hepworth acoustics

DAIRY CREST WWTP, DAVIDSTOW

2018 BASELINE NOISE ASSESSMENT

On behalf of:

Dairy Crest

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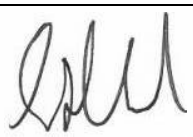
Report prepared by: Graham Bowland BSc MIOA – Technical Director	
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1.0 INTRODUCTION

1.1 Hepworth Acoustics Ltd was commissioned to carry out a baseline noise assessment relating to the Waste Water Treatment Plant (WWTP) associated with the Davidstow Creamery, which is ~850m to the west of the WWTP.

1.2 The noise assessment has been commissioned to evaluate operational noise emissions from the WWTP after completion of various works pertaining both to improvements in noise control and also more general operational improvements/alterations.

1.3 Accordingly, a key purpose of the noise assessment is to establish the refreshed baseline for noise emissions from the WWTP, against which any future ongoing improvements, if necessary, may be evaluated.

1.4 The scope of the noise assessment has been discussed and agreed with the Environment Agency.

1.5 A detailed programme of noise measurements and weather monitoring has been undertaken on and around the WWTP site over an extended period. The measured data has been assessed with reference to relevant British Standard guidelines.

1.6 The various noise units and indices referred to in this report are described in Appendix I. All noise levels mentioned in the text have been rounded to the nearest decibel, as fractions of decibels are imperceptible.

2.0 ACOUSTIC CRITERIA

BS 4142

2.1 Relevant guidance relating to assessment of noise from the WWTP is set out in British Standard 4142: 2014 *Methods for rating and assessing industrial and commercial sound*. The standard provides methods for rating and assessing sound of an industrial nature from industrial or commercial premises.

2.2 The 'rating' level is based on the 'specific' L_{Aeq} sound level attributable to the operation with an 'acoustic feature' penalty added for any sound sources which give rise to tonal, impulsive, intermittent, or other characteristics readily distinctive against the residual acoustic environment.

2.3 BS 4142 stipulates that impacts should be assessed over a reference time interval of 1-hour during the daytime (0700-2300hrs) and 15-minutes during the night-time (2300-0700hrs).

2.4 An initial numerical estimate of the impact of the operation is determined by subtracting the background level from the rating level. BS 4142 states that:

- Typically, the greater this difference, the greater the magnitude of the impact
- A difference of around +10dB or more is likely to be an indication of a significant adverse impact, depending on the context
- A difference of around +5dB is likely to be an indication of an adverse impact, depending on the context
- The lower the rating level is relative to the measured background level, the less likely it is that the operation will have an adverse impact or a significant adverse impact.
- Where the rating level does not exceed the background sound level, this is an indication of the specific sound source having a low impact, depending on the context.

2.5 Where the initial estimate of the impact needs to be modified due to the context, BS 4142 states that all pertinent factors should be taken into account in determining whether the initial estimate of the impact needs to be modified, including:

- The absolute level of noise
- The character and level of the residual noise
- The sensitivity of the receptor

2.6 Regarding background sound levels, BS 4142 requires *that "values are reliable and suitably represent the particular circumstances and periods of interest… the objective is not simply to ascertain a lowest measured background sound level, but rather to quantify what is typical during particular time periods*". It is also stated that "*diurnal patterns can have a major influence on background sound levels and, for example, the middle of the night can be distinctly different (and potentially of lesser importance) compared to the start or end of the night-time period for sleep purposes*".

BS 8233

2.7 British Standard 8233: 2014 *Guidance on sound insulation and noise reduction for buildings,* recommends design criteria for acceptable noise levels within residential accommodation. BS 8233 guidelines for the daytime and night-time are summarised in Table 1.

Table 1 : BS 8233 Recommended Internal Noise Levels

Activity	Location	Internal Noise Levels	
		Daytime 0700-2300hrs	Night-time 2300-0700hrs
Resting	Living room	35 dB $L_{Aeq,16hr}$	-
Dining	Dining room / area	40 dB $L_{Aeq,16hr}$	-
Sleeping (daytime resting)	Bedroom	35 dB $L_{Aeq,16hr}$	30 dB $L_{Aeq,8hr}$

2.8 BS 8233 clarifies that the above guidance relates only to noise without specific character (e.g. such as that which does not have a distinguishable, discrete and continuous tone, is irregular enough to attract attention, or has strong low-frequency content) and that where such characteristics are present, lower noise limits might be appropriate.

2.9 Regarding outdoor living areas, BS 8233 states that "*it is desirable that the external noise level does not exceed 50dB $L_{Aeq,T}$, with an upper guideline value of 55dB L_{Aeq}, which would be acceptable in noisier environments.*".

3.0 NOISE SURVEYS

3.1 A detailed programme of noise measurements has been undertaken on and around the WWTP site over the period 1700hrs on Thursday 26 July – 1300hrs on Tuesday 7 August 2018.

Trewassa Noise Monitoring

3.2 Continuous monitoring of noise levels was undertaken at a single location to the south of residential properties at Trewassa, which is a hamlet to the northwest/north-northwest of the WWTP, identified as Location A in Figure 1. The monitoring was undertaken in sequential 15-minute samples.

3.3 The measurement microphone was mounted ~3m above local ground to minimise any noise from wind in long grass on the adjacent Cornish hedge.

3.4 Sample audio recording and continuous weather monitoring was also undertaken over this period, although due to data transfer problems some periods of weather data are missing over 1-3 August 2018. The weather data was recorded by the WWTP system and the data passed to us.

3.5 Further to analysis of the available weather data and audio recordings, all data recorded over the 48-hour period commencing at 1900hrs 27 July 2018 has been removed from the analysis, due to strong winds and rain precluding measurement of representative noise levels for the majority of this time.

