Noise Impact Assessment

Site Address: DCS, 12 Baron Ave, Earls Barton, Northamptonshire, NN6 0JE

Client Name: DCS – Tim Tyson

Project Reference No: NP-009785

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1. Introduction

NOVA Acoustics Ltd has been commissioned to prepare a noise impact assessment for the installation of new equipment and plant as part of an environmental permit variation ('the Proposed Development') at Davis Commercial Services Ltd, 12 Baron Ave, Earls Barton, Northamptonshire, NN6 0JE ('the Site').

The applicant is preparing to submit an application to vary environmental permit No. EB3100HN to the Environment Agency ('EA'). This report has been compiled to accompany the permit variation to be submitted to the EA.

A noise survey has been undertaken to establish the prevailing background and ambient sound levels at the closest Noise Sensitive Receptors ('NSRs'). The report details the existing background and ambient sound climate and the predicted noise emissions associated with the Proposed Development. Measures required to mitigate noise impact have been recommended where necessary and assessed in accordance with the relevant performance standards, legislation, policy and guidance. This noise assessment is necessarily technical in nature; therefore, a glossary of terms is included in Appendix A to assist the reader.

1.1 Standards, Legislation, Policy & Guidance

The following performance standards, legislation, policy and guidance have been considered to ensure good acoustic design in the assessment:

- The Environmental Permitting (England and Wales) Regulations 2016 (as amended).
- The Environment Agency Guidance 'Noise and Vibration Management: Environmental Permits (Jan 2022)'.
- National Planning Policy Framework (2023).
- Noise Policy Statement for England (2010).
- BS4142:2014+A1:2019 – 'Methods for rating and assessing commercial and industrial sound'.

Further information on the legislation can be found in Appendix B.

1.2 Proposal Brief

The site sorts and recycles commercial refrigeration waste. The site currently exists across open land and a steel portal frame warehouse that has been Use Class B8 for a number of years. In 2019, under application No. WP/19/00136/CRA ('*certificate of lawful; existing use for B2 Use'*), the Borough of Wellingborough Council commented that the *"planning department and enforcement team has not received any complaints regarding the use of the land and buildings"*. It is understood that due to the current ongoing operations, the Use Class is B2.

Currently, the site receives commercial refrigeration waste via HGVs that are temporally stored externally in the yard. The waste is then transported via electric forklifts or HGVs to the main building where it is manually dismantled with powered screw drivers and hammers. The dismantled waste is then processed through a crusher and granulator (located within the main building) and transported via conveyor belts and bagged/skipped. HGVs then collect the processed waste and take it off site.

The proposal is for HGVs to deliver commercial refrigeration waste where a single electric forklift will unload it to be stored temporally in the yard. When ready, the electric forklift will re-load the waste onto an HGV trailer and be transported to the new 'A1' building up to 3 times day. The waste would then be manually dismantled within the new A1 building. Smaller items of waste are placed into skips (within A1) and then tipped into larger skips outside A1 via an electric forklift. HGV/skip wagons then collect the processed waste from outside the new A1 building up to once an hour, typically 2 to 3 times a day. Larger items of waste containing insulation foam are then transported into the main building via electric forklifts and processed through a crusher and granulator (located within the main building) and transported via conveyor belts and bagged/skipped. Processed waste from within the main building are stockpiled against the eastern elevation of the main building, where a bulker is loaded once a day via a diesel 360 grabber.

NOVA Acoustics has been informed of the following operational times:

- Current:
    - All on-site operations take place between the hours of 08:00 and 22:00,
    - All roller shutter doors are lowered to leave a 1.5m gap at 18:30 hours.
- Proposed:
    - Internal operations within the new A1 building occur between 06:00 to 22:00 hours,
    - All other on-site operations occur between the hours of 08:00 and 22:00,
    - All roller shutter doors are lowered to leave a 1.5m gap at 18:30 hours.

2. Environmental Noise Survey

2.1 Measurement Methodology

The following table outlines the measurement dates and particulars. As the site was unable to completely shut down, surrogate background monitoring locations had to be sort. The acoustic environment at MP1 was found to be uninfluenced by the noise emissions emitted from the site. MP2 was influenced the noise emissions generated by the site, therefore, the time periods immediately before and after the sites operational hours have been considered exclusively. In all instances a 130mm diameter windshield was fitted to the microphones.

Location	Survey Dates	Measurement Particulars
MP1	11-15/08/2023	Equipment mounted on a lamppost along Prince St. The microphone was approximately 3.5m above the ground and at least 3.5m from any other large reflective surface.
MP2	04-06/04/2023	Equipment mounted on a lamppost along Packwood Crescent. The microphone was positioned approximately 3.5m above the ground and at least 3.5m from any other large reflective surface.
MP3	11/08/2023	Equipment mounted on a tripod 1.5m above the ground in line with the closest façade of NSR3. Measurement taken during mid-afternoon break to inform the expected background sound levels at NSR3.

Table 1 – Measurement Methodology

The figure below outlines the site surroundings and measurement locations:

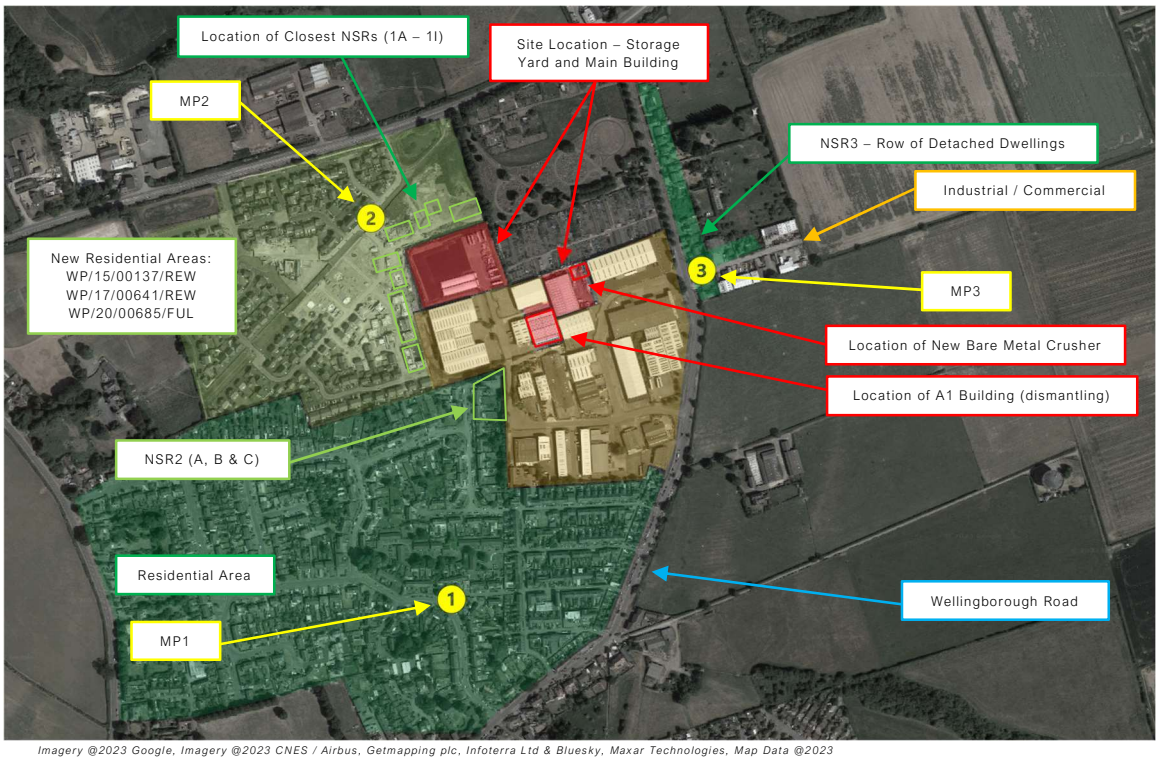


Figure 1 – Measurement Locations and Site Surroundings

2.2 Context & Subjective Impression

The area surrounding the site is mixed in nature with both industrial premises and residential dwellings in close proximity. The site is situated on the fringes of an industrial estate that extends to the south and south-east. Situated to the immediate north, north-west and west of the sites' storage yard is a new housing development (relevant planning applications shown in Figure 1) consisting of 280 No. dwellings.

The acoustic environment at MP2 was found to be dominated by road traffic noise emissions from the A4500 road and surrounding road networks. It should be noted that at the time of the survey, access to the bottom of the housing development was prohibited due to ongoing construction works. Whilst noise emissions from construction activities were audible, they were not deemed to be dominant, nor heavily influencing the background sound levels measured at MP1. Consideration was given to including hours immediately before and after the construction sites operational hours, however, rush hour traffic was deemed to have heavily influenced the acoustic environment which would result in less representative background sound levels.

The closest NSRs to the storage yard are those new build properties at the northern and western site boundary. The site drawings for the new housing development have been taken from the planning portal and used to locate the closest NSRs (NSR1A at the north-east of boundary down to NSR1I at the south-west boundary) which have been indicated in Figure 1. During the site visits, the noise emissions generated by the loading and unloading of waste was clearly perceptible at these closest NSRs and at MP2, particularly during lulls in road traffic flow.

A two-storey apartment block is situated at the end of 'The Pyghtle'. This is considered to be NSR2(A), and the terraced dwellings just southwards are labelled NSR2(B & C). During the attended monitoring at NSR2(A), noise emissions from other HGV pass-bys and 'M&B Commercials' were clearly audible. Noise emissions from the DCS's storage yard were faintly audible when loading/unloading takes place, however, noise generated by the proposed activities within and adjacent to the new A1 building (for the purpose of this assessment) were clearly perceptible. The noise emissions included those from the diesel 360 grabber, the electric forklift tipping waste into skips and transient noise breakout from the open roller shutter door that faces southwards. The acoustic environment at NSR2 activity was deemed to be low in level during periods of little or no site, and sporadically influenced by HGV activity from within the industrial estate. Noise breakout from the adjacent industrial units was minimal and not audible over the distant road traffic noise emissions from the surrounding road networks.

A row of detached dwellings along Wellingborough Road are considered as NSR3, the closest being approximately 137m to east of the site located on the junction at Titley Bawk Ave. During the attended monitoring at NSR3 the noise emissions from the site were just perceptible during lulls in road traffic flow. The noise emissions were faintly audible, primarily continuous and broadband in nature, breaking out from the open roller shutter door of the main building that faces eastwards towards NSR3, however, impulsivity from waste tipping was also just perceptible. During periods of minimal / no on-site activity and lulls in road traffic flow, the acoustic environment was deemed to be akin of that experienced at MP1.

The acoustic environment at MP1 was deemed to be low in level and was dominated by nonanthropogenic noise sources (bird song and tree rustling). Sporadic road traffic noise emissions then dominate the noise profile during pass-bys.

2.3 Environmental Noise Survey Results

Background & Ambient Sound Level Results Summary

The following section outlines the measured background sound levels that have been used as the baseline for the subsequent BS4142 noise assessments.

The background sound levels measured at MP1 have been derived from the operational time periods of:

- 06:00 to 07:00 hours when internal operations are proposed with the new A1 building,
- 07:00 to 22:00 hours when all other on-site activities occur (between 07:00 – 13:00 hours on Saturdays and excluding Sundays).

The background sound levels measured at MP2 have been derived from the hours immediately before 08:00 hours and after 22:00 hours. The table below outlines the background and ambient sound levels used as the baseline for the noise impact assessments (highlighted in bold). Full time histories, statistcal analysis and weather conditons can be seen in Appendix C.

Description	Lowest $L_{Aeq,1hr}$ (dB)	$L_{A90,15min}$ (dB)
MP1: 06:00 – 07:00 hours (Proposed A1 Building Internal Ops)	**45** **(Saturday: 06:00 – 07:00)**	**41**
MP1: 07:00 – 22:00 hours (All Site Activities)	**45** **(Tuesday: 20:00 – 21:00)**	**40**
MP2: 07:00 – 08:00 hours	53	52
MP2: 22:00 – 23:00 hours	49	48

Table 2 – Background & Ambient Sound Level Results Summary

Please note that the background sound levels measured at MP1 have been used as the baseline for the subsequent BS4142 assessments. The location of MP2 was compromised due to ongoing construction works at the time of the survey. Upon further site visits it became apparent that the closest gardens and façades of NSR1 (all closest plots) are not as subjected to the road traffic noise emissions from the A4500 and the noise profile was more akin to that at MP1.

Short-Term Ambient & Background Sound Level Results Summary

The table below outlines the ambient and background sound levels measured at NSR3 during an approximate 10-minute break during the late afternoon; no noise emissions were generated by the site during this period.

Description	$L_{Aeq,1min}$ (dB)	$L_{A90,1min}$ (dB)	Notes
MP3: 18:21 – 18:33 hours (breaktime)	41 – 61	36 – 44	Sporadic road traffic noise from Wellingborough Road dominant.

Table 3 – Background & Ambient Sound Level Results Summary – MP3

As seen in the table above, similar sound levels to MP1 were recorded at MP3 during a breaktime on-site, suggesting that the ambient and background sound levels measured at MP1 are fair representation of

those found at NSR3, particularly during the late afternoon and evening when road traffic levels have decreased.

3. BS4142 NIA of Existing Operations

In the following section of the report, the impact of the noise emissions generated by the site's current operations are assessed.

3.1 Summary of On-Site Measurements – Existing Operations

For all onsite measurements the following measurement methodology was adhered to:

- Internal ambient measurements were taken at 1.5m above the ground in various locations within the warehouse units.
- Where residual sound levels could not be measured due to the nature of operations, measurements were instead taken at a location where the noise source of interest was dominant; a difference of at least 10 dB was sort after.
- All measurements were taken using a fast time-weighting and the sound level meter was set to log every 0.1s.

Short-Term Sound Level Results Summary

The following table outlines the results summary of the spot measurements taken on-site.

Description	1/1 Octave Frequency Band (Hz, L_{eq}, dB)								Overall (dBA)
	63	125	250	500	1k	2k	4k	8k	
Specific Sound Level of Electric FL Loading Waste onto HGV Trailer (9m)	60	55	57	56	56	58	57	50	64
Internal Ambient Noise Level of Main Building	76	78	80	81	81	78	74	69	85
Main Building East RSD (5m)	67	64	66	70	70	68	61	54	74
Main Building East RSD (10m)	64	63	63	68	68	65	61	54	72
Main Building West RSD (5m)	66	66	68	70	68	66	60	52	73
Main Building West RSD (10m)	66	66	65	66	65	63	56	47	69
Specific Sound Level of Electric FL Tipping Processed Waste Outside of Main Building (15m)	64	62	56	59	65	68	66	61	73
Ambient Sound Level at Site Entrance to Main Building	55	51	50	47	48	41	33	23	51

Table 4 – On-Site Spot Measurement Results Summary

3.2 Specific Sound Levels & Noise Modelling Data

Noise Breakout Emissions from Main Building

The noise breaking out of the main processing building has been calculated within SoundPlan 9.0 software in accordance with BS12354. The following assumptions have been made within the calculations:

- The building is a 100mm brick-built structure (assumed min. density of 1600 kg/m^3) with a composite panel roof akin to Kingspan KS1000RW panels. The assumed sound reductions have been calculated within INSUL 9.0 or the manufacturers datasheets which can be found in Appendix D.
- All fire doors are expected to be FD30 solid core fire doors which have been modelled as 45mm MDF in INSUL 9.0.
- Both roller shutter doors are a minimum 0.6mm steel, however, they remain completely open between the hours of 08:00 to 18:30, at which point they are pulled down to leave a 1.5m gap at the bottom.

The following table outlines the assumed sound reduction values for each building fabric element.

Description	1/1 Octave Frequency Band (Hz, R dB)								Rw (dB)
	63	125	250	500	1k	2k	4k	8k	
100mm Brick (INSUL 9.0)	35	38	34	38	46	53	59	59	44
KS1000RW Panel (Manufacturer Datasheet)	20	18	20	24	20	29	39	47	25
45mm Solid Core Fire Door (INSUL 9.0)	22	25	29	29	31	40	49	49	33
0.6mm Profile Steel RSD (INSUL 9.0)	8	10	14	19	24	29	34	34	23
Gaps / Open RSD	0	0	0	0	0	0	0	0	0

Table 5 – Assumed Sound Reduction Values of Building Fabric Elements

The external measurements of the roller shutter doors have indicated higher internal noise levels than had been initially measured. The table below outlines the corrected internal ambient noise levels of the main building which have been calibrated within the noise modelling software.

Description	1/1 Octave Frequency Band (Hz, L_{eq}, dB)								Overall (dBA)
	63	125	250	500	1k	2k	4k	8k	
Internal Ambient Noise Level of Main Building	76	78	80	81	81	78	74	69	85
Corrected Internal Ambient Noise Level	79	81	83	84	84	81	77	72	88

Table 6 – Corrected Internal Ambient Noise Levels of Main Building

Sound Power Levels of External Noise Sources

The table below outlines the sound power levels of all external operations (corrected for residual noise where applicable) and the on-time corrections over a 1-hour period. Full calculations can be found in Appendix E and all on-time corrections have been applied within the noise modelling software. Where spot measurements of existing on-site operations could not be conducted, noise data obtained by NOVA Acoustics for similar sites have been utilised; references are detailed within the table below.

