

APPENDIX Q

ACOUSTIC ASSESSMENT

KAUPAPA PAEWIRA

Waste to Energy Facility
Acoustic Assessment

Prepared for:
Global Contracting Solutions Ltd

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SLR 

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BASIS OF REPORT

This report has been prepared by SLR Consulting NZ Limited (SLR) with all reasonable skill, care and diligence, and taking account of the timescale and resources allocated to it by agreement with Global Contracting Solutions Ltd (the Client). Information reported herein is based on the interpretation of data collected, which has been accepted in good faith as being accurate and valid.

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DOCUMENT CONTROL

Reference	Date	Prepared	Checked	Authorised
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1 Introduction

Global Contracting Solutions Limited (the Applicant) propose to develop and operate a waste to energy facility at 401 Racecourse Road in Te Awamutu. SLR Consulting NZ Limited (SLR) has been commissioned to undertake an assessment of acoustic effects associated with the construction and operation of the proposed waste to energy facility (the facility).

This assessment evaluates the noise effects from the proposed facility against the relevant noise rules set out in the Waipa District Plan (the Plan); outlines the existing ambient background noise levels near the site; and predicts the noise levels likely to be generated by the construction and operation of the facility. Where required, appropriate noise control measures to achieve compliance have been recommended.

A description of acoustic terminology is provided in Appendix A.

2 Site and Project Description

2.1 Project Location

The subject site is situated between the Te Awamutu Dairy Manufacturing site (understood to be owned and operated by Fonterra) and the Waipa Racing Club Racecourse. The subject site has an approximate footprint of 100,000 m² and is located on Industrial zoned land, as identified in the Plan. The immediate surrounding land comprises Residential zoned land towards the north, east and south with Industrial zoned land south and west of the site (see Figure 1).

The closest residential dwellings are east of the site, along Racecourse Road. Although the Waipa Racing Club Racecourse is currently utilised as a racecourse, it is zoned for future residential development. SLR also notes that the school grounds of Te Wharekura o Nga Purapura o Te Aroha school, south and across the Managapiko Stream, are on land zoned Residential and within the "Flood Hazard Area". SLR has been advised by the project planner (Terra Consulting) that the school and sports grounds are unlikely to be developed for residential use in the future. However, assessment of potential effects has been based on future development of this land to contain dwellings set back 25 m based on advice from the planner.

Fonterra owned industrial property neighbours the site to the south and west, a wastewater treatment plant directly west of the site and a storage building to the northwest. The dairy factory is south and across the Managapiko Stream.

The neighbouring properties to the site are indicated in Figure 1, with the nearest receivers summarised in Table 1.

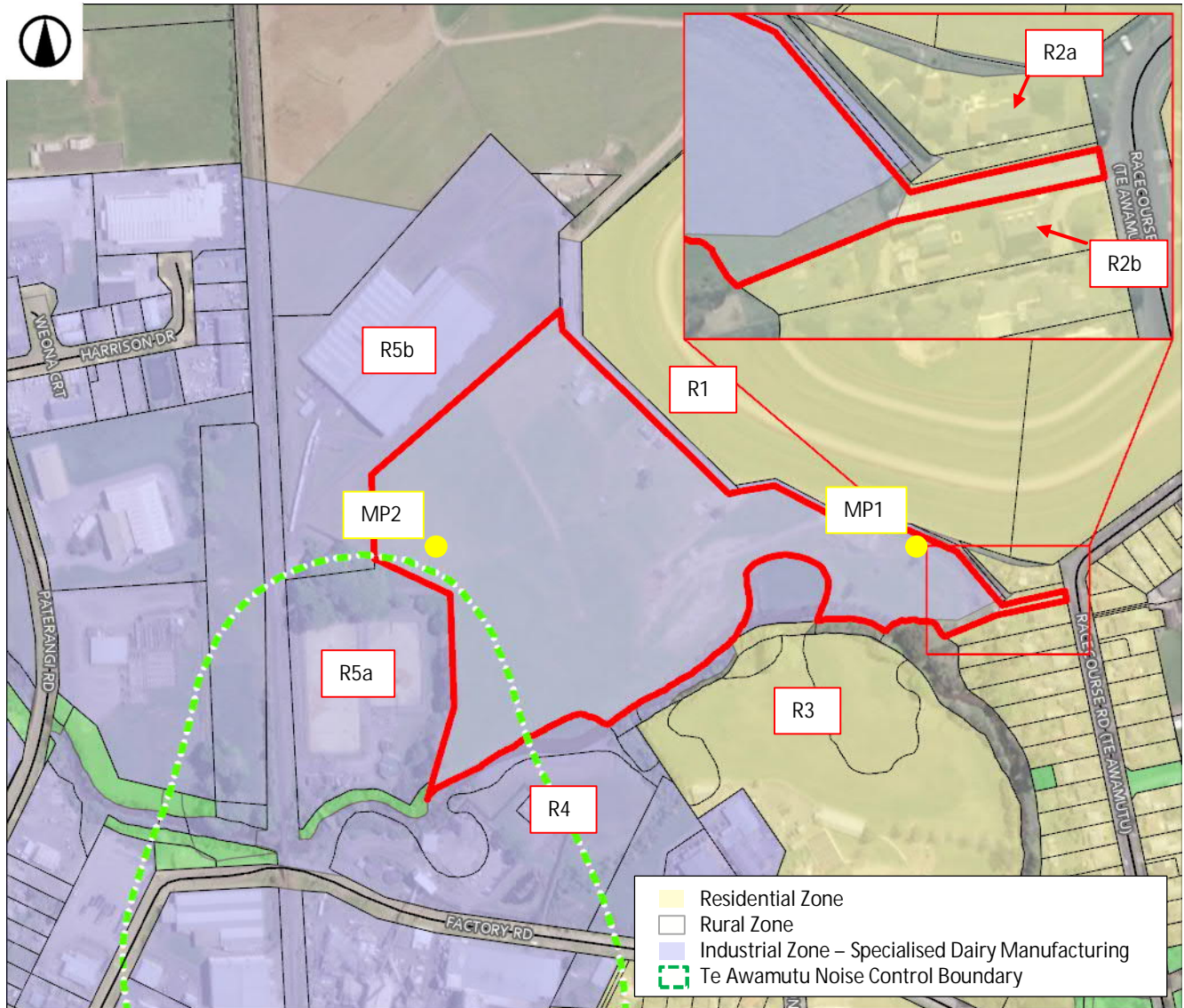
2.2 Nearby Receivers

The closest existing residential properties are located along Racecourse Road. These are more than 350 m from the closest façade of the proposed buildings (in this instance the Tipping Hall).

The proposed site entrance is off Racecourse Road with the entry road passing between the two dwellings at 381 and 417 Racecourse Road.

Other receivers not noted in the Table 1 are located further from the site and therefore the predicted noise levels at these receivers are expected to be the same or lower.

Figure 1 Aerial imagery with the Waipa District Zoning overlay and site boundary (red outline)



Whilst currently used as a racecourse, SLR has been advised that future residential development of the Waipa Racing Club Racecourse (1025 Racecourse Road) is likely to be setback to form a buffer from industrial activities. SLR understands that such a buffer area could extend up to 100 m from the industrial area. In assuming a conservative approach, SLR has assessed receivers at the Racecourse set back a distance of 50 m from the site boundary.

Table 1 Summarised list of receivers identified surrounding the proposed Facility

Figure 3 reference	Property Address	Zone	Comment / Notes
R1	1025 Racecourse Road	Residential	Waipa Racing Club Racecourse Future development of the site assumed to be single storey dwellings setback 50 m from shared boundary.
R2a	417 Racecourse Road	Residential	Nearest existing residential dwelling (single storey) north of the entrance to the facility.
R2b	381 Racecourse Road	Residential	Nearest existing residential dwelling (double storey) south of the entrance to the facility.
R3	190 Factory Road	Residential	Te Wharekura o Nga Purapura o Te Aroha school. Future development of school grounds (if developed) assumed to be setback 25 m from shared boundary.
R4	1498 Alexandra Street	Specialised Industrial	Fonterra owned industrial property - Te Awamutu Dairy Factory.
R5a	Racecourse Road (LOT 1 DPS 44966 ALOT 421 PSH)	Specialised Industrial	Fonterra owned industrial property – wastewater treatment plant.
R5b	Racecourse Road (Lot 3 DPS 11877)	Specialised Industrial	Fonterra owned industrial property – Storage building.

2.3 Project Description

The facility is proposed to operate 24 hours a day, 7 days a week. The general operation involves burning feedstock to produce super-heated steam which in turn drives a turbine that generates electricity – resulting in approximately 15 MW of electricity added to the local grid network. The facility is proposed to receive feedstock from several sources (i.e., municipal waste, remediation of old landfills, end-of-life tyres, plastic and flock which is by-products from metal recycling industry) of up to 480 tonnes per day which is sorted to create feedstock for burning.

The facility is proposed to be open to receive waste between 7:00 am to 5:00 pm (Monday to Saturday) and 8:00 am to 6:00 pm (on Sundays and public holidays). Different streams of waste are proposed to be transported to the facility from local providers across the North Island. It is anticipated that some of the material arriving at the site can be recycled instead of burnt; this material is proposed to be separated from the other waste and recycled at other recycling facilities across the North Island.