3.6 Table 2 provides the summary of the noise levels measured at Location A.

3.7 To provide a suitable summary of the considerable quantity of data recorded, the range of $L_{Aeq,15min}$, $L_{Amax,15min}$ and $L_{A90,15min}$ values has been determined for each 1-hour period, along the logarithmic average of $L_{Aeq,15min}$ and arithmetic average of $L_{A90,15min}$. Accounting for the appropriate assessment time intervals prescribed by BS 4142, the hourly data has been considered for the night-time period, as this shows the range of 15-minute values in each hour, where for the daytime period, for ease this has been averaged further in to each daytime 4-hour period, hence still showing the range of 1-hour values and illustrating the general variations over time. This results in a larger quantity of data for the night-time period being presented than for the daytime.

3.8 All 15-minute $L_{Aeq,15min}$, $L_{Amax,15min}$ and $L_{A90,15min}$ values are plotted graphically in Appendix II. This graph also includes the measured wind speed and also an 'illustrative wind factor', which is based upon the wind speed multiplied by either a positive or negative figure, of a magnitude relative to the wind direction, compared to the axis from the WWTP to Location A. For ease, this has been corrected to be scaled in-between the noise data and wind speed data on the graph in Appendix II, centred at 30.

Table 2 : Summary of Noise Measurements at Trewassa

Time Period Start	Noise Level dB (T=15min)					Time Period Start	Noise Level dB (T=15min)				
	$L_{Aeq,T}$		$L_{Amax,T}$	$L_{A90,T}$			$L_{Aeq,T}$		$L_{Amax,T}$	$L_{A90,T}$	
	Range	Ave.	Range	Range	Ave.		Range	Ave.	Range	Range	Ave.
26/07 1700	42-56	52	51-73	38-48	42	02/08 15:00	42-44	43	53-61	40-43	41
26/07 1900	44-55	47	54-74	42-45	44	02/08 19:00	41-44	43	46-66	39-43	41
26/07 2300	45-46	45	48-53	44-45	45	02/08 23:00	41-42	41	46-51	40-40	40
27/07 0000	45-45	45	49-52	44-44	44	03/08 00:00	42-42	42	45-51	41-41	41
27/07 0100	44-45	45	47-57	43-44	44	03/08 01:00	42-43	43	45-59	41-42	42
27/07 0200	46-48	47	53-56	45-46	45	03/08 02:00	42-44	43	46-51	42-43	42
27/07 0300	46-46	46	50-56	45-45	45	03/08 03:00	44-45	44	46-62	43-43	43
27/07 0400	45-46	46	50-52	45-45	45	03/08 04:00	43-44	43	46-48	42-43	43
27/07 0500	46-47	46	54-62	45-45	45	03/08 05:00	43-44	43	47-55	42-43	42
27/07 0600	45-46	45	53-62	44-45	44	03/08 06:00	43-44	44	49-53	42-43	42
27/07 0700	45-47	46	51-62	43-46	45	03/08 07:00	43-46	45	48-71	42-44	43
27/07 1100	46-49	47	51-75	45-46	45	03/08 11:00	41-46	44	47-72	39-43	40
27/07 1500	47-49	48	52-66	45-47	46	03/08 15:00	42-46	44	50-67	40-42	41
29/07 1900	45-48	46	48-69	43-45	44	03/08 19:00	42-46	43	46-70	40-42	41
29/07 2300	45-46	45	48-60	44-45	44	03/08 23:00	42-42	42	46-48	41-41	41
30/07 0000	45-45	45	48-50	44-45	44	04/08 00:00	42-42	42	45-47	40-41	40
30/07 0100	45-45	45	48-49	44-45	44	04/08 01:00	41-42	41	45-52	40-40	40
30/07 0200	45-46	45	48-49	44-45	44	04/08 02:00	41-42	41	44-46	40-41	40
30/07 0300	45-45	45	48-49	44-44	44	04/08 03:00	41-41	41	44-49	40-40	40
30/07 0400	45-46	45	48-58	44-45	44	04/08 04:00	40-41	41	44-47	39-40	39
30/07 0500	45-47	46	48-64	44-45	45	04/08 05:00	40-41	41	45-57	39-40	39
30/07 0600	45-47	46	54-63	44-45	45	04/08 06:00	41-42	41	47-53	39-41	40
30/07 0700	45-48	47	52-67	44-46	45	04/08 07:00	41-43	42	46-60	40-42	41
30/07 1100	42-46	44	50-66	39-44	41	04/08 11:00	41-51	46	48-74	39-41	40
30/07 1500	43-48	45	50-68	41-44	42	04/08 15:00	42-50	45	52-75	38-44	41
30/07 1900	45-48	46	48-66	43-45	44	04/08 19:00	43-52	46	51-74	41-43	42
30/07 2300	45-49	46	47-75	44-44	44	04/08 23:00	43-47	45	55-66	41-43	42
31/07 0000	45-48	46	47-70	44-44	44	05/08 00:00	44-47	45	53-73	43-44	43
31/07 0100	45-45	45	48-48	44-44	44	05/08 01:00	45-46	45	53-65	43-45	44
31/07 0200	45-45	45	47-61	44-44	44	05/08 02:00	44-46	45	51-63	43-45	43
31/07 0300	45-45	45	47-59	44-44	44	05/08 03:00	43-45	44	52-56	42-44	43
31/07 0400	45-45	45	47-50	44-45	44	05/08 04:00	44-45	45	50-58	43-44	44
31/07 0500	45-49	47	50-69	45-46	45	05/08 05:00	46-51	49	65-71	44-45	44
31/07 0600	46-46	46	54-62	45-45	45	05/08 06:00	46-47	46	57-63	44-45	44
31/07 0700	45-49	46	53-72	43-45	44	05/08 07:00	45-47	46	54-69	44-44	44
31/07 1100	43-48	44	52-73	40-44	41	05/08 11:00	44-46	45	54-66	43-44	43
31/07 1500	43-47	45	51-73	41-43	42	05/08 15:00	40-47	43	50-66	38-44	40
31/07 1900	44-46	45	47-64	42-45	44	05/08 19:00	43-45	44	45-63	41-44	43
31/07 2300	45-45	45	47-59	44-44	44	05/08 23:00	43-44	43	47-60	42-43	42
01/08 0000	45-49	46	47-67	44-44	44	06/08 00:00	43-44	43	49-66	42-43	42
01/08 0100	45-45	45	48-50	44-44	44	06/08 01:00	44-45	44	49-55	43-44	44
01/08 0200	45-45	45	47-52	44-44	44	06/08 02:00	43-44	43	47-55	42-43	42
01/08 0300	45-45	45	48-53	44-44	44	06/08 03:00	43-44	43	45-58	42-43	43
01/08 0400	45-47	46	47-64	44-45	45	06/08 04:00	43-45	44	48-63	43-43	43
01/08 0500	45-47	46	47-66	45-45	45	06/08 05:00	44-45	44	54-60	43-43	43
01/08 0600	46-46	46	52-62	45-45	45	06/08 06:00	44-46	45	51-60	43-44	43
01/08 0700	45-52	48	52-69	44-49	45	06/08 07:00	43-45	44	50-67	41-44	42
01/08 1100	46-51	48	55-74	45-47	45	06/08 11:00	41-45	43	47-70	38-42	40
01/08 1500	46-52	48	50-66	45-49	46	06/08 15:00	41-48	43	48-68	39-41	40
01/08 1900	45-47	46	48-67	44-45	45	06/08 19:00	43-48	44	50-73	41-43	42
01/08 2300	45-46	46	48-51	45-45	45	06/08 23:00	43-44	43	48-49	42-42	42
02/08 0000	45-50	47	50-65	44-45	45	07/08 00:00	43-44	43	48-61	42-42	42
02/08 0100	45-46	46	48-55	44-45	44	07/08 01:00	42-43	43	47-50	41-42	41
02/08 0200	45-45	45	48-51	44-44	44	07/08 02:00	43-43	43	46-48	42-42	42
02/08 0300	45-46	46	48-50	44-45	45	07/08 03:00	44-44	44	47-53	42-43	43
02/08 0400	46-47	46	50-52	45-45	45	07/08 04:00	44-44	44	47-52	43-43	43
02/08 0500	45-47	46	49-62	44-46	45	07/08 05:00	43-46	44	52-65	42-43	43
02/08 0600	46-46	46	55-56	45-45	45	07/08 06:00	44-46	45	54-65	42-43	43
02/08 0700	45-46	45	48-63	44-44	44	07/08 07:00	43-45	44	51-65	40-42	41
02/08 1100	44-48	46	49-73	43-46	44	07/08 11:00	43-44	44	53-62	40-42	41

