



ACOUSTIC
CONSULTANTS LTD

Noise Control Advice

Rooted Tree & Landscapes
Graig Road, Cilmaengwyn, SA8 4QN

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Client	Local Authority:
Rooted Tree & Landscapes Ltd	

Document Control

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The report has been prepared in good faith, with all reasonable skill and care, based on information provided or available at the time of its preparation and within the scope of work agreement with the Client. We disclaim any responsibility to the Client and others in respect of any matters outside the scope of the above. The report is provided for the sole use of the named Client and is confidential to them and their professional advisors. No responsibility is accepted to other parties.

The report limits itself to addressing solely on the noise, acoustic, and vibration aspects as included in this report. We provide advice only in relation to noise, vibration and acoustics. It is recommended that appropriate expert advice is sought on all the ramifications (e.g. CDM, structural, condensation, fire, legal, etc.) associated with any proposals in this report or as advised and concerning the appointment. It should be noted that noise predictions are based on the current information as we understand it and, on the performances noted in this report. Any modification to these parameters can alter the predicted level. All predictions are in any event subject to a degree of tolerance of normally plus or minus three decibels. If this tolerance is not acceptable, then it would be necessary to consider further measures.

Table of Contents

1.	Introduction	4
2.	The Site	5
3.	Local Authority Requirements	10
4.	Assessment Methodology	11
5.	Noise Monitoring	14
6.	British Standard 4142:2014	21
7.	Noise Control Measures	25
8.	Effect of Noise Control Measures	28
9.	Alternative Noise Control	32
10.	Noise Management	33
11.	Summary & Conclusions	34
12.	Appendix 1 – Glossary of Acoustic Terminology	35

1. Introduction

Acoustic Consultants Limited (ACL) have been appointed to provide acoustic advice with the aim of reducing the impact of noise on nearby residential premises from operations associated with the processing of tree wood to make fire logs at the Rooted Tree and Landscaping site on Graig Road, Cilmaengwyn, Swansea, SA8 4QN.

Our client has received a notification of noise complaints via the Local Authority. We understand that the LA have not issued a noise abatement notice at this time. We understand their correspondence with our client has been with the aim of providing noise control measures to be implemented to bring the impact of noise an acceptable level.

ACL have undertaken an attended noise survey at the site to obtain noise data of all noise generating operations at the site which have been measured under controlled conditions to allow for noise modelling and assessment.

The noise data obtained is presented within this report along with noise control measures to aid in reducing, as far as feasible, and using best available techniques (BAT), the impact of noise at the nearby sensitive receivers (NSRs). We also provide an outline noise management plan.

The author of this report is a Full Associate Member of the Institute of Acoustics (MIOA) and has over five years' experience in the field of noise and is considered suitably qualified to undertake this noise impact assessment.

The report has been approved by a Full Member of the Institute of Acoustics (MIOA) and Director of the company with over 16 years' experience in the industry.

2. The Site

2.1. Site Use & Surrounding Area

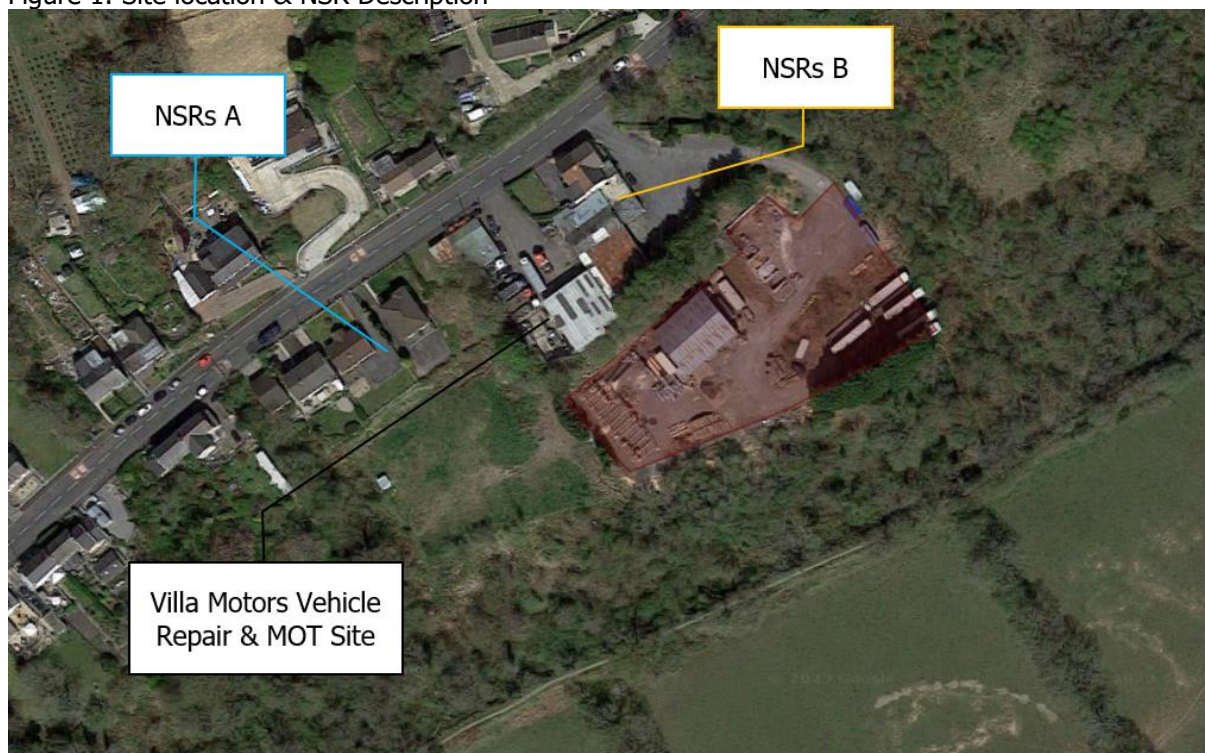
Rooted Tree & Landscapes site is set in a semi-rural, predominantly residential area. The site processes, cuts and stores firewood to sell. The client has advised that the site typically operates from 08:00 to 17:00 hours, with staff arriving from 07:00 to manually load equipment into work vehicles for their day; this does not form part of the noise complaints as we understand.

The existing operational site is flanked by dwellings to the north and north-west along Graig Road. In addition to this a vehicle garage, Villa Motor Repairs, is located to the immediate north of our client's site and is a substantial vehicle mechanics premises that undertakes MOTs and repairs of cars, and larger vehicles, such as HGVs. This unit separates the Rooted Tree site from the nearest dwelling (by distance) to the north.

The Rooted Tree site is set lower, topographically, than the NSRs. Due to the layout of the site, area, and other buildings, we have identified the most sensitive receiver(s) as noted in the following figure.

The following satellite image provides context of the site and layout of the surrounding area. The Rooted Tree site is highlighted in red.

Figure 1: Site location & NSR Description



2.2. Site Machines & Processes

We have highlighted areas of operation at the site with different colours, to aid in providing further descriptions and assessment. This information has been provided based on site observations and discussions with the client.