Process Flow Description

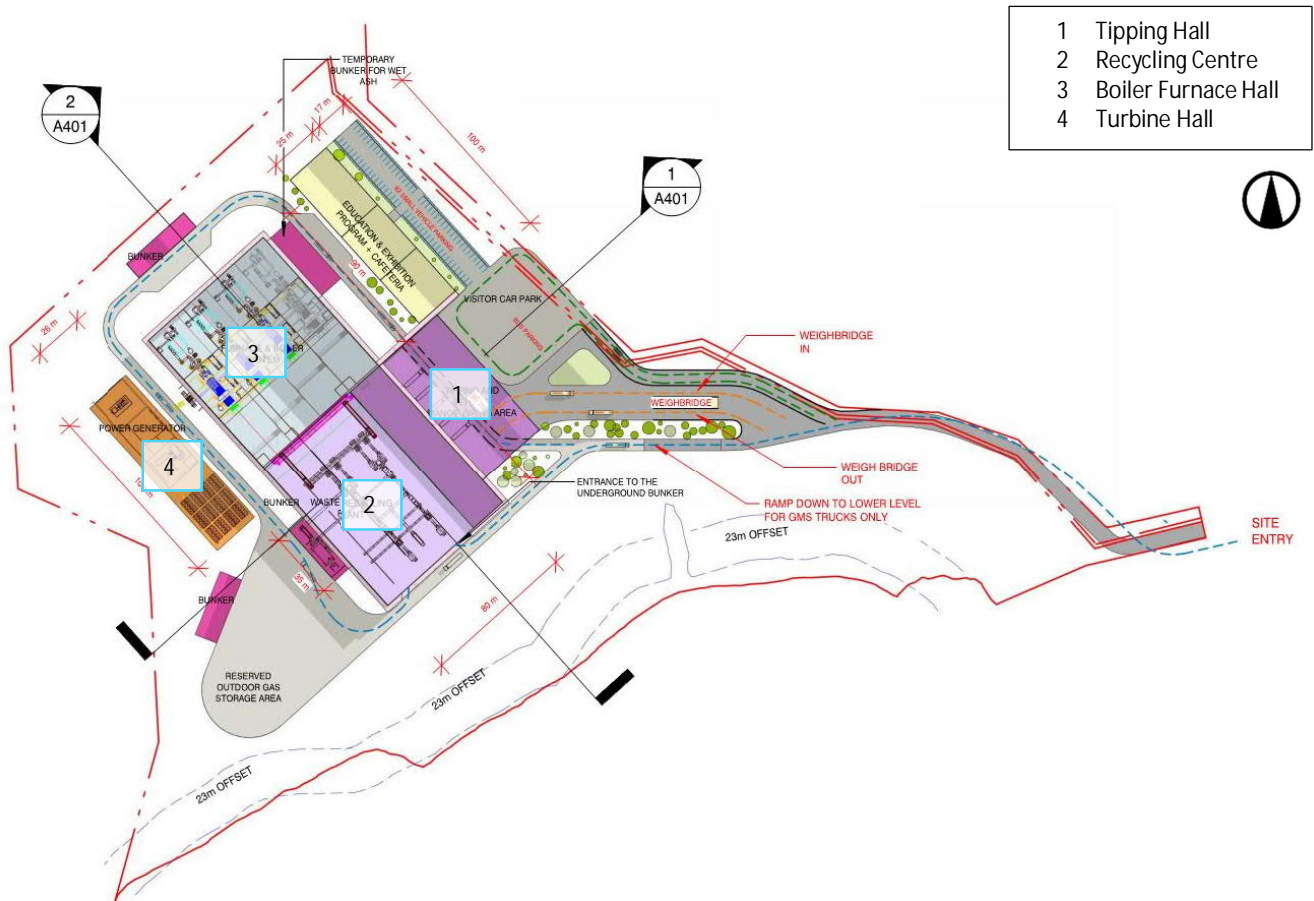
The operation of the facility is proposed to take place inside enclosed buildings, approximately 170 m by 80 m. In general, the facility is proposed to comprise a Tipping Hall, Recycling Centre, Boiler Furnace Hall and Turbine Hall.

General waste, transported by truck, enters the site from Racecourse Road and is unloaded inside the tipping hall (1) where the material is conveyed to the Recycling Centre (2). Recoverable material is sorted and screened from the Solid Derived Fuel (SDF). The recyclable material is separated for removal to other facilities for recycling.

The SDF is conveyed into the Boiler Furnace Hall (3) where it is stored inside the fuel storage bunkers. The SDF is mixed and fed to feed the furnace burners to heat up the boiler system, generating super-heated steam. The steam is piped to the Turbine Hall (4) a separate building, where the steam drives a turbine to produce electricity. The generated electricity feeds into the local network by an onsite substation which is located within the Turbine Hall building (4).

The proposed site layout drawn up by Terra Consultants (dated 20 July 2021) is shown in Figure 2.

Figure 2 Proposed Site Layout plan



3 Existing Noise Environment

Two unattended noise loggers were deployed in the vicinity of the subject site to establish the existing noise levels in the area. The noise measurements were undertaken from Wednesday 11 August 2021 to Monday 16 August 2021 using two Svantek 957 Type 1 sound level meters. Measurements were undertaken in general accordance with New Zealand Standard NZS 6801:2008 “Acoustics – Measurement of environmental sound” (NZS 6801). Weather conditions during the survey were appropriate (mostly dry and sunny with wind speeds of less than 5 m/s), rain fall events during the period have been excluded from the analysis.

Measurement position MP1 was chosen to be representative of the ambient noise levels at the existing dwellings along Racecourse Road and the future potential dwellings on the Waipa Racing Club Racecourse land. Measurement position MP2 was chosen to be representative of the ambient noise levels at the industrial properties west of the facility. The measurement positions are shown in Figure 1.

The results of the ambient noise survey are summarised in Table 2 and Table 3, broken down on a day-by-day and night-by-night basis to reflect the Plan assessment periods with reference to the NZS 6802:2008 “Acoustics - Environmental Noise” (NZS 6802) methodology. The graphical 24hour representation of both measurement positions are provided in Appendix B.

Table 2 Existing Noise Levels – MP1 Racecourse Road Residential Area (dB)

Date	Daytime		Night-time		
	LAeq,T Average	LAeq,15min Range	LAeq,T Average	LAeq,15min Range	LAfmax Range
11 August 2021	58	46 - 74	51	44 - 60	56 - 73
12 August 2021	51	44 - 58	48	39 - 55	59 - 80
13 August 2021	53	47 - 60	52	44 - 62	53 - 75
14 August 2021	58	49 - 68	50	44 - 58	53 - 75
15 August 2021	50	45 - 56	46	42 - 51	51 - 74
16 August 2021	51	45 - 55	-	-	-

Table 3 Existing Noise Levels – MP2 Industrial Area west of the site (dB)

Date	Daytime		Night-time		
	LAeq,T Average	LAeq,15min Range	LAeq,T Average	LAeq,15min Range	LAfmax Range
11 August 2021	52	48 - 56	53	49 - 59	65 - 72
12 August 2021	52	49 - 56	52	46 - 59	59 - 74
13 August 2021	53	49 - 59	53	50 - 57	64 - 76
14 August 2021	55	50 - 61	52	50 - 60	56 - 75
15 August 2021	50	48 - 54	50	48 - 54	61 - 71
16 August 2021	50	49 - 51	-	-	-

During the site visits to set up and collect the equipment, it was observed that the dairy factory's operations was the controlling noise source at both measurement locations. Local traffic was audible at MP1.

The ambient noise levels at MP1 (existing residential land) were noted to be controlled by the operations from the dairy factory located to the south-west of the subject site. The ambient noise levels at MP2 (the industrial zoned land) were controlled by the wastewater treatment plant, during periods when the aerators were operating, and the dairy factory (to the south) at other times.

The measured daytime average noise level at both locations was 53 dB LAeq(day). The measured night-time noise levels at MP1 ranged between 39 – 62 dB LAeq(15min) (an average of 49 dB LAeq(15min)) and between 46 – 60 dB LAeq(15min) (an average of 52 dB LAeq(15min)) at MP2.

Based on observations during the deployment and collection of the equipment, the measured noise levels are considered representative of typical levels in the vicinity of the measurement positions and therefore the levels experienced by the surrounding receivers.

SLR notes that the existing measured noise levels at the closest residential zoned land were 3 dB higher than the permitted activity noise limits at residential receivers during the day (an average of 53 dB LAeq vs a limit of 50 dB LAeq). The existing night-time measured noise levels were up to 20 dB higher than the permitted activity noise limits at residential receivers during the night (highest 15-minute noise levels of up to 62 dB LAeq(15min) vs a limit of 40 dB LAeq), this is four as subjectively loud as the permitted night-time limit at residential receivers.

Related to the measured noise levels at the closest industrial zoned land the daytime noise levels are below the permitted activity noise limits (an average of 53 dB LAeq vs a limit of 60 dB LAeq). However, the night-time measured noise level were up to 15 dB higher than the permitted activity noise limits (highest 15-minute noise levels of up to 60 dB LAeq(15min) vs a limit of 45 dB LAeq), this is more than twice as subjectively loud as the permitted night-time limit. The Plan limits discussed further in Section 4 below.

4 Project Performance Standards

4.1 Construction Noise

Rule 7.4.2.23 of the Plan requires that all construction noise be measured, assessed and comply with the limits of New Zealand Standard NZS 6803:1999 Acoustics - Construction Noise (NZS 6803). Section 7.2 of NZS 6803 recommends the following noise limits, which apply at 1 m from the façade of any building occupied during the works.

It is anticipated that the construction of the facility could last more than 20 weeks, therefore the long-term duration construction noise limits for receivers in residential zones (Table 4) and industrial or commercial buildings (Table 5) are applicable.

In summary, the relevant “long-term” duration limits for daytime construction are 70 dB LAeq / 85 dB LAmax at the residential dwellings and 70 dB LAeq at industrial or commercial buildings.

Table 4 Recommended upper limits for construction noise received in residential zones and dwellings in rural areas

Time of Week	Time Period	Long-term duration (more than 20 weeks)	
		LAeq, dB	LAmax, dB
Weekdays	6:30 am-7:30 am	55	75
	7:30 am – 6:00 pm	70	85
	6:00 pm – 8:00 pm	65	80
	8:00 pm – 6:30 am	45	75
Saturdays	6:30 am-7:30 am	45	75
	7:30 am – 6:00 pm	70	85
	6:00 pm – 8:00 pm	45	75
	8:00 pm – 6:30 am	45	75
Sundays and public holidays	6:30am – 7:30 am	45	75
	7:30 am – 6:00 pm	55	85
	6:00 pm – 8:00 pm	45	75
	8:00 pm – 6:30 am	45	75

Table 5 Recommended upper limits for construction noise received in industrial or commercial areas for all days of the year

Time Period	Long-term duration (more than 20 weeks)
	LAeq, dB
7:30 am – 6:00 pm	70
6:00 pm – 7:30 am	75

4.2 Construction Vibration

Rule 7.4.2.22 of the Plan states the following regarding vibration emanating from a site:

“Rule 7.4.2.22 Vibration emanating from a site shall meet the limits recommended in and be measured and assessed in accordance with New Zealand Standard NZS 4403:1996 Code of Practice for Storage, Handling, and Use of Explosives”

The above referenced New Zealand Standard NZS 4403:1996 is specific to the use of explosives which is not relevant to the planned activities at this site as no use of explosives is proposed.