3.9 Over the course of the remainder of the survey period, it is understood that operations at the WWTP may be generally described as normal and routine, with the following exceptions:

- Over the approximate period 1730-1915hrs on Thursday 26 July 2018 elevated noise levels are noted and a specific sound has been identified via the audio recording. This is characterised by a sporadic loud tonal sound that shifts gradually up and down in pitch. It is noted that this gave rise to the highest measured noise levels over the course of the monitoring. The sound does not appear to have occurred on any other occasion during the noise monitoring period. Audio recordings of the sound have been provided but it has not as yet been possible to determine the precise source.
- During the daytime on Monday 6 and Tuesday 7 August 2018, vacuum tankers were in operation towards the southwestern area of the WWTP. This generates a low-frequency pumping sound which is constant when in operation, but is intermittent between loads. Although this generates high levels of noise at its source, the impact on the overall noise at Trewassa was noted to be slight due to the location of the operation. The vacuum tankers were towed on and off site by tractors and hence this was a further noise source.

3.10 The data in Table 2 demonstrates that generally noise levels were fairly steady over the monitoring period. Typically, the L_{Aeq} and corresponding L_{A90} values were also close in values, indicating that noise levels were generally steady over the course of individual 15-minute sample periods.

3.11 The graph in Appendix II indicates that wind speed and direction had a clear influence on measured noise levels.

3.12 Consideration of the measured third octave band noise levels also demonstrates some variation in the character of the noise, although it is likely that this also is attributable to wind/speed direction to a degree. In general, however, it is observed that the frequency content is fairly broad, with a slight dominance in the mid-frequency range of 500Hz-1kHz and a slight tonal component within the 160Hz third octave band.

Treworra Noise Monitoring

3.13 It addition to the above long-term monitoring, two shorter periods of noise monitoring were undertaken at a single location close to residential properties at Treworra, which is >450m to the east of the WWTP, identified as Location B in Figure 1.

3.14 Noise measurements were undertaken in sequential 15-minute samples over the period 0015-0300 on Friday 27 July 2018 in light southwest/south-southwesterly winds and subsequently over the period 0000-0230hrs on Tuesday 7 August 2018 in light north/northwesterly winds.

3.15 The measurement microphone was mounted at ~2m above a raised area of local ground.

3.16 Table 3 provides a summary of the measured noise levels at Location B.

Table 3 : Summary of Noise Measurements at Treworra

Time Period Start	Noise Level dB				
	$L_{Aeq,15min}$		$L_{Amax,15min}$	$L_{A90,15min}$	
	Range	Logarithmic Average	Range	Mean	Arithmetic Average
27/07 0015-0300	33-37	35	40-56	31-35	33
07/08 0000-0230	28-35	32	37-60	25-29	28

3.17 Comparison of the noise levels measured at Treworra with the noise levels measured over the precise same 15-minute sample periods at Trewassa indicate that there was a relatively steady relationship between the two locations on both occasions, and that the levels at Treworra were typically 10-12dB lower during the 27 July survey and typically 12-14dB lower during the 7 August 2018 survey.

Background Noise Measurements

3.18 The L_{A90} background noise levels at both measurement locations were significantly influenced by noise from the WWTP during all measurement periods, although road traffic was also noticeable during the daytime at Trewassa during more northerly wind conditions.

