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Acoustics 

UNDERHILL ROAD AGGREGATE PROCESSING  
ASSESSMENT OF NOISE EFFECTS

Rp 002 20201133 | 21 December 2021

Project: **UNDERHILL ROAD AGGREGATE PROCESSING**

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Report No.: **Rp 002 R01 20201133**

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## 1.0 INTRODUCTION

PJ Warren Earthmovers Ltd proposes to carry out aggregate processing and stockpiling at Underhill Road, Featherston. Marshall Day Acoustics was engaged by Russell Hooper Consulting on behalf of PJ Warren Earthmoving to predict the potential noise generated by these activities. The noise predictions were then compared against guideline noise limits, established using the permitted activity noise standards of the Wairarapa Combined District Plan (“the District Plan”). A report of our findings was completed in April 2021<sup>1</sup>.

A review of that report was carried out by Styles Group (July 2021) (‘the Styles report’) which identified a number of acoustical aspects considered to require further investigation. These aspects included:

- Predicted activity noise levels at all receivers identified in our report;
- Assessment of noise effects at any property where written approval has not been received;
- Recommended conditions to provide sufficient certainty that the predicted noise levels will not be exceeded;
- Noise levels from the crushing plant at various locations within the site;
- Compliance with noise limits at notional boundaries.

On 5 November 2021, and again on 12 November 2021, we carried out site visits and measured the noise from various items of plant, including trial operations of the crusher and the screener. At the time of our 5 November 2021 site visit, we installed a noise logger for a period of 7 days. This provided an understanding of the ambient noise in this area.

Since our initial April 2021 report, we have refined our calculation model to take into account updated information regarding notional boundary locations, as well as information obtained from our site visits. This included plant noise levels, bund construction and location, and material extraction and processing methodologies.

From the Resource Consent Application, we understand that the Applicant currently has a Resource Consent from the Greater Wellington Regional Council to extract aggregate from the ground within the subject site<sup>2</sup>. However, for the purposes of an assessment of noise effects, we have also considered the noise from the extraction and transportation of the aggregate.

A glossary of terms used in this report is included in Appendix A.

## 2.0 ACOUSTIC PERFORMANCE STANDARDS

Since our April 2021 report, the legislative status of the proposed activity has been clarified by Russell Hooper Consulting. We now understand that the extraction and removal of materials from the subject site is a permitted activity, as long as it complies in all respects with the requirements of the Wairarapa Combined District Plan (the District Plan). However, the on-site processing (screening and crushing) of the materials is not permitted in this zone, and the status of the processing activities is therefore discretionary.

Regardless of compliance with any noise Standard, there is a general obligation in terms of Section 16 of the RMA which, in summary, states that an activity shall adopt the best practicable option (BPO) to ensure that the emission of noise does not exceed a reasonable level. For the April 2021 assessment, we based our opinion of what would constitute a “reasonable noise level” for an activity such as this on the permitted activity noise criteria within the District Plan.

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<sup>1</sup> Marshall Day report Rp 001 R02 20201133 April 2021

<sup>2</sup> “Resource Consent Application – Proposal to crush and stockpile aggregate” Russell Hooper Consulting October 2020



From discussions with PJ Warren Earthmovers Ltd, we understand that the hours of the processing activities would be 8:00am to 5:00pm Monday to Friday. We further understand that these operations do not typically take place consistently 5 days per week every week but can occur intermittently. In times of inclement weather, particularly during winter months, the hours of activity are generally reduced. In our report Rp001 R02 20201133, we concluded that, considering the proposed hours of operation, compliance with the District Plan permitted activity limit of **55 dBA L<sub>10</sub>** (7.00am – 7.00pm) at any notional boundary would be considered reasonable.

## 2.1 Noise Descriptors

### 2.1.1 L<sub>10</sub>

The District Plan requires that noise is measured in accordance with New Zealand Standard NZS 6801:1991 “*Measurement of Sound*” and assessed in accordance with New Zealand Standard NZS 6802:1991 “*Assessment of Environmental Sound*”. The 1991 Standards use the L<sub>10</sub> descriptor for the data measure. L<sub>10</sub> is the noise level equalled or exceeded for 10% of the measurement period. This is commonly referred to as the average maximum noise level.

One of the limitations of using L<sub>10</sub> is that it does not fully describe the impact of noise, by disregarding 90% of data in any measurement period. An example of this is where a load of aggregate may be dumped into a truck. Without appropriate management (particularly with the first load), there can be a brief yet high noise event as the material impacts the tray of the truck. Yet unless this event is of a duration greater than 10% of the measurement period (for instance, 90 seconds of a 15-minute measurement period) it is disregarded by the L<sub>10</sub> descriptor.

### 2.1.2 L<sub>Aeq</sub>

Accordingly, since our April 2021 assessment, we have revised our conclusion regarding guideline noise limits to consider the noise descriptors of the more recent New Zealand Standards NZS 6801:2008 “*Acoustics – Measurement of environmental sound*” and NZS 6802:2008 “*Acoustics - Environmental Noise*”. These have superseded the 1991 Standards.

The 2008 versions use L<sub>Aeq</sub> as the descriptor of the noise under assessment. It is the equivalent continuous A-weighted sound level and is commonly referred to as the average sound level, measured in dB. L<sub>Aeq</sub> takes into account all noise sources contributing to a measurement during a measurement period. The standard measurement interval for the 2008 Standards is 15 minutes. Therefore, the descriptor is expressed as dB, L<sub>Aeq(15 min)</sub>.

We consider applying the L<sub>Aeq(15min)</sub> to this proposal is a more appropriate approach to assessment, compared to using the L<sub>10</sub> descriptor. Additionally, our on-site measurements show that for the crusher and the screening operation, the difference between the L<sub>10</sub> and L<sub>Aeq</sub> descriptors is no more than 1 to 2 dB (with the L<sub>10</sub> the higher value). Note that with the implementation of the National Planning Standards, use of the L<sub>Aeq</sub> descriptor will be required in all District Plan noise standards.

## 2.2 Guideline Noise Limit

Taking into account the discussion above, we consider a guideline noise limit of **55 dB L<sub>Aeq(15 min)</sub>** to be reasonable. Additionally, NZS 6802:2008 (Section 8.6.2) notes that a daytime noise limit of 55 dBA L<sub>Aeq(15 min)</sub> would provide reasonable protection of health and amenity associated with the use of land for residential purposes.

A discussion of the noise effects of an activity complying with this guideline limit is set out further in this report.

### 3.0 PREDICTED NOISE LEVELS

#### 3.1 Crusher Location

The Styles report has assumed that the crusher may be moved to various locations within the site. This assumption is based on a comment in the original resource consent application<sup>3</sup>. However, since the completion of Application and following discussion with PJ Warren Earthmovers Ltd, we understand that the crusher location would be static at a single location. The approximate location is shown in Figure 1. This is based on the location as observed during our site visits.

