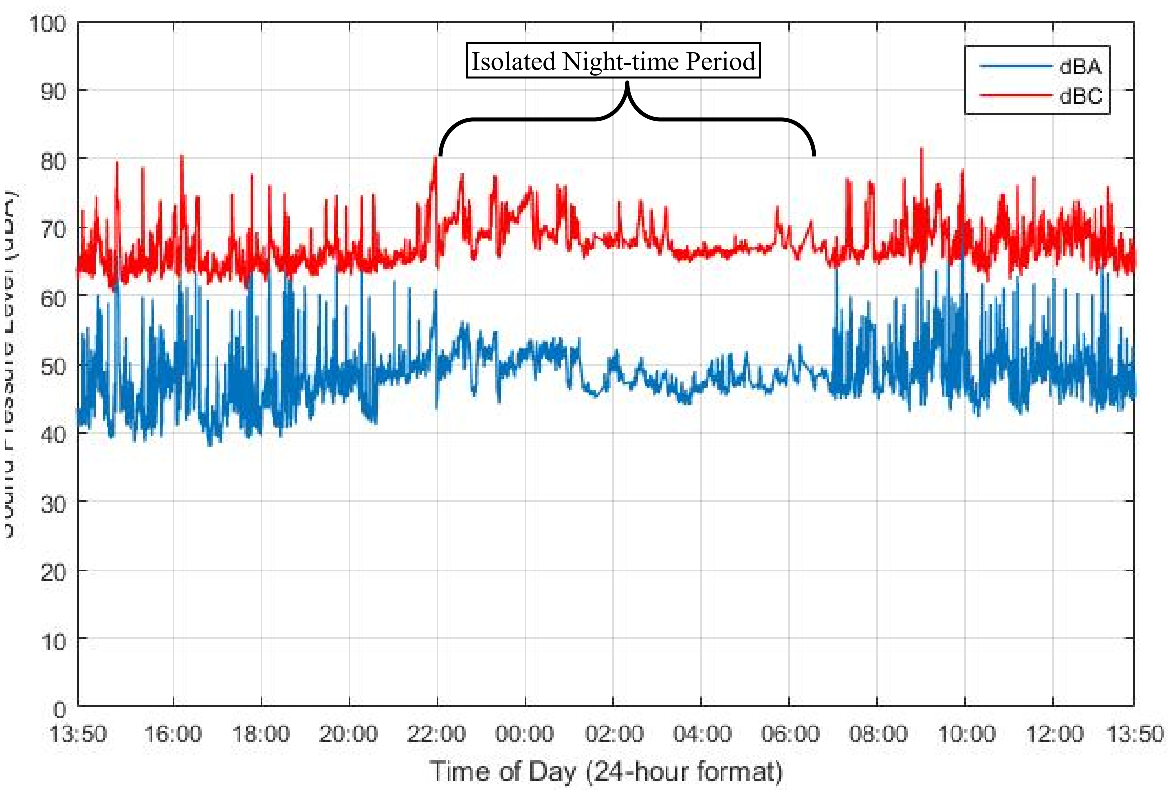

Figure 30. Noise Monitor #3, 15-Second L_{eq} Sound Levels (June 19 - 20, 2018)

Noise Monitor #3

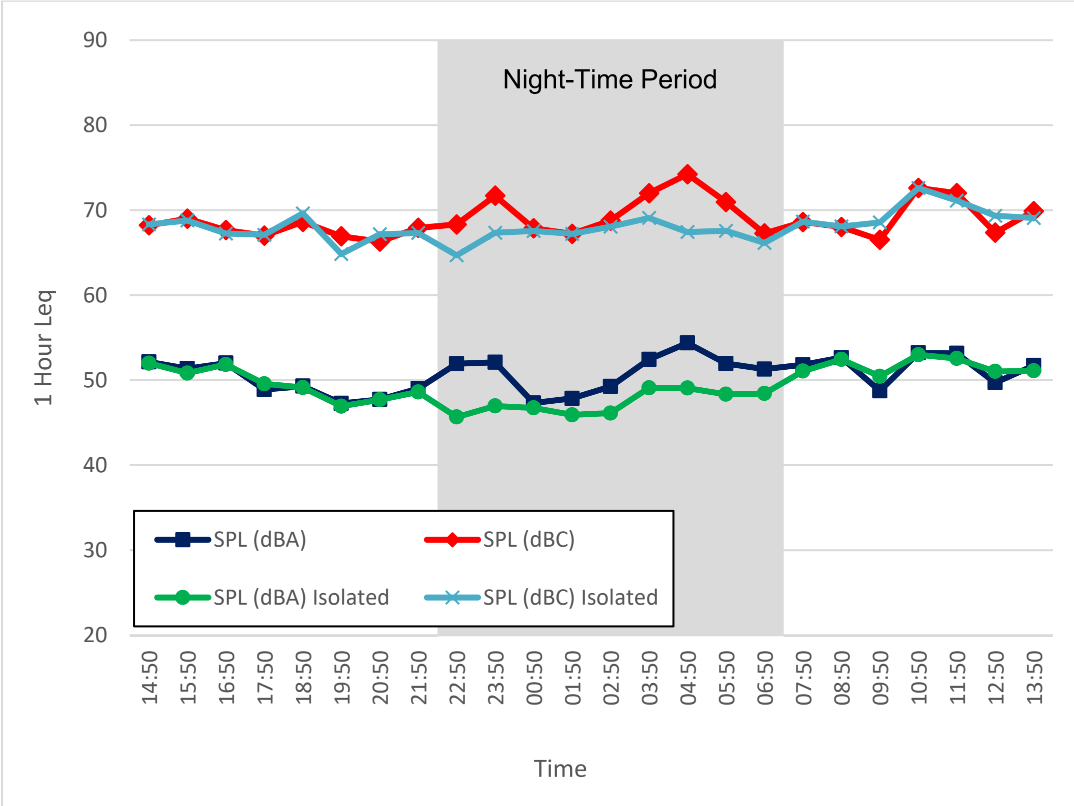

Figure 31. Noise Monitor #3, 1-Hour L_{eq} Sound Levels (June 18 - 19, 2018)

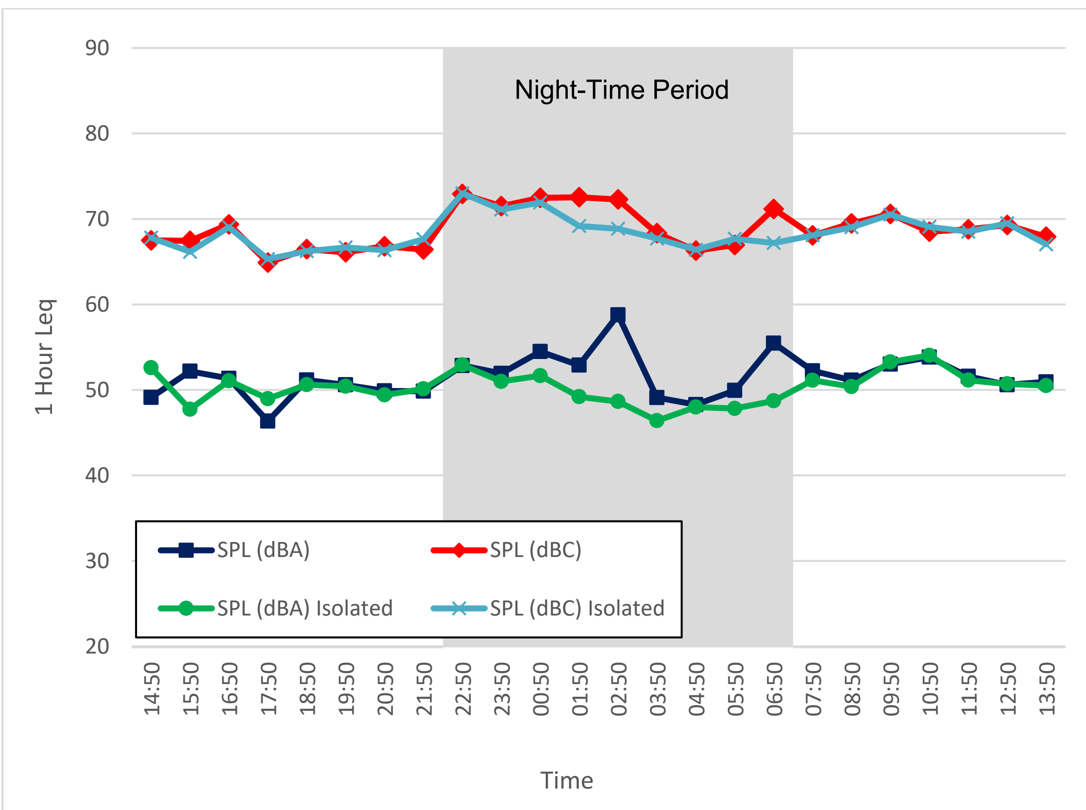

Figure 32. Noise Monitor #3, 1-Hour L_{eq} Sound Levels (June 19 - 20, 2018)

Noise Monitor #3

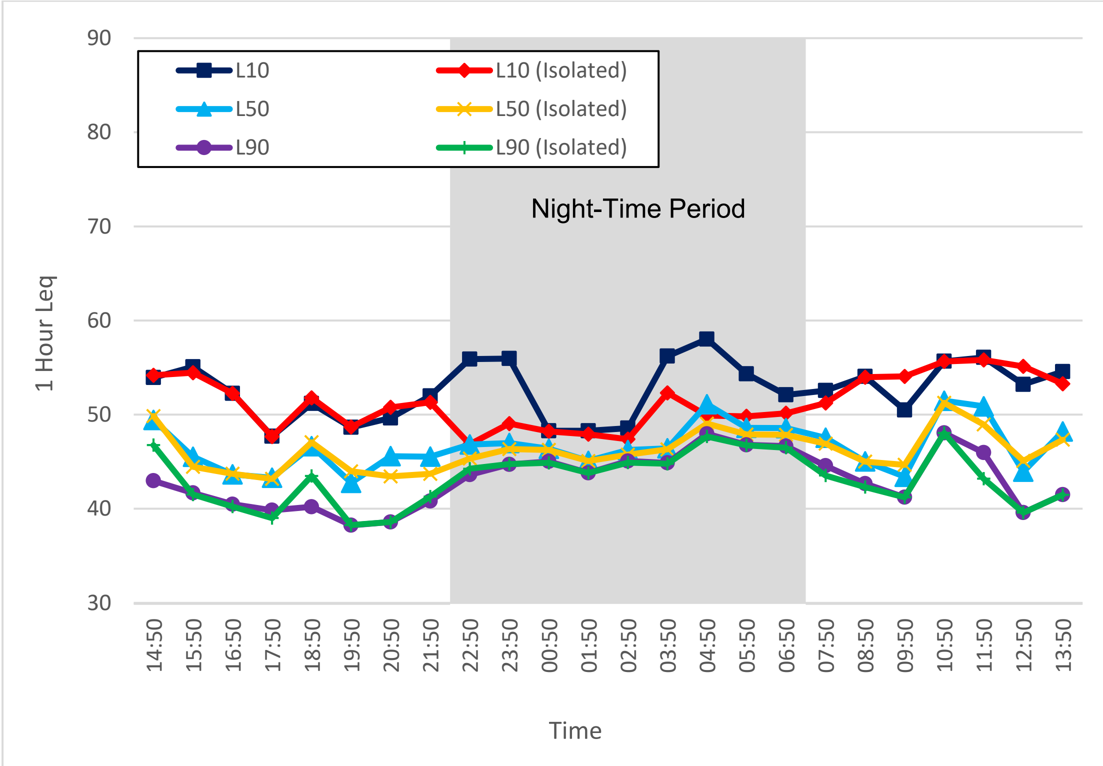

Figure 33. Noise Monitor #3, 1-Hour L_{10}, L_{50}, L_{90} L_{eq} Sound Levels (June 18 - 19, 2018)

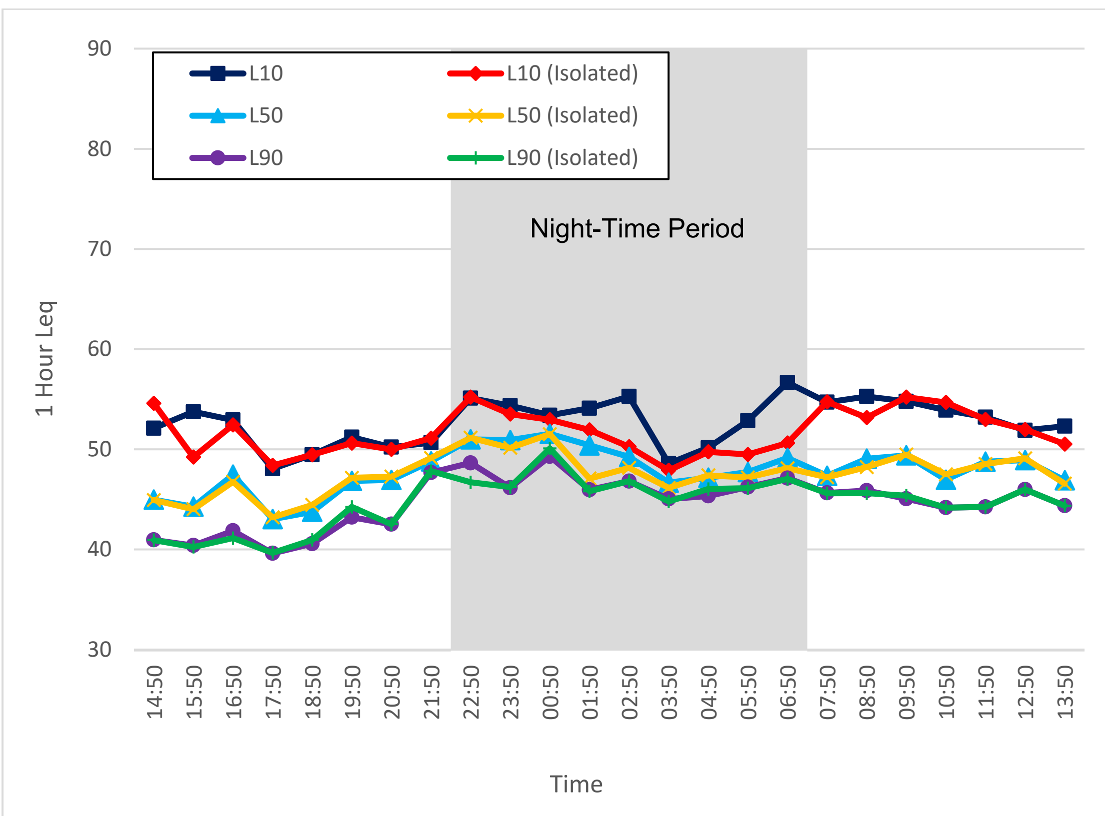

Figure 34. Noise Monitor #3, 1-Hour L_{10}, L_{50}, L_{90} L_{eq} Sound Levels (June 19 - 20, 2018)

Noise Monitor #3

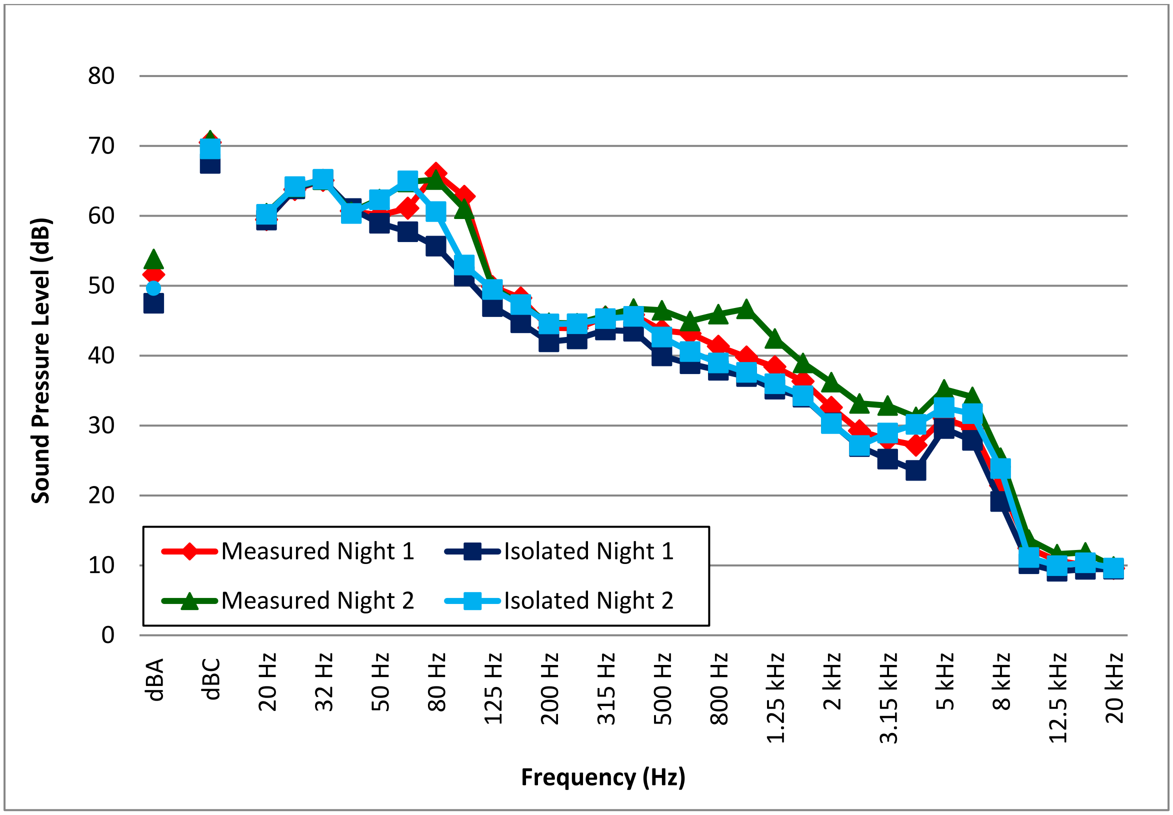

Figure 35. Noise Monitor #3, 1/3 Octave L_{eq} Sound Levels (June 18 - 20, 2018)

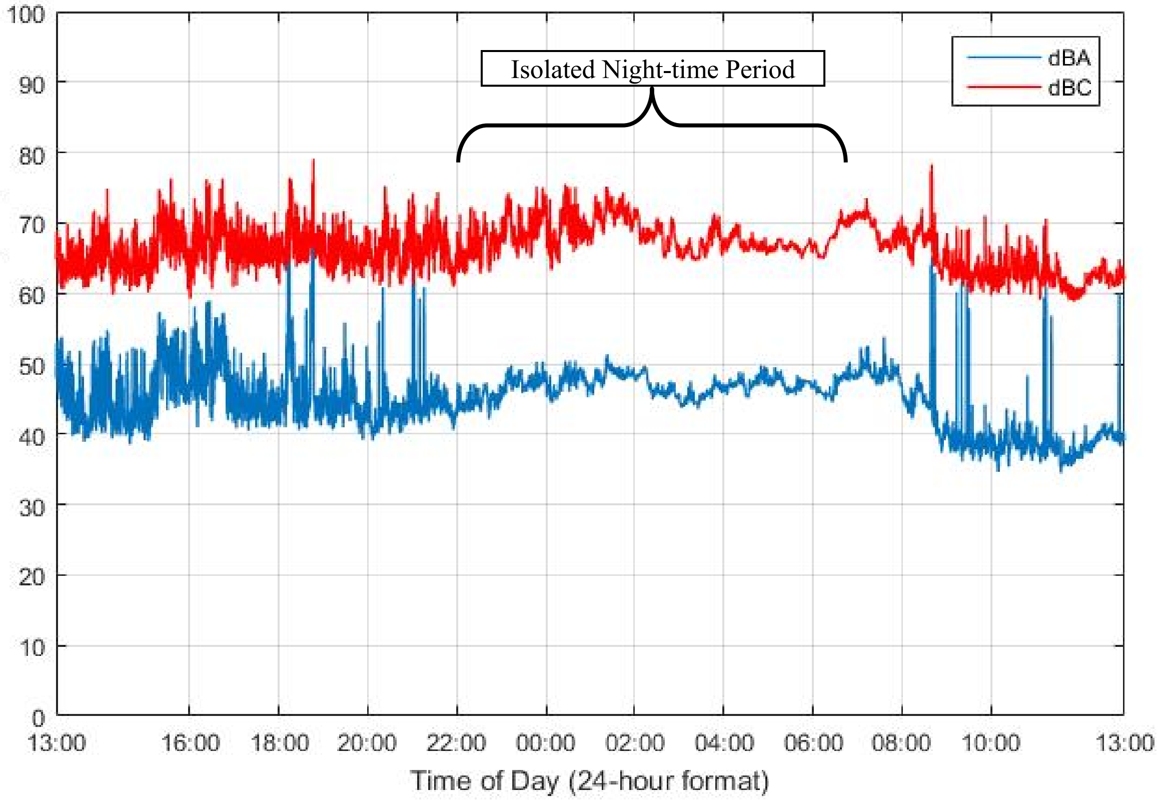

Figure 36. Noise Monitor #4, 15-Second L_{eq} Sound Levels (July 24 - 25, 2018)

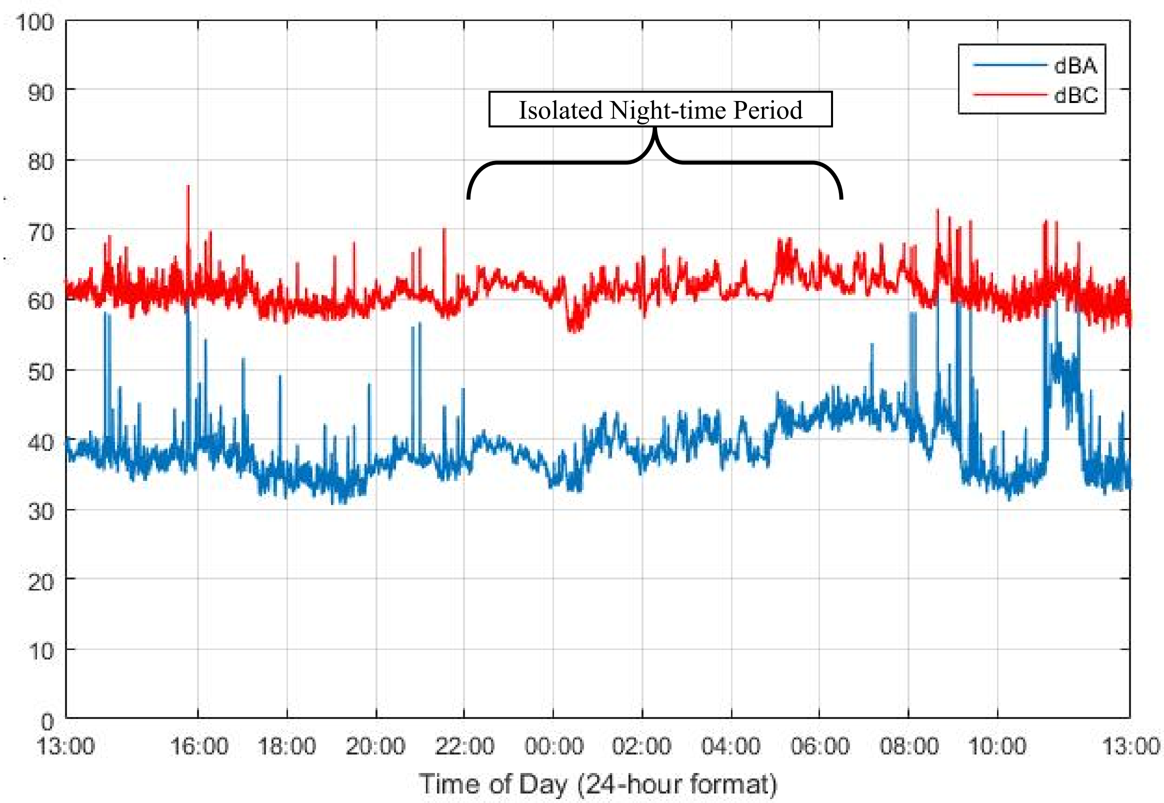

Figure 37. Noise Monitor #4, 15-Second L_{eq} Sound Levels (July 25 - 26, 2018)

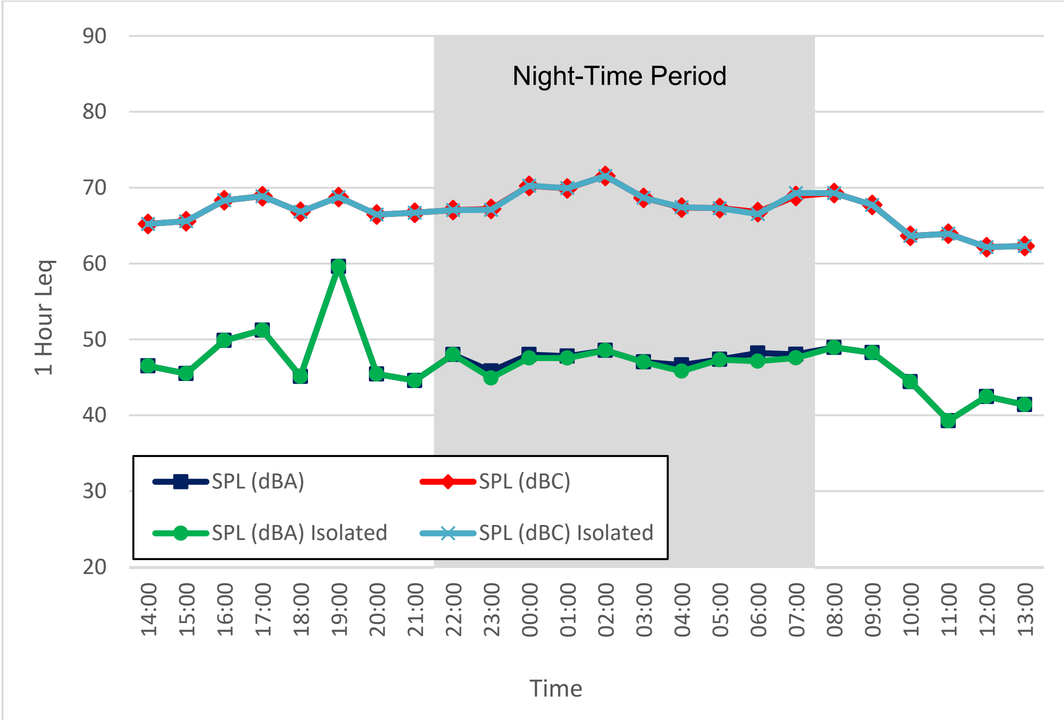

Figure 38. Noise Monitor #4, 1-Hour L_{eq} Sound Levels (July 24 - 25, 2018)

Noise Monitor #4

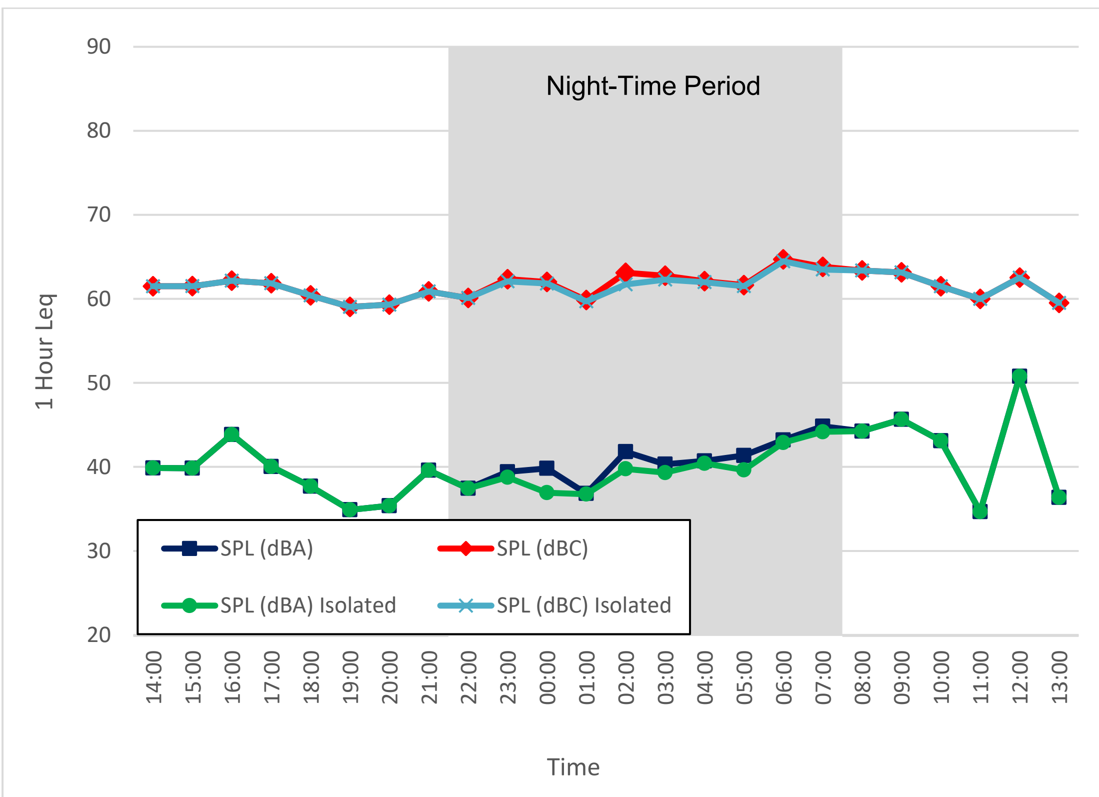

Figure 39. Noise Monitor #4, 1-Hour L_{eq} Sound Levels (July 25 - 26, 2018)

Noise Monitor #4

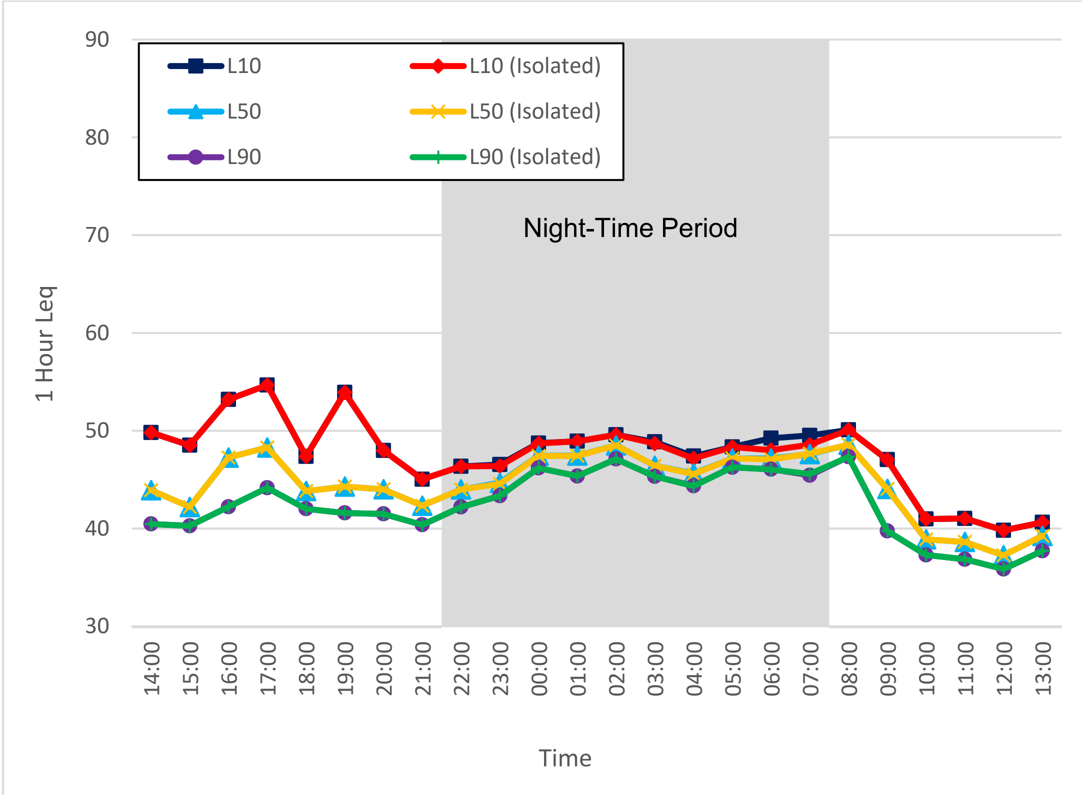

Figure 40. Noise Monitor #4, 1-Hour L_{10}, L_{50}, L_{90} L_{eq} Sound Levels (July 24 - 25, 2018)

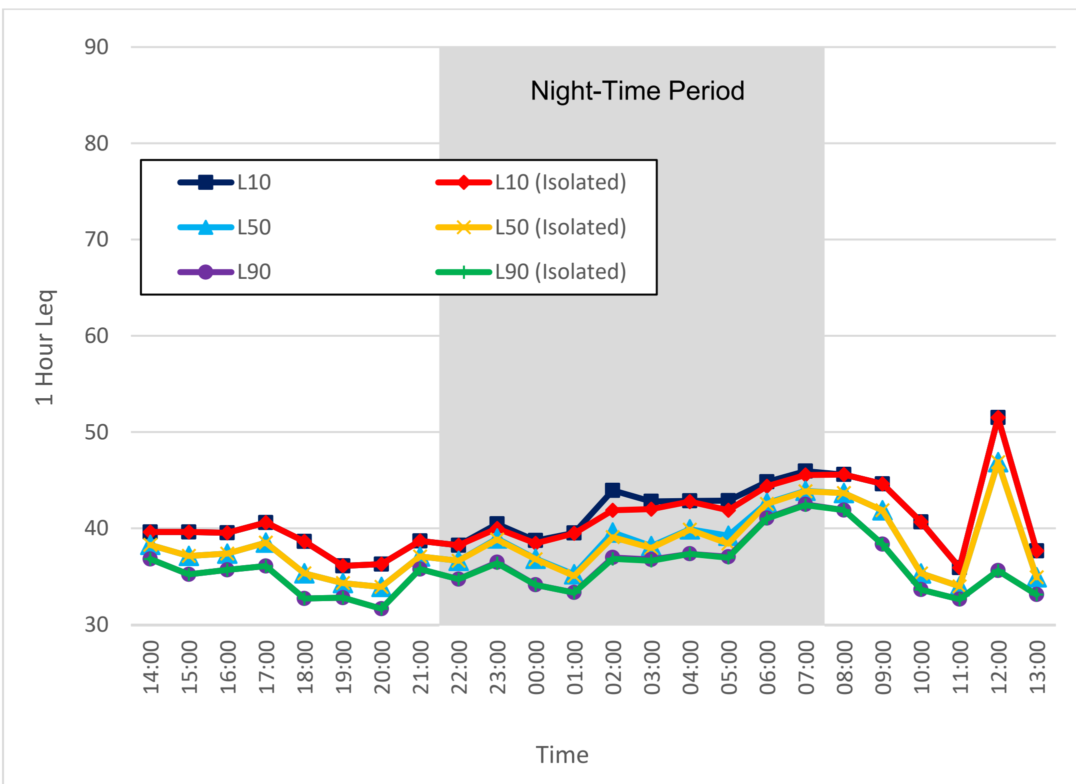

Figure 41. Noise Monitor #4, 1-Hour L_{10}, L_{50}, L_{90} L_{eq} Sound Levels (July 25 - 26, 2018)

Noise Monitor #4

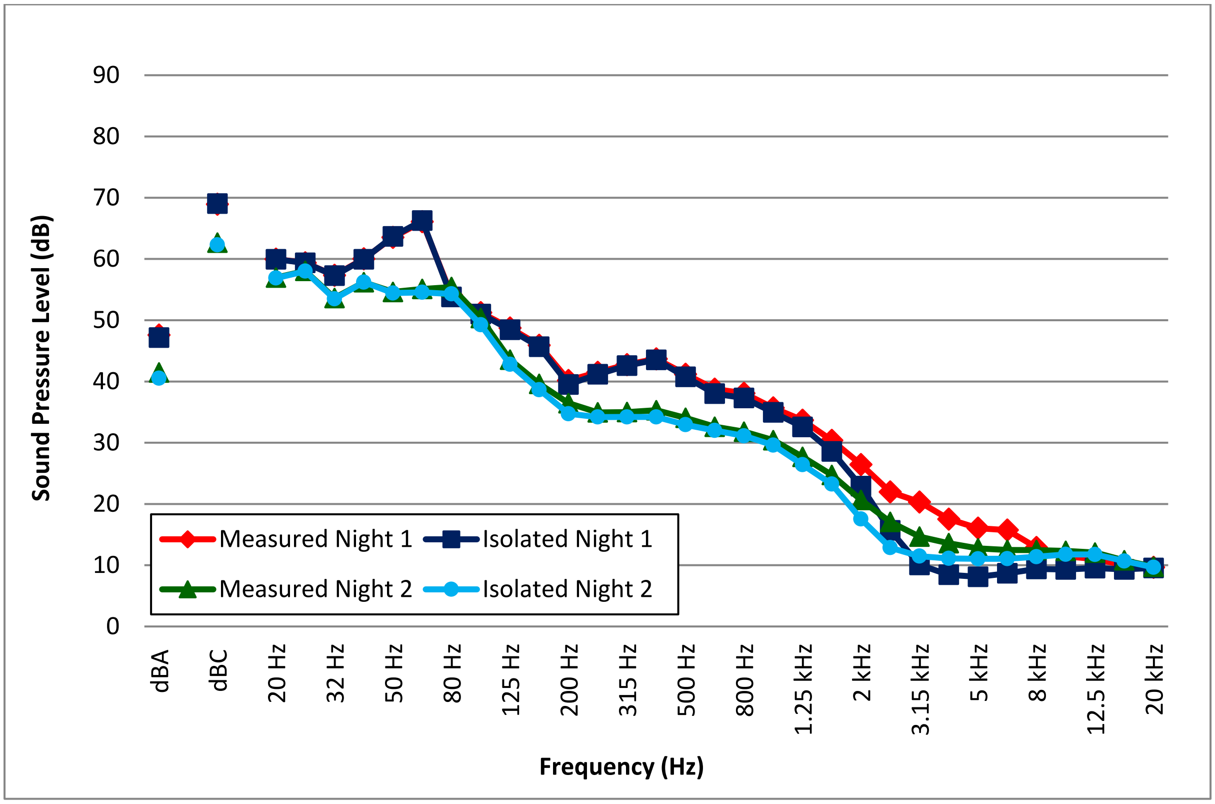

Figure 42. Noise Monitor #4, 1/3 Octave L_{eq} Sound Levels (July 24 - 26, 2018)

Noise Monitor #5

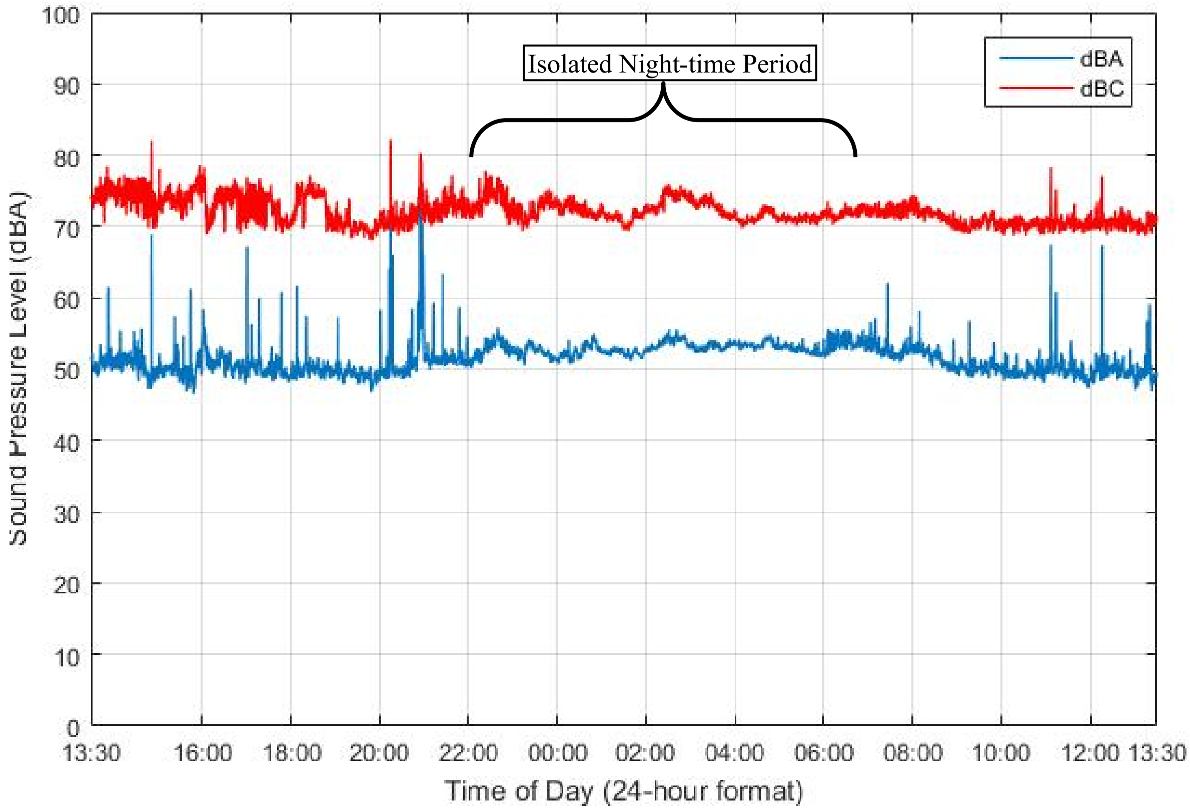

Figure 43. Noise Monitor #5, 15-Second L_{eq} Sound Levels (June 18 – 19, 2018)

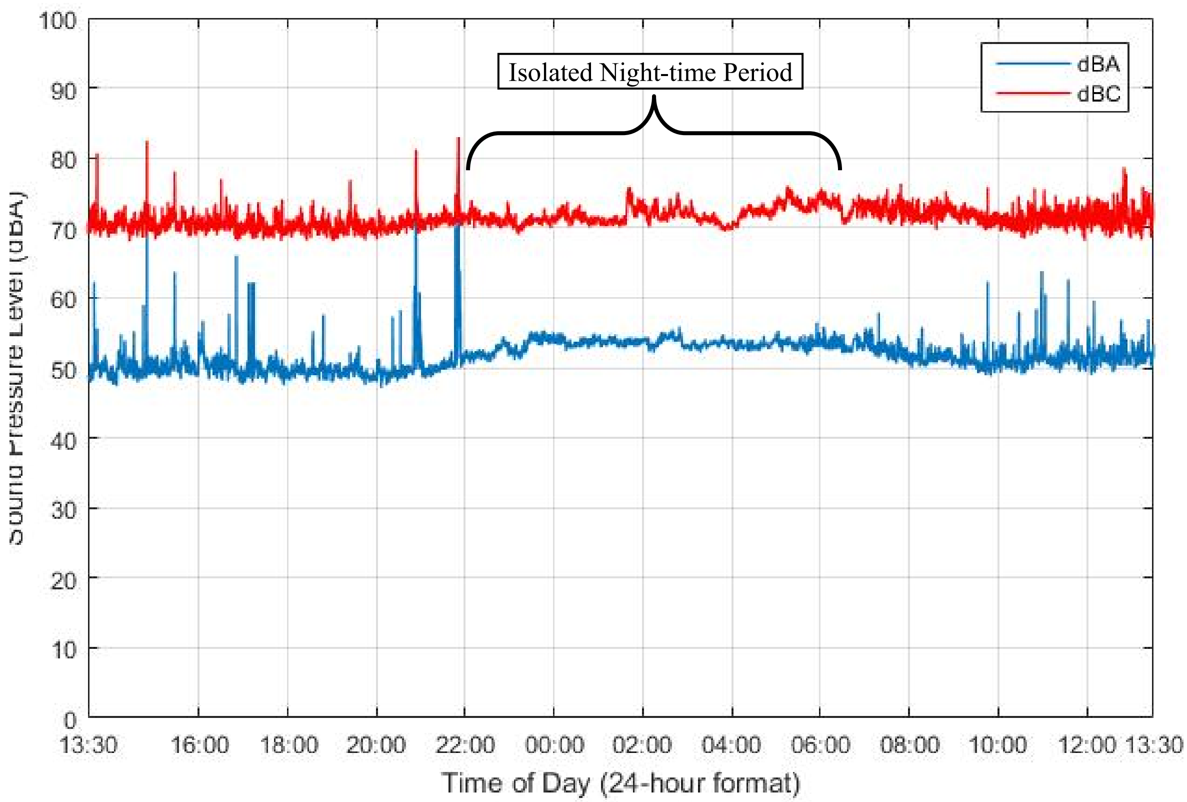

Figure 44. Noise Monitor #5, 15-Second L_{eq} Sound Levels (June 19 – 20, 2018)

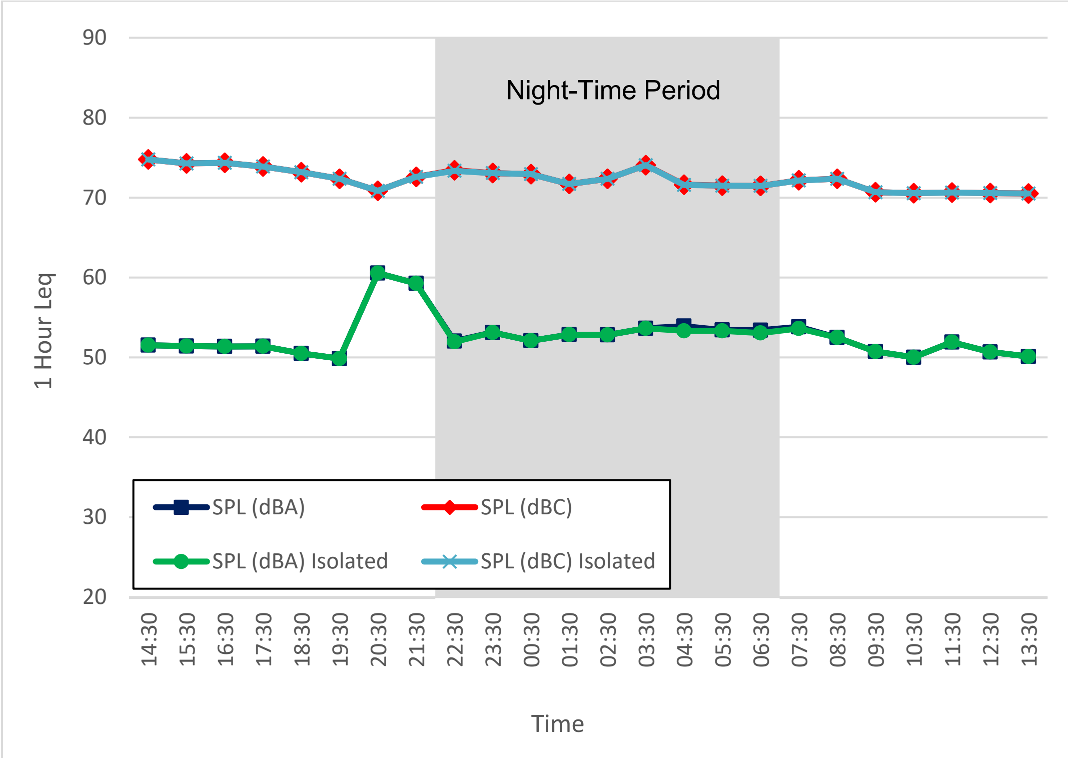

Figure 45. Noise Monitor #5, 1-Hour L_{eq} Sound Levels (June 18 – 19, 2018)

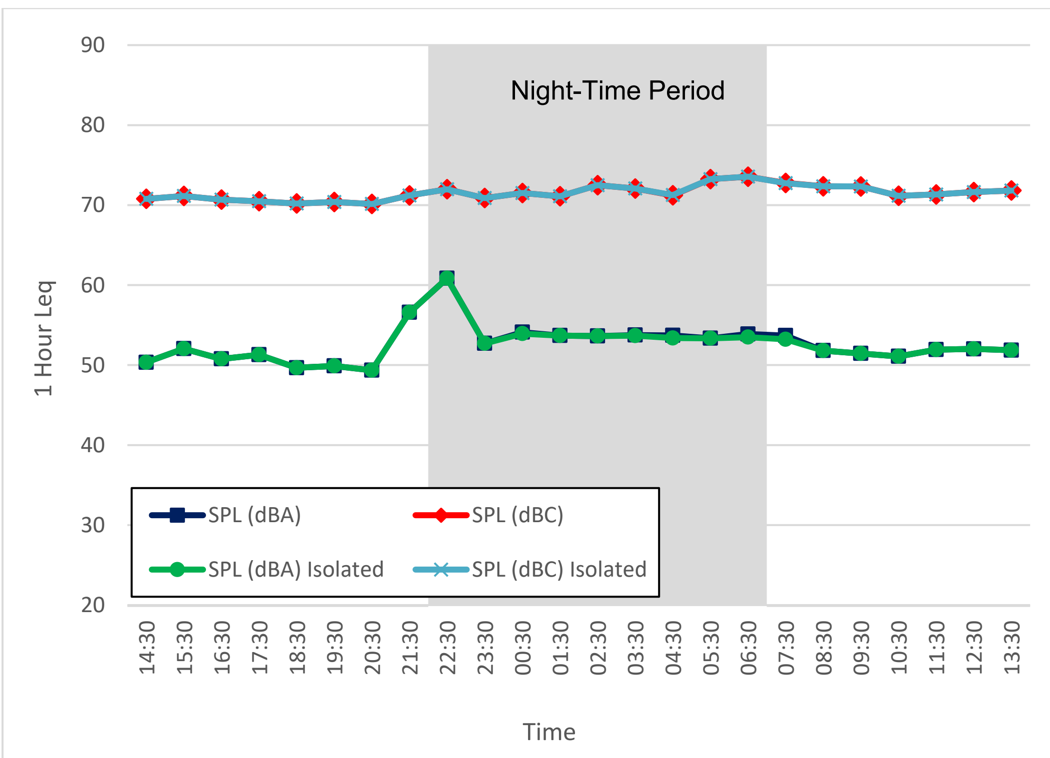

Figure 46. Noise Monitor #5, 1-Hour L_{eq} Sound Levels (June 19 – 20, 2018)