3.19 Noise from the WWTP forms an intrinsic and established component of the prevailing background noise climate in the local area. However, as part of the assessment procedure discussed with the Environment Agency, we have undertaken further noise measurements in the locality in an effort to determine what the notional worst-case night-time L_{A90} background noise levels might typically be in the absence of noise from the WWTP.

3.20 Notional 'Background' noise measurements were therefore carried out at Locations C and D, identified Figure 1, in 5-minute samples during the early hours of both Friday 27 July 2018 and Tuesday 7 August 2018, hence in contrasting wind conditions as set out above.

3.21 Locations C and D are considered likely to be the best available locations to provide a broadly representative indication of notional night-time L_{A90} background noise levels (i.e. in the absence of the WWTP noise) for the residential properties that are exposed to WWTP noise.

3.22 At Locations C and D the measurement microphone was mounted at ~1.5m above local ground. At Location C, this was approximately 3.5m from a barn/warehouse, such that this structure provided shielding of noise from the WWTP and the Creamery. Location C was in a slight valley and hence shielded from distant noise sources.

3.23 During the 27 July survey, the background noise levels at both Locations C and D were typically in the range 27-30 dB L_{A90}. This represents a low background noise level. During the 7 August survey, the background noise levels at both Locations C and D were typically in the range 20-22 dB L_{A90}. This represents a very low background noise level.

On-site Noise Measurements

3.24 A set of reference noise level measurements was undertaken on the WWTP site in locations near to individual fixed items of noise generating equipment, groups of fixed items, and buildings housing such items.

3.25 This was carried out during the daytime on Monday 6 and Tuesday 7 August 2018 as part of an exercise to assist in determining the most significant noise sources at the site.

3.26 The measurement locations are identified in Figure 2 and described in Table 4 along with the overall measured noise levels. As the fixed noise sources emit generally steady noise levels when in operation, the L_{A90} noise level measurements have been considered.

Table 4 : Summary of On-Site Noise Measurements of Fixed Noise Sources

Location Number (as per Figure 2)	Description	Noise Level L_{A90} dB
1	1m from noisy pipe on gantry between BT1 and Divert [A)]	78
2	1m from two pumps between BT1 and Divert [A)]	82
3	Midway between outside edges of BT1 and Divert [A)]	65
4	Above manhole set back from BT1 and Divert [A)]	60
5	At site boundary set back from BT1 and Divert [A)]	53
6	5m in front of centrifuges (1 on) and atomiser	62
7	5m from half open doors of DAF 1	71
8	5m from roller shutter main open DAF 2	72
9	1m from open pipe [B)]	77
10	At site boundary north of DAF 2	61
11	1m from AT1a aerator/blower	77
12	1m from AT1a aerator (blower not operating)	67
13	1m from AT1b aerator/blower	78
14	North of AT2	56
15	Southeast of AT2	50
16	1m above edge of AT2	68
17	1m from misshapen pipe [C)]	90
18	1m from MCC Generator [D)]	83
19	Rear of DAF 1	71
20	At site boundary, 2m from pumps	67

Notes:

A) The most significant source of noise at the site, particularly at Trewassa, is considered to be the equipment associated with, and/or located in-between, Balancing Tank 1 (BT1) and the Divert Tank. This includes noisy pumps located at ground level, and also noise generated at high level from flexible pipework entering the covered tanks, especially BT1. Accordingly, close-up measurements have been undertaken at ground and gantry levels, as well as measurements from the group of sources at increasing distances. There is a direct line-of-sight from the gantry level noise sources to Trewassa.

B) Measurement relates to a large piece of metal pipe which connects back to noisy gantry level items on BT1. Although the noise level at 1m from the pipe opening is relatively high, this is not considered a highly significant noise source at sensitive receptors due to its orientation.

C) Measurement relates to a piece of flexible pipework running along the ground. It is considered that there is a potentially high level of acoustic energy within this pipe in any case, however this is being exacerbated by a low frequency resonance emitting from a short section that appears to have been misshapen, likely due to being run over by a tractor.

D) Understood to be a temporary item.

3.27 The L_{90} third octave band noise levels corresponding to each of the above measurements are provided in Appendix III.

3.28 As well as the fixed noise sources some measurements were undertaken of tractor activity. Noise levels were measured at typically 30m from a tractor manoeuvring and idling at the sludge processing plant. During this time there was further tractor activity passing in-bound and out-bound from the WWTP site towing vacuum tankers. This was considered representative of worst-case intensity of tractor activity at the site. Over the course of a 5-minute period a noise level of 59dB L_{Aeq} was measured. After tractor activity had ceased a further brief noise measurement was undertaken of the steady residual ambient noise at the same location, and 54dB L_{Aeq} was measured. On this basis a worst-case reference noise level for tractor activity of 57dB L_{Aeq} at 30m may be derived. Accounting for distance and ground absorption, it is likely that this would correspond to a level not exceeding 40dB L_{Aeq} at Location A. As such, this activity noise will not generally contribute to the overall noise level from the WWTP, even though the characteristics of the sound may be distinguishable from the general ambient noise.

Equipment Details

3.29 The noise monitoring at Location A was undertaken using a Rion NL-52 Sound Level Meter (s/n 420711), at Location B using a Norsonic 118 Type 1 Integrating Sound Level Meter (s/n. 31617) and at all other locations using a Bruel & Kjaer 2260 Type 1 Integrating Sound Level Meter (s/n. 2467014).

3.30 The equipment was field calibrated on 26/27 July 2018 using a Norsonic 1251 Acoustic Calibrator (s/n. 20804) and on 6/7 August 2018 using a Rion NC-76 Acoustic Calibrator (s/n. 35173596). No variation in the calibrated noise levels was observed.

3.31 The measurement microphones were fitted with windshields and mounted in free-field conditions at all locations.

4.0 ASSESSMENT OF MEASURED NOISE LEVELS

4.1 It is appropriate to consider the noise impact of the WWTP at the nearest residences by way of assessment in accordance with the guidelines set out in BS 4142.