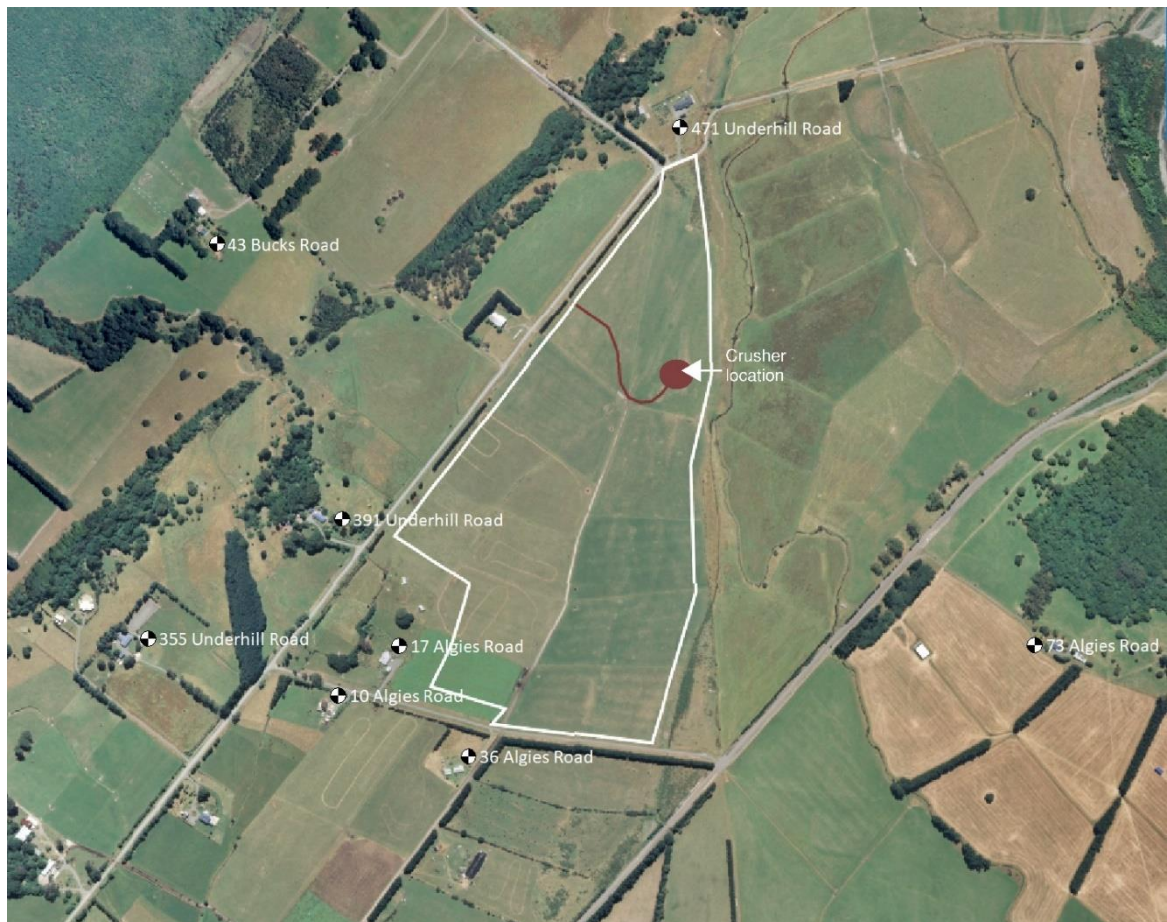


Figure 1: Approximate locations of subject site (white outline), crusher location and dwellings within this assessment. (Base image: LINZ)

#### 3.2 Screener Location

We understand that the aggregate excavation and screening would take place incrementally across the site. As each work area is completed, another would be commenced. In order to understand the range of noise levels resulting from the proposed aggregate processing and stockpiling activities, we have modelled a number of scenarios to represent the various possible activity locations.

#### 3.3 Bunding

For each area of work including the crusher operation, we have assumed a bund of effectively 3 metres in height on the crusher/screener & excavator side, i.e., the machinery at least 1 metre below ground level, and the top of the bund itself being at least 2metres in height above ground level.

<sup>3</sup> "Resource Consent Application: Proposal to crush and stockpile aggregate" Russell Hooper Consulting October 2020

### 3.4 Assessment Locations

With the exception of the area immediately southeast of the subject site, we have not been informed of any potential future notional boundaries which may be established. However, the noise contours set out in Figure 3 demonstrate locations of potential exceedance of the 55 dB  $L_{Aeq(15 \text{ min})}$  guideline noise limit, should a future notional boundary be established within the 55 dB  $L_{Aeq(15 \text{ min})}$  contour.

Locations of the dwellings closest to the subject site and included in our assessment are:

- 471 Underhill Road;
- 391 Underhill Road;
- 355 Underhill Road;
- 43 Bucks Road;
- 73 Algies Road;
- 36 Algies Road;
- 17 Algies Road;
- 10 Algies Road.

Properties located at greater distances from the subject site may also be exposed to noise from its operation, but noise levels would be less than for the properties considered in this assessment. This is due to additional attenuation from increased distances, ground absorption, and screening due to intervening terrain.

### 3.5 Sound Power Levels

Our site measurements indicate that under typical workload, the various plant items and their sound power levels ( $L_{WA}$ ) are as follows:

- McCloskey 105 Screen:  $L_{WA}$  118 dB;
- Terex Cobra 290R Crusher:  $L_{WA}$  114 dB;
- Truck and trailer units accessing and departing from the site:  $L_{WA}$  104 dB.

Note that the  $L_{WA}$  levels for the screener and the crusher as measured are similar to the levels reported in our April 2021 report.

Noise from other plant items was not measured during the site visit. This was due to them not being on site, or that they were not operated in isolation from other plant items. For instance, the noise from the excavator associated the operation of the screening plant was not able to be measured, as noise from the screener dominated. Therefore, for these items, we used noise data obtained from noise measurements of similar equipment, carried out by us.

- Wheeled loader:  $L_{WA}$  107 dB;
- Tracked excavator 20 – 30 tonne:  $L_{WA}$  108 dB;
- Dump truck:  $L_{WA}$  107 dB.

### 3.6 Noise Modelling

We have calculated the noise emissions from site activities in accordance with ISO 9613-2: 1996 as implemented in SoundPLAN® environmental noise modelling software. ISO 9613-2 considers a range of frequency dependent attenuation factors, including propagation distance, atmospheric absorption, ground effect, reflections, and acoustic screening.



Site activities have been modelled using the plant described above. Truck and trailer movements extend from the site access road intersection with Underhill Road to the primary crushing location, returning on that same route. We understand from PJ Warren Earthmovers that there may be up to 100 truck and trailer movements per day.

### 3.6.1 Aggregate Processing Scenarios

To test the extents of these activities, we have calculated the noise from the proposed extraction and screening activities at six different locations across the site, with the crusher remaining in the same location.

Figure 2 shows the various scenarios (location numbers 1 to 6) we have tested, to find the extents of the possible activity locations while still remaining within the established noise guidelines. Note that for each of these scenarios, the crusher location remains the same. The blue points identify the screener and excavator at each location. The truck routes are shown as yellow lines.

#### *Bunds*

The bunds are identified in Figure 2 by the brown lines. Note that the locations of these may vary on site. In all cases, the bunding should be positioned as close as possible to the activity and interrupt the line of sight between the noise sources and the closest receivers. The height between the top of the bund and the reduced level (RL) of each work location should be at least 3 metres.



Figure 2: Locations of various processing scenarios within the site. (Base image: LINZ)

### 3.7 Extraction Operation

From discussion with PJ Warren Earthmoving Ltd and Russell Hooper Consulting, we understand that the extraction operations of excavation and transporting of materials off-site is currently consented under the Greater Wellington Regional Council and is subject to the District Plan standards for a permitted activity. Consequently, the focus of our assessment is on the processing aspects



(screening, crushing). However, for an assessment of cumulative effects, we have included the extraction operations.

### 3.8 Predicted Noise Levels

Taking the scenarios of Figure 2 into account, we calculate that in order to remain within the 55 dBA  $L_{Aeq(15 \text{ min})}$  guideline noise limit, aggregate processing should not take place any closer than **300 metres from any dwelling**, or 280 metres from any notional boundary. Additionally, a bund as discussed above needs to be located close to the processing. Table 1 sets out the predicted noise levels at the notional boundary of each assessment location, taking into account the noise bunding at each processing location. For each of these scenarios, the crusher location is static, located as show in Figures 1 and 2. The noise of the crusher has been included in all scenarios.