Noise Monitor #5

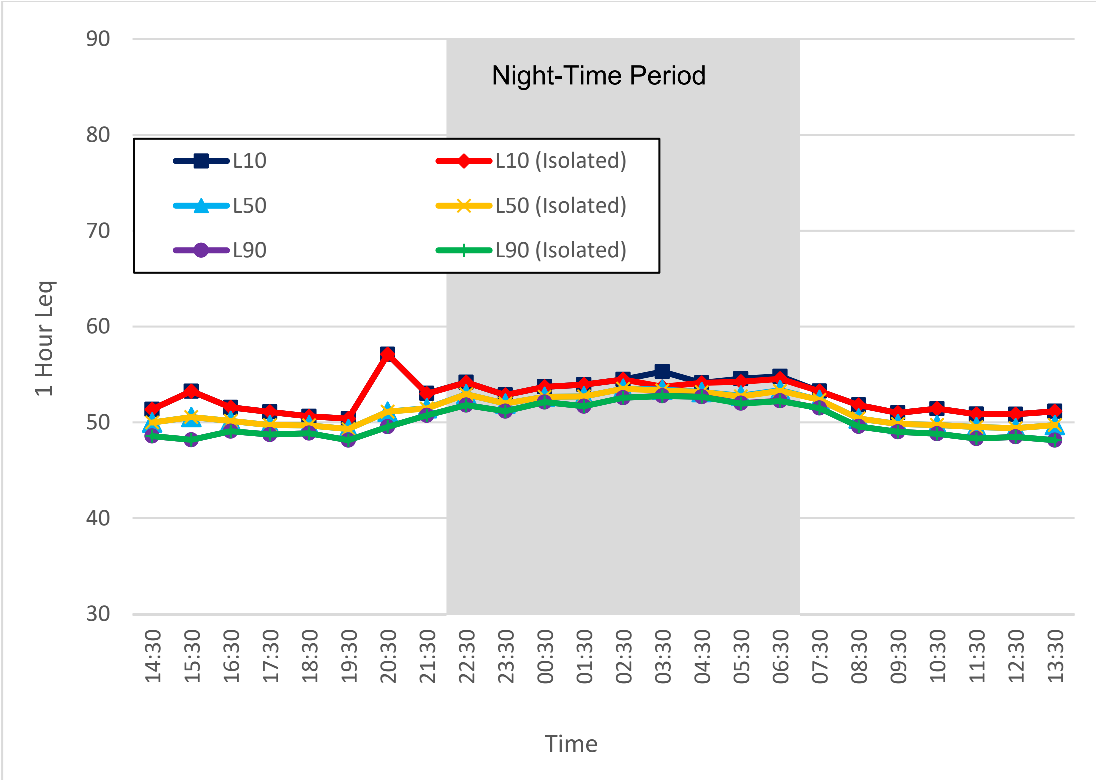

Figure 47. Noise Monitor #5, 1-Hour L_{10}, L_{50}, L_{90} L_{eq} Sound Levels (June 18 – 19, 2018)

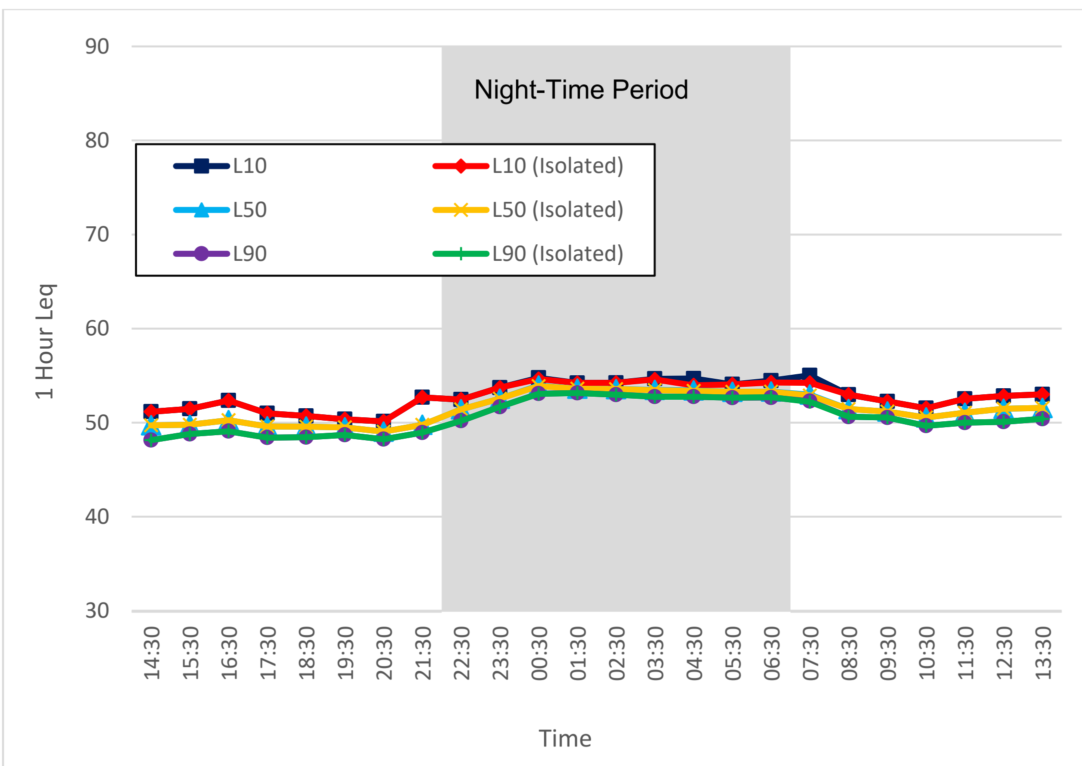

Figure 48. Noise Monitor #5, 1-Hour L_{10}, L_{50}, L_{90} L_{eq} Sound Levels (June 19 – 20, 2018)

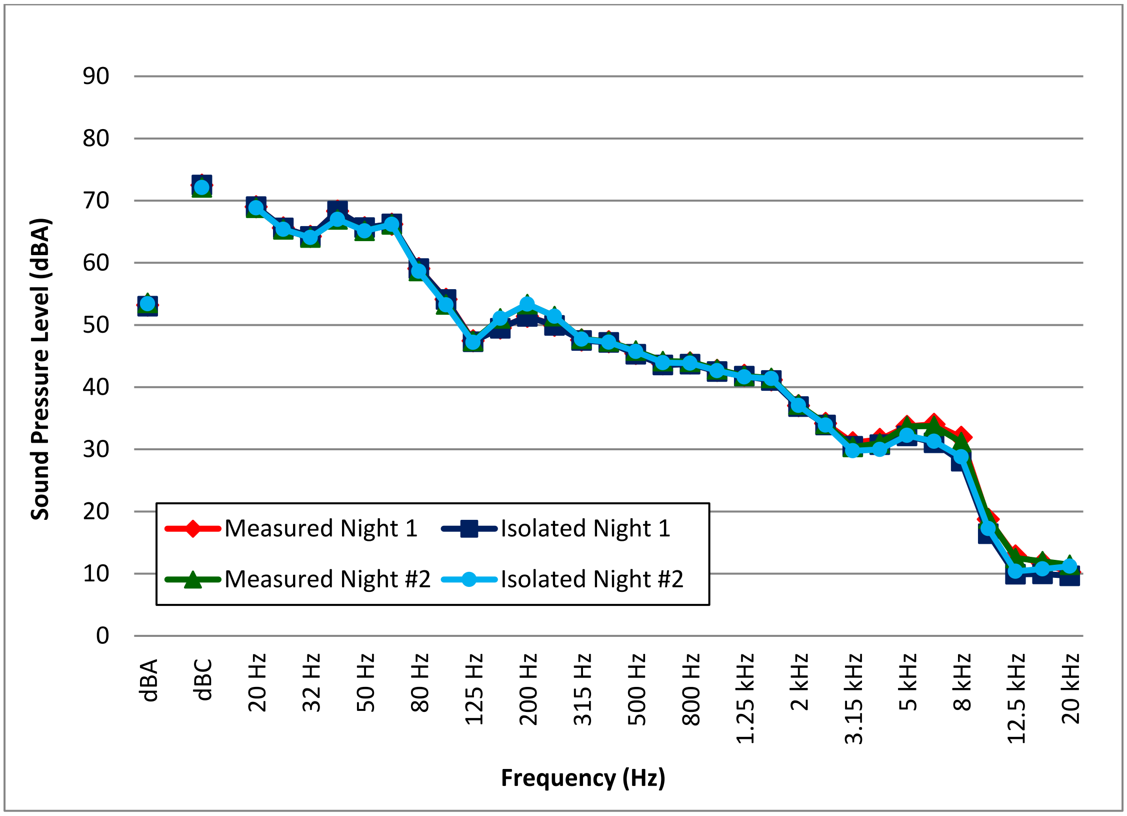

Figure 49. Noise Monitor #5, 1/3 Octave L_{eq} Sound Levels (June 18 – 20, 2018)

Noise Monitor #6

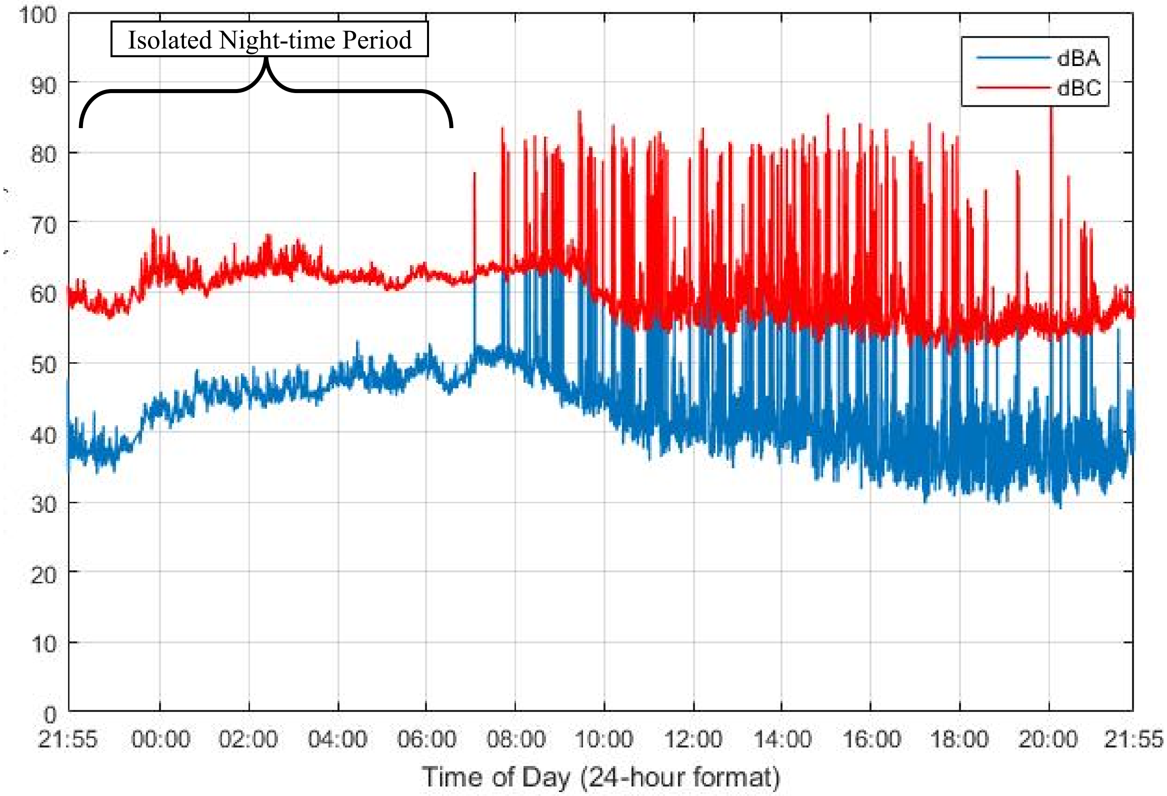

Figure 50. Noise Monitor #6, 15-Second L_{eq} Sound Levels (June 18 – 19, 2018)

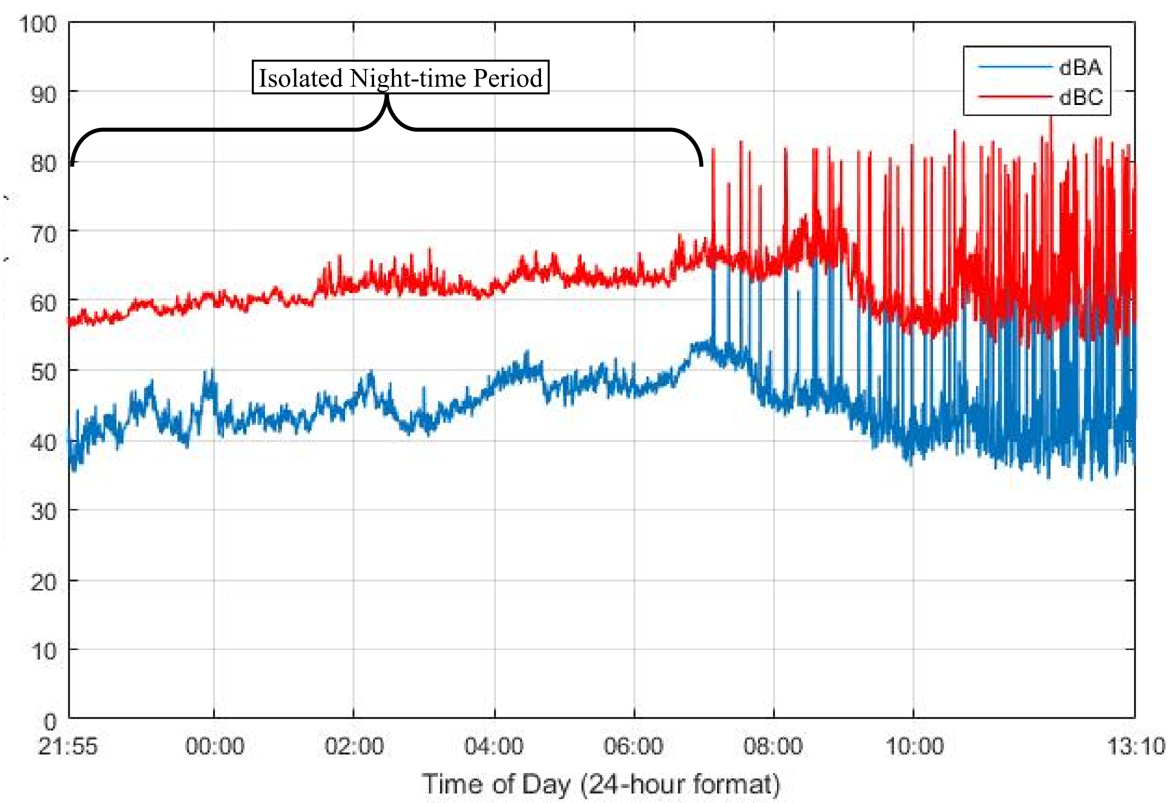

Figure 51. Noise Monitor #6, 15-Second L_{eq} Sound Levels (June 19 – 20, 2018)

Noise Monitor #6

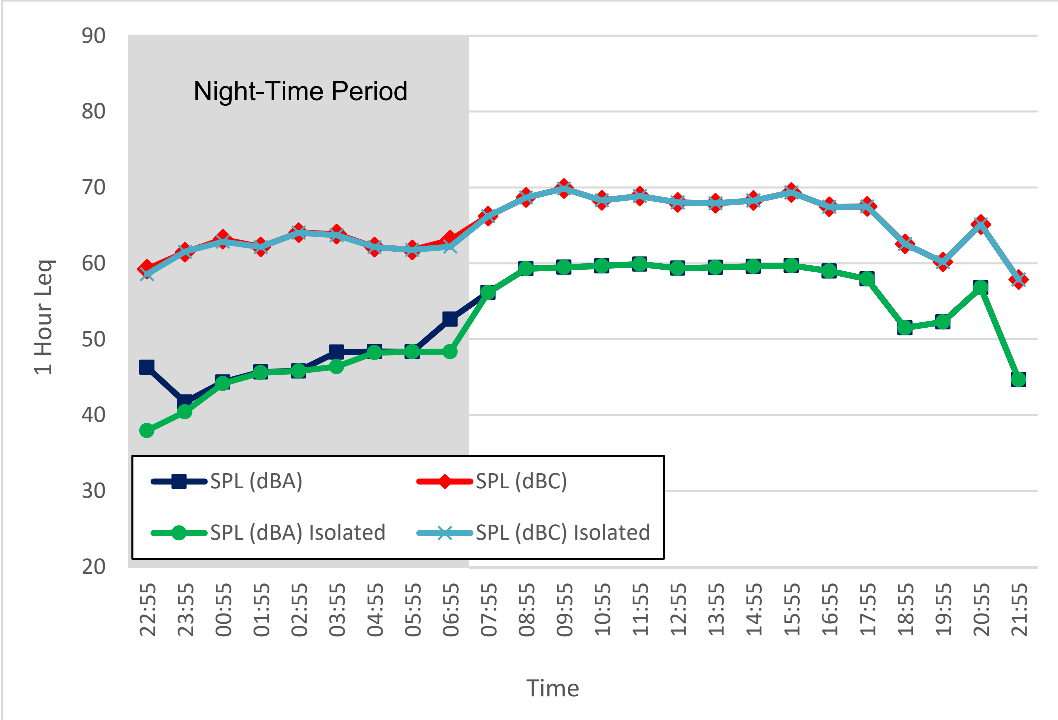

Figure 52. Noise Monitor #6, 1-Hour L_{eq} Sound Levels (June 18 – 19, 2018)

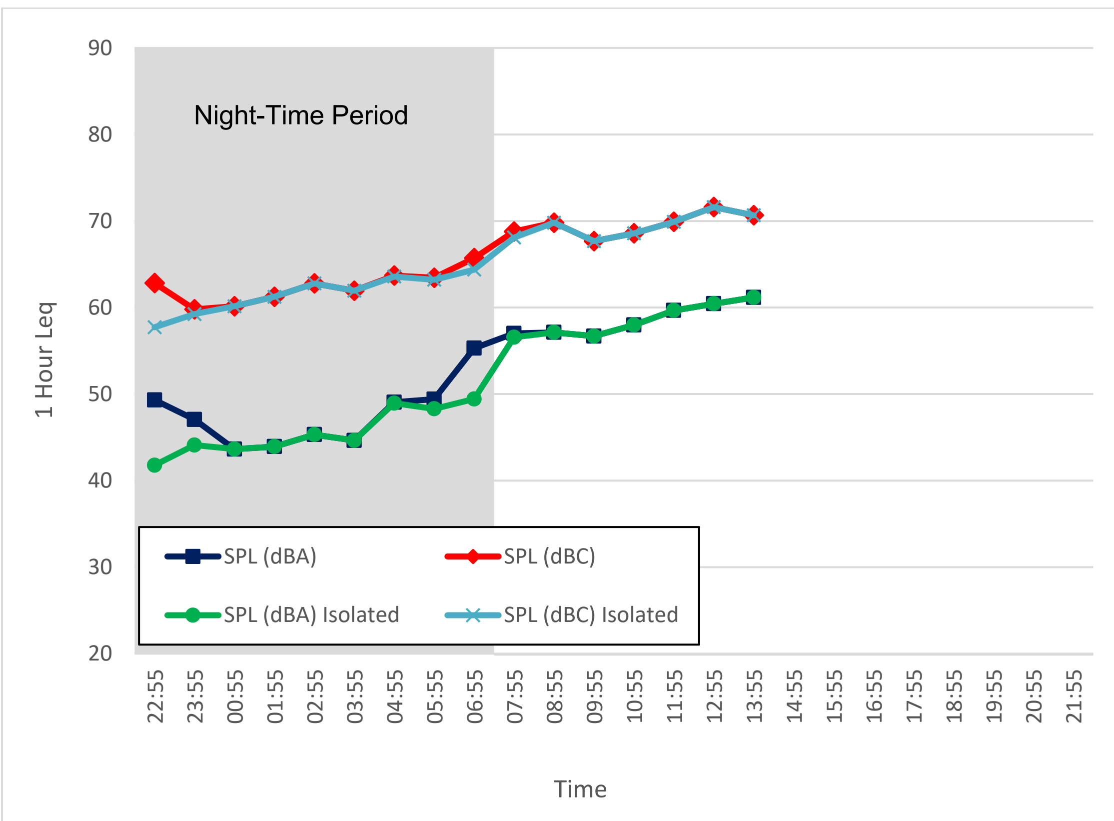

Figure 53. Noise Monitor #6, 1-Hour L_{eq} Sound Levels (June 19 – 20, 2018) [1]

[1] As previously discussed, an equipment malfunction occurred reducing data for the day-time hours.

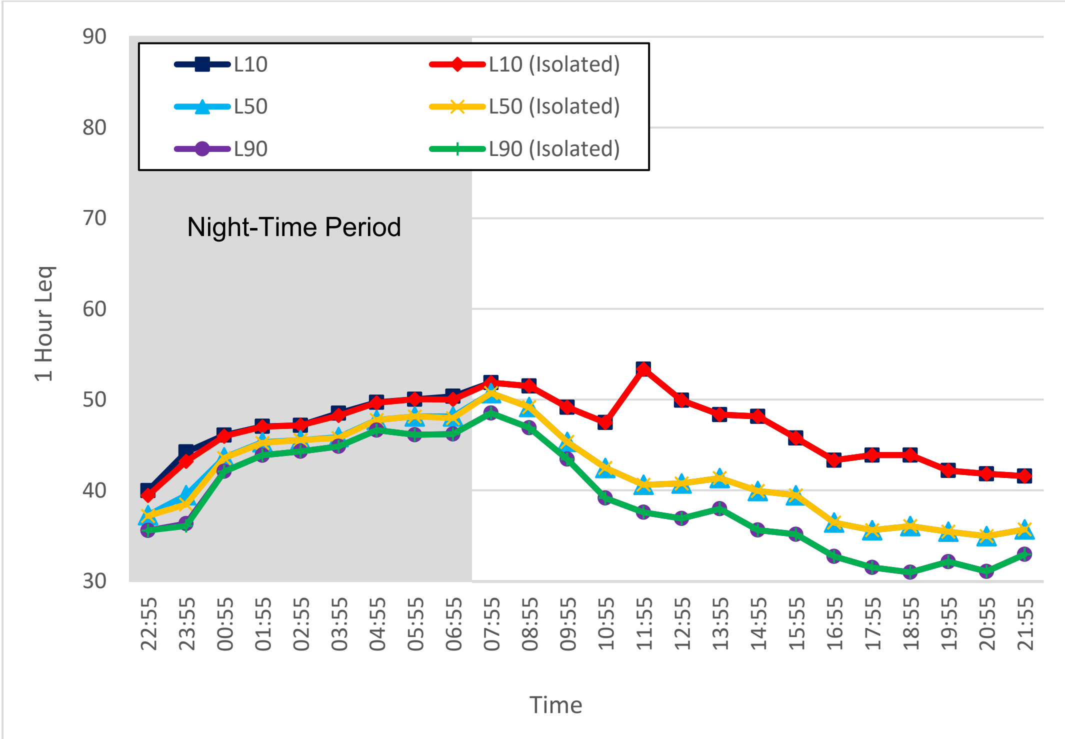

Figure 54. Noise Monitor #6, 1-Hour L_{10}, L_{50}, L_{90} L_{eq} Sound Levels (June 18 – 19, 2018)

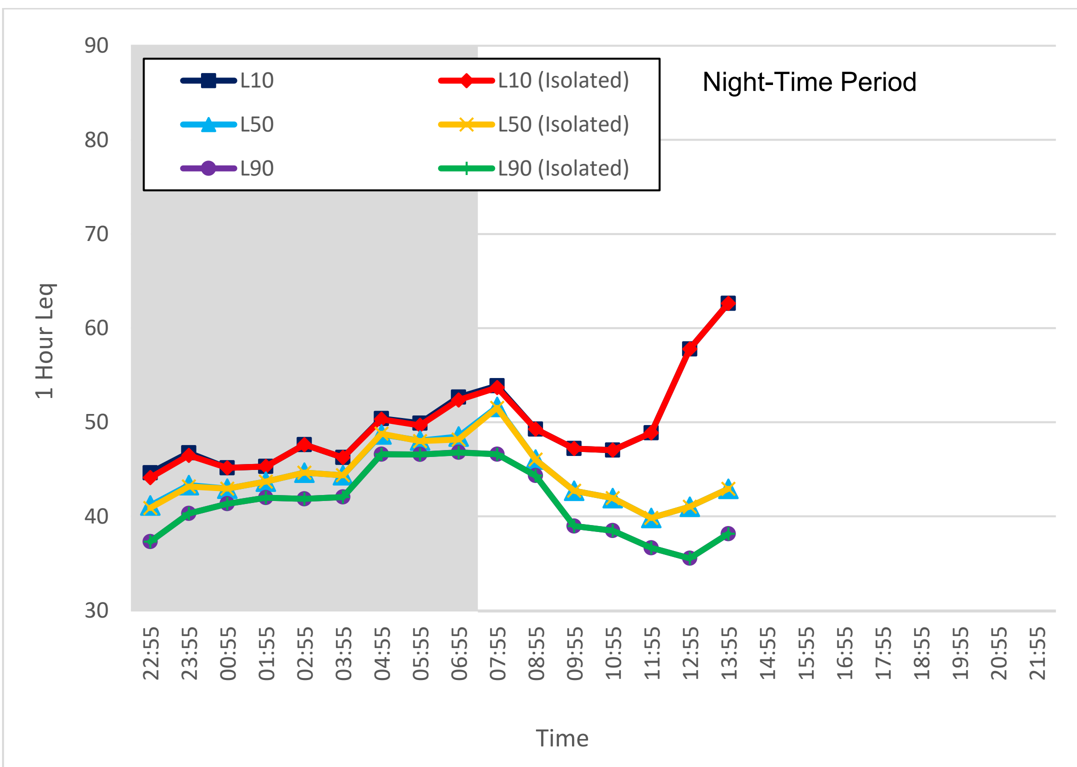

Figure 55. Noise Monitor #6, 1-Hour L_{10}, L_{50}, L_{90} L_{eq} Sound Levels (June 19 – 20, 2018) [1]

[1] As previously discussed, an equipment malfunction occurred reducing data for the day-time hours.

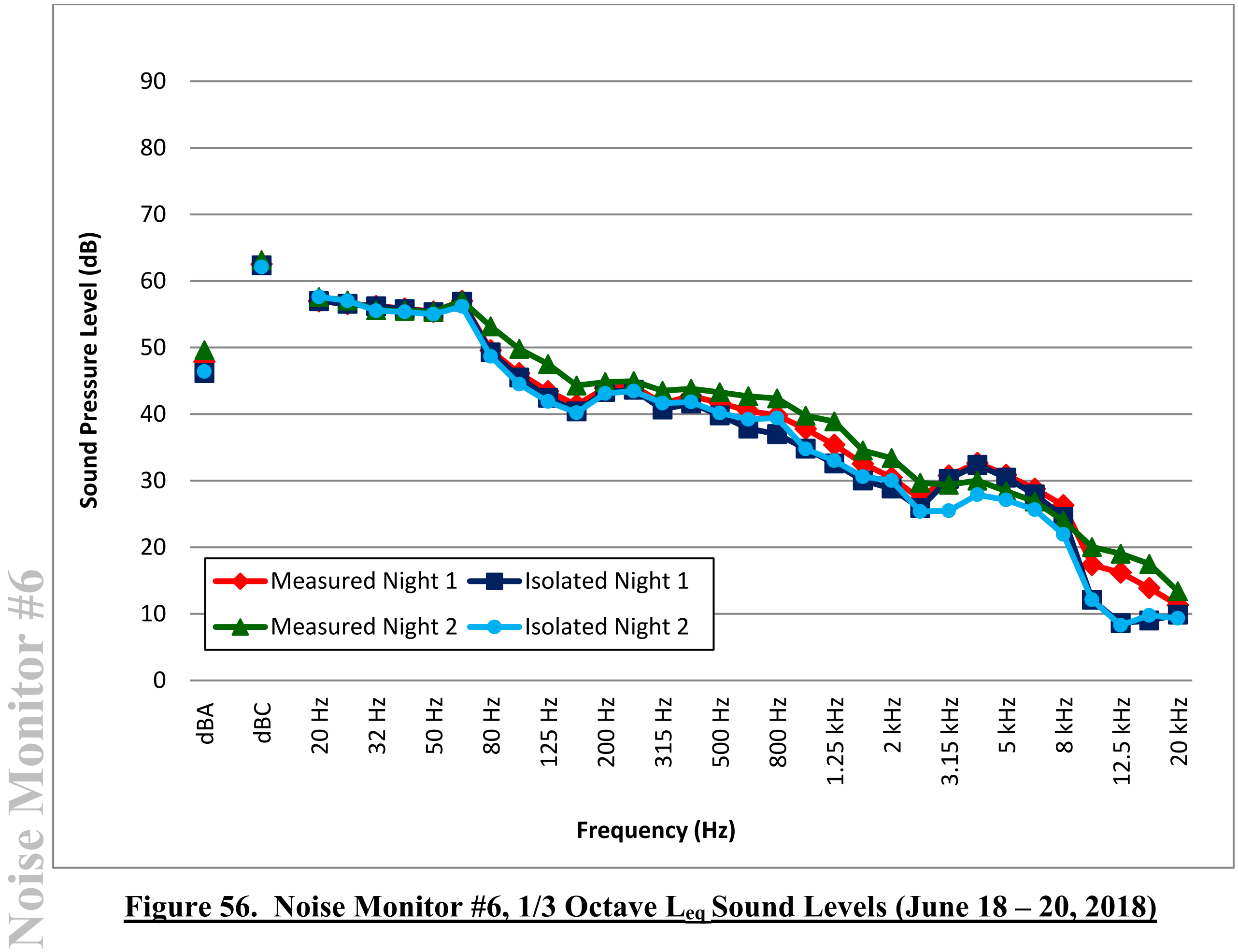

Figure 56. Noise Monitor #6, 1/3 Octave L_{eq} Sound Levels (June 18 – 20, 2018)

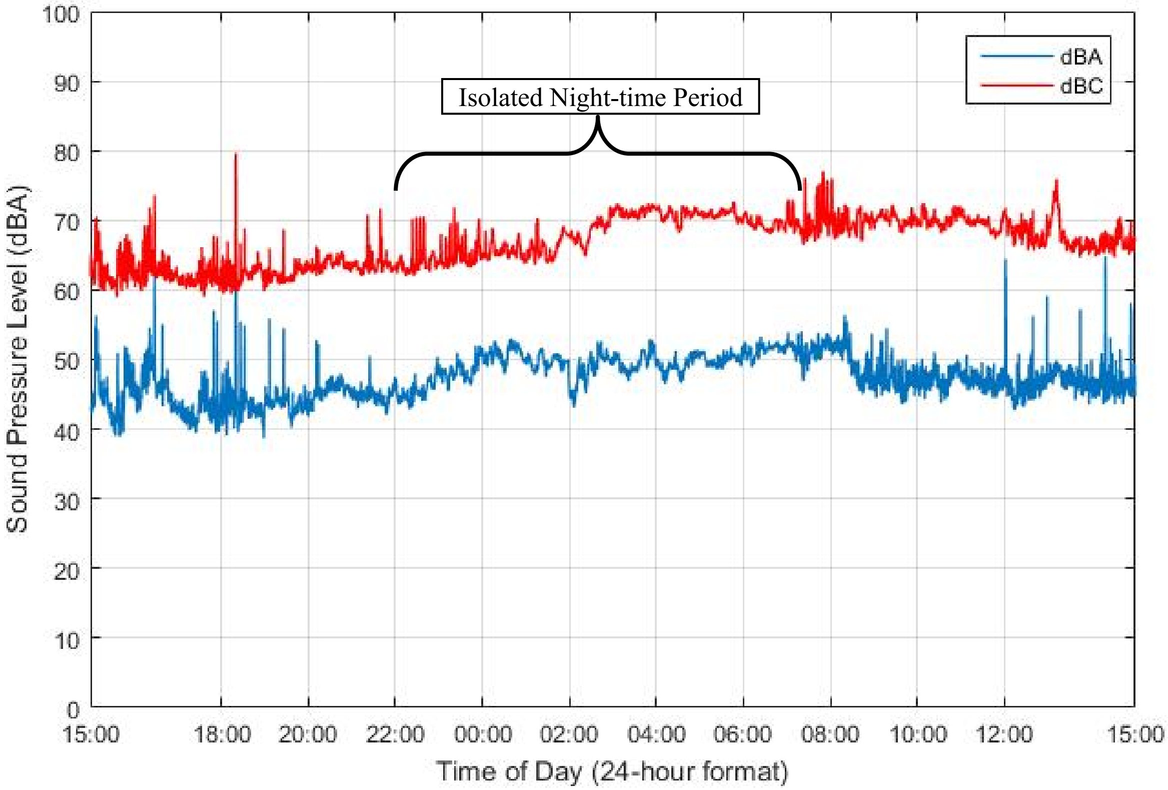

Figure 57. Noise Monitor #8, 15-Second L_{eq} Sound Levels (July 24 - 25, 2018)

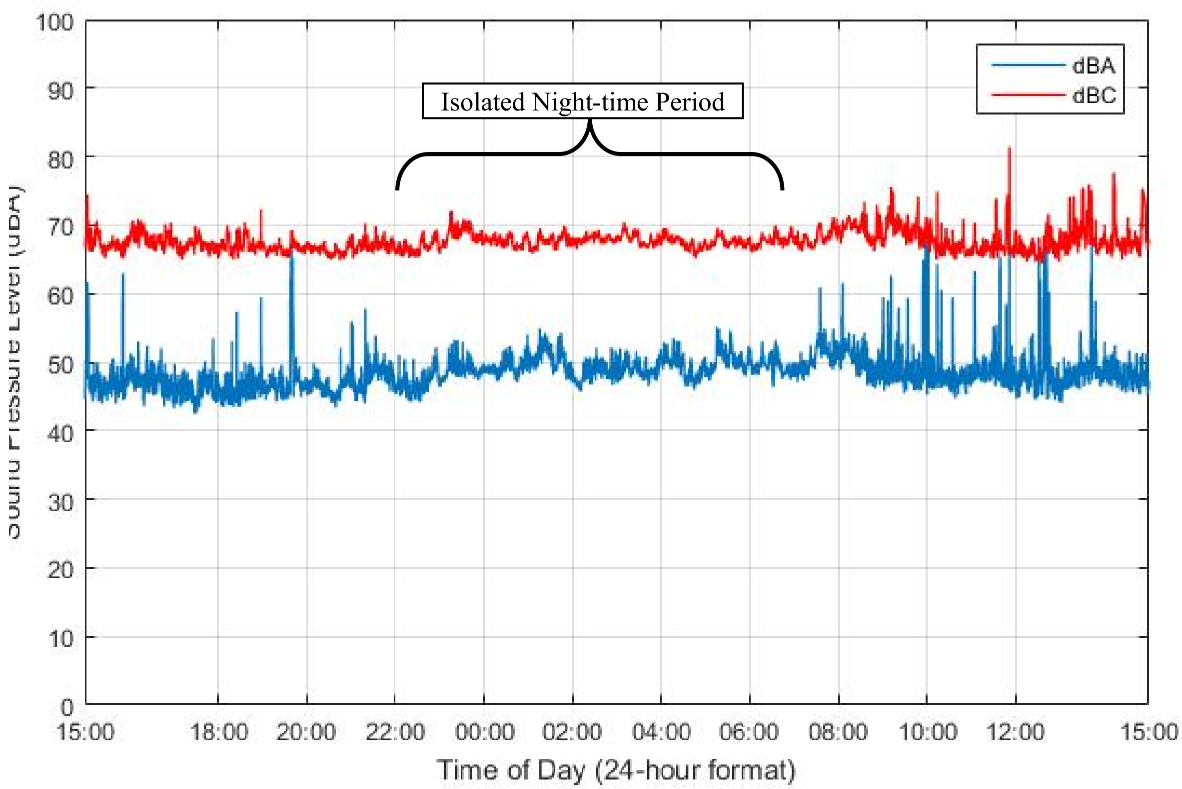

Figure 58. Noise Monitor #8, 15-Second L_{eq} Sound Levels (July 25 - 26, 2018)

Noise Monitor #8

Noise Monitor #8

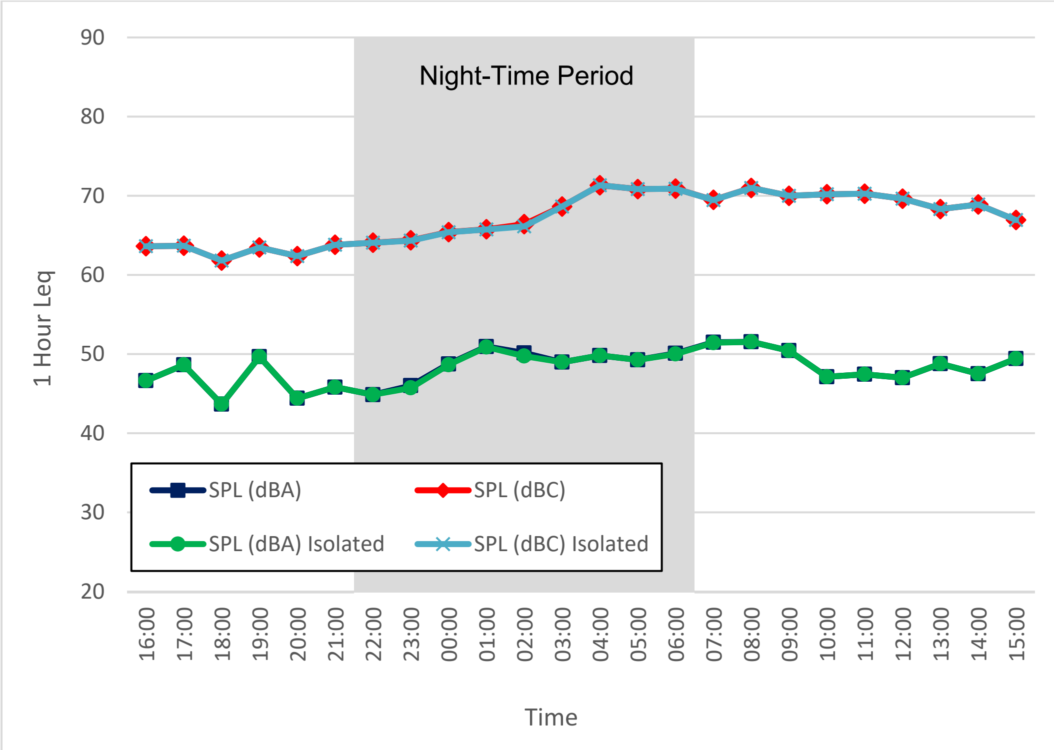

Figure 59. Noise Monitor #8, 1-Hour L_{eq} Sound Levels (July 24 - 25, 2018)

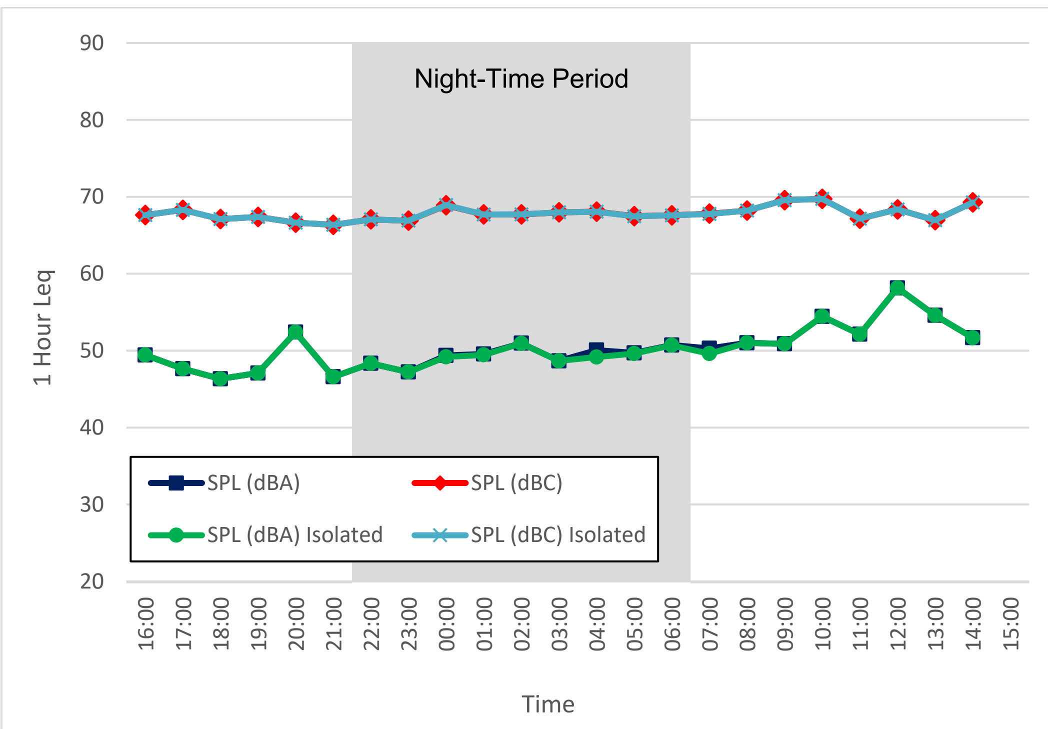

Figure 60. Noise Monitor #8, 1-Hour L_{eq} Sound Levels (July 25 - 26, 2018)

Monitor #8 Noise

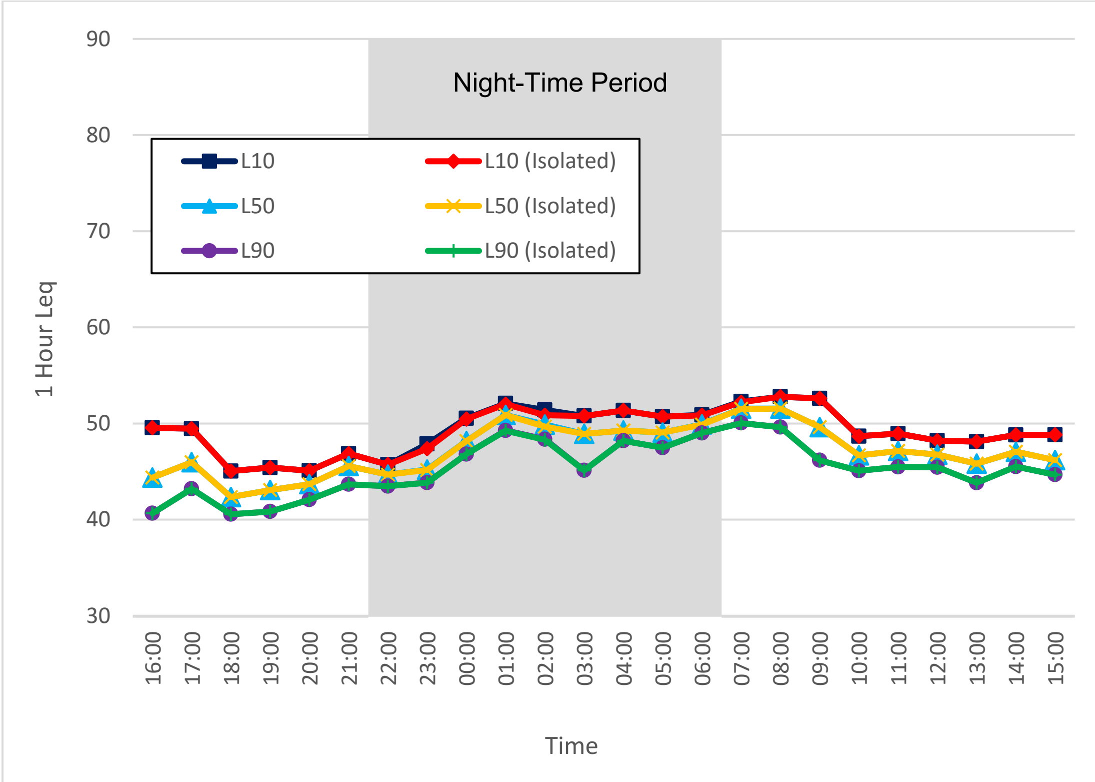

Figure 61. Noise Monitor #8, 1-Hour L_{10}, L_{50}, L_{90} L_{eq} Sound Levels (July 24 - 25, 2018)

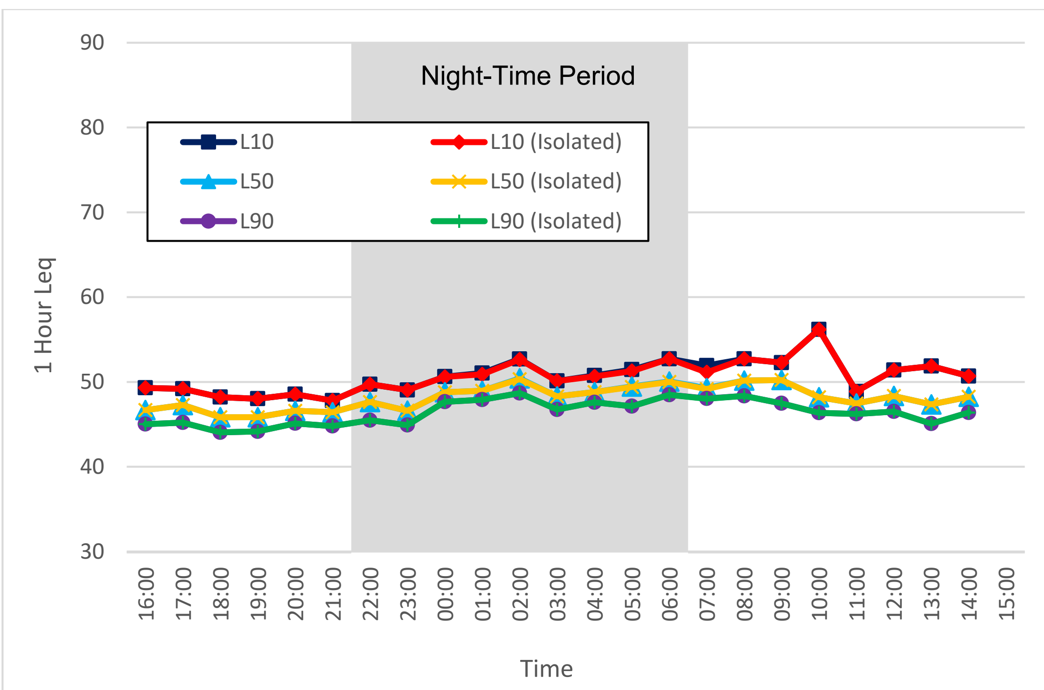

Figure 62. Noise Monitor #8, 1-Hour L_{10}, L_{50}, L_{90} L_{eq} Sound Levels (July 25 - 26, 2018)

Noise Monitor #8

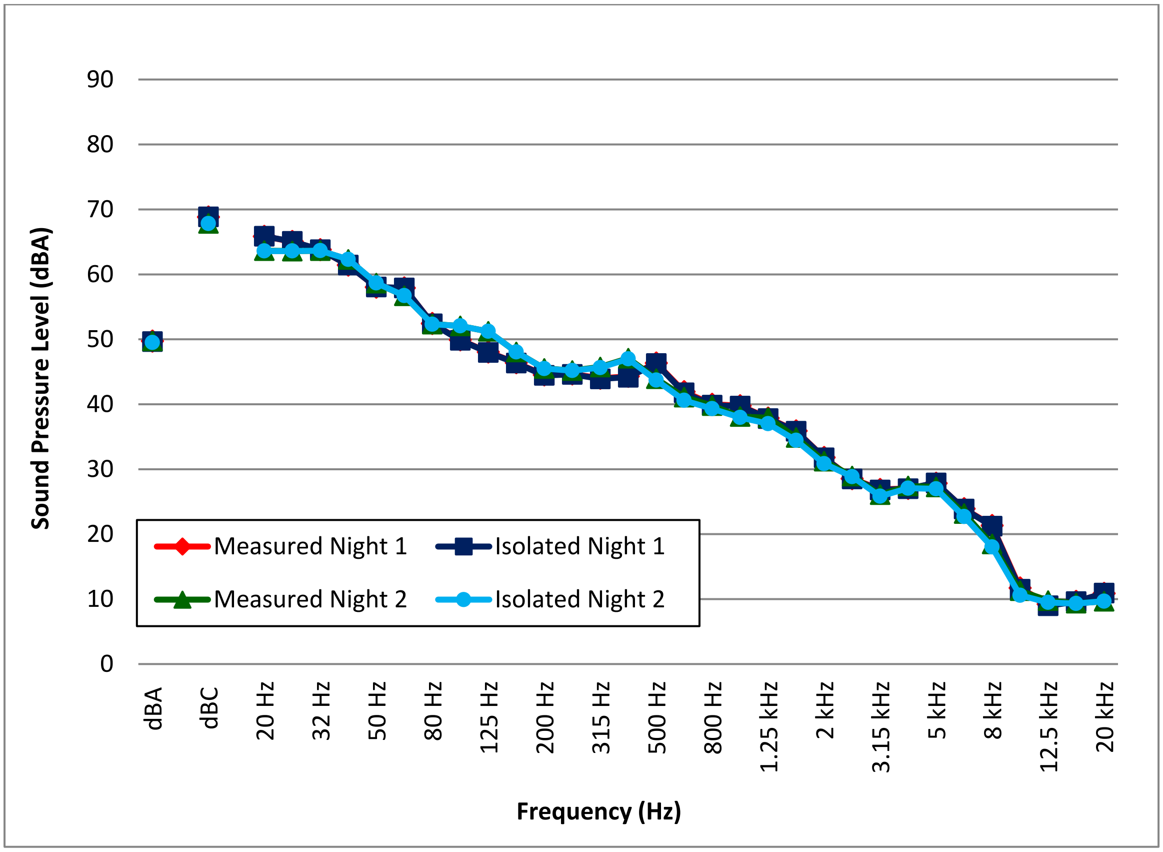

Figure 63. Noise Monitor #8, 1/3 Octave L_{eq} Sound Levels (July 24 - 26, 2018)

