



Nuisance Mechanical Plant Investigation

42 Carlos Street, Aberfoyle 2055

Final Report – 1040-01

NoiseNet Operations Pty Ltd	Customer Name:	City of Aberfoyle
ABN: 26 624 212 175	Report Number:	1040-01
noisenet.com.au	Issue Date:	17/03/21
P: 1800 266 479		

Customer Ref No.:	City of Aberfoyle	Monitoring Type:	Single Monitor
Property Type:	Residential House		
Property Address:	42 Carlos Street, Aberfoyle 2055		
Property Code:	2055_1040	Report Issue:	Final Report

Compiled By:	Jonathan South	Reviewed By	Stuart Clough
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1 OBJECTIVE

NoiseNet was commissioned by the City of Aberfoyle to investigate noise from multiple mechanical plant located at the neighbouring residential property, 40 Carlos Street, Aberfoyle 2055.

To facilitate the investigation, unattended noise monitoring was conducted, with the data analysed to ascertain;

- 1) Different types of mechanical plant noise measured by the noise monitor,
- 2) Potential physical mechanical plant associated with the measured noise,
- 3) Identifiable patterns in mechanical plant operating modes and times,
- 4) Impact of mechanical plant on noise sensitive receivers,

2 SITE CONTEXT AND NOISE MONITORING

2.1 SITE DESCRIPTION

The complainant property, (42 Carlos Street, Aberfoyle 2055) is located in a primarily residential area. The acoustic environment is typical of a residential area, with noise from general residential activities impacting the property. Particularly, noise associated with the operation of fixed mechanical plant at 40 Carlos street, including a reverse cycle air conditioner, inbuilt house vacuum and pool pump and filtration equipment located next door at 40 Carlos Street, Aberfoyle 2055, has been noted as a source of noise nuisance for the complainant. See Figure 1 for details.

To gather data and recordings of mechanical plant and other noises, a noise monitor was installed on the complainant property. For further details on monitoring and mechanical plant, refer to Figure 1 to Figure 4 and Sections 2.2.

2.2 UNATTENDED NOISE MONITORING

A NoiseNet noise monitor (S/N: 5000, Microphone: LZID, NATA Certification: CT-4096) was installed on the complainant property, used for noise classification and providing decibel levels.

The noise monitor was installed on a ladder at the alfresco deck on the west part of 42 Carlos Street, approximately 2 meters above ground level and 10 meters from the mechanical plant at 40 Carlos Street. A masonry wall divides the two properties, and obscures line of sight between the noise monitor and mechanical plant. Refer to Figure 1, Figure 2 and Figure 4 for further details. The monitoring position was chosen to allow clear measurement of the mechanical plant as it impacts external habitable areas of the complainant property, as well as the façade of internal lounge and living areas.

The noise monitor recorded noise between 3:00pm 5th February 2021 and 10:30am on 26th February 2021. Refer to Section A.1 for further information regarding NoiseNet noise monitoring equipment.



Figure 1 – Complainant property, surrounding residents and noise monitoring location.



Figure 2 - Noise monitor location, in situ.



Figure 3 – View of Mechanical Plant locations, from complainant property.

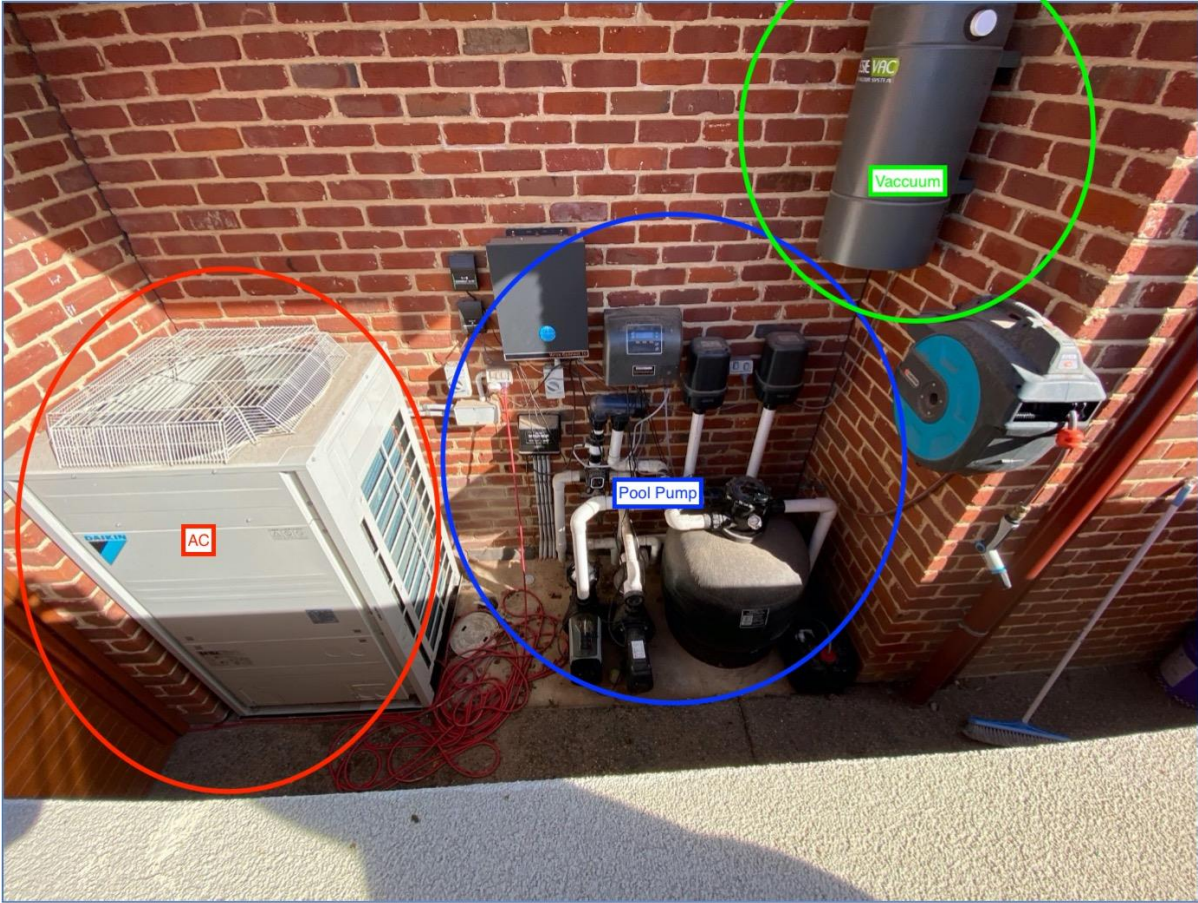


Figure 4 – View of Target Mechanical Plant at Location A, looking over the fence.

3 CRITERIA

General noise amenity in City of Aberfoyle is managed under Local Nuisance and Litter Control Act 2017, with Section 4 defining local noise nuisance from mechanical plant as follows:

- a) *Noise generated on premises, if an authorized officer forms the opinion*
 - i. *That-*
 - A. *In the case of fixed machine noise generated on domestic premises-the noise has travelled from the domestic premises to a habitable room, or an outdoor courtyard or entertainment area, on a neighboring premises*
 - ii. *That the level, nature or extent of the noise (including its volume, pitch, vibrational frequency, prevalence or frequency of occurrence) is such as to constitute an unreasonable interference with the enjoyment of the neighboring premises by persons occupying those premises.*

In addition, the Environmental Protection (noise) Policy 2007, Part 6, Division 2, Clause 25 applies, which describes criteria for fixed domestic machine noise as:

Situation	Noise Limit for mechanical plant dB(A)	
	Day (7:00am-10:00pm)	Night (10:00pm-7:00am)
If ambient noise level (at the time of operation) is ≤ 52dB(A) during the day or ≤ 45dB(A) during the night	52	45
If ambient noise level (at the time of operation) is > 52dB(A) during the day or > 45dB(A) during the night	ambient +0	ambient +0

Table 1 - EPP Noise Goals

The monitoring, and analysis undertaken for this report is not intended to be fully EPP compliant, and should not be used for enforcement under EPP legislation. Results should be taken as indicative in relation to EPP prescribed noise limits.

It is up to the discretion of the assessing officer and council to determine whether the mechanical plant detected in this report constitutes a nuisance under the applicable legislation.

4 ANALYSIS PROCEDURE

In order to analyse the large amount of data gathered by the noise monitor, both manual and automated analysis techniques were utilised, with the goal to be able to pinpoint times (to sufficient time accuracy) when different mechanical plant are in operation. The procedure is described in the following sections.

4.1 MANUAL REVIEW TO IDENTIFY MECHANICAL PLANT

Using a complainant provided noise diary, and on-location video of the various mechanical plant in operation, audio data was analysed to determine the operating characteristics of each noise source. This process revealed that each mechanical plant had a unique acoustic signature that may be used to identify when the plant is in operation.

The identified mechanical plant are described below, with audio samples provided for context. Further details are provided in Section 4.2.

Noise Source ID	Physical Source of Noise	General Description of Noise	Audio filename (Timestamp corresponds to start of file)	Description of Audio file
AC	Daikinn R410A Reverse cycle Airconditioning (AC) unit, located at Plant Location A.	Low frequency hum, with moving air wash. Intermittent higher frequency hiss of compressor activity.	AC_2021-02-09T22_27_49+1030.wav	The AC unit is heard in one operating mode from 0m:0s to 0m:4s. It then enters a second mode of operation until 1m:24s. Between 1m:24s and the end of the file, the AC enters a third mode of operation.
Pool Pump	Astral and Viron Pool Fibreglass media filter and associated pumps, located at Plant Location A.	Mechanical noise from a medium RPM motor, accompanied by softer wash of liquid.	Pool_Pump_2021-02-07T07_06_05+1030.wav	Birds and other ambient noise from the beginning of the file until 0m:14s. The Pool Pump turns on at 0m:14s and continues operation until the end of the file.
Vacuum	Aussie Vac central ducted vacuum system, location at Plant Location A.	Loud whine from a high ROM motor, in addition to wash from the movement of high velocity air.	Vacuum_2021-02-12T09_38_46+1030.wav	Birds and other ambient noise from the beginning of the file until 1m:05s. The Vacuum turns on at 1m:05s and continues operation until the end of the file.
AC (Location B)	Daikin RY1SOKUY1 Not able to be identified in this report.	Not able to be identified in this report.	Not able to be identified in this report.	Not able to be identified in this report.

4.2 CHARACTERISING PLANT NOISE

To characterise the mechanical plant noise for classification and identification purposes, the various datasets were collated to a timescale of 30 seconds, chosen to capture the continuous nature of mechanical plant operation (plant noise is not expected to vary significantly within 30 seconds), as well as retaining good time resolution (operation times will be accurate to within a 30 second window).