4.2 To inform the initial estimate of the impact in line with BS 4142, it is necessary to determine representative background, specific and rating levels.

4.3 It is initially proposed to consider the notional background noise levels measured remotely at Locations C and D, away from WWTP noise.

4.4 In terms of the specific level, based on a review of the overall data set from Location A, and notwithstanding very occasional exceedances, it is considered that a level of 48dB L_{Aeq} is representative of typical worst-case conditions at Location A, accounting for variations relating to plant operation and also wind conditions. In more favourable conditions, specific levels less than 45dB L_{Aeq} are common at Location A.

4.5 Location A is closer to the WWTP than any of the residences at Trewassa. It is predicted that noise levels at the actual residential locations will be at least 2dB lower than those measured, i.e. a typical worst-case specific noise level of 46dB L_{Aeq}.

4.6 It is considered that an acoustic feature penalty of +4dB is applicable to the overall noise due to a number of tonal components to the noise. This is considered highly robust as the individual components are well masked by the general ambient noise from the site. This hence yields a worst-case rating level of 50dB L_{Ar} at residential locations.

4.7 The rating level of 50dB is therefore greater than 20dB higher than the worst-case night-time background noise levels measured at Locations C and D. In line with BS 4142, the initial estimate of the impact based on a notional background noise environment, which does not include WWTP noise clearly indicates a significant adverse impact, depending on the context.

4.8 However, assessment on this basis needs to be treated with caution, as the WWTP is essentially a permanent noise source, so comparison to those background noise levels represents an artificial scenario, not one experienced at the actual receptors. Conversely, given that the background noise environment at actual receptors is in fact controlled by the same WWTP noise as the specific, any BS 4142 initial estimate of the impact assessment based on comparison to measurable background noise levels may tend towards an under-estimation of impact.

4.9 In line with BS 4142, it is necessary to consider the indications of the initial assessment in view of the full context of the case. Of particular relevance are the guidelines of BS 4142 that "*where background noise levels and rating levels are low, absolute levels might be as, or more, relevant than the margin by which the rating level exceeds background.*"

4.10 It is hence considered that absolute noise levels are a more appropriate measure of potential noise impact in this case.

4.11 Based on a typical noise reduction of ~15dB via a partially open window, considering a situation with windows open at the worst affected residences at Trewassa, the typical worst-case specific external noise level of 46dB L_{Aeq} may result in an internal noise level within the BS 8233 guideline daytime values but slightly in excess of the guideline night-time values. Furthermore, as set out herein, the guideline absolute noise level values in BS 8233 relate only to noise without specific character, and that where characteristics are present, lower noise limits might be appropriate.

4.12 As such, it is recommended that further reductions of WWTP noise levels are recommended in order to safeguard residential amenity at Trewassa.

4.13 Any measures capable of reducing WWTP noise at Trewassa are also likely to result in reductions of noise at Treworra, however at that location noise levels have already be shown to be considerably lower in the present situation (compared to at Trewassa).

5.0 ASSESSMENT OF POTENTIAL NOISE MITIGATION MEASURES

5.1 In the context of the WWTP site and the above assessment, it is considered that rather than identifying specific targets for further reductions in the overall noise from the WWTP site, this should be approached on the basis of best available and practicable measures.

5.2 As discussed, the most significant WWTP noise sources are considered to be those located close in between the BT1 and Divert tanks. Although the pumps at ground level generate slightly higher levels of noise than the noise emissions for the pipework at gantry level, it is the latter that is considered the more important at Trewassa.

5.3 This is due in part to the lack of ground absorption that is afforded to noise sources located at higher level at the site, compared to those at ground level, which benefit more from propagation over the intervening farmland, when considered at Trewassa.

5.4 As such, it is also considered that a significant component of the overall noise at Trewassa is attributable to the blowers located at gantry level around tanks, particularly those around AT1a and AT1b. However, this is less distinct from the other accumulated noise.

5.5 Many of the areas of site where higher levels are generated at ground level (e.g. DAF 1 and DAF 2) are effectively screened from Trewassa by way of intervening tanks etc. However, this general accumulated noise is also reflected towards Trewassa from the walls of the taller tanks on the site, and again this path of propagation is potentially exacerbated by the lack of ground absorption.

5.6 It is recommended that the main priority in terms of noise mitigation will be to address the primary noise sources at gantry level on the BT1 and the Divert Tanks. The most significant noise source of noise is circled on the photograph, which is a length of flexible pipe at the top of BT1. It may be possible to make system changes to prevent or reduce this noise, or alternatively high-specification acoustic duct/pipe lagging may be considered. It is likely that several layers of lagging would be required. Whilst the circled area is the most significant, mitigation should be considered for all noise sources on the gantry.

5.7 Further to this primary item, it is recommended that all other noisy items in this area of the site are examined and noise levels reduced as best possible. Particularly relevant are the pumps at ground level between the BT1 and Divert Tanks and it may be possible to construct an acoustic enclosure over these units.

5.8 It is also recommended that all gantry level noise sources are mitigated as best possible, potentially including full or partial enclose of the blower units associated with aerators in their current location, or relocation of the blower to ground level locations, which is likely to be beneficial on its own, and will potentially also make applying further mitigation (if necessary) more straightforward.

5.9 Any full / partial acoustic enclosures should typically be formed of solid materials of superficial mass not less than 15kg/m^2 on appropriate framing, with an acoustically absorbent lining to the inner face, typically achieved by way of mineral fibre (e.g. minimum 50mm thick with density 30-60 kg/m^3) retained behind perforated steel sheeting.

5.10 Where full / partial enclosures are recommended, it will be necessary to consult with manufacturers / suppliers of the relevant items to confirm that the proposed noise control measures will not impede the operation of the machinery.