Noise Monitor #9

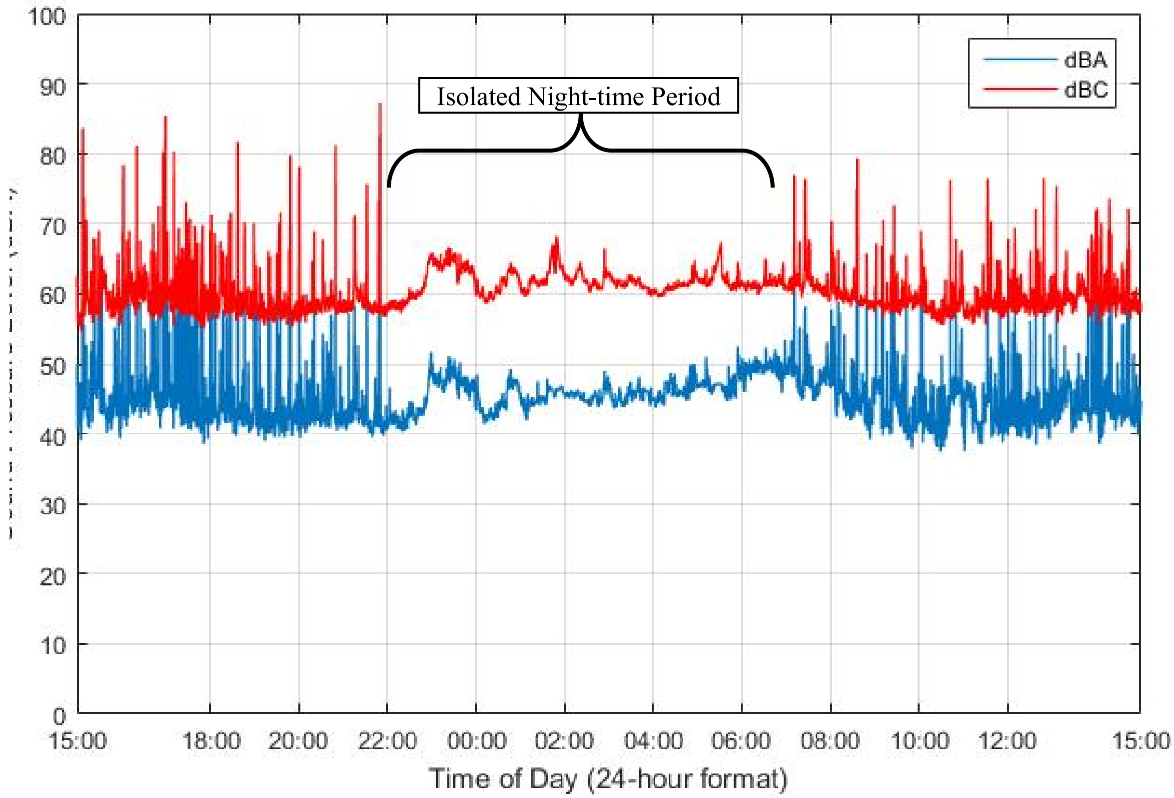

Figure 64. Noise Monitor #9, 15-Second L_{eq} Sound Levels (June 18 – 19, 2018)

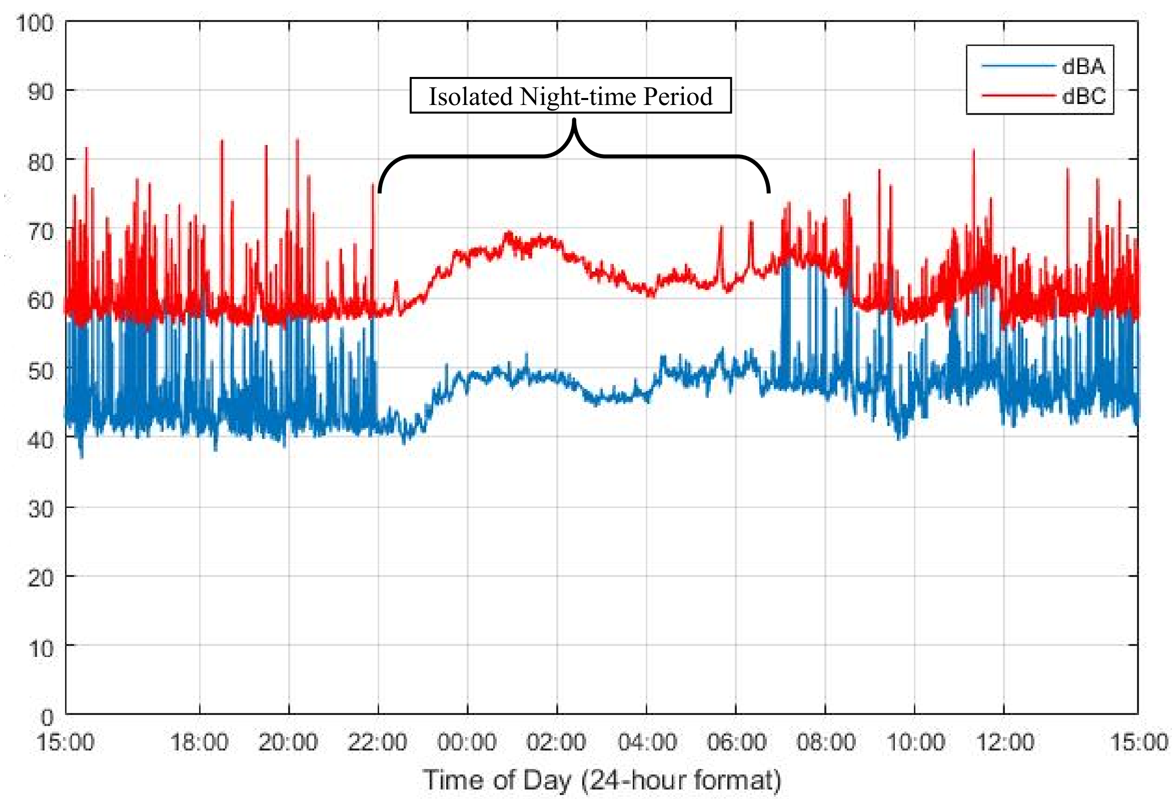

Figure 65. Noise Monitor #9, 15-Second L_{eq} Sound Levels (June 19 – 20, 2018)

Noise Monitor #9

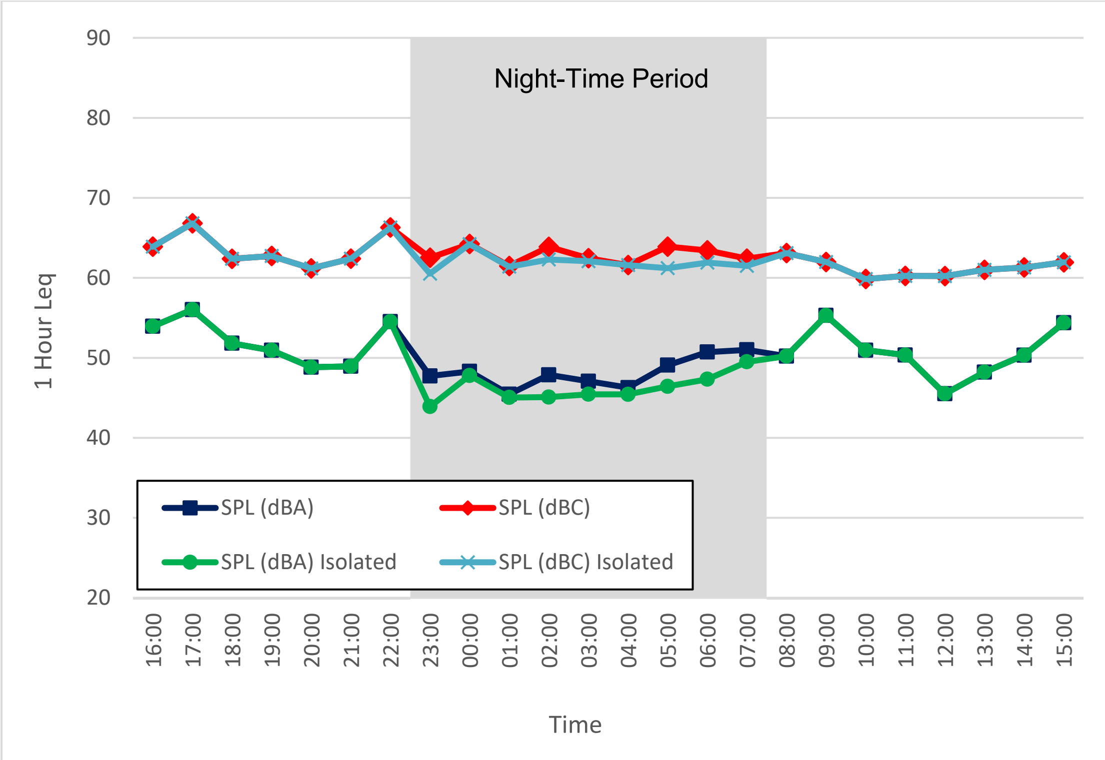

Figure 66. Noise Monitor #9, 1-Hour L_{eq} Sound Levels (June 18 – 19, 2018)

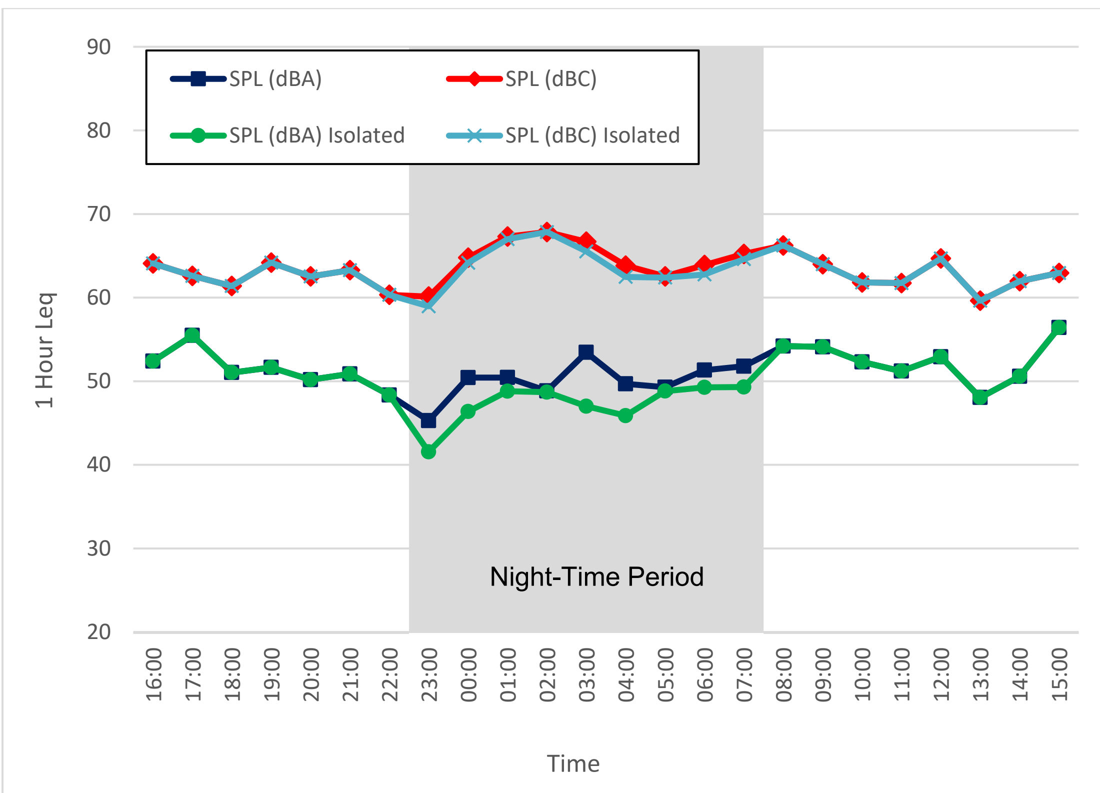

Figure 67. Noise Monitor #9, 1-Hour L_{eq} Sound Levels (June 19 – 20, 2018)

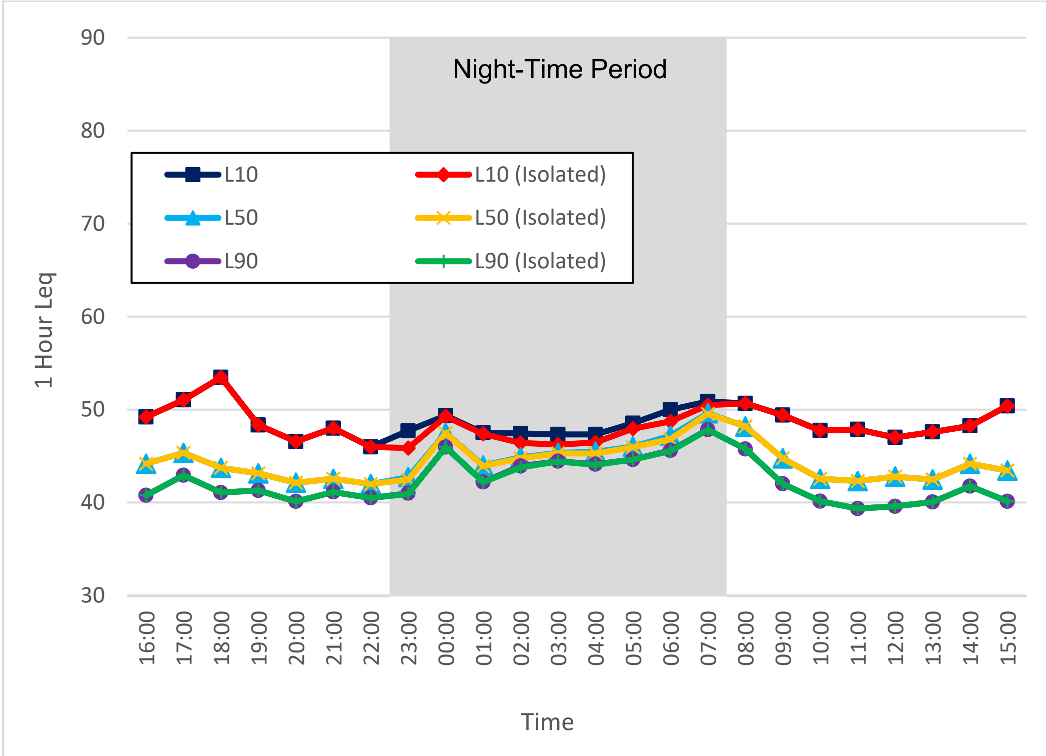

Figure 68. Noise Monitor #9, 1-Hour L_{10}, L_{50}, L_{90} L_{eq} Sound Levels (June 18 – 19, 2018)

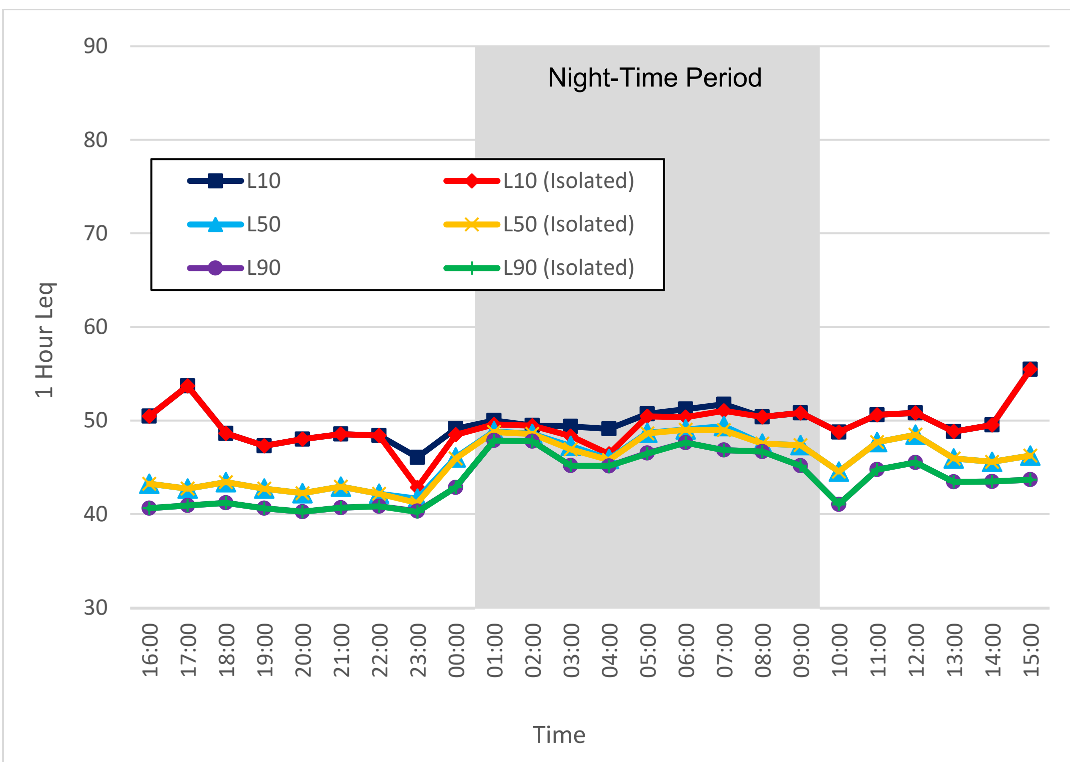

Figure 69. Noise Monitor #9, 1-Hour L_{10}, L_{50}, L_{90} L_{eq} Sound Levels (June 19 – 20, 2018)

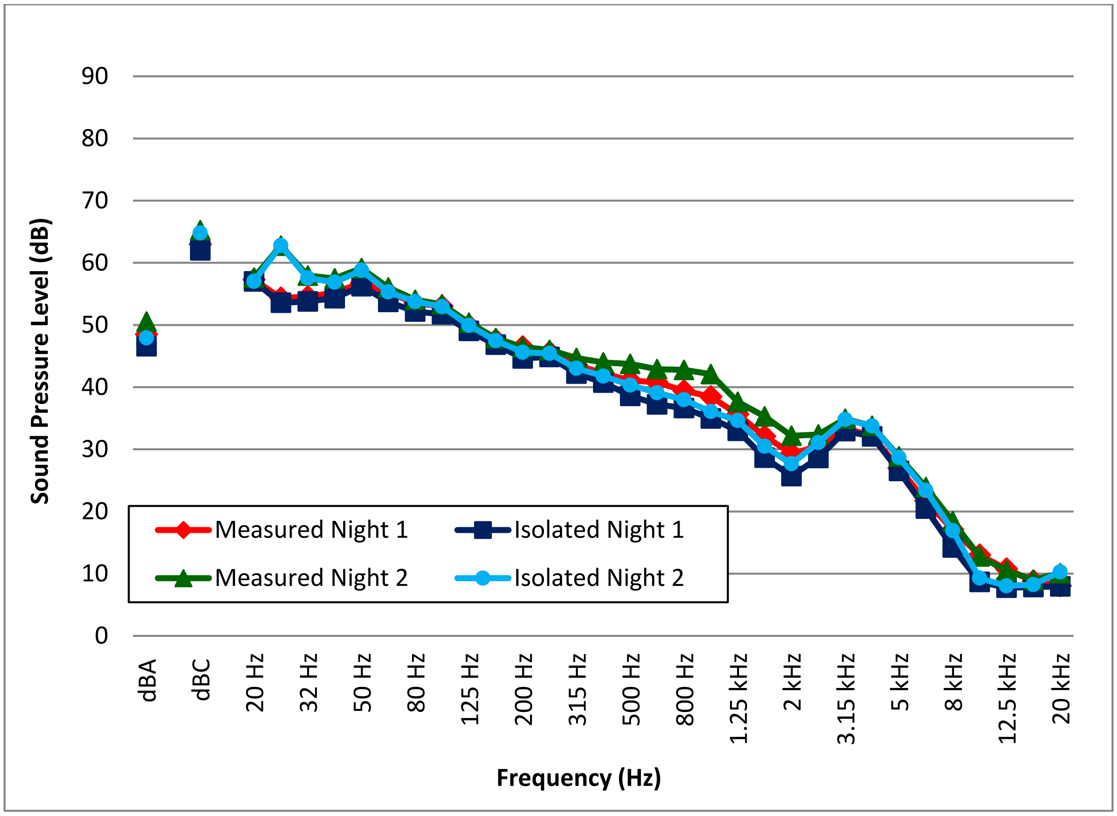

Figure 70. Noise Monitor #9, 1/3 Octave L_{eq} Sound Levels (June 18 – 20, 2018)

Noise Monitor #9

Noise Monitor #10

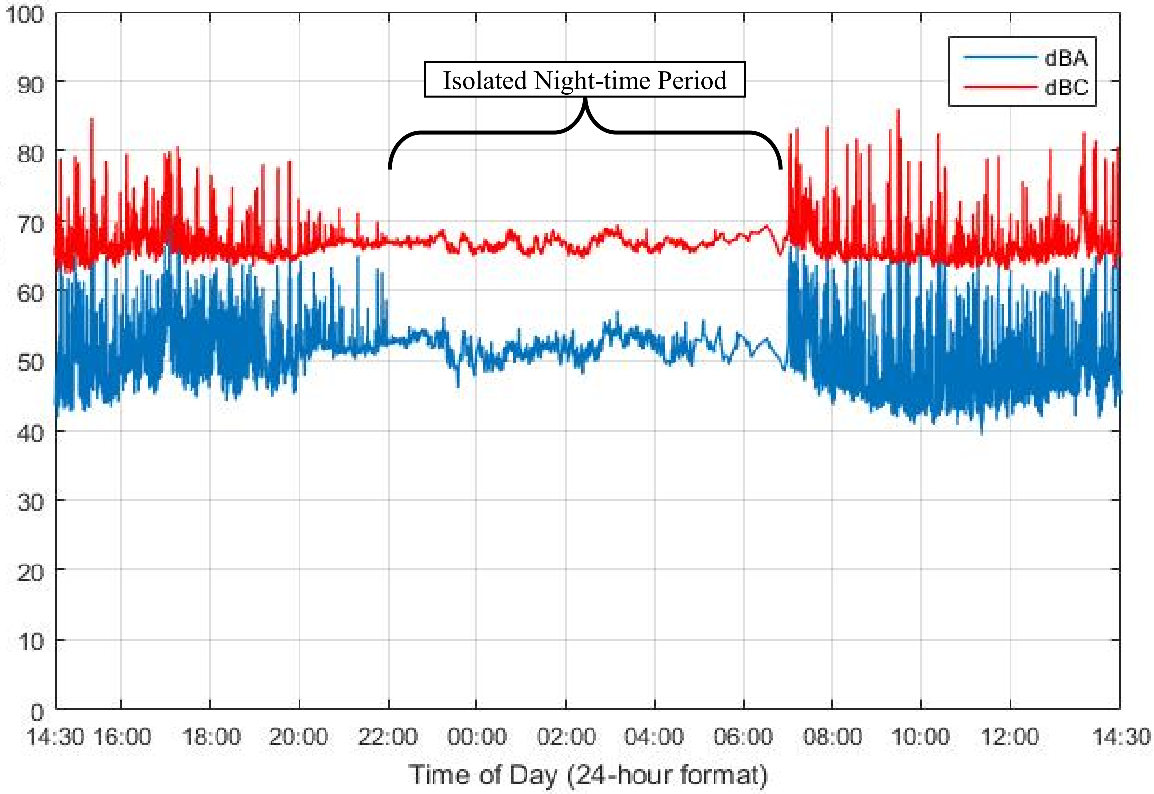

Figure 71. Noise Monitor #10, 15-Second L_{eq} Sound Levels (June 18 – 19, 2018)

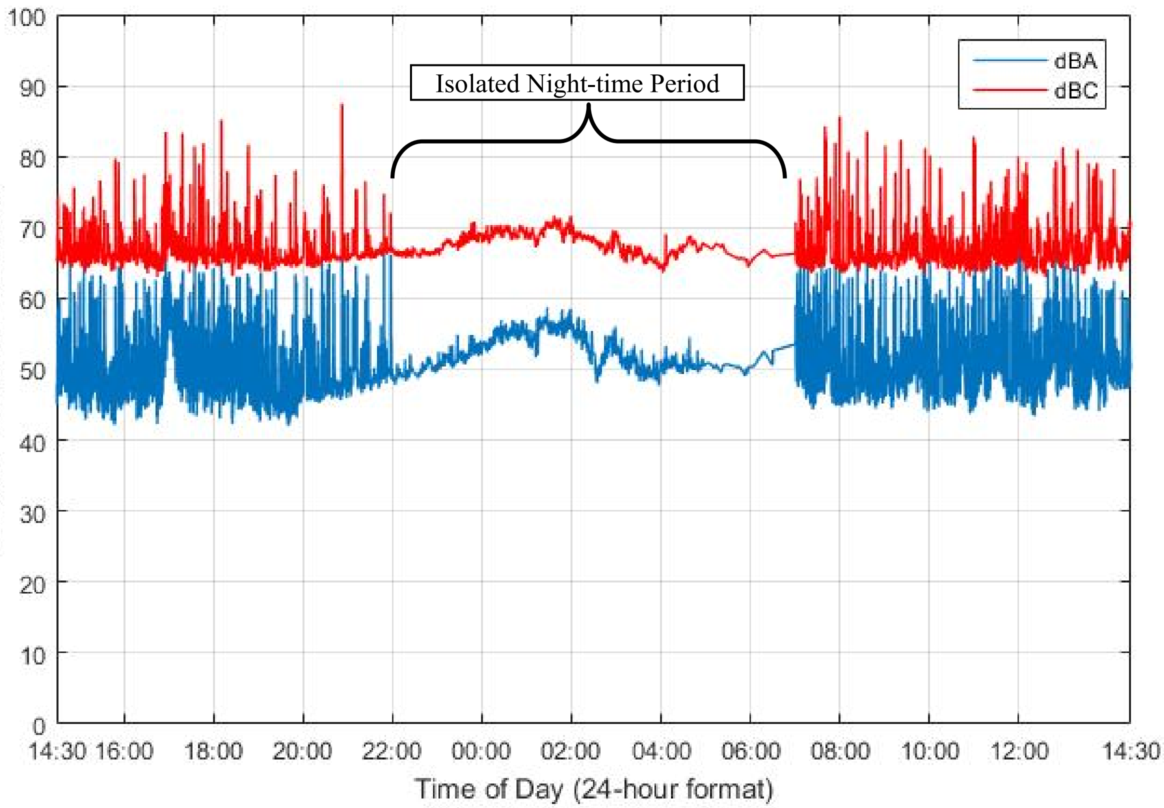

Figure 72. Noise Monitor #10, 15-Second L_{eq} Sound Levels (June 19 – 20, 2018)

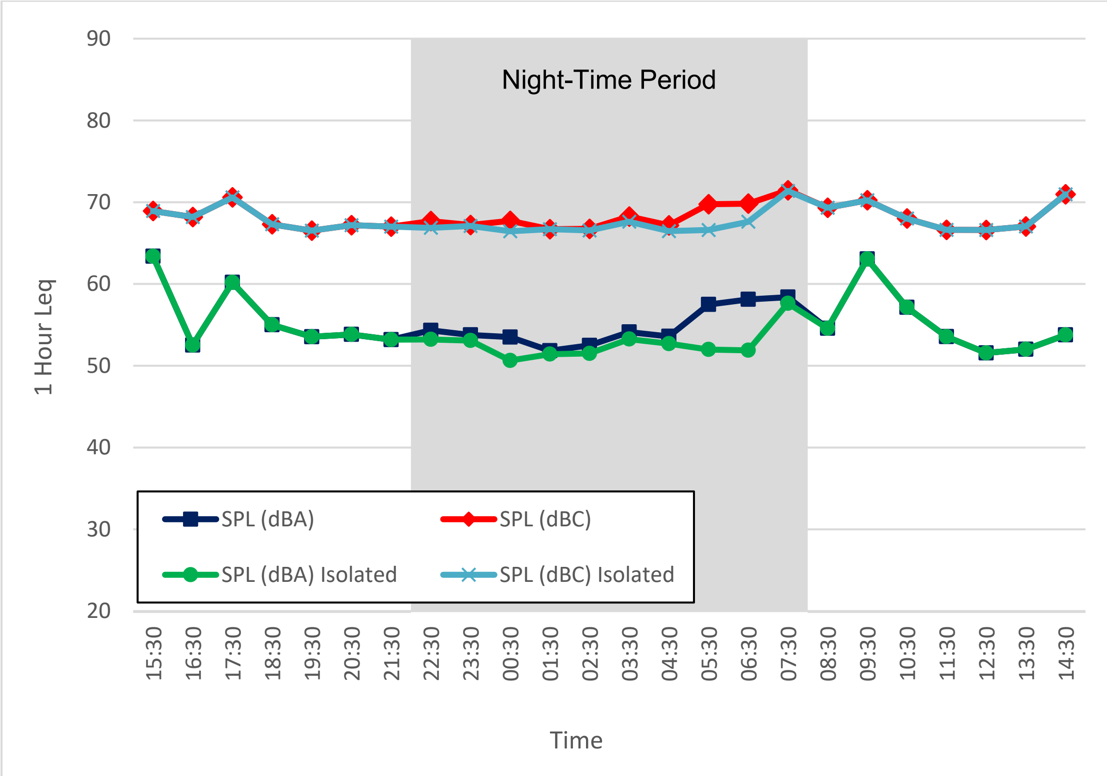

Figure 73. Noise Monitor #10, 1-Hour L_{eq} Sound Levels (June 18 – 19, 2018)

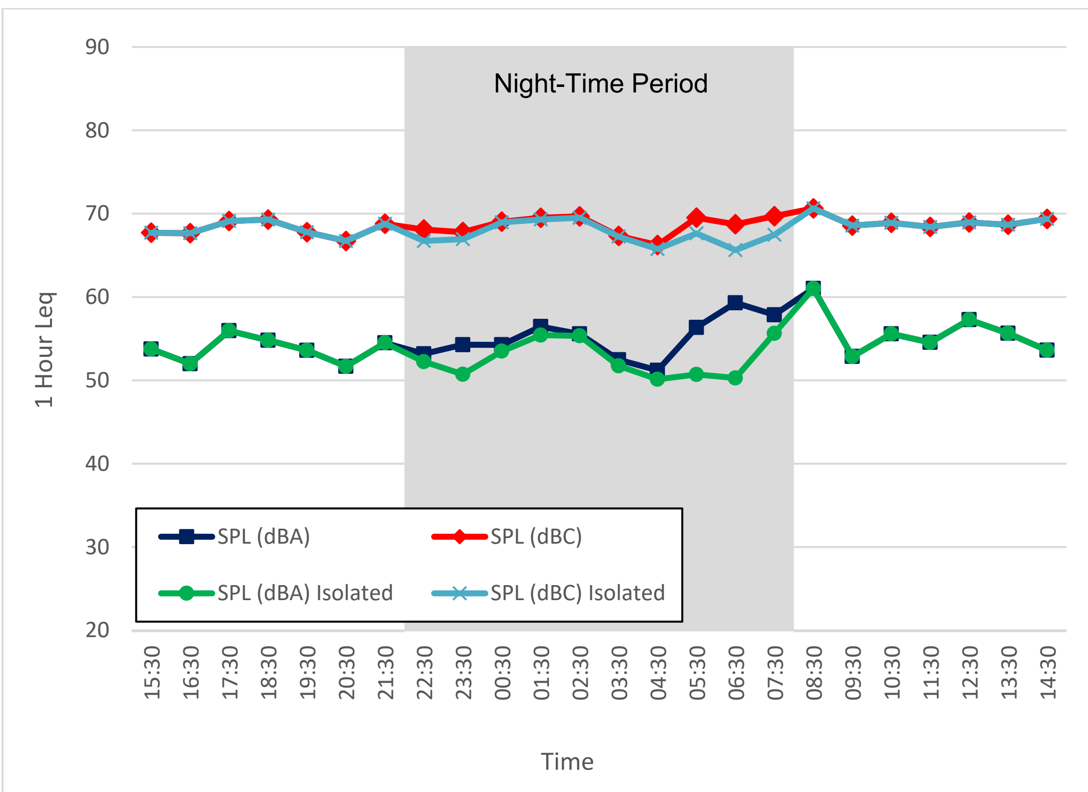

Figure 74. Noise Monitor #10, 1-Hour L_{eq} Sound Levels (June 19 – 20, 2018)

Monitor #10

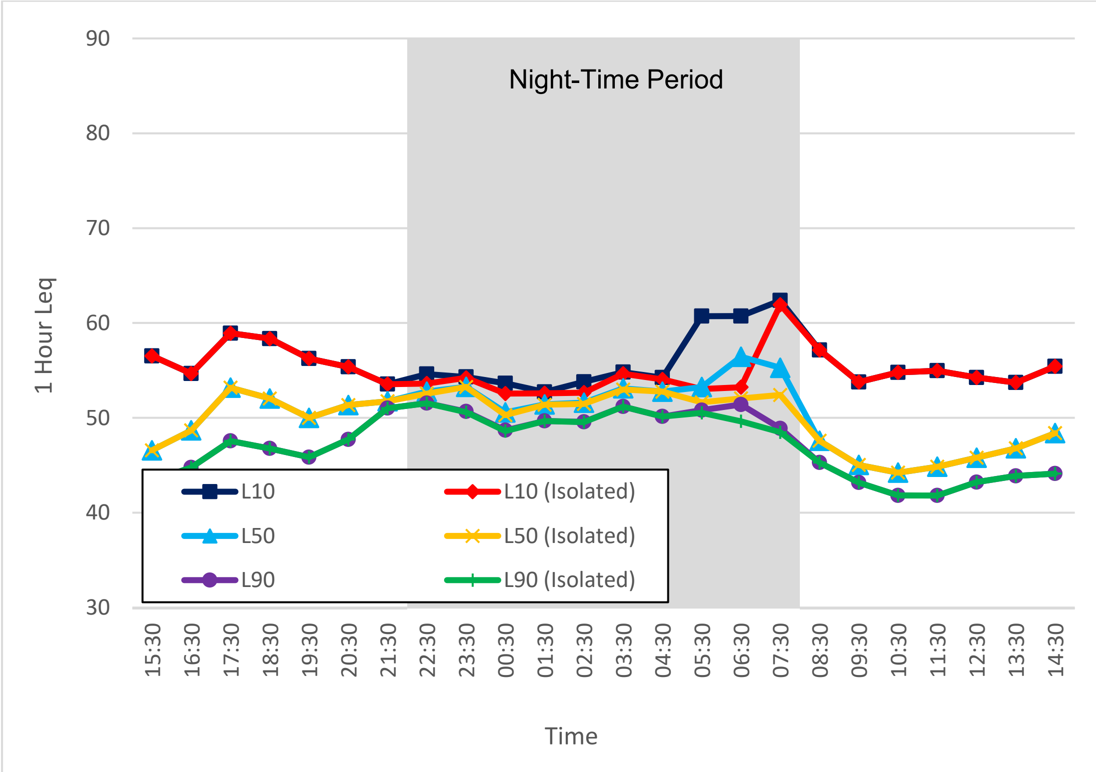

Figure 75. Noise Monitor #10, 1-Hour L_{10}, L_{50}, L_{90} L_{eq} Sound Levels (June 18 – 19, 2018)

Noise

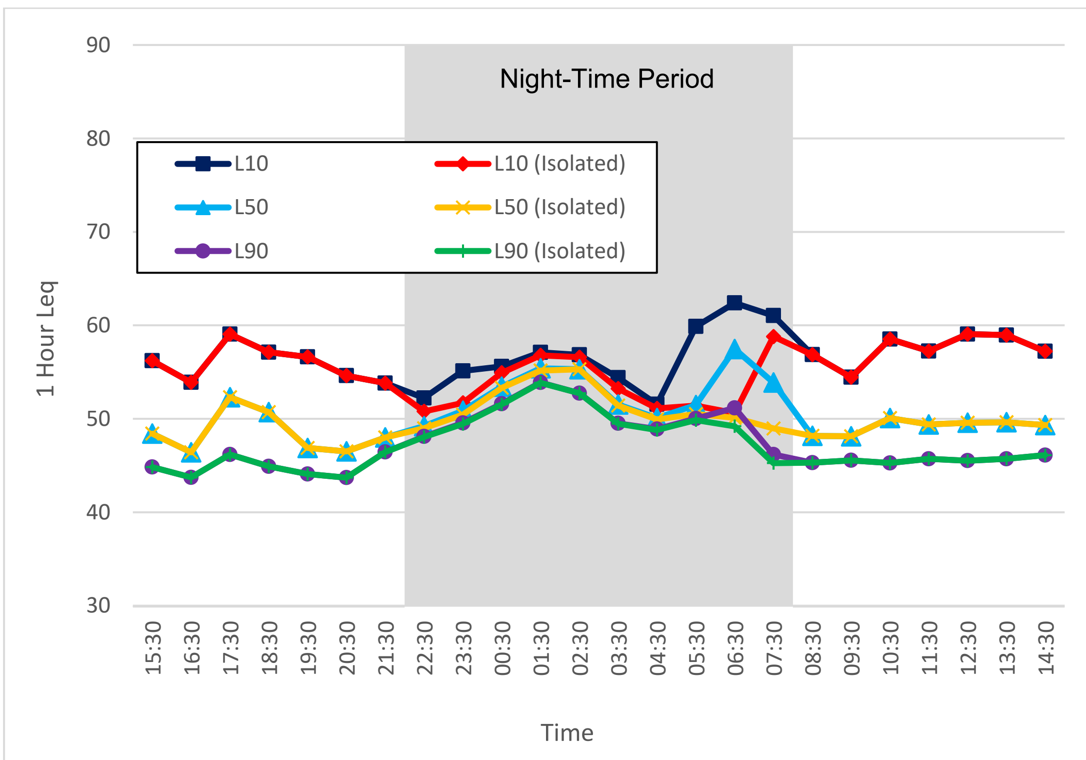

Figure 76. Noise Monitor #10, 1-Hour L_{10}, L_{50}, L_{90} L_{eq} Sound Levels (June 19 – 20, 2018)

Noise Monitor #10

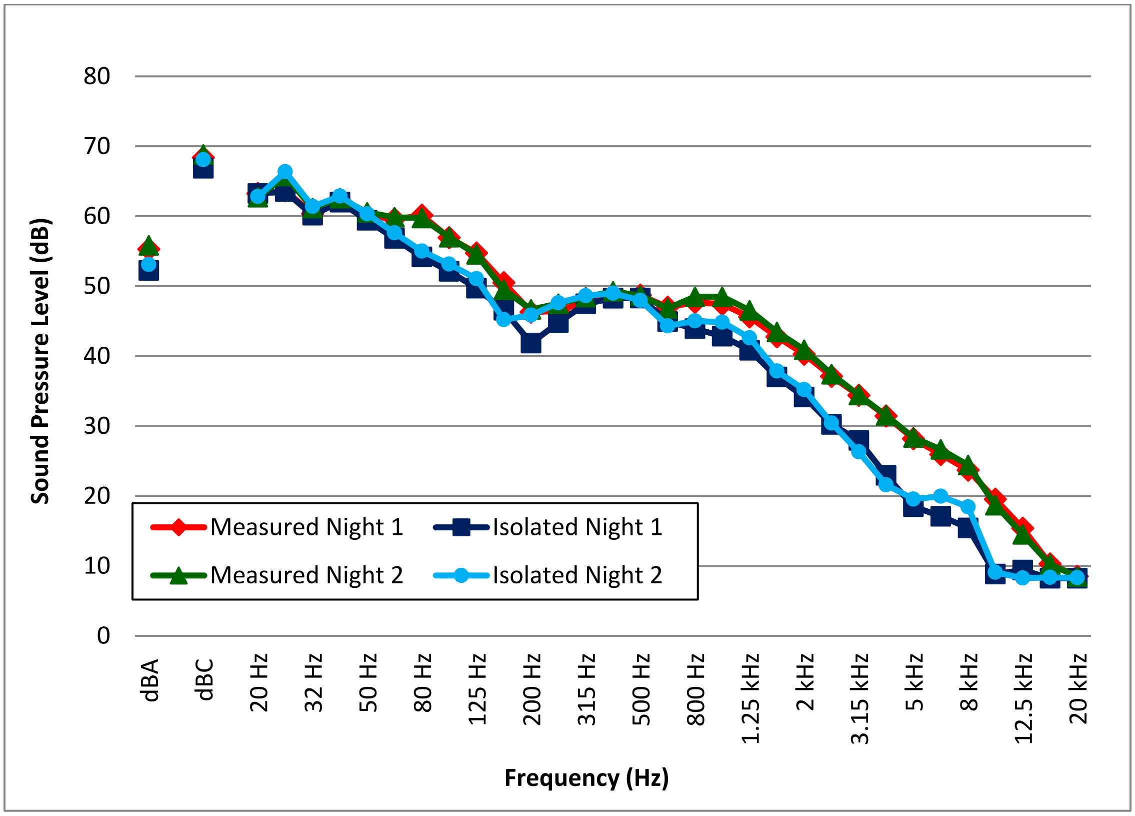

Figure 77. Noise Monitor #10, 1/3 Octave L_{eq} Sound Levels (June 18 – 20, 2018)

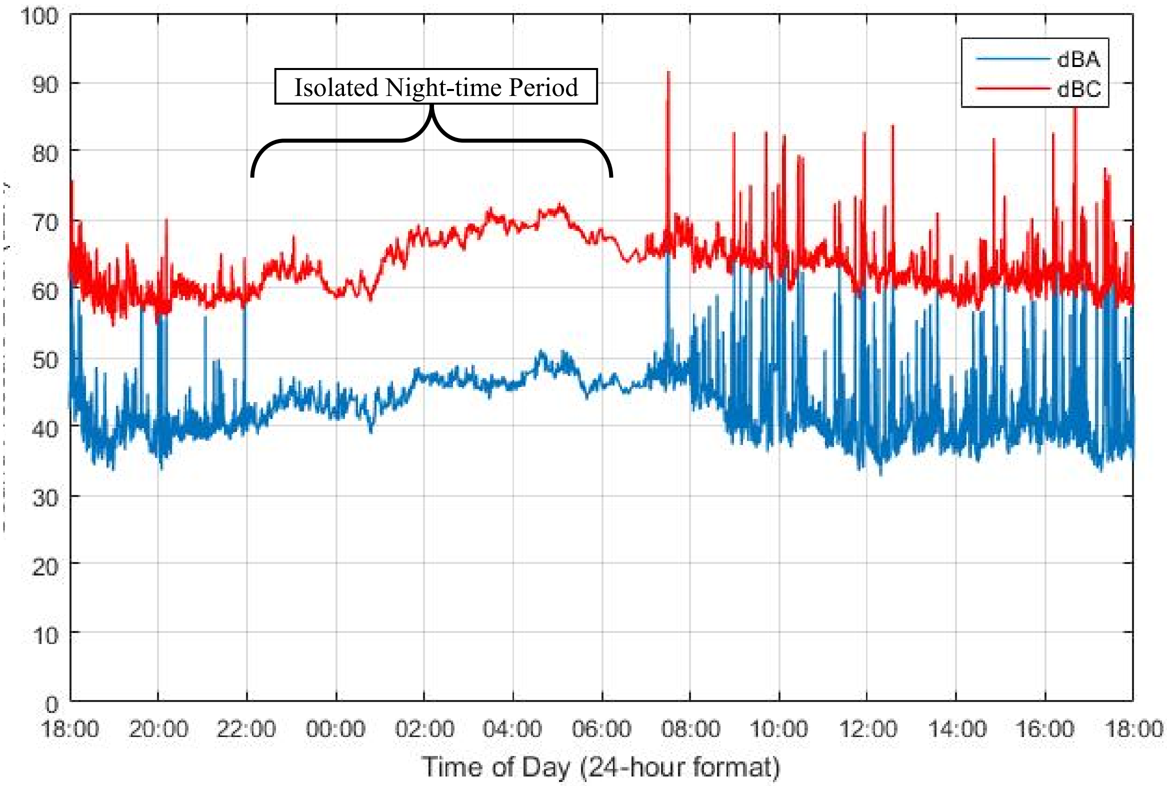

Figure 78. Noise Monitor #11, 15-Second L_{eq} Sound Levels (July 24 – 25, 2018)

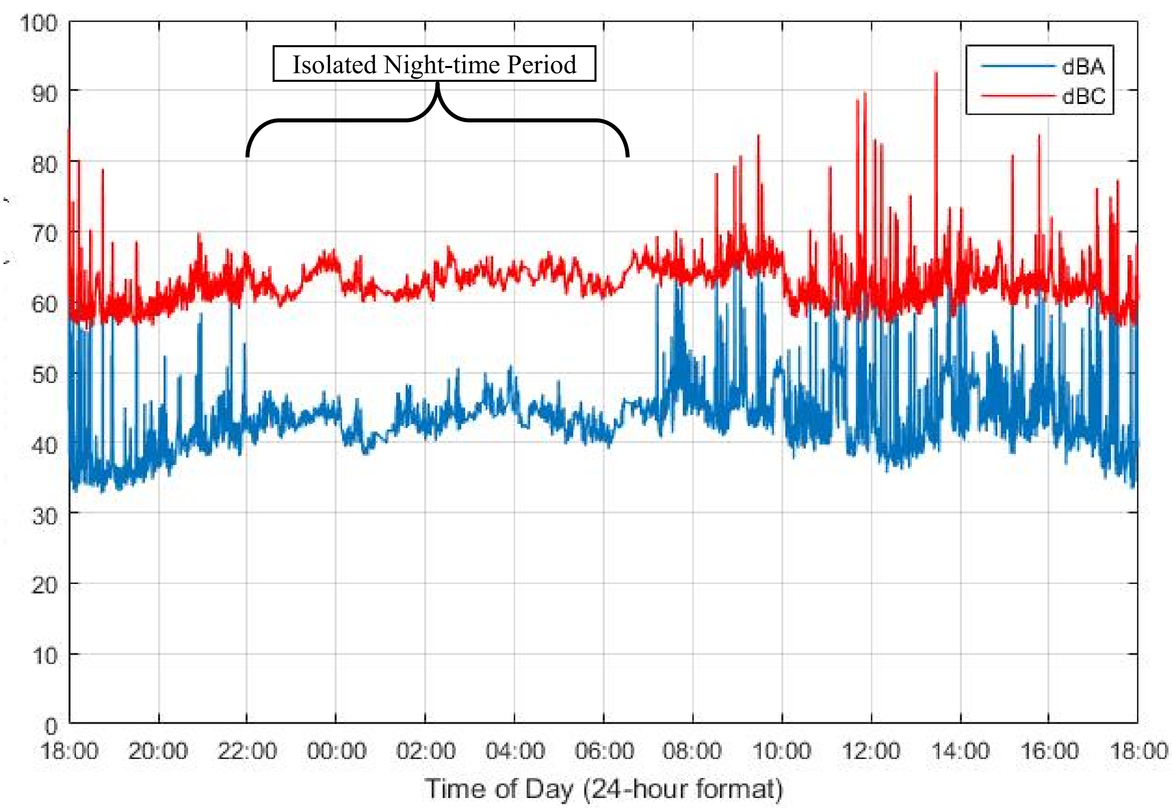

Figure 79. Noise Monitor #11, 15-Second L_{eq} Sound Levels (July 25 – 26, 2018)