However, SLR understands that Waipa District Council typically require¹ construction vibration effects to be assessed based on the German Standard DIN 4150-3:2016 Structural vibration – Effects of vibration on structures (DIN4150). This standard is commonly referenced in NZ for assessment of potential vibration construction effects.

DIN4150 provides guideline vibration levels which “when complied with, will not result in damage that will have an adverse effect on the structure’s serviceability.” For residential buildings, the standard considers serviceability to have been reduced if:

- Cracks form in plastered surfaces of walls.
- Existing cracks in the building become enlarged.
- Partitions become detached from load bearing walls or floors.

These effects are deemed “minor damage”.

DIN 4150:2016 guideline values for evaluating short-term and long-term vibration on structures are provided in Table 6 and Table 7, where short-term vibrations are defined as those that do not occur often enough to cause structural fatigue and do not produce resonance in the structure being evaluated and long-term vibrations are all the other types of vibration.

Table 6 Guideline values for vibration velocity to be used when evaluating the effects of short-term vibrations on structures (DIN 4150-3:2016) (mm/s)

Type of Structure	Vibration Peak Particle Velocity (PPV) at the Foundation at a Frequency of			Topmost floor, horizontal direction	Floor slabs vertical direction
	<10 Hz	10 - 50 Hz	50 - 100 Hz	All frequencies	
Commercial / Industrial	20	20 - 40	40 - 50	40	20
Dwellings	5	5 - 15	15 - 20	15	20
Structures sensitive to or under a preservation order.	3	3 - 8	8 - 10	8	20

¹ Email dated 17 November 2021 from Quentin Budd of the Waipa District Council.

Table 7 Guideline values for vibration velocity to be used when evaluating the effects of long-term vibrations on structures (DIN 4150-3:2016) (mm/s)

Type of Structure	Topmost floor, horizontal direction	Floor slabs vertical direction
Commercial	10	10
Dwelling	5	10
Structures sensitive to or under a preservation order.	2.5	10

4.3 Operational Noise

Rule 7.4.2.18 of the Plan set the following noise limits for noise generated on Industrial zoned land:

"7.4.2.18 Activities shall be conducted, and buildings located, designed and used to ensure that they do not exceed the following noise limits at the boundary of the site:

- (a) Monday to Saturday – 7:00am to 10:00pm 60 dBA (Leq)
- (b) Sundays and public holidays – 8:00am to 6:00pm 50 dBA (Leq)
- (c) At all other times 45 dBA (Leq)
- (d) No single event noise level shall exceed 70 dBA (Lmax)
 Night-time – 10:00 pm to 7:00 am

Within the boundary of any site zoned Residential or Large Lot Residential:

- (e) Monday to Saturday – 7:00am to 10:00pm 50 dBA (Leq)
- (f) Sundays and public holidays – 8:00am to 8:00pm 50 dBA (Leq)
- (g) At all other times 40 dBA (Leq)
- (h) No single event noise level shall exceed 70 dBA (Lmax)
 Night-time – 10:00 pm to 7:00 am

All noise levels shall be measured and assessed in accordance with the requirements of New Zealand Standard NZS 6801:2008 "Acoustics – Measurement of environmental sound" and in accordance with New Zealand Standard NZS 6802:2008 "Acoustics - Environmental Noise".

SLR notes that the subject site access road, adjacent to the residential buildings, is on land zoned Residential. However, the noise limits from Residential to Residential are the same as the noise limits set for Industrial to Residential properties. This does not change the applicable noise limits at the properties either side of the access road.

SLR understand that the status of the activity, due to the proposed type of activity and zoning the of land, is non-complying. Therefore, in addition to the above limits, the following requirements (Section 21.1.7.13 of the Plan) are to be considered in assessing the potential noise effects. The relevant section is reproduced below (Figure 3).

Figure 3 Extract from the Waipa District Plan – Section 21

21.1.7.13	Noise - Te Awamutu and Hautapu Dairy Manufacturing sites	<p>(a) The time and frequency that the activity occurs.</p> <p>(b) The duration of noise continuance.</p> <p>(c) Any adverse effects on occupants of buildings either on-site or on surrounding properties and any special characteristics of the noise and subsequent effects on well-being, health and safety, and on the amenity values of the surrounding environment.</p> <p>(d) The extent to which all practicable means have been employed to reduce noise emissions.</p> <p>(e) The extent to which the proposed mitigation measures reduce the impact of noise on surrounding residents.</p>
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4.4 Resource Management Act (RMA)

Section 16 and 17 of the RMA state the following, which applicable to the project:

“16 Duty to avoid unreasonable noise

- (1) Every occupier of land (including any premises and any coastal marine area), and every person carrying out an activity in, on, or under a water body or the coastal marine area, shall adopt the best practicable option to ensure that the emission of noise from that land or water does not exceed a reasonable level.”
- (2) A national environment standard, plan, or resource consent made or granted for the purpose of any of sections 9, 12, 13, 14, 15, 15A and 15B may prescribe noise emission standards, and is not limited in its ability to do so by subsection (1).

17 Duty to avoid, remedy, or mitigate adverse effects

- (1) Every person has a duty to avoid, remedy, or mitigate any adverse effect on the environment arising from an activity carried on by or on behalf of the person, whether or not the activity is carried on in accordance with—
 - a. any of sections 10, 10A, 10B, and 20A; or
 - b. a national environmental standard, a rule, a resource consent, or a designation.
- (2) The duty referred to in subsection (1) is not of itself enforceable against any person, and no person is liable to any other person for a breach of that duty.
- (3) Notwithstanding subsection (2), an enforcement order or abatement notice may be made or served under Part 12 to—
 - a. require a person to cease, or prohibit a person from commencing, anything that, in the opinion of the Environment Court or an enforcement officer, is or is likely to be noxious, dangerous, offensive, or objectionable to such an extent that it has or is likely to have an adverse effect on the environment; or

- b. require a person to do something that, in the opinion of the Environment Court or an enforcement officer, is necessary in order to avoid, remedy, or mitigate any actual or likely adverse effect on the environment caused by, or on behalf of, that person.
- (4) Subsection (3) is subject to section 319(2) (which specifies when an Environment Court shall not make an enforcement order)."

SLR considers that the adoption, prediction and assessment of noise and vibration effects, in accordance with the above Plan performance standards, would satisfy the requirements of the RMA in relation to the assessment of such effects.

5 Construction Assessment

5.1 Noise

At the time of writing, a detailed programme of construction works, hours and likely plant to be used onsite is not available; therefore, the assessment of construction noise has been based on information and data from SLR's experience working on similar scale developments.

It is understood that the construction works would occur during the hours of 7:30 am and 6:00 pm, Monday to Saturday. The construction of the project could include clearing and leveling the site, paving and building erection. A summary of equipment and reference sound pressure levels (SPLs) has been provided in Table 8, these SPLs are based on in-house measurements undertaken by SLR of other similar activities and published data².

The noted approximate setback distances to compliance have been calculated in accordance with the methodology in NZS 6803 and include façade corrections. Construction works are not normally operated continuously (with periods of down time between the higher noise generating activities where plant is moving or other necessary logistical activities taking place). With reference to the assessment methodology in NZS 6803 (Annex D), a duration adjustment of up to 3 dB has allowed for in the assessment. It should be noted that the excavator engines are often a 1 m or more back from the work locations.

Table 8 Construction equipment and typical noise emission levels

Plant Item	Plant Noise Level at 10m	Approximate setback distance to compliance ¹ without mitigation
Excavator (<20t) with bucket attachment	75 dB LAeq	20 m
Vibratory Compaction Roller (≤20 t) ²	75 dB LAeq	20 m
Non-vibratory Compaction Roller (<5 t)	60-65 dB LAeq	5 m
Rotary Piling Rig	80 dB LAeq	30 m
Driven Impact Piling	85 dB LAeq	55 m

Notes to Table:

- NZS 6803 compliance level is 70 dB LAeq, representative of the day-time limit (7:30 am to 6:00 pm).
- The setback distance for a non-vibratory compactor is based on 6 movements (passing by an individual receiver) every 15 minutes as the compactor is expected to be moving across the site and not idling/stationary at one location.

² BS 5228-1: 2009 Code of practice for noise and vibration control on construction and open sites – Part 1; Noise

Compliance with the 70 dB LAeq construction noise limit is expected at approximately 60 m from the noisiest activity (impact piling) without mitigation measures. The nearest existing dwelling is over 350 m from the works, therefore the construction of the facility is expected to comply with the relevant limits of NZS 6803.

Vehicle trips (trucks on and off the site), during the construction of the facility, would generate short-term and temporary noise levels at the receivers either side of the access road. SLR anticipates that compliance with the limits would be achieved at these receivers given the limited duration of such events – if needed acoustic screening along the access road would assist reduce noise levels for the two immediately adjoining receivers.

5.2 Vibration

Table 9 presents the predicted setback distances to comply with the vibration criteria during the construction phase, to avoid cosmetic damage to buildings. These reference levels should be considered indicative only due to the potential difference in machinery and ground conditions etc.

Table 9 Plant items and the indicative distance to comply with the applicable vibration limits

Type of Works	Plant Item	Distance to achieve DIN 4105-3 Guideline PPV in mm/s of vibration in horizontal plane at Residential dwellings highest floor at all frequencies – 5 mm/s PPV
Impact Driven Piling	5 tonnes hammer weight with up to 1 m drop height	18 m
Excavation	Large Tracked Excavator (20-40 tonnes)	5 m
Compaction	Vibratory Compaction Roller (≤20 tonnes)	15 m
	Non-vibratory Compaction Roller (<5 tonnes)	<1 m

Compliance with the vibration guideline criteria is anticipated at a distance of up to 18 metres from the proposed works. With the exception of formation of the access road, the nearest receiver to the works is over 350 metres. Therefore, the surrounding buildings are located sufficiently distant from the works that the vibration levels generated by the bulk earthworks are anticipated to meet these guideline values with a margin of comfort.