5.11 There is some significant noise associated with DAF 1 and DAF 2. However, in the first instance it is recommended that noise emissions are kept under control simply by ensuring the doors and shutters are kept closed. It is noted that there is presently a notable level of noise break-out to the rear of the DAF 2 building, i.e. to the northwest of the building facing towards Trewassa. This is due to very high internal noise levels from the plant within the building, and also a generally low specification of cladding, which includes open spaces where the upper cladding overhangs the lower level blockwork. However, this building is partly screened from Trewassa (particularly the southern end of the building where the noisiest plant is located) by the intervening BT1 tank and is hence presently less significant at Trewassa than other more dominant noise sources. It is possible, but not certain, that this would become more distinct, and hence a dominant noise source, if existing primary sources are successfully abated. It is therefore recommended that any need to mitigate the DAF 2 noise is re-assessed at a later stage.

5.12 The same is broadly true of other notable noise levels around the site; i.e. while some ground level items away from the north boundary of the site generate variously high levels of noise, these are not distinctively noticeable at Trewassa, and rather contribute to the accumulated general noise, and as such consideration of mitigation in their regard should be re-assessed subsequent to any abatement of the existing main sources of noise.

5.13 It is considered that the noise of the occasional tractor activity that occurs at the site is generally of an acceptable level and character at Trewassa during the daytime, but that this should be kept to a minimum, and ideally excluded, at night.

6.0 SUMMARY AND CONCLUSION

6.1 A baseline noise assessment relating to the Waste Water Treatment Plant (WWTP) associated with the Davidstow Creamery has been carried out.

6.2 A detailed programme of noise measurements and weather monitoring has been undertaken on and around the WWTP site over an extended period. The measured data has been assessed with reference to relevant British Standard guidelines.

6.3 Outline recommendations have been provided for further mitigation measures to assist with noise control at the site.

Figure 1: Off-Site Noise Measurement Locations

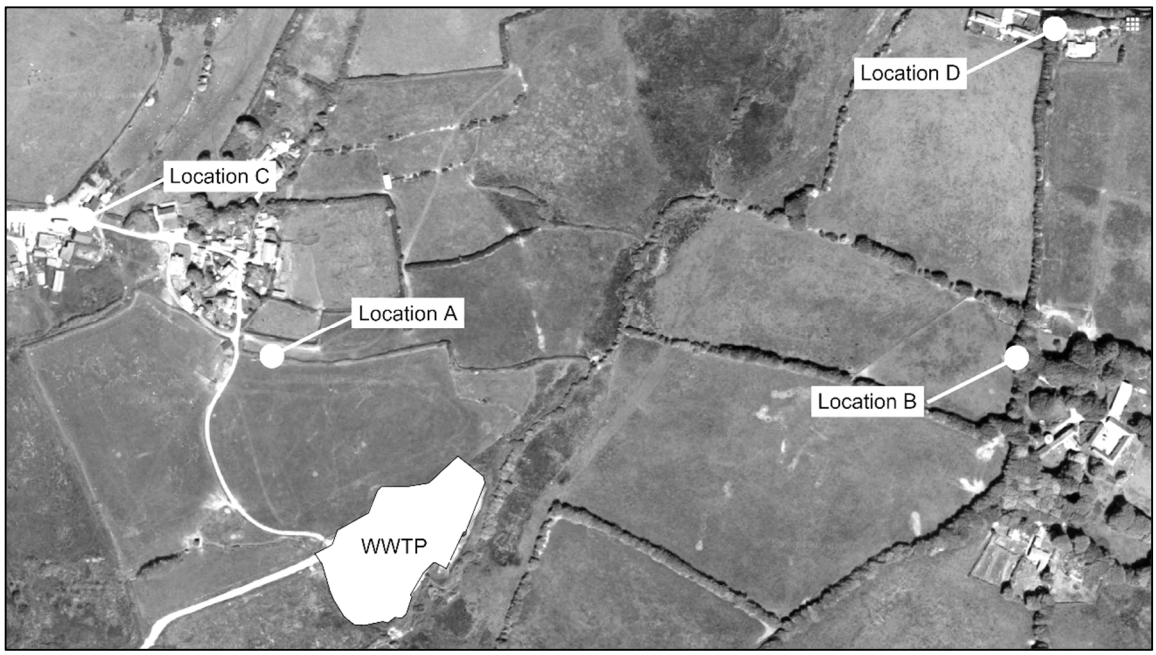
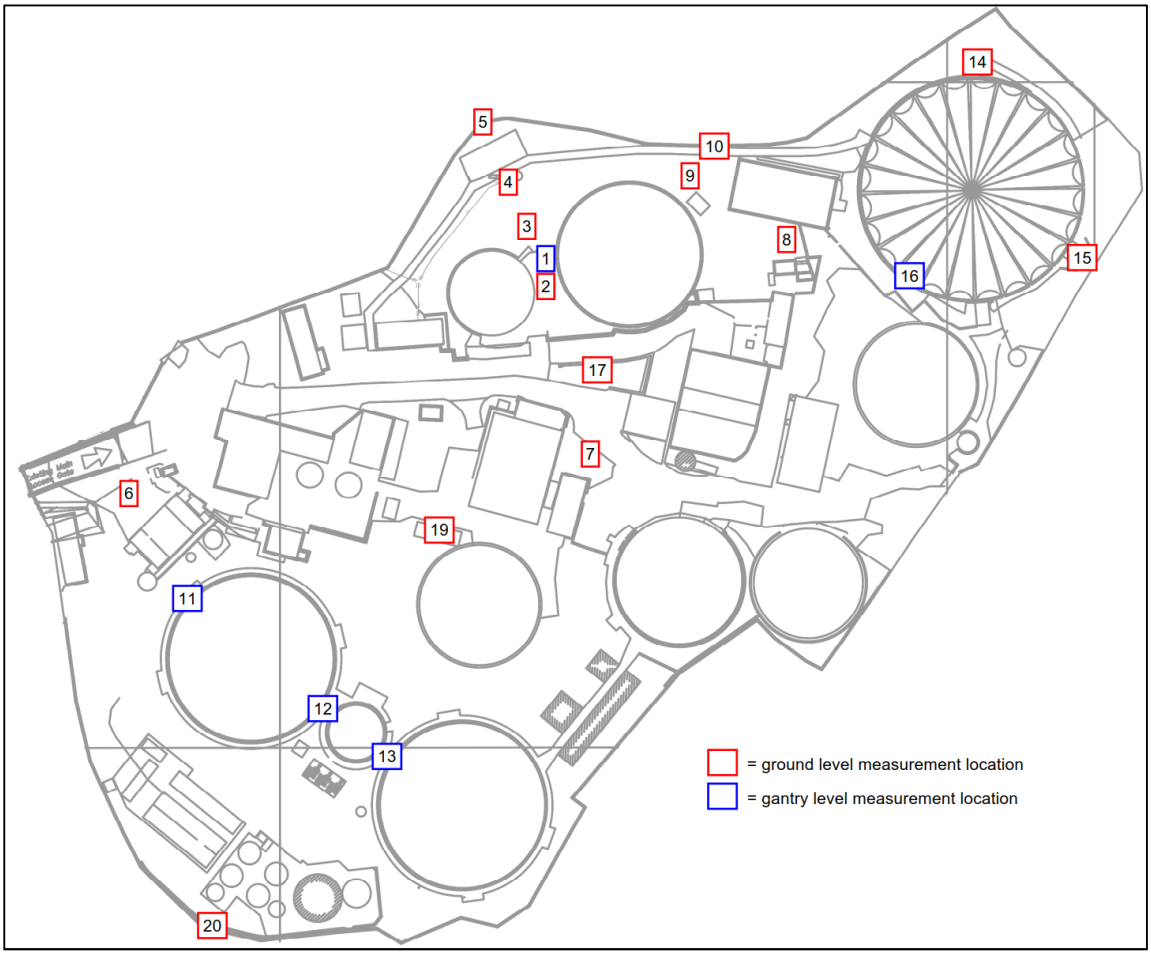