Noise Monitor #11

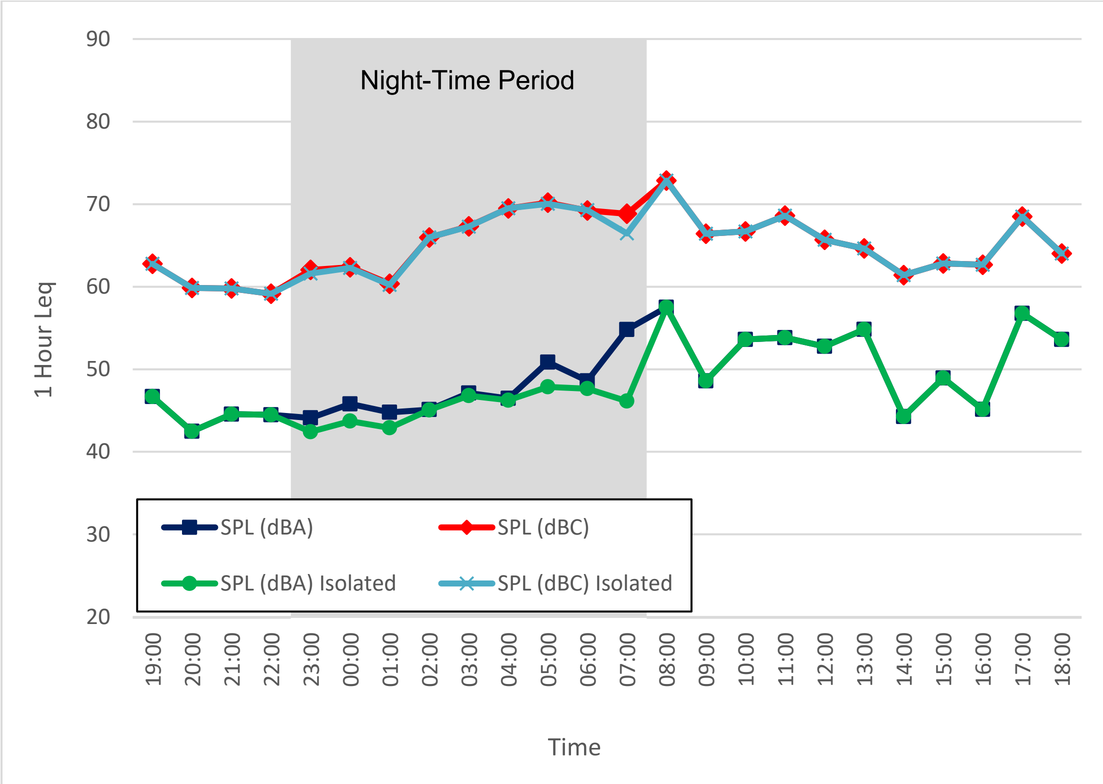

Figure 80. Noise Monitor #11, 1-Hour L_{eq} Sound Levels (July 24 – 25, 2018)

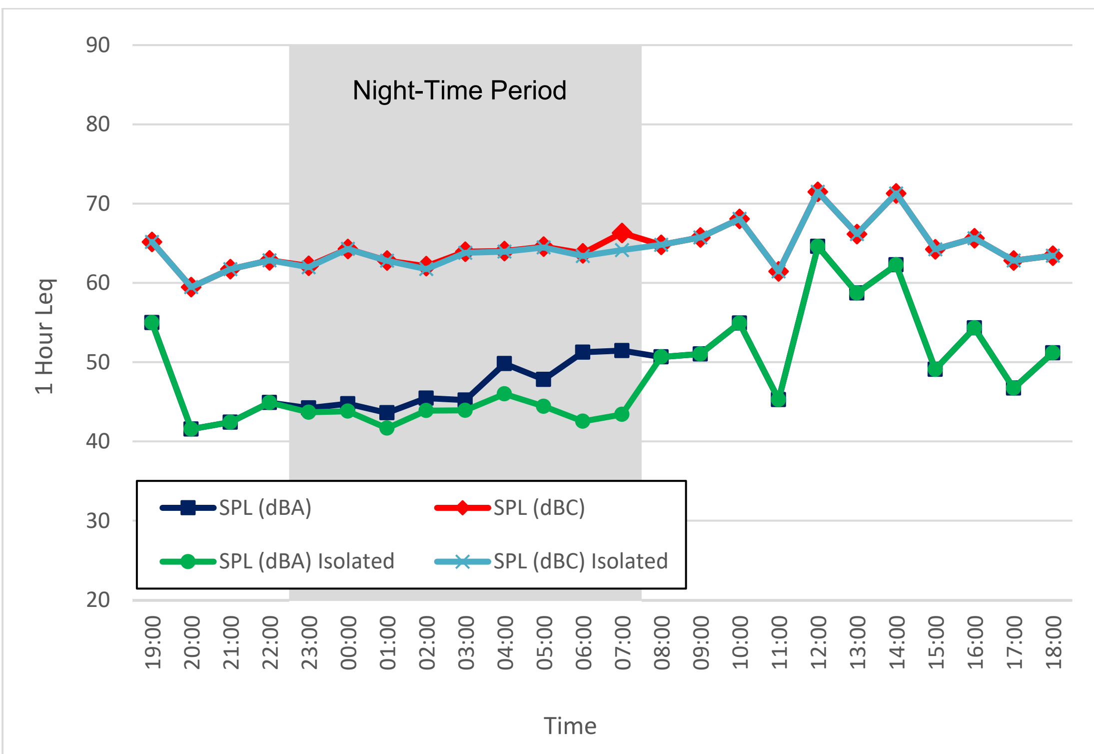

Figure 81. Noise Monitor #11, 1-Hour L_{eq} Sound Levels (July 25 – 26, 2018)

Noise Monitor #11

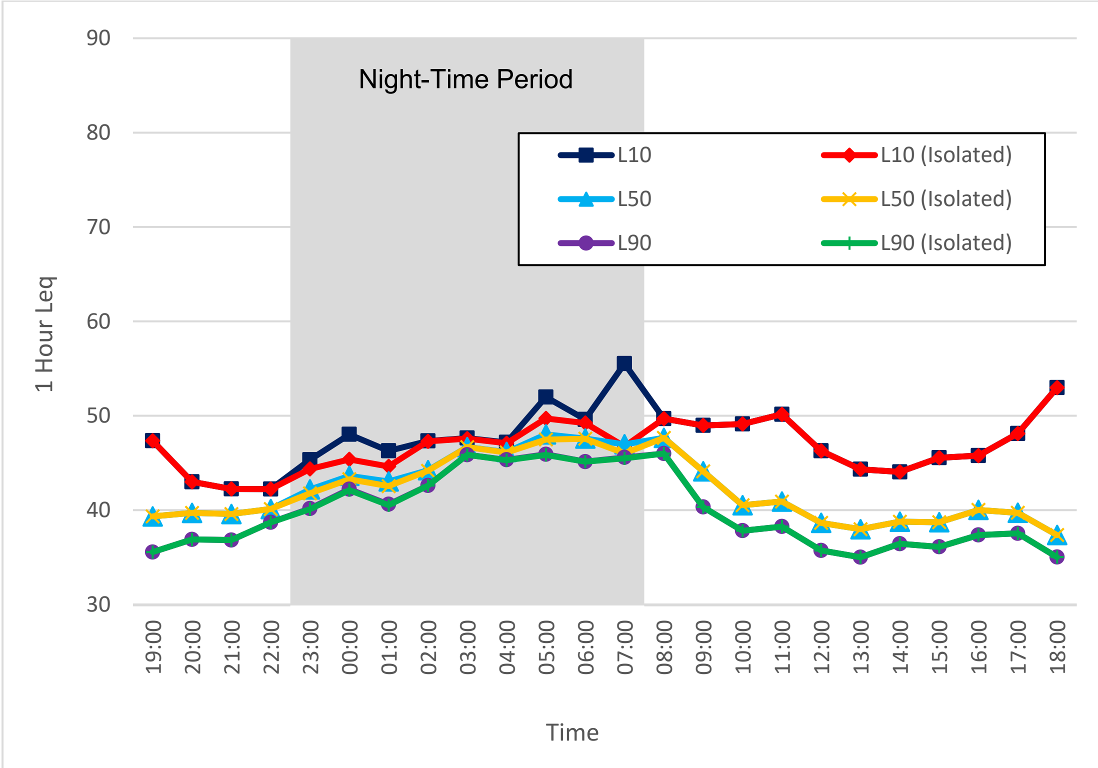

Figure 82. Noise Monitor #11, 1-Hour L_{10}, L_{50}, L_{90} L_{eq} Sound Levels (July 24 – 25, 2018)

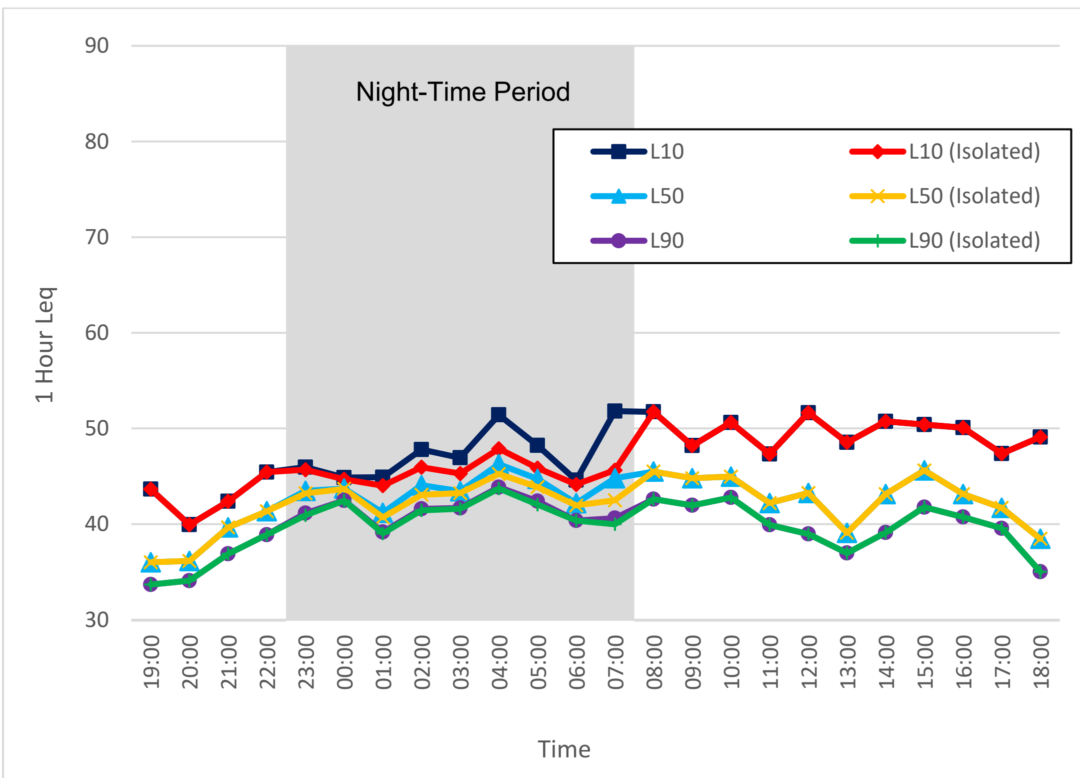

Figure 83. Noise Monitor #11, 1-Hour L_{10}, L_{50}, L_{90} L_{eq} Sound Levels (July 25 – 26, 2018)

Noise Monitor #11

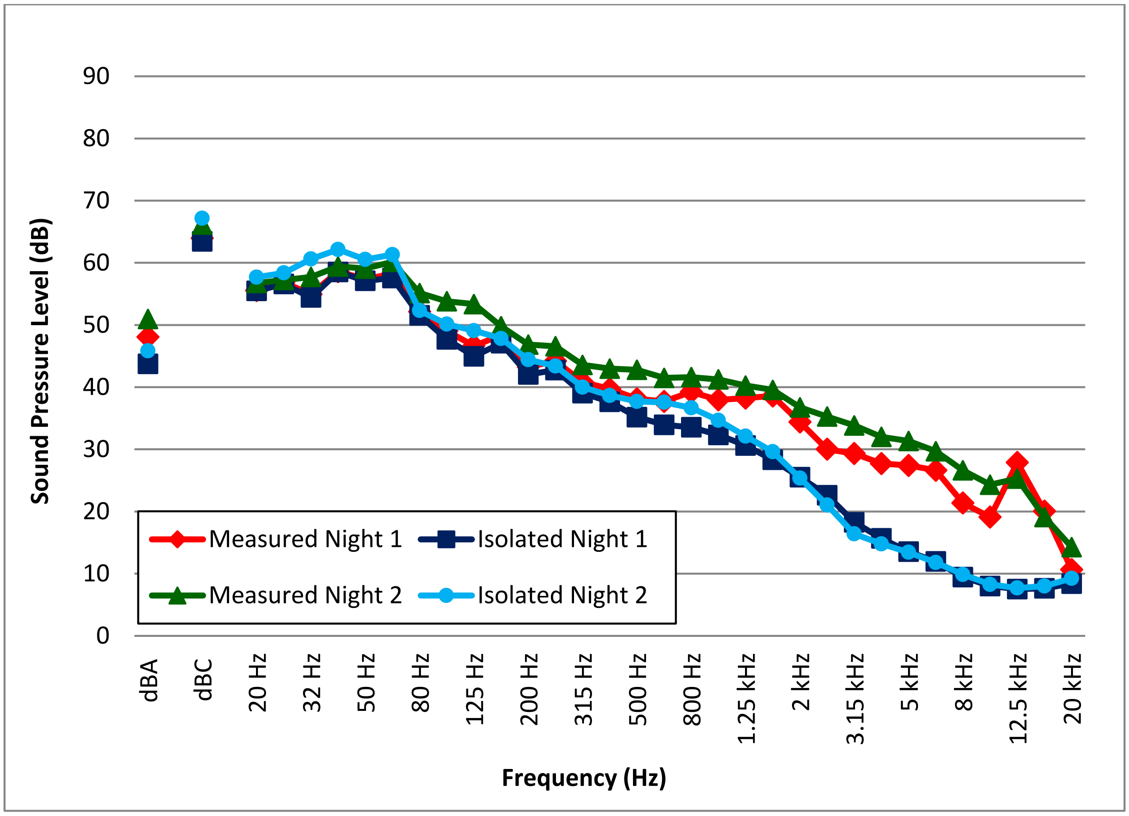

Figure 84. Noise Monitor #11, 1/3 Octave L_{eq} Sound Levels (July 24 – 26, 2018)

Noise Monitor #12 - Period 1

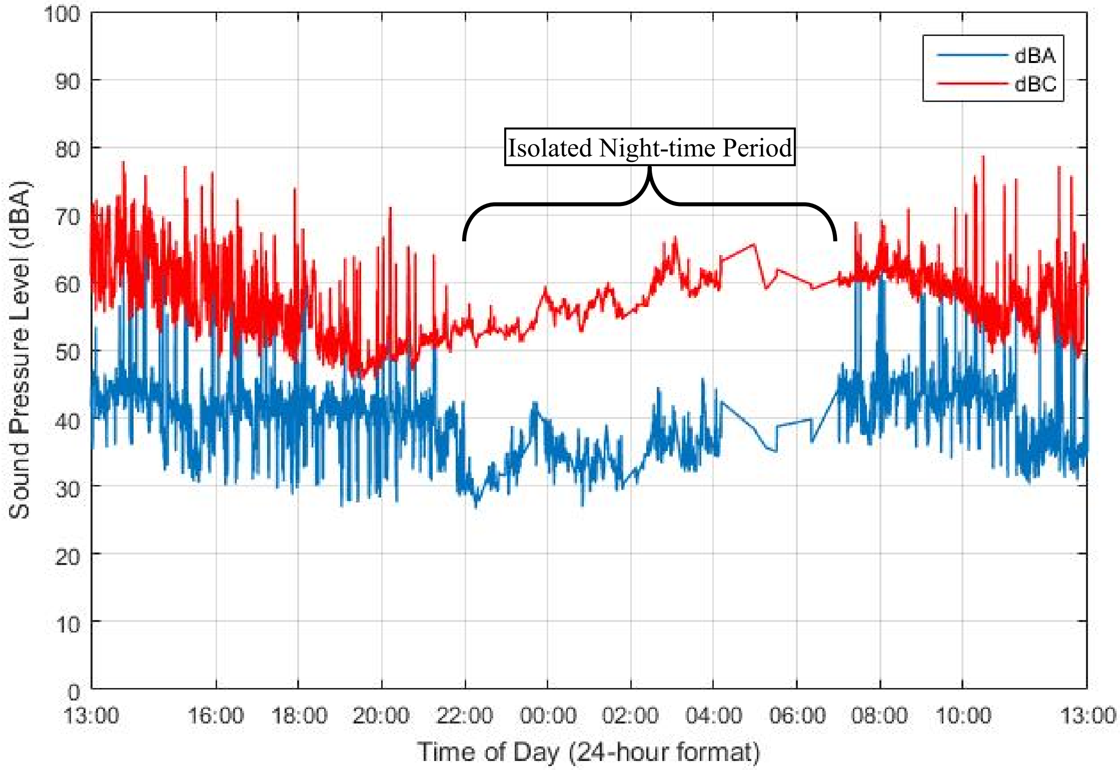

Figure 85. Noise Monitor #12, 15-Second L_{eq} Sound Levels (June 18 - 19, 2018)

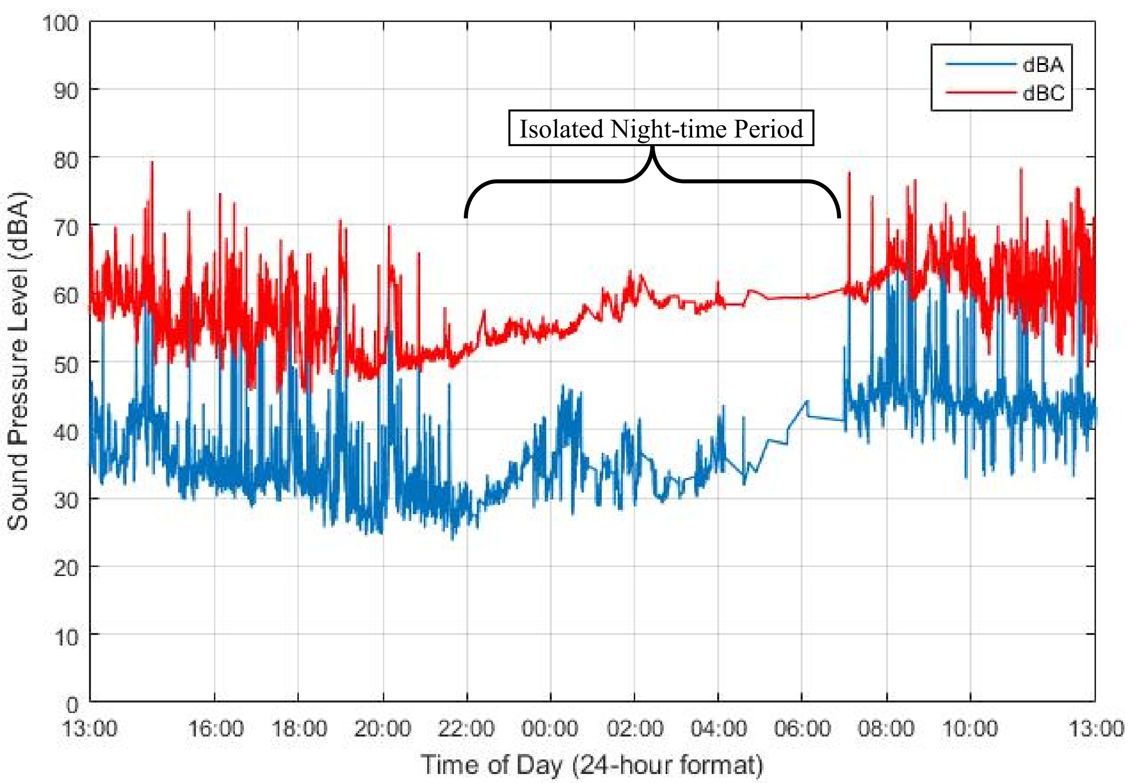

Figure 86. Noise Monitor #12, 15-Second L_{eq} Sound Levels (June 19 - 20, 2018)

Noise Monitor #12 - Period 1

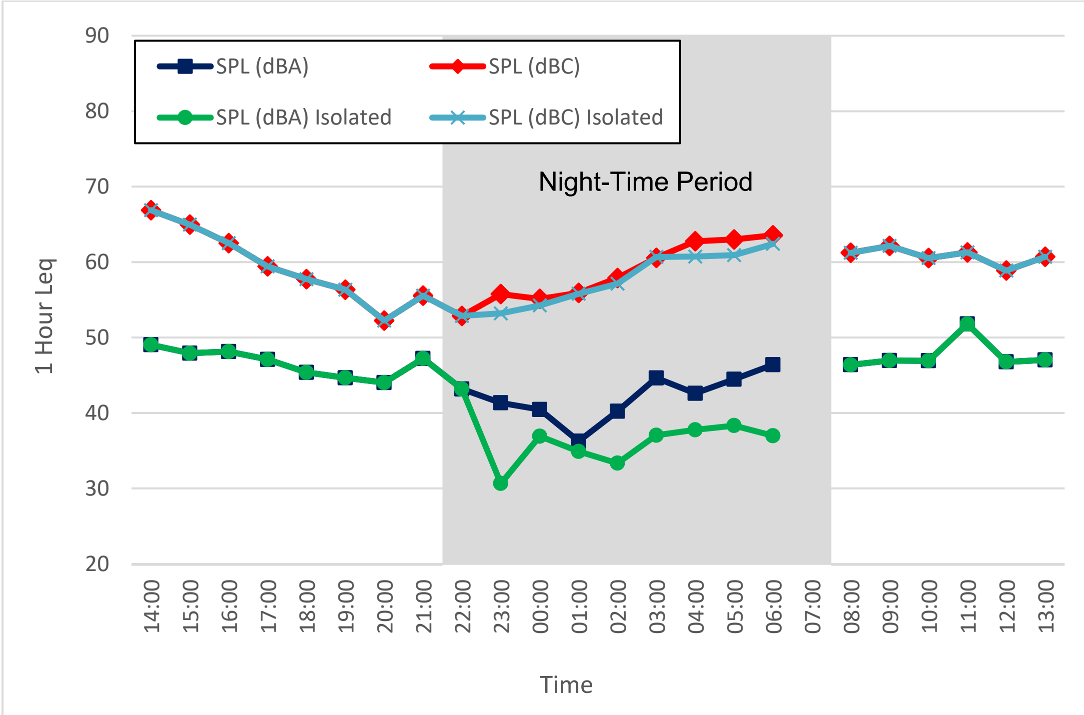

Figure 87. Noise Monitor #12, 1-Hour L_{eq} Sound Levels (June 18 - 19, 2018) [1]

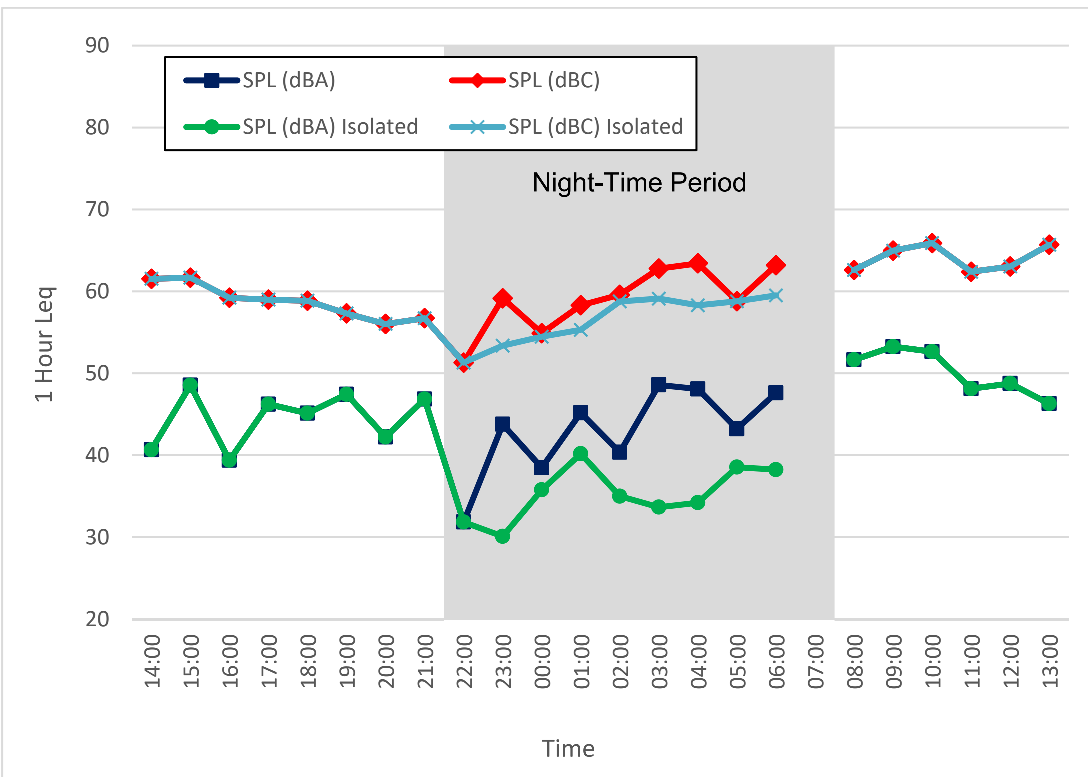

Figure 88. Noise Monitor #12, 1-Hour L_{eq} Sound Levels (June 19 - 20, 2018) [2]

[1] Data from 06:00 to 07:00 was almost entirely removed due to the morning rush hour and "morning chorus".
[2] Data from 06:00 to 07:00 was almost entirely removed due to the morning rush hour and "morning chorus".

Noise Monitor #12 - Period 1

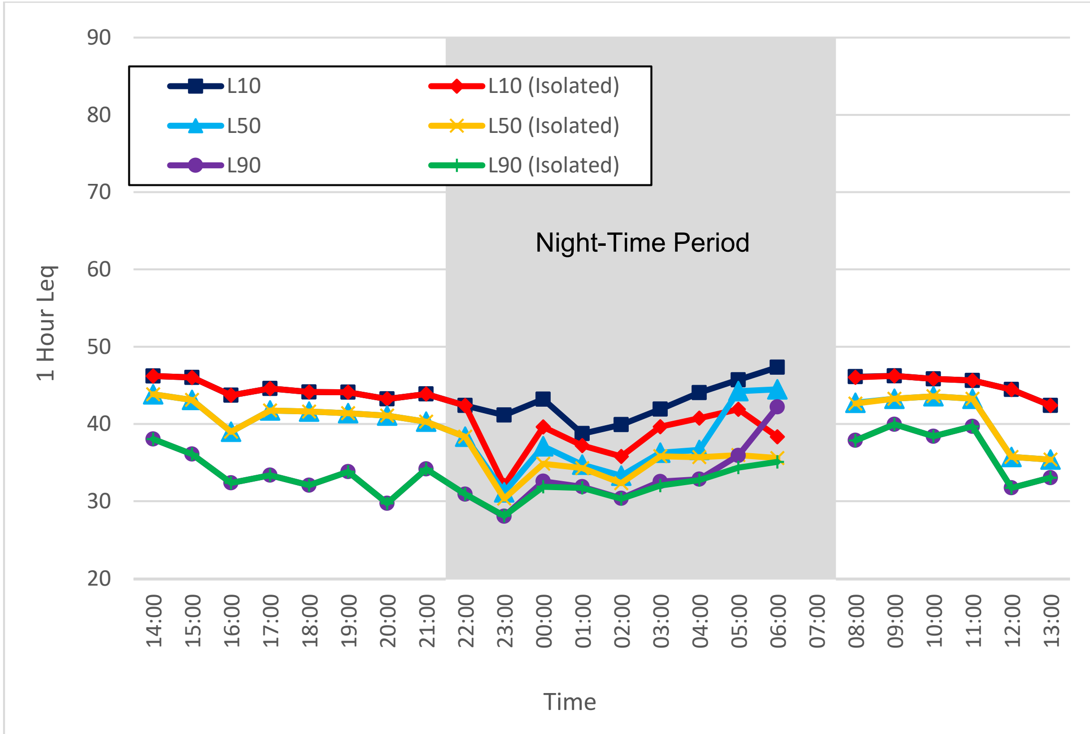

Figure 89. Noise Monitor #12, 1-Hour L_{10}, L_{50}, L_{90} L_{eq} Sound Levels (June 18 - 19, 2018) [1]

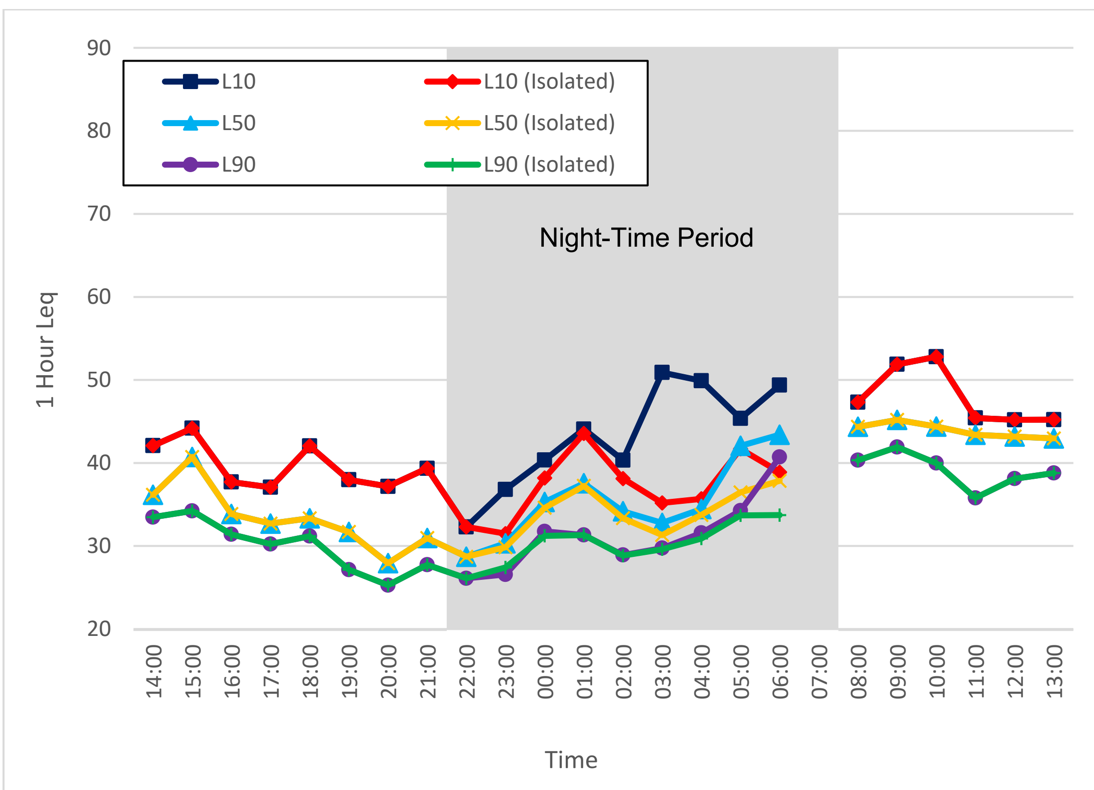

Figure 90. Noise Monitor #12, 1-Hour L_{10}, L_{50}, L_{90} L_{eq} Sound Levels (June 19 - 20, 2018) [2]

[1] Data from 06:00 to 07:00 was almost entirely removed due to the morning rush hour and "morning chorus".
[2] Data from 06:00 to 07:00 was almost entirely removed due to the morning rush hour and "morning chorus".

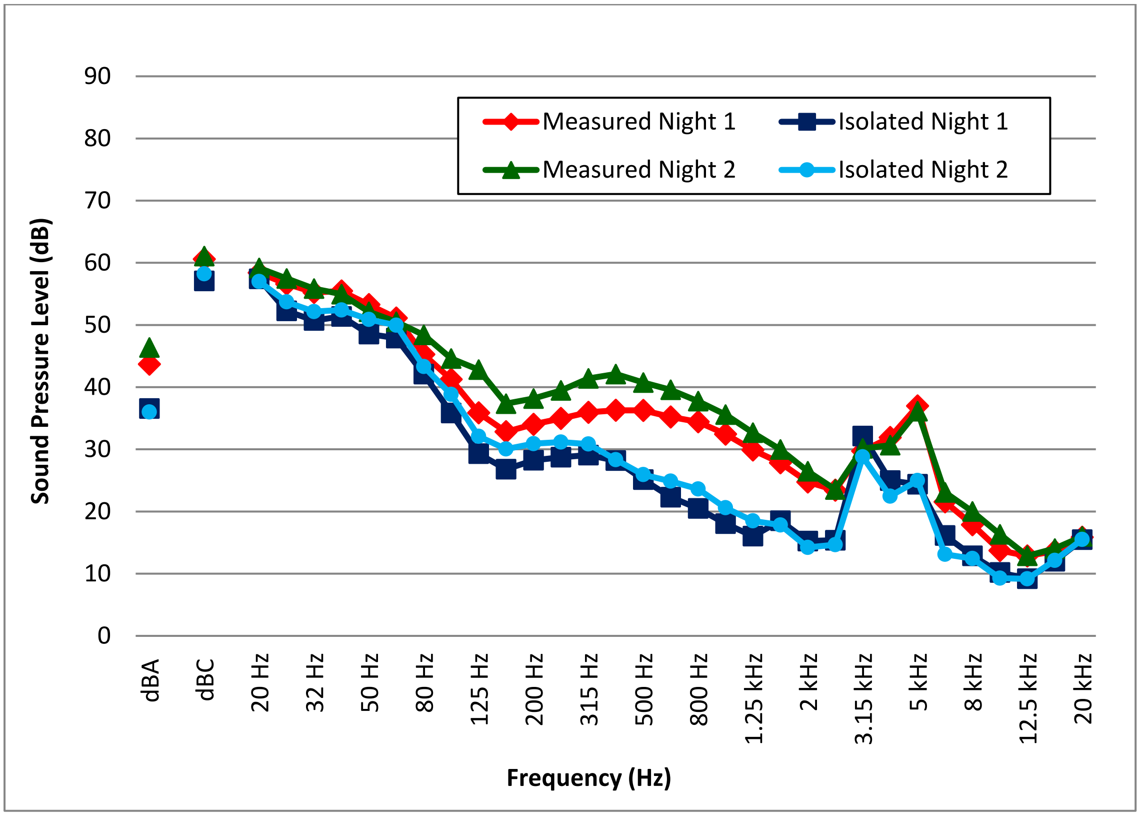

Figure 91. Noise Monitor #12, 1/3 Octave L_{eq} Sound Levels (June 18 - 20, 2018)

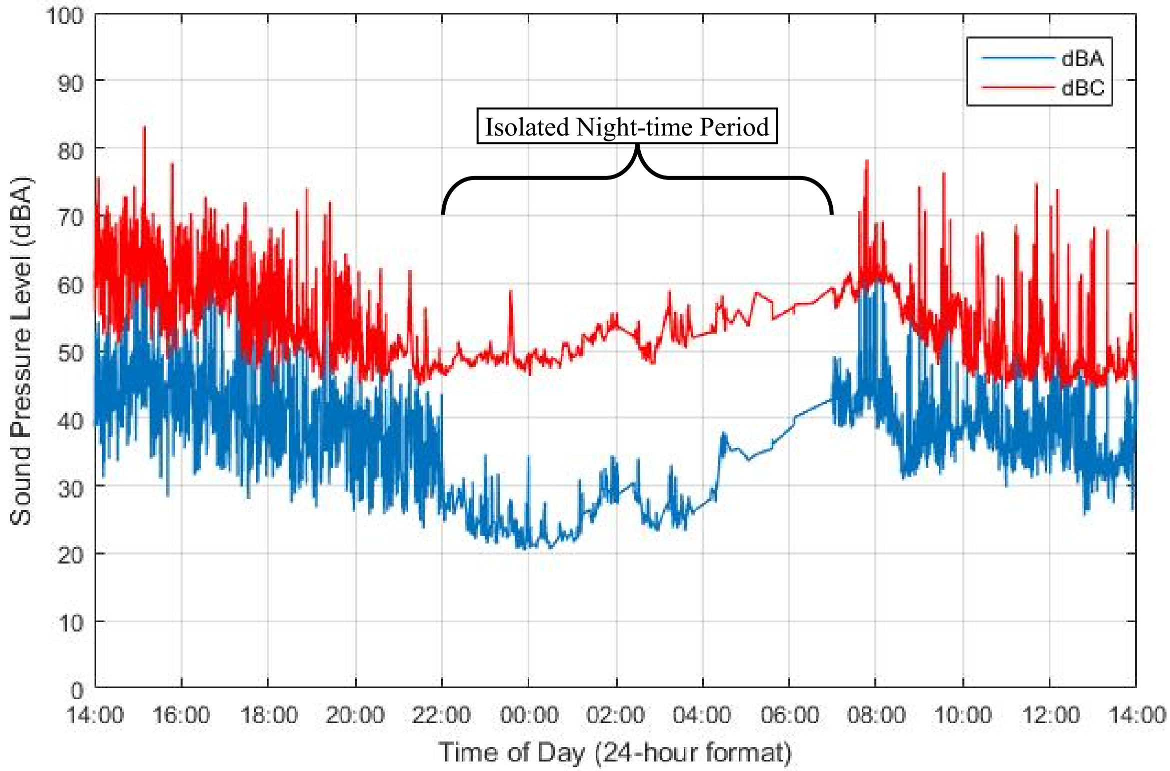

Figure 92. Noise Monitor #12, 15-Second L_{eq} Sound Levels (July 24 – 25, 2018)

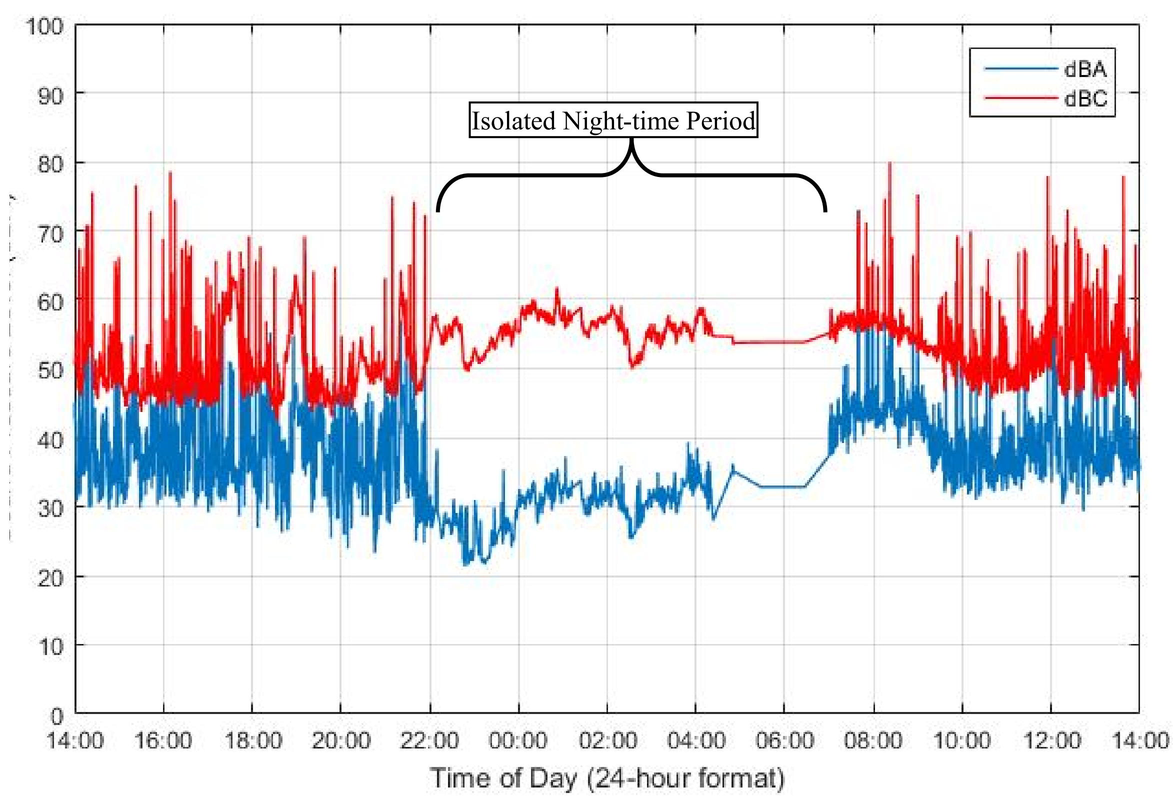

Figure 93. Noise Monitor #12, 15-Second L_{eq} Sound Levels (July 25 – 26, 2018)

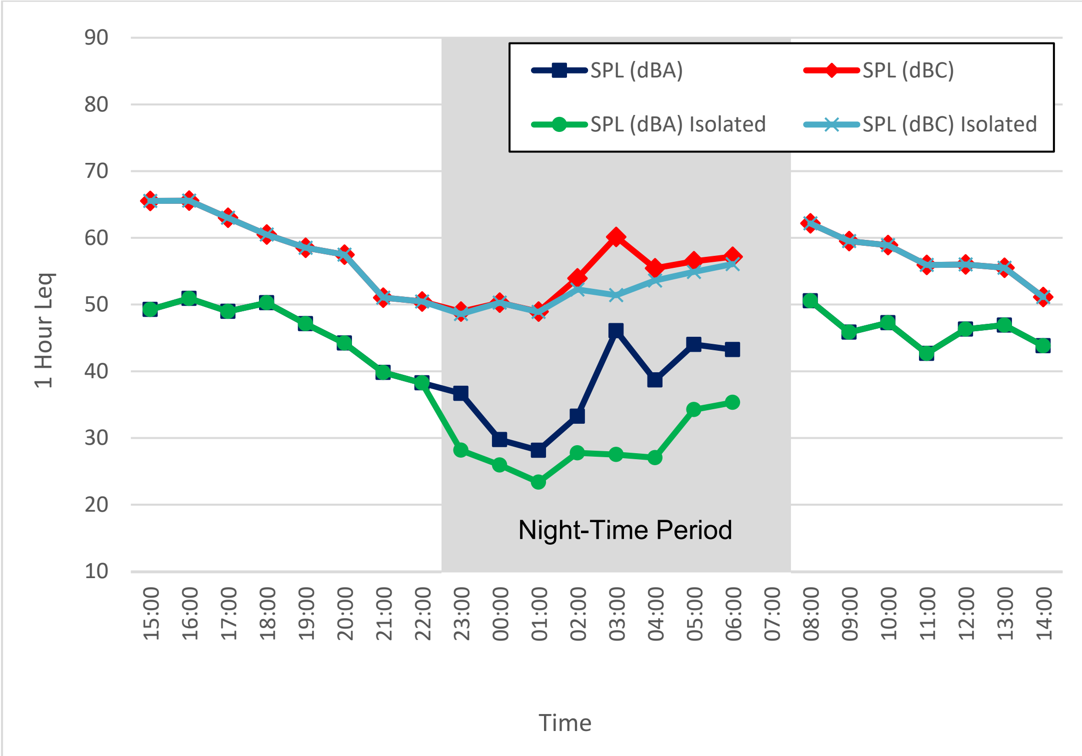

Figure 94. Noise Monitor #12, 1-Hour L_{eq} Sound Levels (July 24 – 25, 2018)[1]

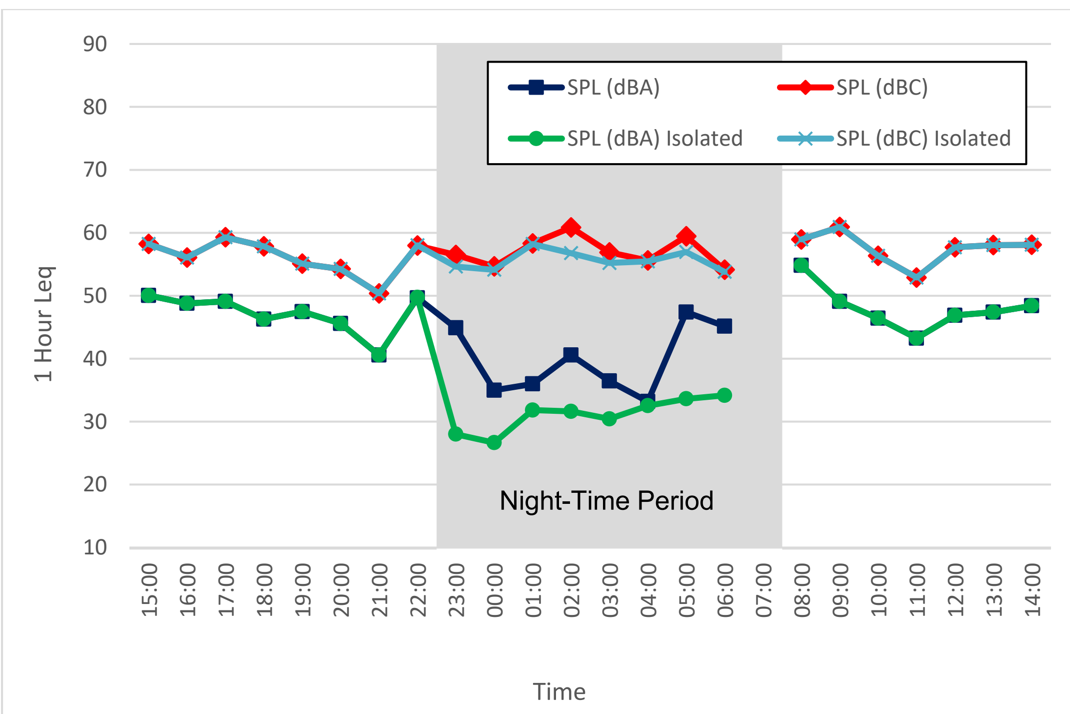

Figure 95. Noise Monitor #12, 1-Hour L_{eq} Sound Levels (July 25– 26, 2018) [2]

[1] Data from 06:00 to 07:00 was almost entirely removed due to the morning rush hour and "morning chorus".
[2] Data from 06:00 to 07:00 was entirely removed due to traffic along the adjacent road.

Noise Monitor #12 - Period 2

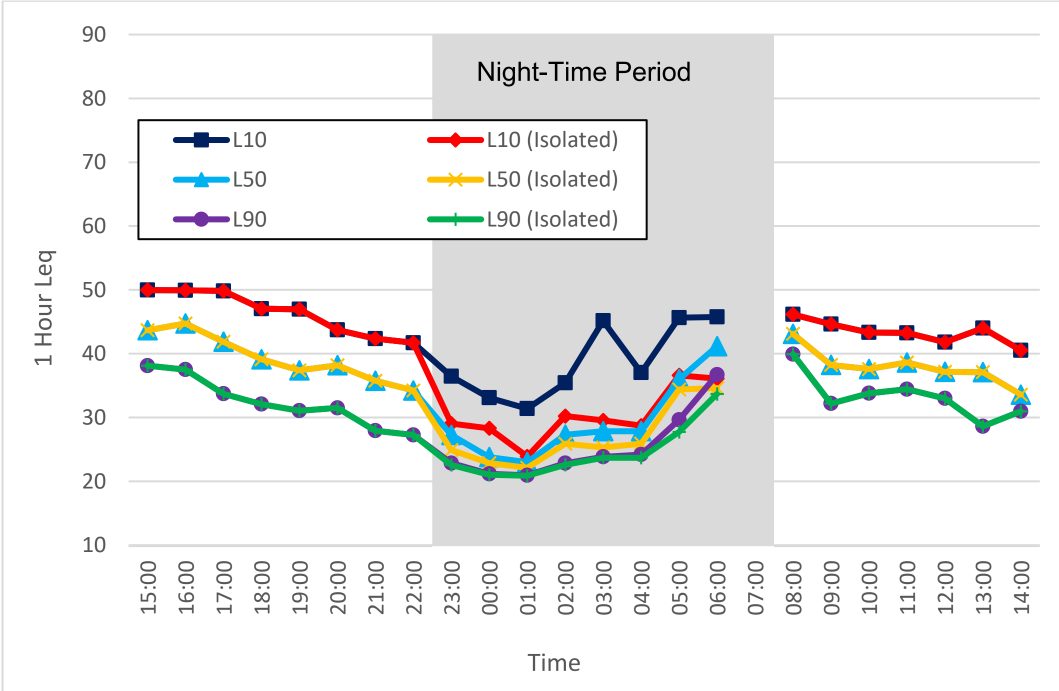

Figure 96. Noise Monitor #12, 1-Hour L_{10}, L_{50}, L_{90} L_{eq} Sound Levels (July 24 – 25, 2018) [1]

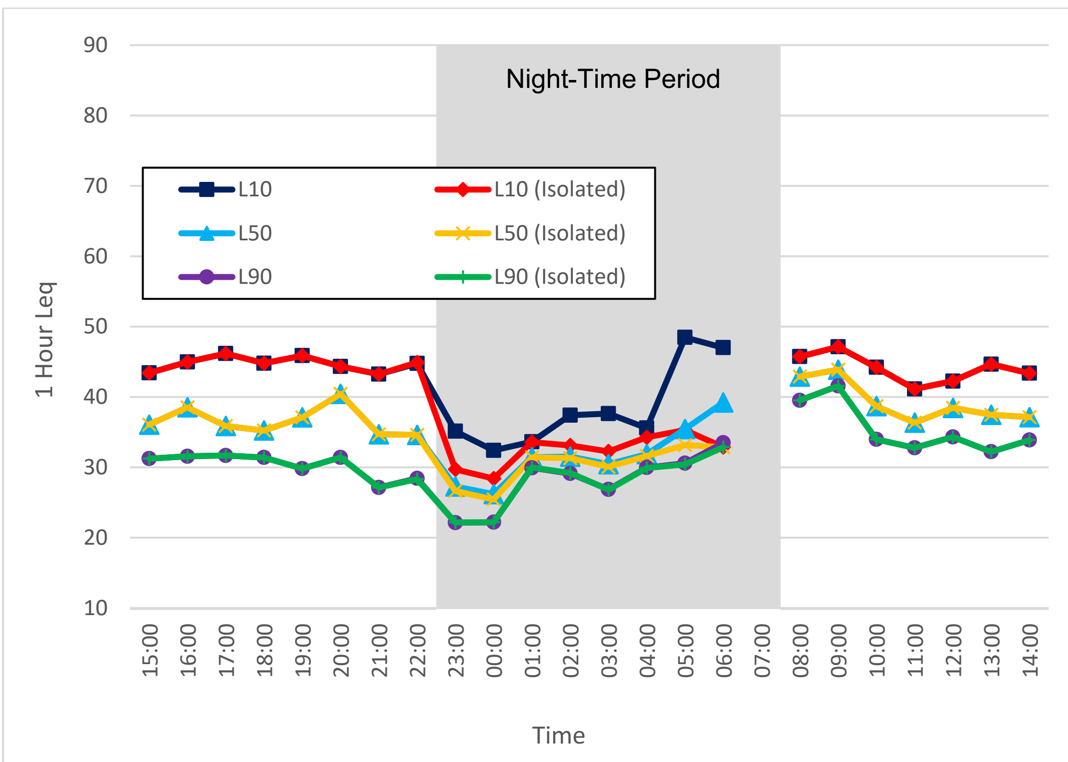

Figure 97. Noise Monitor #12, 1-Hour L_{10}, L_{50}, L_{90} L_{eq} Sound Levels (July 25 – 26, 2018) [2]

[1] Data from 06:00 to 07:00 was almost entirely removed due to the morning rush hour and "morning chorus".
[2] Data from 06:00 to 07:00 was entirely removed due to traffic along the adjacent road.