Figure 2: Site areas & referenced notes

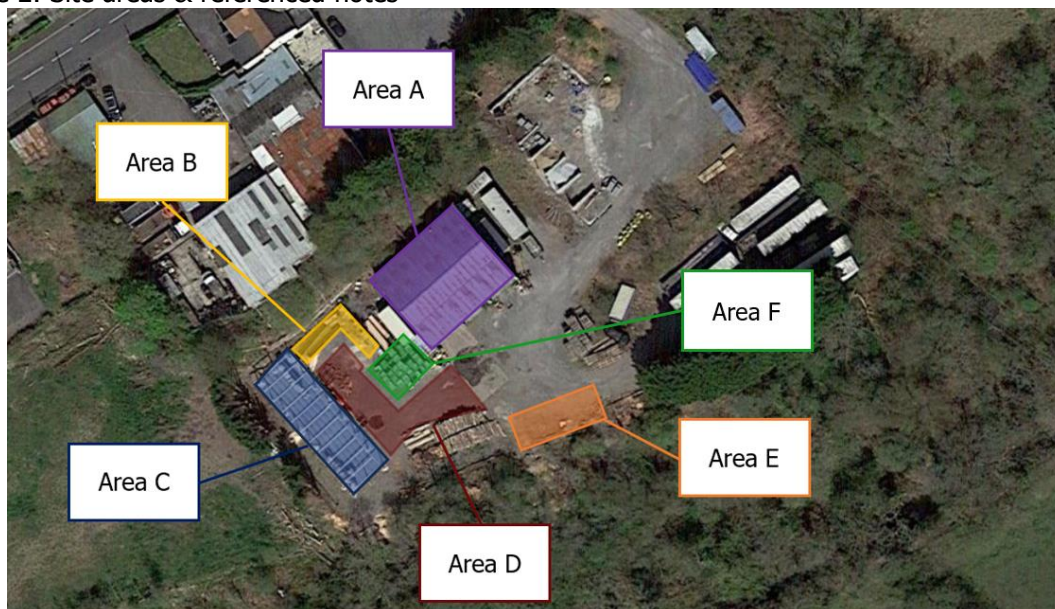


Table 1: Site Use Areas & Descriptions

Area	Description	Noise Notes
A	Office / Storage	No noise generation
B	Temporary / Overflow processed log storage	Use of forklift to maneuver log cages
C	Processed log storage	Use of forklift to maneuver log cages
D	Main forklift use area	Use of forklift
E	Area of chainsaw use	Use of chainsaw (electric / diesel)
F	Log Processor Log clearer Log storage cage drop	Main log processing unit, loading, chopping, clearing & dropping log to cage

Photos from our site visit are provided below. As these images show, all machines and operations are open to the atmosphere.

The existing structures are wide slatted wood, with several tarpaulin-type sheets covering some of the openings.

2.2.1. Log Processing

This information has been provided based on site observations and discussions with the client. The log processor is a Uniforest 443 which is an electric machine connected to a hydraulic feeding conveyor belt. The log lengths are fed into the machine by the conveyor belt, currently from the east-side of the noted area F. The conveyor belt and loading operation are not noise generating processes. The following photos show the first conveyor belt and log loading location.

Site Photo 1: First Log Conveyor Belt & Loading Position for Log Processor



The log processing machine is manually operated to a degree, to ensure the log size and shape is appropriate for the processor's safety enclosure. Once the log is secure within the main processing section, the saw is pulled down and the cut log is pushed to the second conveyor belt.

The process of the machine cutting the logs is a noise generating operation. The main noise source is due to the saw operating (mechanical noise), along with the contact between the rotating saw and wood.

The second conveyor belt is a movable unit, both side-to-side, and up-and-down.

Once the log is processed it is passed up the second conveyor belt to the "Cleaner". The Cleaner is a custom-made unit that our client has had made. This is a unit constructed with metal rods that is designed to remove unwanted bark and splinters from the processed log before storing. The logs are dropped from the second conveyor belt on to the top of the Cleaner. This generates noise from the impact of the logs falling onto the metal rods, and then rolling down the unit towards a storage cage.

The storage cages are unlined, rodded, metal cages to allow for air flow to the logs. The logs drop from the Cleaner into the cage.

The photo below shows the typical setup of the Cleaner and storage cage after the second conveyor belt. The second conveyor belt is typically positioned perpendicular to the Clearing rack.

Site Photo 2: Setup of Second Conveyor Belt, Log Cleaner, and Storage Cage



Use of the entire log processing operation noted above can be constant during a working day, as a worst-case scenario during busy periods.

As can be seen in the photos above, the log processing unit is open to the atmosphere, with no immediate screening (e.g., enclosure/barrier) in terms of noise propagation.

2.2.2. **Chainsaws**

This information has been provided based on site observations and discussions with the client.

Chainsaws are used at the site to cut longer lengths of log trunks to more manageable sizes for processing through the Uniforest machine. Our client has indicated that since conversations with the Local Authority have taken place, the site has purchased electric chainsaws, in place of using petrol chainsaws.

However, from our site visit and discussions with site management, the preference would be to use petrol chainsaws due to effectiveness and efficiency of use for the business. When in use, the chainsaw can produce a high level of noise at the site location.

We have been informed that use of chainsaws can be up to 1-hour per day.

2.2.3. **Forklift / Loaded**

This information has been provided based on site observations and discussions with the client.

Use of the forklift and loader is for manoeuvring logs and storage cages across the site for processing. The vehicles are diesel operated. Use of the forklift is frequent but not constant, and from discussions with site management a reasonable consideration is that it is used for 15-minutes within a 1-hour assessment period.

3. Local Authority Requirements

3.1. Noise Complaint

We understand that noise complaints have been received about operations at the Rotted Tree site in relation to processing of logs for firewood. The location of the complaints is unknown to us at the time of survey and writing.

From an email with the LA dated 21st November 2023 prior to the site survey, we understand that the main concerns of noise are as follows (but not limited to):

- Motorised wood processor
- Dropping of logs into metal barrels
- Chainsaws (diesel and electric)

3.2. Local Authority Agreement

Prior to attending the Rooted Tree & Landscaping site, we provided the Local Authority case officers with a proposed survey methodology to ensure every element of concern was addressed from the outset. The survey method was generally accepted on the 25th of October 2023, with one query on noise characteristic penalties, and the application of British Standard 4142:2014+A1:2019 in the assessment of the noise.

A response to Local Authority was emailed on the 26th of October 2023 stating:

"The penalty allocation will result wholly on the site survey and noise characteristics / impact that are measured (quantitatively / subjectively) during the site survey. I cannot comment on what penalties might be applied (if at all) until the attended measurements are undertaken.

In terms of the method of applying any required penalties, this will be undertaken in accordance with BS4142 where appropriate. The method will be used as a tool to assess the noise characteristics and impact a the NSRs.

In terms of the background measurements, the location will be representative of the noted NSR. Background measurement data sets will discard any existing operational noise."

The scope of British Standard 4142:2014+A1:2019 clearly states it is not intended to be used for the assessment of noise nuisance. However, our proposal was to utilise the Standard as a tool for the analysis and assessment of noise from operations at the site. The survey methodology was accepted and given the go ahead by the Local Authority on the 10th of November 2023.