Figure 2: On-Site Noise Measurement Locations



Appendix I: Noise Units & Indices

Sound and the decibel

A sound wave is a small fluctuation of atmospheric pressure. The human ear responds to these variations in pressure, producing the sensation of hearing. The ear can detect a very wide range of pressure variations. In order to cope with this wide range of pressure variations, a logarithmic scale is used to convert the values into manageable numbers. Although it might seem unusual to use a logarithmic scale to measure a physical phenomenon, it has been found that human hearing also responds to sound in an approximately logarithmic fashion. The dB (decibel) is the logarithmic unit used to describe sound (or noise) levels. The usual range of sound pressure levels is from 0 dB (threshold of hearing) to 120dB (threshold of pain).

Due to the logarithmic nature of decibels, when two noises of the same level are combined together, the total noise level is (under normal circumstances) 3 dB(A) higher than each of the individual noise levels e.g. 60 dB(A) plus 60 dB(A) = 63 dB(A). In terms of perceived 'loudness', a 3 dB(A) variation in noise level is a relatively small (but nevertheless just noticeable) change. An increase in noise level of 10 dB(A) generally corresponds to a doubling of perceived loudness. Likewise, a reduction in noise level of 10 dB(A) generally corresponds to a halving of perceived loudness.

The ear is not equally sensitive to sound at all frequencies. It is less sensitive to sound at low and very high frequencies, compared with the frequencies in between. Therefore, when measuring a sound made up of different frequencies, it is often useful to 'weight' each frequency appropriately, so that the measurement correlates better with what a person would actually hear. This is usually achieved by using an electronic filter called the 'A' weighting, which is built into sound level meters. Noise levels measured using the 'A' weighting are denoted dB(A) or dBA.

Frequency and Hertz (Hz)

As well as the loudness of a sound, the frequency content of a sound is also very important. Frequency is a measure of the rate of fluctuation of a sound wave. The unit used is cycles per second, or hertz (Hz). Sometimes large frequency values are written as kiloHertz (kHz), where 1 kHz = 1000 Hz.

Young people with normal hearing can hear frequencies in the range 20 Hz to 20 kHz. However, the upper frequency limit gradually reduces as a person gets older.