**Table 1: Predicted Aggregate Processing Noise Levels**

Receiver	Predicted Noise Levels $L_{Aeq(15 \text{ min})}$ , dB					
	Location 1	Location 2	Location 3	Location 4	Location 5	Location 6
471 Underhill Rd	54	49	48	48	49	54
391 Underhill Rd	47	49	51	54	49	48
355 Underhill Rd	42	43	45	46	43	42
43 Bucks Rd	45	44	44	46	44	46
73 Algies Rd	49	50	48	46	50	46
36 Algies Rd	45	48	53	51	48	46
17 Algies Rd	47	49	54	54	49	47
10 Algies Rd	46	47	50	50	47	46

Figure 3 shows the predicted noise levels in the form of contours, combined for all processing scenarios. The contours show the predicted highest noise level that a dwelling would receive, at some point during aggregate processing.

The figures included as Appendix B show the predicted noise contours for each separate processing scenario (1 to 6).

Figure 4 shows the extent of operations to comply with the 55 dBA  $L_{Aeq(15 \text{ min})}$  guideline noise limit.

- Within the white dotted line, extraction and processing can occur;
- Within the blue line, extraction only can occur.

### 3.9 Special Audible Characteristics

Where a sound has a distinctive character which may affect its acceptability within a community, then a reduction of 5 dB may be applied to the noise standard, in accordance with Sections 4.4 and 4.5 of NZS 6802: 1991. Such characteristics would include the sound being noticeably impulsive or tonal.

Implementation of the 2008 Standard has the same effect, although in place of the reducing the noise standard, the predicted or measured noise level would be increased by 5 dB (NZS 6802:2008 Section 6.3 and Appendix B).

For this reason, sound with special audible characteristics should be avoided. For an activity such as this, possible special audible characteristics (SAC) include noise from tonal reversing signals, track squeal from tracked equipment, or tailgates banging.

The following noise mitigation should be implemented to ensure that the risk of application of the SAC penalty is avoided, and ensure that BPO is taken to reduce operational noise emissions as far as practicable:

- Ensure that equipment is properly maintained;
- Mitigate track squeal from tracked equipment (may include tensioning and watering or lubricating the tracks regularly)
- The access route and any other vehicle paths that are developed on the site should be maintained and kept free of potholes etc. to minimise truck noise;
- Loading/unloading techniques to minimise the banging of tailgates;
- The processed material (particularly the first loads) should be carefully placed into the truck & trailer trays, rather than “dumped” from a height above the tray;
- Avoid tonal reversing or warning alarms (suitable alternatives may include flashing lights, broadband audible alarms or reversing cameras inside vehicles).

In the following calculations, we have assumed the implementation of measures to avoid SAC and have not applied the +5 dB penalty. Such measures should be included in a Noise Management Plan, which is discussed in Section 5 of this report.

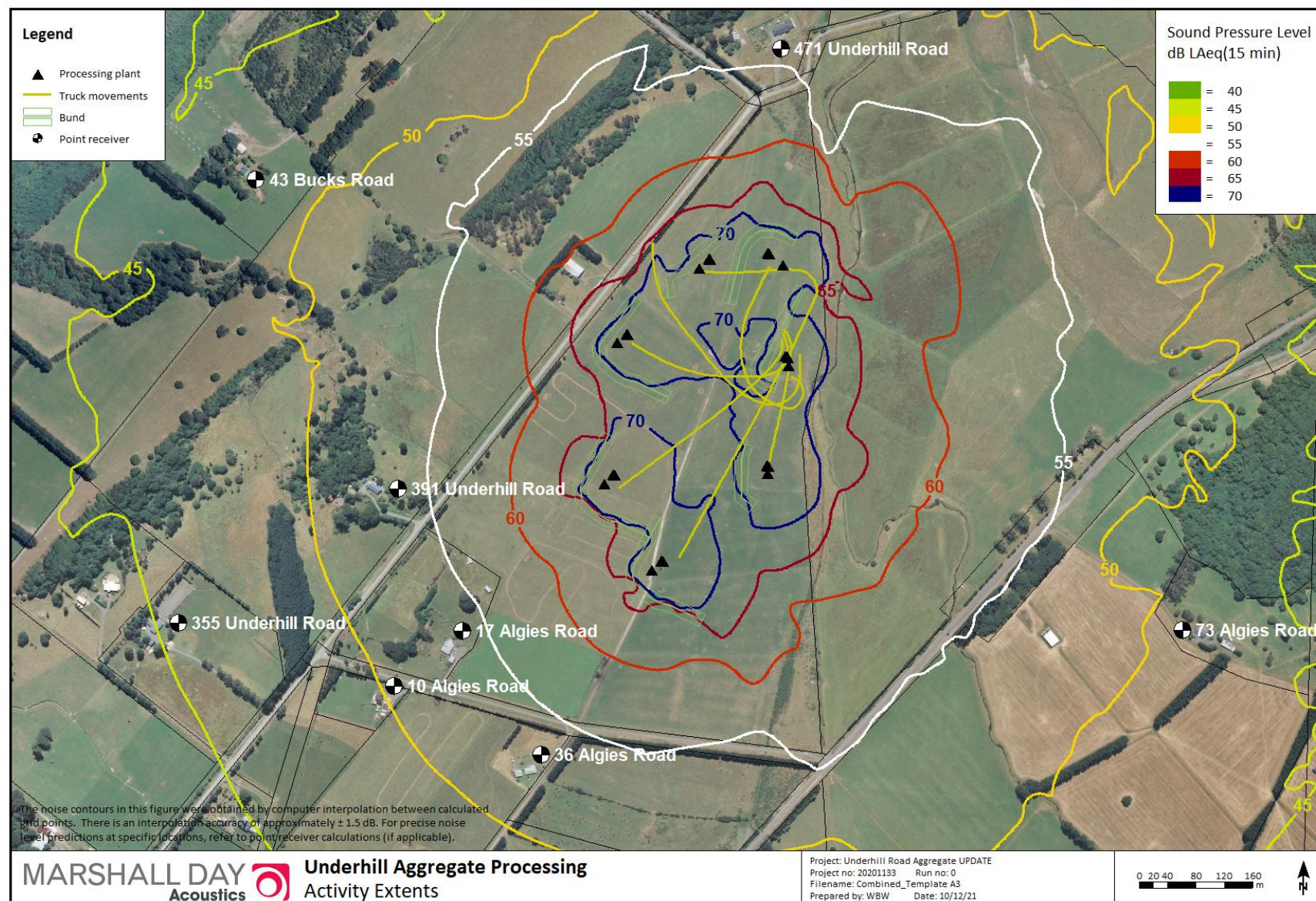


Figure 3: Noise contours from activities at the locations representing the extents of the processing area (*base image: LINZ*)





Figure 4: Extent of works. White dotted line is for processing with bunds; blue dotted line is for extraction only. (base image: LINZ)

## **4.0 ASSESSMENT OF NOISE EFFECTS**

The existing noise environment provides a baseline for assessing noise effects. Effects can be assessed by quantifying the noise levels that people would experience due to the aggregate processing activities. The change in noise environment can then be interpreted in relation to subjective responses of people and possible annoyance.

### **4.1 Existing Noise Environment**

#### **4.1.1 Noise Level Survey**

We measured the current ambient noise levels in this area over the period 5 November 2021 to 12 November 2021. This was carried out by means of continuous data logging extending over the seven days' duration. The noise logger was located in free field conditions within the subject site, some 125 metres east of Underhill Road, and approximately 350 metres southwest of the current aggregate excavation area. Due to the nature of the noise sources in this area in the absence of aggregate processing activities, we consider that this location is representative of the noise environment at the dwelling notional boundaries identified in this report.

Where meteorological conditions were found to be unsuitable for environmental noise surveys, these periods were excluded from the reported data. This is the case when wind speeds exceeded 5 m/s and rainfall exceeded 6 mm/h.

For the purposes of this assessment, our focus has been on the proposed hours of aggregate processing activity. The hours of operation for crushing and screening would be 8:00 am to 5:00 pm Monday to Friday.

Appendix C shows the location of the noise logger. Appendix D sets out the details of the long term noise measurements. Appendix E contains the specific details of the noise survey.