Description	1/1 Octave Frequency Band (Hz, Lw dB)								Overall Lw (dBA)	Time Correction
	63	125	250	500	1k	2k	4k	8k		
Electric FL Unloading/Loading HGV	87	82	84	83	83	85	84	78	91	15-mins
Electric FL Tipping Processed Waste Adjacent to Main Building	96	94	88	91	97	100	98	93	104	5-mins

Table 7 – L_W of External Noise Sources

The table below outlines the time corrected sound power levels of a single HGV and electric forklift pass-by over a 1-hour period. Please note that the sound power levels presented in the following table are the input values only, speed and the number of events has been applied within the noise modelling software. Full calculations can be found in Appendix E. Where spot measurements of existing on-site operations could not be conducted due to little activity, noise data obtained by NOVA Acoustics for similar sites have been utilised:

- Electric forklift pass-bys were measured at 3m and an average SEL was calculated from multiple measurements.
- HGV pass-bys were measured at 3m.

Description	1/1 Octave Frequency Band (Hz, Lw dB)								Overall Lw (dBA)
	63	125	250	500	1k	2k	4k	8k	
HGV Pass-by (Report No. 6152FF)	102	95	93	91	90	89	83	77	95
Electric FL Pass-by (Report No. NP-008984)	49	50	50	53	53	51	51	41	58

Table 8 – Time Corrected L_W of Mobile Plant

Noise Modelling

The following assumptions have been made within the SoundPlan 9.0 noise modelling software:

- To accurately model the land surrounding the Site, the topographical data has been taken from the EA's 'National LIDAR Programme' on the DEFRA Data Services Platform.
- For the purpose of the assessment, the ground between the source and receivers is considered to consist of primarily acoustically 'hard' surfaces.
- Where source data was provided with octave band data, it was used to facilitate noise modelling in accordance with ISO 9613-2. ISO 9613-2 assumes a 'downwind' model to the NSRs.
- The sound map grid height has been set to 1.5m, however, the noise levels used in the assessment has been taken from the most exposed point of each façade.
- The site and all other buildings and any intervening objects have been modelled according to measurements taken on-site and those provided by the LIDAR data.
- One situation has been assessed:
    - 08:00 to 22:00 hours when all operations take place.
- The noise emissions breaking out of the main processing building are calculated within the noise modelling software in accordance with BS12354 assuming the following:
    - The internal ambient noise levels presented in Table 6,
    - The sound reduction values for each building fabric element presented in Table 5,
    - A -3 dB diffusivity term correction for breakout from solid reflective building structures,
    - A 0 dB diffusivity term correction for breakout from open roller shutter doors.
- Any building fabric elements are assumed to behave as area noise sources which is calculated within the SoundPlan software considering the formula: $L_W = L_{P1m} + 10*Log(S)$, where S is the surface area of the building element and L_{P1m} are the external noise levels calculated in accordance with BS12354.
- The following on-time corrections per 1-hour assessment period have been made within the noise model for each scenario:
    - 20 No. electric forklift movements between the yard and the main building,
    - 5 No. electric forklift movements between the processed waste stockpile area and the main building,
    - 1 No. HGV pass-by from the yard to the main building,
    - 1 No. HGV entering & exiting the yard,
    - 15-minutes of an electric forklift unloading/loading a HGV within the yard and adjacent to main building,
    - 5-minutes of an electric forklift tipping processed waste into the stockpile adjacent to the eastern elevation of the main building.
- The sound levels presented in Table 4 have been used to inform the noise model.

The sound map showing the specific sound levels emissions from the site can be seen in the following figures.

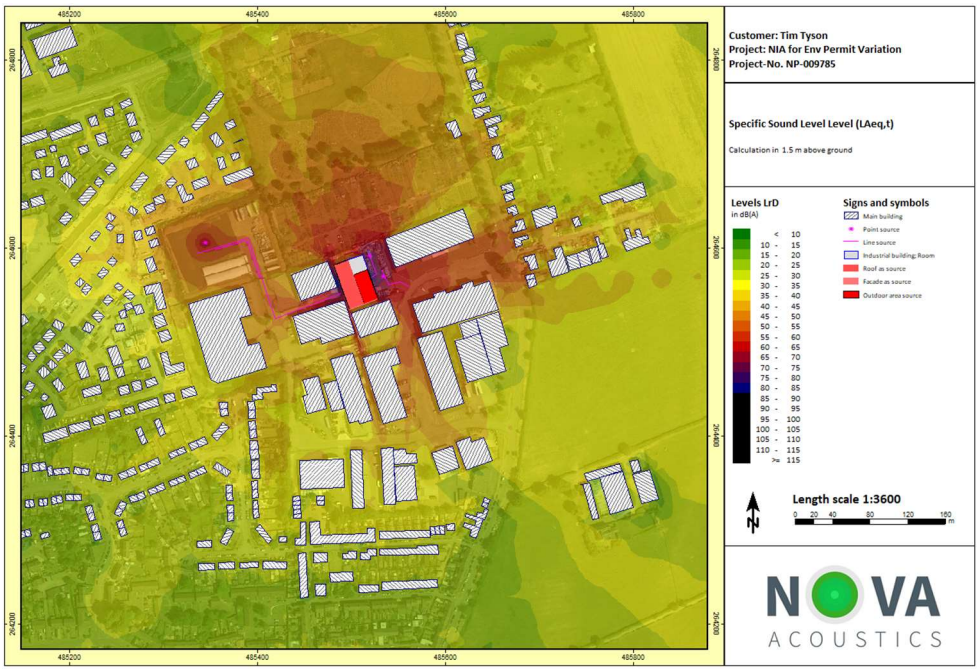


Figure 2 – Specific Sound Level Map (Existing Operations)

3.3 BS4142 Noise Impact Assessment of Existing Operations

The BS4142 noise impact assessments are conducted at the most affected NSRs in the following table.

Description	NSR								
	1(C)	1(E)	1(G)	1(H)	1(I)	2(A)	3(A)	3(C)	3(D)
Predicted Specific Sound Level	46	45	45	45	43	39	49	49	49
Acoustic Feature Correction	+6*	+6*	+6*	+6*	+6*	+3**	+3**	+3**	+3**
Rating Sound Level ($L_{Ar,T}$)	52	51	51	51	49	42	52	52	52
Background Sound Level MP1 $L_{A90,15min}$: 07:00 to 22:00 hours	40	40	40	40	40	40	40	40	40
Exceedance of L_{A90}	+12	+11	+11	+11	+9	+2	+12	+12	+12

Table 9 – BS4142 Noise Impact Assessment of Existing Operations

**A +6 dB penalty for 'clearly perceptible' impulsivity has been applied in accordance with the subjective method of BS4142. The noise emissions from the loading/unloading of waste is at times impulsive as forklift operatives accidentally knock the metal waste against the HGV trailer and when placing waste onto the floor.*

***A +3 dB penalty for 'just perceptible' impulsivity has been applied in accordance with the subjective method of BS4142. The impulsive noise emissions from manual dismantling within the main building and from the loading/unloading of waste is much less perceptible at NSR2 and NSR3 compared with NSR1.*

Discussion:

The BS4142 assessment above shows that the rating sound levels during operations between 08:00 to 16:00 hours at the most affected NSRs are causing:

- NSR1 – 'adverse impact, dependent on context',
- NSR2 – 'low impact, dependent on context',
- NSR3 – 'adverse impact, dependent on context.

When assessed in accordance with the NPSE and NPPF this equates to:

- NSR1 – between 'Lowest Observed Adverse Effect Level' ('LOAEL') and 'Significant Observed Adverse Effect Level ('SOAEL'),
- NSR2 – 'No Observed Adverse Effect Level ('NOAEL')
- NSR3 – between 'Lowest Observed Adverse Effect Level' ('LOAEL') and 'Significant Observed Adverse Effect Level ('SOAEL').

The BS4142 assessment shows that the rating sound levels during operations between 16:00 to 22:00 hours are causing:

- NSR1 – 'adverse impact, dependent on context' to 'significant adverse impact, dependent on context.
- NSR2 – a low level of 'adverse impact, dependent on context',
- NSR3 – 'significant adverse impact, dependent on context.

When assessed in accordance with the NPSE and NPPF this equates to:

- NSR1 – between 'Lowest Observed Adverse Effect Level' ('LOAEL') and 'Significant Observed Adverse Effect Level ('SOAEL'),
- NSR2 – 'Lowest Observed Adverse Effect Level' ('LOAEL'),
- NSR3 – 'Significant Observed Adverse Effect Level ('SOAEL').

It is understood that the site has been operating for several years and that the industrial estate is frequently busy with other HGV movements, however, it is clear that the site is currently causing impact, which is further corroborated by the subjective impression obtained during the site visits.

4. BS4142 NIA of Proposed Permit Variation

In the following section of the report, the impact from the proposed permit variation is assessed.

4.1 Adopted Criteria

To ensure low impact, the following criteria has been adopted:

- The cumulative BS4142 rating sound levels of the permit variation shall not exceed the background sound level by greater than 5 dB.
- The specific sound levels from the permit variation shall not constructively add to the existing ambient sound levels at each NSR by more that what is classified as 'not significant' in accordance with the IEMA 'Guidelines on Noise Impact'.

4.2 Summary of On-Site Measurements – Proposed Operations

Short-Term Sound Level Results Summary

The following table outlines the results summary of the spot measurements taken on-site.

Description	1/1 Octave Frequency Band (Hz, L_{eq}, dB)								Overall (dBA)
	63	125	250	500	1k	2k	4k	8k	
Average Internal Ambient Noise Level of A1 Building During Manual Dismantling	74	76	77	79	80	80	76	70	85
A1 Building South RSD at 1m	74	73	72	72	73	73	71	66	79
A1 Building South RSD at 8m	72	70	69	70	71	69	66	62	75
Doosan DX-250 WHM 360 Grabber Loading Metal Waste into Skip (15m)	71	70	73	69	71	65	59	55	74
FL Tipping Dismantled Waste into Skip Adjacent to A1 (5m)	79	76	81	82	83	82	80	77	88

Table 10 – On-Site Spot Measurement Results Summary (Proposed Operations)

4.3 Specific Sound Levels & Noise Modelling Data

Noise Breakout Emissions from Main Building

No material change in noise emissions emitted from the main building for the following reasons:

- The internal ambient noise profile is dominated by noise emissions generated by the crusher unit and associated fixed plant, which is to be retained.
- No alteration in the operational times is proposed.

The internal noise levels presented in Table 4 have also been used in the following assessment.

Noise Breakout Emissions from A1 Building

The new A1 building is to house all manual dismantling. The noise breaking out of the new A1 building has been calculated within SoundPlan 9.0 software in accordance with BS12354. The following assumptions have been made within the calculations:

- The building is a steel portal frame and composite panel (akin to Kingspan KS1000RW) structure. A 2m tall internal leaf constructed from 100mm blockwork (assumed min. density of 1600 kg/m^3) exists. The assumed sound reductions have been calculated within INSUL 9.0 or the manufacturers datasheets which can be found in Appendix D.
- All fire doors are expected to be FD30 solid core fire doors which have been modelled as 45mm MDF in INSUL 9.0.
- Both roller shutter doors are a minimum 0.6mm steel, however, they remain completely open between the hours of 08:00 to 18:30, at which point they are pulled down to leave a 1.5m gap at the bottom.

The following table outlines the assumed sound reduction values for each building fabric element.

Description	1/1 Octave Frequency Band (Hz, R dB)								Rw (dB)
	63	125	250	500	1k	2k	4k	8k	
100mm Blockwork (INSUL 9.0)	35	38	35	38	46	54	60	60	44
KS1000RW Panel (Manufacturer Datasheet)	20	18	20	24	20	29	39	47	25
45mm Solid Core Fire Door (INSUL 9.0)	22	25	29	29	31	40	49	49	33
0.6mm Profile Steel RSD (INSUL 9.0)	8	10	14	19	24	29	34	34	23
Gaps / Open RSD	0	0	0	0	0	0	0	0	0

Table 11 – Assumed Sound Reduction Values of Building Fabric Elements (A1)

Sound Power Levels of External Noise Sources

The unloading/loading of metal refrigeration waste is to remain the same, however, the following is proposed:

- Only HGVs will transport the waste to new A1 building for manual dismantling.
- Electric forklifts will transport larger items of dismantled waste with insulation foam into the main building for further processing. Electric forklifts then tip a portion of the processed waste into the stockpile located outside of the main building (to remain the same).
- A bulker HGV is then loaded with the stockpiled processed waste via a Doosan 360 grabber up to once an hour, typically 2 to 3 times a day.
- An electric forklift will tip smaller items of dismantled waste (from within A1) to skips located adjacent to the southern roller shutter of the A1 building.
- RORO/skip wagons then collect the processed waste from outside the new A1 building up to once an hour, typically 2 to 3 times a day.

The table below outlines the sound power levels of all proposed external operations (corrected for residual noise where applicable) and the on-time corrections over a 1-hour period. Full calculations can be found in Appendix E and all on-time corrections have been applied within the noise modelling software. Where spot measurements of existing on-site operations could not be conducted, noise data obtained by NOVA Acoustics for similar sites have been utilised; references are detailed within the table below.

Description	1/1 Octave Frequency Band (Hz, L_W dB)								Overall L_W (dBA)	Time Correction
	63	125	250	500	1k	2k	4k	8k		
Electric FL Unloading/Loading HGV	87	82	84	83	83	85	84	78	91	15-mins
Electric FL Tipping Processed Waste Adjacent to Main Building	96	94	88	91	97	100	98	93	104	5-mins
Doosan DX-250 WHM 360 Grabber Loading Waste into Skip / Bulker	103	102	105	101	103	97	91	87	105	20-mins
RORO Skip Collection (Report No. 7011FR)	88	88	86	89	88	86	80	71	92	5-mins
Electric FL Tipping Waste into Skip Adjacent to A1	101	98	103	104	105	104	102	99	110	1-min

Table 12 – L_W of Proposed External Noise Sources

The table below outlines the time corrected sound power levels of a single HGV and electric forklift pass-by over a 1-hour period. Please note that the sound power levels presented in the following table are the input values only, speed and the number of events has been applied within the noise modelling software. Full calculations can be found in Appendix E.

Description	1/1 Octave Frequency Band (Hz, L_w dB)								Overall L_w (dBA)
	63	125	250	500	1k	2k	4k	8k	
HGV Pass-by (Report No. 6152FF)	102	95	93	91	90	89	83	77	95
Electric FL Pass-by (Report No. NP-008984)	49	50	50	53	53	51	51	41	58

Table 13 – Time Corrected L_w of Mobile Plant

Noise Modelling

The following assumptions have been made within the SoundPlan 9.0 noise modelling software:

- The same environmental standards and noise map particulars have been assumed.
- Three situations have been assessed:
    - 06:00 to 07:00 hours when manual dismantling of waste is to place within the new A1 building as part of the proposed environmental permit variation,
    - 07:00 to 22:00 hours showing the specific sound level emissions from the proposed permit variation only,
    - 07:00 to 22:00 hours when all operations take place.
- The noise emissions breaking out of the main processing building are identical to the existing scenario.
- The noise emissions breaking out of the new A1 building are calculated within the noise modelling software in accordance with BS12354 assuming the following:
    - The internal ambient noise levels presented in Table 10,
    - The sound reduction values for each building fabric element presented in Table 11,
    - A -3 dB diffusivity term correction for breakout from solid reflective building structures,
    - A 0 dB diffusivity term correction for breakout from open roller shutter doors.
- Any building fabric elements are assumed to behave as area noise sources which is calculated within the SoundPlan software considering the formula: $L_W = L_{P1m} + 10*Log(S)$, where S is the surface area of the building element and L_{P1m} are the external noise levels calculated in accordance with BS12354.
- The following on-time corrections per 1-hour assessment period have been made within the noise model for the 07:00 to 22:00 hours scenario of all operations:
    - 20 No. electric forklift movements between the new A1 building and main building,
    - 5 No. electric forklift movements between the processed waste stockpile area and the main building,
    - 2 No. HGV movements between the yard to the new A1 building,
    - 1 No. HGV entering & exiting the yard,
    - 15-minutes of an electric forklift unloading/loading a HGV within the yard,
    - 5-minutes of an electric forklift tipping processed waste into the stockpile adjacent to the eastern elevation of the main building,
    - 1-minute of the electric forklift tipping dismantled waste into a skip by the A1 building,
    - 1 No. RORO HGV enters and exits the site adjacent to the A1 building,
    - 5-minutes of a RORO skip collection adjacent to the A1 building,
    - 1 No. bulker HGV entering and exiting the yard adjacent to the main building,
    - 20-minutes of the Doosan 360 grabber loading the bulker HGV,
- The on-time corrections for the noise model of specific emissions from the proposed permit variation between the hours of 07:00 to 22:00 includes the same as above, excluding the noise breakout from the main processing building or the electric forklift unloading/loading the HGV trailer in the yard.
- The noise model of the specific emissions between 06:00 to 07:00 hours include only noise breakout from the manual dismantling within the new A1 building.

The sound map showing the specific sound levels emissions from the site can be seen in the following figures.