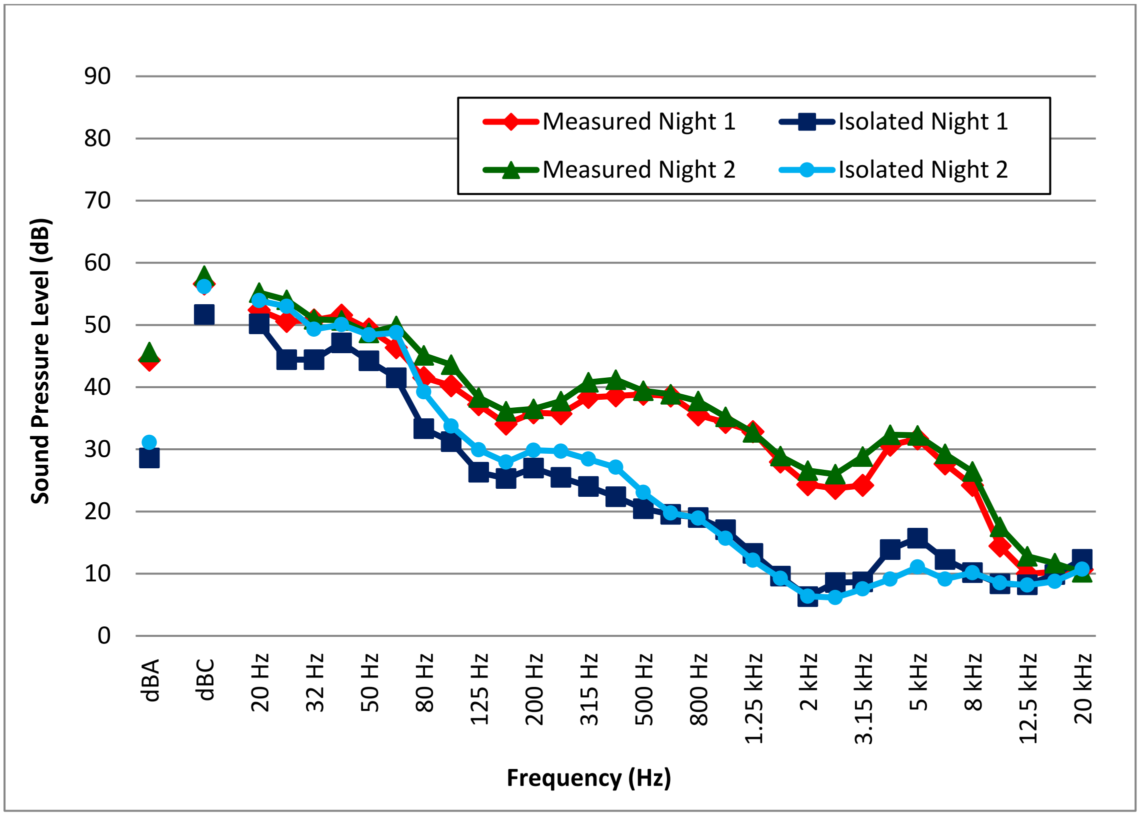

Figure 98. Noise Monitor #12, 1/3 Octave L_{eq} Sound Levels (July 24 – 26, 2018)

Noise Monitor #13

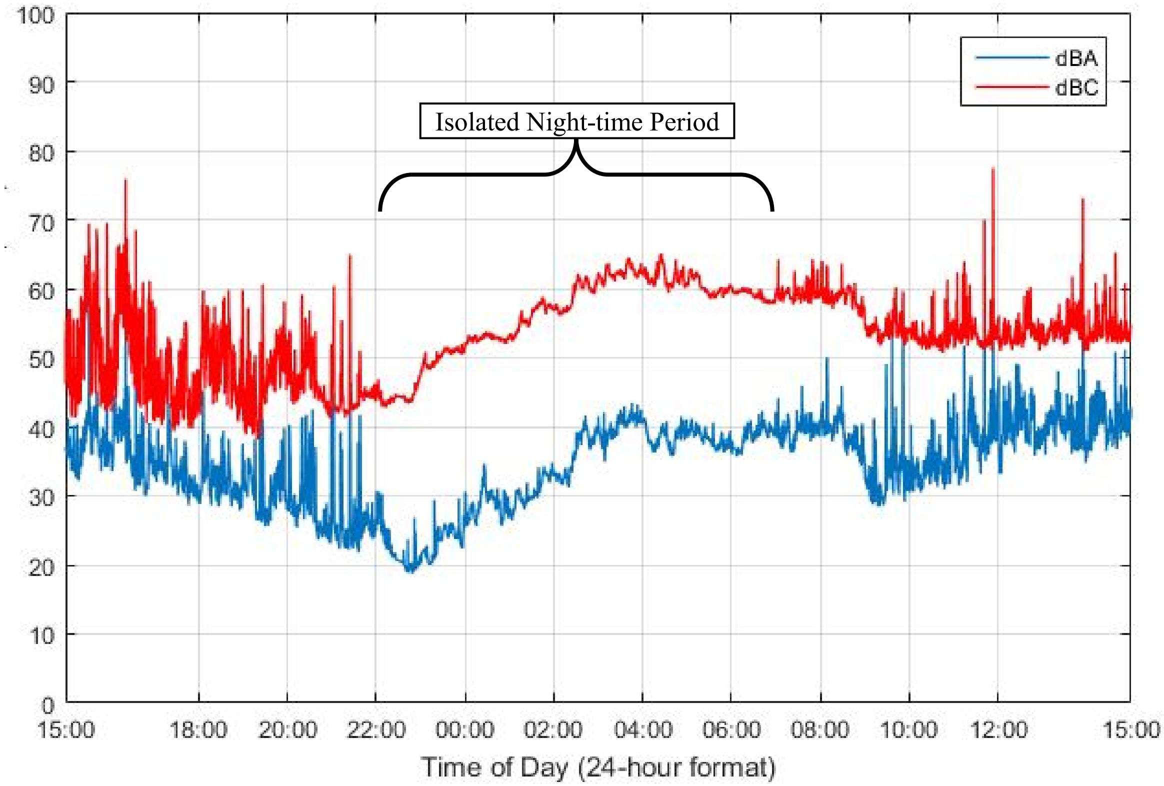

Figure 99. Noise Monitor #13, 15-Second L_{eq} Sound Levels (July 24 – 25, 2018)

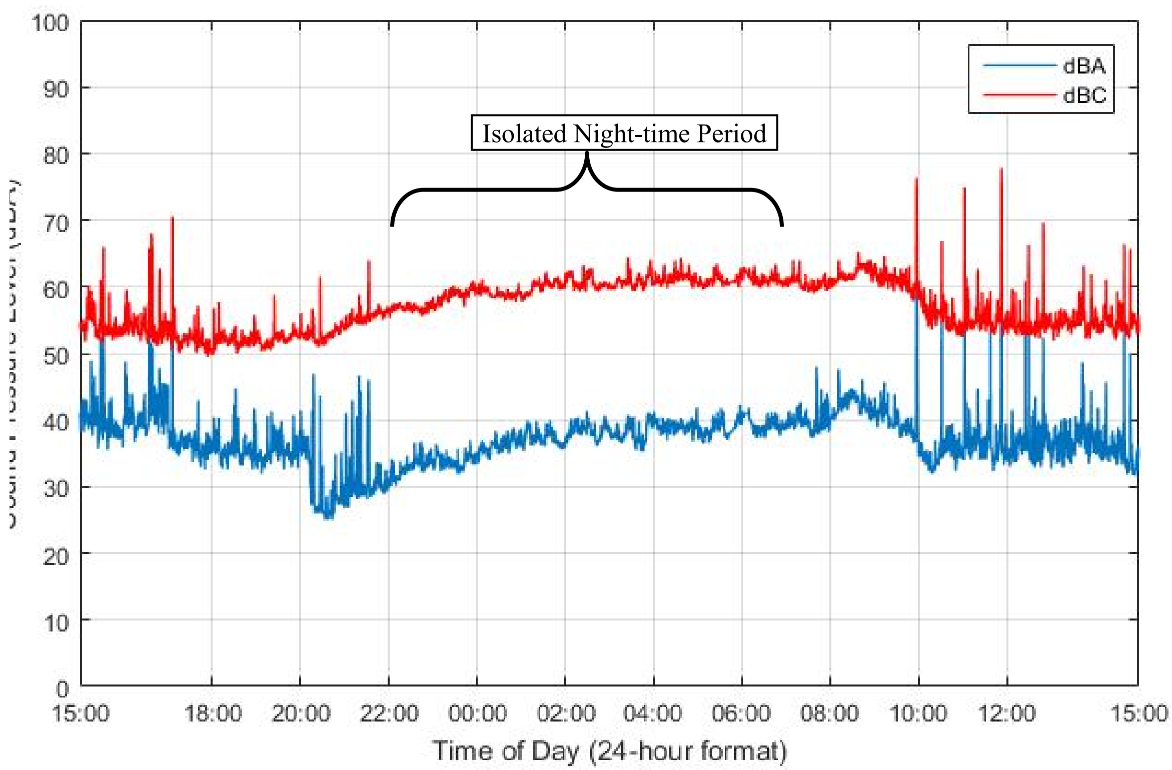

Figure 100. Noise Monitor #13, 15-Second L_{eq} Sound Levels (July 25 – 26, 2018)

Noise Monitor #13

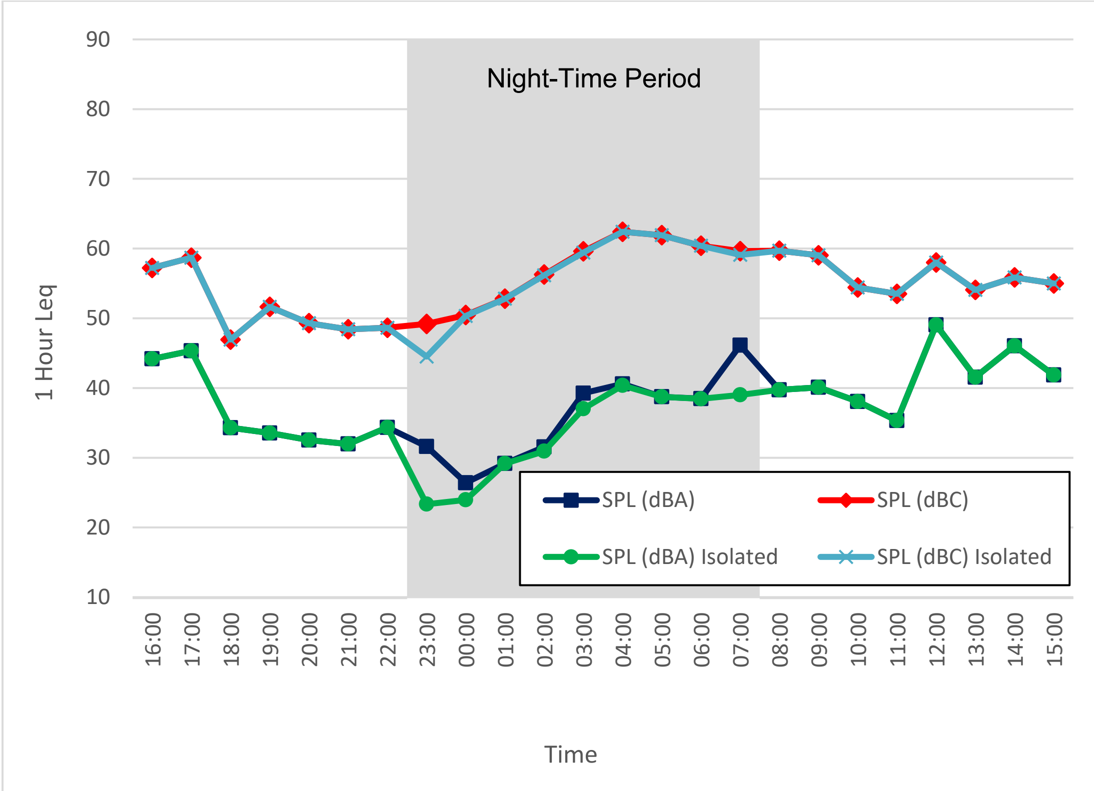

Figure 101. Noise Monitor #13, 1-Hour L_{eq} Sound Levels (July 24 – 25, 2018)

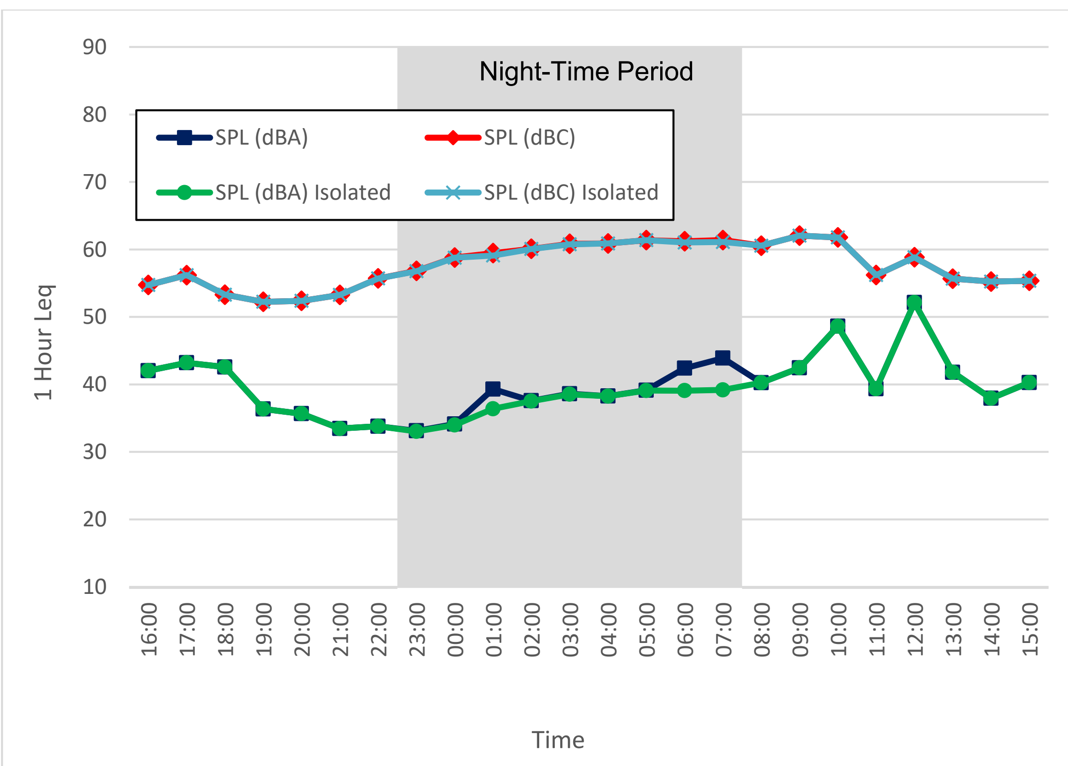

Figure 102. Noise Monitor #13, 1-Hour L_{eq} Sound Levels (July 25 – 26, 2018)

Noise Monitor #13

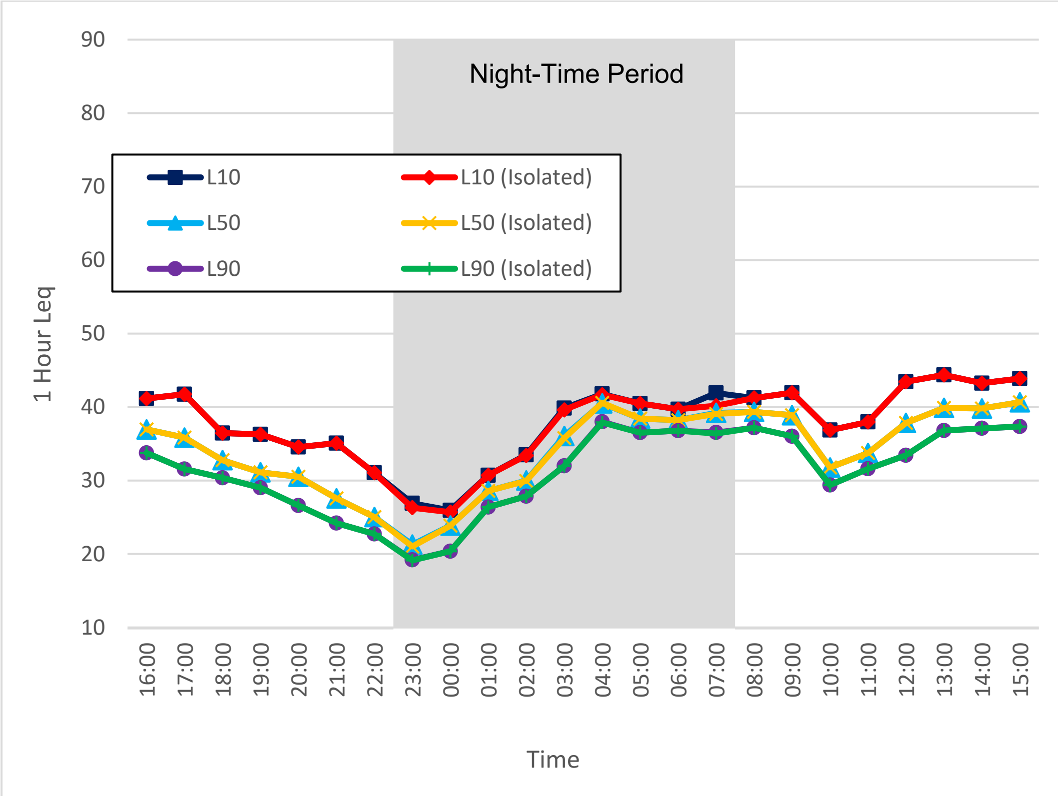

Figure 103. Noise Monitor #13, 1-Hour L_{10}, L_{50}, L_{90} L_{eq} Sound Levels (July 24 – 25, 2018)

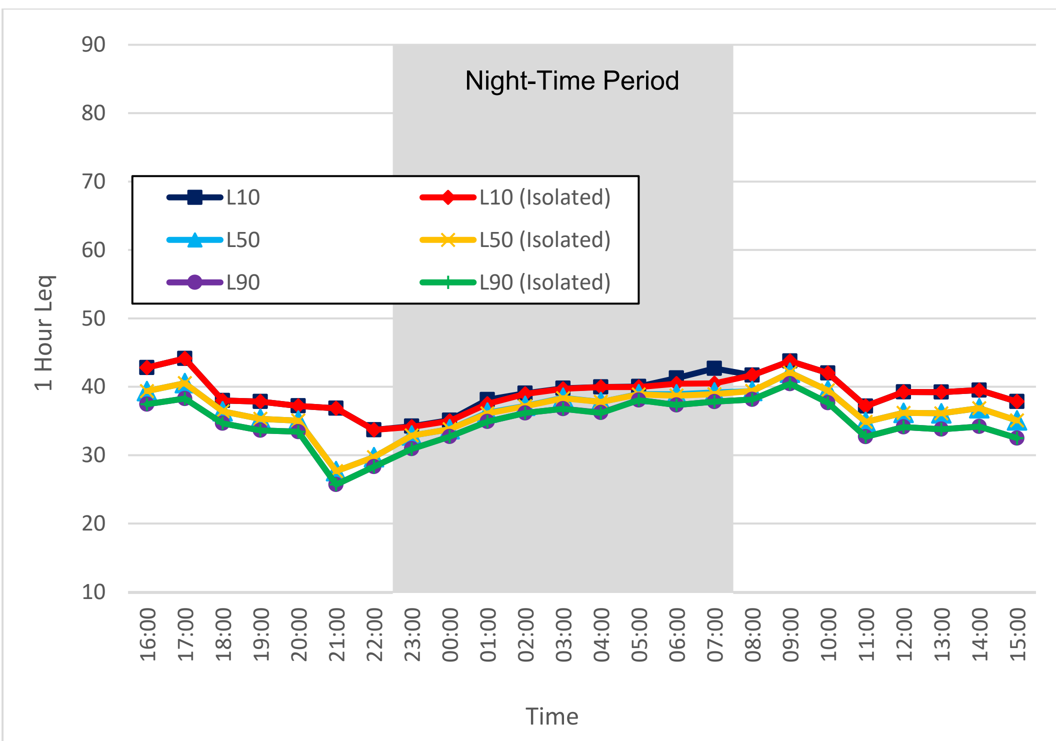

Figure 104. Noise Monitor #13, 1-Hour L_{10}, L_{50}, L_{90} L_{eq} Sound Levels (July 25 – 26, 2018)

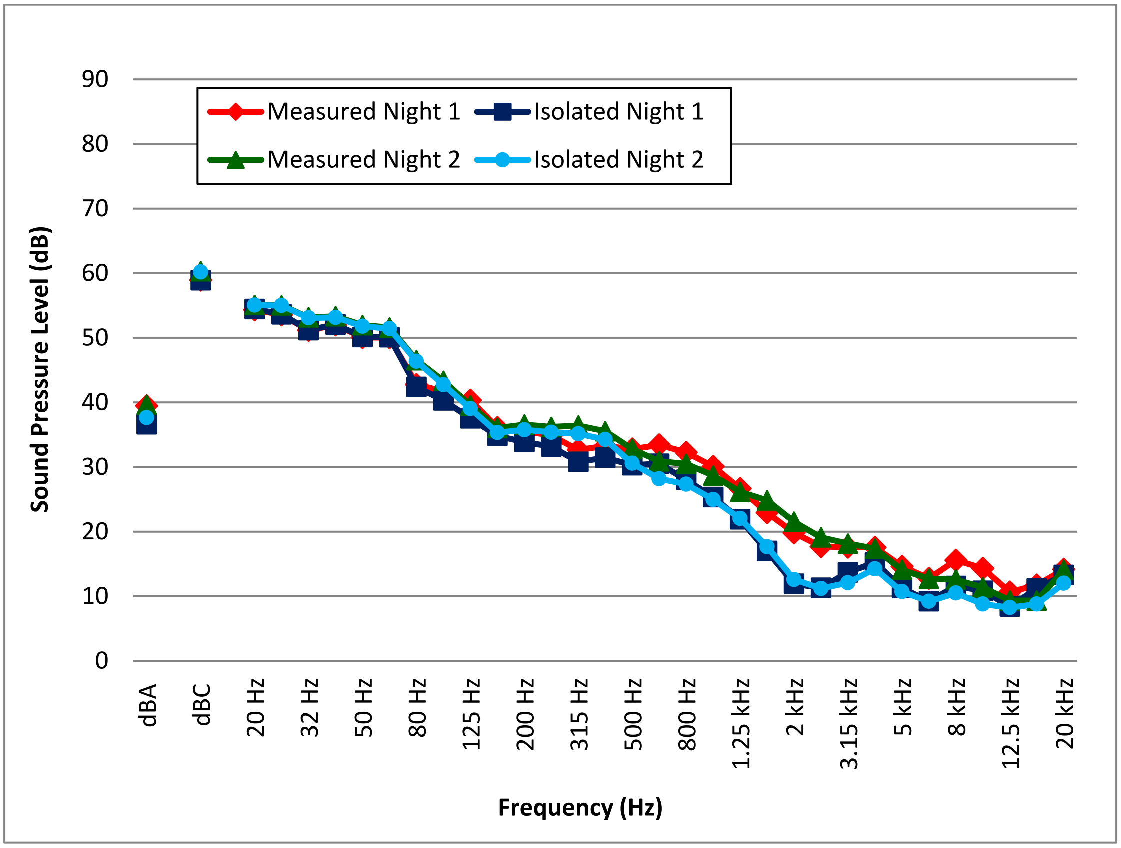

Figure 105. Noise Monitor #13, 1/3 Octave L_{eq} Sound Levels (July 24 – 26, 2018)

Appendix I MEASUREMENT EQUIPMENT USED

Noise Monitors

The environmental noise monitoring equipment used consisted of a Brüel and Kjær Type 2250/2270 Precision Integrating Sound Level Meter enclosed in an environmental case, a tripod, a weather protective microphone hood, and in certain cases, an external battery. The system acquired data in 15-second L_{eq} samples using 1/3 octave band frequency analysis and overall A-weighted and C-weighted sound levels. The sound level meter conforms to Type 1, ANSI S1.4, ANSI S1.43, IEC 61672-1, IEC 60651, IEC 60804 and DIN 45657. The 1/3 octave filters conform to S1.11 – Type 0-C, and IEC 61260 – Class 0. The calibrator conforms to IEC 942 and ANSI S1.40. The sound level meter, pre-amplifier and microphone were certified on May 09, 2017 / January 19, 2017 / January 19, 2017 / November 14, 2016 / November 11, 2016 / November 10, 2016 / April 25, 2018 / April 25, 2018 / May 09, 2017 and the calibrator (type B&K 4231) was certified on January 30, 2018 by a NIST NVLAP Accredited Calibration Laboratory for all requirements of ISO 17025: 1999 and relevant requirements of ISO 9002:1994, ISO 9001:2000 and ANSI/NCSL Z540: 1994 Part 1. All measurement methods and instrumentation conform to the requirements of the AER Directive 038. Simultaneous digital audio was recorded directly on the sound level meter using a 8 kHz sample rate for more detailed post-processing analysis. Refer to the next section in the Appendix for a detailed description of the various acoustical descriptive terms used.

Weather Monitors

Each weather monitoring system used for the study consisted of an Orion Weather Station 9510-A-1 with a WXT520 Self-Aspirating Radiation Shield Sensor Unit, a Weather MicroServer 9590 Data-logger, and a Lightning Arrestor. The Data-logger and batteries were located in a grounded, weather protective case. The Sensor Unit was mounted on a sturdy survey tripod (with supporting guy-wires) at approximately 5.0 m above ground. The system was set up to record data in 1-minute samples obtaining the wind-speed, peak wind-speed, and wind-direction in a rolling 2-minute average as well as the 1-minute temperature, relative humidity, barometric pressure, rain rate and total rain accumulation.

Record of Calibration Results

Description	Date	Time	Pre / Post	Calibration Level	Calibrator Model	Serial Number
Monitor #1	July 24, 2018	11:50	Pre	93.9 dBA	B&K 4231	2656414
Monitor #1	July 26, 2018	16:10	Post	93.8 dBA	B&K 4231	2656414
Monitor #2	June 18, 2018	13:50	Pre	93.9 dBA	B&K 4231	2656414
Monitor #2	June 20, 2018	14:15	Post	93.8 dBA	B&K 4231	2656414
Monitor #3	June 18, 2018	13:35	Pre	93.9 dBA	B&K 4231	2656414
Monitor #3	June 20, 2018	14:00	Post	93.9 dBA	B&K 4231	2656414
Monitor #4	July 24, 2018	14:20	Pre	93.9 dBA	B&K 4231	2656414
Monitor #4	July 26, 2018	15:20	Post	93.9 dBA	B&K 4231	2656414
Monitor #5	June 18, 2018	13:20	Pre	93.9 dBA	B&K 4231	2656414
Monitor #5	June 20, 2018	13:45	Post	93.9 dBA	B&K 4231	2656414
Monitor #6	June 18, 2018	13:00	Pre	93.9 dBA	B&K 4231	2656414
Monitor #6	June 20, 2018	13:25	Post	93.9 dBA	B&K 4231	2656414
Monitor #8	July 24, 2018	14:35	Pre	93.9 dBA	B&K 4231	2656414
Monitor #8	July 26, 2018	18:10	Post	93.9 dBA	B&K 4231	2656414
Monitor #9	June 18, 2018	14:45	Pre	93.9 dBA	B&K 4231	2656414
Monitor #9	June 20, 2018	15:53	Post	93.8 dBA	B&K 4231	2656414
Monitor #10	June 18, 2018	14:20	Pre	93.9 dBA	B&K 4231	2656414
Monitor #10	June 20, 2018	16:43	Post	93.9 dBA	B&K 4231	2656414
Monitor #11	July 24, 2018	17:20	Pre	93.9 dBA	B&K 4231	2656414
Monitor #11	July 26, 2018	18:30	Post	93.8 dBA	B&K 4231	2656414
Monitor #12 #1	June 18, 2018	12:25	Pre	93.9 dBA	B&K 4231	2656414
Monitor #12 #1	June 20, 2018	15:05	Post	93.9 dBA	B&K 4231	2656414
Monitor #12 #2	July 24, 2018	13:10	Pre	93.9 dBA	B&K 4231	2656414
Monitor #12 #2	July 26, 2018	17:05	Post	93.8 dBA	B&K 4231	2656414
Monitor #13	July 24, 2018	13:05	Pre	93.9 dBA	B&K 4231	2656414
Monitor #13	July 26, 2018	17:30	Post	93.8 dBA	B&K 4231	2656414

B&K 4231 Calibrator Calibration Certificate

Scantek, Inc.
CALIBRATION LABORATORY
ISO 17025: 2005, ANSI/NCSL Z540:1994 Part 1
ACCREDITED by NVLAP (an ILAC MRA signatory)

NVLAP®
CALIBRATION
NVLAP Lab Code: 200625-0

Calibration Certificate No.40042

Instrument:	**Acoustical Calibrator**	*Date Calibrated:* **1/30/2018** *Cal Due:*		
Model:	**4231**	*Status:*	**Received**	**Sent**
Manufacturer:	**Brüel and Kjær**	*In tolerance:*	X	X
Serial number:	**2656414**	*Out of tolerance:*		
Class (IEC 60942):	**1**	*See comments:*		
Barometer type:		*Contains non-accredited tests:* __Yes _X_ No		
Barometer s/n:				
Customer:	**ACI Acoustical Consultants Inc.**	*Address:* **5031 - 210 Street, Edmonton, Alberta, CANADA T6M 0A8**		
Tel/Fax:	**780-414-6373 / 780-414-6376**			

Tested in accordance with the following procedures and standards:
Calibration of Acoustical Calibrators, Scantek Inc., Rev. 10/1/2010

Instrumentation used for calibration: Nor-1504 Norsonic Test System:

Instrument - Manufacturer	Description	S/N	Cal. Date	Traceability evidence Cal. Lab / Accreditation	Cal. Due
483B-Norsonic	SME Cal Unit	31061	Jul 28, 2017	Scantek, Inc./ NVLAP	Jul 28, 2018
DS-360-SRS	Function Generator	88077	Sep 15, 2016	ACR Env./ A2LA	Sep 15, 2018
34401A-Agilent Technologies	Digital Voltmeter	MY47011118	Sep 20, 2017	ACR Env./ A2LA	Sep 20, 2018
HM30-Thommen	Meteo Station	1040170/39633	Oct 25, 2017	ACR Env./ A2LA	Oct 25, 2018
140-Norsonic	Real Time Analyzer	1403978	Mar 22, 2017	Scantek, Inc. / NVLAP	Mar 22, 2018
PC Program 1018 Norsonic	Calibration software	v.6.1T	Validated Nov 2014	Scantek, Inc.	-
4192-Brüel&Kjær	Microphone	2854675	Nov 11, 2017	Scantek, Inc. / NVLAP	Nov 11, 2018
1203-Norsonic	Preamplifier	92268	Oct 18, 2017	Scantek, Inc./ NVLAP	Oct 18, 2018

Instrumentation and test results are traceable to SI (International System of Units) through standards maintained by NIST (USA) and NPL (UK)

Calibrated by:	Jeremy Gotwalt	**Authorized signatory:**	Steven E. Marshall
Signature	[signature]	Signature	[signature]
Date	1/30/18	Date	1/30/2018

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B&K 2250 Unit #1 SLM Calibration Certificate

Scantek, Inc.
CALIBRATION LABORATORY
ISO 17025: 2005, ANSI/NCSL Z540:1994 Part 1
ACCREDITED by NVLAP (an ILAC MRA signatory)

NVLAP® CALIBRATION
NVLAP Lab Code: 200625-0

Calibration Certificate No.38467

Instrument: **Sound Level Meter**
Model: **2250**
Manufacturer: **Brüel and Kjær**
Serial number: **2488495**
Tested with: **Microphone 4189 s/n 2471133**
Preamplifier ZC0032 s/n 3271
Type (class): **1**
Customer: **ACI Acoustical Consultants Inc.**
Tel/Fax: **780-414-6373 / 780-414-6376**

Date Calibrated: **5/9/2017** *Cal Due:*

Status:	Received	Sent
In tolerance:	X	X
Out of tolerance:		
See comments:		

Contains non-accredited tests: __Yes **X** No
Calibration service: __ Basic **X** Standard
Address: **5031 - 210 Street**
Edmonton, Alberta
CANADA T6M 0A8

Tested in accordance with the following procedures and standards:
Calibration of Sound Level Meters, Scantek Inc., Rev. 6/26/2015
SLM & Dosimeters – Acoustical Tests, Scantek Inc., Rev. 7/6/2011

Instrumentation used for calibration: Nor-1504 Norsonic Test System:

Instrument - Manufacturer	Description	S/N	Cal. Date	Traceability evidence Cal. Lab / Accreditation	Cal. Due
483B-Norsonic	SME Cal Unit	31061	Jul 27, 2016	Scantek, Inc./ NVLAP	Jul 27, 2017
DS-360-SRS	Function Generator	88077	Sep 15, 2016	ACR Env./ A2LA	Sep 15, 2018
34401A-Agilent Technologies	Digital Voltmeter	MY47011118	Sep 15, 2016	ACR Env./ A2LA	Sep 15, 2017
HM30-Thommen	Meteo Station	1040170/39633	Nov 1, 2016	ACR Env./ A2LA	Nov 1, 2017
PC Program 1019 Norsonic	Calibration software	v.6.1T	Validated Nov 2014	Scantek, Inc.	-
1251-Norsonic	Calibrator	30878	Nov 10, 2016	Scantek, Inc./ NVLAP	Nov 10, 2017

Instrumentation and test results are traceable to SI (International System of Units) through standards maintained by NIST (USA) and NPL (UK).

Environmental conditions:

Temperature (°C)	Barometric pressure (kPa)	Relative Humidity (%)
23.0	100.11	41.8

Calibrated by:	Jeremy Gotwalt	**Authorized signatory:**	Steven E. Marshall
Signature	[signature]	Signature	[signature]
Date	5/9/17	Date	5/9/2017

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B&K 2250 Unit #1 Microphone Calibration Certificate

Scantek, Inc.
CALIBRATION LABORATORY
ISO 17025: 2005, ANSI/NCSL Z540:1994 Part 1
ACCREDITED by NVLAP (an ILAC MRA signatory)

NVLAP®
CALIBRATION
NVLAP Lab Code: 200625-0

Calibration Certificate No.38468

Instrument: **Microphone**
Model: **4189**
Manufacturer: **Brüel & Kjær**
Serial number: **2471133**
Composed of:

Date Calibrated: **5/8/2017** *Cal Due:*

Status:	Received	Sent
In tolerance:	X	X
Out of tolerance:		
See comments:		

Contains non-accredited tests: __Yes _X_ No

Customer: **ACI Acoustical Consultants Inc.**
Tel/Fax: **780-414-6373/780-414-6376**
Address: **5031 - 210 Street**
Edmonton, Alberta
CANADA T6M 0A8

Tested in accordance with the following procedures and standards:
Calibration of Measurement Microphones, Scantek, Inc., Rev. 2/25/2015

Instrumentation used for calibration: N-1504 Norsonic Test System:

Instrument - Manufacturer	Description	S/N	Cal. Date	Traceability evidence Cal. Lab / Accreditation	Cal. Due
483B-Norsonic	SME Cal Unit	31061	Jul 27, 2016	Scantek, Inc./ NVLAP	Jul 27, 2017
DS-360-SRS	Function Generator	88077	Sep 15, 2016	ACR Env./ A2LA	Sep 15, 2018
34401A-Agilent Technologies	Digital Voltmeter	MY47011118	Sep 15, 2016	ACR Env./ A2LA	Sep 15, 2017
HM30-Thommen	Meteo Station	1040170/39633	Nov 1, 2016	ACR Env./ A2LA	Nov 1, 2017
PC Program 1017 Norsonic	Calibration software	v.6.1T	Validated Nov 2014	Scantek, Inc.	-
1253-Norsonic	Calibrator	28326	Nov 10, 2016	Scantek, Inc./ NVLAP	Nov 10, 2017
1203-Norsonic	Preamplifier	92268	Oct 17, 2016	Scantek, Inc./ NVLAP	Oct 17, 2017
4180-Brüel&Kjær	Microphone	2246115	Oct 26, 2015	NPL-UK / UKAS	Oct 26, 2017

Instrumentation and test results are traceable to SI - BIPM through standards maintained by NPL (UK) and NIST (USA)

Calibrated by:	Jeremy Gotwalt	**Authorized signatory:**	Steven E. Marshall
Signature	[signature]	Signature	[signature]
Date	5/8/17	Date	5/9/2017

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B&K 2270 Unit #2 SLM Calibration Certificate

Scantek, Inc.
CALIBRATION LABORATORY
ISO 17025: 2005, ANSI/NCSL Z540:1994 Part 1
ACCREDITED by NVLAP (an ILAC MRA signatory)

NVLAP®
CALIBRATION
NVLAP Lab Code: 200625-0

Calibration Certificate No.37710

Instrument: **Sound Level Meter**
Model: **2270**
Manufacturer: **Brüel and Kjær**
Serial number: **3002718**
Tested with: **Microphone 4189 s/n 2850742**
Preamplifier ZC0032 s/n 18754
Type (class): **1**
Customer: **ACI Acoustical Consultants Inc.**
Tel/Fax: **780-414-6373 / -6376**

Date Calibrated: **1/19/2017** *Cal Due:*

Status:	Received	Sent
In tolerance:	X	X
Out of tolerance:		
See comments:		

Contains non-accredited tests: __Yes X No
Calibration service: __ Basic X Standard
Address: **5031 - 210 Street**
Edmonton, Alberta, CANADA
T6M 0A8

Tested in accordance with the following procedures and standards:
Calibration of Sound Level Meters, Scantek Inc., Rev. 6/26/2015
SLM & Dosimeters – Acoustical Tests, Scantek Inc., Rev. 7/6/2011

Instrumentation used for calibration: Nor-1504 Norsonic Test System:

Instrument - Manufacturer	Description	S/N	Cal. Date	Traceability evidence Cal. Lab / Accreditation	Cal. Due
483B-Norsonic	SME Cal Unit	31061	Jul 27, 2016	Scantek, Inc./ NVLAP	Jul 27, 2017
DS-360-SRS	Function Generator	88077	Sep 15, 2016	ACR Env./ A2LA	Sep 15, 2018
34401A-Agilent Technologies	Digital Voltmeter	MY47011118	Sep 15, 2016	ACR Env./ A2LA	Sep 15, 2017
HM30-Thommen	Meteo Station	1040170/39633	Nov 1, 2016	ACR Env./ A2LA	Nov 1, 2017
PC Program 1019 Norsonic	Calibration software	v.6.1T	Validated Nov 2014	Scantek, Inc.	-
1251-Norsonic	Calibrator	30878	Nov 10, 2016	Scantek, Inc./ NVLAP	Nov 10, 2017

Instrumentation and test results are traceable to SI (International System of Units) through standards maintained by NIST (USA) and NPL (UK).

Environmental conditions:

Temperature (°C)	Barometric pressure (kPa)	Relative Humidity (%)
22.8	100.31	40.2

Calibrated by:	Jeremy Gotwalt	**Authorized signatory:**	Steven E. Marshall
Signature	[signature]	Signature	[signature]
Date	1/19/17	Date	1/20/2017

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B&K 2270 Unit #2 Microphone Calibration Certificate

Scantek, Inc.
CALIBRATION LABORATORY
ISO 17025: 2005, ANSI/NCSL Z540:1994 Part 1
ACCREDITED by NVLAP (an ILAC MRA signatory)

NVLAP® CALIBRATION
NVLAP Lab Code: 200625-0

Calibration Certificate No.37711

Instrument:	**Microphone**	*Date Calibrated:* **1/18/2017** *Cal Due:*		
Model:	**4189**	*Status:*	**Received**	**Sent**
Manufacturer:	**Brüel & Kjær**	*In tolerance:*	X	X
Serial number:	**2850742**	*Out of tolerance:*		
Composed of:		*See comments:*		
		Contains non-accredited tests: __Yes _X_ No		

Customer: **ACI Acoustical Consultants Inc.**
Tel/Fax: **780-414-6373/-6376**
Address: **5031 - 210 Street, Edmonton, Alberta, CANADA T6M 0A8**

Tested in accordance with the following procedures and standards:
Calibration of Measurement Microphones, Scantek, Inc., Rev. 2/25/2015

Instrumentation used for calibration: N-1504 Norsonic Test System:

Instrument - Manufacturer	Description	S/N	Cal. Date	Traceability evidence Cal. Lab / Accreditation	Cal. Due
483B-Norsonic	SME Cal Unit	31061	Jul 27, 2016	Scantek, Inc./ NVLAP	Jul 27, 2017
DS-360-SRS	Function Generator	88077	Sep 15, 2016	ACR Env./ A2LA	Sep 15, 2018
34401A-Agilent Technologies	Digital Voltmeter	MY47011118	Sep 15, 2016	ACR Env./ A2LA	Sep 15, 2017
HM30-Thommen	Meteo Station	1040170/39633	Nov 1, 2016	ACR Env./ A2LA	Nov 1, 2017
PC Program 1017 Norsonic	Calibration software	v.6.1T	Validated Nov 2014	Scantek, Inc.	-
1253-Norsonic	Calibrator	22909	Nov 10, 2016	Scantek, Inc./ NVLAP	Nov 10, 2017
1203-Norsonic	Preamplifier	92268	Oct 17, 2016	Scantek, Inc./ NVLAP	Oct 17, 2017
4180-Brüel&Kjær	Microphone	2246115	Oct 26, 2015	NPL-UK / UKAS	Oct 26, 2017

Instrumentation and test results are traceable to SI - BIPM through standards maintained by NPL (UK) and NIST (USA)

Calibrated by:	Jeremy Gotwalt	**Authorized signatory:**	Steven E. Marshall
Signature	[signature]	Signature	[signature]
Date	1/18/17	Date	1/20/2017

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B&K 2270 Unit #3 SLM Calibration Certificates

Scantek, Inc.
CALIBRATION LABORATORY
ISO 17025: 2005, ANSI/NCSL Z540:1994 Part 1
ACCREDITED by NVLAP (an ILAC MRA signatory)

NVLAP®
CALIBRATION
NVLAP Lab Code: 200625-0

Calibration Certificate No.37708

Instrument:	**Sound Level Meter**	*Date Calibrated:* **1/19/2017**	*Cal Due:*
Model:	**2270**	*Status:*	**Received** / **Sent**
Manufacturer:	**Brüel and Kjær**	*In tolerance:*	X / X
Serial number:	**3002730**	*Out of tolerance:*	
Tested with:	**Microphone 4189 s/n 2850741** **Preamplifier ZC0032 s/n 18750**	*See comments:*	
		Contains non-accredited tests:	__Yes X No
Type (class):	**1**	*Calibration service:*	__ Basic X Standard
Customer:	**ACI Acoustical Consultants Inc.**	*Address:*	**5031 - 210 Street** **Edmonton, Alberta, CANADA** **T6M 0A8**
Tel/Fax:	**780-414-6373 / -6376**		

Tested in accordance with the following procedures and standards:
Calibration of Sound Level Meters, Scantek Inc., Rev. 6/26/2015
SLM & Dosimeters – Acoustical Tests, Scantek Inc., Rev. 7/6/2011

Instrumentation used for calibration: Nor-1504 Norsonic Test System:

Instrument - Manufacturer	Description	S/N	Cal. Date	Traceability evidence Cal. Lab / Accreditation	Cal. Due
483B-Norsonic	SME Cal Unit	31061	Jul 27, 2016	Scantek, Inc./ NVLAP	Jul 27, 2017
DS-360-SRS	Function Generator	88077	Sep 15, 2016	ACR Env./ A2LA	Sep 15, 2018
34401A-Agilent Technologies	Digital Voltmeter	MY47011118	Sep 15, 2016	ACR Env./ A2LA	Sep 15, 2017
HM30-Thommen	Meteo Station	1040170/39633	Nov 1, 2016	ACR Env./ A2LA	Nov 1, 2017
PC Program 1019 Norsonic	Calibration software	v.6.1T	Validated Nov 2014	Scantek, Inc.	-
1251-Norsonic	Calibrator	30878	Nov 10, 2016	Scantek, Inc./ NVLAP	Nov 10, 2017

Instrumentation and test results are traceable to SI (International System of Units) through standards maintained by NIST (USA) and NPL (UK).

Environmental conditions:

Temperature (°C)	Barometric pressure (kPa)	Relative Humidity (%)
23.3	100.34	42.3

Calibrated by:	Jeremy Gotwalt	**Authorized signatory:**	Steven E. Marshall
Signature	[signature]	Signature	[signature]
Date	1/19/17	Date	1/20/2017

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B&K 2270 Unit #3 Microphone Calibration Certificates

Scantek, Inc.
CALIBRATION LABORATORY
ISO 17025: 2005, ANSI/NCSL Z540:1994 Part 1
ACCREDITED by NVLAP (an ILAC MRA signatory)

NVLAP® CALIBRATION
NVLAP Lab Code: 200625-0

Calibration Certificate No.37709

Instrument: **Microphone**
Model: **4189**
Manufacturer: **Brüel & Kjær**
Serial number: **2850741**
Composed of:

Date Calibrated: **1/18/2017** *Cal Due:*

Status:	Received	Sent
In tolerance:	X	X
Out of tolerance:		
See comments:		

Contains non-accredited tests: __Yes _X_ No

Customer: **ACI Acoustical Consultants Inc.**
Tel/Fax: **780-414-6373/-6376**
Address: **5031 - 210 Street**
Edmonton, Alberta, CANADA
T6M 0A8

Tested in accordance with the following procedures and standards:
Calibration of Measurement Microphones, Scantek, Inc., Rev. 2/25/2015

Instrumentation used for calibration: N-1504 Norsonic Test System:

Instrument - Manufacturer	Description	S/N	Cal. Date	Traceability evidence Cal. Lab / Accreditation	Cal. Due
483B-Norsonic	SME Cal Unit	31061	Jul 27, 2016	Scantek, Inc./ NVLAP	Jul 27, 2017
DS-360-SRS	Function Generator	88077	Sep 15, 2016	ACR Env./ A2LA	Sep 15, 2018
34401A-Agilent Technologies	Digital Voltmeter	MY47011118	Sep 15, 2016	ACR Env./ A2LA	Sep 15, 2017
HM30-Thommen	Meteo Station	1040170/39633	Nov 1, 2016	ACR Env./ A2LA	Nov 1, 2017
PC Program 1017 Norsonic	Calibration software	v.6.1T	Validated Nov 2014	Scantek, Inc.	-
1253-Norsonic	Calibrator	22909	Nov 10, 2016	Scantek, Inc./ NVLAP	Nov 10, 2017
1203-Norsonic	Preamplifier	92268	Oct 17, 2016	Scantek, Inc./ NVLAP	Oct 17, 2017
4180-Brüel&Kjær	Microphone	2246115	Oct 26, 2015	NPL-UK / UKAS	Oct 26, 2017

Instrumentation and test results are traceable to SI - BIPM through standards maintained by NPL (UK) and NIST (USA)

Calibrated by:	Jeremy Gotwalt	**Authorized signatory:**	Steven E. Marshall
Signature	[signature]	Signature	Steven E Marshall
Date	1/18/17	Date	1/20/2017

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B&K 2270 Unit #4 SLM Calibration Certificate

Scantek, Inc.
CALIBRATION LABORATORY

ISO 17025: 2005, ANSI/NCSL Z540:1994 Part 1
ACCREDITED by NVLAP (an ILAC MRA signatory)

NVLAP®
CALIBRATION
NVLAP Lab Code: 200625-0

Calibration Certificate No.37319

Instrument:	**Sound Level Meter**	*Date Calibrated:* **11/14/2016** *Cal Due:*	
Model:	**2270**	*Status:*	**Received** / **Sent**
Manufacturer:	**Brüel and Kjær**	*In tolerance:*	X / X
Serial number:	**2644639**	*Out of tolerance:*	
Tested with:	**Microphone 4189 s/n 2643219** **Preamplifier ZC0032 s/n 8255**	*See comments:*	
		Contains non-accredited tests:	__Yes X No
Type (class):	**1**	*Calibration service:*	__ Basic X Standard
Customer:	**ACI Acoustical Consultants Inc.**	*Address:*	**5031 - 210 Street** **Edmonton, Alberta, CANADA** **T6M 0A8**
Tel/Fax:	**780-414-6373 / -6376**		

Tested in accordance with the following procedures and standards:
Calibration of Sound Level Meters, Scantek Inc., Rev. 6/26/2015
SLM & Dosimeters – Acoustical Tests, Scantek Inc., Rev. 7/6/2011

Instrumentation used for calibration: Nor-1504 Norsonic Test System:

Instrument - Manufacturer	Description	S/N	Cal. Date	Traceability evidence Cal. Lab / Accreditation	Cal. Due
483B-Norsonic	SME Cal Unit	31061	Jul 27, 2016	Scantek, Inc./ NVLAP	Jul 27, 2017
DS-360-SRS	Function Generator	88077	Sep 15, 2016	ACR Env./ A2LA	Sep 15, 2018
34401A-Agilent Technologies	Digital Voltmeter	MY47011118	Sep 15, 2016	ACR Env./ A2LA	Sep 15, 2017
HM30-Thommen	Meteo Station	1040170/39633	Nov 1, 2016	ACR Env./ A2LA	Nov 1, 2017
PC Program 1019 Norsonic	Calibration software	v.6.1T	Validated Nov 2014	Scantek, Inc.	-
1251-Norsonic	Calibrator	30878	Nov 10, 2016	Scantek, Inc./ NVLAP	Nov 10, 2017

Instrumentation and test results are traceable to SI (International System of Units) through standards maintained by NIST (USA) and NPL (UK).