#### **4.1.2 Ambient Noise Levels**

In the absence of aggregate activities on the subject site, the daytime ambient noise levels are relatively low, with contribution from occasional vehicles on Underhill Road and occasional rail traffic on the Wellington – Wairarapa line, approximately 650 to 700 metres east of Underhill Road. Other noise sources are typical of a rural area and include occasional intermittent sounds such as chainsaws, birds, and dogs.

Our measurements show that in the absence of aggregate processing activities, the ambient noise levels in this area are typically 37 to 47 dBA  $L_{10(15 \text{ min})}$ , 35 to 44 dB  $L_{Aeq(15 \text{ min})}$ , and 30 to 36 dBA  $L_{95(15 \text{ min})}$  over the proposed hours of operation.

## **4.2 Assessment of Noise Effects**

### **4.2.1 Subjective Perception of Noise Level Changes**

The subjective impression of changes in noise level can generally be correlated with the numerical change in noise level. While every person reacts differently to noise level changes, research shows a general correlation between noise level changes and subjective responses.

Our experience has shown that the subjective perception of a noise level change can be translated into an effect. This effect is based on people's annoyance reaction to noise level increases. Note that people may have an annoyance reaction to a greater or lesser degree, depending on their perception of the activities.

Table 2 shows the indicative subjective responses to explain the noise level changes discussed in this report.

**Table 2: Noise level change compared with general subjective perception**

Noise level change	General subjective perception <sup>4</sup>
1–2 decibels	Insignificant/imperceptible change
3–4 decibels	Just perceptible change
5–8 decibels	Appreciable change
9–11 decibels	Halving/doubling of loudness
>11 decibels	More than halving/doubling of loudness

#### 4.2.2 Noise Level Increases

As noted above, the current daytime ambient noise levels in this area range typically from 35 to 44 dB  $L_{Aeq(15min)}$ . In reference to the predicted aggregate processing noise levels shown in Table 1, we assess the increase to the existing daytime noise levels at each assessment location as being between 3 and 20 dB, depending on the locations of the aggregate processing and receiver. This would be considered by a general population to be a just perceptible increase, to a more than doubling of the current noise levels.

#### 4.2.3 Noise Effects

In considering these predicted noise levels in the context of the existing ambient noise levels, the noise of the aggregate processing would be clearly audible, at times at all assessment locations. However, “audibility” of an activity does not automatically mean “adverse” or “annoying”. Controlling or managing the noise can provide a way of controlling and managing any adverse noise effects.

Measures to mitigate the adverse or annoying aspects of this noise would incorporate implementation of the BPO to reduce the aggregate processing noise as much as practicable, including to less than the guideline noise limit, where this can be achieved. Implementation of measures to manage this noise as set out below will ensure that the aggregate extraction noise, while it may be audible, will be reasonable. To ensure that this is achieved, we recommend that a Noise Management Plan (NMP) is prepared by a suitably qualified person prior to the aggregate processing works commencing on the Site. This is discussed below.

### 5.0 NOISE MANAGEMENT PLAN

The NMP should be implemented throughout the entire life of the site to manage noise levels.

As discussed, the overarching approach of the NMP should align with Section 16 of the Resource Management Act (RMA) which, in summary, states that an activity shall adopt the best practicable option to ensure that the emission of noise does not exceed a reasonable level. This means that if it is practicably possible to reduce noise to even lower than the guideline noise limit at any receiver, actions to achieve this should be implemented.

The NMP should include (but not be limited to) details regarding:

- Noise mitigation, including the bunding at each processing location as discussed within this report;
- Limiting the hours of the processing of aggregate to within the stated times of 8:00am to 5:00pm Monday to Friday;

<sup>4</sup> Based on research by Zwicker & Scharf (1965); and Stevens (1957, 1972).



- Maintenance and/or upgrading the site access route and any other vehicle paths that are developed on the site to be kept free of undulations, potholes etc. to minimise truck noise;
- Minimising the banging of tailgates;
- Careful placement of the processed material (particularly the first loads) into the truck & trailer trays, rather than “dumping” from a height above the tray;
- Ensuring that equipment is properly maintained;
- Mitigation of track squeal from tracked equipment (may include tensioning and watering or lubricating the tracks regularly);
- Avoidance of tonal reversing or warning alarms (suitable alternatives may include flashing lights, broadband audible alarms or reversing cameras inside vehicles).
- Mitigation measures (discussed above);
- Community liaison (providing contact details for complaints);
- Noise monitoring. This would include measurement of aggregate processing noise, received at selected representative receiver locations. Noise measurements would provide PJ Warren Earthmoving Ltd with information regarding processing methodology; identify any processes that are unnecessarily noisy; provide confidence to potentially affected residents that their concerns are being considered; and identify compliance or non-compliance with the relevant noise limits; and
- Staff training.

## 6.0 THE STYLES REPORT

Much of this updated report addresses various points raised in the Styles report. However, some further items are discussed in this section.

On page 2 of the Styles report, the subject of the reasonableness of the permitted activity noise levels is raised. The Styles report states that the determination of this should be reached through an assessment of effects that takes into account:

1. *“The overall noise levels and noise effects likely to be generated by the proposal, considering factors such as character, timing, duration and intensity of the noise levels”.*

### ***Our response***

Three of these aspects (overall noise levels, timing, duration) are addressed above in this report. The other two are discussed below.

## 6.1 Character

In terms of character, it is unclear what the Styles report means by this term. However, we offer the following comments:

### 6.1.1 Special Audible Characteristics

This is addressed in Section 3.10 and Section 5 of this report.

### 6.1.2 Environment

Aggregate extraction and subsequent processing are activities that typically take place in rural areas. Therefore, we consider that the noise of such activities would not be out of character for this area.

## 6.2 Intensity

It is not clear to us what is intended here by the term “intensity”. This term has a specific meaning in acoustics, usually defined as the acoustic energy which flows per unit time per unit area perpendicular to the direction of flow at the point of measurement. The measurement of sound intensity requires specialised techniques that are not included in the scope of this Project.

2. *“The noise effects of the activity in the context of the “rural character or amenity” of the existing noise environment, taking into account the ambient and background sound levels in the locality”.*

### **Our response**

This has been addressed above. We conclude that with appropriate noise management through implementation of a NMP, the resulting noise would be reasonable at all assessment locations.

3. *“The noise effects of the proposal in the context of what could reasonably be expected to occur in the zone, taking into account the “normal functioning of rural activities” permitted in the zone”*

### **Our response**

Much of this has been addressed above. However, in addition, Section 4.1 of the Wairarapa Combined District Plan notes that the rural zone is characterised by (among other qualities) being a “working productive landscape, with a wide range of agricultural, horticultural and forestry purposes, with potential for **associated effects, including noises and odours**” (emphasis added).

In Section 4.5.2 (f) “Noise Limits” subsection (i), the District Plan notes that in the Rural zone the noise associated with primary production (e.g. tractors, harvesters, etc.) is excluded from needing to comply with any noise rules. It is our opinion that the noise from aggregate processing, especially when received at the setback distance discussed in this report (300 metres), would be similar to the noise from some aspects of primary production (for instance, diesel-engined machinery such as harvesters, tractors, etc.). Consequently, we consider that this would be the type of noise that is contemplated by the District Plan for this zone. Further, we are applying noise limits and other management to this noise, whereas under the District Plan, the noise from primary production can continue unabated, with no controls over character, timing, or duration.

Elsewhere (for instance, on page 7) the Styles report notes that often noise from machinery associated with primary production is seasonal and intermittent. While this may be the case, there is no rule that requires this to be so. Various activities on one area of land may produce noise throughout the year. Frost fans may operate during winter months (typically at night and during very early morning hours). At other times, harvesting, crop maintenance, ploughing, etc may occur, each requiring the use of noise-producing machinery.