4. Assessment Methodology

The following sections provide our proposed methods of noise assessment.

4.1. British Standard 4142:2014

As noted above, the scope of this Standard is not intended for the use in noise nuisance. However, it can be used as a guide for the purposes of investigating noise complaints.

The methods described in the British Standard use outdoor sound levels to assess the likely effects of sound upon people who might be inside or outside a dwelling or other premises used for residential purposes.

The initial estimate principle is that of establishing the 'difference' between the 'rating level' and the 'background sound level'. The 'rating level' is the 'specific sound level' of the source over a period of one hour during the day (07:00 to 23:00 hours) and over a period of 15 minutes during the night (23:00 to 07:00 hours). Clause 9 entitled 'Rating Level' 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."

An acoustic character correction should be added to the 'specific sound level' if it exhibits any tonality, impulsivity, other specific characteristics and/or intermittency at the assessment location. The value of the character correction varies, dependent on the prominence of the character of the sound source at the assessment location. In Clause 11 of the Standard, entitled 'Assessment of the Impacts', it states:

"Obtain an initial estimate of the impact of the specific sound by subtracting the measured background sound level (see Clause 8) from the rating level (see Clause 9), and consider the following."

- *Typically, the greater this difference, the greater the magnitude of the impact.*
- *A difference of around +10 dB or more is likely to be an indication of a significant adverse impact, depending on the context.*
- *A difference of around +5 dB 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 low impact, depending on the context."*

It should be noted that the numerical outcome only represents the initial estimate of impact, as stated in the first paragraph of Clause 11, and that contextual matters should be considered before determining what the potential impact is. The second part of Clause 11 sets out three contextual matters that should be taken into account once the initial numerical estimate has been determined. It is important to note that the three listed is not exhaustive and all pertinent factors should be considered.

4.2. British Standard 8233:2014

BS8233:2014 entitled 'Guidance on sound insulation and noise reduction for buildings', provides advice on noise as it affects buildings of all types, giving consideration to various common sources of noise.

It provides 'absolute levels' in terms of indoor noise from external sources within a dwelling. Section 7.7.2 Table 4 of the British Standard provides internal ambient noise levels for dwellings from noise sources 'without a specific character' as follows:

Table 2: British Standard 8233:2014 Internal Noise Criteria

Activity	Location	Daytime (07:00 to 23:00)	Night-time (23:00 to 07:00)
Resting	Living Room	35 dB $L_{Aeq,16\text{ hour}}$	-
Dining	Dining Room/area	40 dB $L_{Aeq,16\text{ hour}}$	-
Sleeping (daytime resting)	Bedroom	35 dB $L_{Aeq,16\text{ hour}}$	30 dB $L_{Aeq,8\text{ hour}}$

"7.7.3.2 Design criteria for external noise

For traditional external areas that are used for amenity space, such as gardens and patios, it is desirable that the external noise level does not exceed 50 dB $L_{Aeq,T}$, with an upper guideline value of 55 dB $L_{Aeq,T}$ which would be acceptable in noisier environments."

We would therefore consider an external noise level of 50 dB $L_{Aeq,T}$ to be applicable at the gardens of the NSRs.

4.3. WHO

World Health Organisation (WHO) guidance in "Guidelines for Community Noise, 1999". aims to protect populations from the adverse health impacts of noise. The WHO Guideline values for community noise (for dwellings) 1999 are as follows.

Table 3: WHO Guideline values for community noise (for dwellings) 1999

Specific Environment	Critical health effect(s)	L _{Aeq} (dB)	Time base (hours)	L _{Amax,fast} (dB)
Outdoor living area	Serious annoyance, daytime and evening	55	16	-
	Moderate annoyance, daytime and evening	50	16	-
Dwelling, indoors	Speech intelligibility and moderate annoyance, daytime and evening	35	16	-
Inside bedrooms	Sleep disturbance, window open	30	8	45

These are typically replicated through BS8233, noted above.

5. Noise Monitoring

A fully attended noise monitoring exercise was undertaken at the site on Tuesday the 21st of November 2023. The survey was attended by site management to demonstrate equipment, machinery, and processes.

5.1. Monitoring Procedure

It was decided that the survey would be undertaken from the start of an entire log processing operation, and work through measuring the equipment in chronological order. The ACL operative, James Abbass, undertook measurements at the NSRs once the log processor was operating, to gain an understanding of the level of noise impacting upon the occupants at the dwellings. Further measurements of the machines and processes at the site would then be carried out. The following list provides the order in which we undertook initial noise measurements at the site.

- Avant 750 collecting & manoeuvring logs from Area E to Area F
- Avant 750 placing logs on Uniforest conveyor belt
- Measurement at rear of NSRs and street to the north
- Measurements of logs dropping on the cleaner
- Measurements of log processor operating
- Forklift operation and movements

Once the above measurements were complete, further monitoring was undertaken based on initial subjective assessments carried out by the ACL operative. These are listed below:

- Processed logs being dropped into an empty, unlined, storage crate
- Logs dropping with second conveyor belt set at a lower height to cleaning rack
- Processed logs being dropped into an empty, base-lined, crate
 - The storage crate was lined with 2x layers of 15mm blue foam that our Client had on site

The Cleaning rack was then moved 90° to be in line with the front of the conveyor belt and lowered to the lowest possible height.

- Processed logs being dropped on the Cleaning rack once in line with conveyor belt
- Measurements of chainsaw use
- 15-minute measurement of operations at NSRs (Locations 1a & 2a)
- Background measurements at NSRs with no Rooted Tree operations underway

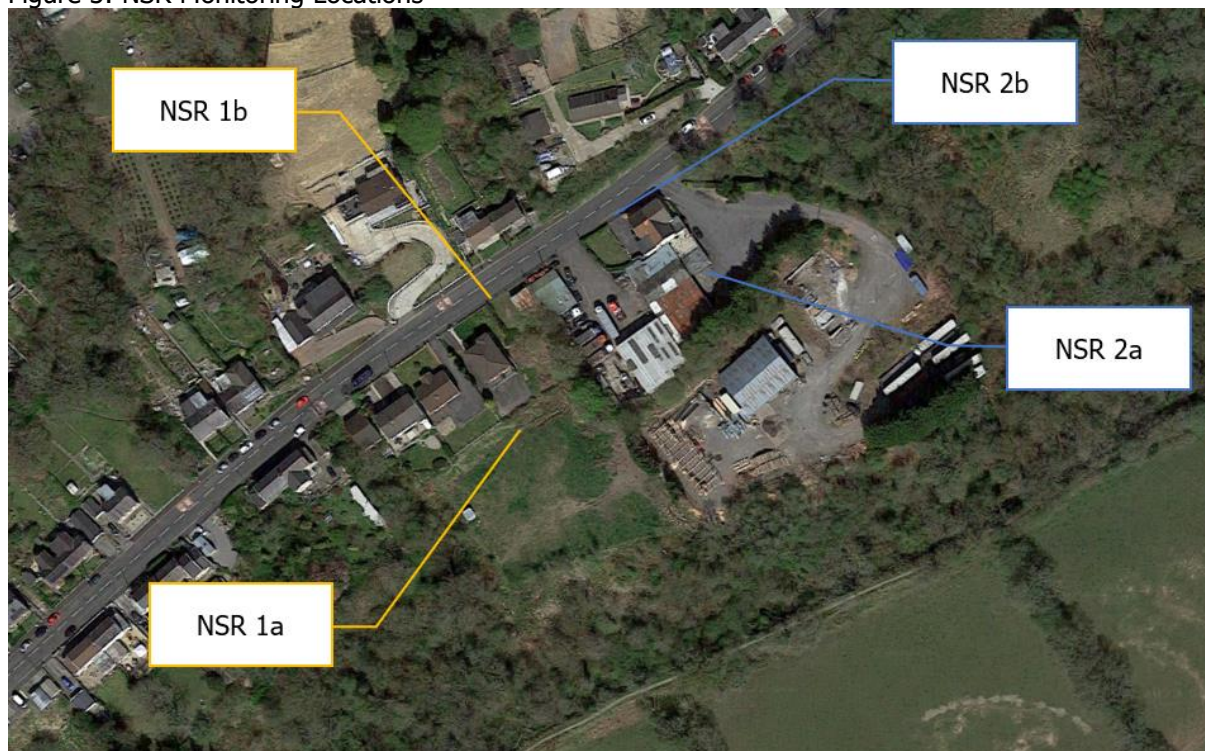
Measurements of machines and equipment were 30-seconds in duration. All locations were in a free-field position at a height of 1.5 metres above the ground.