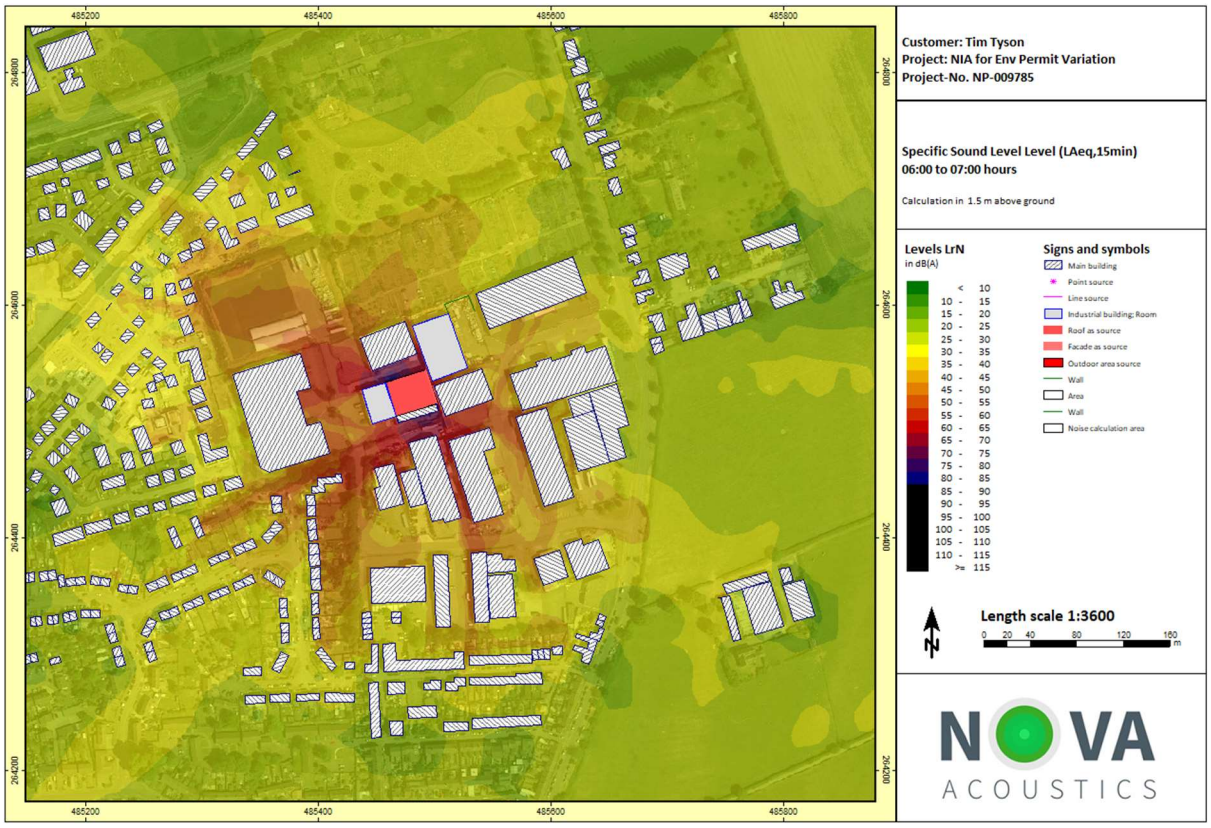


Figure 3 – Specific Sound Level Map (Proposed Operations: 06:00 to 07:00 hours)

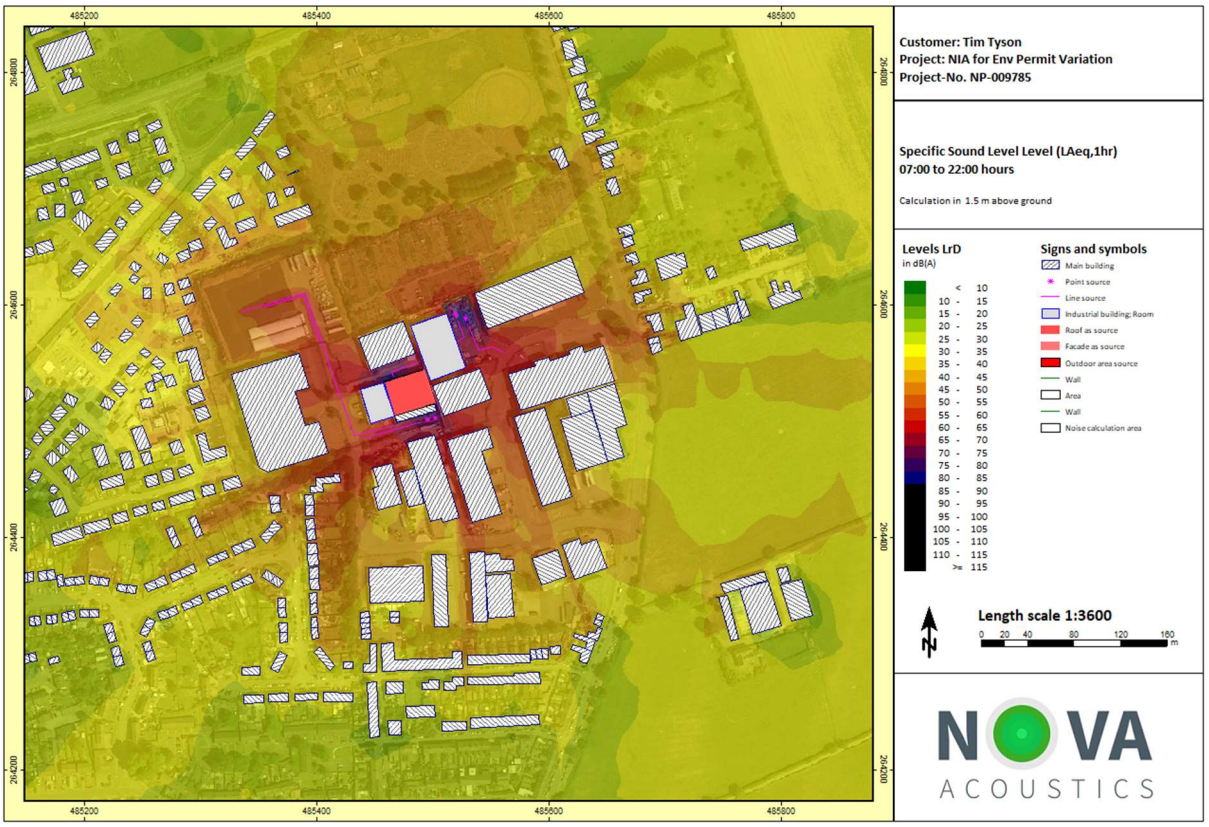


Figure 4 – Specific Sound Level Map (Proposed Operations: 07:00 to 22:00 hours)

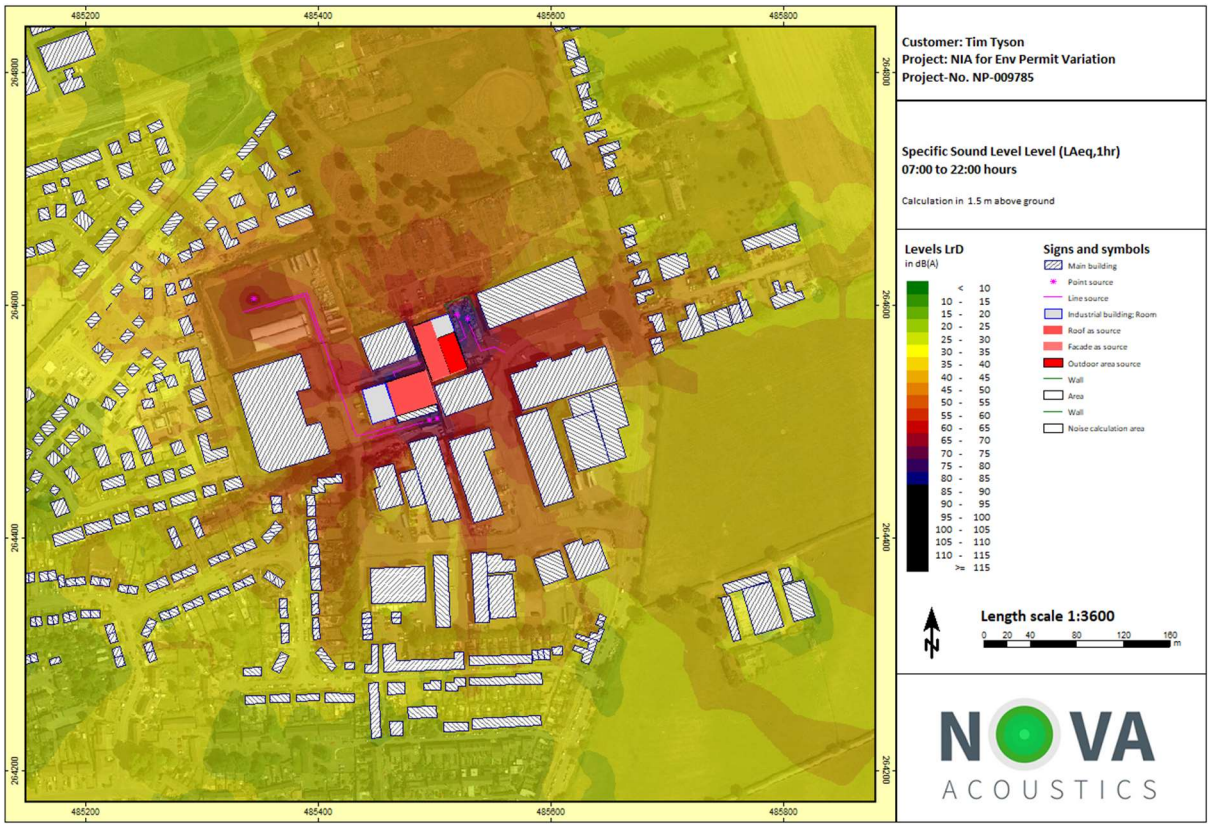


Figure 5 – Specific Sound Level Map (Cumulative Operations: 07:00 to 22:00 hours)

4.4 BS4142 Noise Impact Assessment of Proposed Operations

The BS4142 noise impact assessments are conducted at the closest NSRs in the following tables.

06:00 to 07:00 hours – Specific of Manual Dismantling in New A1 Building

NIA of Proposed Operations: 06:00 – 07:00 hours (Manual Dismantling in A1 Building)									
Description	NSR								
	1(C)	1(E)	1(G)	1(H)	1(I)	2(A)	3(A)	3(C)	3(D)
Predicted Specific Sound Level of Proposed Operations	43	45	46	46	45	55	33	31	34
Acoustic Feature Correction	+3**	+3**	+3**	+3**	+3**	+6**	+3**	+3**	+3**
Rating Sound Level ($L_{Ar,T}$)	46	48	49	49	48	61	36	34	37
Background Sound Level MP1 $L_{A90,15min}$: 06:00 to 07:00 hours	41	41	41	41	41	41	41	41	41
Exceedance of L_{A90}	+5	+7	+8	+8	+7	+20	-5	-7	-5

Table 14 – BS4142 Noise Impact Assessment of Proposed Operations (06:00 to 07:00 hours)

**A +6 dB penalty for 'clearly perceptible' impulsivity has been applied in accordance with the subjective method of BS4142 due to the impulsive noise emissions from manual dismantling within the A1 building.*

***A +3 dB penalty for 'just perceptible' impulsivity has been applied in accordance with the subjective method of BS4142 due to the impulsive noise emissions from manual dismantling within the A1 building.*

Discussion:

The BS4142 assessment above shows that the rating sound levels during operations between 06:00 to 07:00 hours at the closest NSRs are causing:

- NSR1 – 'adverse impact, dependent on context,
- NSR2 – 'significant adverse impact, dependent on context,
- NSR3 – 'low impact, dependent on context.

When assessed in accordance with the NPSE and NPPF this equates to:

- NSR1 – Between 'Lowest Observed Adverse Effect Level ('LOAEL') and 'Significant Observed Adverse Effect Level ('SOAEL'),
- NSR2 – 'Significant Observed Adverse Effect Level ('SOAEL'),
- NSR3 – Between 'No Observed Effect level' ('NOEL') to 'No Observed Adverse Effect Level ('NOAEL').

07:00 to 22:00 hours – Specific to Proposed Permit Variation Operations

NIA of Proposed Operations: 07:00 to 22:00 hours (Specific to Proposed Permit Variation)									
Description	NSR								
	1(C)	1(E)	1(G)	1(H)	1(I)	2(A)	3(A)	3(C)	3(D)
Existing Specific Sound Level (Table 9)	46	45	45	45	43	39	49	49	49
Predicted Specific Sound Level of Proposed Operations	46	47	47	48	46	56	48	50	41
Acoustic Feature Correction	+3*	+3*	+3*	+3*	+3*	+6**	+6**	+6**	+6**
Rating Sound Level ($L_{Ar,T}$)	49	50	50	51	49	62	54	56	47
Background Sound Level MP1 $L_{A90,15min}$: 07:00 to 22:00 hours	40	40	40	40	40	40	40	40	40
Exceedance of L_{A90}	+9	+10	+10	+11	+9	+22	+14	+16	+7

Table 15 – BS4142 Noise Impact Assessment of Proposed Operations (07:00 to 22:00 hours)

**A +3 dB penalty for 'clearly perceptible' impulsivity has been applied in accordance with the subjective method of BS4142 due to the impulsive noise emissions from manual dismantling within the A1 building.*

***A +6 dB penalty for 'clearly perceptible' impulsivity has been applied in accordance with the subjective method of BS4142. The impulsive noise emissions from manual dismantling within the A1 building, the tipping of waste into the skips adjacent to A1 are clearly perceptible at NSR2.*

Discussion:

The BS4142 assessment above shows that the rating sound levels during operations between 16:00 to 22:00 hours at the closest NSRs are causing:

- NSR1 – 'significant adverse impact, dependent on context,
- NSR2 – 'significant adverse impact, dependent on context,
- NSR3 – 'significant adverse impact, dependent on context.

When assessed in accordance with the NPSE and NPPF this equates to:

- NSR1 – 'Significant Observed Adverse Effect Level ('SOAEL'),
- NSR2 – 'Significant Observed Adverse Effect Level ('SOAEL'),
- NSR3 – 'Significant Observed Adverse Effect Level ('SOAEL').

07:00 to 22:00 hours – Cumulative of Existing and Proposed Permit Variation Operations

NIA of Proposed Operations: 07:00 to 22:00 hours (Cumulative of Existing and Proposed)									
Description	NSR								
	1(C)	1(E)	1(G)	1(H)	1(I)	2(A)	3(A)	3(C)	3(D)
Existing Specific Sound Level (Table 9)	46	45	45	45	43	39	49	49	49
Predicted Cumulative Specific Sound Level of All Operations	48	48	49	49	47	56	51	52	50
Acoustic Feature Correction	+6*	+6*	+6*	+6*	+6*	+6**	+6**	+6**	+6**
Rating Sound Level ($L_{Ar,T}$)	54	54	55	55	53	62	57	58	56
Background Sound Level MP1 $L_{A90,15min}$: 07:00 to 22:00 hours	40	40	40	40	40	40	40	40	40
Exceedance of L_{A90}	+14	+14	+15	+15	+13	+22	+17	+18	+16

Table 16 – BS4142 Noise Impact Assessment of Cumulative Operations (07:00 to 22:00 hours)

**A +6 dB penalty for 'clearly perceptible' impulsivity has been applied in accordance with the subjective method of BS4142. The noise emissions from the loading/unloading of waste is at times impulsive as forklift operatives accidentally knock the metal waste against the HGV trailer and when placing waste onto the floor.*

***A +6 dB penalty for 'clearly perceptible' impulsivity has been applied in accordance with the subjective method of BS4142. The impulsive noise emissions from manual dismantling within the A1 building, the tipping of waste into the skips adjacent to A1 are clearly perceptible at NSR2.*

Discussion:

The BS4142 assessment above shows that the rating sound levels during operations between 07:00 to 22:00 hours at the closest NSRs are causing:

- NSR1 – 'significant adverse impact, dependent on context,
- NSR2 – 'significant adverse impact, dependent on context,
- NSR3 – 'significant adverse impact, dependent on context.

When assessed in accordance with the NPSE and NPPF this equates to:

- NSR1 – 'Significant Observed Adverse Effect Level ('SOAEL'),
- NSR2 – 'Significant Observed Adverse Effect Level ('SOAEL'),
- NSR3 – 'Significant Observed Adverse Effect Level ('SOAEL').

4.5 Proposed Mitigation Measures

The following section of the report outlines the mitigation measures necessary to reduce the noise impact from the proposed operations as part of the environmental permit variation.

The following mitigation measures should be correctly implemented and retained thereafter:

- The roller shutter door along the eastern elevation of the main processing building must remain closed at all times other than when processed waste must be tipped into the stockpile. The opening of the roller shutter door must be kept to a minimum by completing as few trips as possible, and during this period the crusher and associated plant located within the main building must cease operating.
- The roller shutter door along the northern elevation of the A1 building and the western elevation of the main processing building should be fitted with a fast-acting steel roller shutter and remain closed unless forklifts are entering or exiting.
- The tipping of dismantled waste via an electric forklift and the RORO skip collection by the A1 building should be housed within the new A1 building. All RSDs would have to remain closed at all times other than when all internal works have ceased to allow mobile plant and the RORO skip wagon to enter and collect skips; the RSD should then remain closed again.
- The tipping of processed waste adjacent to the main processing and all 360-grab bulker loading operations should be housed within a steel portal frame structure constructed from composite panelling (akin to KS1000 panels). The structure has been modelled with a footprint of 22m x 15m, and a sloping shed style roof 3m at the northern elevation and 6m at the southern elevation. The façades and roofing should be internally lined with an absorbent layer; for the purpose of this assessment the EMTEC WCAC 40 linings have been assumed, however, any 40mm mineral wool lining with a perforated steel sheet would suffice. All manufacturers' datasheets can be found in Appendix F.

Specific Sound Levels & Noise Modelling Data

The table below outlines the predicted internal noise levels incident upon the bulker loader and waste tipping structure considering the sources are 6m from the façades and 3m from the roofing. Full calculations can be found in Appendix E.