The spectral content for each 30 seconds of audio was extracted from client provided video, and key monitoring times, and a statistical L90 calculated in each frequency bin. This measure shows a number of strong tonal characteristics in the spectrum, which are uniquely associated with the operation of each mechanical plant.

The AC unit was observed to have a number of operating modes. Most operating modes showed three strong tonal features at approximately 75Hz, 110Hz and 150Hz (Operating Mode 1, Figure 5), which decreases in frequency by approximately 15 Hz in Operating Mode 2 (Figure 6). The observed AC spectrum is appropriate to have a +8dB penalty applied to the continuous source noise level, for tonal and low frequency characteristics, when compared to EPP criteria.

The Pool Pump was found to have primary tonal features at approximately 300Hz and 400Hz, shown in Figure 7. The observed Pool Pump spectrum is appropriate to have a +5dB penalty applied to the continuous source level, for a tonal characteristic, when compared to EPP criteria.

The Vacuum was observed with some tonal features at approximately 150Hz and 200Hz, shown in Figure 8.

Examining complainant noted times of operation AC unit at Location B, no uniquely identifiable acoustic signature was able to be extracted (either very similar signature to the AC unit at Location A, or not strong enough to stand out against it). As such, no specific identification of the AC unit at location B was able to be made during this period of monitoring (though it may have been operational).

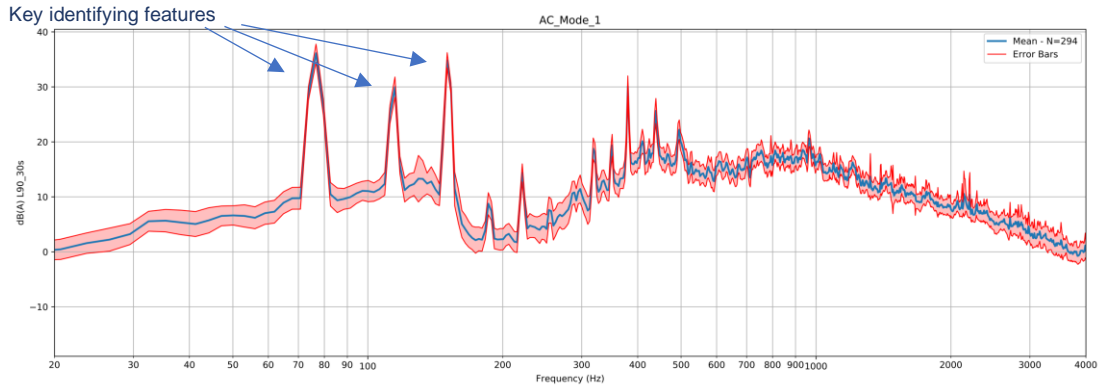


Figure 5 – Spectral Content of the AC unit – Operating Mode 1

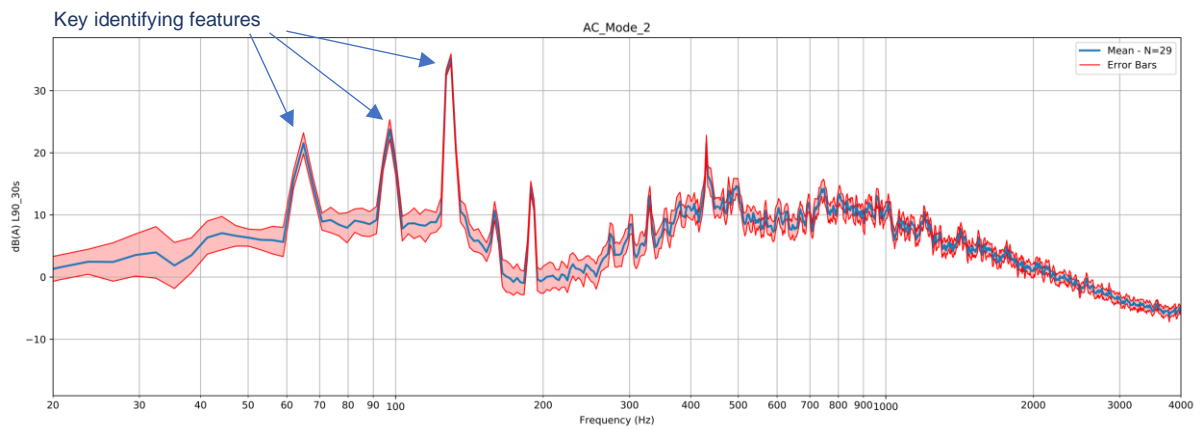


Figure 6 – Spectral Content of the AC unit – Operating Mode 2

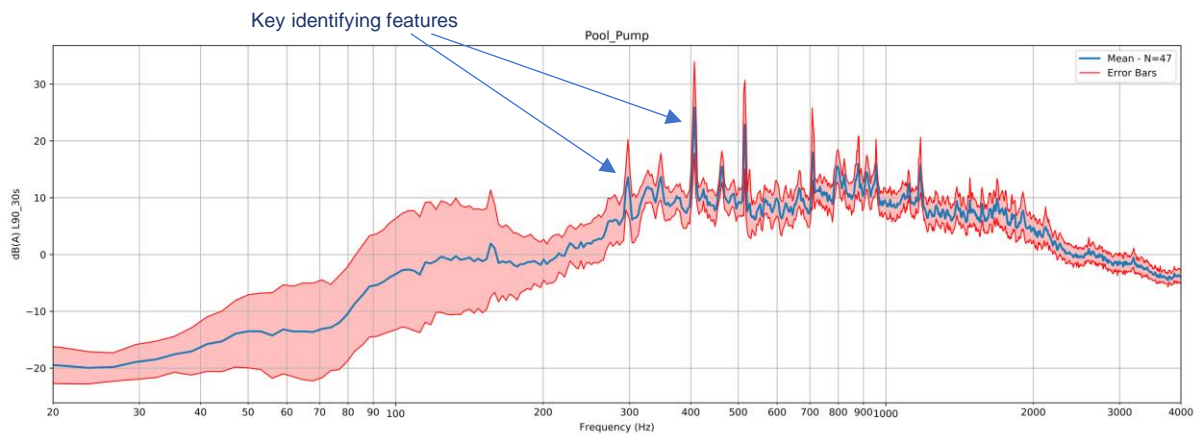


Figure 7 – Spectral Content of the Pool Pump

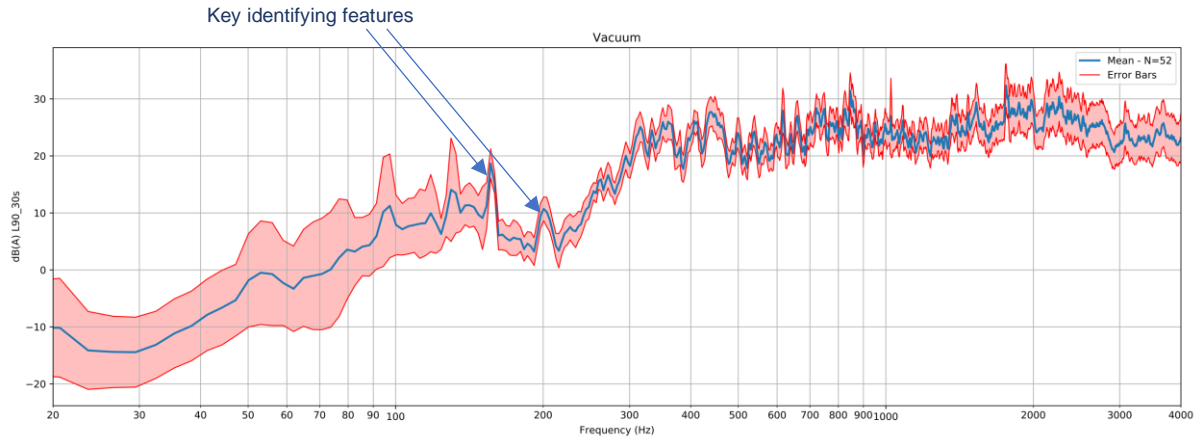


Figure 8 – Spectral Content of the Vacuum

4.3 AUTOMATED IDENTIFICATION OF PLANT OPERATION

The 30 second L90 spectrum was extracted from the monitored audio stream, generating a set of features which can be compared to the known signatures of each mechanical plant. If the identifying features of the mechanical plant are determined to be present to a reasonable level, and for a minimum of 5 consecutive minutes, we determine the plant as being operational. This method also allows for detection of simultaneous operation of mechanical plant.

The method will not trigger a detection if the mechanical plant noise is not present in the audio stream, not present at comparatively high intensity, or if it is being masked by other significant noises.

The output of this model can then be examined to determine accuracy, broad operation trends and further times for manual review.

4.4 ACCURACY

These methods can typically reliably distinguish and identify the operation of mechanical plant with sufficiently distinct acoustic signatures. However, the automation techniques used are not 100% accurate, and the possibility of false positive identification, or misidentification of mechanical plant exists, particularly in the presence of other obscuring noise.

For this report, the AC unit at Location B was deemed not able to be identified with sufficient certainty. It may have been operational during the monitoring period, and during times when other plant were identified. Further monitoring specifically targeting this mechanical plant may be warranted.

5 RESULTS

Based on the analysis methodology presented in Section 4 above, operating times of the AC unit, Pool Pump and Vacuum, all at Location A, were successfully extracted from the available data. Once the detections have been established, analysis of the full monitoring period is possible; establishing ambient noise levels in the absence of plant operation, continuous source noise levels, usage patterns etc.

5.1 AMBIENT NOISE LEVELS

Ambient noise levels in the absence of the source noises were found first by ignoring all time periods when any mechanical plant was detected to be in operation, then taking the average of all 15 minute Leq measurements during the relevant day or night period. Results are shown in Table 3, with the applicable EPP criteria shown in Table 4. As the monitoring location was found to be significantly impacted by the operation of the target mechanical plant (plant was detected for over 50% of the monitoring duration), the stated ambient noise levels may not be representative of typical residential locations in the locality.

Ambient Noise Levels dB(A)	
Day (7:00am-10:00pm)	Night (10:00pm-7:00am)
47	39

Table 3 – Ambient Noise Levels

Applicable EPP Criteria dB(A)	
Day (7:00am-10:00pm)	Night (10:00pm-7:00am)
52	45

Table 4 – Applicable EPP criteria

5.2 AC Unit

All detected operation of the AC unit over the monitoring period is presented in Appendix A.1.