The noise from the proposed activities on the subject site would also have a degree of intermittency and seasonal nature. Although they may work for the full 5 days (Monday to Friday) on some weeks, in discussion with PJ Warren Earthmoving Ltd, we understand that for other weeks it may be only 1 to 3 days, depending on the demand. Additionally, inclement weather can restrict site activities as ground conditions provide constraints. This can result in reduced activities, particularly over the winter months.

Note also that the highest predicted noise levels at a receiver location would only occur when the activity is closest to that location.

### 6.3 Crusher Noise Levels

On page 3 the Styles report comments that the noise levels from the crusher will depend on several aspects, including its location on the subject site. Although the Application document suggests that the crusher location may vary around the site, we were informed by PJ Warren Earthmovers Ltd prior to our initial assessment of Rp 001 R02 that this would not be the case, but that it would remain at a single location. Consequently, this single location has been included in our modelling.

In addition, the bunding as discussed in this report would be implemented.

On page 4, the Styles report comments that *“Aggregate is not typically screened until it is crushed”*. The basis of this comment is not clear to us. In any event, we have been both informed by PJ Warren Earthmovers Ltd, and have observed on site, that the extracted material is screened prior to crushing.

### 6.4 Consent Conditions

A series of objectives to be achieved by consent conditions is set out on pages 8 and 9 of the Styles report. We offer the following comments:

#### 6.4.1 Cumulative Noise Levels

We agree that the cumulative noise levels from the subject site activities should be controlled by imposition of a noise limit, applicable at notional boundaries. We further recommend that the guideline limits established in Section 2.2 of this report be adopted for this purpose.

#### 6.4.2 Location of Crusher and Screening

Our comments in Section 6.3 regarding crusher location apply to this condition recommendation. In terms of the screen, the implementation of effective bunding is as important as the location. Although this is shown in Figures 2 to 4 of this report, as a guide for PJ Warren Earthmovers Ltd, in conjunction with the bunding as described, aggregate screening should not take place any closer than 300 metres from any dwelling, or 280 metres from any notional boundary. In any event, as noted, the objective of any conditions should be the achievement of compliance with noise limits at an assessment location.

#### 6.4.3 Acoustic Performance of Screening and Bunds

Bullet points 2 and 3 of the Styles report (page 8) both recommend specific acoustic performance for the crusher, screening, and bunds. Presumably this means specified sound power levels for the plant items, and specified barrier effect for the bunds. While these may be helpful, our opinion is that the end of these aspects of the operations is the noise level at an assessment location. Consequently, these requirements can usefully be simplified to be reflected in the first bullet point, that is, the imposition of a noise limit, applicable at notional boundaries.

#### 6.4.4 Special Audible Characteristics and Noise Management Plan

The bullet points on Page 9 of the Styles report addressing the above can both be covered off by a NMP as discussed in this report.

## 7.0 RECOMMENDED CONDITIONS

1. Four weeks prior to the commencement of aggregate processing works on the Site, the consent holder shall provide to the Team Leader – Resource Consents, a Noise Management Plan. The Noise Management Plan shall be produced by a person suitably qualified and experienced in noise assessment and control and shall specify the mitigation measures to be undertaken to ensure that aggregate processing noise from the site, if measured anywhere within a notional boundary of a dwelling, either consented or established at the time of consent, shall not exceed:
  - 55 dB  $L_{Aeq(15\text{ min})}$  Monday to Friday 0800 – 1700 hours;

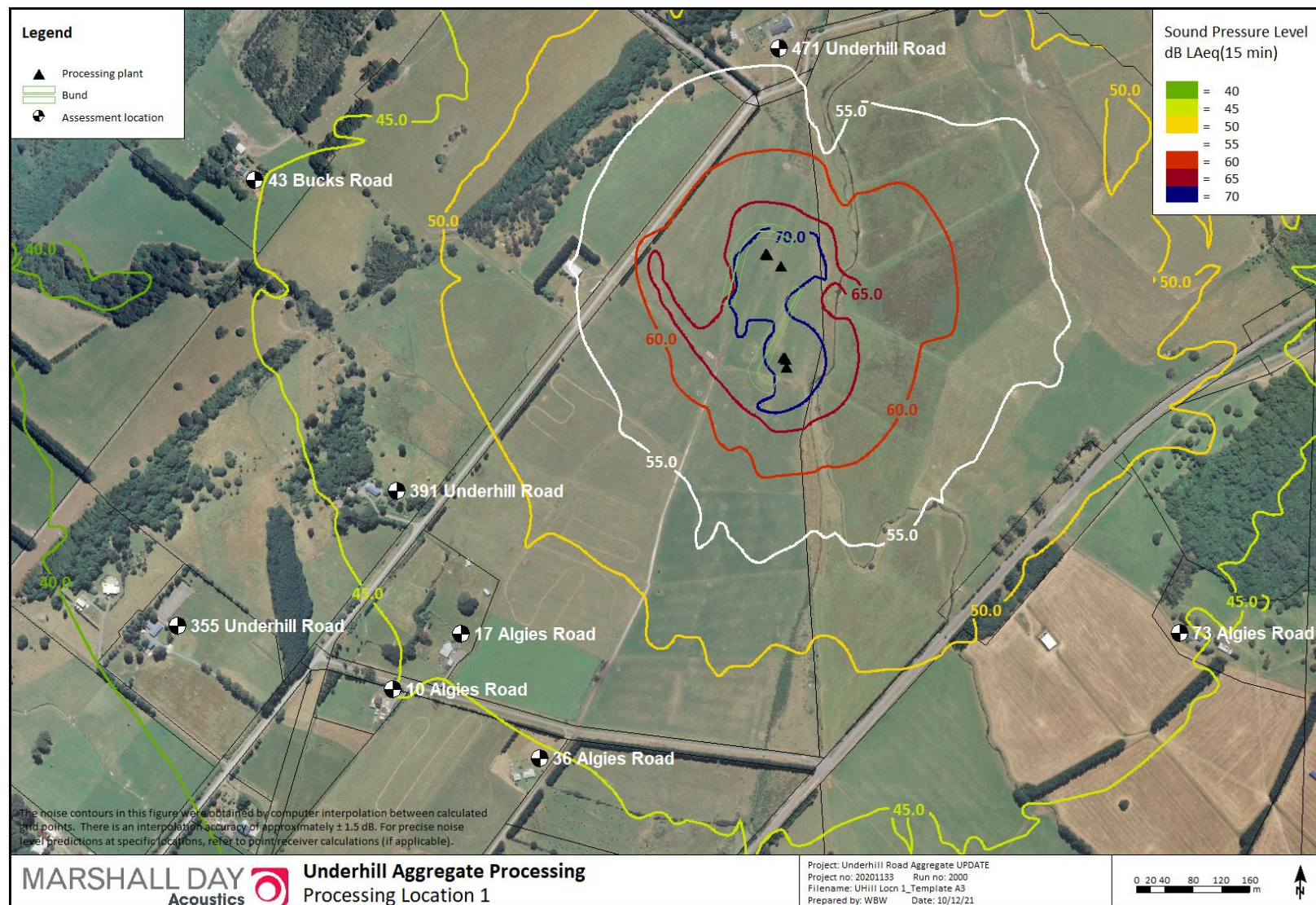


- 40 dB  $L_{Aeq(15 \text{ min})}$  all other times.
- Noise levels shall be measured and assessed in accordance with NZS6802:2008 “*Acoustics – Measurement of Environmental Sound*” and NZS6802:2008 “*Environmental Noise*”.
2. Within six months of full operation, the consent holder shall monitor noise emissions from the site to assess compliance with the above condition. The survey locations shall be agreed between Council and the consent holder.
  3. If noise emissions from the site do not exceed a maximum 55 dB  $L_{Aeq(15 \text{ min})}$ , then no further action is required. If that standard is not met, then the consent holder shall:
    - i. Within four weeks of the date of the report and following consultation with the Team Leader - Resource Consents provide a revised Noise Management Plan specifying the further mitigation measures to be undertaken to ensure that noise from the site complies with the limits of Condition 1.
    - ii. Undertake the further mitigation measures specified within a further four weeks from the provision of the revised Noise Management Report.
    - iii. Within four weeks of undertaking those further mitigation measures, monitor noise emissions from the site to assess whether noise from the site would comply with the limits of Condition 1.
    - iv. If noise emissions from the site still exceed the limits of Condition 1, the process of this condition shall be repeated until that standard is met.
  4. If within the first year the Council reasonably considers that the required standard cannot be met and gives the consent holder two months’ notice of its intention to do so, then it shall be entitled to give notice under s129 of the Act to review the conditions of consent to ensure that owners and occupiers of rural dwellings are not unreasonably affected by noise.