5.2. Monitoring Locations

Noise measurements of the machines and equipment used at the site were carried out at multiple locations. The measurement locations were stationary around the equipment in use and measured with a laser measure. All locations used within the data set are detailed by distance from the source within the measured noise level table below.

Measurements at the NSRs were carried out in the locations noted below. Measurements were undertaken at the rear of the properties, as well as to the front on the street.

Figure 3: NSR Monitoring Locations



5.3. Monitoring Equipment

Sound Pressure Levels were measured using sound level meters with a half-inch condenser microphone. The equipment is checked annually using a Quality System meeting the requirements of British Standard EN ISO/IEC 17025:2005 and in accordance with British Standard EN 10012:2003 and traceable to the National Standards.

This equipment was checked and calibrated as noted below and the certificates are available for inspection. Table 4 provides the equipment and calibration status.

Table 4: Equipment and Calibration Status

Equipment Description / Manufacturer / Type	Serial Number	Date of Calibration	Calibration Certification Number
SLM, NTI, XL2	A2A-09705-E0	10/10/2023	UK-23-113
Pre-Amp, NTI, MA220	5332	10/10/2023	UK-23-113
Microphone, NTI, MC230A	A14374	10/10/2023	UK-23-113
Calibrator, NOR-1251	35230	30/11/2022	42658
SLM, Svantek, 977A	69510	09/03/2022	1501934-1
Pre-Amplifier, Svantek, SV12L	73650	09/03/2022	1501934-1
Microphone, ACO Pacific, 7052E	70151	09/03/2022	1501934-1
Calibrator, Larson Davis, CAL200	17892	17/04/2023	44016

The measurement systems were calibrated before use with the noted calibrator. The measurement systems were checked after the survey for calibration drift. A drift of 0.0dB was measured on both systems after the survey. The measured calibrations are not expected to adversely impact the measured data.

5.4. Weather Conditions

The weather conditions are as follows and are not expected to have adversely affected the measured data.

Table 5: Weather Conditions During Survey

Wind Speed (m/s)	Prevailing Wind Direction	Average Air Temperature (°C)	Precipitation (time/hrs)	Cloud Cover (%)
2 to 3	N	~10	0	25

5.5. Measured Noise Levels

5.5.1. Equipment & Operations

The following table provides the measured noise levels of noted machines, equipment, or process.

Table 6: Measured Equipment Noise Levels

Noise Source & Measurement Distance (m)	Measured $L_{eq,T}$ / Octave Band (Hz), dB								dB(A)
	63	125	250	500	1000	2000	4000	8000	
Avant grabber collecting logs & moving to conveyor belt / 6m	85	78	79	77	73	68	62	53	78
Avant placing logs on belt / 15m	78	75	74	72	66	61	55	47	73
Logs dropping on cleaning rack / 5.5m	59	64	72	65	67	64	62	58	71
South of Log Processor / 4m	64	72	76	74	73	74	73	69	80
Fork loading a full storage cage of logs & reversing / 3m	75	67	61	62	60	59	56	47	66
Fork driving forward with full cage / 3m	83	72	62	69	62	61	61	55	70
Fork reversing / 4m	85	75	63	70	65	64	65	58	73
Fork moving empty cage into loading position / 4m	80	71	62	66	61	60	61	55	69
Logs hitting cleaning rack	59	66	70	74	77	72	69	63	80
Logs dropping on cleaning rack / 15m	56	59	57	59	59	57	56	47	64
Logs dropping on cleaning rack / 15m	59	60	59	58	57	57	56	48	63

Noise Source & Measurement Distance (m)	Measured $L_{eq,T}$ / Octave Band (Hz), dB								dB(A)
	63	125	250	500	1000	2000	4000	8000	
Logs dropping on cleaning rack with Conveyor belt at lower height / 7.5m	64	65	62	61	60	61	59	52	67
Logs dropping on cleaning rack with Conveyor belt at lower height / 7.5m	60	60	61	60	60	62	61	52	67
Logs dropping into cage with 2x layers of foam / 7.5m	60	68	67	68	71	69	67	61	75
Logs dropping into cage with 2x layers of foam / 7.5m	60	67	67	70	71	69	68	61	76
Log cleaning rack moved 90 degrees, in line with Conveyor belt / 6m	59	67	66	65	65	65	63	57	71
Log cleaning rack moved 90 degrees, in line with Conveyor belt / 15m	60	62	61	60	59	58	57	50	65
Petrol chainsaw / 8.5m	62	75	77	75	74	75	74	67	81
Electric chainsaw / 8.5m	51	52	53	59	65	63	60	58	69

5.5.2. Levels of Operations at NSR

The following table provides the measured equivalent noise level of operations at monitoring location 1a. During the measurement, works from the Rooted Tree site consisted of the Log Processor, logs dropping onto the cleaning rack, storage crates being moved on the site, use of the petrol chainsaw, and use of the electric chainsaw.

Table 7: Measured Levels of Operations at NSR 1a

Source	Measured $L_{eq,T}$ dB
Whole 15-minute period	46 dB $L_{Aeq,15minute}$
Logs dropping on cleaning rack	47 dB $L_{Aeq,10seconds}$
Petrol chainsaw	47 dB $L_{Aeq,1minute}$
Electric chainsaw	42 dB $L_{Aeq,20seconds}$

Logs being dropped on to the cleaning rack is just perceptible at the NSR locations. It should be noted that the setup of the cleaning rack at this point was in line with the second conveyor belt, and at the lowest height possible for this measurement.

The petrol chainsaw is clearly audible at the location, whilst the electric chainsaw is only just perceptible with careful listening.

Based on our measurements at the locations, noise from logs dropping on to the cleaning rack is just perceptible at the NSRs.