Figure 9, Figure 10 and Figure 11 show selected examples of the AC unit, beginning, during and ceasing operation. The impact from the AC unit on the acoustic environment is clearly observable, with the ambient noise level rising or falling approximately 10-15dB when the unit begins or ceases operation. While in operation, the AC unit is typically the primary source of noise at the monitoring location, with noise levels showing very little deviation while active.

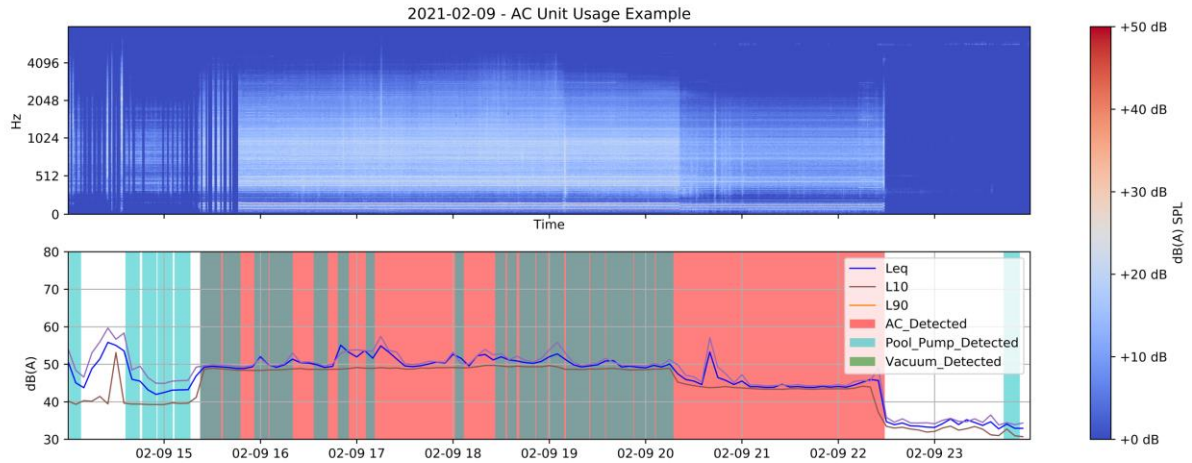


Figure 9 – Operation of AC Unit (and other detected plant), 2021-02-09T14:00 to 2021-02-19T00:00

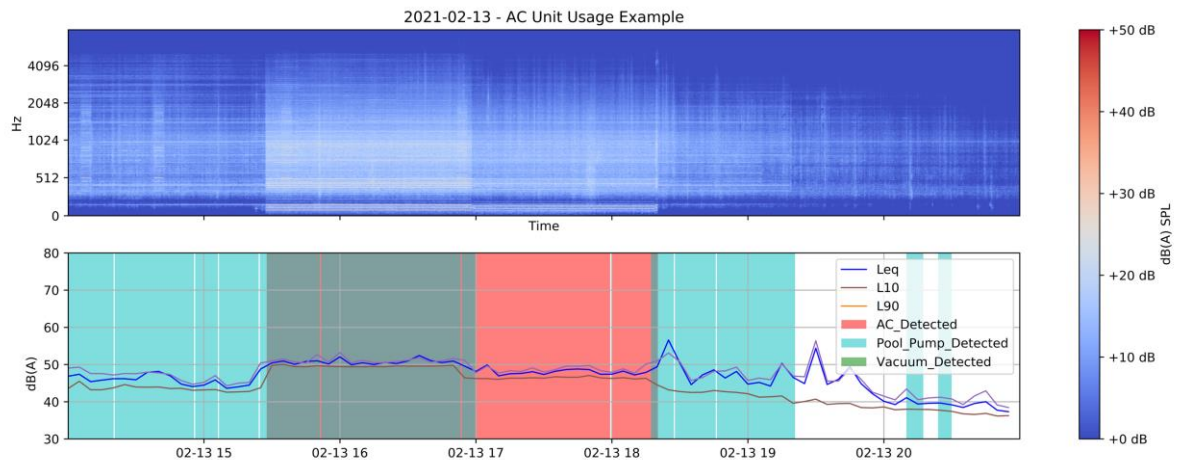


Figure 10 – Operation of AC Unit (and other detected plant), 2021-02-13T14:00 to 2021-02-13T21:00

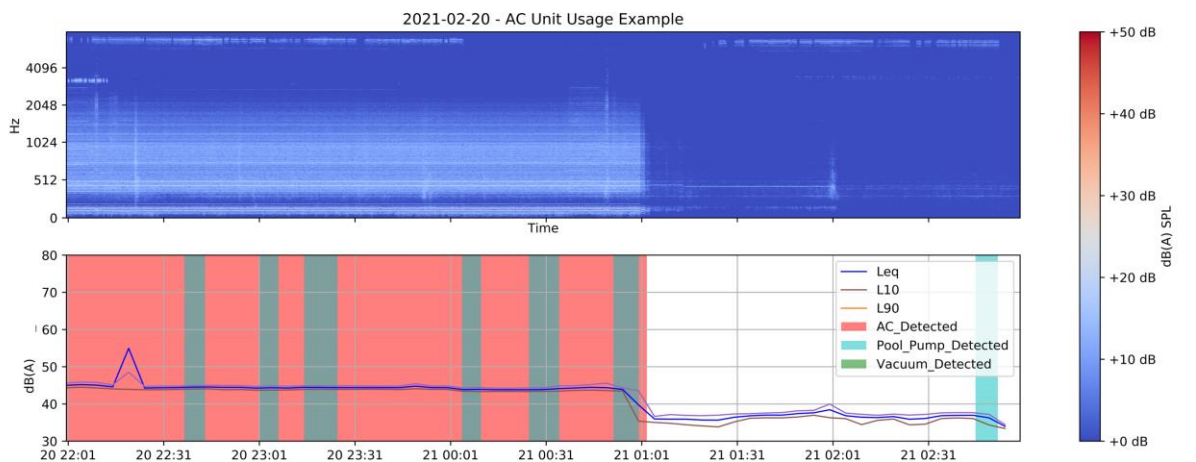


Figure 11 – Operation of AC Unit (and other detected plant), 2021-02-20T22:00 to 2021-02-21T01:00

The continuous source noise level is found first by considering only times when the AC unit was detected to be operational, then taking the average of each 15 minute Leq, summarised in

Source	Continuous source noise level dB(A)		EPP Compliance	
	Average Measured Level	+8dB penalty for tonality and LF characteristic	Day (7:00am-10:00pm)	Night (10:00pm-7:00am)
AC unit	50	58	No (+6db)	No (+13db)

Table 5 – AC source noise levels and EPP Compliance.

Figure 12 shows the detected usage pattern of the AC unit over the monitored period. Values show the proportion of the hour for which the AC unit was detected to be operational.

Percentage of hour operational	Date																					
	5/2/21	6/2/21	7/2/21	8/2/21	9/2/21	10/2/21	11/2/21	12/2/21	13/2/21	14/2/21	15/2/21	16/2/21	17/2/21	18/2/21	19/2/21	20/2/21	21/2/21	22/2/21	23/2/21	24/2/21	25/2/21	26/2/21
0:00	0	0	0	0	0	0	0.51	0	0	0	0	0	0.99	1	0.99	1	1	0	0	0	0	0
1:00	0	0	0.1	0	0	0	0	0	0	0	0	0	0.99	1	1	1	0.04	0	0	0	0	0
2:00	0	0	0	0	0	0	0	0	0	0	0	0	0.99	1	1	1	0	0	0	0	0	0
3:00	0	0	0	0	0	0	0	0	0	0	0	0	0.48	1	1	1	0	0	0	0	0	0
4:00	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0.98	0	0	0	0	0	0
5:00	0	0	0	0	0	0	0	0	0	0	0	0	0.15	0.98	1	0.63	0	0	0	0	0	0
6:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0.99	0.72	0.45	0	0	0	0	0	0
7:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0.79	0.74	0.4	0	0	0	0	0	0
8:00	0	0	0	0	0	0	0.11	0	0	0	0	0	0.27	0.99	0.68	0.29	0	0.04	0	0	0	0
9:00	0	0	0	0	0	0.24	0.22	0	0	0	0	0	0.97	0.96	0.96	0.61	0	0.05	0	0	0	0
10:00	0	0	0	0	0	0.46	0.52	0	0	0	0	0.35	1	1	1	0.99	0.11	0	0	0	0	0
11:00	0	0	0	0	0	0.94	0.61	0	0	0	0.56	1	0.99	1	1	0.99	0.73	0	0	0	0	0
12:00	0	0	0	0	0	1	0.76	0	0	0	1	1	1	1	0.99	1	0.97	0	0	0	0	0
13:00	0	0	0	0	0	1	0.76	0.42	0	0	0.98	1	1	1	0.99	1	0.78	0	0	0	0	0
14:00	0	0	0	0	0	1	0.89	1	0	0	0.89	0.98	1	0.99	1	0.99	0.9	0	0	0	0	0
15:00	0	0	0	0	0.46	1	0.5	0.84	0.54	0.08	1	1	1	1	1	0.97	0.83	0	0	0	0	0
16:00	0	0	0	0	1	1	0.41	1	1	1	1	0.96	1	1	0.99	1	0.92	0	0	0	0	0
17:00	0	0	0	0	1	1	0.95	0.85	0.99	1	1	0.99	0.99	0.99	0.98	1	0.39	0	0	0	0	0
18:00	0	0	0	0	1	1	1	0.99	0.34	1	1	1	1	1	0.99	0.92	0	0	0	0	0	0
19:00	0	0	0	0	1	1	1	0.74	0	1	1	1	1	1	0.72	1	0	0	0	0	0	0
20:00	0	0	0	0	1	1	1	0	0	0.49	1	0.99	1	0.99	0.97	0.98	0	0	0	0	0	0
21:00	0	0	0	0	1	1	0.02	0	0	0	0.55	0.99	1	1	0.93	1	0	0	0	0	0	0
22:00	0	0	0	0	0.48	1	0	0	0	0	0	1	1	0.99	1	1	0	0	0	0	0	0
23:00	0	0	0	0	0	1	0	0	0	0	0	1	1	1	0.99	1	0	0	0	0	0	0

Figure 12 – AC Usage Patterns over the monitoring period. Proportion of hour that AC unit was detected to be operational (e.g 0.5 means the source was detected for 30 minutes total duration within that hour).

5.3 Pool Pump

All detected operation of the Pool Pump over the monitoring period is presented in Appendix A.1.

Figure 13, Figure 14 and Figure 15 show selected examples of the Pool Pump, beginning, during and ceasing operation. The impact from the Pool pump on the acoustic environment is most clearly observable during nighttime or early morning operation, wherein the background noise level is set by the operation of the pump.