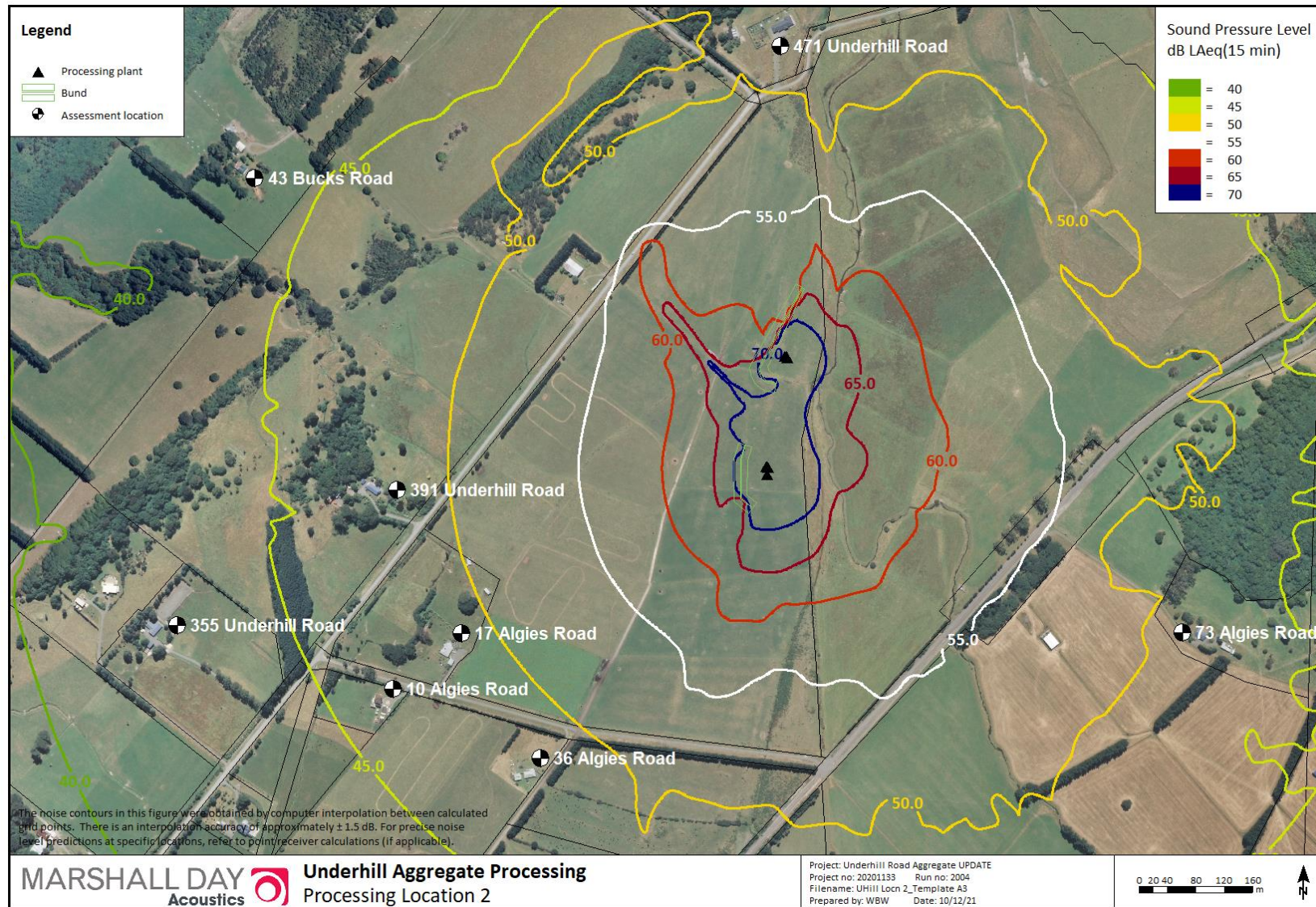
## APPENDIX A GLOSSARY OF TERMINOLOGY

<b>Noise</b>	A sound that is unwanted by, or distracting to, the receiver.
<b>Ambient</b>	The ambient noise level is the noise level measured in the absence of the intrusive noise or the noise requiring control. Ambient noise levels are frequently measured to determine the situation prior to the addition of a new noise source.
<b>dB</b>	Decibel (dB) is the unit of sound level. Expressed as a logarithmic ratio of sound pressure (P) relative to a reference pressure (Pr), where $dB = 20 \times \log(P/Pr)$ .
<b>dBA</b>	The unit of sound level which has its frequency characteristics modified by a filter (A-weighted) to more closely approximate the frequency bias of the human ear. A-weighting is used in airborne acoustics.
<b>SPL or <math>L_p</math></b>	Sound Pressure Level: A logarithmic ratio of a sound pressure measured at distance, relative to the threshold of hearing (20 $\mu$ Pa RMS) and expressed in decibels.
<b>SWL or <math>L_w</math></b>	Sound Power Level: A logarithmic ratio of the acoustic power output of a source relative to 10-12 watts and expressed in decibels. Sound power level is calculated from measured sound pressure levels and represents the level of total sound power radiated by a sound source.
<b><math>L_{10}</math></b>	The noise level equalled or exceeded for 10% of the measurement period. This is commonly referred to as the average maximum noise level.
<b><math>L_{Aeq}</math></b>	The equivalent continuous A-weighted sound level. Commonly referred to as the average sound level and is measured in dB.
<b>Special Audible Characteristics</b>	Distinctive characteristics of a sound which are likely to subjectively cause adverse community response at lower levels than a sound without such characteristics. Examples are tonality (e.g. a hum or a whine) and impulsiveness (e.g. bangs or thumps).
<b>NZS 6801:1991</b>	New Zealand Standard NZS 6801:1991 <i>"Measurement of Sound"</i>
<b>NZS 6802:1991</b>	New Zealand Standard NZS 6802:1991 <i>"Assessment of Environmental Sound"</i>
<b>NZS 6801:2008</b>	New Zealand Standard NZS 6801:2008 <i>"Acoustics – Measurement of environmental sound"</i>
<b>NZS 6802:2008</b>	New Zealand Standard NZS 6802:2008 <i>"Acoustics - Environmental Noise"</i>

APPENDIX B NOISE CONTOURS (Base image: LINZ)