Compaction as part of the access road construction is recommended to be carried out by a non-vibratory compaction roller (<10 tonnes). The use of a larger vibratory roller could be used at other locations setback more than 15 m from surrounding dwellings.

The vibration effects from vehicles accessing the site are expected to be negligible (i.e., very unlikely to cause annoyance), provided the road surface is monitored and maintained to be smooth and even, without lips and cracks. This is the primary mitigation tool, and the best practicable option for avoiding and mitigating operational vibration effects.

There is also potential for the generation of intermittent vibration by dropping heavy objects, running over ledges or impacting unexpected items. It is not feasible to predict how regularly these events may occur, or what levels of vibration may be generated from these individual events, due to their arbitrary nature. They can, however, be readily minimised or avoided through considered management practices.

6 Operational Noise

6.1 Noise Modelling Methodology and Assumptions

SLR has predicted operational noise levels generated by the proposed facility in accordance with the algorithms detailed in ISO 9613-2: 1996 Acoustics – Attenuation of sound during propagation outdoors – Part 2: General method of calculation. The ISO 9613 calculation method considers a range of frequency-dependent attenuation factors that include atmospheric absorption, ground attenuation, meteorological conditions (e.g., wind increasing noise propagation efficiency) barrier effects and the directivity of a noise source.

The noise model takes into consideration the following sources, discussed in more detail in the relevant sub-sections:

- Tipping Hall (Section 6.3.1)
- Recycling Centre (Section 6.3.2)
- Boiler Furnace Hall (Section 6.3.3)
- Turbine Hall (Section 6.3.4)
- Vehicle Movements (Section 6.3.5)

Details regarding the supply air ventilation to the furnace hall have not yet been finalised. It is considered that with proper selection of equipment in terms of noise emission, standard methods of noise control such as screening and attenuators (if required) and appropriate siting, the system could comply with the relevant noise limits. Review of the system design by an acoustic specialist is recommended, prior to the system design being finalised.

6.2 Model Assumptions

The acoustic propagation model is based on the following general assumptions:

- All receivers have been calculated as free-field and positioned 1.5 m above receiver level (i.e., ground or first floor level).
- A ground absorption factor of zero (0) representative of a hard reflective surface.
- Substation is near the Turbine Hall building and based on SLR experience and the area near the Turbine Hall the noise from the substation is insignificant.

6.3 Source Noise Description and Information

The noise source information described below, is based on SLR experience working on similar energy from waste projects internationally and from advice provided by the project design team.

6.3.1 Tipping Hall

Access to the tipping hall is through a double gate system to control odours and/or contaminants when vehicles enter the building. This double door system minimise the level of noise emitted to the environment. Because trucks delivering new feedstock are limited to daytime hours, no noise is expected to be emitted from the tipping hall during the night-time period.

The modelling is based on the following:

- An internal reverberant sound level of 66-67 dBA L_{prev} (based on an average of 15 trucks entering and leaving the building within an hour).
- The building facade and roof being constructed from profile metal cladding secured to 0.55 BMT steel stud, with fibrous insulation and lined with 10 mm standard density plasterboard (or similar construction), resulting in a sound insulation rating of $R_w \geq 35$ dB.
- Impact and instantaneous noise events (crashing or banging of materials) are anticipated to be contained within the building. Therefore, no Special Audible Characteristic (SAC) penalty has been applied to the noise source.

6.3.2 Recycling Centre

At the recycling centre the refuse waste material is sorted through several lines within an enclosed building separating SDF from recyclable material. The recycling centre is operational from 6:00 am to 6:00 pm, spanning over the day / night-time period.

The modelling is based on the following:

- An internal reverberant sound level of 85 dBA L_{prev} .
- The building wall being constructed of pre-cast concrete, with a sound insulation rating of $R_w \geq 50$ dB.
- The building roof being constructed from profile metal cladding secured to 0.55 BMT steel stud, with fibrous insulation and lined with 10 mm standard density plasterboard (or similar construction), resulting in a sound insulation rating of $R_w \geq 35$ dB.
- Impact and instantaneous noise events (crashing or banging of materials) are anticipated to be contained within the building. Therefore, no SAC penalty has been applied to the noise source.

6.3.3 Boiler Furnace Hall

The Boiler Furnace Hall comprises a three-unit system comprises the SDF storage bunker, fuel dosing, furnace line with combustion air system, boiler, de-ashing system and stack. The combustion process is proposed to operate continuously to provide a stable supply of steam for electricity generation.

The modelling is based on the following:

- An internal reverberant sound level of 85 dBA L_{prev} .

- The building wall being constructed of pre-cast concrete, with a sound insulation rating of $R_w \geq 50$ dB.
- The building roof being constructed from profile metal cladding secured to 0.55 BMT steel stud, with fibrous insulation and lined with 10 mm standard density plasterboard (or similar construction), resulting in a sound insulation rating of $R_w \geq 35$ dB.
- Each of the three stacks located no greater than 3 m above the height at which the stack penetrates the roof. Each stack was modelled with a sound power level of 85 dB L_{WA} (as advised by project plant engineers LAMBION).
- Due to the potential for low frequency content associated with this activity, SLR has applied a SAC penalty of 5 dB to the Boiler Furnace Hall building and stack noise sources.

6.3.4 Turbine Hall

The turbine hall is separate to the main building. It houses the turbine and generator with cooling condenser units located outside. The turbine hall and associated activities are anticipated to operate continuously.

The modelling is based on the following:

- An internal reverberant sound level of 85 dBA L_{prev}.
- The building wall and roof being constructed of pre-cast concrete, with a sound insulation rating of $R_w \geq 50$ dB.
- All cooling condenser units located at ground level with a sound power level per unit of 85 dB L_{WA}.
- Due to the potential for a tonality to arise, SLR has applied a SAC penalty to the turbine hall building.

6.3.5 Vehicle Movements

Access to and from the facility is through the access road of Racecourse Road, passing between 381 and 417 Racecourse Road. After initial review and project team discussion, no heavy vehicles are proposed to access the site during night-time hours to minimise the potential for night-time noise effects at properties close to the access road.

The expected vehicle trip generation for the site, as modelled, is summarised below:

Light Vehicle Movements

A total of up to 50 staff are expected to arrive and leave the site per day (100 movements per day), with some occurring within the night-time timeframe.

- Daytime³
 - Based on the facility's operational hours, it is estimated that up to 55 staff movements could occur during the daytime period. With a peak of up to 33 vehicles arriving or departing the site in the busiest hour (33 vehicle movements).
 - An average of 6 vehicles arriving and departing per hour (12 vehicle movements) has been used in the assessment.

³ Daytime hours are defined as between 7:00 am and 10:00 pm (Monday to Saturday) and 8:00 am to 8:00 pm on Sundays and public holidays.

- Night-time⁴
 - It has been assumed that up to 11 vehicles could arrive or depart the site in the peak 15 minutes (11 vehicle movements).

Heavy Vehicle Movements

- Daytime⁴
 - Heavy Productivity Motor Vehicles (HPMV's):

It is anticipated that up to 30 HPMV's could arrive and depart the site during the day. With a peak of up to 5 vehicles arriving and departing the site in the busiest hour (10 vehicle movements).

An hourly average of 2 vehicles (4 vehicle movements) was used to calculate the contribution of HPMV's.
 - Class 2 and 3 Trucks:

The project expects up to 100 trucks (Class 2 medium rigid truck and Class 3 medium truck and trailer) to arrive at the site to deliver material at the tipping hall per day. A peak of up to 22 trucks arriving and departing the site could occur in the busiest hour (44 vehicle movements).

An hourly average of 7 vehicles (14 vehicle movements) was used to calculate the contribution of class 2 & 3 trucks.

In addition to trucks delivering material to the site, the applicant anticipates that some of the by-product material is removed for recycling. This has been assumed to be an average of 1 vehicles per hour (2 vehicle movements).
- Night-time⁵
 - No trucks are proposed to enter or exit the site during the night-time period. Therefore, no night-time truck movements were calculated in the assessment.

Vehicle Source Levels

Vehicle movements were modelled as a moving point source with the following sound power levels:

- 87 dB L_{WA} for light vehicles (e.g., cars).
- 98 dB L_{WA} for Class 2 and 3 trucks (i.e., ISUZU N Series to F Series, Gross vehicle mass 5-16 tonnes).
- 105 dB L_{WA} for Heavy Productivity Motor Vehicles (i.e., ISUZU F-Heavy Series to GIGA Series, Gross vehicle mass 18-29 tonnes or B-trains).

⁴ Night-time hours are between 10:00 pm and 7:00 am (Monday to Saturday) and the hours outside of 8:00 am – 8:00 pm on Sundays.

⁵ Night-time hours are between 10:00 pm and 7:00 am (Monday to Saturday) and the hours outside of 8:00 am – 8:00 pm on Sundays.

Figure 4 Example of the Class 2 and 3 trucks



Figure 5 Example of the Heavy Productivity Motor Vehicles



These LWA levels are based on SLR in-house measurements from other comparable projects that involved similar sized vehicles.

SLR has measured characteristic L_{AFmax} noise levels generated by car doors slamming of approximately 70 dB L_{Aeq} at 10 m away. The release of air brakes by heavy vehicles (perceived as a 'hiss') generates the highest levels associated with trucks, with measured levels of 85 dB L_{Aeq} at a distance of 10 m from the noise source.

SLR anticipates that based on the proposed activities during the night-time period (no trucks) such maximum instantaneous events would be limited to car door slams. Given the distance to receivers, the L_{AFmax} criterion is expected to be achieved, therefore the following assessment does not consider this criterion further.