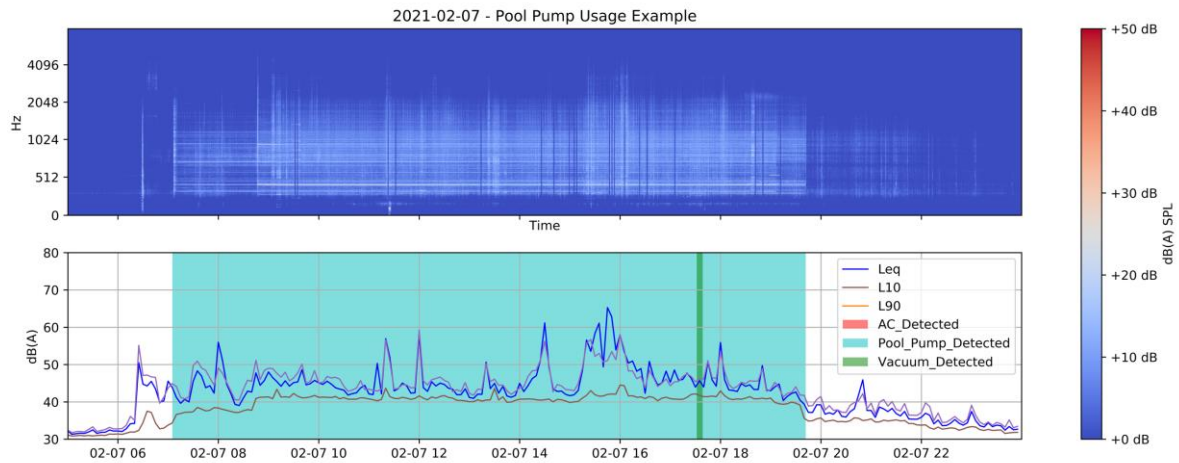


Figure 13 – Operation of Pool Pump (and other detected plant), 2021-02-07T05:00 to 2021-02-07T23:00

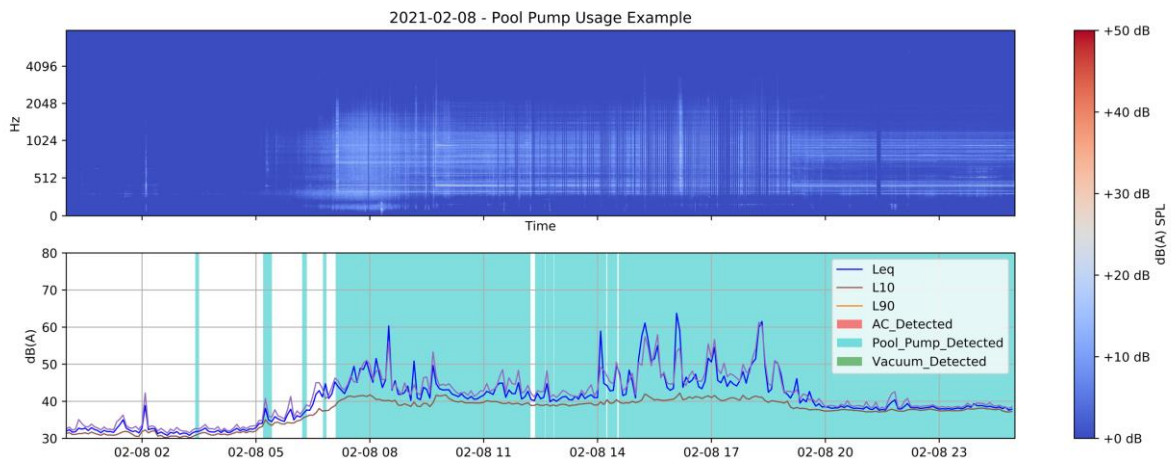


Figure 14 – Operation of Pool Pump (and other detected plant), 2021-02-08T00:00 to 2021-02-09T00:00

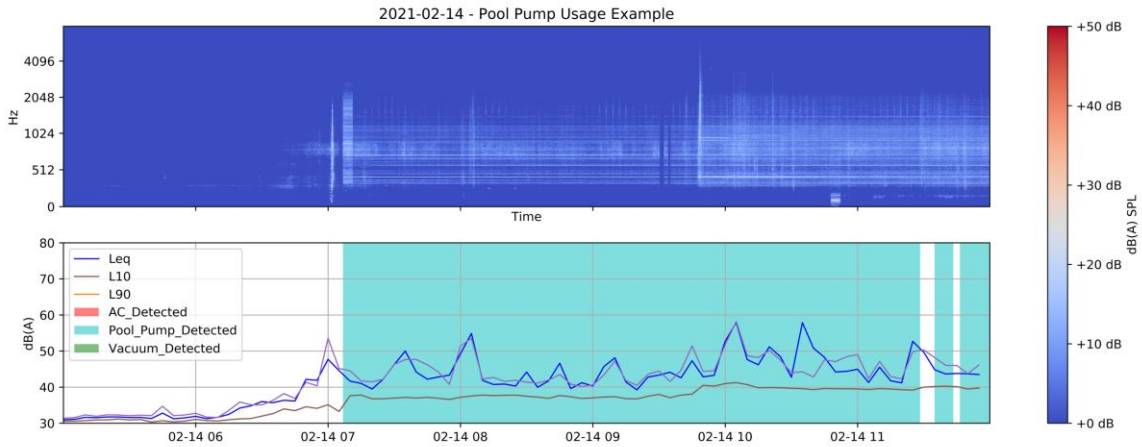


Figure 15 – Operation of Pool Pump (and other detected plant), 2021-02-04T05:00 to 2021-02-14T12:00

The continuous source noise level is found first by considering only times when the Pool Pump was detected to be operational during the night time hours, then taking the average of each 15 minute L90¹, summarised in Table 6.

Source	Continuous source noise level dB(A)		EPP Compliance	
	Average Measured Level	+5dB penalty for tonality characteristic	Day (7:00am-10:00pm)	Night (10:00pm-7:00am)
Pool Pump	43	48	Yes	No (+3db)

Table 6 – Pool Pump source noise levels and EPP Compliance.

Figure 16 shows the detected usage pattern of the Pool Pump over the monitored period. Values show the proportion of the hour for which the Pool Pump was detected to be operational.

¹ The L90 was used in favour of the Leq (as per EPP guidelines for continuous source level), as the Leq is significantly impacted by noises other than from the Pool Pump.

Percentage of hour operational	Date																					
	5/2/21	6/2/21	7/2/21	8/2/21	9/2/21	10/2/21	11/2/21	12/2/21	13/2/21	14/2/21	15/2/21	16/2/21	17/2/21	18/2/21	19/2/21	20/2/21	21/2/21	22/2/21	23/2/21	24/2/21	25/2/21	26/2/21
0:00					1	0	0.21	0	0	0	0	0.11	0.13	0.37	0.09	0.99	0.39	0	0	0	0	0
1:00					1	0	0	0	0	0	0	0	0	0.98	0.51	1	0	0	0	0	0	0
2:00					1	0	0	0.1	0	0	0	0	0.1	1	0.8	1	0.12	0	0	0	0	0
3:00				0.1	1	0.09	0	0	0	0	0	0	0	0.82	0.99	1	0	0.11	0	0	0	0
4:00					1	0	0	0.09	0	0	0	0	0	0.75	0.14	0.38	0	0	0	0	0	0
5:00				0.23	1	0	0.11	0	0	0	0	0	0.23	0.93	0.1	0	0	0	0	0	0	0
6:00					1	0	0.09	0	0	0	0	0	0.01	0.74	0.09	0	0	0	0	0	0	0.1
7:00		0.54	0.91	0.89	1	0.89	0.22	0.89	0.88	0.89	0.89	0.81	0.74	0.98	0.32	0.98	0.88	0.88	0.8	0.88	0.88	0.88
8:00		0.92	1	1	1	1	0.27	0.99	1	1	1	0.37	0.98	0.19	0	0.63	1	1	1	1	1	0.99
9:00		0.83	0.98	0.98	0.94	0.92	0.03	0.87	0.97	0.97	0.92	0.39	0.49	0.32	0.46	0.4	0.92	0.97	0.96	0.97	0.97	0.96
10:00		0.9	1	1	1	0.58	0.25	1	1	1	0.99	0.73	0.39	0.55	0.32	0.41	0.96	0.99	1	0.99	1	0.54
11:00		0.99	0.98	0.95	0.99	0	0.72	0.99	0.99	0.84	0.59	0.59	0.61	0.75	0.83	0.4	0.65	1	1	1	1	
12:00		0.86	1	0.83	0.73	0.55	0.8	0.81	0.87	0.7	0.37	0.62	0.38	0.18	0.61	0.53	0	0.47	1	0.98	0.99	
13:00		0.97	0.99	0.92	0.6	0.81	0.4	0.06	0.97	0.96	0.55	0.72	0.67	0.1	0.45	0.12	0.73	0.85	1	0.98	0.99	
14:00		0.88	0.97	0.76	0.43	0.96	0.62	0.16	0.98	0.57	0.42	0.57	0.39	0.12	0.3	0.1	0.38	0.96	1	0.77	0.91	
15:00	0.38	0.94	0.96	0.73	0.51	0.96	0.16	0	0.97	0.76	0.58	0.59	0	0	0.89	0.09	0.22	1	0.99	0.77	0.95	
16:00	0.89	0.97	0.97	0.78	0.59	0.96	0	0	0.99	0.82	0.76	0.89	0	0.36	0.43	0.05	0.32	0.99	0.99	0.62	1	
17:00	1	0.97	0.99	0.57	0.09	0.91	0	0	0	0.32	0.86	0.85	0	0.92	0.6	0.27	0.77	1	1	1	1	
18:00	1	0.99	0.98	0.67	0.6	0.77	0.16	0.51	0.69	0.36	0.58	0.43	0	0.46	0.63	0.51	0.99	1	1	1	1	
19:00	0.22	0.1	0.69	0.99	0.96	0.14	0	0.09	0.35	0.06	0.5	0.21	0.19	0.47	0.83	0.99	0.05	0.11	0.11	0.3	0.37	
20:00	0	0	0	1	0.28	0.31	0.04	0	0.22	0.05	0	0.13	0.57	0.34	0.99	0.82	0	0	0	0	0	0
21:00	0	0	0	0.88	0	0	0.07	0	0	0.05	0	0.47	0.31	0.1	0.84	0.16	0	0.1	0	0	0	0
22:00	0	0	0	1	0	0	0	0	0	0	0	0.85	0.27	0.09	0.99	0.11	0	0	0	0	0	0
23:00	0	0	0	1	0.17	0	0	0	0	0	0	0.93	0.12	0	0.94	0.27	0	0	0	0	0	0

Figure 16 – Pool Pump Usage Patterns over the monitoring period. Proportion of hour that Pool Pump unit was detected to be operational (e.g 0.5 means the source was detected for 30 minutes total duration within that hour).