Description	1/1 Octave Frequency Band (Hz, L_{eq}, dB)								Overall (dBA)
	63	125	250	500	1k	2k	4k	8k	
Façades & Closed 0.6mm RSD	80	77	78	74	76	72	68	64	80
Roof	82	81	83	79	81	76	72	68	84

Table 17 – Internal Ambient Noise Levels of Bulker Loader & Waste Tipping Structure

The table below shows the predicted internal noise levels within the new A1 building considering the dismantled waste tipping and RORO skip wagon collections both occur in the southeastern most corner; no closer than 2m from any façade. Full calculations can be found in Appendix F.

Description	1/1 Octave Frequency Band (Hz, L_{eq}, dB)								Overall (dBA)
	63	125	250	500	1k	2k	4k	8k	
A1 Building East Wall	77	77	79	81	82	82	78	74	87
A1 Building South Wall & RSD	75	77	78	80	81	81	77	71	86
A1 Building Roof	75	77	78	80	81	81	77	72	86

Table 18 – Mitigated Internal Ambient Noise Levels of A1 Building

Any areas where an increase in internal noise level was not predicted, the existing internal noise levels seen in Table 10 have been used.

Noise Modelling

The following assumptions have been made within the SoundPlan 9.0 noise modelling software:

- The same environmental standards and noise map particulars have been assumed.
- Three situations have been assessed:
    - 06:00 to 07:00 hours when manual dismantling of waste is to place within the new A1 building as part of the proposed environmental permit variation,
    - 07:00 to 22:00 hours showing the specific sound level emissions from the proposed permit variation only,
    - 07:00 to 22:00 hours when all operations take place.
- The noise emissions breaking out of the new A1 building now consider the internal noise levels presented in Table 18 and where internal level are not expected to increase, the sound levels in Table 10 have been used.
- The noise emissions breaking out of the proposed bulker loading structure consider the internal noise levels presented in Table 17. The RSD must remain closed during noisy works.
- The noise emissions breaking out of the main processing building are identical to the existing scenario with the exception of the southern RSD being closed during all periods of internal operations.
- The following on-time corrections per 1-hour assessment period have been made within the noise model for the 07:00 to 22:00 hours scenario of all operations:

  - 20 No. electric forklift movements between the A1 building and main building,
  - 5 No. electric forklift movements between the processed waste stockpile area and the main building,
  - 2 No. HGV movements between the yard to the new A1 building,
  - 1 No. HGV entering & exiting the yard,
  - 15-minutes of an electric forklift unloading/loading an HGV within the yard,
  - 5-minutes of an electric forklift tipping processed waste into the stockpile within the proposed steel structure,
  - 1-minute of the electric forklift tipping dismantled waste into a skip within A1 building,
  - 1 No. RORO HGV enters and exits the A1 building extension (the RSD door remains closed and all noisy operations cease when the door has to be opened).
  - 5-minutes of a RORO skip collection within the A1 building,
  - To form a worst-case scenario, it is assumed that the northern RSD of the A1 building and the western RSD of the main processing building are open 25% of the 1-hour reference time period. This is deemed appropriate for fast-acting RSDs used as the forklifts enter and exit. It should be stressed that BAT is assumed to be implemented; this is outlined in the noise management plan.
  - 1 No. bulker HGV entering and exiting the proposed steel structure adjacent to the main building,
  - 20-minutes of the Doosan 360 grabber loading the bulker HGV within the proposed structure,
- The on-time corrections for the noise model of specific emissions from the proposed permit variation between the hours of 07:00 to 22:00 includes the same as above, excluding the noise breakout from the main processing building or the electric forklift unloading/loading the HGV trailer in the yard,
- The noise model of the specific emissions between 06:00 to 07:00 hours include only noise breakout from the manual dismantling within the new A1 building.

The sound map showing the specific sound levels emissions from the site considering the proposed mitigation measures can be seen in the following figures.

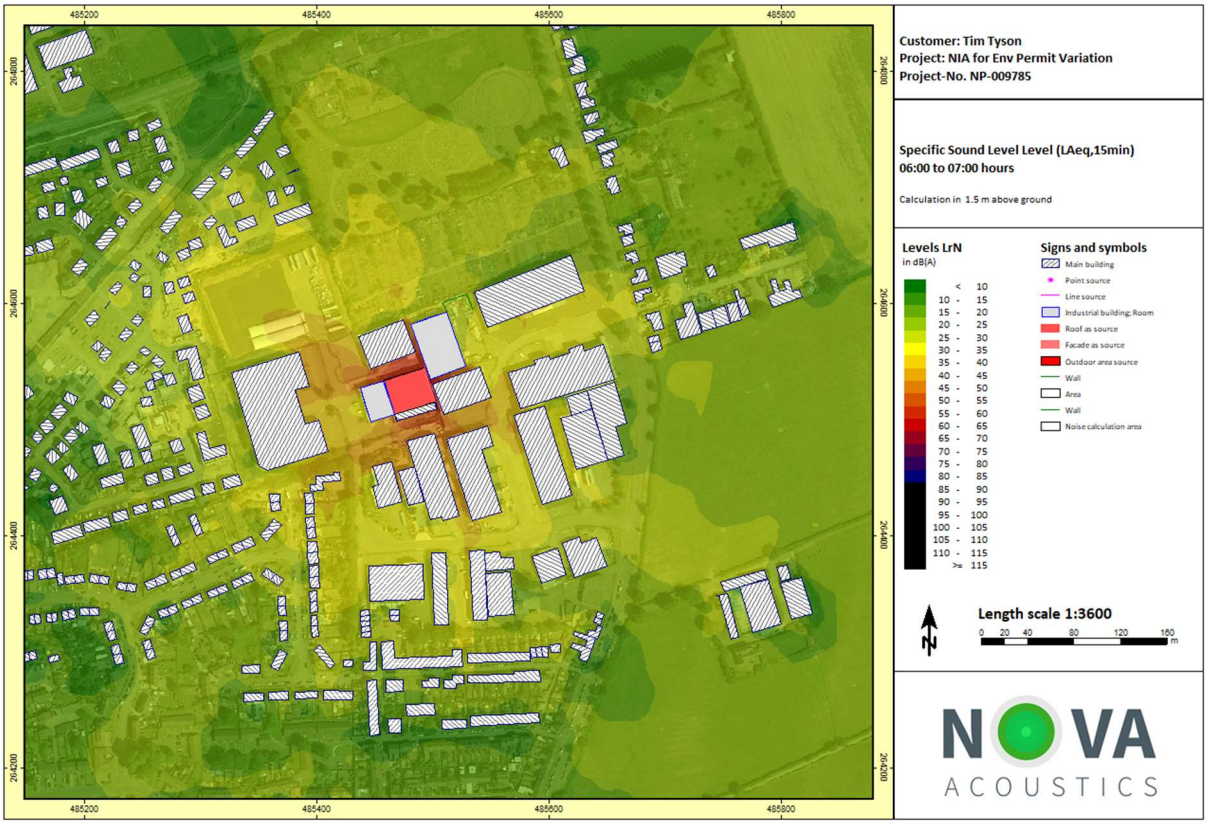


Figure 6 – Specific Sound Level Map (Proposed Mitigated Operations: 06:00 to 07:00 hours)

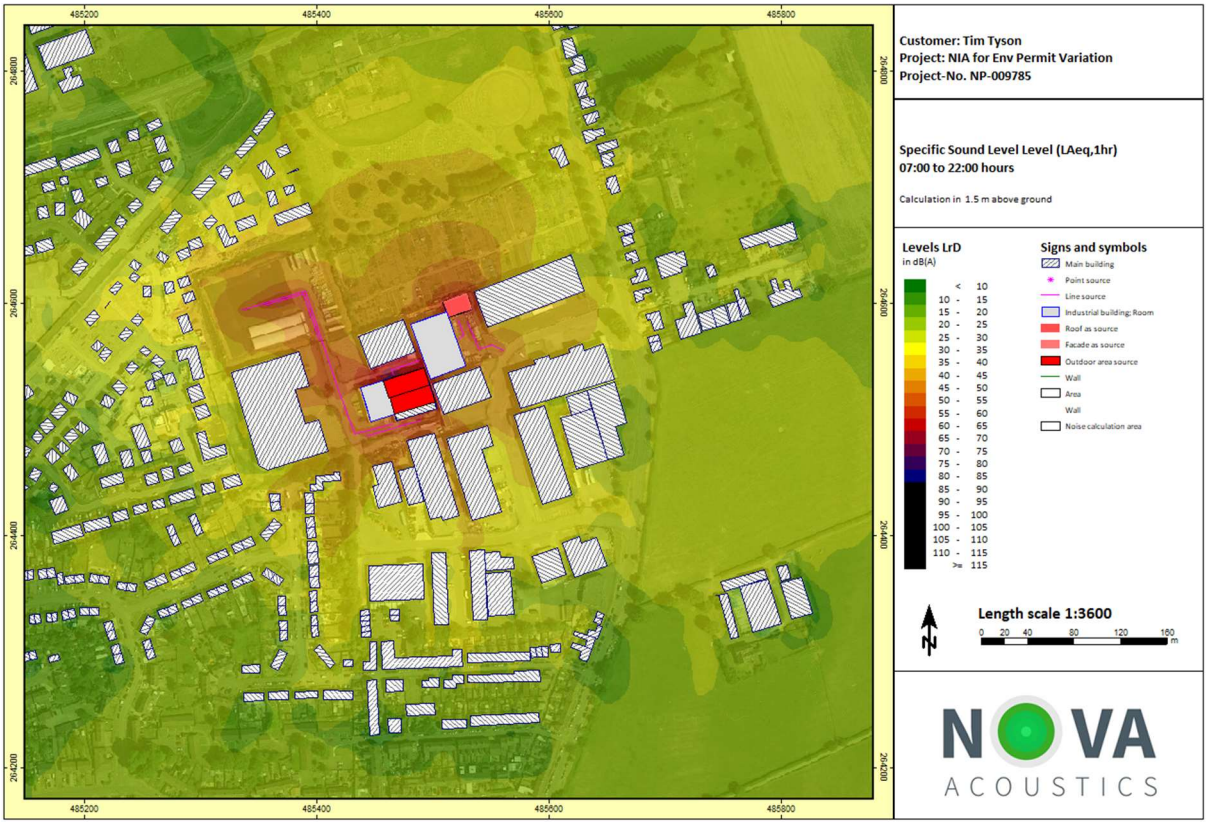


Figure 7 – Specific Sound Level Map (Proposed Mitigated Operations: 07:00 to 22:00 hours)

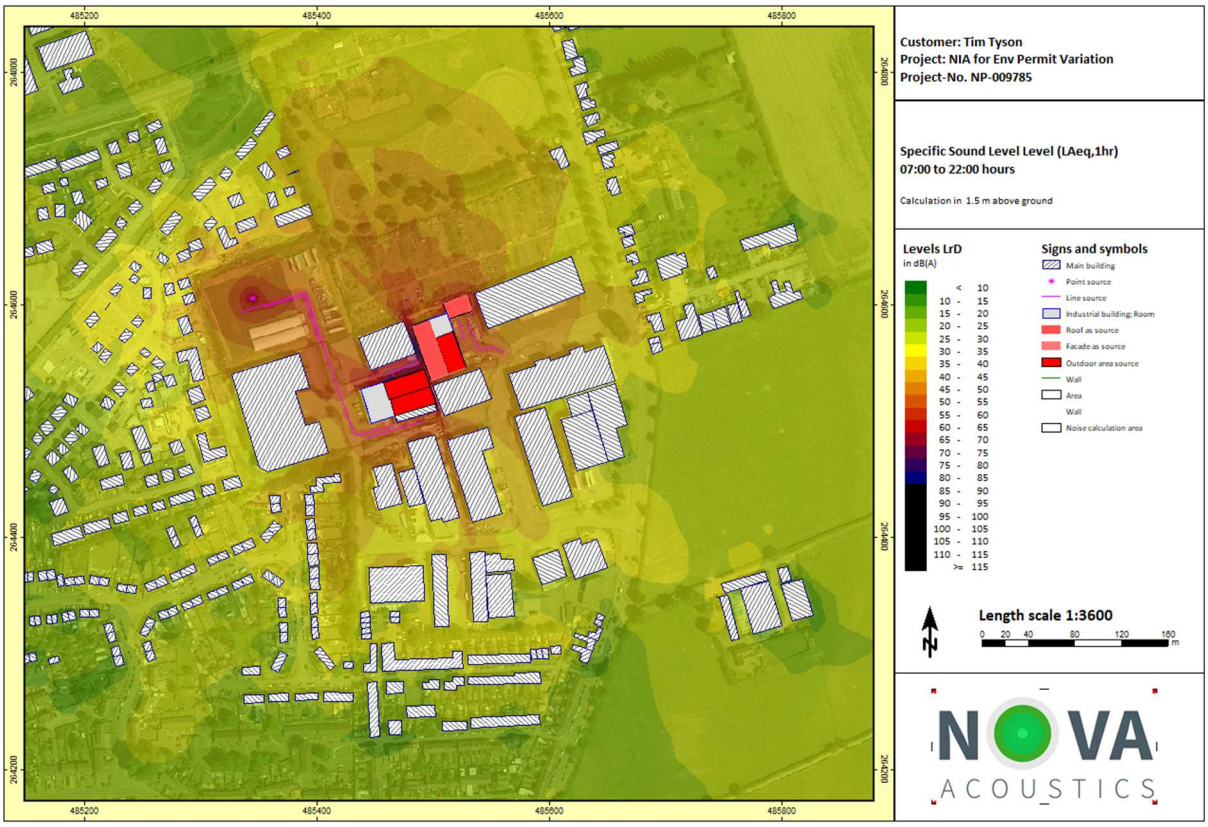


Figure 8 – Specific Sound Level Map (Cumulative Mitigated Operations: 07:00 to 22:00 hours)

BS4142 Noise Impact Assessment of Proposed Mitigated Operations

The BS4142 noise impact assessments are conducted at the closest NSRs in the following tables.

06:00 to 07:00 hours – Specific of Manual Dismantling in New A1 Building

NIA of Mitigated Operations: 06:00 – 07:00 hours (Manual Dismantling in A1 Building)									
Description	NSR								
	1(C)	1(E)	1(G)	1(H)	1(I)	2(A)	3(A)	3(C)	3(D)
Predicted Specific Sound Level of Unmitigated Operations	43	45	46	46	45	55	33	31	34
Predicted Mitigated Specific Sound Levels	32	33	33	32	33	39	30	30	32
Acoustic Feature Correction	+3*	+3*	+3*	+3*	+3*	+3*	+3*	+3*	+3*
Rating Sound Level ($L_{Ar,T}$)	35	36	36	35	36	42	33	33	35
Background Sound Level MP1 $L_{A90,15min}$: 06:00 to 07:00 hours	41	41	41	41	41	41	41	41	41
Exceedance of L_{A90}	-6	-5	-5	-6	-5	+1	-8	-8	-6

Table 19 – BS4142 Noise Impact Assessment of Mitigated Operations (06:00 to 07:00 hours)

***A +3 dB penalty for 'just perceptible' impulsivity has been applied in accordance with the subjective method of BS4142 due to the impulsive noise emissions from manual dismantling within the A1 building being reduced by the closing of the roller shutter door.*

Discussion:

The BS4142 assessment above shows that the rating sound levels during operations between 06:00 to 07:00 hours at the closest NSRs are causing:

- NSR1 – 'low impact, dependent on context,
- NSR2 – 'Low impact, dependent on context' to a low level of 'adverse impact, dependent on context,
- NSR3 – 'low impact, dependent on context.

When assessed in accordance with the NPSE and NPPF this equates to:

- NSR1 – 'No Observed Effect Level ('NOEL') to 'No Observed Adverse Effect Level ('NOAEL'),
- NSR2 – 'No Observed Adverse Effect Level' ('NOAEL') to 'Lowest Observed Adverse Effect Level ('LOAEL'),
- NSR3 – 'No Observed Effect level' ('NOEL').

07:00 to 22:00 hours – Specific to Proposed Permit Variation

NIA of Proposed Mitigated Operations: 07:00 to 22:00 hours (Specific to Proposed Permit Variation)									
Description	NSR								
	1(C)	1(E)	1(G)	1(H)	1(I)	2(A)	3(A)	3(C)	3(F)
Existing Specific Sound Level (Table 9)	46	45	45	45	43	39	49	49	49
Predicted Specific Sound Level of Unmitigated Operations	53	53	53	54	52	56	54	55	55
Predicted Mitigated Specific Sound Levels	39	40	40	40	38	41	33	33	34
Acoustic Feature Correction	+3*	+3*	+3*	+3*	+3*	+3*	+3*	+3*	+3*
Rating Sound Level ($L_{Ar,T}$)	42	43	43	43	41	44	36	36	37
Background Sound Level MP1 $L_{A90,15min}$: 07:00 to 22:00 hours	40	40	40	40	40	40	40	40	40
Exceedance of L_{A90}	+2	+3	+3	+3	+1	+4	-4	-4	-3

Table 20 – BS4142 Noise Impact Assessment of Mitigated Operations (07:00 to 22:00 hours)

**A +3 dB penalty for 'just perceptible' impulsivity has been applied in accordance with the subjective method of BS4142. It is expected that the audibility of impulsive events would be reduced due to sources being full enclosure by the A1 building and bulker loading structure.*

Discussion:

The BS4142 assessment above shows that the rating sound levels during operations between 08:00 to 22:00 hours at the closest NSRs are causing:

- NSR1 – Low level of 'adverse impact, dependent on context',
- NSR2 – Low level of 'adverse impact, dependent on context',
- NSR3 – 'low impact, dependent on context'.