Noise from the petrol chainsaw presents clear subjective noise characteristics.

Noise from the log processor is audible with careful listening but does not present clear subjective noise characteristics at the NSRs.

Noise from the forklift use is not clearly discernible over the residual noise climate.

5.5.3. Baseline Measurements

The following table provides the measured equivalent and background noise levels obtained while no operations at Rooted Tree were being carried out. Measurements were undertaken at monitoring locations 1a and 2a.

Table 8: Measured Baseline Noise Levels

Location	$L_{A90,15minutes}$ (dB)	$L_{Aeq,15minutes}$ (dB)
1a	43	45
2a	43	45

The residual noise climate at the two locations is dictated by distant road traffic, making up the background noise levels, along with local road traffic, bird call and wind through the nearby trees, making up the equivalent noise climate.

5.5.4. Notes & Observations

During the attended monitoring it was noted that the most dominant sources of noise from operations at the Rooted Tree site associated with log processing for firewood are as follows:

- Petrol chainsaw use
- Logs hitting the cleaning rack
- Log processing machine (Uniforest 443)

All the above noise sources are clearly audible at the rear of the nearby dwellings. Subjectively, the ACL operative identified NSRs A as the most sensitive receiver.

Subjective assessments conclude that use of the petrol chainsaw presents clear noise characteristics at the NSRs.

Logs hitting the metal cleaning unit present noise characteristics that are just perceptible at the NSRs. The log processor and forklift do not present clear noise characteristics at the NSRs.

6. British Standard 4142:2014

As noted above, this Standard is not intended for use in assessing noise nuisance; its intended use is for planning assessment. However, the methodology can be utilised as a tool to provide initial assessment of the impact from industrial noise sources. It can also be used to determine appropriate noise character corrections that may be required to derive the rating noise level, L_r , at the nearby dwellings.

6.1. Initial Assessment

A British Standard 4142:2014 assessment of the impact of operations noise has been undertaken at the position of the noted NSRs. It should again be noted this is a planning tool and not intended for nuisance, however it does provide guidance on the level of impact. The Rooted Tree log processing site is not open during the evening or night-time hours. Therefore, the following considers the daytime hours (07:00 to 18:00) only.

6.1.1. Background Sound Level

From the measured data we have determined a typical background sound level to be 43 dB $L_{A90,1\text{hour}}$ during the day.

6.1.2. Specific Sound Level

The specific sound level of noise due to the plant is 47 dB $L_{Aeq,T}$ at the NSRs. These are the levels determined at the noise-sensitive receiver without any character corrections applied.

6.1.3. Character Corrections

Character corrections should be added to the 'specific sound level' if it exhibits any *tonality, impulsivity, other specific characteristics and/or intermittency* at the assessment location. Based on our site visit and knowledge of such air handling units, corrections to be applied are as follows:

- **Tonality** – There was no perceived tonality at the NSR's. We have also carried out a tonality check in accordance with Appendix C of BS4142. Our data also indicates that equipment is not tonal in nature.
- **Impulsivity** – The machines and operations (dropping of logs) are considered impulsive. A +3dB penalty is applied for impulsivity that is just perceptible.
- **Intermittency** – From our site visit, intermittency of equipment is distinguishable at the NSRs, including from the use of chainsaws. A +3dB penalty is applied.
- **Other Sound Characteristics** – No correction is applied for other sound.

6.2. Initial Estimate of Impact

Considering the data and information provided above, the British Standard 4142:2014 initial estimate at the sensitive receiver location is as follows.

The table provides an assessment with and separately, without, the petrol chainsaw operating.

Table 9: British Standard 4142:2014 Initial Estimate

Parameter	Day
Background Sound Level, $L_{A90,T}$	43 dB
Specific Sound Level $L_{Aeq,T}$	47 dB
Acoustic Character Correction	+6 dB
Rating Level $L_{Ar,T}$	53 dB
Difference between rating and background level	+10 dB

This means that the rating sound level will result in a British Standard 4142:2014 assessment 'difference' at the NSR of +10 dB.

When assessed in accordance with BS4142 it is an indication that noise from operations result in a significant impact during the day. It should be noted context needs to be considered.

6.3. Context

BS4142 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 effective assessment cannot be conducted without an understanding of the reason(s) for the assessment and the context in which the sound occurs/will occur. When making assessment and arriving at decisions, therefore, it is essential to place the sound in context."

We provide the following contextual assessments.

6.3.1. Absolute Levels

The document states:

"1) The absolute level of sound. For a given difference between the rating level and the background sound level, the magnitude of the overall impact might be greater for an acoustic environment where the residual sound level is high than for an acoustic environment where the residual sound level is low. Where background sound levels and rating levels are low, absolute levels might be as, or more, relevant than the margin by which the rating level exceeds the background. This is especially true at night. Where residual sound levels are very high, the residual sound might itself result in adverse impacts or significant adverse impacts, and the margin by which the rating level exceeds the background might simply be an indication of the extent to which the specific sound source is likely to make those impacts worse.

With regard to 'absolute levels', the most relevant guidance is British Standard 8233:2014 and WHO 1999.

Internally to a dwelling during the day, indoor ambient noise levels should not exceed 35 dB $L_{Aeq}(16hr)$.

The internal level is approximately 15 dB(A) quieter than the external free-field level (as stated by the WHO) allowing for the attenuation of a partially open window.

Therefore, based on the above, the worst-case absolute level assessment is follows.

Table 10: Absolute level assessment

NSR	Predicted External Level	Open Window Correction dB(A)	Predicted Internal Level $L_{As,T}$ dB	Within Criteria
A	47 $L_{As,1hr}$ dB	-15	32	YES
B		-15	32	YES

As can be seen from the table above, the absolute level within the NSRs, considering an open window for natural ventilation, falls within the criteria of BS8233 and guidance in WHO.

6.3.2. Residual Noise Levels

Regarding residual noise levels (the existing noise levels without any Rooted Tree operations considered, the document states:

"2) The character and level of the residual sound compared to the character and level of the specific sound."

The measured residual sound level of 45 dB $L_{Aeq,T}$, noted in Section 5.5.3, is exceeded by the operational noise levels by a small margin of 2 decibels of 47 dB $L_{Aeq,T}$ at a location representative of the NSRs.

6.4. **BS4142 Summary**

Measured noise levels have been compared to the existing background sound levels at the site, and locations representative of the NSRs. Noise levels from operations with and without the petrol chainsaw exceed the background sound levels by 10, and 7 dB respectively.

A contextual assessment indicates that absolute levels within the NSRs (with a partially open window) are within BS8233 criteria and WHO guidelines. Alongside that the operational noise levels marginally exceed the residual noise climate by 2dB.

A difference of 3dB in sound pressure levels is widely considered and accepted as the first instance of being a perceptible variance in level.

However, the large exceedance of operational noise over background sound levels would dictate that noise control measures should be implemented to reduce the impact of noise at the NSRs.

Subjectively, the noise from operations of the log processor creates an adverse change in noise climate. Noise from the chainsaw creates a clear significant change in the noise climate.