Glossary of Terms

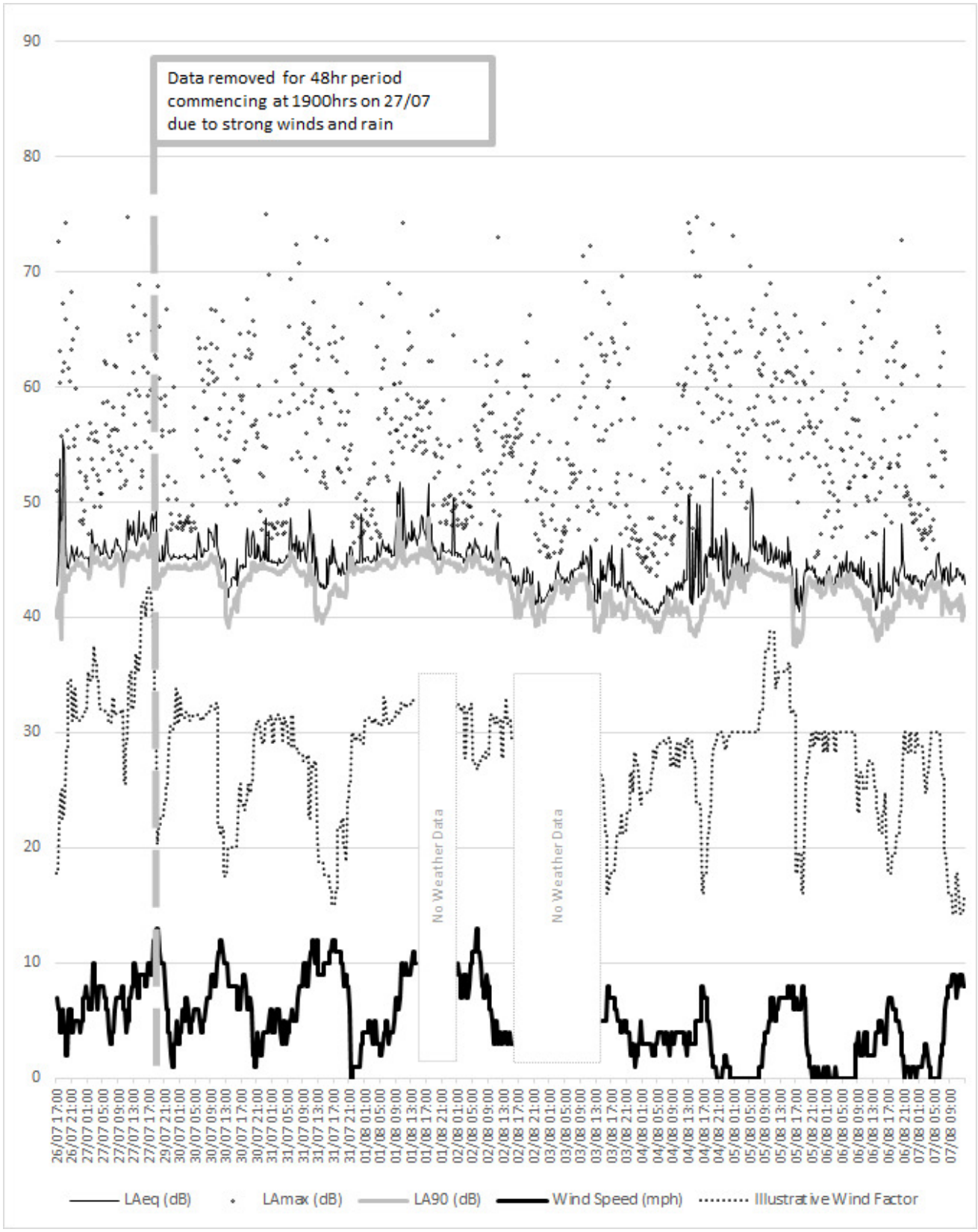
When a noise level is constant and does not fluctuate, it can be described adequately by measuring the dB(A) level. However, when the noise level varies with time, the measured dB(A) level will vary as well. In this case it is therefore not possible to represent the noise climate with a simple dB(A) value. In order to describe noise where the level is continuously varying, a number of other indices can be used. The indices used in this report are described below.

L_{Aeq} This is the A–weighted 'equivalent continuous noise level' which is an average of the total sound energy measured over a specified time period. In other words, L_{Aeq} is the level of a continuous noise which has the same total (A–weighted) energy as the real fluctuating noise, measured over the same time period. It is increasingly being used as the preferred parameter for all forms of environmental noise.

L_{Amax} This is the maximum A–weighted noise level that was recorded during the monitoring period.

L_{A90} This is the A–weighted noise level exceeded for 90% of the time period. L_{A90} is used as a measure of background noise.

Appendix II: Logged Noise and Wind Data at Trewassa – Location A



Appendix III: Third Octave L_{90} On-site Noise Measurements

Location No. (Fig 2)	Noise Level L_{90} dB																							
	Third Octave Band Centre Frequency (Hz)																							
	50	63	80	100	125	160	200	250	315	400	500	630	800	1k	1.25k	1.6k	2k	2.5k	3.15k	4k	5k	6.3k	8k	10k
1	62	58	61	62	64	67	62	66	61	56	59	57	59	63	61	67	66	70	69	66	69	61	54	55
2	77	66	57	60	65	67	66	63	65	67	68	67	66	79	68	67	66	66	63	65	61	60	62	54
3	67	55	51	55	61	65	64	57	53	58	52	51	50	55	49	51	51	53	52	51	49	43	41	40
4	55	51	49	49	47	58	57	44	45	46	44	44	47	53	44	46	44	47	47	46	44	40	37	34
5	58	49	47	48	50	54	52	45	40	39	39	38	39	38	37	37	37	40	42	40	38	31	27	24
6	57	53	52	52	56	55	56	55	53	52	52	51	49	50	50	51	50	48	46	45	43	40	40	33
7	75	63	58	64	66	70	69	60	57	61	63	59	62	59	58	58	57	57	57	56	55	52	48	44
8	64	56	68	56	56	65	57	57	65	61	63	65	61	60	60	60	58	59	58	58	57	52	51	48
9	70	68	68	57	60	63	58	61	79	78	63	62	55	57	48	49	43	44	44	37	34	28	26	22
10	67	68	63	54	57	54	53	54	58	60	55	51	45	42	41	43	38	38	37	36	33	29	27	24
11	66	64	65	68	70	71	74	74	71	63	64	67	64	65	63	65	62	63	62	60	60	54	53	51
12	62	61	64	64	63	63	62	62	61	59	59	59	57	57	52	52	51	52	50	48	47	45	44	43
13	65	66	67	68	69	70	72	77	75	63	64	69	69	66	65	66	65	65	63	61	60	55	56	53
14	50	47	54	53	48	47	46	43	43	44	43	45	46	49	46	44	41	37	34	31	26	21	20	20
15	48	39	43	45	44	44	42	41	39	38	38	38	41	39	39	38	37	35	34	32	31	29	27	24
16	61	56	58	58	60	59	60	60	60	60	60	59	56	56	56	56	55	53	53	52	50	49	46	45
17	76	66	61	75	87	98	96	90	71	65	65	59	61	56	54	53	52	53	52	51	48	43	41	37
18	83	69	71	80	86	88	86	77	71	70	69	70	66	66	66	64	64	63	66	72	59	55	55	54
19	68	61	81	72	59	59	57	60	62	64	62	62	61	60	60	59	56	55	53	51	51	49	50	47
20	57	54	55	49	46	47	50	50	48	51	49	46	51	48	47	50	49	45	44	50	40	47	66	50