When assessed in accordance with the NPSE and NPPF this equates to:

- NSR1 – 'Lowest Observed Adverse Effect Level ('LOAEL'),
- NSR2 – 'Lowest Observed Adverse Effect Level ('LOAEL'),
- NSR3 – 'No Observed Effect Level ('NOEL') to 'No Observed Adverse Effect Level ('NOAEL').

07:00 to 22:00 hours – Cumulative of Existing and Proposed Permit Variation Operations

NIA of Mitigated Operations: 07:00 to 22:00 hours (Cumulative of Existing and Proposed)									
Description	NSR								
	1(C)	1(E)	1(G)	1(H)	1(I)	2(A)	3(A)	3(C)	3(D)
Existing Specific Sound Level (Table 9)	46	45	45	45	43	39	49	49	49
Predicted Cumulative Specific Sound Level of All Unmitigated Operations	48	48	49	49	47	56	51	52	50
Predicted Mitigated Specific Sound Levels	43	43	44	44	42	42	37	37	37
Acoustic Feature Correction	+6*	+6*	+6*	+6*	+6*	+3**	+3**	+3**	+3**
Rating Sound Level ($L_{Ar,T}$)	49	49	50	50	48	45	40	40	40
Background Sound Level MP1 $L_{A90,15min}$: 07:00 to 22:00 hours	40	40	40	40	40	40	40	40	40
Exceedance of L_{A90}	+9	+9	+10	+10	+8	+5	0	0	0

Table 21 – BS4142 Noise Impact Assessment of Mitigated Operations (07:00 to 22:00 hours)

**A +6 dB penalty for 'clearly perceptible' impulsivity has been applied in accordance with the subjective method of BS4142. The noise emissions from the loading/unloading of waste is at times impulsive as forklift operatives accidentally knock the metal waste against the HGV trailer and when placing waste onto the floor.*

***A +3 dB penalty for 'just perceptible' impulsivity has been applied in accordance with the subjective method of BS4142. It is expected that the audibility of impulsive events would be reduced due to sources being full enclosure by the A1 building and bulker loading structure.*

Discussion:

The BS4142 assessment above shows that the rating sound levels during operations between 07:00 to 22:00 hours at the closest NSRs are causing:

- NSR1 – 'Adverse Impact' to 'significant adverse impact, dependent on context',
- NSR2 – 'adverse impact, dependent on context',
- NSR3 – 'significant adverse impact, dependent on context'.

When assessed in accordance with the NPSE and NPPF this equates to:

- NSR1 – Between 'Lowest Observed Adverse Effect level' ('LOAEL') to 'Significant Observed Adverse Effect Level ('SOAEL'),
- NSR2 – 'No Observed Adverse Effect Level ('NOAEL') to 'Lowest Observed Adverse Effect level' ('LOAEL')
- NSR3 – 'No Observed Effect Level' ('NOEL') to 'No Observed Adverse Effect Level ('NOAEL').

The adopted criteria of a permit variation rating sound level of no greater than 5 dB above the background sound level can be achieved should the proposed mitigation measures be implemented. However, it is prudent to consider the following contextual factors given the exceedances over the background sound level when considering the cumulative assessment of the existing and permit variation noise emissions.

The receptors labelled NSR1 that surround the temporary waste storage yard are highly influenced by the unloading and loading of waste via an electric FL; this process is the primary reason for the 'significant' exceedance. It should be recognised that this process has existed since the site became operational in 2019 and that no material change in its operation is proposed as part of the permit variation. The specific sound level emissions from this process are identical in all assessed situations. Mitigating this process is thought to be particularly onerous due to the NSR locations and height.

Notwithstanding the above, the mitigated cumulative sound levels from both the existing operations and proposed permit variation (NSR1(G) – 44 dBA) are predicted to increase the ambient noise level by no more than 2.5 dB; this is classed as 'not significant' when assessed in accordance with the IEMA Guidelines on Noise Impact.

The 5 dB exceedance of the background sound level at NSR2 is thought to be a worst-case pre-BAT scenario. The internal noise level of the A1 building is largely influenced by the dismantling of refrigeration waste, which was thought to be conducted without the consideration of BAT. Reducing dropping heights, reducing the need use hammers (particularly metal ones) and lining the dismantling areas with an impact resistant layer (typically a rubber-based resilient material) would further reduce the internal noise levels; it is thought that a minimum reduction of 3 dB could be achieved through the correct implementation of BAT (see Section 6).

The 'low impact' at NSR3 would occur for up to 3-hours a day when the Doosan 360 grabber is loading a bulker HGV or waste is tipped into the stockpile. To lower the noise impact further, BAT must be implemented and include:

- Install exhaust silencers,
- It is recommended to install an impact dampening material within the HGV holds. HGV holds can be surfaced with abrasion-resistant rubber to reduce noise generated by material impact.

According to the HSE, impact noise can be reduced by up to 10 dBA or more with the measure in place.

- Reduce drop heights when placing processed waste into the bulkers,
- Ensure loading occurs during social daytime hours, e.g., 08:00 to 18:00 hours.

Further BAT is outlined in the noise management plan in Section 6 of this report.

5. Conclusion and Action Plan

The site has been assessed against the requirements of BS4142 and the EA's policies and guidance. A mitigation scheme has been provided to reduce the noise impact from the proposed environment permit variation.

The BS4142 assessment of the operations has shown that 'significant adverse impact, dependent on context' is likely to be taking place at the surrounding NSRs.

Should the mitigation measures specified within the report be adhered to, the noise emissions from the permit variation alone are predicted to cause between 'low impact' and a low level of 'adverse impact, dependent on context' in accordance with BS4142 at surrounding NSRs. Considering the context of the site and surrounding area, it is thought that the following should be taken into consideration:

- The 'Significant adverse impact' at NSR1 was largely due to the forklift unloading/loading of HGVs, which is process that has not changed since the site became operational in 2019 and that no material change in this process is proposed.
- The 'Adverse impact' at NSR2 could be reduced to a low level of 'adverse impact, dependent on context' through the strict implementation of BAT in accordance with the noise management plan.
- The 'low impact' at NSR3 would occur for up to 3-hours a day, for all other times, an even lower level of 'low impact' would be expected. The BAT outlined in the noise management plan must be implemented and adhered too for the lifetime of the site.

The following 'Action Plan' is outlined to ensure the design considerations and specifications from this report are duly implemented:

1. The proposed mitigation measures specified in Section 4 should be implemented in full, retained thereafter and maintained throughout their lifetime.
2. The noise management plan outlined in Section 6 must be adhered to throughout the site's lifetime.

The findings of this report will require written approval from the Local Planning Authority and Environment Agency prior to work commencing.

6. Noise Management Plan

This noise management plan outlines the methods by which the site operator will systematically assess and minimise the potential impacts of noise generated by the site. The noise management plan is a working document with the specific aim to ensure that:

- Noise impact is considered as part of routine inspections.
- Noise is primarily controlled at source by good operational practices and 'Best Available Techniques ('BAT'), including physical and management control measures.
- All appropriate measures are taken to prevent or, where that is not reasonably practical, to reduce noise emissions from the site.

The noise management plan addresses the impact of noise and the control measures employed to mitigate the risk. These are supported through monitoring procedures to identify elevated levels and review complaints should they arise. The complaints management procedure is also addressed, which includes the management responsibilities.

6.1 Hours of Operation

- All on-site operations will take place between 08:00 to 22:00 hours Monday to Friday, and 08:00 to 14:00 hours on Saturdays.

6.2 Equipment Maintenance

All failed/broken plant and equipment will be replaced with equivalents that produce equal or lower levels of noise. This will be verified with manufacturers technical datasheets or on-site noise measurements.

All plant and machinery will be regularly and properly maintained in accordance with the preventative maintenance schedule of which the appropriate staff will be trained in.

6.3 Operator Monitoring Plan

Monitoring of noise emissions from the site will be undertaken both subjectively and objectively.

Continuous Subjective Noise Monitoring

- All operational staff will, as part of their induction, be made aware of their roles and responsibility. It is the responsibility of all staff to be aware of noise on site and to report any potential noise issues to the sites Operations Manager at the earliest opportunity.
- All staff will have refresher training on noise issues, prevention and management at six-monthly intervals.
- If members of staff report any instances of elevated noise, this should be investigated immediately. In the event that increased noise levels are verified, the source of the noise should be taken out of commission and must be fixed/corrected prior to the equipment being put back into commission.
- A visual inspection of all equipment should be made before use to ensure that there are no obvious faults or malfunctions that could lead to elevated noise levels.
- It will be ensured that all noise mitigation measures (e.g., enclosures) are installed as per manufacturer's guidance and maintained throughout their lifetime.

Objective Noise Monitoring

- A class 2 sound level meter will be purchased to measure sound levels on site. This will take place during typical operations when the site is in use and associated plant vehicles are operating as normal.

Monthly Measurements

Noise levels will be measured at monthly intervals at the site perimeter in the location shown below.

Figure 9 – NMP Monthly Measurement Positions

- $L_{Aeq,1hour}$ and $L_{Aeq,15min}$ (A-weighted noise levels averaged over the 1-hour daytime and 15minute nighttime assessment periods) and L_{AFmax} noise levels will be recorded. Measurements taken on site will be compared with previous measurements. If $L_{Aeq,T}$ noise levels increase by more than 3 dB from the previous month then the cause of the increase shall be investigated.
- When the source of the elevated noise levels is discovered, remedial work shall be undertaken to reduce noise emissions to 'normal' levels. If complex remedial work is required, the offending equipment will be taken out of commission until repair work is completed. This will be logged in an IMS (Issue Management System).

6.4 BAT Control Measures

Mobile Plant

- Any associated reversing alarms should be non-tonal white noise.
- Engines will be switched off when not in use. Vehicles will not be left idling.
- Ensure plant and machinery are regularly well maintained.
- Avoid unnecessary horn usage and revving of engines.
- Switch off equipment and engines from the waste distribution vehicles when not required.

- Keep access roads clear and well maintained. Avoid the formation of potholes and other uneven road surfaces which can generate excessive noise.
- Minimise drop heights of materials where possible.
- An exhaust silencer must be fitted to the Doosan 360 grabber. The make, model and manufactures datasheets must be provided to a competent individual to predict its effectiveness.
- It is recommended to install an impact dampening material within the HGV holds. HGV holds can be surfaced with abrasion-resistant rubber to reduce noise generated by material impact.

Manual Dismantling

- Minimise drop heights of materials where possible.
- The floor of the manual dismantling area within the A1 building must be lined with an impact dampening material to reduce impulsive noise emissions. This will need to be maintained and visual inspections must be made monthly to ensure it is kept in an effective condition.
- All hammers used for manual dismantling must be lined with rubber-based resilient material to reduce impulsive noise emissions. This will need to be maintained and visual inspections must be made monthly to ensure they are kept in an effective condition.

Noise Breakout

- It will be ensured that all roller shutter doors remain closed at all times when noisy internal operations are occurring. The only exception will be the northern RSD of the A1 building and western RSD of the main processing building. If any other RSD must be opened, then all internal works must cease.
- Staff must temporally stockpile product throughout the day the to ensure the least plant down time.

Processed Waste Tipping & Bulker Loading Adjacent to Main Processing Building

- A steel portal-frame structure including composite steel panels akin to KS1000RW panels must be erected in the location outlined in the figure below. The unit must house all tipping of processed waste that current occurs within the yard, and all bulker HGV loading via the Doosan 360 grab unit.
- The structure must be lined with an absorbent product akin to the EMTEC WCAC 40 lining, however, any 40mm mineral wool lining with a perforated steel sheet would suffice.
- All roller shutter doors must remain closed during noisy works.

Figure 10 – Bulker Loading & Waste Tipping Structure Location

6.5 Management Control Measures

- Users of on-site plant and equipment complete a daily defect log at the beginning of the working day if they observe that their vehicle is not working to its optimum. An on-site mechanic actions the defect log on the same working day and machines are not used until this action has been completed.
- Tool-box talks are provided by site management on a regular basis to site operatives. These talks include all aspects of the management plans for this site.
- Plant maintenance schedules using the manufacturer's recommendations where vehicles are serviced after 500 hours of operation.
- Pre-use checks are completed prior to using plant and equipment daily.
- Defects are reported and actions are taken to rectify the problem or remove the offending item from service until such time as the issue is resolved.
- All plant and equipment are visually inspected by the operator at the end of the working day.
- Throughout the day operators are vigilant in checking vulnerable areas like exhausts and engine bays.
- Specialist contractors are used to perform maintenance outside the scope and expertise of the site management and operatives.
- All documentation relating to plant and equipment maintenance is retained in the site office for inspection.

6.6 Noise Complaint Investigation

An issue management system (IMS) will be implemented and completed by the site manager, this will include a site diary, plus forms and records of complaints. Further to this, a complaints procedure will be implemented; this procedure will allow for all complaints, feedback and requests made by third parties regarding the site's operational activities, health and safety performance or quality of service/product.

A phone number for the head office can be obtained online in order to allow for any member of the public to lodge a complaint without entering the operational site. The operations manager will be specifically assigned to deal with complaints.

All complaints received from third parties including statutory authorities, statutory consultees, members of the general public and representatives of the company will be forwarded to the operations manager to action as below within 2 hours (where feasible). The complaint will be logged in the incident database within 72 hours.

- The operations manager will ensure that:
- The complaint is investigated to identify the cause, if necessary, this may involve direct communication with the complainant.
- The noise source will be measured using a class 2 sound level meter and compared with monthly objective monitoring records.
- In the event of elevated noise being detected, the presence of 'abnormal' onsite activity is assessed and if necessary, action is taken immediately to prevent a reoccurrence of the same problem. These actions must be documented.
- The complainant will be contacted and given information on the investigations conducted and actions taken as appropriate.
- All complaints are reported to regional directors and discussed at site meetings.
- Details of other complaints are sent to the other company personnel as appropriate.

If the investigation indicates that the complaint has not been justified this will be clearly recorded on the incident report. All complaints will be logged.

Reporting Measures

In the event of elevated levels of noise being identified, the event will be reported into an issue management system (IMS) by a member of operational staff. Upon notification of an environmental incident, the site manager will complete an incident reporting form. The completed form is then distributed throughout the company for review at operational, management and health and safety meetings.

All performance failures will be categorised for input into the IMS as follows:

- Minor event: quick fix possible, locally resolved.
- Medium event: brief disruption to service, management intervention required.
- Major event: significant disruption to service.

Each non-conformance category must have a given deadline for rectification. The deadline for each category is:

- Minor Event: within 24 hours
- Medium Event: within 6 hours
- Major Event: within 1 hour

The IMS will record any actions taken to rectify the issue, ensure that any necessary actions or review are recorded onto the IMS and ensure that the person reporting the incident is notified. The site manager will investigate the performance failure within a reasonable time frame (ideally 2 hours). Once the issue has been resolved, the corrective action will be entered onto the system and the issue will be closed.

Appendix A – Acoustic Terminology

A-weighted sound pressure level, L_{pA}	Quantity of A-weighted sound pressure given by the following formula in decibels (dBA). $L_{pA} = 10 \log_{10} (pA/p_0)^2$. Where: pA is the A-weighted sound pressure in pascals (Pa) and $p0$ is the reference sound pressure (20 µPa)
Background Sound	Underlying level of sound over a period, T, which might in part be an indication of relative quietness at a given location
Equivalent continuous A-weighted sound pressure level, $L_{Aeq,T}$	Value of the A-weighted sound pressure level in decibels (dB) of a continuous, steady sound that, within a specified time interval, T, has the same mean-squared sound pressure as the sound under consideration that varies with time
Facade level	Sound pressure level 1 m in front of the facade
Free-field level	Sound pressure level away from reflecting surfaces
Indoor ambient noise	Noise in a given situation at a given time, usually composed of noise from many sources, inside and outside the building, but excluding noise from activities of the occupants
Noise Criteria	Numerical indices used to define design goals in a given space
Noise Rating (NR)	Graphical method for rating a noise by comparing the noise spectrum with a family of noise rating curves
Octave Band	Band of frequencies in which the upper limit of the band is twice the frequency of the lower limit
Percentile Level, $L_{AN,T}$	A-weighted sound pressure level obtained using time-weighting “F”, which is exceeded for N% of a specified time interval
Rating Level, $L_{Ar,Tr}$	Equivalent continuous A-weighted sound pressure level of the noise, plus any adjustment for the characteristic features of the noise
Reverberation time, T	Time that would be required for the sound pressure level to decrease by 60 dB after the sound source has stopped
Sound Pressure, p	root-mean-square value of the variation in air pressure, measured in pascals (Pa) above and below atmospheric pressure, caused by the sound
Sound Pressure Level, L_p	Quantity of sound pressure, in decibels (dB), given by the formula: $L_p = 10\log_{10}(p/p_0)^{2.}$ Where: p is the root-mean-square sound pressure in pascals (Pa) and $p0$ is the reference sound pressure (20 µPa)
Weighted sound reduction index, R_w	Single-number quantity which characterizes the airborne sound insulating properties of a material or building element over a range of frequencies

Appendix B – Standards, Legislation, Policy, and Guidance

This report is to be primarily based on the following standards, legislation, policy and guidance.