7. Noise Control Measures

Based on the above measured noise data and our site visit, we consider the dominant noise sources are as follows:

- Petrol chainsaw use
- Logs hitting the cleaning rack
- Log processing machine (Uniforest 443)

The following noise control measures will aim to reduce, as far as feasible, and within best available techniques (BAT) at the site, the impact of noise at the NSRs.

We also base the following on initial conversations with site management at Rooted Tree.

The following is in outline only, and the end performance of any noise control measures implemented will be down to installation, workmanship, and detailing. It should be noted these measures may not be feasible, during not business and operational constraints.

We have also provided outline measures in Section ?? which follow BAT.

7.1. Proposed Measures

As noted above, the existing site and operations are all open to the atmosphere.

To control the propagation of noise to the NSRs we proposed constructing a fully enclosed unit that incorporates only the necessary openings to allow operations to take place.

To control the noise of the log processor and logs dropping onto the cleaning rack, we advise the construction of a unit to enclose Areas B, C, D, and F below.

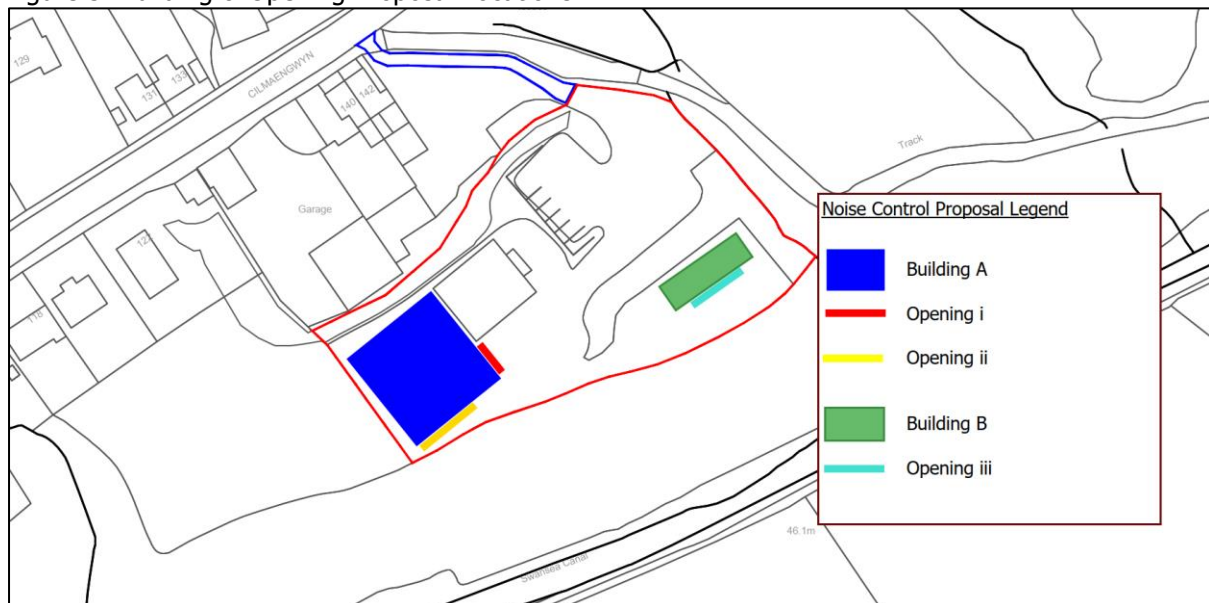
Figure 4: Reference Areas



In addition to this, we advise the construction of an enclosed unit to house the petrol chainsaw. We have included this to the east corner of the existing site, set away from the NSRs.

We have marked up the following site plan to indicate the locations and extent of the proposals. Please note, these are not to scale, and are for information only. The dimensions of the buildings that we have proposed and modelled are listed below and can be amended to reflect requirements. If any dimensions are amended, the noise modelling will require reassessment.

Figure 5: Building & Opening Proposal Locations



The following table provides the dimensions that we have considered for the above in our noise model.

Table 11: Building & Opening Information

Element	Dimensions h x w x l (metres)	Orientation	Intended Use
Building A	6 x 18 x 17	--	Log processing unit. Log cleaning rack and storage cages. Storing of cages via forklift.
Opening i	2 x 2	East	Opening for loading of logs to be processed. First conveyor belt for loading via Avant vehicle.
Opening ii	4 x 5	South	Opening for forklift access. Log cage maneuvering out of storage.
Building B	4 x 6 x 20	--	Chainsaw use (petrol and electric)
Opening iii	4 x 6	South	Access to load logs to be cut. Access to carry cut logs to processing area.

7.2. Building Fabric

We have used the same building fabric details for both buildings.

7.2.1. Walls & Roof

To model the proposed units, we have considered the use of Kingspan Quadcore KS1000RW Wall / Roof Panels.

These provide the following sound reduction index (SRI), sourced from the Kingspan product webpage. These are expected to be suitable for site use, however, if this is not feasible alternatives should be suggested. Any alternatives will require reassessment.

Table 12: SRI of Proposed Kingspan KS1000RW Wall & Roof Panels

Frequency Band (Hz)	63	125	250	500	1000	2000	4000	8000	R _w
SRI (dB)	20	18	20	24	20	29	39	47	25

7.2.2. Openings

We would expect the openings for access with a forklift vehicle would be constructed using a roller shutter door or similar.

We advise that the chosen material have a minimum surface mass of 10kg/m². The access door to Building A should be closed during typical operations, and all equipment switched off when it is opened for loading access.

We have not considered any windows to any of the façades. If this were desired, the noise modelling would require reassessment.

7.2.3. Ventilation

As noted above, we have considered the openings to be fully opening during use. Therefore, we have not considered any other ventilation measures to be required.

If this were to change, and ventilation is expected to be installed, the noise model will require reassessment.

8. Effect of Noise Control Measures

8.1. Noise Modelling Parameters

The noise emission has been modelled in the noise modelling software Cadna:A by DataKustik. The modelling software calculates sound levels based on the inputted sound emission values, source, and receiver locations, and primarily distance, barrier and ground attenuation. Calculations are undertaken using the General Method of Calculation from ISO 9613.

The parameters within the Cadna:A model are as follows and are considered reasonable assumptions with simplified geometry of the buildings:

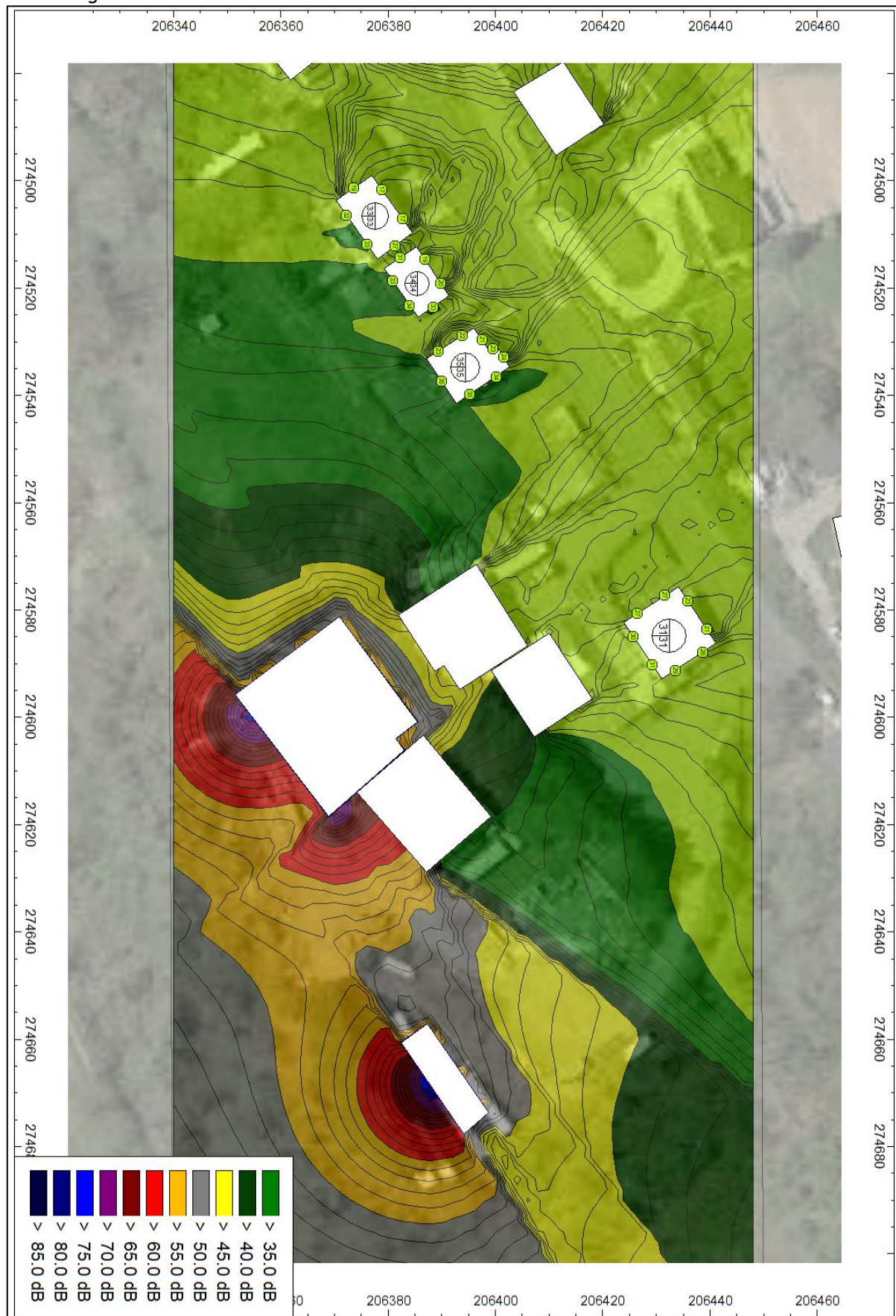
- The building heights are based on site visit observations and Google Earth imagery.
- The proposed building heights are provided above.
- The order of reflections is 3, and all buildings are reflective.
- Building evaluations are undertaken at 1.5m above the ground.
- The noise map is calculated at 1.5m above the ground.
- The ground across the site and surrounding area is considered hard and reflective ($G=0$).
- Topography of the site is considered flat. This is not the case at the site, however, due to the nature of the project being required because of noise complaints, we have not included topography data to account for a worst-case assessment to the NSRs.
- The predictions are based on the measured data provided above.
- The proposed building construction details are provided above.
- The proposed buildings have been input to the noise model as noise generating building areas.
- Log processing and logs dropping on to the cleaning rack are constant over the 1-hour assessment period.
- Petrol chainsaw use has been considered as a constant noise source over the same 1-hour assessment period. This is not likely to occur frequently but considers the worst-case scenario.
- The access door (Opening ii) is considered to be closed during operation.

8.2. Noise Modelling Results

The following noise map provides the noise modelling predictions based on the above details.

The noise map is calculated with the proposed buildings SRIs noted above.

Figure 6: Noise Map due to Operational Noise from Proposed Site Upgrades at Rooted Tree Log Processing Site



8.3. Noise Assessment

The noise modelling results above indicate that the worst-case façade level at the NSRs due to operations noted above is 35 dB $L_{Aeq,T}$.

This is the predicted level with the petrol chainsaw operating at the same time as the log processor. However, our noise modelling indicates that the petrol chainsaw has no effect on the worst-case NSR now it is sited away from the dwellings.

The predictions are based on the above details, and final performance is subject to design, installation, detailing, and workmanship.

8.3.1. Comparison to Existing Background Noise

With the same character corrections applied (+6 dB), this equates to a L_r of 41 dB $L_{Aeq,T}$ at the worst-case NSR, and falls under the measured background noise level of 43 dB $L_{A90,T}$.

In terms of planning, this would achieve the aims of PPW, and BS4142.

8.3.2. Absolute Levels

Based on the above predictions, the noise level inside a dwelling with a partially open window considered could be 20 dB $L_{Aeq,T}$.

This falls comfortably below and achieves the aims of BS8233 criteria and WHO guidelines for speech intelligibility and annoyance.

8.3.3. Residual Levels

Based on the above, the predicted L_s falls 10dB below the existing residual noise climate at the NSRs. This indicates that noise will not be detrimental to the health and wellbeing of occupants at the NSRs.

Alongside this, it is also an indication that characteristics of noise may not be distinguishable over the existing noise climate.

8.3.4. Amenity Spaces

Based on the above noise modelling, the predicted level within the worst-case garden of the NSRs is below 45 dB $L_{Aeq,T}$.

This falls comfortably below and achieves the aims of BS8233 criteria and WHO guidelines for annoyance.

8.4. **Summary of Noise Control Measure Assessment**

Based on the above proposals, acceptable levels of noise due to Rooted Tree log processing operations could be achieved, subject to installation, detailing, and workmanship.

The assessment indicates that with the noted noise control measures implemented, noise levels due to works will fall below existing background sound levels and be within BS8233 and WHO criteria for inside a dwelling.

The predicted levels also indicate that noise due to works will fall below the existing residual noise climate at the site and NSRs.

Noise levels within the gardens of NSRs fall within BS8233 and WHO criteria and guidelines.

9. Alternative Noise Control

If the above noise control advice is not feasible due to business constraints or similar, the following options could also provide noise control measures, however, they may not provide the same reduction of noise impact as that noted above.

1. Barriers

Barriers could be installed to the boundaries and noise generating areas of the site. In certain areas where noise emission is high, i.e., petrol chainsaw and log processor, canopies would likely be required in addition to barriers.

The location and construction details of barriers could be investigated if the above control measures are not feasible.

2. Reduced Working Hours

A reduction in working hours would not change the outcome in terms of BS4142. However, a reduction in hours of noise generating work would reduce the impact that the noise creates at the NSRs.

3. Noise Management Plan

Site operations could follow a NMP that is agreed upon with the Local Authority. We provide an outline NMP below.