5.4 Vacuum

All detected operation of the Vacuum over the monitoring period is presented in Appendix A.1.

Figure 17 shows a selected example of the Vacuum in operation. The impact from the Vacuum system on the acoustic environment is clearly observable, with a consistent noise level approximately 20dB above background noise level at the time (which itself is primarily Pool Pump noise).

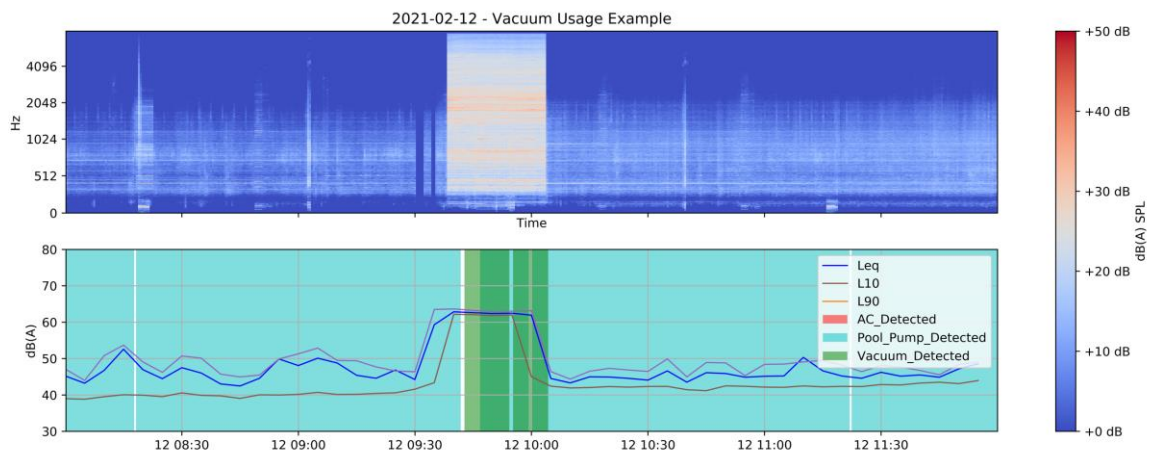


Figure 17 – Operation of Vacuum (and other detected plant), 2021-02-12T09:00 to 2021-02-12T12:00

The continuous source noise level is found first by considering only times when the Vacuum was detected to be operational then taking the average of each 15 minute Leq (or the length of the duration of noise), summarised in Table 7.

Source	Continuous source noise level dB(A)		EPP Compliance	
	Average Measured Level	+0dB no penalty correction	Day (7:00am-10:00pm)	Night (10:00pm-7:00am)
Vacuum	63	63	No (+11)	No (+18) not measured directly

Table 7 – Vacuum source noise levels and EPP Compliance.

Figure 18 shows the detected usage pattern of the Vacuum over the monitored period. Values show the proportion of the hour for which the Vacuum was detected to be operational. It is noted that the complainant believes the usage of the vacuum system during the monitored period was less than what they considered typical. Additional monitoring may be required should typical usage patterns need to be established.

Percentage of hour operational	Date																									
	5/2/21	6/2/21	7/2/21	8/2/21	9/2/21	10/2/21	11/2/21	12/2/21	13/2/21	14/2/21	15/2/21	16/2/21	17/2/21	18/2/21	19/2/21	20/2/21	21/2/21	22/2/21	23/2/21	24/2/21	25/2/21	26/2/21				
0:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
2:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
3:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
4:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
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9:00	0	0	0	0	0	0	0	0.27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
10:00	0	0	0	0	0	0	0	0.07	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
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15:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
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22:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
23:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	

Figure 18 – Vacuum Usage Patterns over the monitoring period. Proportion of hour that Vacuum unit was detected to be operational (e.g 0.5 means the source was detected for 30 minutes total duration within that hour).

6 DISCUSSION

The detected usage patterns of the AC unit in location A, in conjunction with the measured noise levels during its various operational cycles indicate that the AC unit is having severe impact on noise amenity at the complainant property. Although the unit may usually be used during daytime hours, it was observed to be operation all hours of the day and night, sometimes for multiple days at a time (17th-21st February). The low frequency and tonal nature of the AC noise also present significant additional noise impact and potential for nuisance. While in operation, noise from the AC unit would be clearly audible over all other noises, and overwhelmingly becomes the baseline acoustic environment at the monitoring position. The noise would not vary significantly in most outdoor areas at the rear of the complainant property. Additionally, the AC noise would likely impact on internal habitable areas such as the living room and lounge at the rear of the property. The AC unit is very likely in breach of local nuisance regulations, and EPP criteria.

The detected usage patterns of the Pool Pump in Location A, in conjunction with the measured noise levels during its various operational cycles indicate that the Pool Pump system is having moderate impact on noise amenity at the complainant property. The system appears to have a typical operational duty between 7am and 7pm, though was observed to continue overnight on multiple days. Though the pump noise may be obscured by other noises during the day, it would be audible at night time and early morning hours, and during quiet days. The tonal nature of the pump noise also present additional potential for noise nuisance. The noise is very likely in breach of local nuisance regulations, and night time EPP criteria.

The detected operation of the Vacuum in Location A, in conjunction with the measured noise levels during its one observed period of usage indicate that the vacuum would have extreme impact on noise amenity at the complainant property. The noise observed noise level of 63dB(A) at the monitoring position means that conversation may be difficult in outdoor areas when the vacuum is in operation. Although only one period of usage, for approximately 30 minutes, was observed during the monitoring period, this was noted by the complainant as less than typical usage of the Vacuum, which may be used sporadically any day, from 10-30 minutes at a time. Additional monitoring may be required if typical usage patterns need to be established. Noise from the vacuum is very likely to be in breach of local nuisance regulations, and EPP criteria.

No detection of the AC unit in Location B was able to be made from the gathered data. Additional noise monitoring targeting usage of this mechanical plant may be required should usage patterns and noise levels need to be established.

Overall, any isolated operation of the three individual mechanical plant in Location A would present a cause for concern in relation to noise nuisance. With two of the three plant showing regular and consistent usage (AC and Pool Pump), with suspected sporadic usage of the third (vacuum), the noise impact on the complainant is considered to be extreme, and having a severe impact on the acoustic amenity of the rear external and potentially internal areas of 42 Carlos Street.

The physical location, orientation and installation of mechanical plant at Locations A and B appear to have had little consideration given to the impact they may cause to residents at 42 Carlos Street. There is direct line of site to the AC unit at location B, and the hard reflective surfaces surrounding the plant at location A mean that the majority of noise from these plant are projected into noise sensitive areas of 42 Carlos Street.

It is highly recommended that a suitably qualified acoustic consultant perform a thorough review of all mechanical plant located at 40 Carlos Street, and provide guidelines on any mitigation measures, and/or usage restrictions that may be required to ensure compliance with regulations and reasonable acoustic amenity is achieved. If possible, usage of the AC unit and Vacuum

system should be restricted to the daytime period only, with the minimum possible usage until mitigation measures can be put in place.

7 CONCLUSION

A noise monitor was installed at 42 Carlos Street, Aberfoyle 2055 to investigate potential nuisance mechanical plant located at the neighbouring residential property, 40 Carlos Street, Aberfoyle 2055. Information from council officers and the complainant was collated with the gathered data to reveal three unique acoustic signatures from mechanical plant which occurred with consistency over the monitored period. These signatures were consistent with a reverse cycle airconditioner, pool pump and central vacuum system. Recordings and data were analysed, with operational times of the three mechanical plant extracted. An additional noted AC unit was not able to be identified from noise monitoring.

The mechanical plant at 40 Carlos Street were found to have a severe impact on the acoustic amenity at 42 Carlos Street. It is recommended that all the identified mechanical plant be reviewed by a suitably qualified acoustic consultant, with temporary restrictions put in place until mitigation measures can be carried out.

It is up to the discretion of the assessing officer and council to determine whether the mechanical plant detected in this report constitutes a nuisance under the applicable legislation.

Compiled By:

Jonathan South

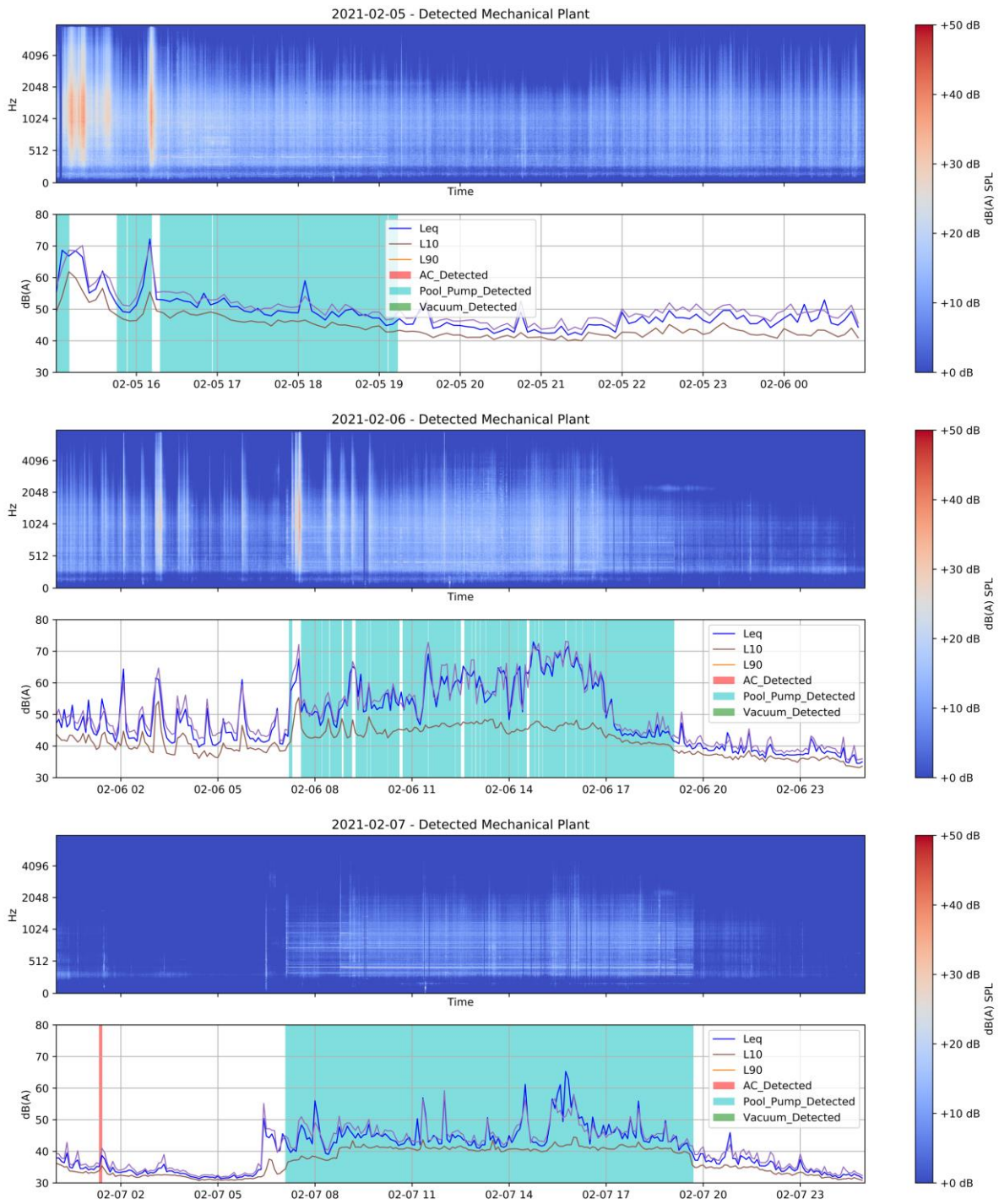


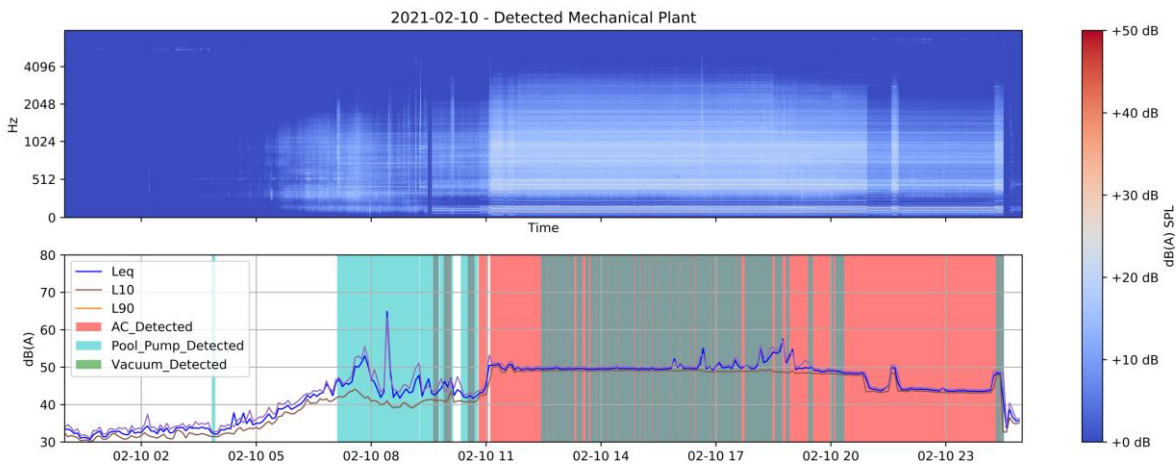
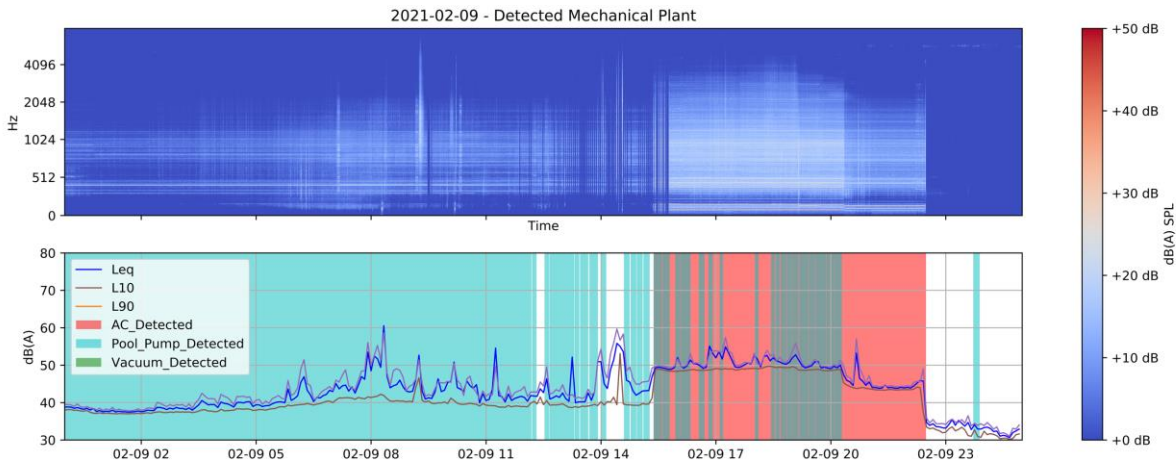
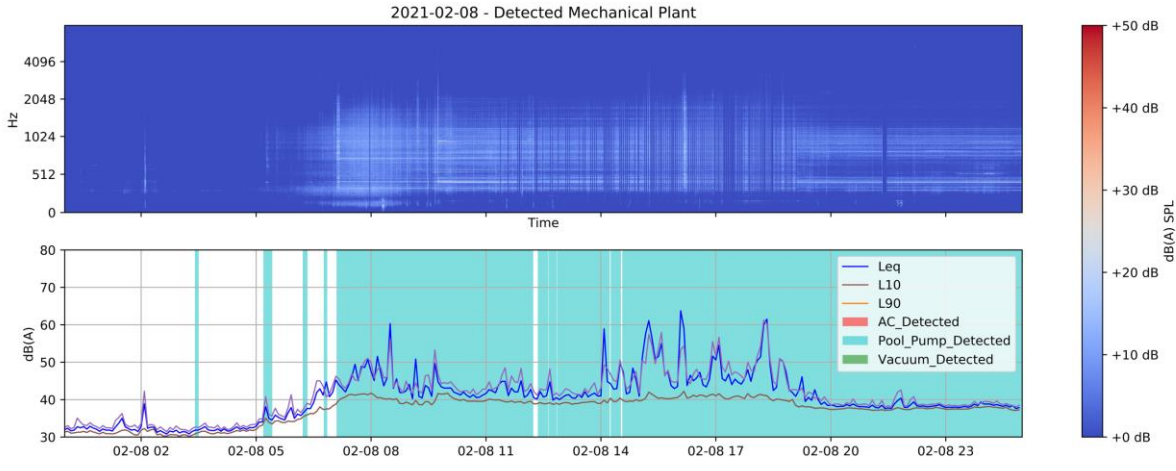
Reviewed By:

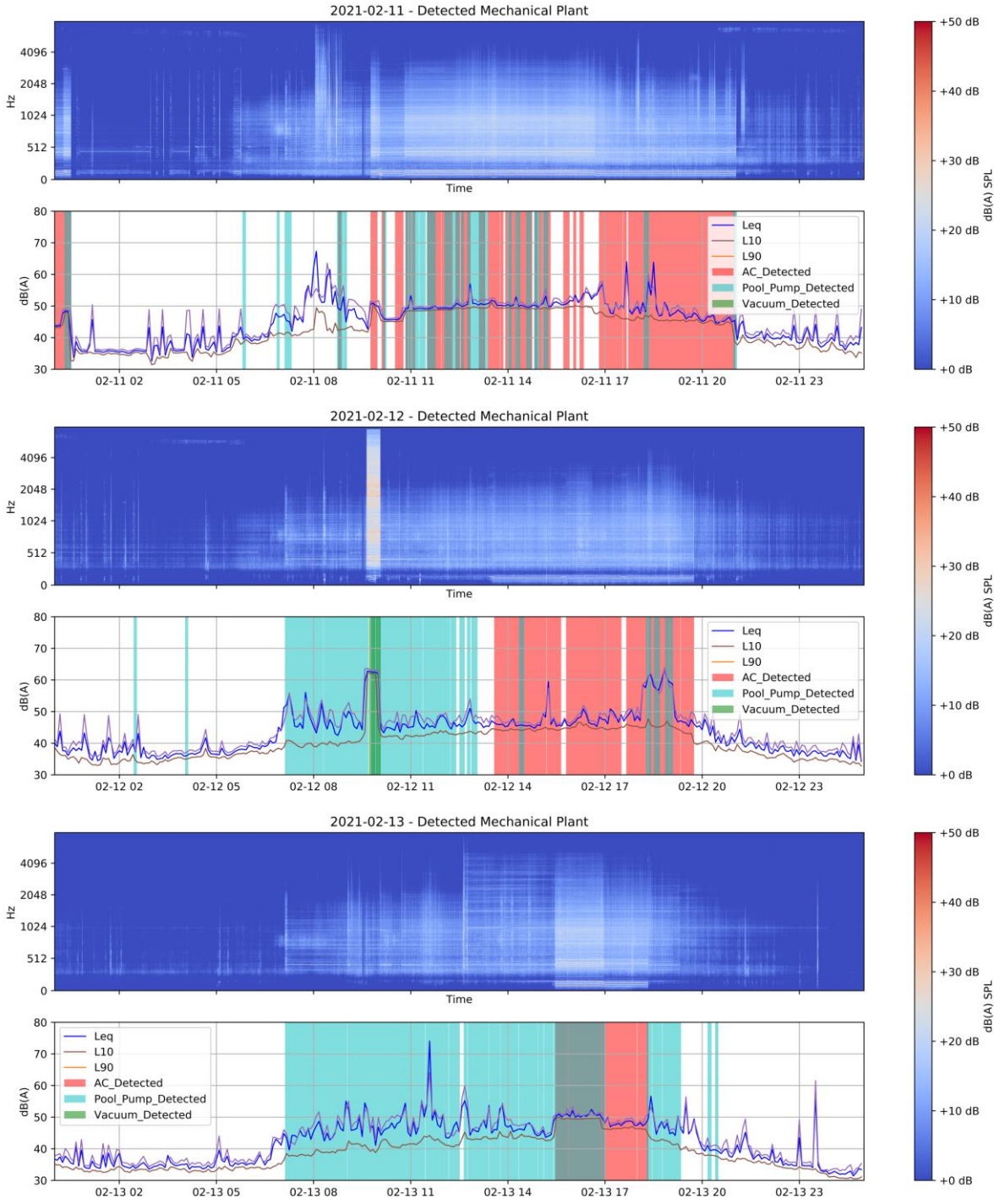
Stuart Clough

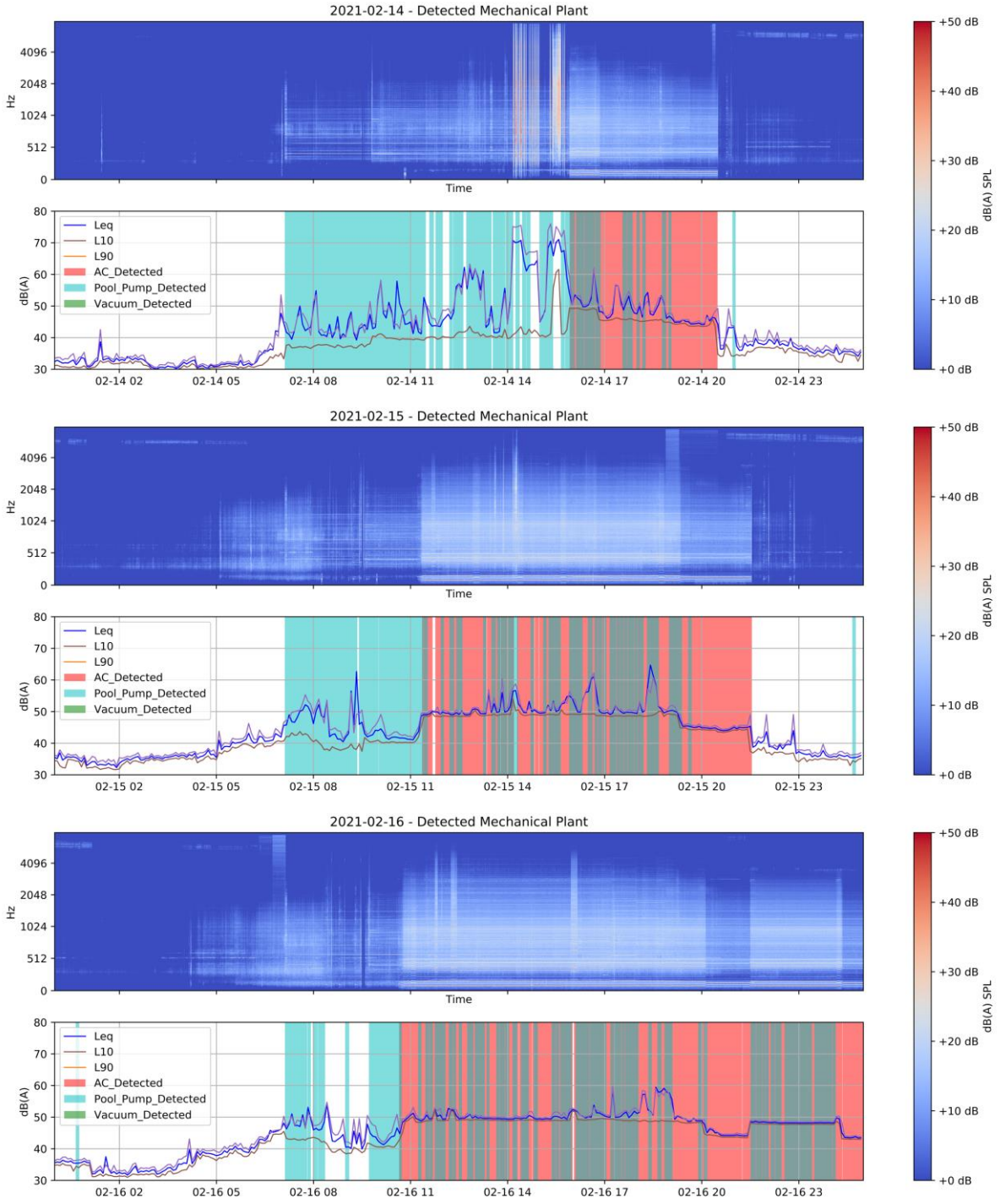


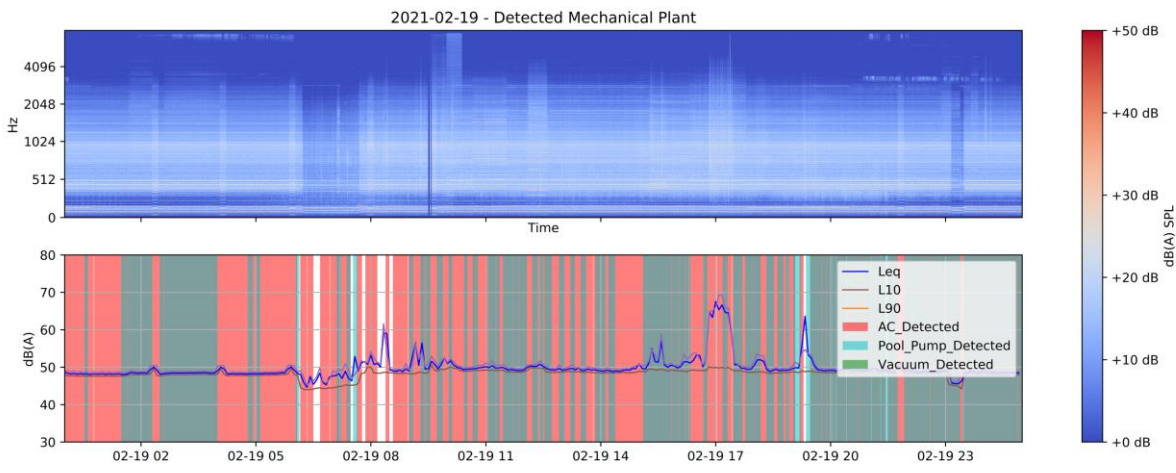
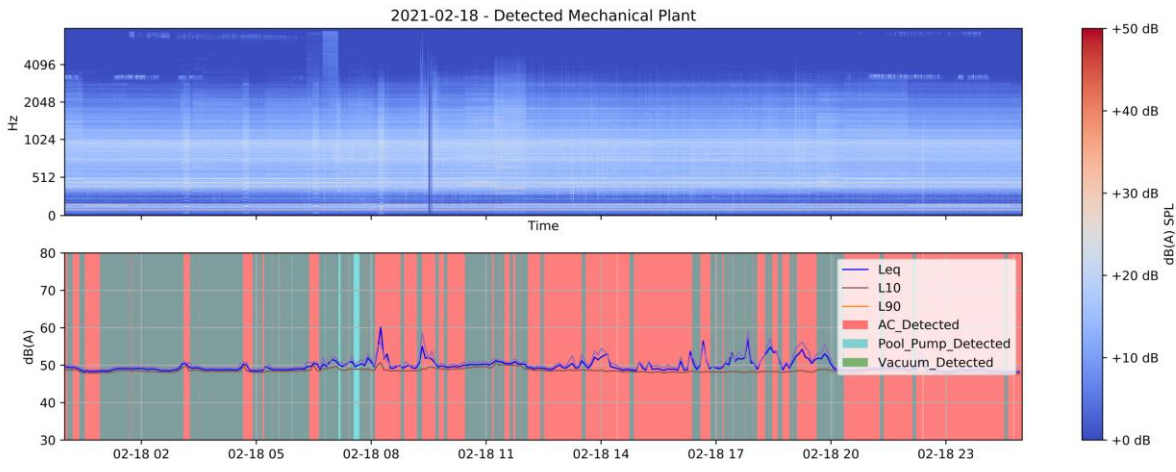
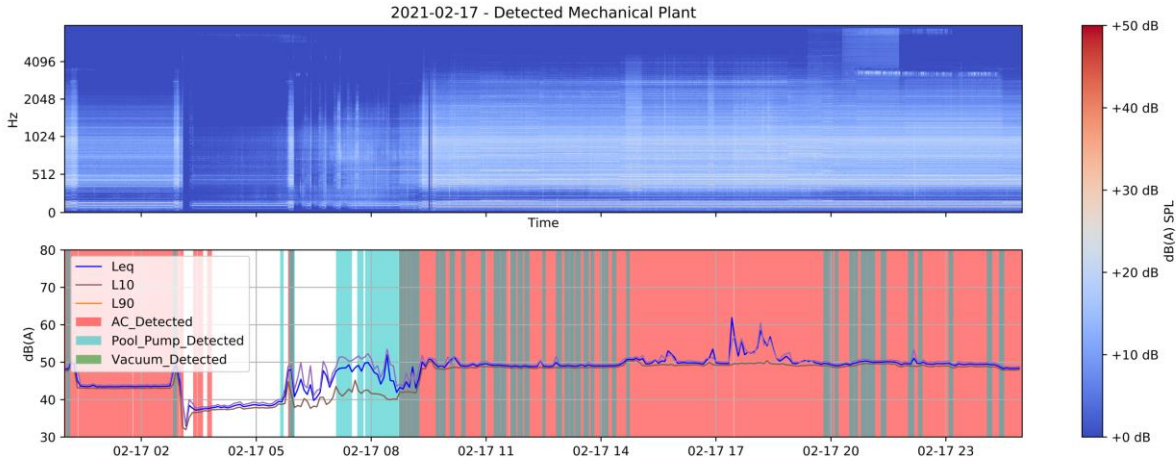
A.1 FULL MONITORING RESULTS