B.1 – National Planning Policy Framework (2023)

Government policy on noise is set out in the National Planning Policy Framework (NPPF), published in 2021. This replaced all earlier guidance on noise and places an emphasis on sustainability. In section 15, Conserving and enhancing the natural and local environment, paragraph 174e, it states:

Preventing new and existing development from contributing to, being put at unacceptable risk from, or being adversely affected by, unacceptable levels of soil, air, water or noise pollution or land instability. Development should, wherever possible, help to improve local environmental conditions such as air and water quality, taking into account relevant information such as river basin management plans;

Paragraph 185 states:

Planning policies and decisions should also ensure that new development is appropriate for its location taking into account the likely effects (including cumulative effects) of pollution on health, living conditions and the natural environment, as well as the potential sensitivity of the site or the wider area to impacts that could arise from the development. In doing so they should:

a) *Mitigate and reduce to a minimum potential adverse impact resulting from noise from new development – and avoid noise giving rise to significant adverse impacts on health and the quality of life;*
b) *Identify and protect tranquil areas which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason; and*
c) *Limit the impact of light pollution from artificial light on local amenity, intrinsically dark landscapes and nature conservation.*

B.2 – Noise Policy Statement for England (2010)

Paragraph 185 of the NPPF also refers to advice on adverse effects of noise given in the Noise Policy Statement for England (NPSE). This document sets out a policy vision to:

Promote good health and a good quality of life through the effective management of noise within the context of Government policy on sustainable development.

To achieve this vision the Statement identifies the following three aims:

Through the effective management and control of environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development:

- Avoid significant adverse impacts on health and quality of life;
- Mitigate and minimise adverse impacts on health and quality of life;
- Where possible, contribute to the improvement of health and quality of life.

In achieving these aims the document introduces significance criteria as follows:

SOAEL – Significant Observed Adverse Effect Level

This is the level above which significant adverse effects on health and quality of life occur. It is stated that "significant adverse effects on health and quality of life should be avoided while also considering the guiding principles of sustainable development".

LOAEL – Lowest Observed Adverse Effect Level

This is the level above which adverse effects on health and quality of life can be detected. It is stated that the second aim above lies somewhere between LOAEL and SOAEL and requires that: "all reasonable steps should be taken to mitigate and minimise adverse effects on health and quality of life while also considering the guiding principles of sustainable development. This does not mean that such adverse effects cannot occur."

NOEL – No Observed Effect Level

This is the level below which no effect can be detected. In simple terms, below this level, there is no detectable effect on health and quality of life due to the noise. This can be related to the third aim above, which seeks: "where possible, positively to improve health and quality of life through the pro-active management of noise while also considering the guiding principles of sustainable development, recognising that there will be opportunities for such measures to be taken and that they will deliver potential benefits to society. The protection of quiet places and quiet times as well as the enhancement of the acoustic environment will assist with delivering this aim."

The NPSE recognises that it is not possible to have a single objective noise-based measure that is mandatory and applicable to all sources of noise in all situations and provides no guidance as to how these criteria should be interpreted. It is clear, however, that there is no requirement to achieve noise levels where there are no observable adverse impacts but that reasonable and practicable steps to reduce adverse noise impacts should be taken in the context of sustainable development and ensure a balance between noise sensitive and the need for noise generating developments.

Any scheme of noise mitigation outlined in this report will, therefore, aim to abide by the above principles of the NPPF and NPSE whilst recognizing the constraints of the site.

B.3 – BS4142:2014+A1:2019 – 'Methods for rating and assessing industrial and commercial sound'

Overview

BS4142:2014 sets out a method to assess the likely effect of sound from factories, industrial premises or fixed installations and sources of an industrial nature in commercial premises, on people who might be inside or outside a dwelling or premises used for residential purposes in the vicinity.

The procedure contained in BS4142:2014 for assessing the effect of sound on residential receptors is to compare the measured or predicted sound level from the source in question, the $L_{Aeq,T}$ 'specific sound level', immediately outside the dwelling with the $L_{A90,T}$ background sound level.

Where the sound contains a tonality, impulsivity, intermittency and other sound characteristics, then a correction depending on the grade of the aforementioned characteristics of the sound is added to the

specific sound level to obtain the $L_{Ar,Tr}$ 'rating sound level'. A correction to include the consideration of a level of uncertainty in sound measurements, data and calculations can also be applied when necessary.

Rating Penalty

Section 9 of BS4142:2014 describes how the rating sound level should be derived from the specific sound level, by deriving a rating penalty.

BS4142:2014 states:

"Certain acoustic features can increase the significance of impact over that expected from a basic comparison between the specific sound level and the background sound level. Where such features are present at the assessment location, add a character correction to the specific sound level to obtain the rating level. This can be approached in three ways:

a) subjective method;
b) objective method for tonality;
c) reference method."

Due to the nature of the development the subjective method has been adopted to derive the rating sound level from the specific sound level. This is discussed in Section 9.2 of BS4142:2014, which states:

"Where appropriate, establish a rating penalty for sound based on a subjective assessment of its characteristics. This would also be appropriate where a new source cannot be measured because it is only proposed at that time, but the characteristics of similar sources can subjectively be assessed. Correct the specific sound level if a tone, impulse or other characteristics occurs, or is expected to be present, for new or modified sound sources."

BS4142:2014 defines four characteristics that should be considered when deriving a rating penalty, namely; tonality; impulsivity; intermittency; and other sound characteristics, which are defined as:

a) Tonality

A rating penalty of +2 dB is applicable for a tone which is "just perceptible", +4 dB where a tone is "clearly perceptible", and +6 dB where a tone is "highly perceptible".

b) Impulsivity

A rating penalty of +3 dB is applicable for impulsivity which is "just perceptible", +6 dB where it is "clearly perceptible", and +9 dB where it is "highly perceptible".

c) Other Sound Characteristics

BS4142:2014 states that where "the specific sound features characteristics that are neither tonal nor impulsive, though otherwise are readily distance against the residual acoustic environment, a penalty of +3 dB can be applied."

d) Intermittency

BS4142:2014 states that when the "specific sound has identifiable on/off conditions, the specific sound level ought to be representative of the time period of length equal to the reference time interval which contains the greatest total amount of on time … if the intermittency is readily distinctive against the residual acoustic environment, a penalty of +3 dB can be applied."

Background Sound Level

The background sound level is the underlying level of sound over a period, T, and is indicative of the relative quietness at a given location. It does not reflect the occurrence of transient and/or higher sound level events and is generally governed by continuous or semi-continuous sounds.

To ensure the background sound level values used within the assessment are reliable and suitably represent both the particular circumstance and periods of interest, efforts have been made to quantify a 'typical' background sound level for a given period. The purpose has not been to simply select the lowest measured value. Diurnal patterns have also been considered as they can have a major influence on background sound levels, 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.

Since the intention is to determine a background sound level in the absence of the specific sound that is under consideration, it is necessary to understand that the background sound level can in some circumstances legitimately include industrial and/or commercial sounds that are present as separate to the specific sound.

Assessment of Impact

BS4142:2014 states: "The significance of sound of an industrial and/or commercial nature depends upon both the margin by which the rating level of the specific sound source exceeds the background sound level and the context in which the sound occurs". An estimation of the impact of the specific sound can be obtained by the difference of the rating sound level and the background sound level and considering the following:

- "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 sound level, the less likely it is that the specific sound source 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 negligible impact, depending on the context."

Interpreting the guidance given in BS4142:2014, with consideration of the guidance given in the NPSE and NPPG Noise, an estimation of the impact of the rating sound is summarised in the following text:

- A rating sound level that is +10 dB above the background sound level is likely to be an indication of a Significant Observed Adverse Effect Level;
- A rating sound level that is +5 dB above the background sound level is likely to be an indication of a Lowest Observed Adverse Effect Level;
- The lower the rating sound level is relative to the measured background sound level, the less likely it is that the specific sound source will have an adverse impact or a significant adverse impact. Where the rating sound level does not exceed the background sound level, this is an

indication of the specific sound source having a negligible impact and would therefore classified as No Observed Adverse Effect Level.

During the daytime, the assessment is carried out over a reference time period of 1-hour. The periods associated with day or night, for the purposes of the Standard, are 07.00 to 23.00 and 23.00 to 07.00, respectively.

B.4 – Environmental Permitting (England and Wales) Regulations 2016 (as amended)

The regulations require that operators of permitted installations conduct their activities to prevent, or where that is not possible, to reduce to a minimum, pollution arising from their operations. For the processing of food stuffs, noise is a potential significant pollutant. The legislation requires that all pollutants (including noise and vibration) meet the standards required and demonstrate Best Available Techniques (BAT).

Assessment of the impacts of noise from a proposed installation requires an assessment to predict the significance of the potential impacts.

Additional guidance and reference to national standards for the monitoring and evaluation of noise are accepted as appropriate metrics for assessing the significance of impacts. The relevant guidance is detailed below.

Horizontal Guidance for Noise Part 2 – Noise Assessment and Control (H3)

Agency Guidance note H3 provides advice on assessing the potential impact of noise from permitted installations. The guidance notes that:

> *"Regulation of noise under IPPC will bring together several legislative regimes with different scope but similar purpose and, in the case of A1 installations, will require a co-ordinated approach between the Regulator and both the Planning functions and the Environmental Health or Environmental Protection Teams of local authorities. At an early stage, lead planning and environmental health/protection officers should be identified to ensure an effective liaison and consultation process."*

It is therefore appropriate to reference guidance used by planning authorities in determining planning applications and, where possible, align compliance requirements to avoid confusion or conflict between similarly required regulatory outcomes.

H3 endorses the use of the following specific guidance and standards for the assessment of noise from permitted installations:

- National Planning Policy Framework 2021 (NPPF)
- Planning Practice Guidance (ProPG)
- British Standard 4142:2014+A1:2019 – 'Methods for rating industrial noise affecting mixed residential and industrial areas'
- British Standard 5228:2009+A1:2014 – 'Noise and vibration control on construction and open sites'
- British Standard 7445:2003 – 'Description and measurement of environmental noise'
- World Health Organisation Guidelines for Community Noise: 1999.

It is expected that controls on noise emissions put in place under the environmental permit requirements should be consistent with those required under other regulatory regimes. It is therefore also appropriate to also consider planning policy when setting appropriate noise controls.

It is normal for permitted installations to demonstrate compliance by preparing a Noise Management Plan (NMP). The NMP addresses physical, operational and management controls exercised by the operator of the installation to comply with 'Best Available Techniques' ('BAT').

Appendix C – Environmental Survey

C.1 – Time History Noise Data

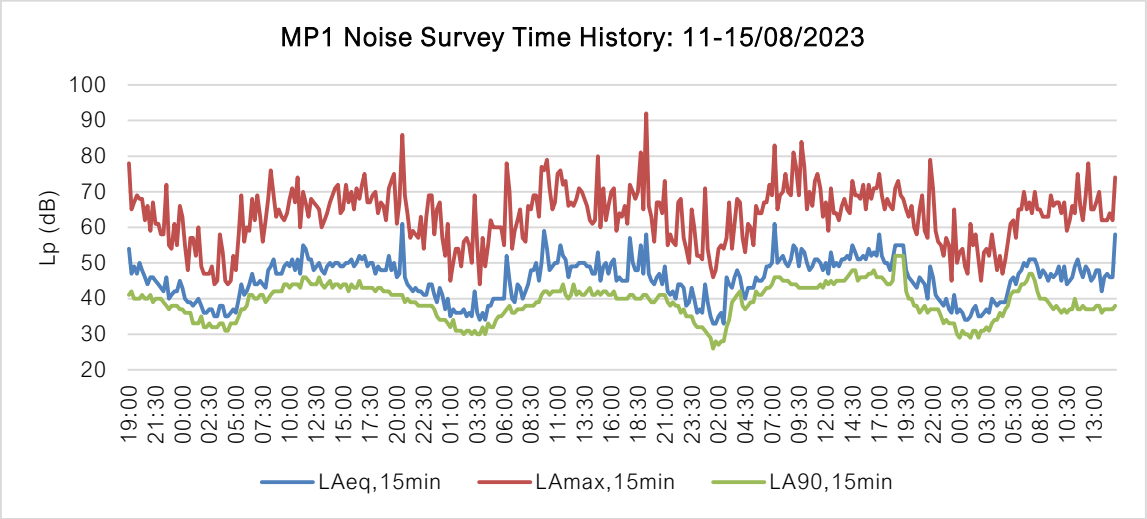


Figure 11 – MP1 Noise Survey Time History (Full Period)

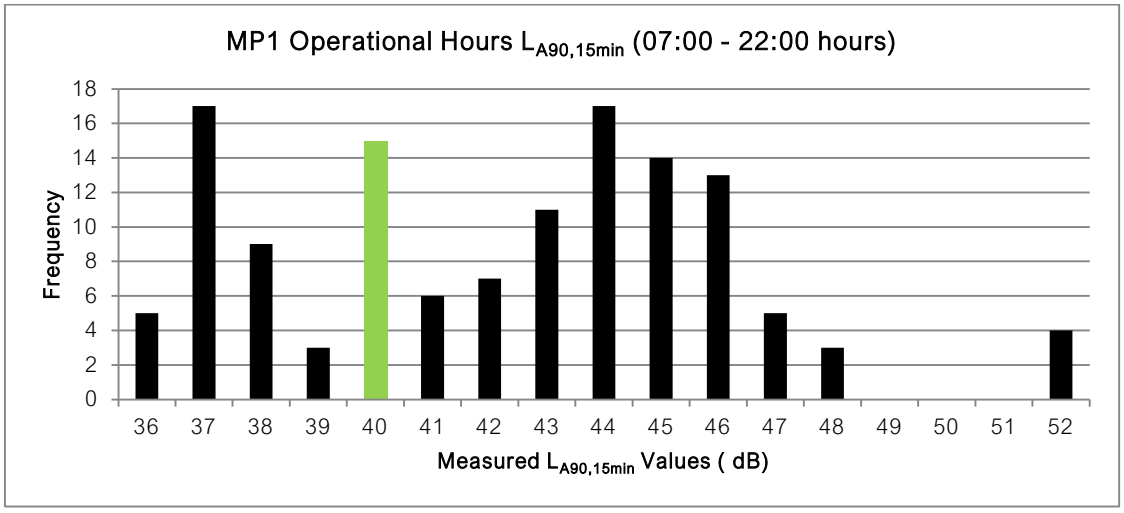


Figure 12 – MP1 $L_{A90,15min}$ Background Sound Level (07:00 – 22:00 hours)

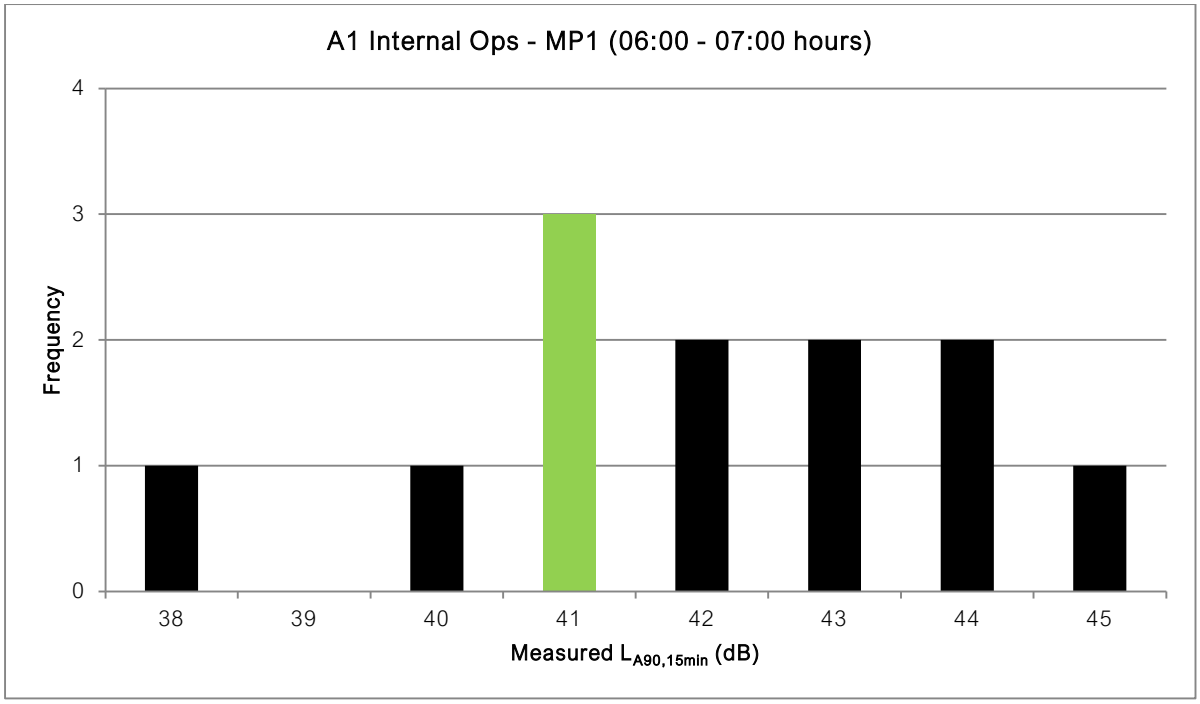


Figure 13 – MP1 $L_{A90,15min}$ Background Sound Level (06:00 – 07:00 hours)

C.2 – Surveying Equipment

Piece of Equipment	Serial No.	Calibration Deviation
Svantek 971 Class 1 Sound Level Meter	87159	≤0.1
CESVA CB006 Class 1 Calibrator	901911	
Svantek 971 Class 1 Sound Level Meter	61464	≤0.1
CESVA CB006 Class 1 Calibrator	901911	

Table 22 – Surveying Equipment

All equipment used during the survey was field calibrated at the start and end of the measurement period with a negligible deviation of ≤0.1 dB. All sound level meters are calibrated every 24 months and all calibrators are calibrated every 12 months by a third-party calibration laboratory. All microphones were fitted with a protective windshield for the entire measurements period. Calibration certificates can be provided upon request.