10. Noise Management

To minimise the impact of noise at the NSRs we advise the following points as outline:

1. All staff (new and existing) to be made aware of the noise complaints received.
2. All staff (new and existing) to be briefed on the noise control measures to be implemented at site.
3. No noise generating works are to commence before 08.00 hours every day.
4. All diesel vehicles have their engines switched off when not in use.
5. No diesel engines are to be left idling.
6. The second conveyor belt and cleaning rack must be positioned in line with each other in the machine set up.
7. The second conveyor belt must be lowered to it lowest possible height with the above considered.
8. Petrol chainsaw use must be limited to a continuous 1-hour period as a maximum.
9. Any new noise generating equipment may require assessment to ensure predicted noise levels do not increase at the NSRs.
10. A complaint phone number and email address should be publicly displayed on the site and monitored by staff.
11. Where a noise complaint from the public is received, it should be directed to the site manager.
12. On receipt of a noise complaint, the site manager, or other trained staff, should investigate the cause in a professional and constructive manner. A log of complaints should be kept by management. When considered necessary, measures should be put in place to reduce the likelihood of the complaints reoccurring.
13. The site manager should ensure the complaint is investigated and a response provided to the complainant within 10 working days. The response should include information of the investigations conducted and any actions taken as appropriate to minimise impact. The response will be issued via email or letter, along with an accompanying phone call to ensure site and community relationships are upheld. The complaint and response will be logged appropriately within a complaints log form.

11. Summary & Conclusions

Rooted Tree and Landscaping appointed Acoustic Consultants Limited to provide acoustic consultancy in relation to noise complaints received due to operations at their fire log processing and storage site at Graig Road, Cilmaengwyn, Swansea, SA8 4QN.

We understand that no noise abatement notice has been issued at this time. Instead, the Local Authority have requested a noise assessment and any relevant noise control measures be investigated.

A fully attended site noise survey has been conducted to obtain noise data of machines and operations associated with the fire log processing.

Initial assessment of the measured data showed that noise from operations exceeds existing background sound level by up to 10dB, and the residual noise climate by 2dB.

Initial assessment shows that indoor ambient noise levels within the NSRs is expected to currently be within BS8233 criteria and WHO guidelines.

Noise control measures are proposed in the form of new building structures to enclose the noise generating works. These are noted in the report above, along with a proposed construction type, that is expected to be suitable. Minimum sound reduction indices are also provided. Any alternatives may require reassessment.

We also provide alternative measures that could be investigated and discussed if the measures in Section 7 and 8 are not feasible.

We also provide an outline noise management plan, to ensure the relationship between commercial premises and nearby dwellings is upheld.

12. Appendix 1 – Glossary of Acoustic Terminology

A-weighted sound pressure p_A – value of overall sound pressure, measured in pascals (Pa), after the electrical signal derived from a microphone has been passed through an A-weighting network.

A-weighted sound pressure level, L_{pA} – quantity of A-weighted sound pressure given by the following formula in decibels (dBA)

$$L_{pA} = 10 \log_{10} (p_A/p_0)^2$$

where:

p_A is the A-weighted sound pressure in pascals (Pa);
 p_0 is the reference sound pressure (20 μ Pa)

Background sound level, $L_{A90,T}$ – A-weighted sound pressure level that is exceeded by the residual sound assessment location for 90% of a given time interval, T, measured using weighting F and quoted to the nearest whole number of decibels

Break-in - noise transmission into a structure from outside.

Decibel (dB) – The decibel is the unit used to quantify sound pressure levels. The human ear has an approximately logarithmic response to acoustic pressure over a very large dynamic range (typically 20 micro-Pascals to 100 Pascals). Therefore, a logarithmic scale is used to describe sound pressure levels and also sound intensity and power levels. The logarithms are taken to base 10. Hence an increase of 10 dB in sound pressure level is equivalent to an increase by a factor of 10 in the sound pressure level (measured in Pascals). Subjectively, this increase would correspond to a doubling of the perceived loudness of sound.

Equivalent continuous A-weighted sound pressure level, $L_{Aeq,T}$ – value of the A-weighted sound pressure level in decibels of continuous steady sound that, within a specified time interval, $T = t_2 - t_1$, has the same mean-squared sound pressure as a sound that varies with time, and is given by the following equation:

$$L_{Aeq,T} = 10 \lg_{10} \left\{ (1/T) \int_{t_1}^{t_2} [p_A(t)^2/p_0^2] dt \right\} \quad (1)$$

where:

p_0 is the reference sound pressure (20 μ Pa); and

$p_A(t)$ is the instantaneous A-weighted sound pressure (Pa) at time t

NOTE The equivalent continuous A-weighted sound pressure level is quoted to the nearest whole number of decibels.

Facade level – sound pressure level 1 m in front of the façade. Facade level measurements of L_{pA} are typically 1 dB to 3 dB higher than corresponding free-field measurements because of the reflection from the facade.

Free-field level – sound pressure level away from reflecting surfaces. Measurements made 1.2 m to 1.5 m above the ground and at least 3.5 m away from other reflecting surfaces are usually regarded as free-field. To minimize the effect of reflections the measuring position has to be at least 3.5 m to the side of the reflecting surface (i.e. not 3.5 m from the reflecting surface in the direction of the source).

Octave and Third Octave Bands – The human ear is sensitive to sound over a range of frequencies between approximately 20 Hz to 20 kHz and is generally more sensitive to medium and high frequencies than to low frequencies within the range. There are many methods of describing the frequency content of a noise. The most common methods split the frequency range into defined bands, in which the mid-frequency is used as the band descriptor and in the case of octave bands is double that of the band lower. For example, two adjacent octave bands are 250 Hz and 500 Hz. Third octave bands provide a fine resolution by dividing each octave band into three bands. For example, third octave bands would be 160 Hz, 250 Hz, 315 Hz for the same 250 Hz octave band.

Sound pressure level – Sound pressure level is stated on many of the charts. It is the amplitude of the acoustic pressure fluctuations in a sound wave, fundamentally measured in Pascals (Pa), typically from 20 micro-Pascals to 100 Pascals, but commonly simplified onto the decibel scale.

Sound reduction index, R – laboratory measure of the sound insulating properties of a material or building element in a stated frequency band.

Specific sound level, $L_s = L_{Aeq,T_r}$ – equivalent continuous A-weighted sound pressure level produced by the specific sound source at the assessment location over a given reference time interval, T_r .

Structure-borne noise – audible noise caused by the vibration of elements of a structure, the source of which is within a building or structure with common elements.

Rating level, L_{A,r,T_r} – Specific sound level plus any adjustment for the characteristic features of the sound.

Reverberation Time, T – The reverberation time is defined as the time taken for a noise level in an enclosed space to decay by 60 dB from a steady level once the noise source has stopped. It is measured in seconds. Often a 60 dB decay cannot be measured so the reverberation time is measured over a lesser range and corrected back to the time for a 60 dB drop assuming a constant decay rate. Common parameters are T20 (time taken for a 20 dB decay multiplied by three) and T30 (time taken for a 30 dB decay multiplied by two).

Vibration Dose Value, VDV – measure of the total vibration experienced over a specified period of time.

Estimated Vibration Dose Value, $eVDV$ – estimation of the total vibration experienced over a specified period of time. This is usually based on the number of events and shortened measurement data.

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. The weighted sound reduction index is used to characterize the insulation of a material or product that has been measured in a laboratory (see BS EN ISO 717-1).



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