Environmental conditions:

Temperature (°C)	Barometric pressure (kPa)	Relative Humidity (%)
21.5	100.29	38.8

Calibrated by:	Jeremy Gotwalt	**Authorized signatory:**	Valentin Buzduga
Signature	[signature]	Signature	[signature]
Date	11/14/16	Date	11/14/2016

Calibration Certificates or Test Reports shall not be reproduced, except in full, without written approval of the laboratory.
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B&K 2270 Unit #4 Microphone Calibration Certificate

Scantek, Inc.
CALIBRATION LABORATORY
ISO 17025: 2005, ANSI/NCSL Z540:1994 Part 1
ACCREDITED by NVLAP (an ILAC MRA signatory)

NVLAP®
CALIBRATION
NVLAP Lab Code: 200625-0

Calibration Certificate No.37320

Instrument: **Microphone**
Model: **4189**
Manufacturer: **Brüel & Kjær**
Serial number: **2643219**
Composed of:

Date Calibrated: **11/10/2016** *Cal Due:*

Status:	Received	Sent
In tolerance:	X	X
Out of tolerance:		
See comments:		

Contains non-accredited tests: __Yes _X_ No

Customer: **ACI Acoustical Consultants Inc.**
Tel/Fax: **780-414-6373/-6376**
Address: **5031 - 210 Street Edmonton, Alberta, CANADA T6M 0A8**

Tested in accordance with the following procedures and standards:
Calibration of Measurement Microphones, Scantek, Inc., Rev. 2/25/2015

Instrumentation used for calibration: N-1504 Norsonic Test System:

Instrument - Manufacturer	Description	S/N	Cal. Date	Traceability evidence Cal. Lab / Accreditation	Cal. Due
483B-Norsonic	SME Cal Unit	31061	Jul 27, 2016	Scantek, Inc./ NVLAP	Jul 27, 2017
DS-360-SRS	Function Generator	88077	Sep 15, 2016	ACR Env./ A2LA	Sep 15, 2018
34401A-Agilent Technologies	Digital Voltmeter	MY47011118	Sep 15, 2016	ACR Env./ A2LA	Sep 15, 2017
HM30-Thommen	Meteo Station	1040170/39633	Nov 1, 2016	ACR Env./ A2LA	Nov 1, 2017
PC Program 1017 Norsonic	Calibration software	v.6.1T	Validated Nov 2014	Scantek, Inc.	-
1253-Norsonic	Calibrator	28326	Nov 10, 2015	Scantek, Inc./ NVLAP	Nov 10, 2016
1203-Norsonic	Preamplifier	92268	Oct 17, 2016	Scantek, Inc./ NVLAP	Oct 17, 2017
4180-Brüel&Kjær	Microphone	2246115	Oct 26, 2015	NPL-UK / UKAS	Oct 26, 2017

Instrumentation and test results are traceable to SI - BIPM through standards maintained by NPL (UK) and NIST (USA)

Calibrated by:	Jeremy Gotwalt	Authorized signatory:	Valentin Buzduga
Signature	[signature]	Signature	[signature]
Date	11/10/16	Date	11/14/2016

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B&K 2250 Unit #5 SLM Calibration Certificate

Scantek, Inc.
CALIBRATION LABORATORY
ISO 17025: 2005, ANSI/NCSL Z540:1994 Part 1
ACCREDITED by NVLAP (an ILAC MRA signatory)

NVLAP® CALIBRATION
NVLAP Lab Code: 200625-0

Calibration Certificate No.37315

Instrument:	**Sound Level Meter**	*Date Calibrated:* **11/11/2016** *Cal Due:*		
Model:	**2250**	*Status:*	**Received**	**Sent**
Manufacturer:	**Brüel and Kjær**	*In tolerance:*	X	X
Serial number:	**2722894**	*Out of tolerance:*		
Tested with:	**Microphone 4189 s/n 2719777**	*See comments:*		
	Preamplifier ZC0032 s/n 13895	*Contains non-accredited tests:* __Yes X No		
Type (class):	**1**	*Calibration service:* __ Basic X Standard		
Customer:	**ACI Acoustical Consultants Inc.**	*Address:* **5031 - 210 Street, Edmonton, Alberta, CANADA T6M 0A8**		
Tel/Fax:	**780-414-6373 / -6376**			

Tested in accordance with the following procedures and standards:
Calibration of Sound Level Meters, Scantek Inc., Rev. 6/26/2015
SLM & Dosimeters – Acoustical Tests, Scantek Inc., Rev. 7/6/2011

Instrumentation used for calibration: Nor-1504 Norsonic Test System:

Instrument - Manufacturer	Description	S/N	Cal. Date	Traceability evidence Cal. Lab / Accreditation	Cal. Due
483B-Norsonic	SME Cal Unit	31061	Jul 27, 2016	Scantek, Inc./ NVLAP	Jul 27, 2017
DS-360-SRS	Function Generator	88077	Sep 15, 2016	ACR Env./ A2LA	Sep 15, 2018
34401A-Agilent Technologies	Digital Voltmeter	MY47011118	Sep 15, 2016	ACR Env./ A2LA	Sep 15, 2017
HM30-Thommen	Meteo Station	1040170/39633	Nov 1, 2016	ACR Env./ A2LA	Nov 1, 2017
PC Program 1019 Norsonic	Calibration software	v.6.1T	Validated Nov 2014	Scantek, Inc.	-
1251-Norsonic	Calibrator	30878	Nov 10, 2016	Scantek, Inc./ NVLAP	Nov 10, 2017

Instrumentation and test results are traceable to SI (International System of Units) through standards maintained by NIST (USA) and NPL (UK).

Environmental conditions:

Temperature (°C)	Barometric pressure (kPa)	Relative Humidity (%)
23.6	99.58	30.5

Calibrated by:	Jeremy Gotwalt	**Authorized signatory:**	Valentin Buzduga
Signature	[signature]	Signature	[signature]
Date	11/11/16	Date	11/14/2016

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B&K 2250 Unit #5 Microphone Calibration Certificate

Scantek, Inc.
CALIBRATION LABORATORY
ISO 17025: 2005, ANSI/NCSL Z540:1994 Part 1
ACCREDITED by NVLAP (an ILAC MRA signatory)

NVLAP®
CALIBRATION
NVLAP Lab Code: 200625-0

Calibration Certificate No.37316

Instrument: **Microphone**
Model: **4189**
Manufacturer: **Brüel & Kjær**
Serial number: **2719777**
Composed of:

Date Calibrated: **11/10/2016** *Cal Due:*

Status:	Received	Sent
In tolerance:	X	X
Out of tolerance:		
See comments:		

Contains non-accredited tests: __Yes _X_ No

Customer: **ACI Acoustical Consultants Inc.**
Tel/Fax: **780-414-6373/-6376**
Address: **5031 - 210 Street, Edmonton, Alberta, CANADA T6M 0A8**

Tested in accordance with the following procedures and standards:
Calibration of Measurement Microphones, Scantek, Inc., Rev. 2/25/2015

Instrumentation used for calibration: N-1504 Norsonic Test System:

Instrument - Manufacturer	Description	S/N	Cal. Date	Traceability evidence Cal. Lab / Accreditation	Cal. Due
483B-Norsonic	SME Cal Unit	31061	Jul 27, 2016	Scantek, Inc./ NVLAP	Jul 27, 2017
DS-360-SRS	Function Generator	88077	Sep 15, 2016	ACR Env./ A2LA	Sep 15, 2018
34401A-Agilent Technologies	Digital Voltmeter	MY47011118	Sep 15, 2016	ACR Env./ A2LA	Sep 15, 2017
HM30-Thommen	Meteo Station	1040170/39633	Nov 1, 2016	ACR Env./ A2LA	Nov 1, 2017
PC Program 1017 Norsonic	Calibration software	v.6.1T	Validated Nov 2014	Scantek, Inc.	-
1253-Norsonic	Calibrator	28326	Nov 10, 2015	Scantek, Inc./ NVLAP	Nov 10, 2016
1203-Norsonic	Preamplifier	92268	Oct 17, 2016	Scantek, Inc./ NVLAP	Oct 17, 2017
4180-Brüel&Kjær	Microphone	2246115	Oct 26, 2015	NPL-UK / UKAS	Oct 26, 2017

Instrumentation and test results are traceable to SI - BIPM through standards maintained by NPL (UK) and NIST (USA)

Calibrated by:	Jeremy Gotwalt	Authorized signatory:	Valentin Buzduga
Signature	[signature]	Signature	[signature]
Date	11/10/16	Date	11/14/2016

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B&K 2250 Unit #6 SLM Calibration Certificate

Scantek, Inc.
CALIBRATION LABORATORY
ISO 17025: 2005, ANSI/NCSL Z540:1994 Part 1
ACCREDITED by NVLAP (an ILAC MRA signatory)

NVLAP® CALIBRATION
NVLAP Lab Code: 200625-0

Calibration Certificate No.37313

Instrument: **Sound Level Meter**
Model: **2250**
Manufacturer: **Brüel and Kjær**
Serial number: **2661161**
Tested with: **Microphone 4189 s/n 2650730**
Preamplifier ZC0032 s/n 9935
Type (class): **1**
Customer: **ACI Acoustical Consultants Inc.**
Tel/Fax: **780-414-6373 / -6376**

Date Calibrated: **11/10/2016** *Cal Due:*

Status:	Received	Sent
In tolerance:	X	X
Out of tolerance:		
See comments:		

Contains non-accredited tests: __Yes _X_ No
Calibration service: __ Basic _X_ Standard
Address: **5031 - 210 Street**
Edmonton, Alberta, CANADA
T6M 0A8

Tested in accordance with the following procedures and standards:
Calibration of Sound Level Meters, Scantek Inc., Rev. 6/26/2015
SLM & Dosimeters – Acoustical Tests, Scantek Inc., Rev. 7/6/2011

Instrumentation used for calibration: Nor-1504 Norsonic Test System:

Instrument - Manufacturer	Description	S/N	Cal. Date	Traceability evidence Cal. Lab / Accreditation	Cal. Due
483B-Norsonic	SME Cal Unit	31061	Jul 27, 2016	Scantek, Inc./ NVLAP	Jul 27, 2017
DS-360-SRS	Function Generator	88077	Sep 15, 2016	ACR Env./ A2LA	Sep 15, 2018
34401A-Agilent Technologies	Digital Voltmeter	MY47011118	Sep 15, 2016	ACR Env./ A2LA	Sep 15, 2017
HM30-Thommen	Meteo Station	1040170/39633	Nov 1, 2016	ACR Env./ A2LA	Nov 1, 2017
PC Program 1019 Norsonic	Calibration software	v.6.1T	Validated Nov 2014	Scantek, Inc.	-
1251-Norsonic	Calibrator	30878	Nov 10, 2016	Scantek, Inc./ NVLAP	Nov 10, 2017

Instrumentation and test results are traceable to SI (International System of Units) through standards maintained by NIST (USA) and NPL (UK).

Environmental conditions:

Temperature (°C)	Barometric pressure (kPa)	Relative Humidity (%)
22.1	100.26	38.2

Calibrated by:	Jeremy Gotwalt	**Authorized signatory:**	Valentin Buzduga
Signature	[signature]	Signature	[signature]
Date	11/10/16	Date	11/14/2016

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B&K 2250 Unit #6 Microphone Calibration Certificate

Scantek, Inc.
CALIBRATION LABORATORY
ISO 17025: 2005, ANSI/NCSL Z540:1994 Part 1
ACCREDITED by NVLAP (an ILAC MRA signatory)

NVLAP®
CALIBRATION
NVLAP Lab Code: 200625-0

Calibration Certificate No.37314

Instrument: **Microphone**
Model: **4189**
Manufacturer: **Brüel & Kjær**
Serial number: **2650730**
Composed of:

Date Calibrated: **11/10/2016** *Cal Due:*

Status:	Received	Sent
In tolerance:	X	X
Out of tolerance:		
See comments:		

Contains non-accredited tests: __Yes _X_ No

Customer: **ACI Acoustical Consultants Inc.**
Tel/Fax: **780-414-6373/-6376**
Address: **5031 - 210 Street, Edmonton, Alberta, CANADA T6M 0A8**

Tested in accordance with the following procedures and standards:
Calibration of Measurement Microphones, Scantek, Inc., Rev. 2/25/2015

Instrumentation used for calibration: N-1504 Norsonic Test System:

Instrument - Manufacturer	Description	S/N	Cal. Date	Traceability evidence Cal. Lab / Accreditation	Cal. Due
483B-Norsonic	SME Cal Unit	31061	Jul 27, 2016	Scantek, Inc./ NVLAP	Jul 27, 2017
DS-360-SRS	Function Generator	88077	Sep 15, 2016	ACR Env./ A2LA	Sep 15, 2018
34401A-Agilent Technologies	Digital Voltmeter	MY47011118	Sep 15, 2016	ACR Env./ A2LA	Sep 15, 2017
HM30-Thommen	Meteo Station	1040170/39633	Nov 1, 2016	ACR Env./ A2LA	Nov 1, 2017
PC Program 1017 Norsonic	Calibration software	v.6.1T	Validated Nov 2014	Scantek, Inc.	-
1253-Norsonic	Calibrator	28326	Nov 10, 2015	Scantek, Inc./ NVLAP	Nov 10, 2016
1203-Norsonic	Preamplifier	92268	Oct 17, 2016	Scantek, Inc./ NVLAP	Oct 17, 2017
4180-Brüel&Kjær	Microphone	2246115	Oct 26, 2015	NPL-UK / UKAS	Oct 26, 2017

Instrumentation and test results are traceable to SI - BIPM through standards maintained by NPL (UK) and NIST (USA)

Calibrated by:	Jeremy Gotwalt	Authorized signatory:	Valentin Buzduga
Signature	[signature]	Signature	[signature]
Date	11/10/16	Date	11/14/2016

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B&K 2250 Unit #7 SLM Calibration Certificate

Scantek, Inc.
CALIBRATION LABORATORY
ISO 17025: 2005, ANSI/NCSL Z540:1994 Part 1
ACCREDITED by NVLAP (an ILAC MRA signatory)

NVLAP®
CALIBRATION
NVLAP Lab Code: 200625-0

Calibration Certificate No.37317

Instrument:	**Sound Level Meter**	*Date Calibrated:* **11/11/2016** *Cal Due:*	
Model:	**2250**	*Status:*	**Received** / **Sent**
Manufacturer:	**Brüel and Kjær**	*In tolerance:*	X / X
Serial number:	**2722859**	*Out of tolerance:*	
Tested with:	**Microphone 4189 s/n 2710791** **Preamplifier ZC0032 s/n 13398**	*See comments:*	
		Contains non-accredited tests:	__Yes X No
Type (class):	**1**	*Calibration service:*	__ Basic X Standard
Customer:	**ACI Acoustical Consultants Inc.**	*Address:*	**5031 - 210 Street** **Edmonton, Alberta, CANADA** **T6M 0A8**
Tel/Fax:	**780-414-6373 / -6376**		

Tested in accordance with the following procedures and standards:
Calibration of Sound Level Meters, Scantek Inc., Rev. 6/26/2015
SLM & Dosimeters – Acoustical Tests, Scantek Inc., Rev. 7/6/2011

Instrumentation used for calibration: Nor-1504 Norsonic Test System:

Instrument - Manufacturer	Description	S/N	Cal. Date	Traceability evidence Cal. Lab / Accreditation	Cal. Due
483B-Norsonic	SME Cal Unit	31061	Jul 27, 2016	Scantek, Inc./ NVLAP	Jul 27, 2017
DS-360-SRS	Function Generator	88077	Sep 15, 2016	ACR Env./ A2LA	Sep 15, 2018
34401A-Agilent Technologies	Digital Voltmeter	MY47011118	Sep 15, 2016	ACR Env./ A2LA	Sep 15, 2017
HM30-Thommen	Meteo Station	1040170/39633	Nov 1, 2016	ACR Env./ A2LA	Nov 1, 2017
PC Program 1019 Norsonic	Calibration software	v.6.1T	Validated Nov 2014	Scantek, Inc.	-
1251-Norsonic	Calibrator	30878	Nov 10, 2016	Scantek, Inc./ NVLAP	Nov 10, 2017

Instrumentation and test results are traceable to SI (International System of Units) through standards maintained by NIST (USA) and NPL (UK).

Environmental conditions:

Temperature (°C)	Barometric pressure (kPa)	Relative Humidity (%)
22.9	99.83	33.4

Calibrated by:	Jeremy Gotwalt	**Authorized signatory:**	Valentin Buzduga
Signature	[signature]	Signature	[signature]
Date	11/11/16	Date	11/14/2016

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B&K 2250 Unit #7 Microphone Calibration Certificate

Scantek, Inc.
CALIBRATION LABORATORY
ISO 17025: 2005, ANSI/NCSL Z540:1994 Part 1
ACCREDITED by NVLAP (an ILAC MRA signatory)

NVLAP® CALIBRATION
NVLAP Lab Code: 200625-0

Calibration Certificate No.37318

Instrument: **Microphone**
Model: **4189**
Manufacturer: **Brüel & Kjær**
Serial number: **2710791**
Composed of:

Date Calibrated: **11/10/2016** *Cal Due:*

Status:	Received	Sent
In tolerance:	X	X
Out of tolerance:		
See comments:		

Contains non-accredited tests: __Yes _X_ No

Customer: **ACI Acoustical Consultants Inc.**
Tel/Fax: **780-414-6373/-6376**
Address: **5031 - 210 Street, Edmonton, Alberta, CANADA T6M 0A8**

Tested in accordance with the following procedures and standards:
Calibration of Measurement Microphones, Scantek, Inc., Rev. 2/25/2015

Instrumentation used for calibration: N-1504 Norsonic Test System:

Instrument - Manufacturer	Description	S/N	Cal. Date	Traceability evidence Cal. Lab / Accreditation	Cal. Due
483B-Norsonic	SME Cal Unit	31061	Jul 27, 2016	Scantek, Inc./ NVLAP	Jul 27, 2017
DS-360-SRS	Function Generator	88077	Sep 15, 2016	ACR Env./ A2LA	Sep 15, 2018
34401A-Agilent Technologies	Digital Voltmeter	MY47011118	Sep 15, 2016	ACR Env./ A2LA	Sep 15, 2017
HM30-Thommen	Meteo Station	1040170/39633	Nov 1, 2016	ACR Env./ A2LA	Nov 1, 2017
PC Program 1017 Norsonic	Calibration software	v.6.1T	Validated Nov 2014	Scantek, Inc.	-
1253-Norsonic	Calibrator	28326	Nov 10, 2015	Scantek, Inc./ NVLAP	Nov 10, 2016
1203-Norsonic	Preamplifier	92268	Oct 17, 2016	Scantek, Inc./ NVLAP	Oct 17, 2017
4180-Brüel&Kjær	Microphone	2246115	Oct 26, 2015	NPL-UK / UKAS	Oct 26, 2017

Instrumentation and test results are traceable to SI - BIPM through standards maintained by NPL (UK) and NIST (USA)

Calibrated by:	Jeremy Gotwalt	**Authorized signatory:**	Valentin Buzduga
Signature	[signature]	Signature	[signature]
Date	11/10/16	Date	11/14/2016

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B&K 2250 Unit #8 SLM Calibration Certificate

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NVLAP Lab Code: 200625-0

Calibration Certificate No.40635

Instrument: **Sound Level Meter**
Model: **2250**
Manufacturer: **Brüel and Kjær**
Serial number: **3005978**
Tested with: **Microphone 4189 s/n 2851039**
Preamplifier ZC0032 s/n 20742
Type (class): **1**
Customer: **ACI Acoustical Consultants Inc.**
Tel/Fax: **780-414-6373 / 780-414-6376**

Date Calibrated: **4/25/2018** *Cal Due:*

Status:	Received	Sent
In tolerance:	X	X
Out of tolerance:		
See comments:		

Contains non-accredited tests: __Yes X No
Calibration service: __ Basic X Standard
Address: **5031 - 210 Street**
Edmonton, Alberta
CANADA T6M 0A8

Tested in accordance with the following procedures and standards:
Calibration of Sound Level Meters, Scantek Inc., Rev. 6/26/2015
SLM & Dosimeters – Acoustical Tests, Scantek Inc., Rev. 7/6/2011

Instrumentation used for calibration: Nor-1504 Norsonic Test System:

Instrument - Manufacturer	Description	S/N	Cal. Date	Traceability evidence Cal. Lab / Accreditation	Cal. Due
483B-Norsonic	SME Cal Unit	31061	Jul 28, 2017	Scantek, Inc./ NVLAP	Jul 28, 2018
DS-360-SRS	Function Generator	88077	Sep 15, 2016	ACR Env./ A2LA	Sep 15, 2018
34401A-Agilent Technologies	Digital Voltmeter	MY47011118	Sep 20, 2017	ACR Env./ A2LA	Sep 20, 2018
HM30-Thommen	Meteo Station	1040170/39633	Oct 25, 2017	ACR Env./ A2LA	Oct 25, 2018
PC Program 1019 Norsonic	Calibration software	v.6.1T	Validated Nov 2014	Scantek, Inc.	-
1251-Norsonic	Calibrator	30878	Nov 10, 2017	Scantek, Inc./ NVLAP	Nov 10, 2018

Instrumentation and test results are traceable to SI (International System of Units) through standards maintained by NIST (USA) and NPL (UK).

Environmental conditions:

Temperature (°C)	Barometric pressure (kPa)	Relative Humidity (%)
22.9	99.14	53.5

Calibrated by:	Jeremy Gotwalt	**Authorized signatory:**	Steven E. Marshall
Signature	[signature]	Signature	Steven E Marshall
Date	4/25/18	Date	4/25/2018

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B&K 2250 Unit #8 Microphone Calibration Certificate

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CALIBRATION
NVLAP Lab Code: 200625-0

Calibration Certificate No.40636

Instrument:	**Microphone**	*Date Calibrated:* **4/25/2018** *Cal Due:*		
Model:	**4189**	*Status:*	**Received**	**Sent**
Manufacturer:	**Brüel & Kjær**	*In tolerance:*	**X**	**X**
Serial number:	**2851039**	*Out of tolerance:*		
Composed of:		*See comments:*		
		Contains non-accredited tests: __Yes _X_ No		
Customer:	**ACI Acoustical Consultants Inc.**	*Address:*	**5031 - 210 Street Edmonton, Alberta CANADA T6M 0A8**	
Tel/Fax:	**780-414-6373/780-414-6376**			

Tested in accordance with the following procedures and standards:
Calibration of Measurement Microphones, Scantek, Inc., Rev. 2/25/2015

Instrumentation used for calibration: N-1504 Norsonic Test System:

Instrument - Manufacturer	Description	S/N	Cal. Date	Traceability evidence Cal. Lab / Accreditation	Cal. Due
483B-Norsonic	SME Cal Unit	31061	Jul 28, 2017	Scantek, Inc./ NVLAP	Jul 28, 2018
DS-360-SRS	Function Generator	88077	Sep 15, 2016	ACR Env./ A2LA	Sep 15, 2018
34401A-Agilent Technologies	Digital Voltmeter	MY47011118	Sep 20, 2017	ACR Env./ A2LA	Sep 20, 2018
HM30-Thommen	Meteo Station	1040170/39633	Oct 25, 2017	ACR Env./ A2LA	Oct 25, 2018
PC Program 1017 Norsonic	Calibration software	v.6.1T	Validated Nov 2014	Scantek, Inc.	-
1253-Norsonic	Calibrator	28326	Nov 10, 2017	Scantek, Inc./ NVLAP	Nov 10, 2018
1203-Norsonic	Preamplifier	92268	Oct 18, 2017	Scantek, Inc./ NVLAP	Oct 18, 2018
4180-Brüel&Kjær	Microphone	2246115	Oct 24, 2017	DANAK / DPLA	Oct 24, 2019

Instrumentation and test results are traceable to SI - BIPM through standards maintained by NPL (UK) and NIST (USA)

Calibrated by:	Jeremy Gotwalt	**Authorized signatory:**	Steven E Marshall
Signature	[signature]	Signature	Steven E. Marshall
Date	4/25/18	Date	4/25/2018

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Instrument: **Sound Level Meter**
Model: **2250**
Manufacturer: **Brüel and Kjær**
Serial number: **3006198**
Tested with: **Microphone 4189 s/n 2906926**
Preamplifier ZC0032 s/n 19467
Type (class): **1**
Customer: **ACI Acoustical Consultants Inc.**
Tel/Fax: **780-414-6373 / 780-414-6376**

Date Calibrated: **4/25/2018** *Cal Due:*

Status:	Received	Sent
In tolerance:	X	X
Out of tolerance:		
See comments:		

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Calibration service: __ Basic X Standard
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SLM & Dosimeters – Acoustical Tests, Scantek Inc., Rev. 7/6/2011

Instrumentation used for calibration: Nor-1504 Norsonic Test System:

Instrument - Manufacturer	Description	S/N	Cal. Date	Traceability evidence Cal. Lab / Accreditation	Cal. Due
483B-Norsonic	SME Cal Unit	31061	Jul 28, 2017	Scantek, Inc./ NVLAP	Jul 28, 2018
DS-360-SRS	Function Generator	88077	Sep 15, 2016	ACR Env./ A2LA	Sep 15, 2018
34401A-Agilent Technologies	Digital Voltmeter	MY47011118	Sep 20, 2017	ACR Env./ A2LA	Sep 20, 2018
HM30-Thommen	Meteo Station	1040170/39633	Oct 25, 2017	ACR Env./ A2LA	Oct 25, 2018
PC Program 1019 Norsonic	Calibration software	v.6.1T	Validated Nov 2014	Scantek, Inc.	-
1251-Norsonic	Calibrator	30878	Nov 10, 2017	Scantek, Inc./ NVLAP	Nov 10, 2018

Instrumentation and test results are traceable to SI (International System of Units) through standards maintained by NIST (USA) and NPL (UK).

Environmental conditions:

Temperature (°C)	Barometric pressure (kPa)	Relative Humidity (%)
23.2	99.24	49.7

Calibrated by:	Jeremy Gotwalt	**Authorized signatory:**	Steven E. Marshall
Signature	[signature]	Signature	Steven E. Marshall [signature]
Date	4/25/18	Date	4/25/2018

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NVLAP Lab Code: 200625-0

Calibration Certificate No.40638

Instrument: **Microphone**
Model: **4189**
Manufacturer: **Brüel & Kjær**
Serial number: **2906926**
Composed of:

Customer: **ACI Acoustical Consultants Inc.**
Tel/Fax: **780-414-6373/780-414-6376**

Date Calibrated: **4/25/2018** *Cal Due:*

Status:	Received	Sent
In tolerance:	X	X
Out of tolerance:		
See comments:		

Contains non-accredited tests: __ Yes _X_ No
Address: **5031 - 210 Street**
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Tested in accordance with the following procedures and standards:
Calibration of Measurement Microphones, Scantek, Inc., Rev. 2/25/2015

Instrumentation used for calibration: N-1504 Norsonic Test System:

Instrument - Manufacturer	Description	S/N	Cal. Date	Traceability evidence Cal. Lab / Accreditation	Cal. Due
483B-Norsonic	SME Cal Unit	31061	Jul 28, 2017	Scantek, Inc./ NVLAP	Jul 28, 2018
DS-360-SRS	Function Generator	88077	Sep 15, 2016	ACR Env./ A2LA	Sep 15, 2018
34401A-Agilent Technologies	Digital Voltmeter	MY47011118	Sep 20, 2017	ACR Env./ A2LA	Sep 20, 2018
HM30-Thommen	Meteo Station	1040170/39633	Oct 25, 2017	ACR Env./ A2LA	Oct 25, 2018
PC Program 1017 Norsonic	Calibration software	v.6.1T	Validated Nov 2014	Scantek, Inc.	-
1253-Norsonic	Calibrator	28326	Nov 10, 2017	Scantek, Inc./ NVLAP	Nov 10, 2018
1203-Norsonic	Preamplifier	92268	Oct 18, 2017	Scantek, Inc./ NVLAP	Oct 18, 2018
4180-Brüel&Kjær	Microphone	2246115	Oct 24, 2017	DANAK / DPLA	Oct 24, 2019

Instrumentation and test results are traceable to SI - BIPM through standards maintained by NPL (UK) and NIST (USA)

Calibrated by:	Jeremy Gotwalt	**Authorized signatory:**	Steven E Marshall
Signature	[signature]	Signature	[signature]
Date	4/25/18	Date	4/25/2018

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B&K 2250 Unit #10 SLM Calibration Certificate

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NVLAP® CALIBRATION
NVLAP Lab Code: 200625-0

Calibration Certificate No.38469

Instrument: **Sound Level Meter**
Model: **2250**
Manufacturer: **Brüel and Kjær**
Serial number: **3007542**
Tested with: **Microphone 4189 s/n 2978664**
Preamplifier ZC0032 s/n 22379
Type (class): **1**
Customer: **ACI Acoustical Consultants Inc.**
Tel/Fax: **780-414-6373 / 780-414-6376**

Date Calibrated: **5/9/2017** *Cal Due:*

Status:	**Received**	**Sent**
In tolerance:	X	X
Out of tolerance:		
See comments:		

Contains non-accredited tests: __Yes _X_ No
Calibration service: __ Basic _X_ Standard
Address: **5031 - 210 Street**
Edmonton, Alberta
CANADA T6M 0A8

Tested in accordance with the following procedures and standards:
Calibration of Sound Level Meters, Scantek Inc., Rev. 6/26/2015
SLM & Dosimeters – Acoustical Tests, Scantek Inc., Rev. 7/6/2011

Instrumentation used for calibration: Nor-1504 Norsonic Test System:

Instrument - Manufacturer	Description	S/N	Cal. Date	Traceability evidence Cal. Lab / Accreditation	Cal. Due
483B-Norsonic	SME Cal Unit	31061	Jul 27, 2016	Scantek, Inc./ NVLAP	Jul 27, 2017
DS-360-SRS	Function Generator	88077	Sep 15, 2016	ACR Env./ A2LA	Sep 15, 2018
34401A-Agilent Technologies	Digital Voltmeter	MY47011118	Sep 15, 2016	ACR Env./ A2LA	Sep 15, 2017
HM30-Thommen	Meteo Station	1040170/39633	Nov 1, 2016	ACR Env./ A2LA	Nov 1, 2017
PC Program 1019 Norsonic	Calibration software	v.6.1T	Validated Nov 2014	Scantek, Inc.	-
1251-Norsonic	Calibrator	30878	Nov 10, 2016	Scantek, Inc./ NVLAP	Nov 10, 2017

Instrumentation and test results are traceable to SI (International System of Units) through standards maintained by NIST (USA) and NPL (UK).

Environmental conditions:

Temperature (°C)	Barometric pressure (kPa)	Relative Humidity (%)
22.5	100.05	43.4

Calibrated by:	Jeremy Gotwalt	**Authorized signatory:**	Steven E. Marshall
Signature	[signature]	Signature	[signature]
Date		Date	5/9/2017

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NVLAP Lab Code: 200625-0

Calibration Certificate No.38470

Instrument:	**Microphone**	*Date Calibrated:* **5/8/2017**	*Cal Due:*	
Model:	**4189**	*Status:*	**Received**	**Sent**
Manufacturer:	**Brüel & Kjær**	*In tolerance:*	X	X
Serial number:	**2978664**	*Out of tolerance:*		
Composed of:		*See comments:*		

Contains non-accredited tests: __Yes _X_ No

Customer: **ACI Acoustical Consultants Inc.**
Tel/Fax: **780-414-6373/780-414-6376**
Address: **5031 - 210 Street, Edmonton, Alberta, CANADA T6M 0A8**

Tested in accordance with the following procedures and standards:
Calibration of Measurement Microphones, Scantek, Inc., Rev. 2/25/2015

Instrumentation used for calibration: N-1504 Norsonic Test System:

Instrument - Manufacturer	Description	S/N	Cal. Date	Traceability evidence Cal. Lab / Accreditation	Cal. Due
483B-Norsonic	SME Cal Unit	31061	Jul 27, 2016	Scantek, Inc./ NVLAP	Jul 27, 2017
DS-360-SRS	Function Generator	88077	Sep 15, 2016	ACR Env./ A2LA	Sep 15, 2018
34401A-Agilent Technologies	Digital Voltmeter	MY47011118	Sep 15, 2016	ACR Env./ A2LA	Sep 15, 2017
HM30-Thommen	Meteo Station	1040170/39633	Nov 1, 2016	ACR Env./ A2LA	Nov 1, 2017
PC Program 1017 Norsonic	Calibration software	v.6.1T	Validated Nov 2014	Scantek, Inc.	-
1253-Norsonic	Calibrator	28326	Nov 10, 2016	Scantek, Inc./ NVLAP	Nov 10, 2017
1203-Norsonic	Preamplifier	92268	Oct 17, 2016	Scantek, Inc./ NVLAP	Oct 17, 2017
4180-Brüel&Kjær	Microphone	2246115	Oct 26, 2015	NPL-UK / UKAS	Oct 26, 2017

Instrumentation and test results are traceable to SI - BIPM through standards maintained by NPL (UK) and NIST (USA)

Calibrated by:	Jeremy Gotwalt	**Authorized signatory:**	Steven E. Marshall
Signature	[signature]	Signature	[signature]
Date	5/8/17	Date	5/9/2017

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Appendix II THE ASSESSMENT OF ENVIRONMENTAL NOISE (GENERAL)

Sound Pressure Level

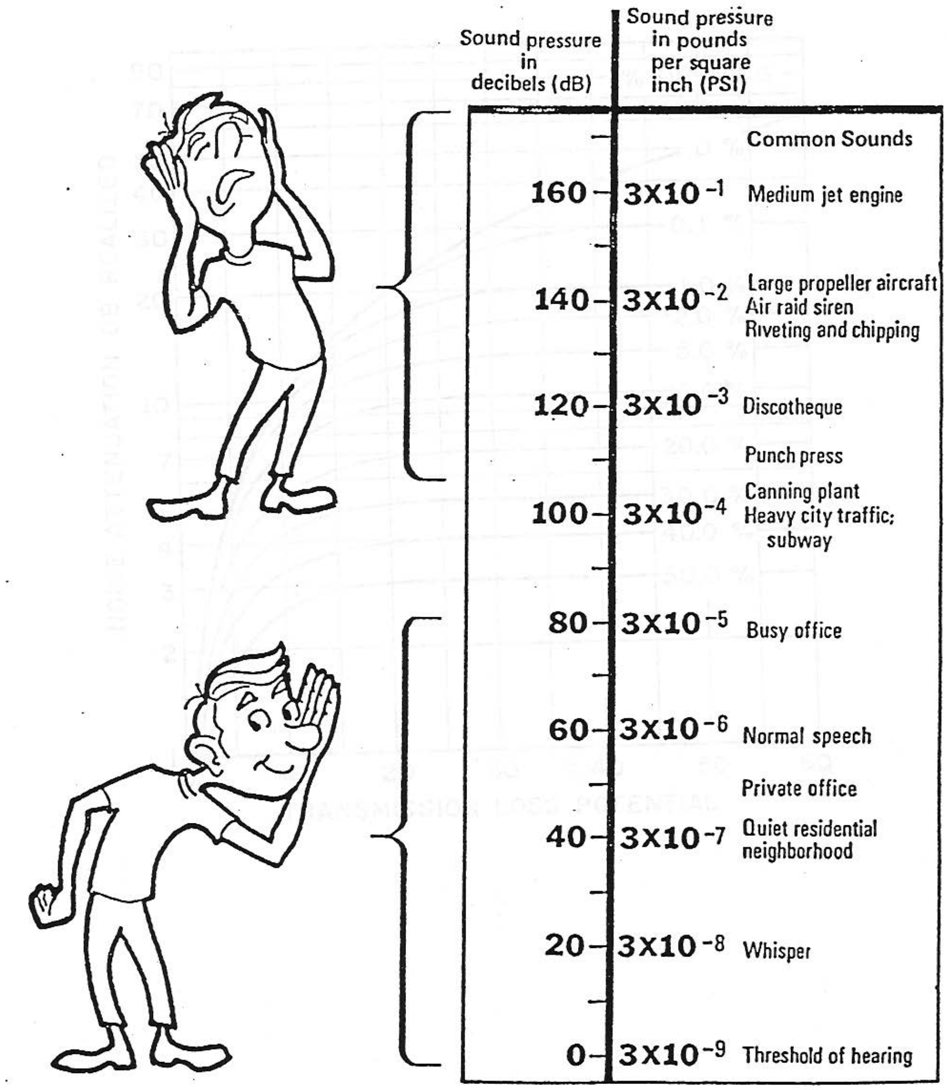
Sound pressure is initially measured in Pascal's (Pa). Humans can hear several orders of magnitude in sound pressure levels, so a more convenient scale is used. This scale is known as the decibel (dB) scale, named after Alexander Graham Bell (telephone guy). It is a base 10 logarithmic scale. When we measure pressure we typically measure the RMS sound pressure.

$$SPL = 10\log_{10}\left[\frac{P_{RMS}^{2}}{P_{ref}^{2}}\right] = 20\log_{10}\left[\frac{P_{RMS}}{P_{ref}}\right]$$

Where: SPL = Sound Pressure Level in dB
P_{RMS} = Root Mean Square measured pressure (Pa)
P_{ref} = Reference sound pressure level ($P_{ref} = 2\text{x}10^{-5}$ Pa = 20 μPa)

This reference sound pressure level is an internationally agreed upon value. It represents the threshold of human hearing for "typical" people based on numerous testing. It is possible to have a threshold which is lower than 20 μPa which will result in negative dB levels. As such, zero dB does not mean there is no sound!

In general, a difference of 1 – 2 dB is the threshold for humans to notice that there has been a change in sound level. A difference of 3 dB (factor of 2 in acoustical energy) is perceptible and a change of 5 dB is strongly perceptible. A change of 10 dB is typically considered a factor of 2. This is quite remarkable when considering that 10 dB is 10-times the acoustical energy!


Sound pressure in decibels (dB)
Sound pressure in pounds per square inch (PSI)
Common Sounds
160 3X10^-1 Medium jet engine
140 3X10^-2 Large propeller aircraft
Air raid siren
Riveting and chipping
120 3X10^-3 Discotheque
Punch press
Canning plant
100 3X10^-4 Heavy city traffic; subway
80 3X10^-5 Busy office
60 3X10^-6 Normal speech
Private office
40 3X10^-7 Quiet residential neighborhood
20 3X10^-8 Whisper
0 3X10^-9 Threshold of hearing

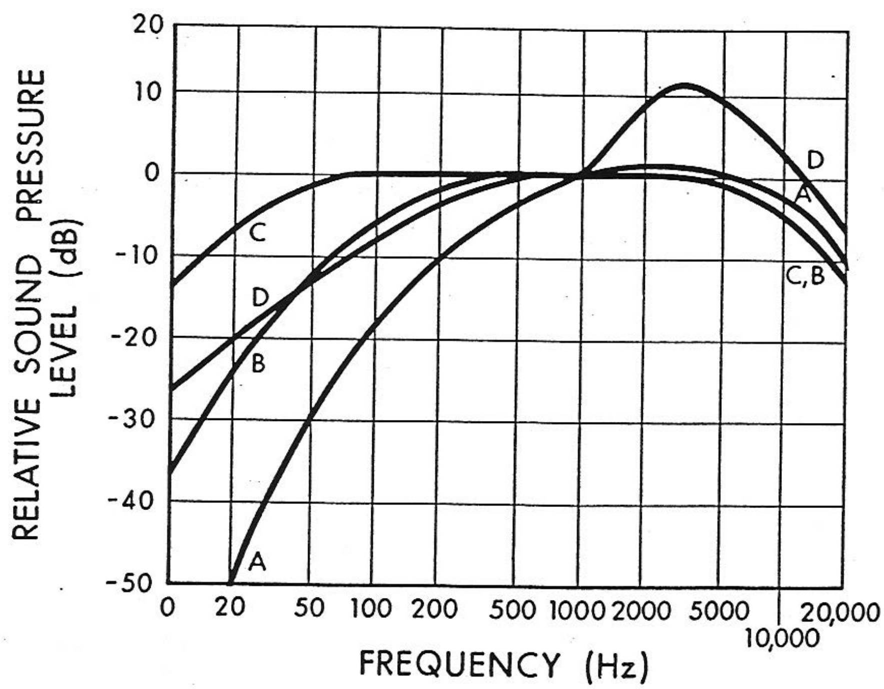
Frequency

The range of frequencies audible to the human ear ranges from approximately 20 Hz to 20 kHz. Within this range, the human ear does not hear equally at all frequencies. It is not very sensitive to low frequency sounds, is very sensitive to mid frequency sounds and is slightly less sensitive to high frequency sounds. Due to the large frequency range of human hearing, the entire spectrum is often divided into 31 bands, each known as a 1/3 octave band.

The internationally agreed upon center frequencies and upper and lower band limits for the 1/1 (whole octave) and 1/3 octave bands are as follows:

Whole Octave Lower Band Limit	Whole Octave Center Frequency	Whole Octave Upper Band Limit	1/3 Octave Lower Band Limit	1/3 Octave Center Frequency	1/3 Octave Upper Band Limit
11	**16**	22	14.1	**16**	17.8
			17.8	**20**	22.4
			22.4	**25**	28.2
22	**31.5**	44	28.2	**31.5**	35.5
			35.5	**40**	44.7
			44.7	**50**	56.2
44	**63**	88	56.2	**63**	70.8
			70.8	**80**	89.1
			89.1	**100**	112
88	**125**	177	112	**125**	141
			141	**160**	178
			178	**200**	224
177	**250**	355	224	**250**	282
			282	**315**	355
			355	**400**	447
355	**500**	710	447	**500**	562
			562	**630**	708
			708	**800**	891
710	**1000**	1420	891	**1000**	1122
			1122	**1250**	1413
			1413	**1600**	1778
1420	**2000**	2840	1778	**2000**	2239
			2239	**2500**	2818
			2818	**3150**	3548
2840	**4000**	5680	3548	**4000**	4467
			4467	**5000**	5623
			5623	**6300**	7079
5680	**8000**	11360	7079	**8000**	8913
			8913	**10000**	11220
			11220	**12500**	14130
11360	**16000**	22720	14130	**16000**	17780
			17780	**20000**	22390

Human hearing is most sensitive at approximately 3500 Hz which corresponds to the ¼ wavelength of the ear canal (approximately 2.5 cm). Because of this range of sensitivity to various frequencies, we typically apply various weighting networks to the broadband measured sound to more appropriately account for the way humans hear. By default, the most common weighting network used is the so-called "A-weighting". It can be seen in the figure that the low frequency sounds are reduced significantly with the A-weighting.



Combination of Sounds

When combining multiple sound sources the general equation is:

$$\Sigma SPL_n = 10\log_{10}\left[\sum_{i=1}^{n} 10^{\frac{SPL_i}{10}}\right]$$

Examples:

- Two sources of 50 dB each add together to result in 53 dB.
- Three sources of 50 dB each add together to result in 55 dB.
- Ten sources of 50 dB each add together to result in 60 dB.
- One source of 50 dB added to another source of 40 dB results in 50.4 dB

It can be seen that, if multiple similar sources exist, removing or reducing only one source will have little effect.

Sound Level Measurements

Over the years a number of methods for measuring and describing environmental noise have been developed. The most widely used and accepted is the concept of the Energy Equivalent Sound Level (L_{eq}) which was developed in the US (1970's) to characterize noise levels near US Air-force bases. This is the level of a steady state sound which, for a given period of time, would contain the same energy as the time varying sound. The concept is that the same amount of annoyance occurs from a sound having a high level for a short period of time as from a sound at a lower level for a longer period of time.
The L_{eq} is defined as:

$$L_{eq} = 10\log_{10}\left[\frac{1}{T}\int_0^T 10^{\frac{dB}{10}}\,dT\right] = 10\log_{10}\left[\frac{1}{T}\int_0^T \frac{P^2}{P_{ref}^2}\,dT\right]$$

We must specify the time period over which to measure the sound. i.e. 1-second, 10-seconds, 15-seconds, 1-minute, 1-day, etc**. An L_{eq} is meaningless if there is no time period associated**.

In general there a few very common L_{eq} sample durations which are used in describing environmental noise measurements. These include:

- L_{eq}24 - Measured over a 24-hour period
- L_{eq}Night - Measured over the night-time (typically 22:00 – 07:00)
- L_{eq}Day - Measured over the day-time (typically 07:00 – 22:00)
- L_{DN} - Same as L_{eq}24 with a 10 dB penalty added to the night-time

Statistical Descriptor

Another method of conveying long term noise levels utilizes statistical descriptors. These are calculated from a cumulative distribution of the sound levels over the entire measurement duration and then determining the sound level at xx % of the time.

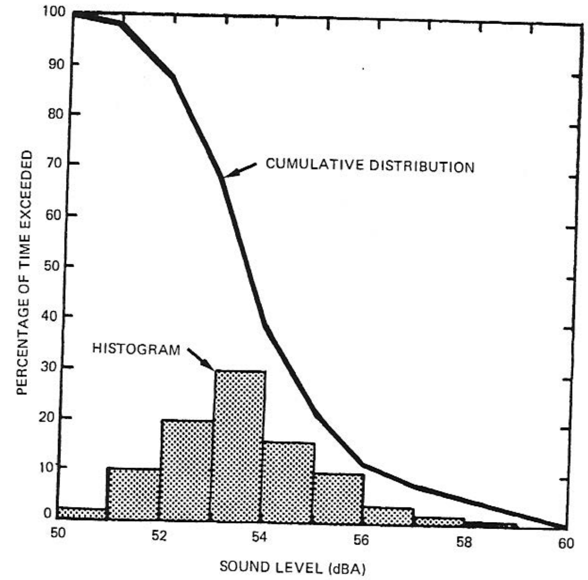


Figure 16.6 Statistically processed community noise showing histogram and cumulative distribution of A weighted sound levels.

Industrial Noise Control, Lewis Bell, Marcel Dekker, Inc. 1994

The most common statistical descriptors are:

L_{min} - minimum sound level measured
L_{01} - sound level that was exceeded only 1% of the time
L_{10} - sound level that was exceeded only 10% of the time.
- Good measure of intermittent or intrusive noise
- Good measure of Traffic Noise

L_{50} - sound level that was exceeded 50% of the time (arithmetic average)
- Good to compare to L_{eq} to determine steadiness of noise

L_{90} - sound level that was exceeded 90% of the time
- Good indicator of typical "ambient" noise levels

L_{99} - sound level that was exceeded 99% of the time
L_{max} - maximum sound level measured

These descriptors can be used to provide a more detailed analysis of the varying noise climate:

- If there is a large difference between the L_{eq} and the L_{50} (L_{eq} can never be any lower than the L_{50}) then it can be surmised that one or more short duration, high level sound(s) occurred during the time period.
- If the gap between the L_{10} and L_{90} is relatively small (less than 15 – 20 dBA) then it can be surmised that the noise climate was relatively steady.

Sound Propagation

In order to understand sound propagation, the nature of the source must first be discussed. In general, there are three types of sources. These are known as ‘point’, ‘line’, and ‘area’. This discussion will concentrate on point and line sources since area sources are much more complex and can usually be approximated by point sources at large distances.