6.4 Proposed Mitigation

The following mitigation measures were incorporated in our calculations:

- No heavy vehicle movement allowed onsite during the night-time period as defined in the Plan. Light vehicles are permitted at all hours onsite.
- Sealing and maintaining the access road.
- An acoustic screen of 1.8 m in height is proposed along the property boundary shared with the Waipa Racing Club (1025 Racecourse Road) to reduce noise from ground level sources (e.g., trucks) at future dwellings, to be constructed prior to occupation of dwellings at 1025 Racecourse Road.
- An acoustic screen of 2.5 m in height is proposed along the property boundary shared with 417 Racecourse Road shielding the single storey dwelling from vehicle movements along the driveway of the site (shown in in Figure 7). The acoustic screen is to be lined with sound absorptive material (such as Stratocell Whisper 25mm panels) to the driveway side to reduce reflections of sound off the barriers.
- A 3.5 m in height is proposed along the property boundary shared with 381 Racecourse Road shielding the double-storey dwelling from vehicle movements along the driveway of the site (shown in in Figure 7). The acoustic screen is to be lined with sound absorptive material (such as Stratocell Whisper 25mm panels) to the driveway side reduce reflections of sound off the barriers.
- A 4.0 m heigh acoustic screen is proposed at the south-eastern and south-western perimeter of the cooling condensers.
- Figure 6 and Figure 7 show the extent of the proposed acoustic screens at the subject site. The screening should be formed of a solid material with a mass of at least 10 kg/m^2 (e.g., 20 mm thick pine, solid metal panels, >6 mm glass or >12 mm acrylic transparent panels) with no gaps between or beneath component parts.

Figure 6 Site layout with proposed acoustic screen location

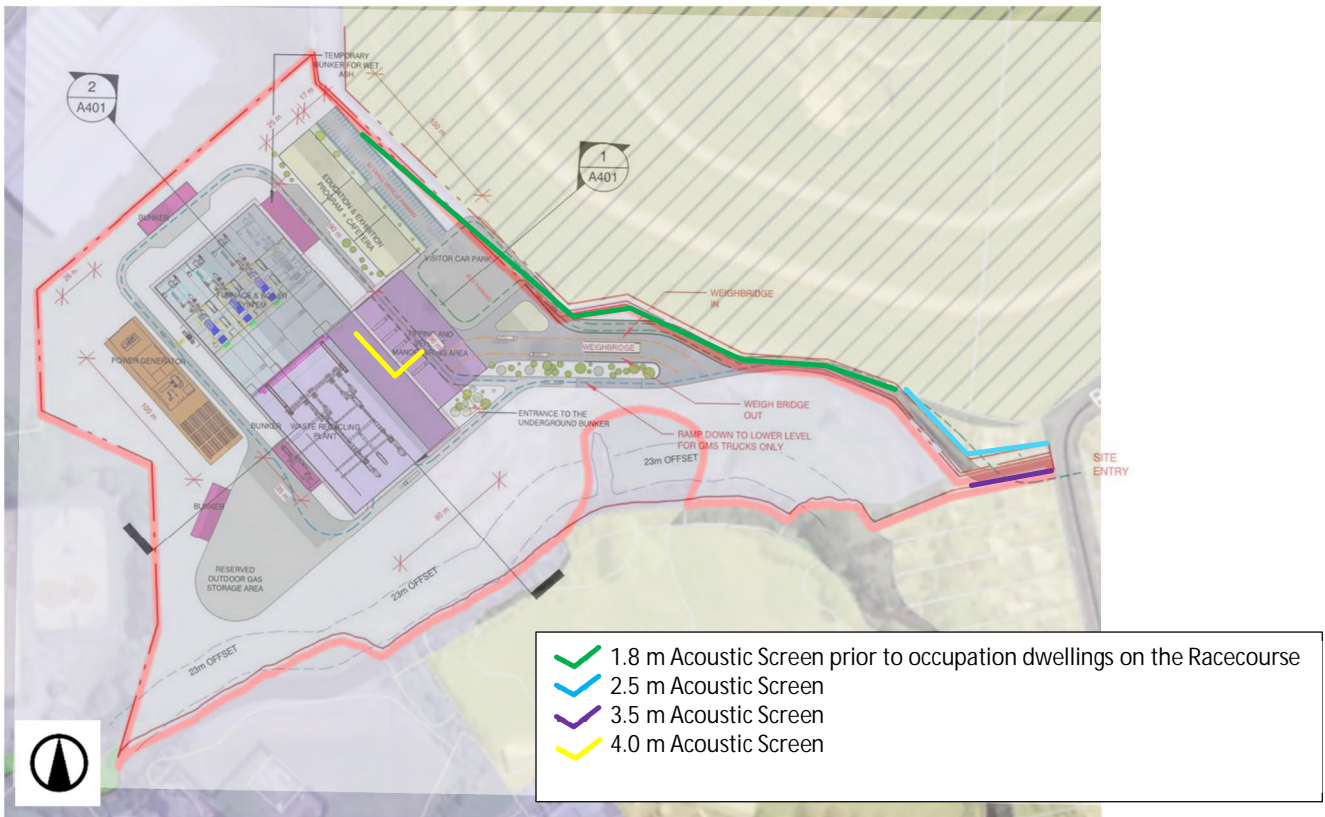
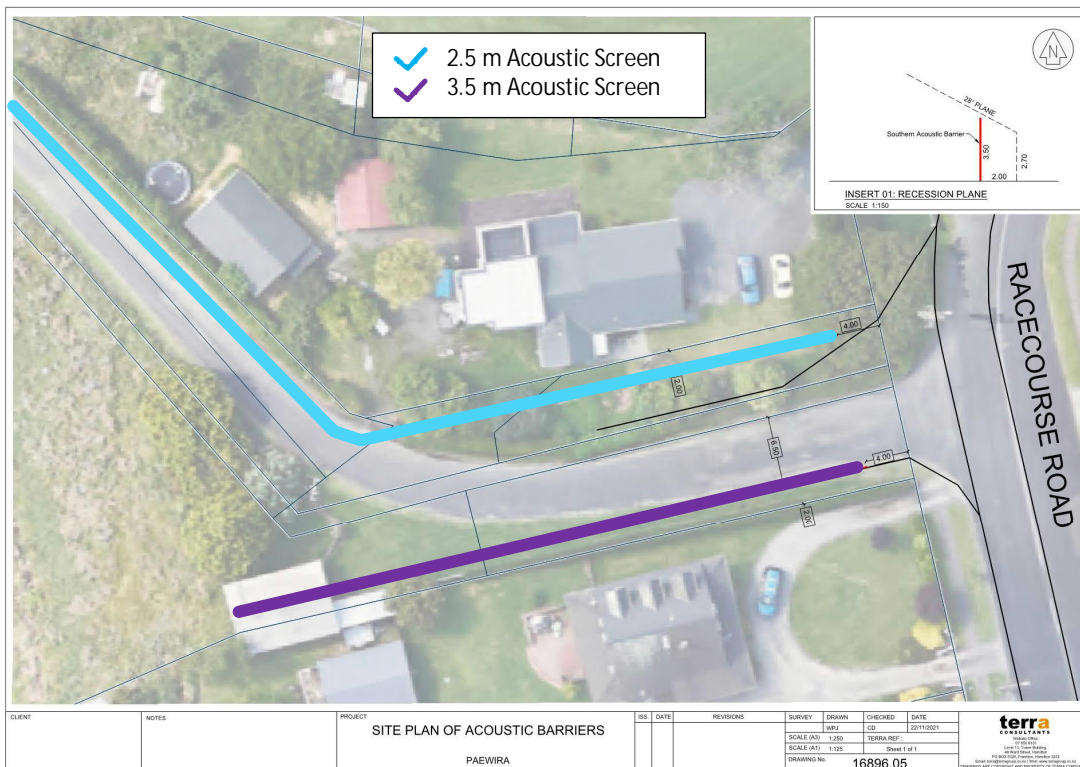


Figure 7 Proposed acoustic screening at entrance of 381 Racecourse Road (provided by Terra Consulting)



6.5 Predicted Operational Levels

The predicted operational rating noise levels are summarised Table 10 and presented as noise contours in Appendix C. The two predicted daytime infringements are indicated in bold.

Table 10 Predicted Operational Rating Noise Levels

Receiver Number and Address			Predicted Rating Level				Comment
			Daytime Period (dB LAeq)		Night-time period (dB LAeq)		
			Predicted	Criteria	Predicted	Criteria	
R1	1025 Racecourse Road at 50m set back from boundary (Waipa Racing Club)	GF	45	50	39	40	Compliance
R2a	417 Racecourse Road	GF	51	50	36	40	See discussion below
R2b	381 Racecourse Road	GF	45	50	33	40	Compliance
		1F	53	50	37	40	See discussion below
R3	190 Factory Road (School's Sport Grounds)	GF	45	50	35	40	Compliance
		1F	45	50	35	40	Compliance
R4	1498 Alexandra Street (Te Awamutu Dairy Factory)	GF	43	60	41	45	Compliance
R5a	Racecourse Road (Wastewater treatment plant)	GF	45	60	45	45	Compliance
R5b	Racecourse Road (Storage building)	GF	45	60	44	45	Compliance

Based on the operation of the proposed facility (Section 6.3) and mitigation measures proposed (Section 6.4) the facility is expected to comply with the Plan daytime and night-time hours at the majority of existing and potential future receivers.

During the daytime, the two residential receivers adjacent to the accessway to the site (417 and the upper floor of 381 Racecourse Road) could experience noise levels 1-3 dB above the Plan noise limit of 50 dB LAeq. These infringements are controlled by heavy vehicles accessing the site via the access road, which passes between the two dwellings.

Levels at other receivers not included in the table above can be expected to comply with the Plan limits as they are further from noise sources and therefore less exposed to noise.

7 Assessment of Noise Effects

The planned centre is predicted to comply with the Plan noise limits at the future residential area (north of the site), the school's grounds (south), the adjacent industrial properties and the majority of existing residential sites. SLR considers that the noise effects at these sites, given compliance with the Plan limits, to be reasonable.

The effects of the two infringements identified in Table 10, using the framework set out in Section 21.1.7.13 of the Plan as a basis, are discussed below.

7.1 417 Racecourse Road

SLR has provided an assessment of the effects of the predicted 1 dB daytime infringement at this receiver against the framework of Section 21.1.7.13 of the Plan below:

“(a) The time and frequency that the activity occurs”

The controlling daytime noise source at this receiver is heavy vehicles entering and leaving the site during the daytime period. Trucks movements are only proposed during the daytime hours (7:00 am and 6:00 pm), there are no evening or night-time truck movements.

“(b) The duration of the noise continuance”

Activity levels at this receiver from trucks would be temporary and intermittent as trucks accessing or leaving the site are not an ongoing or continuous noise source.