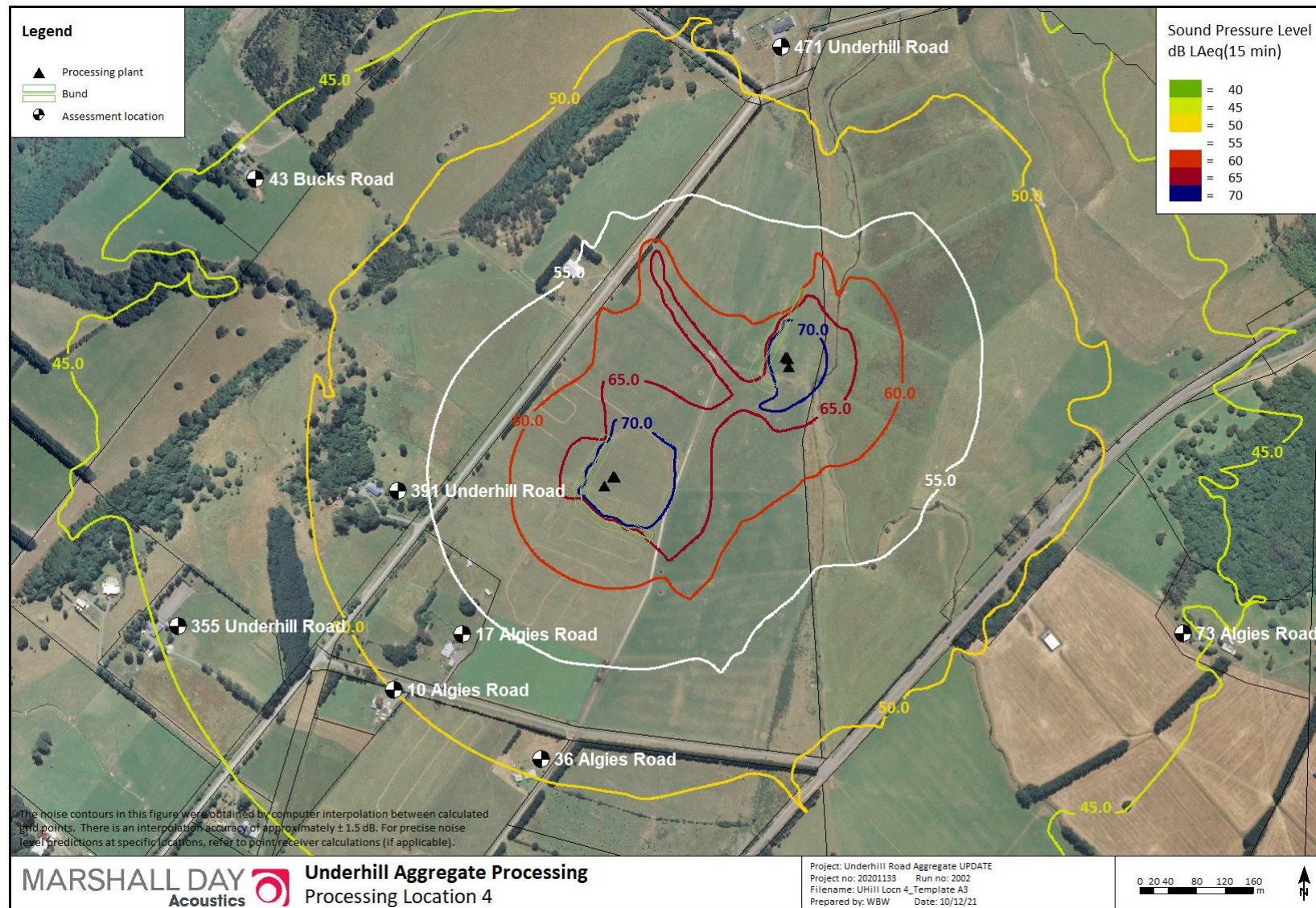




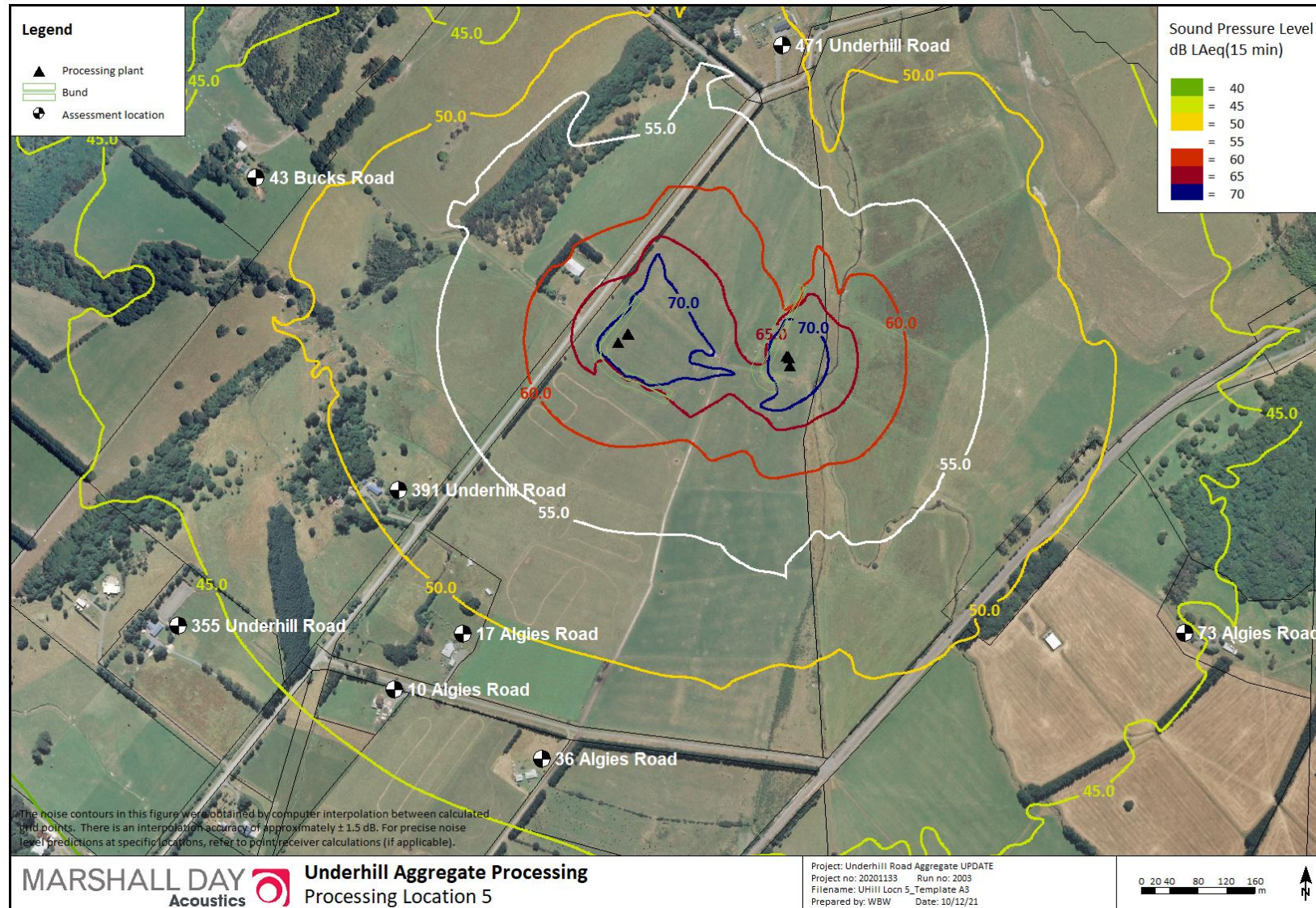




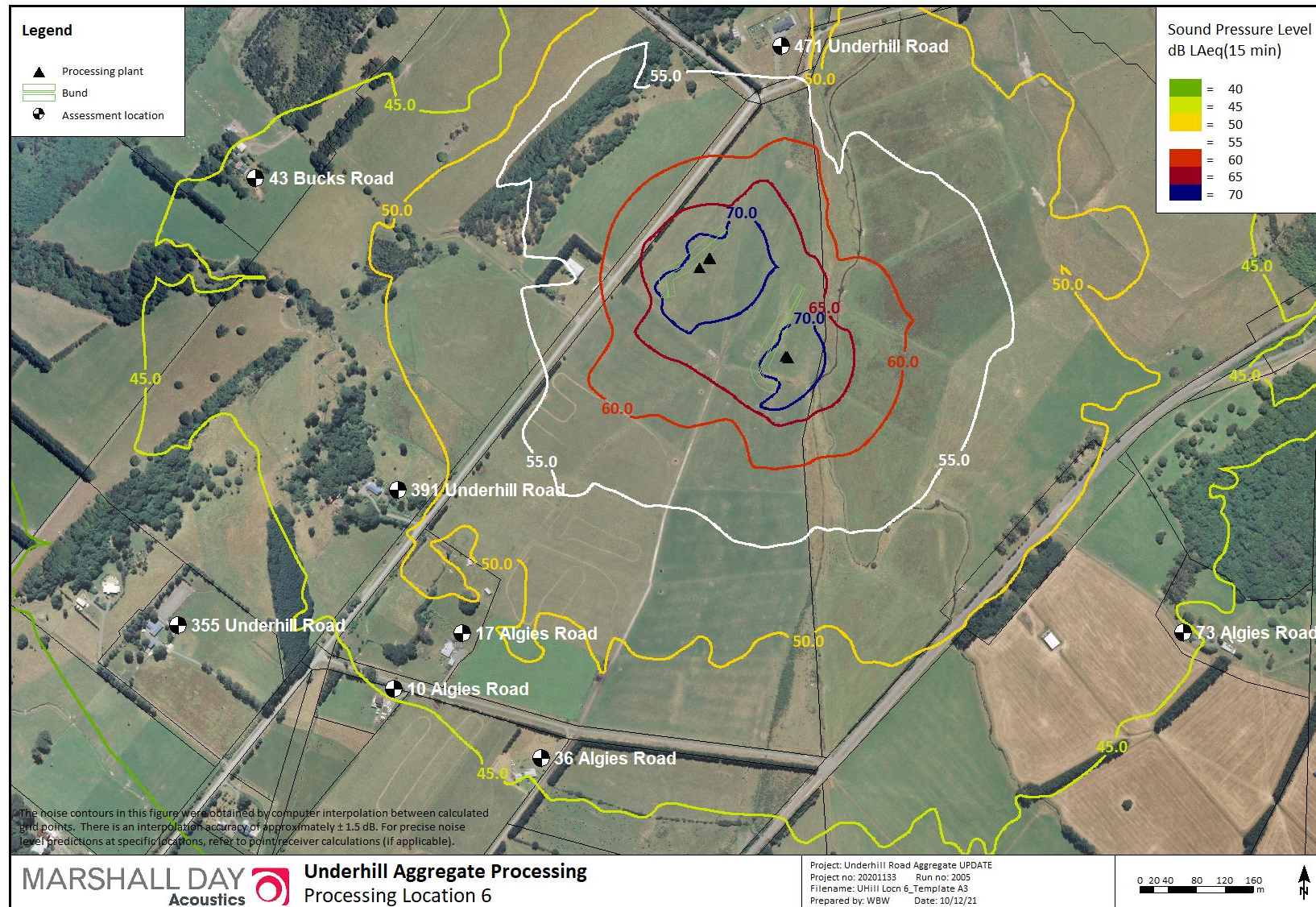














APPENDIX C AMBIENT NOISE MEASUREMENT LOCATION



Figure C1: Location of Underhill noise logger (base image: LINZ).

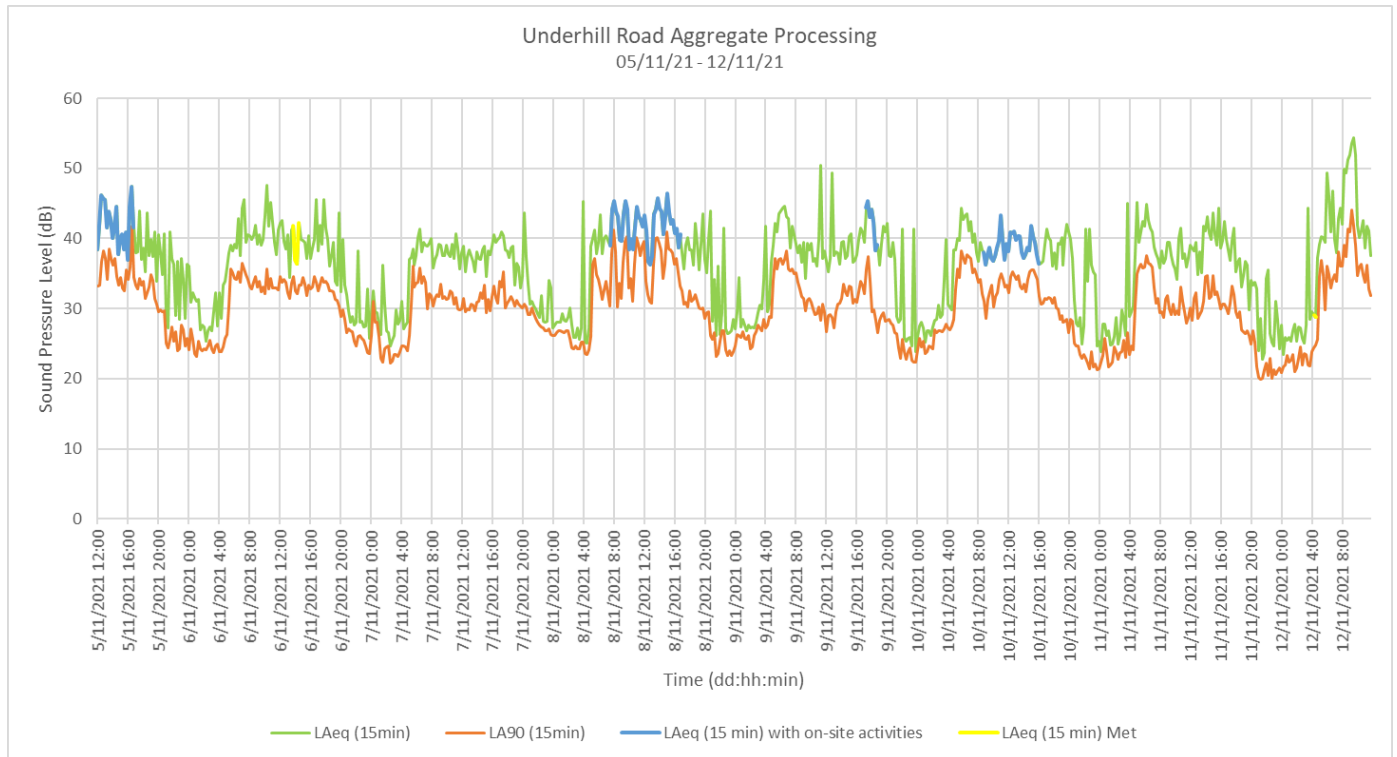




Figure C2: Noise logger on site

## APPENDIX D LONG TERM NOISE MONITORING

Note:  $L_{Aeq}(15 \text{ min})$  Met (yellow line) denotes data not used due to unsuitable meteorological conditions.  $L_{Aeq}(15 \text{ min})$  with on-site activities denotes data not used due to noise contribution from on-site activities.



## APPENDIX E NOISE SURVEY DETAILS

Dates of attended survey and

Personnel:

05/11/21	B. Wood, E. Nelson, Marshall Day Acoustics
12/11/21	E. Nelson, Marshall Day Acoustics

Instrumentation – short term attended:	Brüel & Kjær Type 1 Handheld Analyser Type 2250, serial no. 3011587 calibration due 18/05/23
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Instrumentation – Long term unattended:	01dB Cube Type 1 monitor, serial no. 11190, calibration due 10/12/21
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Field calibrator:	Brüel & Kjær Type 4231 Calibrator, serial no. 2730707, calibration due 16/02/22
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Field Calibration:	All instruments were calibrated before measurements, and the calibration checked after measurements. No significant change ( $\pm 0.1$ dB) was noted.
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Microphone height above ground level:	1.2 to 1.5 metres
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Weather (short term attended measurements).

05/11/21	Overcast 8/8; breeze 0.1 to 0.5 m/s.
12/11/21	Overcast 7/8; wind 1.5 – 2 m/s