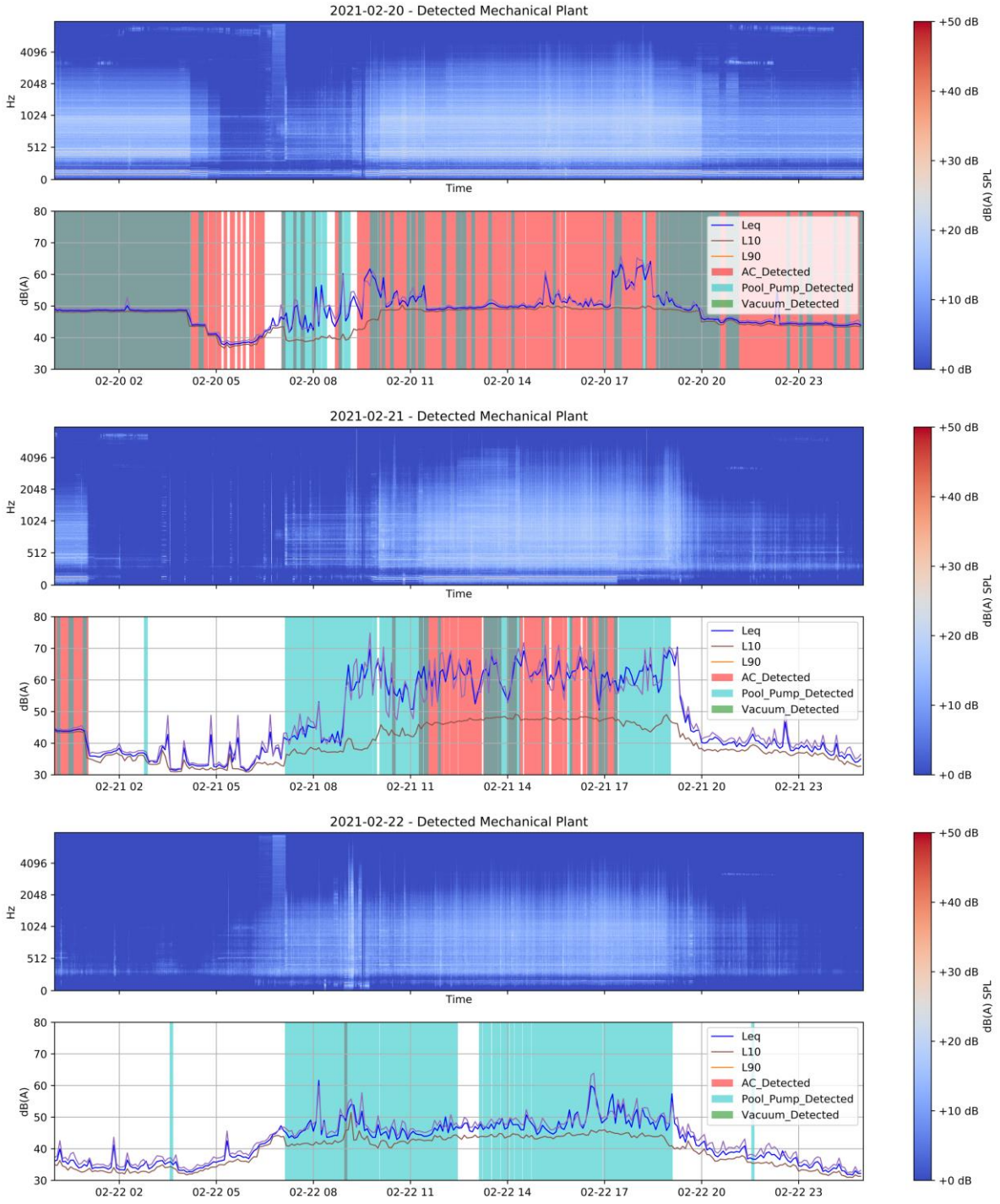


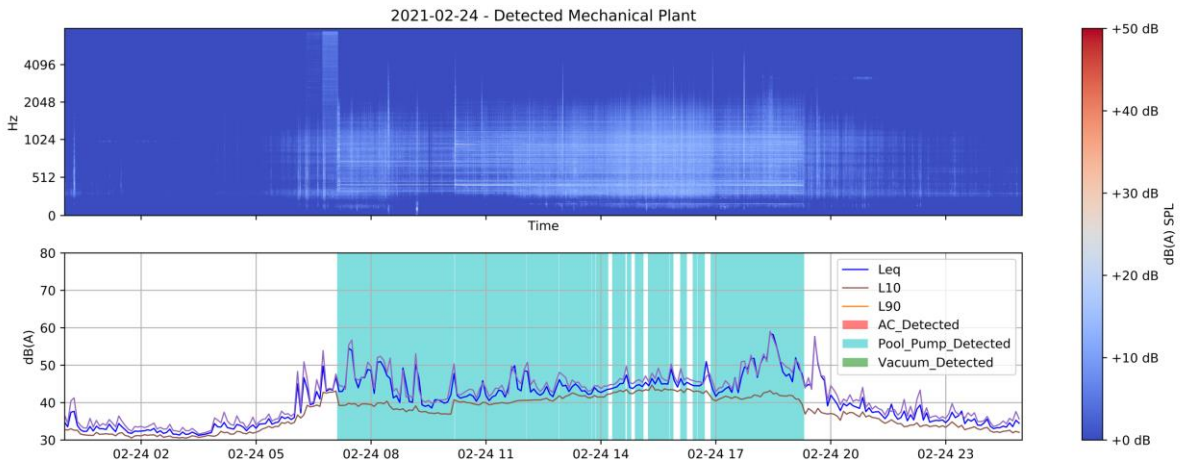
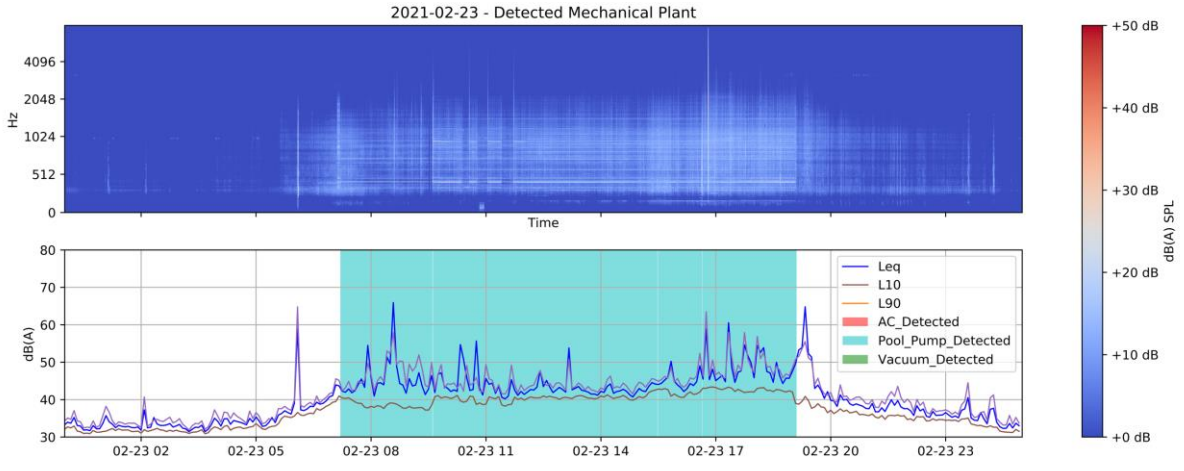


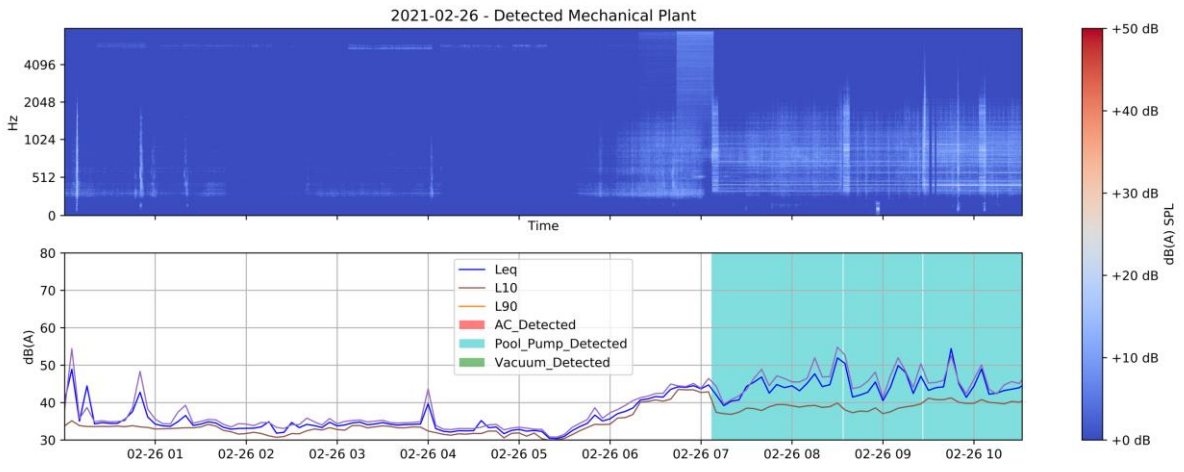
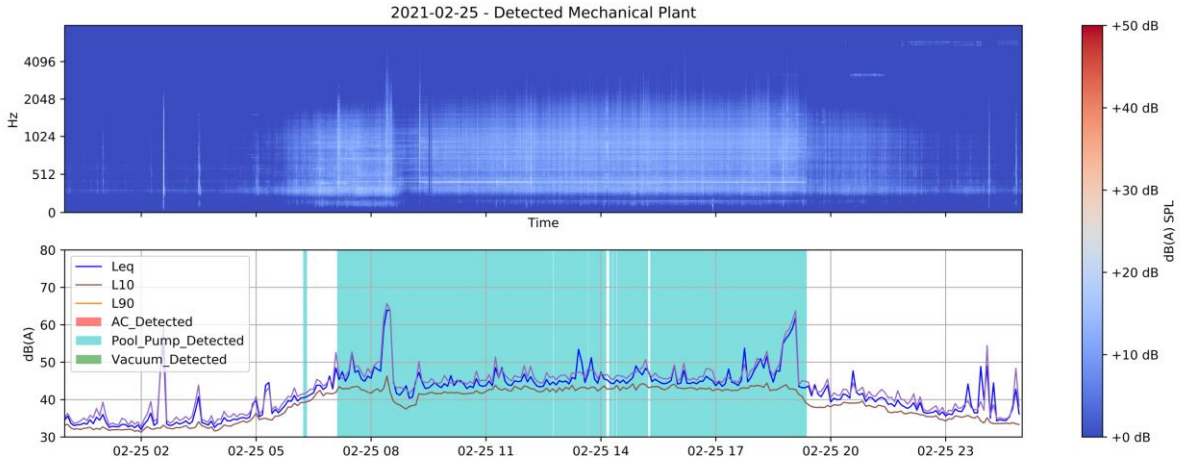












A.2 NOISE MONITOR DETAILS

NoiseNet uses a custom-built noise monitor for our measurement and analysis, with basic onboard components as follows:

- NATA certified Convergence Instruments Noise Sentry NSRTW_mk3 noise monitor.
- Rapsberry Pi 3 micro-computer
- 3G/WiFi wireless communication

Noise data is processed and encrypted on-device, before being transmitted wirelessly to NoiseNet databases. Further processing and analysis is completed on a job specific basis, before being compiled for a client report.

Our noise monitors are designed and built with flexibility, size and low-cost in mind, and with systems in place to provide the benefits of an on-site field technician (sound recognition, spectral and time based analysis, automated data processing), without the associated costs.

All device components are thoroughly pre-tested in-house for acoustic performance, stability and reliability and have been tested for repeated accurate measurement of:

- descriptors including L_p , L_{eq} , L_n ,
- fast response integration time,
- unweighted and A weighting,
- broadband and single octave, between 63Hz and 16kHz
- all of the above to within ± 3 dB, for sound levels between 27dB and 90dB SPL.

Each device is field calibrated using a handheld calibrator before and after each deployment, and operation monitored using the wireless connection throughout the deployment.