“(c) Any adverse effects on occupants of the building either on-site or on surrounding properties and any special characteristics of the noise and subsequent effects on well-being, health and safety, and on the amenity value of the surrounding environment.”

An exceedance of 1 dB above the daytime noise limit is predicted. Such an exceedance is considered negligible, as a difference of 1 dB in noise levels are considered to be imperceptible; therefore the effects would be no different to those associated with fully compliant levels.

A number of relevant documents support this statement in an environmental noise context. For example, Section 4 (Table 4.1) of the New South Wales “Noise Policy for Industry” 2017 (NPfI), defines a residual noise impact of < 2 dB as “negligible”. And Table 4.2 within the NPfI goes on to describe “negligible” as “...would not be discernible by the average listener...”.

Furthermore, the noise anticipated from the operation of the proposed facility is quieter than this receiver is already exposed to due to the nearby dairy plant operation. Due to other industrial activities in the area, heavy traffic is also an existing common occurrence on Racecourse Road.

“(d) The extent to which all practicable means have been employed to reduce noise emissions.”

The proposed mitigation (Section 6.4) takes the form of:

- no trucks in the evening or at night;
- the construction of acoustic boundary screening to shield the ground floor and outdoor amenity spaces of the property as far as practicable; and

- sealing and maintaining the access road to minimise traffic noise effects associated with driving over uneven surfaces.

“(e) The extent to which the proposed mitigation measures reduce the impact of noise on surrounding residents.”

The mitigation measures proposed result in a reduction of 9-11 dB in daytime noise levels compared to unmitigated levels, an effective halving of the subjectively perceived sound levels. Night-time levels are compliant with the avoidance of trucks at night.

Based on the discussions in this section, SLR consider that the potential noise effects from the facility at 417 Racecourse Road to be less than minor.

The noise limits in the plan are a benchmark for reasonable noise received at residential receivers. SLR is of the opinion that the proposed mitigation measures are the best practicable options available for this receiver to reduce the noise level to a reasonable level.

7.2 381 Racecourse Road

SLR has provided an assessment of the effects of the predicted 3 dB daytime infringement at this receiver against the framework of Section 21.1.7.13 of the Plan below:

“(a) The time and frequency that the activity occurs”

The controlling daytime noise source at this receiver is heavy vehicles entering and leaving the site during the daytime period. Trucks movements are only proposed during the daytime hours (7:00 am and 6:00 pm), there are no evening or night-time truck movements.

“(b) The duration of the noise continuance”

Activity levels at this receiver from trucks would be temporary and intermittent as trucks accessing or leaving the site are not an ongoing or continuous noise source.

“(c) Any adverse effects on occupants of the building either on-site or on surrounding properties and any special characteristics of the noise and subsequent effects on well-being, health and safety, and on the amenity value of the surrounding environment.”

An exceedance of 3 dB above the daytime noise limit is predicted at the upper floor of the residence only. The noise levels at ground floor achieve compliance with the Plan noise limits. The level of infringement of the daytime noise limit at the upper floor is considered to be a just perceptible increase compared to the noise limit. Provided that the upper floor's windows are closed the internal noise level inside the rooms of the upper floor are expected to comply with the internal noise criterion for bedrooms commonly adopted in the Plan (35 dB L_{Aeq}).

It should be noted that the upper floor of a dwelling is not typically occupied regularly during the daytime hours. The ground floor and outdoor amenity spaces are typically the most commonly occupied areas during the day and commonly where most focus is placed in terms of providing suitable acoustic amenity. As noted, the predicted levels at ground level meet the Plan noise limit, therefore providing appropriate levels of external acoustic amenity.

The noise anticipated from the operation of the proposed facility is slightly higher than or equal to the level the receiver is already exposed to due to the nearby dairy plant operation and existing traffic noise in the area.

“(d) The extent to which all practicable means have been employed to reduce noise emissions.”

The proposed mitigation (Section 6.4) takes the form of:

- no trucks in the evening or at night;
- the construction of acoustic boundary screening to shield the ground floor and outdoor amenity spaces of the property as far as practicable; and
- sealing and maintaining the access road to minimise traffic noise effects associated with driving over uneven surfaces.

The proposed mitigation, as detailed above, results in sufficient screening at the ground floor of the property to achieve a compliant level during the daytime period and protect the outdoor amenity of the residence.

“(e) The extent to which the proposed mitigation measures reduce the impact of noise on surrounding residents.”

The mitigation measures proposed result in a reduction of up to 14 dB at the ground floor and up to 5 dB at the upper floor, compared to unmitigated levels. This is an effective halving of the subjectively perceived sound levels at ground level. Night-time levels are compliant with the avoidance of trucks at night.

Based on the discussions in this section, SLR consider that the potential noise effects from the facility at 381 Racecourse Road to be less than minor.

8 Recommended Conditions of Consent

SLR recommends that specific conditions of consent be included in the resource consent and has provided the following recommended conditions that can be adopted:

1. Construction activities shall meet the guideline limits in NZS 6803: 1999 Acoustics - Construction Noise and shall be measured and assessed in accordance with the same standard.
2. Noise generated by the operation of the site shall not exceed the following noise limits:

Receiver	Noise Limit	
	Monday to Saturday (7:00 am to 10:00 pm) Sunday and public holidays (8:00 am to 8:00 pm)	At all other times
Residential Zone Receivers (Except - 381 Racecourse Road and 417 Racecourse Road)	50 dB LAeq,T	40 dB LAeq(15min) 70 dB LAFmax
381 Racecourse Road	53 dB LAeq,T	40 dB LAeq(15min) 70 dB LAFmax
417 Racecourse Road	51 dB LAeq,T	42 dB LAeq(15min) 70 dB LAFmax
Industrial Zone Receivers	60 dB LAeq,T	50 dB LAeq(15min) 70 dB LAFmax

3. Operational noise shall be measured in accordance with NZS 6801:2008 "Acoustics – Measurement of environmental sound" and assessed in accordance with NZS 6802:2008 "Acoustics - Environmental Noise".
4. Acoustic screening shall be constructed and maintained as necessary to achieve compliance with the limits in Condition [2].
 Advice note: Construction of any screening along the boundary of Waipa Racing Club [1025 Racecourse Road] shall only be required prior to occupation of dwellings on that site.
5. No heavy vehicles are permitted to access the facility before 7:00 am (Monday to Saturday) and before 8:00 am on Sundays and public holiday.
6. No heavy vehicles are permitted to que along Racecourse Road at any time.

9 Conclusion

SLR has been commissioned to undertake an acoustic assessment of the proposed Waste to Energy Facility at 401 Racecourse Road in Te Awamutu. The proposed facility has been considered with regard to the noise requirements of the Waipa District Council.

The existing ambient environment at the subject site is controlled by the operations of the Te Awamutu Dairy Factory and its associated operations.

Construction generated noise and vibration levels are expected to comply with the limits at surrounding properties due to the distance between the site and receivers.

Following the implementation of mitigation measures to screen the closest existing and future potential dwellings, the predicted noise levels generated by the operation of the proposed development (including vehicle noise) can comply with the relevant daytime and night-time noise limits at the surrounding properties with the exception of slight daytime infringements at two locations.

A negligible infringement of 1 dB above the daytime noise limit is predicted at the existing residence at 417 Racecourse Road, this is due to trucks accessing the site. This level of infringement would be imperceptible compared to compliant levels and is noted to be lower than the existing noise environment due to surrounding industrial activity, therefore the noise effects associated with it would be less than minor.

A slight infringement of up to 3 dB above the daytime noise limit at only the upper floor of 381 Racecourse Road, this is due to trucks accessing the site. This level of infringement could be audible at times when truck movements are close to the dwelling and is noted to be equivalent to the existing noise environment. Therefore, the noise effects associated with it would be less than minor.

Mitigation measures employed to reduce levels at these receivers include construction of extensive acoustic screening along the access way, limiting truck access to daytime hours (no trucks during the evening or night) and maintaining an even/smooth access road.

On the basis of the above, taking into consideration the mitigation and measures proposed, the noise effects are considered reasonable with reference to Section 16 of the RMA in terms of the proposed operation and considering the proposed mitigation measures, confirming the suitability of the site for the proposed facility.

APPENDIX A

Acoustic Terminology

Term	Description
'A' weighted	A frequency adjustment which represents how humans hear sounds.
Ambient noise level	The all-encompassing sound associated with an environment or area.
dB	Decibel
dBA	'A' weighted decibel
DIN 4150:2016	German Standard DIN 4150-3:2016 "Structural vibration – Effects of vibration on structures"
Free field	A monitoring location where the microphone is positioned sufficiently far from nearby surfaces for the measured data to not be influenced by reflected noise.
Impulsive noise	Noise with a high peak of short duration, or sequence of peaks.
Intermittent noise	Noise which varies in level with the change in level being clearly audible
L _{Aeq}	The 'A' weighted equivalent noise level. It is defined as the steady sound level that contains the same amount of acoustical energy as the corresponding time-varying sound.
L _{Amax}	The A' weighted maximum sound pressure level of an event.
Low frequency	Noise containing energy in the low frequency range.
LP or SPL	Sound Pressure Level
Lw or SWL	Sound Power Level
Noise logger	A self-contained, battery powered item of equipment that is used to measure noise levels over several days.
NZS 4403:1996	New Zealand Standard NZS 4403:1996 "Code of Practice for Storage, Handling, and Use of Explosives"
NZS 6801:2008	New Zealand Standard NZS 6802:1991 "Assessment of Environmental Sound".
NZS 6802:2008	New Zealand Standard NZS 6802:2008 "Acoustics – Environmental Noise"
NZS 6803:1999	New Zealand Standard NZS 6803: 1999 "Acoustics - Construction Noise"
R _w	Weighted Sound Reduction Index of a building element. That is, the laboratory tested (or theoretically calculated) sound insulation performance of a single element.
Sound Insulation	A reference to the degree of acoustical separation between any two areas.
Sound or Noise Level	The terms sound and noise are almost interchangeable, except that in common usage noise is often used to refer to unwanted sound.
Steady state noise	Noise which remains relatively constant in level over time, as opposed to time-varying noise which fluctuates over time.
Time weighting	Sound level meters can be set to 'fast' or 'slow' response. 'Fast' corresponds to a 125 ms time constant and 'slow' corresponds to a 1 second time constant.
Tonality	Noise containing a prominent frequency.