C.3 – Meteorological Conditions

As the environmental noise survey was carried out over a long un-manned period no localised records of weather conditions were taken. However, all measurements have been compared with met office weather data of the area, specifically the closest weather station, and the data from the weather station is outlined in the table below. When reviewing the time history of the noise measurements, any scenarios that were considered potentially to be affected by the local weather conditions have been omitted. The analysis of the noise data includes statistical and percentile analysis and review of minimum and maximum values, which aids in the preclusion of any periods of undesirable weather conditions. The weather conditions were deemed suitable for the measurement of environmental noise in accordance with BS7445

Description and Measurement of Environmental Noise. The table below presents the average temperature, wind speed and rainfall range for each 24-hour period during the entire measurement.

Weather Conditions – Great Dodington (Approx. 3km SWW of Site)				
Time Period	Air Temp (⁰C)	Rainfall (mm/h)	Prevailing Wind Direction	Wind Speed (m/s)
11/08/23: 00:00 – 23:59	15.9 – 25.8	0.0	SE	0.0 – 6.0
12/08/23: 00:00 – 23:59	12.9 – 22.4	0.0 – 3.0*	SSW	0.0 – 6.0
13/08/23: 00:00 – 23:59	14.6 – 21.5	0.0 – 3.0**	SSW	0.0 – 7.7 (Mean – 2.0)
14/08/23: 00:00 – 23:59	13.7 – 21.6	0.0 – 8.4***	SSW	0.0 – 6.0 (Mean – 2.0)
15/08/23: 00:00 – 23:59	10.5 – 24.2	0.0	WSW	0.0 – 4.8

Table 23 – Weather Conditions (11-15/08/2023)

**Rainfall occurred outside the time period used for the noise impact assessment (16:15 – 17:00 hours).*

***Rainfall occurred outside time period used for the noise impact assessment (Sunday).*

****Rainfall occurred outside time period used for the noise impact assessment (02:50 – 04:30 hours).*

The table below outlines the weather conditions over the environmental sound survey conducted on 04-06/04/2023. It should be noted that the weather station in the table above did not exist at the time of the survey. Furthermore, the weather conditions during the on-site monitoring (04/04/2023) were favourable with no precipitation and wind speeds of less than 3 m/s.

Weather Conditions – Spinney Hill (Approx. 8km West of Site)				
Time Period	Air Temp (⁰C)	Rainfall (mm/h)	Prevailing Wind Direction	Wind Speed (m/s)
04/04/2023: 00:00 – 23:59	-0.1 – 14.3	0.0	ESE	0.0 – 4.4
05/04/2023: 00:00 – 23:59	4.7 – 11.8	0.0 – 0.8	SSW	0.5 – 4.8
06/04/2023: 00:00 – 23:59	5.8 – 14.1	0.0 – 1.3	W	0.9 – 7.4

Table 24 – Weather Conditions (04-06/04/2023)

Appendix D – Manufacturers' Data Sheets

QuadCore™ RW Trapezoidal Roof Panel

Insulation Core
KS1000 RW insulated roof panels are manufactured with an HCFC, CFC and HFC free QuadCore insulation core.

Fire
Reaction to Fire
- Classified B-s1,d0 according to the European Reaction to Fire classification system (Euroclasses) BS EN 13501–1:2007+A1:2009 when tested on the internal liner. Please contact Technical Services for information relating to the external face
- B_{ROOF} (t4) to BS EN 13501-5:2016

Insurer Approvals
- LPS 1181 Part 1: Issue 1, series of fire growth tests for LPCB approval and is certified to LPS 1181 Grade EXT-B
- FM 4471 Class 1 panel roofs*
- FM 4880 Class 1 fire rating of building panels or interior finish materials, unlimited height
- FM 4882 Class 1 interior wall panels in smoke sensitive occupancies (pharmaceutical manufacturing & storage areas, and food preparation & storage areas or similar occupancies)

*1.5m maximum span only. Please contact Technical Services for more information.

FM APPROVED

LPCB
LPS 1181 : Issue 1.2
Cert. No: 260f & 186f

Environmental
Kingspan Insulated Panels produced in the UK are certified to BES 6001 (Framework Standard for the Responsible Sourcing of Construction Products) 'Very Good'. Kingspan Insulated Panels directly contribute to BREEAM/LEED credits.

Air Leakage
An air leakage rate of $3m^3/hr/m^2$ at 50Pa or less can be achieved when using Kingspan insulated roof and wall panels.

Acoustic
Sound Reduction Index (SRI)

Hz*	63	125	250	500	1K	2K	4K	8K
SRI (dB)	20	18	20	24	20	29	39	47

* Frequency

The KS1000 RW insulated roof panel has a single figure weighted sound reduction Rw = 25dB.

Biological
Kingspan panels are normally immune to attack from mould, fungi, mildew and vermin. No urea formaldehyde is used in the construction, and the panels are not considered deleterious

Materials
Substrate
- Kingspan XL Forté, Kingspan Spectrum, Kingspan AQUA*safe*, Kingspan AQUA*safe55* and Kingspan CLEAN*safe*: Metallic protected steel to BS EN 10346:2015.thickness 0.5mm.
  CLEAN*safe* 15: Metallic protected steel to BS EN10346:2015.thickness 0.4mm
- Stainless Steel: Austenitic Grade 316 stainless steel to BS EN 10088: Part 2: 2014, thickness 0.4mm.
- Aluminium: Please contact Kingspan envirocare Technical Services.

Coatings - External Weather Sheet
- Kingspan XL Forté: Consists of a multi-layer organic coating, embossed with a traditional leather-grain finish.
- Kingspan Spectrum: Consists of a coated semi-gloss finish with slight granular effect.

Coatings - Internal Liner Sheet
- Kingspan CLEAN*safe* 15: The coating has been developed for use as the internal lining of insulated panels. Standard colour is "bright white" with an easily cleaned surface.
- Kingspan AQUA*safe*: The coating has been developed for use as the internal lining of insulated panels to suit high humidity internal environments.
- Kingspan AQUA*safe 55*: The coating has been developed for use as the internal lining of insulated panels to swimming pool internal environments.
- Kingspan CLEAN*safe 120*: The coating has been developed for use as the internal lining of insulated panels where a high level of cleanliness and hygiene is required, and the panels are to be cleaned down on a regular basis.
- Stainless Steel: The stainless steel liner has been developed for use as the internal lining of insulated panels in buildings with a very aggressive/corrosive internal environment.

Acoustic Cladding Systems WCAC 40 & WCAC 30

Usage

The noise level measured at any given point within a plant enclosure or plantroom will be made up of the direct noise level from the enclosed machinery and the reverberant noise level which reflects off the walls of the enclosure. If the enclosure is hard faced, concrete or of brick or blockwork construction, then the reflected reverberant noise level can make a considerable additional contribution to the final overall noise level in the plant area. By fitting sufficient EMTEC WCAC Acoustic Cladding to plant space enclosures it is possible to reduce the reverberant element of the sound pressure level to close to that of the direct component only, thus reducing the final noise level within the plant room.

The EMTEC WCAC Acoustic Cladding System is therefore used to introduce acoustic absorption into reverberant spaces in order to reduce the reverberation time of the contained volume. The EMTEC WCAC Acoustic Cladding Systems are mechanically robust as they are fabricated from either galvanised steel or aluminium components and therefore offer hard wearing protection to the mineral wool absorptive media.

The EMTEC WCAC Acoustic Cladding Systems are used where large items of plant are contained within a plantroom or open topped plant area and the enclosing structure is of hard faced material such as brick, blockwork or plastered walls. The EMTEC WCAC Acoustic Cladding System can be fixed to these surfaces to form an absorbent finish to the walls of the enclosure.

For further information or to discuss your particular requirements it is advisable to consult an EMTEC engineer who will assist in the development of a cost effective design that meets the acoustic criteria.

Construction & Physical Properties

Two types of EMTEC WCAC Acoustic Cladding Systems are available:

WCAC 40 - The EMTEC WCAC 40 Acoustic Cladding System is made up of 100mm deep mineral wool slabs retained behind a framework of channels, Z-section rails and perforated metal trays.

WCAC 30 - The EMTEC WCAC 30 Acoustic Cladding System is made up of 50mm deep mineral wool slabs retained behind a framework of channels, Z-section rails and perforated metal trays.

Standard EMTEC WCAC 40 and WCAC 30 Acoustic Cladding Systems are fabricated from 1.2mm pre-galvanised sheet steel or 1.6mm aluminium extrusions and the punched perforated protection can either be supplied in 0.7mm thick, 3mm hole 32% free-area galvanised steel or 1.2mm thick, 3mm hole 40% free-area aluminium.

The acoustic media contained in the panels is inert, water repellent, non-hygroscopic and non-combustible. The acoustic media is protected with a non-woven mineral tissue behind the perforated inner face to prevent particle migration occurring.

EMTEC WCAC 40 and WCAC 30 Acoustic Cladding Systems can be supplied with external surfaces self-colour or the external surfaces can be polyester powder coated to a standard RAL colour.

EMTEC PAC.30 & PAC.40 Acoustic Panel properties:

WCAC 40 standard depth (thickness)	- 100mm
WCAC 30 standard depth (thickness)	- 50mm
WCAC 40 typical mass per unit area	- 15kg/m^2
WCAC 30 typical mass per unit area	- 12kg/m^2

EMTEC WCAC Acoustic Cladding Systems can be used inside or outside but if external use is envisaged then drain holes need to be incorporated into the rails to ensure any moisture that enters the cladding panels is allowed to dissipate.

Typical Specification Examples

In order to lower the reverberant field within the plant enclosure the walls and roof shall be covered in EMTEC WCAC 40 Acoustic Cladding Panels. The panels shall be arranged so as to cover at least 75% of the total surface area of the walls and roof of the plant enclosure. The panels shall be finished externally in a polyester powder coating to a standard RAL colour.

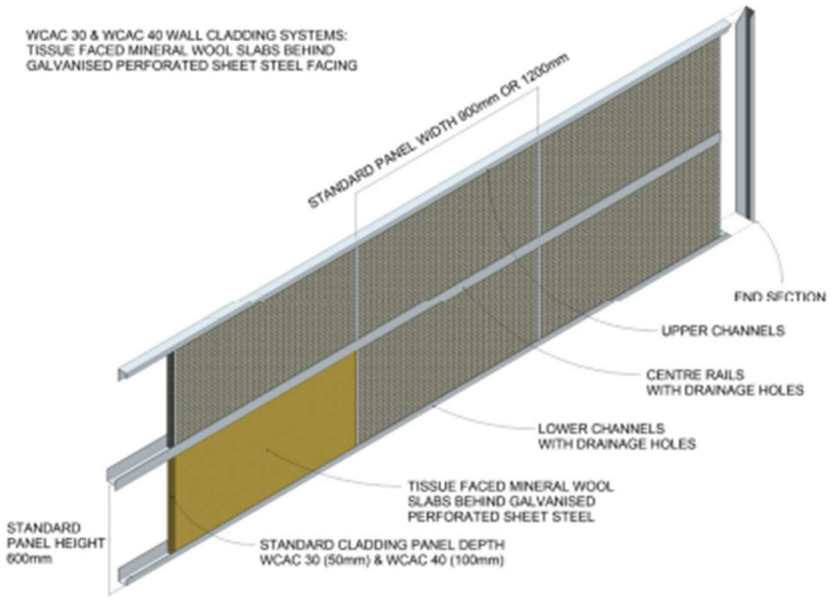
Acoustic Performance – Acoustic Absorption

Emtec's type WCAC Acoustic Cladding Systems incorporate 45kg/m^3 mineral fibre slabs manufactured from long stranded mineral fibres that are bonded into slabs. Emtec do not manufacture this acoustic media, but use products from reputable manufacturers of mineral wool products. The following figures have been extrapolated from manufacturers' published literature and are issued for design guidance.

Acoustic Panel Type	Absorption Coefficient of Panel's Internal Surface at Octave Band Centre Frequencies (Hz)								
	63	125	250	500	1k	2k	4k	8k	SAA
WCAC 40	0.25	0.55	0.90	0.95	0.95	0.95	0.85	0.80	0.97
WCAC 30	0.15	0.20	0.55	0.85	0.90	0.90	0.80	0.70	0.87

Design, Manufacture and Installation

Emtec Products Ltd. offer a comprehensive design service and it is advisable to contact us at an early stage in the Plan of Work so we can collaborate in the development of a design that meets your particular acoustic criteria. It is usual for WCAC Acoustic Cladding to be installed after the walls and ceilings have been built but before any other wall or ceiling mounted equipment has been fitted. Attention to detail is paramount, especially when considering all the usual items that might need to be mounted to the walls and ceiling such as lighting, switches, plugs, fire alarms, cables, conduit, pipe supports etc. Complete Acoustic Wall Cladding Systems can be designed, manufactured and installed by Emtec Products Ltd. If items will need to be fixed to the Acoustic Cladding then point loads or uniformly distributed loads can be considered and any necessary structural enhancements incorporated in the design. Our site management and installation teams are experienced in delivering projects in all sectors, working on developments that include tall buildings, airports, railway systems, hotels, hospitals and schools, as well as domestic projects for private clients.



Appendix E – Full Calculations

Pre-Mitigation

HGV Movement Noise Calculations									
Description	1/1 Octave Frequency Band (Hz, dB)								Overall (dBA)
	63	125	250	500	1k	2k	4k	8k	
HGV Pass-by at 3m (L_{eq})	84	77	75	73	72	71	65	59	77
Lw of HGV Pass-by	102	95	93	91	90	89	83	77	95

Calculated Sound Power Levels of Forklift Movements									
Description	1/1 Octave Frequency Band (Hz, dB)								Overall (dBA)
	63	125	250	500	1k	2k	4k	8k	
SEL of FL Pass-by No. 1	68	67	72	72	67	66	62	58	73
SEL of FL Pass-by No. 2	64	64	66	70	68	71	63	59	75
SEL of FL Pass-by No. 3	68	65	65	69	67	67	74	60	77
SEL of FL Pass-by No. 4	66	71	64	71	76	70	64	57	78
Average SEL of FL Pass-by at 3m	67	68	68	71	71	69	69	59	76
SEL of FL over 1-hour at 3m	31	32	32	35	36	33	33	23	41
Daytime L_W of FL Movement	49	50	50	53	53	51	51	41	58

Description	Item	Source Term	Parameter	dBA	1/1 Octave Frequency Band (Hz, dB)								Lp Dist (m)	Q Factor
					63	125	250	500	1k	2k	4k	8k		
Model / Unit	Specific Sound Level of FL Tipping Processed Waste	Octave-Band Lp	Lp at 15m, Q factor (Q=2)	73	64	62	56	59	65	68	66	61	15	2
No. of	1													
Data Type	Emperical Data		Total Lw	104	96	94	88	91	97	100	98	93		

Description	Item	Source Term	Parameter	dBA	1/1 Octave Frequency Band (Hz, dB)								Lp Dist (m)	Q Factor
					63	125	250	500	1k	2k	4k	8k		
Model / Unit	Electric FL Loading Waste onto HGV	Octave-Band Lp	Lp at 9m, Q factor (Q=2)	64	60	55	57	56	56	58	57	50	9	2
No. of	1													
Data Type	Emperical Data		Total Lw	91	87	82	84	83	83	85	84	78		

Description	Item	Source Term	Parameter	dBA	1/1 Octave Frequency Band (Hz, dB)								Lp Dist (m)	Q Factor
					63	125	250	500	1k	2k	4k	8k		
Model / Unit	FL Dropping Dismantled Waste into Skip by A1 at 5m	Octave-Band Lp	Lp at 5m, Q factor (Q=2)	88	79	76	81	82	83	82	80	77	5	2
No. of	1													
Data Type	Emperical Data		Total Lw	110	101	98	103	104	105	104	102	99		

Description	Item	Source Term	Parameter	dBA	1/1 Octave Frequency Band (Hz, dB)								Lp Dist (m)	Q Factor
					63	125	250	500	1k	2k	4k	8k		
Model / Unit	Doosan DX-250 WMH 360 Grabber Loading Metal Waste into Skip	Octave-Band Lp	Lp at 15m, Q factor (Q=2)	74	71	70	73	69	71	65	59	55	15	2
No. of	1													
Data Type	Emperical Data		Total Lw	105	103	102	105	101	103	97	91	87		

Description	Item	Source Term	Parameter	dBA	1/1 Octave Frequency Band (Hz, dB)								Lp Dist (m)	Q Factor
					63	125	250	500	1k	2k	4k	8k		
Model / Unit	Deisel Crusher at 5m	Octave-Band Lp	Lp at 5m, Q factor (Q=2)	89	82	81	81	84	84	82	79	74	5	2
No. of	1	NP-009237												
Data Type	Emperical Data		Total Lw	111	104	103	103	106	106	104	101	96		

Description	Item	Source Term	Parameter	dBA	1/1 Octave Frequency Band (Hz, dB)								Lp Dist (m)	Q Factor
					63	125	250	500	1k	2k	4k	8k		
Model / Unit	Pro 275-2 Gen Set at 7m (75% Load)	Global Lp dBA	Lp at 7m, Q factor (Q=2)	66									7	2
No. of	1	Typical typical for a 200kW combustion engine from CIBSE Guide B6 Table 4.1.	Typical Spectrum	107	104	107	106	102	102	101	95	88		
			Corrected Spectrum	66	63	66	65	61	61	60	54	47		
Data Type	Manufacturers Data		Total Lw	91	88	91	90	86	86	85	79	72		