Point Source

As sound radiates from a point source, it dissipates through geometric spreading. The basic relationship between the sound levels at two distances from a point source is:

$$\therefore SPL_1 - SPL_2 = 20\log_{10}\left(\frac{r_2}{r_1}\right)$$

Where: SPL_1 = sound pressure level at location 1, SPL_2 = sound pressure level at location 2
r_1 = distance from source to location 1, r_2 = distance from source to location 2

Thus, the reduction in sound pressure level for a point source radiating in a free field is **6 dB per doubling of distance**. This relationship is independent of reflectivity factors provided they are always present. Note that this only considers geometric spreading and does not take into account atmospheric effects. Point sources still have some physical dimension associated with them, and typically do not radiate sound equally in all directions in all frequencies. The directionality of a source is also highly dependent on frequency. As frequency increases, directionality increases.

Examples (note no atmospheric absorption):

- A point source measuring 50 dB at 100m will be 44 dB at 200m.
- A point source measuring 50 dB at 100m will be 40.5 dB at 300m.
- A point source measuring 50 dB at 100m will be 38 dB at 400m.
- A point source measuring 50 dB at 100m will be 30 dB at 1000m.

Line Source

A line source is similar to a point source in that it dissipates through geometric spreading. The difference is that a line source is equivalent to a long line of many point sources. The basic relationship between the sound levels at two distances from a line source is:

$$SPL_1 - SPL_2 = 10\log_{10}\left(\frac{r_2}{r_1}\right)$$

The difference from the point source is that the ‘20’ term in front of the ‘log’ is now only 10. Thus, the reduction in sound pressure level for a line source radiating in a free field is **3 dB per doubling of distance**.

Examples (note no atmospheric absorption):

- A line source measuring 50 dB at 100m will be 47 dB at 200m.
- A line source measuring 50 dB at 100m will be 45 dB at 300m.
- A line source measuring 50 dB at 100m will be 44 dB at 400m.
- A line source measuring 50 dB at 100m will be 40 dB at 1000m.

Atmospheric Absorption

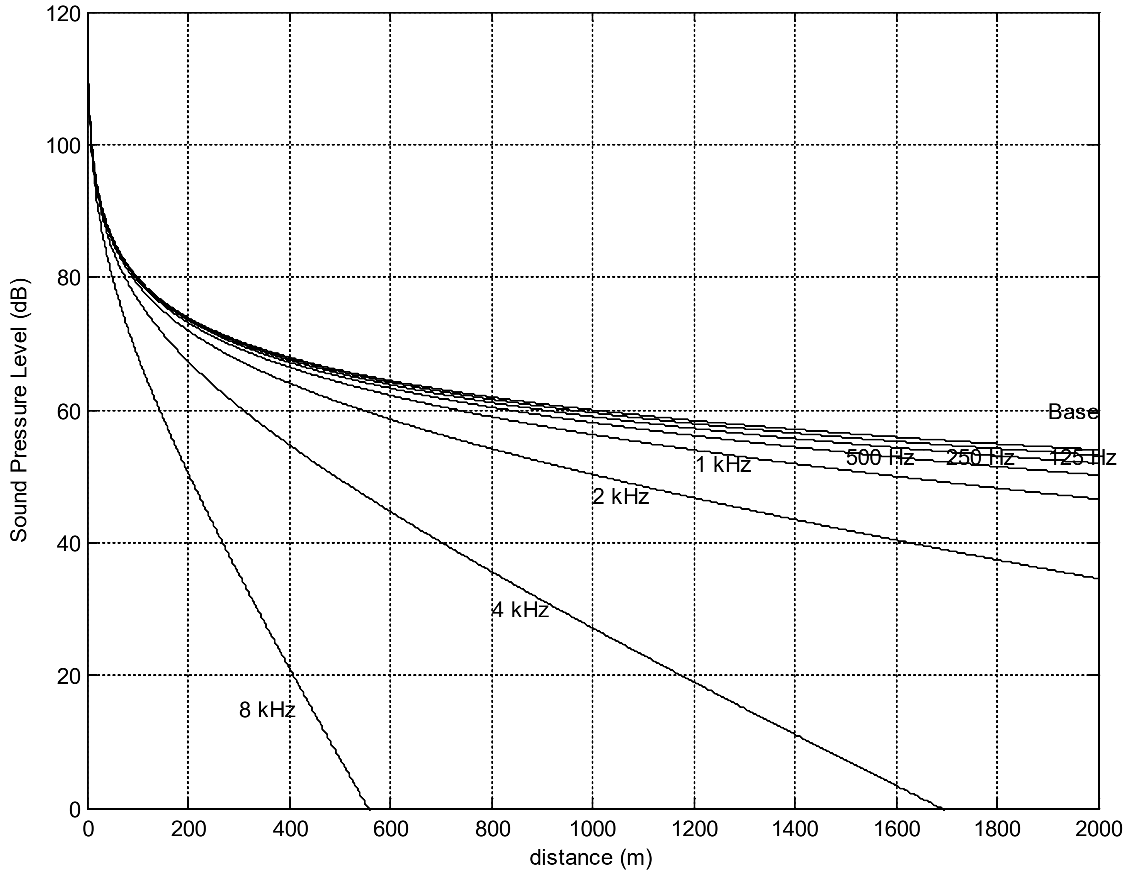
As sound transmits through a medium, there is an attenuation (or dissipation of acoustic energy) which can be attributed to three mechanisms:

1) **Viscous Effects** - Dissipation of acoustic energy due to fluid friction which results in thermodynamically irreversible propagation of sound.
2) **Heat Conduction Effects** - Heat transfer between high and low temperature regions in the wave which result in non-adiabatic propagation of the sound.
3) **Inter Molecular Energy Interchanges** - Molecular energy relaxation effects which result in a time lag between changes in translational kinetic energy and the energy associated with rotation and vibration of the molecules.

The following table illustrates the attenuation coefficient of sound at standard pressure (101.325 kPa) in units of dB/100m.

Temperature ^{o}C	Relative Humidity (%)	Frequency (Hz) 125	250	500	1000	2000	4000
30	20	0.06	0.18	0.37	0.64	1.40	4.40
	50	0.03	0.10	0.33	0.75	1.30	2.50
	90	0.02	0.06	0.24	0.70	1.50	2.60
20	20	0.07	0.15	0.27	0.62	1.90	6.70
	50	0.04	0.12	0.28	0.50	1.00	2.80
	90	0.02	0.08	0.26	0.56	0.99	2.10
10	20	0.06	0.11	0.29	0.94	3.20	9.00
	50	0.04	0.11	0.20	0.41	1.20	4.20
	90	0.03	0.10	0.21	0.38	0.81	2.50
0	20	0.05	0.15	0.50	1.60	3.70	5.70
	50	0.04	0.08	0.19	0.60	2.10	6.70
	90	0.03	0.08	0.15	0.36	1.10	4.10

- As frequency increases, absorption tends to increase
- As Relative Humidity increases, absorption tends to decrease
- There is no direct relationship between absorption and temperature
- **The net result of atmospheric absorption is to modify the sound propagation of a point source from 6 dB/doubling-of-distance to approximately 7 – 8 dB/doubling-of-distance (based on anecdotal experience)**



Atmospheric Absorption at 10ºC and 70% RH

Meteorological Effects

There are many meteorological factors which can affect how sound propagates over large distances. These various phenomena must be considered when trying to determine the relative impact of a noise source either after installation or during the design stage.

Wind

- Can greatly alter the noise climate away from a source depending on direction
- Sound levels downwind from a source can be increased due to refraction of sound back down towards the surface. This is due to the generally higher velocities as altitude increases.
- Sound levels upwind from a source can be decreased due to a "bending" of the sound away from the earth's surface.
- Sound level differences of ±10dB are possible depending on severity of wind and distance from source.
- Sound levels crosswind are generally not disturbed by an appreciable amount
- Wind tends to generate its own noise, however, and can provide a high degree of masking relative to a noise source of particular interest.

Temperature

- Temperature effects can be similar to wind effects
- Typically, the temperature is warmer at ground level than it is at higher elevations.
- If there is a very large difference between the ground temperature (very warm) and the air aloft (only a few hundred meters) then the transmitted sound refracts upward due to the changing speed of sound.
- If the air aloft is warmer than the ground temperature (known as an *inversion*) the resulting higher speed of sound aloft tends to refract the transmitted sound back down towards the ground. This essentially works on Snell's law of reflection and refraction.
- Temperature inversions typically happen early in the morning and are most common over large bodies of water or across river valleys.
- Sound level differences of ±10dB are possible depending on gradient of temperature and distance from source.

Rain

- Rain does not affect sound propagation by an appreciable amount unless it is very heavy
- The larger concern is the noise generated by the rain itself. A heavy rain striking the ground can cause a significant amount of highly broadband noise. The amount of noise generated is difficult to predict.
- Rain can also affect the output of various noise sources such as vehicle traffic.

Summary

- In general, these wind and temperature effects are difficult to predict
- Empirical models (based on measured data) have been generated to attempt to account for these effects.
- Environmental noise measurements must be conducted with these effects in mind. Sometimes it is desired to have completely calm conditions, other times a "worst case" of downwind noise levels are desired.

Topographical Effects

Similar to the various atmospheric effects outlined in the previous section, the effect of various geographical and vegetative factors must also be considered when examining the propagation of noise over large distances.

Topography

- One of the most important factors in sound propagation.
- Can provide a natural barrier between source and receiver (i.e. if berm or hill in between).
- Can provide a natural amplifier between source and receiver (i.e. large valley in between or hard reflective surface in between).
- Must look at location of topographical features relative to source and receiver to determine importance (i.e. small berm 1km away from source and 1km away from receiver will make negligible impact).

Grass

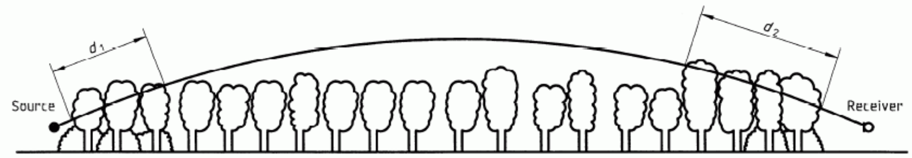
- Can be an effective absorber due to large area covered
- Only effective at low height above ground. Does not affect sound transmitted direct from source to receiver if there is line of sight.
- Typically less absorption than atmospheric absorption when there is line of sight.
- Approximate rule of thumb based on empirical data is:

$$A_g = 18\log_{10}(f) - 31 \qquad (dB/100m)$$

Where: A_g is the absorption amount

Trees

- Provide absorption due to foliage
- Deciduous trees are essentially ineffective in the winter
- Absorption depends heavily on density and height of trees
- No data found on absorption of various kinds of trees
- Large spans of trees are required to obtain even minor amounts of sound reduction
- In many cases, trees can provide an effective visual barrier, even if the noise attenuation is negligible.



NOTE — $d_f = d_1 + d_2$

For calculating d_1 and d_2, the curved path radius may be assumed to be 5 km.

Figure A.1 — Attenuation due to propagation through foliage increases linearly with propagation distance d_f through the foliage

Table A.1 — Attenuation of an octave band of noise due to propagation a distance d_f through dense foliage

Propagation distance d_f m	Nominal midband frequency Hz							
	63	125	250	500	1 000	2 000	4 000	8 000
	Attenuation, dB:							
$10 \leq d_f \leq 20$	0	0	1	1	1	1	2	3
	Attenuation, dB/m:							
$20 \leq d_f \leq 200$	0,02	0,03	0,04	0,05	0,06	0,08	0,09	0,12

Tree/Foliage attenuation from ISO 9613-2:1996

Bodies of Water

- Large bodies of water can provide the opposite effect to grass and trees.
- Reflections caused by small incidence angles (grazing) can result in larger sound levels at great distances (increased reflectivity, Q).
- Typically air temperatures are warmer high aloft since air temperatures near water surface tend to be more constant. Result is a high probability of temperature inversion.
- Sound levels can "carry" much further.

Snow

- Covers the ground for approximately 1/2 of the year in northern climates.
- Can act as an absorber or reflector (and varying degrees in between).
- Freshly fallen snow can be quite absorptive.
- Snow which has been sitting for a while and hard packed due to wind can be quite reflective.
- Falling snow can be more absorptive than rain, but does not tend to produce its own noise.
- Snow can cover grass which might have provided some means of absorption.
- Typically sound propagates with less impedance in winter due to hard snow on ground and no foliage on trees/shrubs.

Appendix III SOUND LEVELS OF FAMILIAR NOISE SOURCES

Used with Permission Obtained from the Alberta Energy Regulator (AER) Directive 038 (February 2007)

Source[1]	**Sound Level (dBA)**
Bedroom of a country home	30
Soft whisper at 1.5 m	30
Quiet office or living room	40
Moderate rainfall	50
Inside average urban home	50
Quiet street	50
Normal conversation at 1 m	60
Noisy office	60
Noisy restaurant	70
Highway traffic at 15 m	75
Loud singing at 1 m	75
Tractor at 15 m	78-95
Busy traffic intersection	80
Electric typewriter	80
Bus or heavy truck at 15 m	88-94
Jackhammer	88-98
Loud shout	90
Freight train at 15 m	95
Modified motorcycle	95
Jet taking off at 600 m	100
Amplified rock music	110
Jet taking off at 60 m	120
Air-raid siren	130

[1] Cottrell, Tom, 1980, *Noise in Alberta*, Table 1, p.8, ECA80 - 16/1B4 (Edmonton: Environment Council of Alberta).

SOUND LEVELS GENERATED BY COMMON APPLIANCES

Used with Permission Obtained from the Alberta Energy Regulator (AER) Directive 038 (February 2007)

Source[1]	**Sound level at 3 feet (dBA)**
Freezer	38-45
Refrigerator	34-53
Electric heater	47
Hair clipper	50
Electric toothbrush	48-57
Humidifier	41-54
Clothes dryer	51-65
Air conditioner	50-67
Electric shaver	47-68
Water faucet	62
Hair dryer	58-64
Clothes washer	48-73
Dishwasher	59-71
Electric can opener	60-70
Food mixer	59-75
Electric knife	65-75
Electric knife sharpener	72
Sewing machine	70-74
Vacuum cleaner	65-80
Food blender	65-85
Coffee mill	75-79
Food waste disposer	69-90
Edger and trimmer	81
Home shop tools	64-95
Hedge clippers	85
Electric lawn mower	80-90

[1] Reif, Z. F., and Vermeulen, P. J., 1979, "Noise from domestic appliances, construction, and industry," Table 1, p.166, in Jones, H. W., ed., *Noise in the Human Environment*, vol. 2, ECA79-SP/1 (Edmonton: Environment Council of Alberta).

Appendix IV DATA REMOVAL

Data Removal Noise Monitoring Location #1

Start Time	End Time	Duration (min)	Reason
7/24/18 22:03	7/24/18 22:04	0.8	Loud Vehicle Passby
7/24/18 22:04	7/24/18 22:05	0.8	Loud Vehicle Passby
7/24/18 22:07	7/24/18 22:08	1.0	Loud Vehicle Passby
7/24/18 22:13	7/24/18 22:13	0.8	Loud Vehicle Passby
7/24/18 22:14	7/24/18 22:15	1.0	Train Passby
7/24/18 22:18	7/24/18 22:20	1.5	Loud Vehicle Passby
7/24/18 22:38	7/24/18 22:39	1.0	Loud Vehicle Passby
7/24/18 22:42	7/24/18 22:43	1.3	Loud Vehicle Passby
7/24/18 22:55	7/24/18 22:56	1.0	Loud Vehicle Passby
7/24/18 23:02	7/24/18 23:03	0.8	Loud Vehicle Passby
7/24/18 23:15	7/24/18 23:16	1.0	Loud Vehicle Passby
7/24/18 23:26	7/24/18 23:27	1.0	Loud Vehicle Passby
7/24/18 23:30	7/24/18 23:31	1.3	Loud Vehicle Passby
7/24/18 23:37	7/24/18 23:38	1.0	Loud Vehicle Passby
7/25/18 00:32	7/25/18 00:33	1.0	Train Passby
7/25/18 01:43	7/25/18 01:44	0.8	Loud Vehicle Passby
7/25/18 02:45	7/25/18 02:46	1.3	Loud Vehicle Passby
7/25/18 03:14	7/25/18 03:15	0.5	Loud Vehicle Passby
7/25/18 03:35	7/25/18 03:36	1.0	Loud Vehicle Passby
7/25/18 03:43	7/25/18 03:44	1.0	Train Passby
7/25/18 03:46	7/25/18 03:47	1.0	Train Passby
7/25/18 03:56	7/25/18 03:57	1.0	Loud Vehicle Passby
7/25/18 03:57	7/25/18 03:59	1.5	Loud Vehicle Passby
7/25/18 04:11	7/25/18 04:12	1.0	Loud Vehicle Passby
7/25/18 04:13	7/25/18 04:14	1.0	Loud Vehicle Passby
7/25/18 04:20	7/25/18 04:22	1.8	Loud Vehicle Passby
7/25/18 04:22	7/25/18 04:23	1.0	Loud Vehicle Passby
7/25/18 04:27	7/25/18 04:29	1.5	Loud Vehicle Passby
7/25/18 04:29	7/25/18 04:30	1.0	Loud Vehicle Passby
7/25/18 04:30	7/25/18 04:31	0.8	Loud Vehicle Passby
7/25/18 04:32	7/25/18 04:33	1.0	Loud Vehicle Passby
7/25/18 04:34	7/25/18 04:35	1.0	Loud Vehicle Passby
7/25/18 04:38	7/25/18 04:39	1.0	Loud Vehicle Passby
7/25/18 04:40	7/25/18 04:42	1.8	Loud Vehicle Passby
7/25/18 04:42	7/25/18 04:46	3.5	Loud Vehicle Passby
7/25/18 04:46	7/25/18 04:47	1.8	Loud Vehicle Passby
7/25/18 04:50	7/25/18 04:52	1.3	Loud Vehicle Passby
7/25/18 04:54	7/25/18 04:55	1.0	Loud Vehicle Passby
7/25/18 04:56	7/25/18 04:59	2.3	Loud Vehicle Passby

Data Removal Noise Monitoring Location #1 Cont.

Start Time	End Time	Duration (min)	Reason
7/25/18 05:00	7/25/18 05:02	2.3	Loud Vehicle Passby
7/25/18 05:05	7/25/18 05:09	4.3	Loud Vehicle Passby
7/25/18 05:20	7/25/18 05:22	2.5	Loud Vehicle Passby
7/25/18 05:26	7/25/18 05:30	3.8	Loud Vehicle Passby
7/25/18 05:30	7/25/18 05:35	4.8	Loud Vehicle Passby
7/25/18 05:36	7/25/18 05:39	3.0	Loud Vehicle Passby
7/25/18 05:40	7/25/18 05:41	1.3	Loud Vehicle Passby
7/25/18 05:44	7/25/18 05:47	2.5	Loud Vehicle Passby
7/25/18 05:48	7/25/18 05:51	3.0	Loud Vehicle Passby
7/25/18 05:51	7/25/18 05:58	7.0	Loud Vehicle Passby
7/25/18 05:58	7/25/18 06:00	1.8	Loud Vehicle Passby
7/25/18 06:00	7/25/18 06:42	42.0	Loud Vehicle Passby
7/25/18 06:42	7/25/18 07:00	18.3	Loud Vehicle Passby
7/25/18 22:02	7/25/18 22:02	0.5	Loud Vehicle Passby
7/25/18 22:10	7/25/18 22:11	1.0	Loud Vehicle Passby
7/25/18 22:13	7/25/18 22:14	1.0	Loud Vehicle Passby
7/25/18 22:14	7/25/18 22:15	0.5	Loud Vehicle Passby
7/25/18 22:17	7/25/18 22:18	0.8	Loud Vehicle Passby
7/25/18 22:20	7/25/18 22:22	1.3	Loud Vehicle Passby
7/25/18 22:25	7/25/18 22:26	1.5	Loud Vehicle Passby
7/25/18 22:59	7/25/18 23:00	1.3	Loud Vehicle Passby
7/25/18 23:02	7/25/18 23:03	0.8	Loud Vehicle Passby
7/25/18 23:19	7/25/18 23:21	1.3	Loud Vehicle Passby
7/25/18 23:25	7/25/18 23:27	1.5	Loud Vehicle Passby
7/25/18 23:44	7/25/18 23:45	0.8	Train Passby
7/25/18 23:52	7/25/18 23:53	0.8	Loud Vehicle Passby
7/26/18 00:29	7/26/18 00:30	1.0	Loud Vehicle Passby
7/26/18 00:36	7/26/18 00:37	1.0	Loud Vehicle Passby
7/26/18 01:25	7/26/18 01:26	0.8	Human Activity
7/26/18 02:15	7/26/18 02:15	0.8	Loud Vehicle Passby
7/26/18 02:39	7/26/18 02:41	1.3	Loud Vehicle Passby
7/26/18 02:47	7/26/18 02:49	1.8	Loud Vehicle Passby
7/26/18 02:51	7/26/18 02:52	1.0	Train Passby
7/26/18 02:59	7/26/18 02:59	0.5	Loud Vehicle Passby
7/26/18 03:27	7/26/18 03:28	0.8	abnormal noise
7/26/18 03:43	7/26/18 03:45	1.3	Loud Vehicle Passby
7/26/18 03:59	7/26/18 04:00	1.0	Loud Vehicle Passby
7/26/18 04:18	7/26/18 04:19	0.8	Loud Vehicle Passby
7/26/18 04:24	7/26/18 04:25	1.0	Loud Vehicle Passby

Data Removal Noise Monitoring Location #1 Cont.

Start Time	End Time	Duration (min)	Reason
7/26/18 04:26	7/26/18 04:27	1.0	Loud Vehicle Passby
7/26/18 04:27	7/26/18 04:29	1.8	Loud Vehicle Passby
7/26/18 04:30	7/26/18 04:32	1.3	Loud Vehicle Passby
7/26/18 04:33	7/26/18 04:34	1.0	Loud Vehicle Passby
7/26/18 04:34	7/26/18 04:36	1.5	Loud Vehicle Passby
7/26/18 04:38	7/26/18 04:40	1.8	Loud Vehicle Passby
7/26/18 04:41	7/26/18 04:43	1.5	Loud Vehicle Passby
7/26/18 04:43	7/26/18 04:49	5.5	Loud Vehicle Passby
7/26/18 04:49	7/26/18 04:57	7.3	Loud Vehicle Passby
7/26/18 04:58	7/26/18 04:59	1.3	Loud Vehicle Passby
7/26/18 05:05	7/26/18 05:06	1.0	Loud Vehicle Passby
7/26/18 05:09	7/26/18 05:11	2.5	Loud Vehicle Passby
7/26/18 05:13	7/26/18 05:14	1.3	Loud Vehicle Passby
7/26/18 05:17	7/26/18 05:18	1.8	Loud Vehicle Passby
7/26/18 05:20	7/26/18 05:22	2.0	Loud Vehicle Passby
7/26/18 05:22	7/26/18 05:24	1.8	Loud Vehicle Passby
7/26/18 05:25	7/26/18 05:26	1.0	Loud Vehicle Passby
7/26/18 05:27	7/26/18 05:30	3.0	Loud Vehicle Passby
7/26/18 05:30	7/26/18 05:39	8.8	Loud Vehicle Passby
7/26/18 05:42	7/26/18 06:00	18.0	Loud Vehicle Passby
7/26/18 06:03	7/26/18 06:31	27.3	Loud Vehicle Passby
7/26/18 06:31	7/26/18 07:04	32.8	Loud Vehicle Passby
	Total Night #1	**142**	
	Total Night #2	**150**	
	Total Data	**292**	

Data Removal Noise Monitoring Location #2

Start Time	End Time	Duration (min)	Reason
6/18/18 22:00	6/18/18 22:03	3.0	Train Passby
6/18/18 22:09	6/18/18 22:14	5.0	Train Passby
6/18/18 22:15	6/18/18 22:28	12.8	Rail Activity
6/18/18 22:29	6/18/18 22:36	7.8	Rail Activity
6/18/18 22:37	6/18/18 22:44	7.5	Rail Activity
6/18/18 22:44	6/18/18 22:58	13.3	Rail Activity
6/18/18 23:07	6/18/18 23:08	1.3	Train Passby
6/19/18 00:28	6/19/18 00:30	1.5	Loud Vehicle Passby
6/19/18 01:35	6/19/18 01:37	1.5	Train Passby
6/19/18 01:41	6/19/18 01:42	0.8	Train Passby
6/19/18 02:06	6/19/18 02:08	1.8	Train Passby
6/19/18 02:17	6/19/18 02:19	1.3	Train Passby
6/19/18 02:37	6/19/18 02:37	0.3	Train Passby
6/19/18 02:37	6/19/18 02:41	4.0	Train Passby
6/19/18 02:41	6/19/18 03:12	30.3	Train Passby
6/19/18 03:34	6/19/18 03:35	1.5	Rail Activity
6/19/18 03:40	6/19/18 03:42	1.5	Train Passby
6/19/18 03:48	6/19/18 03:53	5.5	Train Passby
6/19/18 04:00	6/19/18 04:02	1.8	Train Passby
6/19/18 04:02	6/19/18 04:20	17.8	Rail Activity
6/19/18 04:37	6/19/18 04:40	3.5	Train Passby
6/19/18 04:45	6/19/18 04:46	1.0	Train Passby
6/19/18 04:47	6/19/18 04:49	2.0	Train Passby
6/19/18 04:54	6/19/18 04:55	0.8	Loud Vehicle Passby
6/19/18 05:01	6/19/18 05:04	2.8	Loud Vehicle Passby
6/19/18 05:12	6/19/18 05:14	1.8	Loud Vehicle Passby
6/19/18 05:14	6/19/18 05:15	1.0	Loud Vehicle Passby
6/19/18 05:23	6/19/18 05:25	1.8	Loud Vehicle Passby
6/19/18 05:28	6/19/18 05:29	0.8	Train Passby
6/19/18 05:32	6/19/18 05:33	1.3	Train Passby
6/19/18 05:40	6/19/18 05:40	0.3	Loud Vehicle Passby
6/19/18 05:41	6/19/18 05:43	1.5	Loud Vehicle Passby
6/19/18 05:49	6/19/18 05:50	1.0	Loud Vehicle Passby
6/19/18 05:51	6/19/18 05:53	2.5	Loud Vehicle Passby
6/19/18 06:11	6/19/18 06:11	0.5	Loud Vehicle Passby
6/19/18 06:34	6/19/18 06:34	0.8	Loud Vehicle Passby
6/19/18 06:57	6/19/18 06:58	1.3	Loud Vehicle Passby
6/19/18 21:59	6/19/18 22:01	1.8	Rail Activity
6/19/18 22:02	6/19/18 22:13	10.5	Rail Activity
6/19/18 22:13	6/19/18 22:15	1.8	Rail Activity

Data Removal Noise Monitoring Location #2 Cont.

Start Time	End Time	Duration (min)	Reason
6/19/18 22:15	6/19/18 22:26	11.3	Rail Activity
6/19/18 22:31	6/19/18 22:33	2.3	Rail Activity
6/19/18 22:33	6/19/18 22:35	2.3	Rail Activity
6/19/18 22:35	6/19/18 22:38	2.8	Rail Activity
6/19/18 22:38	6/19/18 22:44	5.3	Rail Activity
6/19/18 22:44	6/19/18 22:45	1.5	Rail Activity
6/19/18 22:45	6/19/18 22:51	6.3	Rail Activity
6/19/18 22:51	6/19/18 22:57	5.8	Rail Activity
6/19/18 23:01	6/19/18 23:02	1.5	Train Passby
6/19/18 23:11	6/19/18 23:12	1.0	Loud Vehicle Passby
6/19/18 23:18	6/19/18 23:19	1.0	Loud Vehicle Passby
6/20/18 02:57	6/20/18 02:59	1.3	Train Passby
6/20/18 03:03	6/20/18 03:04	1.3	Train Passby
6/20/18 03:24	6/20/18 03:25	1.0	Train Passby
6/20/18 03:44	6/20/18 03:45	0.8	Train Passby
6/20/18 03:49	6/20/18 03:52	3.0	Train Passby
6/20/18 03:53	6/20/18 03:54	1.0	Train Passby
6/20/18 03:54	6/20/18 03:55	1.3	Train Passby
6/20/18 04:06	6/20/18 04:08	1.3	Rail Activity
6/20/18 04:08	6/20/18 04:11	3.0	Rail Activity
6/20/18 04:11	6/20/18 04:14	2.5	Rail Activity
6/20/18 04:14	6/20/18 04:18	3.8	Rail Activity
6/20/18 04:18	6/20/18 04:23	4.8	Rail Activity
6/20/18 04:29	6/20/18 04:30	1.0	Rail Activity
6/20/18 04:30	6/20/18 04:37	6.5	Rail Activity
6/20/18 04:37	6/20/18 04:41	3.8	Rail Activity
6/20/18 05:34	6/20/18 05:37	2.8	Train Passby
6/20/18 05:37	6/20/18 05:40	3.0	Train Passby
6/20/18 05:41	6/20/18 05:42	1.3	Loud Vehicle Passby
6/20/18 05:42	6/20/18 05:43	1.0	Train Passby
6/20/18 06:02	6/20/18 06:04	1.3	Train Passby
6/20/18 06:19	6/20/18 06:21	2.0	Train Passby
6/20/18 06:50	6/20/18 06:51	0.8	Loud Vehicle Passby
6/20/18 06:57	6/20/18 06:58	0.8	Loud Vehicle Passby
6/20/18 07:00	6/20/18 07:00	0.5	Loud Vehicle Passby
	Total Night #1	**144**	
	Total Night #2	**104**	
	Total Data	**248**	

Data Removal Noise Monitoring Location #3

Start Time	End Time	Duration (min)	Reason
6/18/18 22:00	6/18/18 22:05	4.5	Train Passby
6/18/18 22:07	6/18/18 22:16	9.8	Train Passby
6/18/18 22:24	6/18/18 22:51	26.5	Train Passby
6/18/18 23:07	6/18/18 23:08	1.3	Train Passby
6/18/18 23:37	6/18/18 23:40	3.5	Train Passby
6/18/18 23:49	6/18/18 23:50	0.8	Emergency Sirens
6/19/18 00:30	6/19/18 00:31	1.0	Train Passby
6/19/18 00:45	6/19/18 00:46	0.8	Train Passby
6/19/18 00:52	6/19/18 00:54	1.3	Train Passby
6/19/18 01:30	6/19/18 01:32	1.8	Train Passby
6/19/18 01:35	6/19/18 01:37	1.8	Train Passby
6/19/18 01:38	6/19/18 01:39	1.3	Train Passby
6/19/18 01:42	6/19/18 01:45	2.3	Train Passby
6/19/18 01:50	6/19/18 01:51	1.0	Train Passby
6/19/18 01:53	6/19/18 01:55	1.8	Train Passby
6/19/18 02:16	6/19/18 02:19	2.3	Train Passby
6/19/18 02:39	6/19/18 02:40	1.5	Train Passby
6/19/18 02:58	6/19/18 02:59	0.8	Train Passby
6/19/18 03:02	6/19/18 03:03	1.0	Train Passby
6/19/18 03:05	6/19/18 03:10	5.0	Train Passby
6/19/18 03:20	6/19/18 03:30	10.0	Rail Activity
6/19/18 03:34	6/19/18 03:37	3.0	Rail Activity
6/19/18 03:40	6/19/18 03:42	2.3	Train Passby
6/19/18 03:46	6/19/18 03:53	6.8	Rail Activity
6/19/18 04:01	6/19/18 04:02	0.8	Train Passby
6/19/18 04:04	6/19/18 04:15	10.5	Rail Activity
6/19/18 04:17	6/19/18 04:22	5.3	Train Passby
6/19/18 04:34	6/19/18 04:43	9.0	Rail Activity
6/19/18 04:47	6/19/18 04:48	0.5	Train Passby
6/19/18 05:20	6/19/18 05:23	2.8	Train Passby
6/19/18 05:25	6/19/18 05:38	13.0	Train Passby
6/19/18 05:46	6/19/18 05:47	1.0	Loud Vehicle Passby
6/19/18 05:48	6/19/18 05:53	4.5	Loud Vehicle Passby
6/19/18 06:03	6/19/18 06:04	1.3	Loud Vehicle Passby
6/19/18 06:08	6/19/18 06:09	1.0	Loud Vehicle Passby
6/19/18 06:14	6/19/18 06:15	1.0	Loud Vehicle Passby
6/19/18 06:19	6/19/18 06:21	2.0	Loud Vehicle Passby
6/19/18 06:23	6/19/18 06:23	0.8	Loud Vehicle Passby
6/19/18 06:25	6/19/18 06:28	2.5	Loud Vehicle Passby
6/19/18 06:38	6/19/18 06:40	2.0	Loud Vehicle Passby

Data Removal Noise Monitoring Location #3

Start Time	End Time	Duration (min)	Reason
6/19/18 06:42	6/19/18 06:43	1.8	Loud Vehicle Passby
6/19/18 06:46	6/19/18 06:48	2.0	Loud Vehicle Passby
6/19/18 06:49	6/19/18 06:50	1.0	Loud Vehicle Passby
6/19/18 06:54	6/19/18 06:59	4.5	Loud Vehicle Passby
6/19/18 22:01	6/19/18 22:02	1.8	Loud Vehicle Passby
6/19/18 22:23	6/19/18 22:25	1.8	Train Passby
6/19/18 22:45	6/19/18 22:47	2.0	Train Passby
6/19/18 23:06	6/19/18 23:07	1.3	Loud Vehicle Passby
6/19/18 23:20	6/19/18 23:21	1.0	Train Passby
6/19/18 23:26	6/19/18 23:27	0.8	Loud Vehicle Passby
6/19/18 23:39	6/19/18 23:40	1.5	Train Passby
6/19/18 23:46	6/19/18 23:49	3.3	Train Passby
6/19/18 23:56	6/19/18 23:58	1.8	Train Passby
6/20/18 00:11	6/20/18 00:13	2.0	Train Passby
6/20/18 00:15	6/20/18 00:19	3.8	Train Passby
6/20/18 00:51	6/20/18 00:52	1.3	Train Passby
6/20/18 00:54	6/20/18 00:56	2.0	Train Passby
6/20/18 01:14	6/20/18 01:18	4.3	Train Passby
6/20/18 01:30	6/20/18 01:32	1.8	Train Passby
6/20/18 01:35	6/20/18 01:47	12.5	Rail Activity
6/20/18 02:09	6/20/18 02:11	1.5	Human Activity
6/20/18 02:14	6/20/18 02:22	7.8	Train Passby
6/20/18 02:32	6/20/18 02:34	1.3	Train Passby
6/20/18 02:35	6/20/18 02:36	1.8	Train Passby
6/20/18 02:50	6/20/18 02:51	0.5	Train Passby
6/20/18 03:03	6/20/18 03:04	0.8	Train Passby
6/20/18 03:05	6/20/18 03:06	1.5	Train Passby
6/20/18 03:07	6/20/18 03:09	2.0	Train Passby
6/20/18 03:52	6/20/18 03:54	1.3	Loud Vehicle Passby
6/20/18 03:54	6/20/18 03:55	1.3	Train Passby
6/20/18 04:07	6/20/18 04:08	1.0	Train Passby
6/20/18 04:25	6/20/18 04:27	2.0	Train Passby
6/20/18 04:31	6/20/18 04:32	1.5	Train Passby
6/20/18 04:53	6/20/18 04:54	0.5	Loud Vehicle Passby
6/20/18 05:02	6/20/18 05:05	2.3	Excessive Bird Noise
6/20/18 05:05	6/20/18 05:09	4.0	Excessive Bird Noise
6/20/18 05:10	6/20/18 05:16	6.3	Train Passby
6/20/18 05:23	6/20/18 05:24	0.8	Loud Vehicle Passby
6/20/18 05:34	6/20/18 05:36	2.0	Loud Vehicle Passby
6/20/18 05:36	6/20/18 05:40	3.3	Loud Vehicle Passby

Data Removal Noise Monitoring Location #3 Cont.

Start Time	End Time	Duration (min)	Reason
6/20/18 05:40	6/20/18 05:42	1.5	Train Passby
6/20/18 05:44	6/20/18 05:46	2.0	Train Passby
6/20/18 05:51	6/20/18 05:53	2.0	Train Passby
6/20/18 05:55	6/20/18 06:00	5.0	Train Passby
6/20/18 06:01	6/20/18 06:05	3.8	Train Passby
6/20/18 06:11	6/20/18 06:12	1.0	Loud Vehicle Passby
6/20/18 06:16	6/20/18 06:29	13.0	Loud Vehicle Passby
6/20/18 06:31	6/20/18 06:32	0.8	Loud Vehicle Passby
6/20/18 06:36	6/20/18 06:41	5.0	Loud Vehicle Passby
6/20/18 06:42	6/20/18 06:43	1.3	Loud Vehicle Passby
6/20/18 06:44	6/20/18 06:44	0.8	Loud Vehicle Passby
6/20/18 06:45	6/20/18 06:47	2.0	Train Passby
6/20/18 06:49	6/20/18 06:49	0.8	Loud Vehicle Passby
6/20/18 06:50	6/20/18 06:52	2.0	Train Passby
6/20/18 06:52	6/20/18 06:55	2.3	Train Passby
	Total Night #1	**159**	
	Total Night #2	**129**	
	Total Data	**287**	

Data Removal Noise Monitoring Location #4

Start Time	End Time	Duration (min)	Reason
7/24/18 22:40	7/24/18 22:41	1.0	Loud Vehicle Passby
7/24/18 22:46	7/24/18 22:48	1.5	Loud Vehicle Passby
7/24/18 23:31	7/24/18 23:33	1.3	Loud Vehicle Passby
7/24/18 23:39	7/24/18 23:40	0.8	Loud Vehicle Passby
7/25/18 00:03	7/25/18 00:04	0.8	Loud Vehicle Passby
7/25/18 00:18	7/25/18 00:19	1.3	Loud Vehicle Passby
7/25/18 02:54	7/25/18 02:55	1.3	Train Passby
7/25/18 03:04	7/25/18 03:05	0.8	Train Passby
7/25/18 03:06	7/25/18 03:07	1.8	Train Passby
7/25/18 03:21	7/25/18 03:25	3.5	Human Activity
7/25/18 03:25	7/25/18 03:27	1.5	Human Activity
7/25/18 04:30	7/25/18 04:32	2.5	Train Passby
7/25/18 05:03	7/25/18 05:05	1.3	Loud Vehicle Passby
7/25/18 05:13	7/25/18 05:14	1.5	Train Passby
7/25/18 05:15	7/25/18 05:17	2.3	Train Passby
7/25/18 05:49	7/25/18 05:54	4.8	Train Passby
7/25/18 05:57	7/25/18 05:58	1.3	Train Passby
7/25/18 06:00	7/25/18 06:02	1.5	Train Passby
7/25/18 06:05	7/25/18 06:05	0.8	Train Passby
7/25/18 06:10	7/25/18 06:15	5.3	Train Passby
7/25/18 06:19	7/25/18 06:22	3.5	Train Passby
7/25/18 06:23	7/25/18 06:26	2.5	Excessive Bird Noise
7/25/18 06:26	7/25/18 06:28	1.8	Train Passby
7/25/18 06:35	7/25/18 06:37	1.5	Train Passby
7/25/18 06:47	7/25/18 06:48	0.8	Train Passby
7/25/18 22:19	7/25/18 22:21	1.8	Train Passby
7/25/18 22:22	7/25/18 22:23	0.8	Train Passby
7/25/18 22:24	7/25/18 22:25	1.5	Train Passby
7/25/18 22:32	7/25/18 22:32	0.5	Train Passby
7/25/18 22:53	7/25/18 22:53	0.5	Train Passby
7/25/18 22:57	7/25/18 23:01	3.8	Train Passby
7/25/18 23:02	7/25/18 23:03	1.0	Train Passby
7/25/18 23:44	7/25/18 23:45	1.5	Human Activity
7/25/18 23:47	7/25/18 23:49	1.8	Human Activity
7/26/18 00:14	7/26/18 00:15	1.5	Train Passby
7/26/18 01:06	7/26/18 01:07	1.3	Loud Vehicle Passby
7/26/18 01:11	7/26/18 01:15	3.8	Train Passby
7/26/18 01:18	7/26/18 01:19	1.5	Loud Vehicle Passby
7/26/18 01:21	7/26/18 01:22	0.8	Train Passby
7/26/18 01:23	7/26/18 01:25	2.5	Train Passby

Data Removal Noise Monitoring Location #4 Cont.

Start Time	End Time	Duration (min)	Reason
7/26/18 01:37	7/26/18 01:38	0.5	Train Passby
7/26/18 01:59	7/26/18 02:00	0.8	Train Passby
7/26/18 02:00	7/26/18 02:01	0.8	Train Passby
7/26/18 02:23	7/26/18 02:26	2.5	Train Passby
7/26/18 02:26	7/26/18 02:28	2.0	Train Passby
7/26/18 02:31	7/26/18 02:33	1.8	Train Passby
7/26/18 02:37	7/26/18 02:39	2.3	Train Passby
7/26/18 03:35	7/26/18 03:37	1.5	Train Passby
7/26/18 04:00	7/26/18 04:03	3.3	Train Passby
7/26/18 04:21	7/26/18 04:22	1.0	Train Passby
7/26/18 04:37	7/26/18 04:45	7.5	Train Passby
7/26/18 04:57	7/26/18 04:58	1.0	Train Passby
7/26/18 05:12	7/26/18 05:14	1.5	Train Passby
7/26/18 05:25	7/26/18 05:26	1.8	Train Passby
7/26/18 05:29	7/26/18 05:31	2.3	Train Passby
7/26/18 05:56	7/26/18 05:58	1.8	Excessive Bird Noise
7/26/18 06:13	7/26/18 06:14	1.0	Train Passby
7/26/18 06:26	7/26/18 06:27	1.3	Loud Vehicle Passby
7/26/18 06:42	7/26/18 06:43	1.0	Loud Vehicle Passby
7/26/18 06:49	7/26/18 06:50	1.0	Loud Vehicle Passby
7/26/18 06:51	7/26/18 06:52	0.8	Loud Vehicle Passby
	Total Night #1	**46**	
	Total Night #2	**61**	
	Total Data	**108**	

Data Removal Noise Monitoring Location #5

Start Time	End Time	Duration (min)	Reason
6/18/18 22:28	6/18/18 22:28	0.8	Loud Vehicle Passby
6/19/18 03:32	6/19/18 03:33	0.8	Human Activity
6/19/18 03:35	6/19/18 03:37	1.3	Human Activity
6/19/18 04:02	6/19/18 04:05	2.8	Excessive Bird Noise
6/19/18 04:16	6/19/18 04:20	4.3	Excessive Bird Noise
6/19/18 04:28	6/19/18 04:30	1.8	Excessive Bird Noise
6/19/18 05:09	6/19/18 05:10	1.0	Loud Vehicle Passby
6/19/18 05:34	6/19/18 05:35	1.8	Loud Vehicle Passby
6/19/18 05:38	6/19/18 05:41	3.3	Loud Vehicle Passby
6/19/18 06:14	6/19/18 06:15	1.0	Excessive Bird Noise
6/19/18 06:23	6/19/18 06:24	0.8	Loud Vehicle Passby
6/19/18 06:39	6/19/18 06:40	1.8	Loud Vehicle Passby
6/19/18 06:41	6/19/18 06:43	1.8	Loud Vehicle Passby
6/19/18 23:33	6/19/18 23:35	1.5	Human Activity
6/19/18 23:37	6/19/18 23:38	0.8	Human Activity
6/19/18 23:48	6/19/18 23:49	0.8	Loud Vehicle Passby
6/20/18 02:52	6/20/18 02:52	0.3	Train Passby
6/20/18 02:54	6/20/18 02:55	1.0	Train Passby
6/20/18 02:59	6/20/18 03:00	1.0	Loud Vehicle Passby
6/20/18 03:22	6/20/18 03:23	0.8	Train Passby
6/20/18 03:57	6/20/18 04:00	3.0	Excessive Bird Noise
6/20/18 04:03	6/20/18 04:06	3.0	Excessive Bird Noise
6/20/18 04:18	6/20/18 04:20	2.3	Excessive Bird Noise
6/20/18 05:36	6/20/18 05:37	1.0	Loud Vehicle Passby
6/20/18 05:40	6/20/18 05:41	0.8	Loud Vehicle Passby
6/20/18 06:07	6/20/18 06:10	2.8	Loud Vehicle Passby
6/20/18 06:13	6/20/18 06:15	1.3	Loud Vehicle Passby
6/20/18 06:29	6/20/18 06:30	1.0	Loud Vehicle Passby
6/20/18 06:35	6/20/18 06:36	1.3	Loud Vehicle Passby
6/20/18 06:44	6/20/18 06:45	1.3	Loud Vehicle Passby
6/20/18 06:46	6/20/18 06:46	0.8	Excessive Bird Noise
6/20/18 06:46	6/20/18 06:48	1.8	Train Passby
6/20/18 06:52	6/20/18 06:54	1.3	Train Passby
	Total Night #1	**23**	
	Total Night #2	**29**	
	Total Data	**52**	

Data Removal Noise Monitoring Location #6

Start Time	End Time	Duration (min)	Reason
6/18/18 22:21	6/18/18 22:22	1.3	Loud Vehicle Passby
6/18/18 22:23	6/18/18 22:25	2.1	Excessive Bird Noise
6/18/18 23:09	6/18/18 23:10	0.8	Train Passby
6/18/18 23:13	6/18/18 23:14	1.1	Train Passby
6/18/18 23:22	6/18/18 23:32	9.6	Train Passby
6/18/18 23:41	6/18/18 23:43	2.3	Train Passby
6/19/18 00:03	6/19/18 00:04	1.3	Train Passby
6/19/18 00:12	6/19/18 00:12	0.8	Train Passby
6/19/18 00:14	6/19/18 00:16	1.3	Loud Vehicle Passby
6/19/18 00:22	6/19/18 00:23	1.1	Train Passby
6/19/18 01:54	6/19/18 01:55	1.1	Train Passby
6/19/18 02:58	6/19/18 02:59	1.6	Excessive Bird Noise
6/19/18 03:40	6/19/18 03:42	2.3	Human Activity
6/19/18 03:44	6/19/18 03:46	2.1	Human Activity
6/19/18 04:36	6/19/18 04:36	0.8	Excessive Bird Noise
6/19/18 06:09	6/19/18 06:09	0.8	Loud Vehicle Passby
6/19/18 06:28	6/19/18 06:29	0.8	Loud Vehicle Passby
6/19/18 06:34	6/19/18 06:35	1.1	Loud Vehicle Passby
6/19/18 06:41	6/19/18 06:44	3.3	Excessive Bird Noise
6/19/18 06:44	6/19/18 06:45	0.8	Loud Vehicle Passby
6/19/18 06:50	6/19/18 06:51	0.8	Loud Vehicle Passby
6/19/18 22:42	6/19/18 22:46	4.1	Loud Vehicle Passby
6/19/18 23:41	6/19/18 23:43	2.3	Loud Vehicle Passby
6/19/18 23:47	6/19/18 23:47	0.3	Human Activity
6/19/18 23:47	6/19/18 23:48	0.6	Loud Vehicle Passby
6/20/18 04:48	6/20/18 04:49	0.8	Train Passby
6/20/18 04:52	6/20/18 04:53	1.1	Train Passby
6/20/18 04:56	6/20/18 04:57	1.8	Loud Vehicle Passby
6/20/18 04:58	6/20/18 04:59	0.8	Train Passby
6/20/18 05:04	6/20/18 05:05	1.3	Train Passby
6/20/18 06:09	6/20/18 06:10	0.8	Loud Vehicle Passby
6/20/18 06:12	6/20/18 06:13	0.6	Excessive Bird Noise
6/20/18 06:25	6/20/18 06:26	0.6	Loud Vehicle Passby
6/20/18 06:30	6/20/18 06:31	0.6	Loud Vehicle Passby
6/20/18 06:35	6/20/18 06:36	0.8	Loud Vehicle Passby
6/20/18 06:45	6/20/18 06:46	1.1	Loud Vehicle Passby
6/20/18 06:53	6/20/18 06:54	1.1	Loud Vehicle Passby
6/20/18 06:58	6/20/18 06:59	0.8	Loud Vehicle Passby

Data Removal Noise Monitoring Location #6 cont.