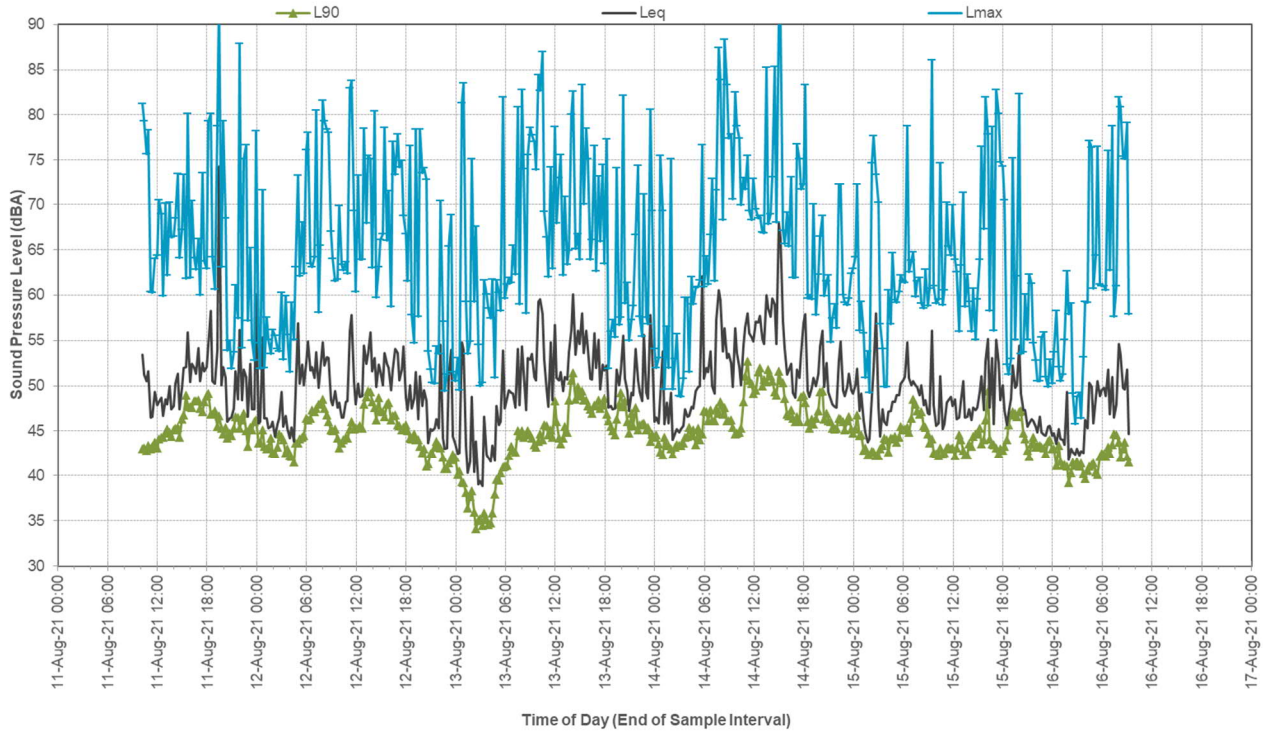
APPENDIX B

Measured Ambient Daily Statistical Plots

Measurement Position 1

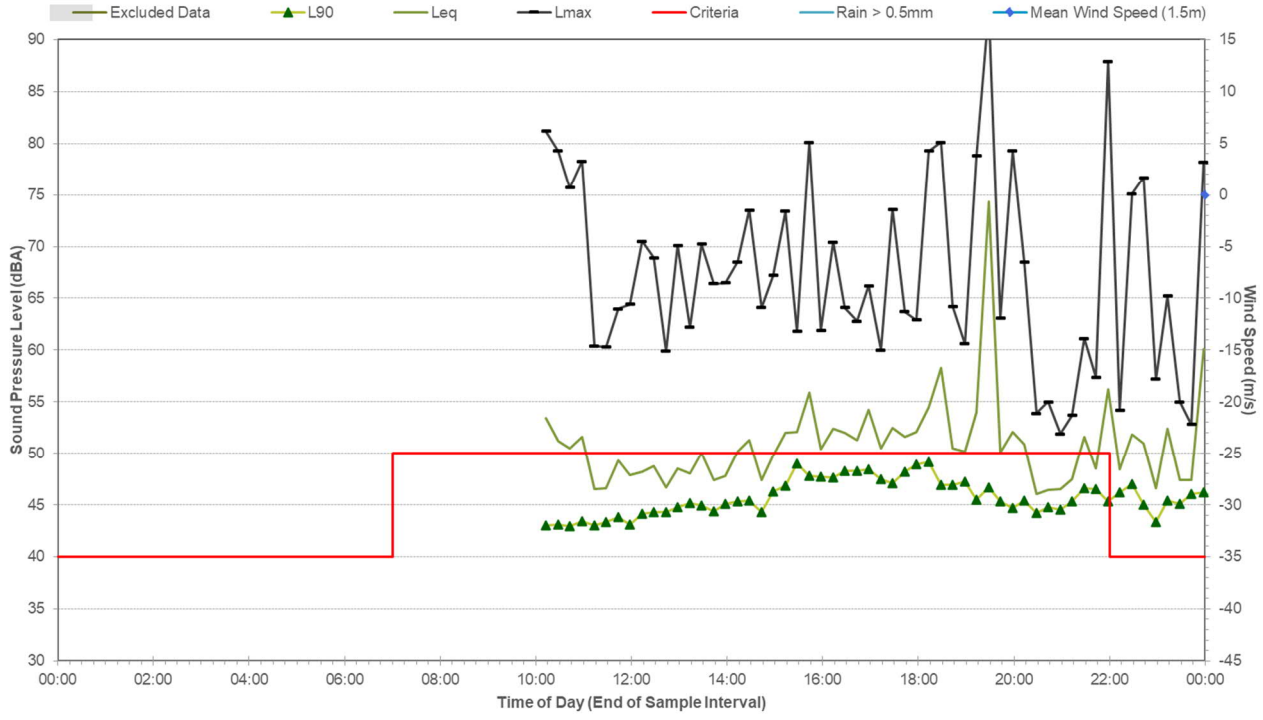
Statistical Ambient Noise Levels

MP1 - Weekly Chart - Wednesday, 11 August 2021



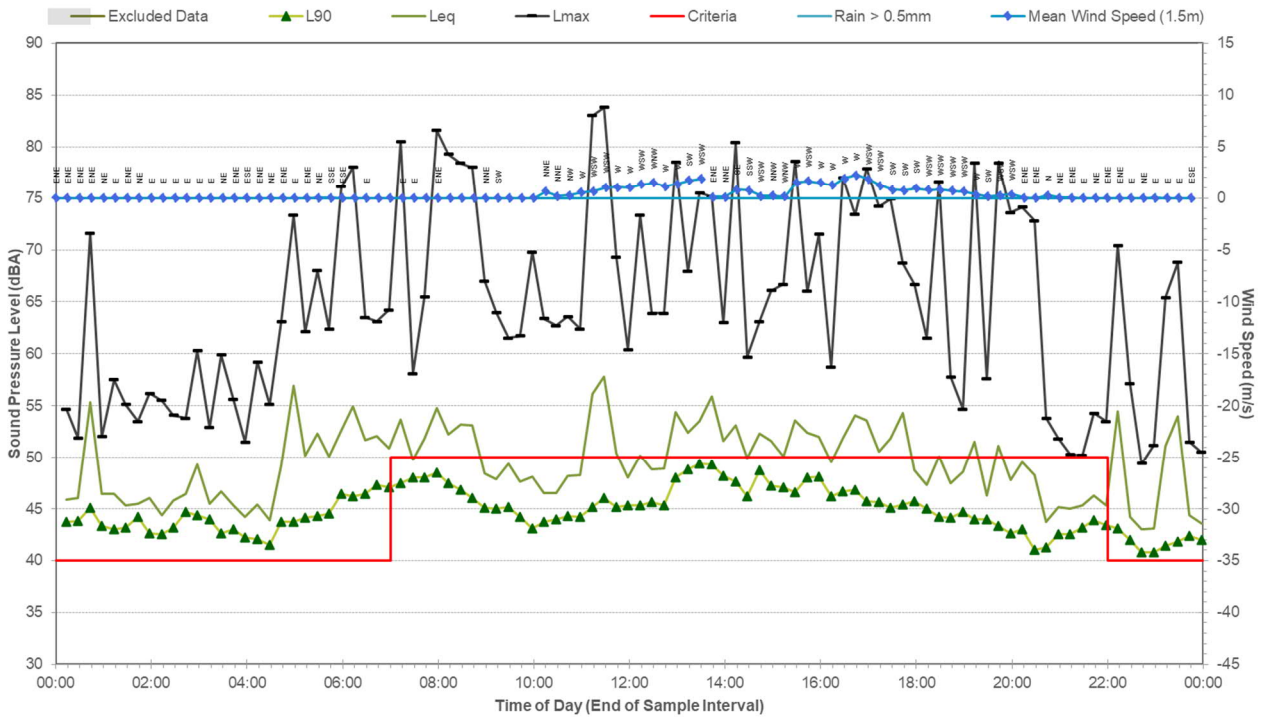
Statistical Ambient Noise Levels

MP1 - Wednesday, 11 August 2021



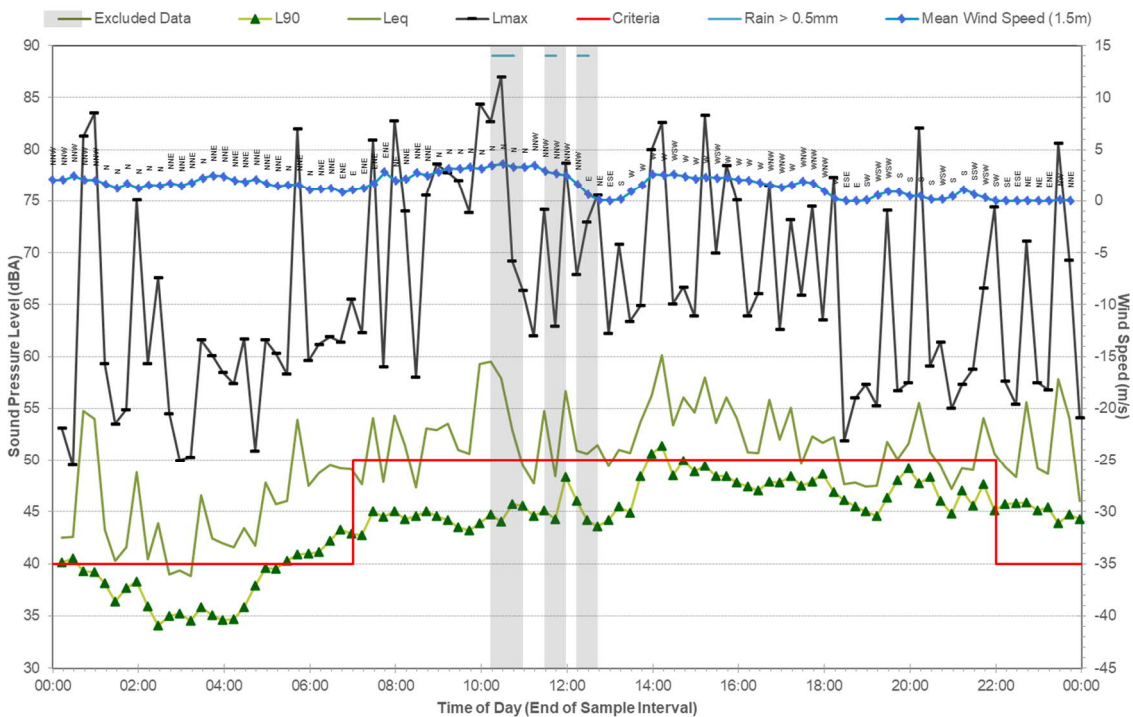