Description	Item	Source Term	Parameter	dBA	1/1 Octave Frequency Band (Hz, dB)								Lp Dist (m)	Q Factor
					63	125	250	500	1k	2k	4k	8k		
Model / Unit	RORO Skip Collection at 2m	Octave-Band Lp	Lp at 2m, Q factor (Q=2)	78	74	74	72	75	74	72	66	57	2	2
No. of	1	NAW Report No. 7011FR												
Data Type	Emperical Data		Total Lw	92	88	88	86	89	88	86	80	71		

Noise Breakout Mitigation Calculations

A1 Building – East Wall

Plant L_w Summary Table												
Description	63	125	250	500	1000	2000	4000	8000	dBA	dB	Distance to receiver wall/ceiling (m)	Source Q
Time Corrected Waste Tip	83	80	85	86	87	86	84	81	92	94	2.0	4
Time Corrected RORO Collection	77	77	75	78	77	75	69	60	82	85	2.0	4
Total	**84**	**82**	**86**	**87**	**88**	**87**	**84**	**81**	**93**	**94**		

Plant Room Dimensions (m)	
Width	33.0
Length	45.0
Height	7.0

Calculated Areas (m^2)	
Walls	1092.0
Floor	1485.0
Ceiling	1485.0
Total	**4062.0**

Absorption Description		63	125	250	500	1000	2000	4000	8000	
Walls equivalent absorption		21.84	21.84	32.76	32.76	32.76	43.68	76.44	76.44	1) Rough Concrete
Floor equivalent absorption		29.70	29.70	44.55	44.55	44.55	59.40	103.95	103.95	1) Rough Concrete
Ceiling A equivalent absorption (1485m2) - %	100%	118.80	118.80	74.25	74.25	74.25	74.25	74.25	74.25	10) Little or no ductw
Sa - Total absorption area		170.3	170.3	151.6	151.6	151.6	177.3	254.6	254.6	
Average absorption coefficient of room		0.04	0.04	0.04	0.04	0.04	0.04	0.06	0.06	
K_{rcv} (dB)		**-16.5**	**-16.5**	**-16.0**	**-16.0**	**-16.0**	**-16.7**	**-18.3**	**-18.3**	

Estimated RT (s)	63	125	250	500	1000	2000	4000	8000
Sabine method	9.8	9.8	11.0	11.0	11.0	9.4	6.6	6.6
Eyering method	9.6	9.6	10.8	10.8	10.8	9.2	6.4	6.4

Approximate Direct levels (SPL)								
Description	63	125	250	500	1000	2000	4000	8000	dBA
Time Corrected Waste Tip	72.2	69.2	74.2	75.2	76.2	75.2	73.2	70.2	81
Total Direct Level L_p	73	71	75	76	77	76	73	70	82
Total Reverberant Level, $L_{p,rcv}$	68	65	70	71	72	70	66	63	76
Total Level at receiver / plant room wall/ceiling	**74**	**72**	**76**	**77**	**78**	**77**	**74**	**71**	**83**
Existing Internal Noise Level	74	76	77	79	80	80	76	70	**85**
Total Internal Noise Level at Element	**77**	**77**	**79**	**81**	**82**	**82**	**78**	**74**	**87**

A1 Building – South Wall & RSD

Plant L_w Summary Table												
Description	63	125	250	500	1000	2000	4000	8000	dBA	dB	)istance to receiver wall/ceiling (m	Source Q
Time Corrected Waste Tip	83	80	85	86	87	86	84	81	92	94	5.0	4
Time Corrected RORO Collection	77	77	75	78	77	75	69	60	82	85	5.0	4
Total	**84**	**82**	**86**	**87**	**88**	**87**	**84**	**81**	**93**	**94**		

Plant Room Dimensions (m)	
Width	33.0
Length	45.0
Height	7.0

Calculated Areas (m^2)	
Walls	1092.0
Floor	1485.0
Ceiling	1485.0
Total	**4062.0**

Absorption Description		63	125	250	500	1000	2000	4000	8000	
Walls equivalent absorption		21.84	21.84	32.76	32.76	32.76	43.68	76.44	76.44	1) Rough Concrete
Floor equivalent absorption		29.70	29.70	44.55	44.55	44.55	59.40	103.95	103.95	1) Rough Concrete
Ceiling A equivalent absorption (1485m2) - %	100%	118.80	118.80	74.25	74.25	74.25	74.25	74.25	74.25	10) Little or no ductw
Sa - Total absorption area		170.3	170.3	151.6	151.6	151.6	177.3	254.6	254.6	
Average absorption coefficient of room		0.04	0.04	0.04	0.04	0.04	0.04	0.06	0.06	
K_{rcv} (dB)		**-16.5**	**-16.5**	**-16.0**	**-16.0**	**-16.0**	**-16.7**	**-18.3**	**-18.3**	

Estimated RT (s)	63	125	250	500	1000	2000	4000	8000
Sabine method	9.8	9.8	11.0	11.0	11.0	9.4	6.6	6.6
Eyering method	9.6	9.6	10.8	10.8	10.8	9.2	6.4	6.4

Approximate Direct levels (SPL)								
Description	63	125	250	500	1000	2000	4000	8000	dBA
Time Corrected Waste Tip	64.2	61.2	66.2	67.2	68.2	67.2	65.2	62.2	73
Total Direct Level L_p	65	63	67	68	69	68	65	62	74
Total Reverberant Level, $L_{p,rcv}$	68	65	70	71	72	70	66	63	76
Total Level at receiver / plant room wall/ceiling	**70**	**67**	**71**	**73**	**73**	**72**	**69**	**66**	**78**
Existing Internal Noise Level	74	76	77	79	80	80	76	70	**85**
Total Internal Noise Level at Element	**75**	**77**	**78**	**80**	**81**	**81**	**77**	**71**	**86**

A1 Building – Roof

Plant L_w Summary Table												
Description	63	125	250	500	1000	2000	4000	8000	dBA	dB	Distance to receiver wall/ceiling (m	Source Q
Time Corrected Waste Tip	83	80	85	86	87	86	84	81	92	94	4.0	4
Time Corrected RORO Collection	77	77	75	78	77	75	69	60	82	85	4.0	4
Total	**84**	**82**	**86**	**87**	**88**	**87**	**84**	**81**	**93**	**94**		

Plant Room Dimensions (m)	
Width	33.0
Length	45.0
Height	7.0

Calculated Areas (m^2)	
Walls	1092.0
Floor	1485.0
Ceiling	1485.0
Total	**4062.0**

Absorption Description		63	125	250	500	1000	2000	4000	8000	
Walls equivalent absorption		21.84	21.84	32.76	32.76	32.76	43.68	76.44	76.44	1) Rough Concrete
Floor equivalent absorption		29.70	29.70	44.55	44.55	44.55	59.40	103.95	103.95	1) Rough Concrete
Ceiling A equivalent absorption (1485m2) - %	100%	118.80	118.80	74.25	74.25	74.25	74.25	74.25	74.25	10) Little or no ductw
Sa - Total absorption area		170.3	170.3	151.6	151.6	151.6	177.3	254.6	254.6	
Average absorption coefficient of room		0.04	0.04	0.04	0.04	0.04	0.04	0.06	0.06	
K_{rev} (dB)		**-16.5**	**-16.5**	**-16.0**	**-16.0**	**-16.0**	**-16.7**	**-18.3**	**-18.3**	

Estimated RT (s)	63	125	250	500	1000	2000	4000	8000
Sabine method	9.8	9.8	11.0	11.0	11.0	9.4	6.6	6.6
Eyering method	9.6	9.6	10.8	10.8	10.8	9.2	6.4	6.4

Approximate Direct levels (SPL)								
Description	63	125	250	500	1000	2000	4000	8000	dBA
Time Corrected Waste Tip	66.2	63.2	68.2	69.2	70.2	69.2	67.2	64.2	75
Total Direct Level L_p	67	65	69	70	71	70	67	64	76
Total Reverberant Level, $L_{p,rev}$	68	65	70	71	72	70	66	63	76
Total Level at receiver / plant room wall/ceiling	**70**	**68**	**72**	**73**	**74**	**73**	**70**	**67**	**79**
Existing Internal Noise Level	74	76	77	79	80	80	76	70	**85**
Total Internal Noise Level at Element	**76**	**77**	**78**	**80**	**81**	**81**	**77**	**72**	**86**

Bulker Loading & Waste Tipping Structure – Façades & RSD

Plant L_w Summary Table															
Description	63	125	250	500	1000	2000	4000	8000	dBA	dB	Distance to receiver wall/ceiling (m)	Source Q	w (m)	h (m)	l (m)
360 Grabber Loading Bulker	98	97	100	96	98	92	86	82	101	105	6.0	2			
5mins of Electric FL Tipping Processed Waste	85	83	77	80	86	89	87	82	93	94	6.0	2			
Total	**98**	**97**	**100**	**96**	**98**	**93**	**89**	**85**	**101**	**105**					

Plant Room Dimensions (m)	
Width	22.0
Length	15.0
Height	4.5

Calculated Areas (m^2)	
Walls	333.0
Floor	330.0
Ceiling	330.0
Total	**993.0**

Absorption Description		63	125	250	500	1000	2000	4000	8000	
Walls equivalent absorption		133.20	199.80	299.70	316.35	316.35	316.35	283.05	266.40	9) Emtec WCAC 40 Cladding
Floor equivalent absorption		6.60	6.60	9.90	9.90	9.90	13.20	23.10	23.10	1) Rough Concrete
Ceiling A equivalent absorption (330m2) - %	100%	132.00	198.00	297.00	313.50	313.50	313.50	280.50	264.00	9) Emtec WCAC 40 Cladding
Sa - Total absorption area		271.8	404.4	606.6	639.8	639.8	643.1	586.7	553.5	
Average absorption coefficient of room		0.27	0.41	0.61	0.64	0.64	0.65	0.59	0.56	
K_{rev} (dB)		**-19.7**	**-22.3**	**-25.9**	**-26.5**	**-26.5**	**-26.6**	**-25.5**	**-25.0**	

Estimated RT (s)	63	125	250	500	1000	2000	4000	8000
Sabine method	0.9	0.6	0.4	0.4	0.4	0.4	0.4	0.4
Eyering method	0.8	0.5	0.3	0.2	0.2	0.2	0.3	0.3

Approximate Direct levels (SPL)									
Description	63	125	250	500	1000	2000	4000	8000	dBA
360 Grabber Loading Bulker	74.2	73.2	76.2	72.2	74.2	68.2	62.2	58.2	77
5mins of Electric FL Tipping Processed Waste	61.2	59.2	53.2	56.2	62.2	65.2	63.2	58.2	70
Total Direct Level L_p	74	73	76	72	74	70	66	61	78
Total Reverberant Level, $L_{p,rev}$	78	75	74	69	71	67	64	60	75
Total Level at receiver / plant room wall/ceiling	**80**	**77**	**78**	**74**	**76**	**72**	**68**	**64**	**80**
Total Internal Noise Level at Element	**80**	**77**	**78**	**74**	**76**	**72**	**68**	**64**	**80**

Bulker Loading & Waste Tipping Structure – Roofing

Plant L_w Summary Table															
Description	63	125	250	500	1000	2000	4000	8000	dBA	dB	Distance to receiver wall/ceiling (m)	Source Q	w (m)	h (m)	l (m)
360 Grabber Loading Bulker	98	97	100	96	98	92	86	82	101	105	3.0	2			
5mins of Electric FL Tipping Processed Waste	85	83	77	80	86	89	87	82	93	94	3.0	2			
Total	**98**	**97**	**100**	**96**	**98**	**93**	**89**	**85**	**101**	**105**					

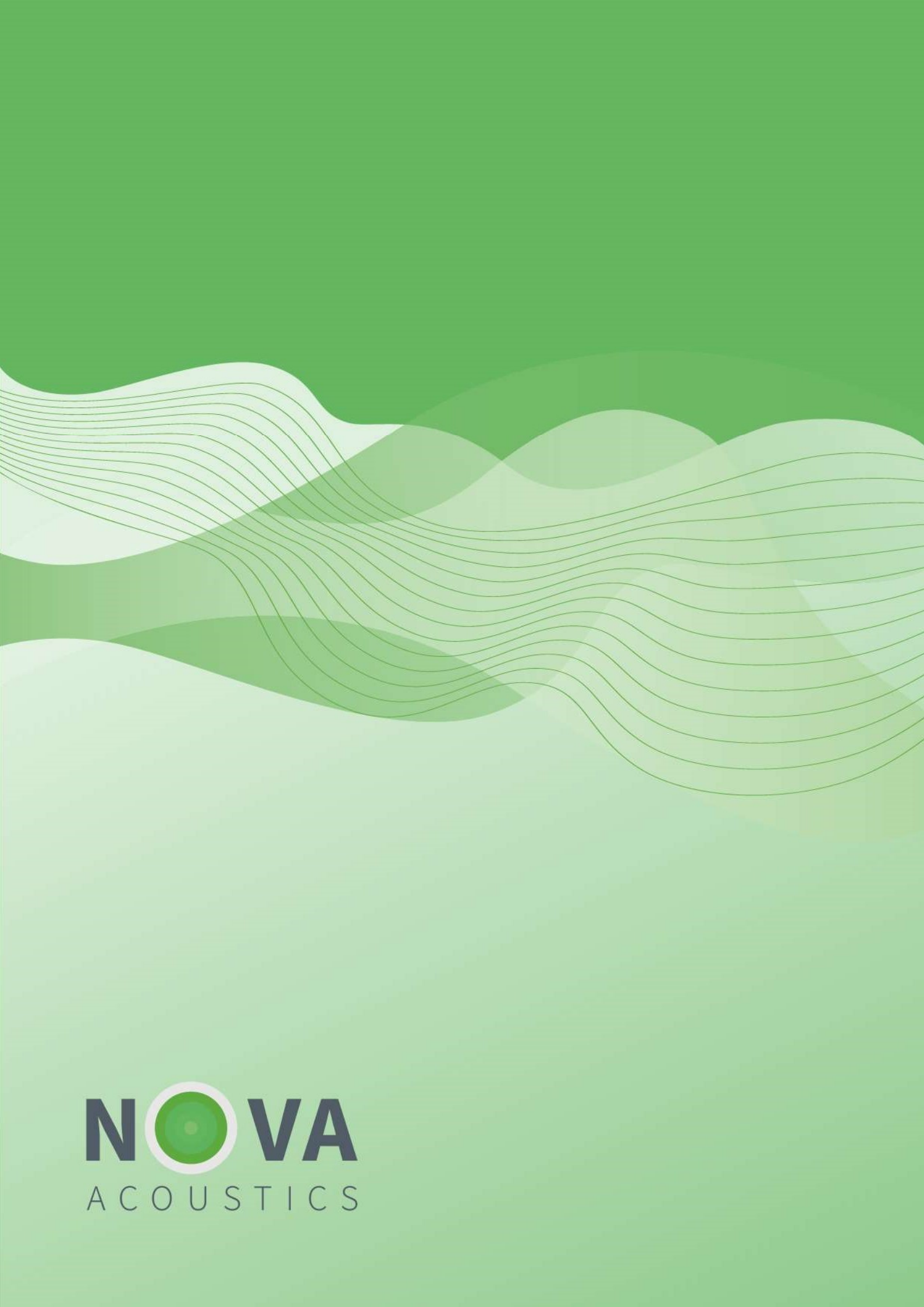
Plant Room Dimensions (m)	
Width	22.0
Length	15.0
Height	4.5

Calculated Areas (m^2)	
Walls	333.0
Floor	330.0
Ceiling	330.0
Total	**993.0**

Absorption Description		63	125	250	500	1000	2000	4000	8000	
Walls equivalent absorption		133.20	199.80	299.70	316.35	316.35	316.35	283.05	266.40	9) Emtec WCAC 40 Cladding
Floor equivalent absorption		6.60	6.60	9.90	9.90	9.90	13.20	23.10	23.10	1) Rough Concrete
Ceiling A equivalent absorption (330m2) - %	100%	132.00	198.00	297.00	313.50	313.50	313.50	280.50	264.00	9) Emtec WCAC 40 Cladding
Sa - Total absorption area		271.8	404.4	606.6	639.8	639.8	643.1	586.7	553.5	
Average absorption coefficient of room		0.27	0.41	0.61	0.64	0.64	0.65	0.59	0.56	
K_{rev} (dB)		**-19.7**	**-22.3**	**-25.9**	**-26.5**	**-26.5**	**-26.6**	**-25.5**	**-25.0**	

Estimated RT (s)	63	125	250	500	1000	2000	4000	8000
Sabine method	0.9	0.6	0.4	0.4	0.4	0.4	0.4	0.4
Eyering method	0.8	0.5	0.3	0.2	0.2	0.2	0.3	0.3

Approximate Direct levels (SPL)								
Description	63	125	250	500	1000	2000	4000	8000	dBA
360 Grabber Loading Bulker	80.2	79.2	82.2	78.2	80.2	74.2	68.2	64.2	83
5mins of Electric FL Tipping Processed Waste	67.2	65.2	59.2	62.2	68.2	71.2	69.2	64.2	76
Total Direct Level L_p	80	79	82	78	80	76	72	67	84
Total Reverberant Level, $L_{p,rev}$	78	75	74	69	71	67	64	60	75
Total Level at receiver / plant room wall/ceiling	**82**	**81**	**83**	**79**	**81**	**76**	**72**	**68**	**84**
Total Internal Noise Level at Element	**82**	**81**	**83**	**79**	**81**	**76**	**72**	**68**	**84**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