Start Time	End Time	Duration (min)	Reason
	Total Night #1	37	
	Total Night #2	19	
	Total Data	57	

Data Removal Noise Monitoring Location #8

Start Time	End Time	Duration (min)	Reason
7/24/18 22:40	7/24/18 22:41	1.3	Loud Vehicle Passby
7/24/18 22:43	7/24/18 22:46	2.8	Loud Vehicle Passby
7/24/18 23:22	7/24/18 23:23	1.0	Loud Vehicle Passby
7/24/18 23:27	7/24/18 23:28	0.8	Loud Vehicle Passby
7/25/18 00:52	7/25/18 00:53	0.8	Loud Vehicle Passby
7/25/18 00:55	7/25/18 00:56	0.8	Loud Vehicle Passby
7/25/18 01:35	7/25/18 01:35	0.8	Loud Vehicle Passby
7/25/18 01:52	7/25/18 01:58	5.5	Train Passby
7/25/18 05:02	7/25/18 05:03	0.8	Loud Vehicle Passby
7/25/18 05:38	7/25/18 05:39	0.5	Loud Vehicle Passby
7/25/18 05:41	7/25/18 05:41	0.5	Loud Vehicle Passby
7/25/18 06:51	7/25/18 06:52	1.5	Loud Vehicle Passby
7/25/18 23:00	7/25/18 23:01	0.8	Loud Vehicle Passby
7/25/18 23:02	7/25/18 23:03	0.8	Loud Vehicle Passby
7/25/18 23:08	7/25/18 23:09	1.0	Train Passby
7/26/18 00:00	7/26/18 00:01	1.0	Train Passby
7/26/18 01:05	7/26/18 01:05	0.5	Loud Vehicle Passby
7/26/18 01:07	7/26/18 01:08	0.8	Loud Vehicle Passby
7/26/18 03:48	7/26/18 03:49	1.5	Train Passby
7/26/18 04:05	7/26/18 04:06	0.8	Train Passby
7/26/18 05:56	7/26/18 05:57	0.8	Train Passby
7/26/18 06:19	7/26/18 06:24	4.8	Excessive Bird Noise
	Total Night #1	**17**	
	Total Night #2	**13**	
	Total Data	**29**	

Data Removal Noise Monitoring Location #9

Start Time	End Time	Duration (min)	Reason
6/18/18 22:00	6/18/18 22:01	1.3	Loud Vehicle Passby
6/18/18 22:05	6/18/18 22:06	1.5	Loud Vehicle Passby
6/18/18 22:11	6/18/18 22:13	1.5	Loud Vehicle Passby
6/18/18 22:25	6/18/18 22:26	1.8	Loud Vehicle Passby
6/18/18 22:34	6/18/18 22:35	1.5	Train Passby
6/18/18 22:44	6/18/18 22:44	0.8	Train Passby
6/18/18 22:48	6/18/18 22:49	1.0	Loud Vehicle Passby
6/18/18 22:52	6/18/18 22:53	1.0	Train Passby
6/18/18 23:07	6/18/18 23:08	1.5	Train Passby
6/19/18 00:02	6/19/18 00:04	1.8	Train Passby
6/19/18 00:26	6/19/18 00:28	1.8	Train Passby
6/19/18 01:23	6/19/18 01:24	0.3	Loud Vehicle Passby
6/19/18 01:39	6/19/18 01:41	1.3	Train Passby
6/19/18 01:42	6/19/18 01:44	2.5	Train Passby
6/19/18 01:47	6/19/18 01:48	1.0	Train Passby
6/19/18 01:49	6/19/18 01:53	3.8	Train Passby
6/19/18 02:07	6/19/18 02:08	0.5	Train Passby
6/19/18 02:18	6/19/18 02:19	1.0	Train Passby
6/19/18 02:24	6/19/18 02:25	1.8	Train Passby
6/19/18 02:30	6/19/18 02:30	0.5	Train Passby
6/19/18 02:39	6/19/18 02:41	1.3	Train Passby
6/19/18 02:48	6/19/18 02:49	1.5	Train Passby
6/19/18 02:52	6/19/18 02:53	1.0	Train Passby
6/19/18 02:55	6/19/18 02:56	0.8	Loud Vehicle Passby
6/19/18 03:00	6/19/18 03:01	1.0	Loud Vehicle Passby
6/19/18 03:34	6/19/18 03:35	1.3	Train Passby
6/19/18 03:41	6/19/18 03:42	0.8	Train Passby
6/19/18 03:48	6/19/18 03:52	4.5	Train Passby
6/19/18 03:57	6/19/18 03:59	1.8	Excessive Bird Noise
6/19/18 03:59	6/19/18 04:00	1.3	Excessive Bird Noise
6/19/18 04:01	6/19/18 04:02	1.0	Train Passby
6/19/18 04:05	6/19/18 04:06	1.5	Train Passby
6/19/18 04:16	6/19/18 04:18	2.3	Train Passby
6/19/18 04:21	6/19/18 04:23	1.5	Train Passby
6/19/18 04:59	6/19/18 05:00	1.3	Loud Vehicle Passby
6/19/18 05:02	6/19/18 05:05	3.0	Loud Vehicle Passby
6/19/18 05:22	6/19/18 05:23	0.8	Train Passby
6/19/18 05:23	6/19/18 05:32	8.8	Train Passby
6/19/18 05:34	6/19/18 05:35	1.0	Loud Vehicle Passby
6/19/18 06:10	6/19/18 06:11	1.0	Loud Vehicle Passby

Data Removal Noise Monitoring Location #9 Cont.

Start Time	End Time	Duration (min)	Reason
6/19/18 06:18	6/19/18 06:18	0.5	Train Passby
6/19/18 06:20	6/19/18 06:21	0.8	Loud Vehicle Passby
6/19/18 06:25	6/19/18 06:26	1.0	Loud Vehicle Passby
6/19/18 06:28	6/19/18 06:30	1.8	Loud Vehicle Passby
6/19/18 06:31	6/19/18 06:32	0.8	Loud Vehicle Passby
6/19/18 22:19	6/19/18 22:23	4.3	Train Passby
6/19/18 22:25	6/19/18 22:27	1.8	Train Passby
6/19/18 22:28	6/19/18 22:29	0.5	Loud Vehicle Passby
6/19/18 22:30	6/19/18 22:33	3.3	Loud Vehicle Passby
6/19/18 22:40	6/19/18 22:42	2.0	Loud Vehicle Passby
6/19/18 22:43	6/19/18 22:44	1.0	Loud Vehicle Passby
6/19/18 22:49	6/19/18 22:51	1.5	Human Activity
6/19/18 22:52	6/19/18 22:55	3.0	Human Activity
6/19/18 23:01	6/19/18 23:02	1.0	Loud Vehicle Passby
6/19/18 23:13	6/19/18 23:14	1.0	Loud Vehicle Passby
6/19/18 23:21	6/19/18 23:22	1.0	Loud Vehicle Passby
6/19/18 23:23	6/19/18 23:24	1.0	Loud Vehicle Passby
6/19/18 23:52	6/19/18 23:56	3.5	Train Passby
6/19/18 23:57	6/19/18 23:57	0.5	Train Passby
6/20/18 00:20	6/20/18 00:22	1.5	Loud Vehicle Passby
6/20/18 00:45	6/20/18 00:50	5.0	Train Passby
6/20/18 01:55	6/20/18 01:56	1.0	Loud Vehicle Passby
6/20/18 02:18	6/20/18 02:19	1.3	Loud Vehicle Passby
6/20/18 02:27	6/20/18 02:35	8.5	Train Passby
6/20/18 02:57	6/20/18 02:59	2.0	Loud Vehicle Passby
6/20/18 03:01	6/20/18 03:08	6.8	Train Passby
6/20/18 03:25	6/20/18 03:26	0.8	Train Passby
6/20/18 03:33	6/20/18 03:34	0.8	Train Passby
6/20/18 03:37	6/20/18 03:39	1.3	Train Passby
6/20/18 03:49	6/20/18 03:51	2.0	Train Passby
6/20/18 03:53	6/20/18 03:55	2.5	Train Passby
6/20/18 04:07	6/20/18 04:08	0.8	Train Passby
6/20/18 04:31	6/20/18 04:32	1.0	Train Passby
6/20/18 04:36	6/20/18 04:37	1.0	Train Passby
6/20/18 04:40	6/20/18 04:41	1.0	Train Passby
6/20/18 05:27	6/20/18 05:28	1.0	Loud Vehicle Passby
6/20/18 05:34	6/20/18 05:35	1.3	Train Passby
6/20/18 05:36	6/20/18 05:38	2.5	Train Passby
6/20/18 06:04	6/20/18 06:07	2.3	Loud Vehicle Passby
6/20/18 06:14	6/20/18 06:16	1.8	Train Passby

Data Removal Noise Monitoring Location #9 Cont.

Start Time	End Time	Duration (min)	Reason
6/20/18 06:17	6/20/18 06:18	1.3	Train Passby
6/20/18 06:20	6/20/18 06:20	0.8	Loud Vehicle Passby
6/20/18 06:28	6/20/18 06:29	1.0	Loud Vehicle Passby
6/20/18 06:31	6/20/18 06:33	1.8	Loud Vehicle Passby
6/20/18 06:43	6/20/18 06:44	1.0	Loud Vehicle Passby
	Total Night #1	**70**	
	Total Night #2	**77**	
	Total Data	**146**	

Data Removal Noise Monitoring Location #10

Start Time	End Time	Duration (min)	Reason
6/18/18 21:59	6/18/18 22:01	2.3	Loud Vehicle Passby
6/18/18 22:03	6/18/18 22:05	2.0	Loud Vehicle Passby
6/18/18 22:07	6/18/18 22:08	0.8	Loud Vehicle Passby
6/18/18 22:11	6/18/18 22:11	0.5	Loud Vehicle Passby
6/18/18 22:13	6/18/18 22:15	1.8	Loud Vehicle Passby
6/18/18 22:23	6/18/18 22:24	1.0	Loud Vehicle Passby
6/18/18 22:26	6/18/18 22:28	1.3	Loud Vehicle Passby
6/18/18 22:55	6/18/18 22:56	1.0	Loud Vehicle Passby
6/18/18 22:57	6/18/18 22:58	0.8	Loud Vehicle Passby
6/18/18 23:00	6/18/18 23:01	1.5	Loud Vehicle Passby
6/18/18 23:05	6/18/18 23:05	0.3	Loud Vehicle Passby
6/18/18 23:07	6/18/18 23:08	1.0	Loud Vehicle Passby
6/18/18 23:27	6/18/18 23:28	0.8	Loud Vehicle Passby
6/18/18 23:30	6/18/18 23:32	2.3	Train Passby
6/18/18 23:36	6/18/18 23:36	0.8	Loud Vehicle Passby
6/18/18 23:37	6/18/18 23:37	0.8	Loud Vehicle Passby
6/18/18 23:59	6/19/18 00:00	1.0	Loud Vehicle Passby
6/19/18 00:01	6/19/18 00:03	2.3	Loud Vehicle Passby
6/19/18 00:08	6/19/18 00:09	0.8	Loud Vehicle Passby
6/19/18 00:11	6/19/18 00:13	1.8	Loud Vehicle Passby
6/19/18 00:25	6/19/18 00:26	1.0	Loud Vehicle Passby
6/19/18 01:08	6/19/18 01:09	1.0	Loud Vehicle Passby
6/19/18 01:12	6/19/18 01:12	0.8	Loud Vehicle Passby
6/19/18 01:25	6/19/18 01:26	1.0	Loud Vehicle Passby
6/19/18 01:39	6/19/18 01:40	0.8	Train Passby
6/19/18 01:42	6/19/18 01:44	1.5	Train Passby
6/19/18 01:47	6/19/18 01:48	1.0	Train Passby
6/19/18 01:52	6/19/18 01:53	1.0	Loud Vehicle Passby
6/19/18 01:55	6/19/18 01:56	1.5	Train Passby
6/19/18 02:00	6/19/18 02:03	2.3	Loud Vehicle Passby
6/19/18 02:25	6/19/18 02:26	1.0	Loud Vehicle Passby
6/19/18 02:39	6/19/18 02:41	1.5	Train Passby
6/19/18 02:52	6/19/18 02:54	1.5	Train Passby
6/19/18 02:59	6/19/18 03:00	1.3	Loud Vehicle Passby
6/19/18 03:27	6/19/18 03:28	1.3	Loud Vehicle Passby
6/19/18 03:49	6/19/18 03:50	1.0	Loud Vehicle Passby
6/19/18 04:03	6/19/18 04:04	1.0	Loud Vehicle Passby
6/19/18 04:09	6/19/18 04:10	0.8	Human Activity
6/19/18 04:12	6/19/18 04:13	0.8	Human Activity
6/19/18 04:16	6/19/18 04:19	3.8	Loud Vehicle Passby

Data Removal Noise Monitoring Location #10 Cont.

Start Time	End Time	Duration (min)	Reason
6/19/18 04:21	6/19/18 04:22	0.8	Loud Vehicle Passby
6/19/18 04:30	6/19/18 04:31	0.8	Loud Vehicle Passby
6/19/18 04:47	6/19/18 04:47	0.8	Loud Vehicle Passby
6/19/18 04:50	6/19/18 04:53	2.3	Loud Vehicle Passby
6/19/18 04:55	6/19/18 04:58	3.0	Loud Vehicle Passby
6/19/18 04:58	6/19/18 05:03	5.3	Loud Vehicle Passby
6/19/18 05:03	6/19/18 05:06	2.8	Loud Vehicle Passby
6/19/18 05:07	6/19/18 05:09	2.0	Loud Vehicle Passby
6/19/18 05:09	6/19/18 05:10	1.3	Loud Vehicle Passby
6/19/18 05:10	6/19/18 05:13	2.3	Loud Vehicle Passby
6/19/18 05:13	6/19/18 05:15	1.8	Loud Vehicle Passby
6/19/18 05:15	6/19/18 05:17	2.3	Loud Vehicle Passby
6/19/18 05:18	6/19/18 05:20	1.8	Loud Vehicle Passby
6/19/18 05:21	6/19/18 05:23	2.0	Loud Vehicle Passby
6/19/18 05:24	6/19/18 05:28	4.3	Loud Vehicle Passby
6/19/18 05:28	6/19/18 05:32	4.0	Loud Vehicle Passby
6/19/18 05:33	6/19/18 05:38	5.0	Loud Vehicle Passby
6/19/18 05:39	6/19/18 05:40	1.0	Loud Vehicle Passby
6/19/18 05:40	6/19/18 05:42	1.5	Loud Vehicle Passby
6/19/18 05:42	6/19/18 05:43	1.0	Loud Vehicle Passby
6/19/18 05:43	6/19/18 05:47	4.3	Loud Vehicle Passby
6/19/18 05:47	6/19/18 05:49	1.3	Loud Vehicle Passby
6/19/18 05:49	6/19/18 05:50	1.3	Loud Vehicle Passby
6/19/18 05:52	6/19/18 05:53	1.8	Loud Vehicle Passby
6/19/18 05:54	6/19/18 05:57	3.5	Loud Vehicle Passby
6/19/18 05:57	6/19/18 05:58	1.0	Loud Vehicle Passby
6/19/18 05:58	6/19/18 06:00	2.0	Loud Vehicle Passby
6/19/18 06:00	6/19/18 06:04	3.3	Loud Vehicle Passby
6/19/18 06:04	6/19/18 06:06	2.0	Loud Vehicle Passby
6/19/18 06:07	6/19/18 06:10	3.3	Loud Vehicle Passby
6/19/18 06:10	6/19/18 06:20	9.3	Loud Vehicle Passby
6/19/18 06:20	6/19/18 06:31	11.3	Loud Vehicle Passby
6/19/18 06:31	6/19/18 06:35	3.5	Loud Vehicle Passby
6/19/18 06:36	6/19/18 06:38	2.8	Loud Vehicle Passby
6/19/18 06:38	6/19/18 06:41	3.0	Loud Vehicle Passby
6/19/18 06:42	6/19/18 06:49	7.5	Loud Vehicle Passby
6/19/18 06:49	6/19/18 06:53	3.5	Loud Vehicle Passby
6/19/18 06:53	6/19/18 06:54	1.3	Loud Vehicle Passby
6/19/18 06:55	6/19/18 06:55	0.8	Loud Vehicle Passby
6/19/18 06:56	6/19/18 06:58	2.5	Loud Vehicle Passby

Data Removal Noise Monitoring Location #10 Cont.

Start Time	End Time	Duration (min)	Reason
6/19/18 06:59	6/19/18 07:00	1.8	Loud Vehicle Passby
6/19/18 22:01	6/19/18 22:02	1.0	Loud Vehicle Passby
6/19/18 22:13	6/19/18 22:16	2.8	Loud Vehicle Passby
6/19/18 22:25	6/19/18 22:26	1.5	Loud Vehicle Passby
6/19/18 22:27	6/19/18 22:33	5.8	Loud Vehicle Passby
6/19/18 22:38	6/19/18 22:38	0.8	Loud Vehicle Passby
6/19/18 22:41	6/19/18 22:43	1.8	Loud Vehicle Passby
6/19/18 22:45	6/19/18 22:46	1.3	Loud Vehicle Passby
6/19/18 22:50	6/19/18 22:53	2.8	Loud Vehicle Passby
6/19/18 23:05	6/19/18 23:06	1.5	Loud Vehicle Passby
6/19/18 23:08	6/19/18 23:09	0.8	Loud Vehicle Passby
6/19/18 23:10	6/19/18 23:11	1.3	Loud Vehicle Passby
6/19/18 23:11	6/19/18 23:13	1.3	Loud Vehicle Passby
6/19/18 23:15	6/19/18 23:16	1.3	Loud Vehicle Passby
6/19/18 23:18	6/19/18 23:19	0.5	Loud Vehicle Passby
6/19/18 23:22	6/19/18 23:25	3.3	Loud Vehicle Passby
6/19/18 23:29	6/19/18 23:30	1.3	Loud Vehicle Passby
6/19/18 23:43	6/19/18 23:44	0.8	Loud Vehicle Passby
6/19/18 23:51	6/19/18 23:52	1.0	Loud Vehicle Passby
6/19/18 23:56	6/19/18 23:57	1.0	Train Passby
6/19/18 23:58	6/19/18 23:59	0.8	Loud Vehicle Passby
6/20/18 00:01	6/20/18 00:01	0.5	Loud Vehicle Passby
6/20/18 00:02	6/20/18 00:05	2.8	Loud Vehicle Passby
6/20/18 00:19	6/20/18 00:20	1.0	Loud Vehicle Passby
6/20/18 00:29	6/20/18 00:31	1.5	Loud Vehicle Passby
6/20/18 00:36	6/20/18 00:37	1.5	Loud Vehicle Passby
6/20/18 00:42	6/20/18 00:43	1.0	Loud Vehicle Passby
6/20/18 00:45	6/20/18 00:47	1.8	Loud Vehicle Passby
6/20/18 00:54	6/20/18 00:54	0.5	Loud Vehicle Passby
6/20/18 00:56	6/20/18 00:57	1.0	Loud Vehicle Passby
6/20/18 01:05	6/20/18 01:06	1.0	Loud Vehicle Passby
6/20/18 01:30	6/20/18 01:31	0.8	Loud Vehicle Passby
6/20/18 01:59	6/20/18 02:00	0.8	Loud Vehicle Passby
6/20/18 02:28	6/20/18 02:30	1.3	Loud Vehicle Passby
6/20/18 02:30	6/20/18 02:31	1.0	Loud Vehicle Passby
6/20/18 02:50	6/20/18 02:53	2.8	Train Passby
6/20/18 02:57	6/20/18 02:58	1.0	Train Passby
6/20/18 02:58	6/20/18 02:59	0.3	Train Passby
6/20/18 03:00	6/20/18 03:02	1.3	Train Passby
6/20/18 03:18	6/20/18 03:19	1.0	Loud Vehicle Passby

Data Removal Noise Monitoring Location #10 Cont.

Start Time	End Time	Duration (min)	Reason
6/20/18 03:47	6/20/18 03:48	1.5	Loud Vehicle Passby
6/20/18 04:09	6/20/18 04:10	1.0	Loud Vehicle Passby
6/20/18 04:11	6/20/18 04:11	0.8	Loud Vehicle Passby
6/20/18 04:12	6/20/18 04:13	0.8	Loud Vehicle Passby
6/20/18 04:15	6/20/18 04:15	0.8	Loud Vehicle Passby
6/20/18 04:22	6/20/18 04:23	1.0	Loud Vehicle Passby
6/20/18 04:24	6/20/18 04:25	1.0	Loud Vehicle Passby
6/20/18 04:31	6/20/18 04:32	1.3	Loud Vehicle Passby
6/20/18 04:34	6/20/18 04:35	1.0	Loud Vehicle Passby
6/20/18 04:42	6/20/18 04:43	1.3	Loud Vehicle Passby
6/20/18 04:45	6/20/18 04:47	1.5	Loud Vehicle Passby
6/20/18 04:50	6/20/18 04:52	2.0	Train Passby
6/20/18 04:57	6/20/18 05:02	5.5	Loud Vehicle Passby
6/20/18 05:02	6/20/18 05:09	6.3	Loud Vehicle Passby
6/20/18 05:09	6/20/18 05:14	4.5	Loud Vehicle Passby
6/20/18 05:14	6/20/18 05:20	5.8	Loud Vehicle Passby
6/20/18 05:21	6/20/18 05:22	1.3	Loud Vehicle Passby
6/20/18 05:22	6/20/18 05:27	4.3	Loud Vehicle Passby
6/20/18 05:27	6/20/18 05:33	5.8	Loud Vehicle Passby
6/20/18 05:33	6/20/18 05:38	5.3	Loud Vehicle Passby
6/20/18 05:38	6/20/18 05:43	5.5	Loud Vehicle Passby
6/20/18 05:44	6/20/18 05:53	8.3	Loud Vehicle Passby
6/20/18 05:54	6/20/18 05:56	2.0	Loud Vehicle Passby
6/20/18 05:56	6/20/18 06:02	5.5	Loud Vehicle Passby
6/20/18 06:02	6/20/18 06:04	2.0	Loud Vehicle Passby
6/20/18 06:04	6/20/18 06:18	13.5	Loud Vehicle Passby
6/20/18 06:18	6/20/18 06:27	9.3	Loud Vehicle Passby
6/20/18 06:27	6/20/18 06:29	2.3	Loud Vehicle Passby
6/20/18 06:30	6/20/18 06:38	8.3	Loud Vehicle Passby
6/20/18 06:38	6/20/18 06:54	15.3	Loud Vehicle Passby
6/20/18 06:54	6/20/18 07:00	6.5	Loud Vehicle Passby
	Total Night #1	**166**	
	Total Night #2	**185**	
	Total Data	**351**	

Data Removal Noise Monitoring Location #11

Start Time	End Time	Duration (min)	Reason
7/24/18 22:06	7/24/18 22:06	0.5	Misc.
7/24/18 22:13	7/24/18 22:14	1.0	Horn
7/24/18 22:34	7/24/18 22:36	2.0	Train Passby
7/24/18 22:38	7/24/18 22:39	1.0	Loud Vehicle Passby
7/24/18 22:39	7/24/18 22:41	2.0	Loud Vehicle Passby
7/24/18 22:47	7/24/18 22:50	2.5	Loud Vehicle Passby
7/24/18 22:58	7/24/18 22:59	1.0	Train Passby
7/24/18 23:07	7/24/18 23:08	1.5	Train Passby
7/24/18 23:09	7/24/18 23:10	1.0	Train Passby
7/24/18 23:28	7/24/18 23:33	5.5	Train Passby
7/24/18 23:47	7/24/18 23:48	1.0	Train Passby
7/24/18 23:49	7/24/18 23:50	0.8	Loud Vehicle Passby
7/24/18 23:54	7/24/18 23:57	3.3	Train Passby
7/24/18 23:58	7/25/18 00:00	2.3	Train Passby
7/25/18 00:13	7/25/18 00:14	0.8	Misc Construction
7/25/18 00:15	7/25/18 00:19	4.5	Misc Construction
7/25/18 00:21	7/25/18 00:23	2.0	Misc Construction
7/25/18 00:23	7/25/18 00:28	4.5	Misc Construction
7/25/18 00:29	7/25/18 00:31	2.5	Misc Construction
7/25/18 00:33	7/25/18 00:34	1.0	Misc Construction
7/25/18 00:43	7/25/18 00:44	1.0	Train Passby
7/25/18 00:49	7/25/18 00:51	2.0	Loud Vehicle Passby
7/25/18 01:35	7/25/18 01:35	0.8	Train Passby
7/25/18 02:34	7/25/18 02:35	1.0	Loud Vehicle Passby
7/25/18 03:19	7/25/18 03:21	2.0	Train Passby
7/25/18 04:19	7/25/18 04:29	9.5	Train Passby
7/25/18 04:33	7/25/18 04:34	1.0	Loud Vehicle Passby
7/25/18 04:36	7/25/18 04:37	1.3	Loud Vehicle Passby
7/25/18 04:38	7/25/18 04:40	1.5	Loud Vehicle Passby
7/25/18 04:45	7/25/18 04:47	2.0	Loud Vehicle Passby
7/25/18 04:48	7/25/18 04:48	0.8	Train Passby
7/25/18 05:03	7/25/18 05:05	1.5	Loud Vehicle Passby
7/25/18 05:37	7/25/18 05:38	0.8	Excessive Bird Noise
7/25/18 05:41	7/25/18 05:43	2.0	Excessive Bird Noise
7/25/18 05:46	7/25/18 05:48	1.3	Train Passby
7/25/18 05:50	7/25/18 05:51	1.5	Excessive Bird Noise
7/25/18 05:52	7/25/18 05:53	1.0	Loud Vehicle Passby
7/25/18 05:58	7/25/18 06:00	1.3	Loud Vehicle Passby
7/25/18 06:07	7/25/18 06:12	5.0	Loud Vehicle Passby
7/25/18 06:12	7/25/18 06:14	2.0	Loud Vehicle Passby

Data Removal Noise Monitoring Location #11 Cont.

Start Time	End Time	Duration (min)	Reason
7/25/18 06:17	7/25/18 06:22	5.5	Loud Vehicle Passby
7/25/18 06:22	7/25/18 06:27	4.3	Loud Vehicle Passby
7/25/18 06:27	7/25/18 06:30	3.3	Loud Vehicle Passby
7/25/18 06:30	7/25/18 06:33	2.8	Loud Vehicle Passby
7/25/18 06:34	7/25/18 06:35	1.8	Loud Vehicle Passby
7/25/18 06:36	7/25/18 06:38	2.5	Loud Vehicle Passby
7/25/18 06:38	7/25/18 06:42	3.5	Loud Vehicle Passby
7/25/18 06:43	7/25/18 06:47	4.0	Loud Vehicle Passby
7/25/18 06:48	7/25/18 06:49	1.8	Loud Vehicle Passby
7/25/18 06:51	7/25/18 06:57	6.0	Loud Vehicle Passby
7/25/18 22:00	7/25/18 22:01	1.0	Train Passby
7/25/18 22:02	7/25/18 22:03	0.5	Train Passby
7/25/18 22:04	7/25/18 22:05	0.8	Train Passby
7/25/18 22:11	7/25/18 22:11	0.3	Train Passby
7/25/18 22:17	7/25/18 22:20	2.8	Misc Construction
7/25/18 22:42	7/25/18 22:43	0.8	Train Passby
7/25/18 22:49	7/25/18 22:49	0.8	Train Passby
7/25/18 22:55	7/25/18 22:55	0.3	Loud Vehicle Passby
7/25/18 23:06	7/25/18 23:07	1.3	Human Activity
7/25/18 23:08	7/25/18 23:09	1.3	Human Activity
7/25/18 23:26	7/25/18 23:27	1.5	Train Passby
7/25/18 23:41	7/25/18 23:42	1.0	Loud Vehicle Passby
7/26/18 00:06	7/26/18 00:08	1.3	Train Passby
7/26/18 00:10	7/26/18 00:11	1.3	Train Passby
7/26/18 00:22	7/26/18 00:23	1.3	Loud Vehicle Passby
7/26/18 00:37	7/26/18 00:38	1.0	Loud Vehicle Passby
7/26/18 00:39	7/26/18 00:40	1.3	Loud Vehicle Passby
7/26/18 00:52	7/26/18 01:07	15.3	Train Passby
7/26/18 01:09	7/26/18 01:15	6.8	Train Passby
7/26/18 01:16	7/26/18 01:20	3.3	Train Passby
7/26/18 01:27	7/26/18 01:28	1.0	Train Passby
7/26/18 01:30	7/26/18 01:33	2.5	Train Passby
7/26/18 01:40	7/26/18 01:41	1.0	Train Passby
7/26/18 01:43	7/26/18 01:44	1.0	Train Passby
7/26/18 01:48	7/26/18 01:48	0.5	Train Passby
7/26/18 02:11	7/26/18 02:12	1.0	Train Passby
7/26/18 02:17	7/26/18 02:18	1.0	Train Passby
7/26/18 02:23	7/26/18 02:24	0.8	Train Passby
7/26/18 02:25	7/26/18 02:26	1.0	Train Passby
7/26/18 02:36	7/26/18 02:39	3.3	Train Passby

Data Removal Noise Monitoring Location #11 Cont.

Start Time	End Time	Duration (min)	Reason
7/26/18 02:53	7/26/18 02:56	3.0	Train Passby
7/26/18 03:01	7/26/18 03:04	3.0	Train Passby
7/26/18 03:10	7/26/18 03:14	3.8	Train Passby
7/26/18 03:14	7/26/18 03:17	2.8	Train Passby
7/26/18 03:23	7/26/18 03:26	3.0	Train Passby
7/26/18 03:27	7/26/18 03:28	1.5	Train Passby
7/26/18 03:30	7/26/18 03:31	1.0	Train Passby
7/26/18 03:31	7/26/18 03:36	5.0	Train Passby
7/26/18 03:40	7/26/18 03:40	0.8	Train Passby
7/26/18 03:46	7/26/18 03:51	4.5	Train Passby
7/26/18 04:03	7/26/18 04:04	0.8	Loud Vehicle Passby
7/26/18 04:05	7/26/18 04:06	1.0	Train Passby
7/26/18 04:08	7/26/18 04:09	1.5	Train Passby
7/26/18 04:10	7/26/18 04:13	2.5	Train Passby
7/26/18 04:13	7/26/18 04:16	3.3	Train Passby
7/26/18 04:16	7/26/18 04:18	2.0	Train Passby
7/26/18 04:20	7/26/18 04:22	2.3	Train Passby
7/26/18 04:23	7/26/18 04:24	1.3	Train Passby
7/26/18 04:27	7/26/18 04:32	5.5	Train Passby
7/26/18 04:34	7/26/18 04:36	1.8	Train Passby
7/26/18 04:38	7/26/18 04:40	1.5	Train Passby
7/26/18 04:54	7/26/18 04:55	1.0	Train Passby
7/26/18 05:07	7/26/18 05:08	1.0	Train Passby
7/26/18 05:22	7/26/18 05:24	1.8	Train Passby
7/26/18 05:36	7/26/18 05:39	3.0	Loud Vehicle Passby
7/26/18 05:51	7/26/18 05:53	1.5	Loud Vehicle Passby
7/26/18 06:02	7/26/18 06:03	1.3	Loud Vehicle Passby
7/26/18 06:10	7/26/18 06:12	1.8	Loud Vehicle Passby
7/26/18 06:13	7/26/18 06:15	1.3	Loud Vehicle Passby
7/26/18 06:15	7/26/18 06:20	5.0	Loud Vehicle Passby
7/26/18 06:21	7/26/18 06:23	1.8	Loud Vehicle Passby
7/26/18 06:28	7/26/18 06:37	9.5	Loud Vehicle Passby
7/26/18 06:41	7/26/18 06:43	1.8	Loud Vehicle Passby
7/26/18 06:43	7/26/18 06:47	3.8	Loud Vehicle Passby
7/26/18 06:48	7/26/18 06:50	1.8	Loud Vehicle Passby
7/26/18 06:51	7/26/18 06:53	2.3	Loud Vehicle Passby
7/26/18 06:55	7/26/18 06:57	1.5	Loud Vehicle Passby
7/26/18 06:58	7/26/18 06:59	1.3	Loud Vehicle Passby

Data Removal Noise Monitoring Location #11 Cont.

Start Time	End Time	Duration (min)	Reason
	Total Night #1	115	
	Total Night #2	149	
	Total Data	264	

Data Removal Noise Monitoring Location #12 (Night 1)

Start Time	End Time	Duration (min)	Reason
6/18/18 22:11	6/18/18 22:14	2.8	Geese
6/18/18 22:20	6/18/18 22:22	1.8	Train Passby
6/18/18 22:22	6/18/18 22:32	10.0	Train Passby
6/18/18 22:44	6/18/18 22:47	2.3	Loud Vehicle Passby
6/18/18 22:48	6/18/18 22:49	1.3	Geese
6/18/18 22:49	6/18/18 22:58	9.0	Non Industrial
6/18/18 23:06	6/18/18 23:06	0.5	Crickets
6/18/18 23:24	6/18/18 23:34	9.8	Frogs/Crickets
6/18/18 23:45	6/18/18 23:52	7.3	Frogs/Crickets
6/18/18 23:52	6/18/18 23:55	3.3	Train Passby
6/19/18 00:00	6/19/18 00:02	1.3	Train Passby
6/19/18 00:13	6/19/18 00:16	2.3	Train Passby
6/19/18 00:20	6/19/18 00:21	0.8	Frogs/Crickets
6/19/18 00:27	6/19/18 00:29	1.3	Train Passby
6/19/18 00:32	6/19/18 00:39	7.8	Frogs/Crickets
6/19/18 01:13	6/19/18 01:13	0.8	Train Passby
6/19/18 01:14	6/19/18 01:17	3.0	Train Passby
6/19/18 01:24	6/19/18 01:27	2.5	Train Passby
6/19/18 01:28	6/19/18 01:30	2.5	Train Passby
6/19/18 01:33	6/19/18 01:34	1.0	Train Passby
6/19/18 01:49	6/19/18 02:06	16.5	Train Passby
6/19/18 02:10	6/19/18 02:17	6.5	Train Passby
6/19/18 02:20	6/19/18 02:24	3.5	Loud Vehicle Passby
6/19/18 02:26	6/19/18 02:29	3.0	Frogs/Crickets
6/19/18 03:04	6/19/18 03:13	8.8	Train Passby
6/19/18 03:35	6/19/18 03:39	4.3	Train Passby
6/19/18 03:52	6/19/18 03:54	2.0	Train Passby
6/19/18 03:56	6/19/18 04:00	3.8	Train Passby
6/19/18 04:11	6/19/18 04:12	1.5	Train Passby
6/19/18 04:12	6/19/18 04:58	45.3	Morning Rush/Chorus
6/19/18 04:58	6/19/18 05:15	16.8	Morning Rush/ Chorus
6/19/18 05:15	6/19/18 05:30	15.3	Morning Rush/ Chorus
6/19/18 05:31	6/19/18 05:48	17.0	Morning Rush/ Chorus
6/19/18 05:48	6/19/18 06:21	32.5	Morning Rush/ Chorus
6/19/18 06:21	6/19/18 06:36	15.0	Morning Rush/ Chorus
6/19/18 06:36	6/19/18 07:00	23.5	Morning Rush/ Chorus
6/19/18 22:00	6/19/18 22:01	0.8	Frogs/Crickets
6/19/18 22:07	6/19/18 22:13	6.5	Excessive Bird Noise
6/19/18 22:18	6/19/18 22:24	6.8	Train Passby
6/19/18 22:27	6/19/18 22:28	1.0	Loud Vehicle Passby

Data Removal Noise Monitoring Location #12 (Night 1) Cont.

Start Time	End Time	Duration (min)	Reason
6/19/18 22:35	6/19/18 22:37	1.8	Loud Vehicle Passby
6/19/18 22:49	6/19/18 22:52	2.8	Aircraft Flyover
6/19/18 22:58	6/19/18 23:00	2.0	Loud Vehicle Passby
6/19/18 23:05	6/19/18 23:07	1.8	Train Passby
6/19/18 23:12	6/19/18 23:17	4.8	Train Passby
6/19/18 23:29	6/19/18 23:35	6.3	Frogs/Crickets
6/19/18 23:46	6/19/18 23:48	1.3	Frogs/Crickets
6/19/18 23:55	6/19/18 23:56	1.0	Loud Vehicle Passby
6/19/18 23:58	6/20/18 00:01	3.3	Train Passby
6/20/18 00:50	6/20/18 00:52	1.5	Train Passby
6/20/18 00:53	6/20/18 00:54	1.3	Train Passby
6/20/18 00:54	6/20/18 01:05	10.8	Train Passby
6/20/18 01:16	6/20/18 01:18	2.3	Train Passby
6/20/18 01:25	6/20/18 01:30	5.5	Train Passby
6/20/18 01:48	6/20/18 01:49	1.3	Train Passby
6/20/18 02:09	6/20/18 02:23	14.3	Train Passby
6/20/18 02:31	6/20/18 02:34	2.8	Loud Vehicle Passby
6/20/18 02:51	6/20/18 03:02	11.8	Train Passby
6/20/18 03:05	6/20/18 03:09	4.0	Train Passby
6/20/18 03:11	6/20/18 03:25	14.0	Train Passby
6/20/18 03:25	6/20/18 03:26	1.8	Loud Vehicle Passby
6/20/18 03:38	6/20/18 03:41	2.8	Train Passby
6/20/18 03:50	6/20/18 03:56	5.5	Excessive Bird Noise
6/20/18 03:59	6/20/18 03:59	0.3	Train Passby
6/20/18 04:09	6/20/18 04:35	25.5	Morning Rush/ Chorus
6/20/18 04:36	6/20/18 04:43	6.3	Morning Rush/ Chorus
6/20/18 04:43	6/20/18 04:53	10.3	Morning Rush/ Chorus
6/20/18 04:54	6/20/18 05:11	17.3	Morning Rush/ Chorus
6/20/18 05:11	6/20/18 05:26	15.3	Morning Rush/ Chorus
6/20/18 05:26	6/20/18 05:38	11.8	Morning Rush/ Chorus
6/20/18 05:39	6/20/18 06:06	26.8	Morning Rush/ Chorus
6/20/18 06:06	6/20/18 06:07	1.5	Morning Rush/ Chorus
6/20/18 06:08	6/20/18 06:18	10.5	Train Passby
6/20/18 06:18	6/20/18 06:59	40.8	Morning Rush/ Chorus
	Total Night #1	**286**	
	Total Night #2	**171**	
	Total Data	**812**	

Data Removal Noise Monitoring Location #12 (Night 2)

Start Time	End Time	Duration (min)	Reason
7/24/18 22:00	7/24/18 22:03	3.3	Non Industrial
7/24/18 22:05	7/24/18 22:07	1.5	Excessive Bird Noise
7/24/18 22:08	7/24/18 22:10	2.3	Excessive Bird Noise
7/24/18 22:10	7/24/18 22:14	3.3	Excessive Bird Noise
7/24/18 22:14	7/24/18 22:16	2.5	Excessive Bird Noise
7/24/18 22:17	7/24/18 22:17	0.3	Excessive Bird Noise
7/24/18 22:17	7/24/18 22:18	1.5	Excessive Bird Noise
7/24/18 22:18	7/24/18 22:22	3.5	Loud Vehicle Passby
7/24/18 22:23	7/24/18 22:25	1.8	Loud Vehicle Passby
7/24/18 22:30	7/24/18 22:31	1.5	Loud Vehicle Passby
7/24/18 22:31	7/24/18 22:34	2.5	Loud Vehicle Passby
7/24/18 22:35	7/24/18 22:36	1.0	Loud Vehicle Passby
7/24/18 22:48	7/24/18 22:49	1.3	Train Passby
7/24/18 22:49	7/24/18 22:53	3.5	Loud Vehicle Passby
7/24/18 23:03	7/24/18 23:06	3.3	Aircraft Flyover
7/24/18 23:10	7/24/18 23:12	2.5	Loud Vehicle Passby
7/24/18 23:19	7/24/18 23:21	2.5	Non Industrial
7/24/18 23:23	7/24/18 23:24	1.0	Loud Vehicle Passby
7/24/18 23:24	7/24/18 23:28	4.3	Train Passby
7/24/18 23:31	7/24/18 23:32	1.3	Owl
7/24/18 23:37	7/24/18 23:39	1.5	Loud Vehicle Passby
7/24/18 23:41	7/24/18 23:42	1.5	Loud Vehicle Passby
7/24/18 23:45	7/24/18 23:47	1.8	Loud Vehicle Passby
7/24/18 23:50	7/24/18 23:53	2.3	Loud Vehicle Passby
7/25/18 00:05	7/25/18 00:09	4.3	Loud Vehicle Passby
7/25/18 00:11	7/25/18 00:15	4.0	Loud Vehicle Passby
7/25/18 00:25	7/25/18 00:28	2.5	Loud Vehicle Passby
7/25/18 00:32	7/25/18 00:37	4.5	Loud Vehicle Passby
7/25/18 00:37	7/25/18 00:39	2.0	Loud Vehicle Passby
7/25/18 00:39	7/25/18 00:42	2.8	Loud Vehicle Passby
7/25/18 00:42	7/25/18 00:46	3.3	Loud Vehicle Passby
7/25/18 00:46	7/25/18 00:49	2.5	Loud Vehicle Passby
7/25/18 00:50	7/25/18 00:52	2.5	Loud Vehicle Passby
7/25/18 00:53	7/25/18 00:57	4.0	Loud Vehicle Passby
7/25/18 01:02	7/25/18 01:06	4.3	Loud Vehicle Passby
7/25/18 01:14	7/25/18 01:25	10.3	Train Passby
7/25/18 01:37	7/25/18 01:38	0.5	Train Passby
7/25/18 01:41	7/25/18 01:44	3.3	Loud Vehicle Passby
7/25/18 01:45	7/25/18 01:48	2.8	Loud Vehicle Passby
7/25/18 01:49	7/25/18 01:51	1.8	Train Passby

Data Removal Noise Monitoring Location #12 (Night 2) Cont.

Start Time	End Time	Duration (min)	Reason
7/25/18 01:51	7/25/18 01:53	2.0	Aircraft Flyover
7/25/18 02:04	7/25/18 02:25	21.3	Train Passby
7/25/18 02:27	7/25/18 02:29	1.5	Train Passby
7/25/18 02:34	7/25/18 02:37	3.3	Loud Vehicle Passby
7/25/18 02:49	7/25/18 02:53	4.0	Loud Vehicle Passby
7/25/18 03:00	7/25/18 03:12	11.8	Human Activity
7/25/18 03:25	7/25/18 03:26	0.8	Coyotes
7/25/18 03:26	7/25/18 03:28	1.5	Coyotes
7/25/18 03:41	7/25/18 03:46	4.5	Train Passby
7/25/18 03:47	7/25/18 04:11	24.8	Train Passby
7/25/18 04:13	7/25/18 04:17	4.0	Rail Activity
7/25/18 04:18	7/25/18 04:20	1.3	Excessive Bird Noise
7/25/18 04:20	7/25/18 04:25	4.5	Excessive Bird Noise
7/25/18 04:25	7/25/18 04:27	2.0	Excessive Bird Noise
7/25/18 04:32	7/25/18 04:40	7.5	Crickets/Frogs
7/25/18 04:40	7/25/18 04:49	9.3	Crickets/Frogs
7/25/18 04:50	7/25/18 05:02	12.5	Morning Rush/ Chorus
7/25/18 05:03	7/25/18 05:14	11.0	Morning Rush/ Chorus
7/25/18 05:14	7/25/18 05:36	22.3	Morning Rush/ Chorus
7/25/18 05:37	7/25/18 05:51	14.3	Morning Rush/ Chorus
7/25/18 05:51	7/25/18 06:06	14.8	Morning Rush/ Chorus
7/25/18 06:07	7/25/18 06:32	24.8	Morning Rush/ Chorus
7/25/18 06:32	7/25/18 06:59	27.3	Morning Rush/ Chorus
7/25/18 21:59	7/25/18 22:01	2.3	Loud Vehicle Passby
7/25/18 22:02	7/25/18 22:02	0.5	Excessive Bird Noise
7/25/18 22:04	7/25/18 22:07	3.0	Loud Vehicle Passby
7/25/18 22:10	7/25/18 22:14	3.3	Train Passby
7/25/18 22:14	7/25/18 22:15	0.8	Train Passby
7/25/18 22:18	7/25/18 22:20	1.5	Loud Vehicle Passby
7/25/18 22:22	7/25/18 22:23	1.0	Train Passby
7/25/18 22:36	7/25/18 22:39	2.8	Loud Vehicle Passby
7/25/18 23:03	7/25/18 23:04	1.3	Loud Vehicle Passby
7/25/18 23:16	7/25/18 23:19	3.0	Loud Vehicle Passby
7/25/18 23:30	7/25/18 23:36	6.0	Loud Vehicle Passby
7/25/18 23:57	7/26/18 00:01	4.0	Human Activity
7/26/18 01:13	7/26/18 01:24	11.0	Train Passby
7/26/18 02:06	7/26/18 02:11	4.8	Train Passby
7/26/18 02:24	7/26/18 02:25	1.3	Train Passby
7/26/18 02:27	7/26/18 02:29	2.0	Loud Vehicle Passby
7/26/18 02:34	7/26/18 02:38	4.3	Loud Vehicle Passby

Data Removal Noise Monitoring Location #12 (Night 2) Cont.

Start Time	End Time	Duration (min)	Reason
7/26/18 02:49	7/26/18 02:53	3.3	Loud Vehicle Passby
7/26/18 02:59	7/26/18 03:03	3.5	Loud Vehicle Passby
7/26/18 03:42	7/26/18 03:44	2.0	Loud Vehicle Passby
7/26/18 03:45	7/26/18 03:47	1.8	Loud Vehicle Passby
7/26/18 04:11	7/26/18 04:12	1.0	Loud Vehicle Passby
7/26/18 04:22	7/26/18 04:22	0.8	Excessive Bird Noise
7/26/18 04:23	7/26/18 04:28	5.0	Crickets/Frogs
7/26/18 04:28	7/26/18 04:49	21.3	Train Passby
7/26/18 04:51	7/26/18 04:52	1.0	Crickets/Frogs
7/26/18 04:52	7/26/18 04:52	0.5	Loud Vehicle Passby
7/26/18 04:52	7/26/18 04:52	0.3	Loud Vehicle Passby
7/26/18 04:52	7/26/18 04:58	5.5	Loud Vehicle Passby
7/26/18 04:58	7/26/18 05:27	29.0	Morning Rush/ Chorus
7/26/18 05:27	7/26/18 05:45	18.3	Morning Rush/ Chorus
7/26/18 05:45	7/26/18 06:17	31.3	Morning Rush/ Chorus
7/26/18 06:17	7/26/18 07:00	43.0	Morning Rush/ Chorus
	Total Night #1	**337**	
	Total Night #2	**220**	
	Total Data	**557**	

Data Removal Noise Monitoring Location #13

Start Time	End Time	Duration (min)	Reason
7/24/18 22:00	7/24/18 22:02	1.8	Aircraft Flyover
7/24/18 22:27	7/24/18 22:35	8.5	Owl
7/24/18 23:01	7/24/18 23:06	4.8	Aircraft Flyover
7/24/18 23:22	7/24/18 23:24	2.0	Excessive Bird Noise
7/24/18 23:37	7/24/18 23:38	0.8	Dog Barking
7/25/18 01:50	7/25/18 01:52	2.3	Aircraft Flyover
7/25/18 02:21	7/25/18 02:23	1.8	Human Activity
7/25/18 02:27	7/25/18 02:29	1.8	Human Activity
7/25/18 02:36	7/25/18 02:37	0.8	Loud bang
7/25/18 03:02	7/25/18 03:03	1.0	Loud Bang
7/25/18 03:15	7/25/18 03:16	0.8	Loud Bang
7/25/18 03:23	7/25/18 03:24	1.0	Loud Bang
7/25/18 05:20	7/25/18 05:20	0.8	Train Passby
7/25/18 06:02	7/25/18 06:05	2.8	Loud Vehicle Passby
7/25/18 06:09	7/25/18 06:12	3.3	Loud Vehicle Passby
7/25/18 06:23	7/25/18 06:25	2.3	Loud Vehicle Passby
7/25/18 06:29	7/25/18 06:31	2.0	Loud Vehicle Passby
7/25/18 06:34	7/25/18 06:35	0.8	Loud Vehicle Passby
7/25/18 06:43	7/25/18 06:44	1.3	Loud Vehicle Passby
7/25/18 06:54	7/25/18 06:55	1.3	Loud Vehicle Passby
7/25/18 22:11	7/25/18 22:13	2.0	Loud Bang
7/25/18 23:28	7/25/18 23:29	1.0	Loud Bang
7/25/18 23:39	7/25/18 23:40	1.3	Loud Bang
7/26/18 00:09	7/26/18 00:10	0.8	Loud Bang
7/26/18 00:19	7/26/18 00:24	5.0	Human Activity
7/26/18 00:26	7/26/18 00:27	0.5	Loud Bang
7/26/18 00:31	7/26/18 00:32	0.5	Loud Bang
7/26/18 01:31	7/26/18 01:32	0.8	Loud Bang
7/26/18 01:43	7/26/18 01:44	0.5	Loud Bang
7/26/18 01:51	7/26/18 01:51	0.3	Loud Bang
7/26/18 01:54	7/26/18 01:55	1.0	Loud Bang
7/26/18 01:57	7/26/18 01:58	0.3	Loud Bang
7/26/18 02:24	7/26/18 02:25	1.3	Loud Bang
7/26/18 02:27	7/26/18 02:28	0.8	Loud Bang
7/26/18 03:14	7/26/18 03:14	0.5	Loud Bang
7/26/18 03:20	7/26/18 03:22	1.3	Loud Bang
7/26/18 04:07	7/26/18 04:08	1.0	Loud Bang
7/26/18 04:44	7/26/18 04:45	0.5	Loud Bang
7/26/18 05:08	7/26/18 05:10	1.3	Loud Bang

Data Removal Noise Monitoring Location #13 Cont.

Start Time	End Time	Duration (min)	Reason
7/26/18 05:14	7/26/18 05:15	0.8	Loud Bang
7/26/18 05:16	7/26/18 05:17	0.8	Loud Bang
7/26/18 05:37	7/26/18 05:38	1.0	Loud Bang
7/26/18 05:42	7/26/18 05:50	7.8	Machinery Noise
7/26/18 06:02	7/26/18 06:09	6.5	Machinery Noise
7/26/18 06:10	7/26/18 06:13	2.8	Loud Vehicle Passby
7/26/18 06:55	7/26/18 06:57	1.8	Loud Vehicle Passby
	Total Night #1	**46**	
	Total Night #2	**37**	
	Total Data	**83**	