Statistical Ambient Noise Levels

MP1 - Thursday, 12 August 2021



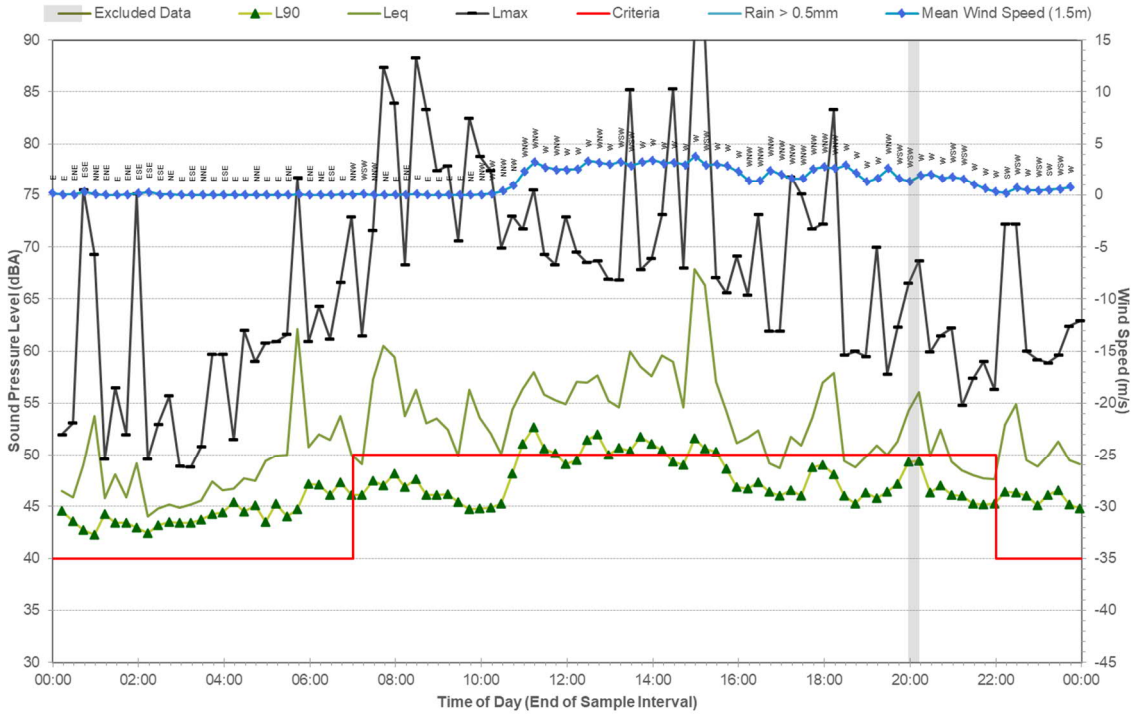
Statistical Ambient Noise Levels

MP1 - Friday, 13 August 2021



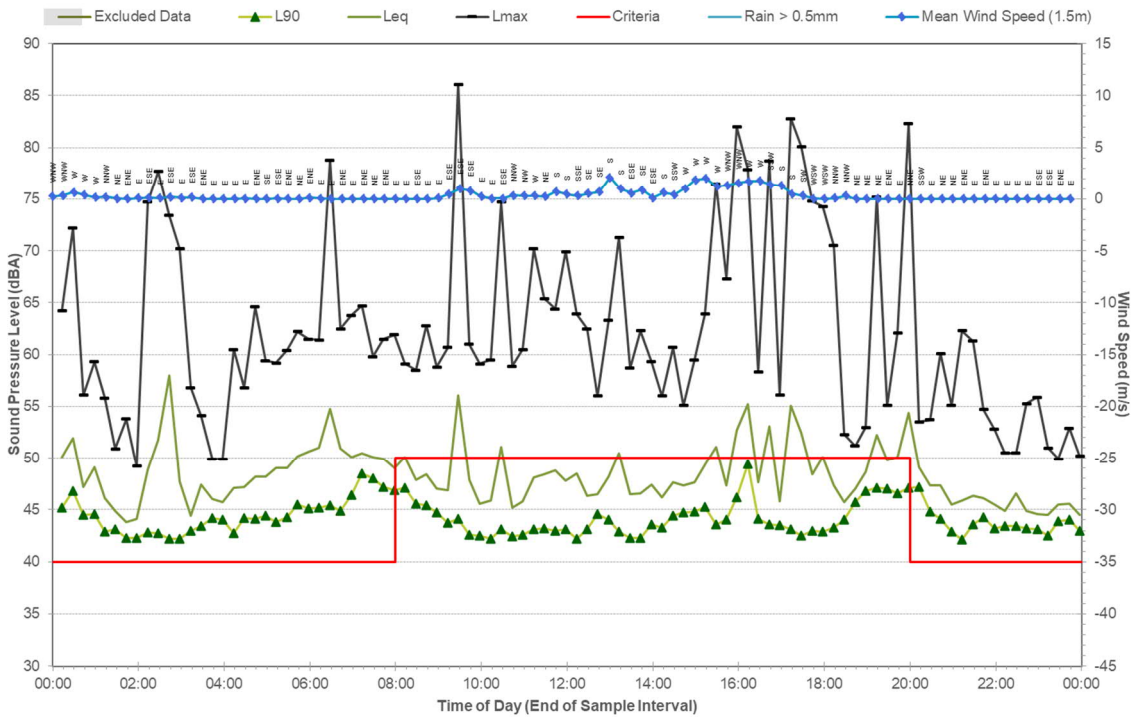
Statistical Ambient Noise Levels

MP1 - Saturday, 14 August 2021



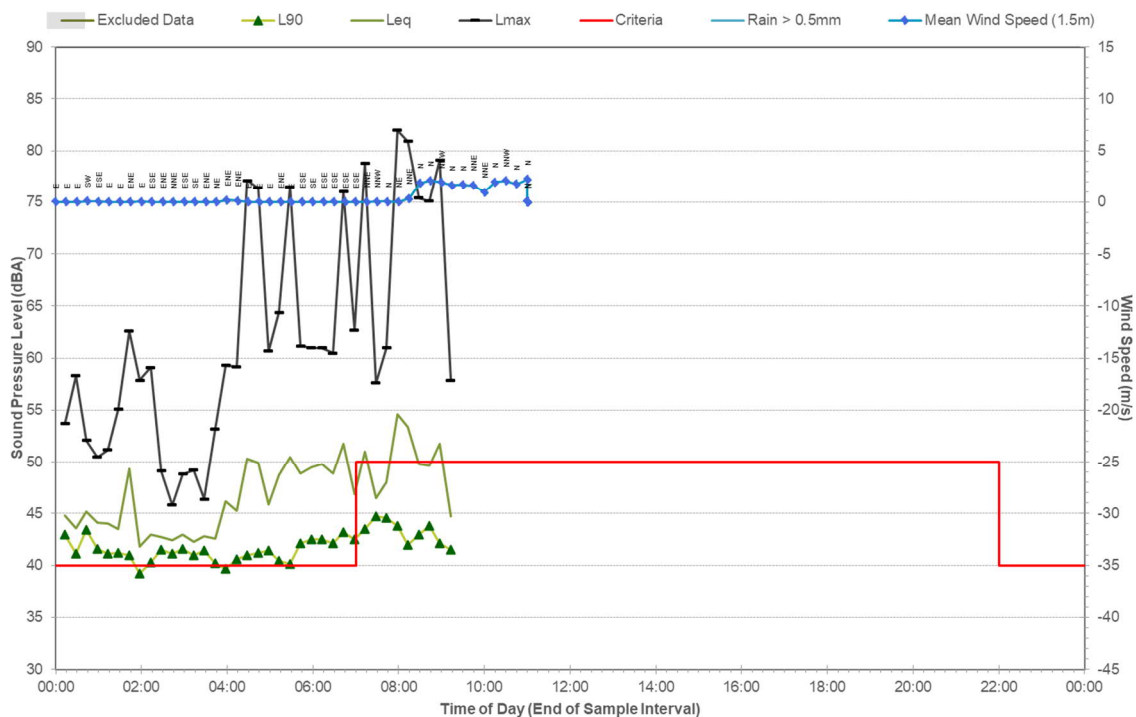
Statistical Ambient Noise Levels

MP1 - Sunday, 15 August 2021



Statistical Ambient Noise Levels

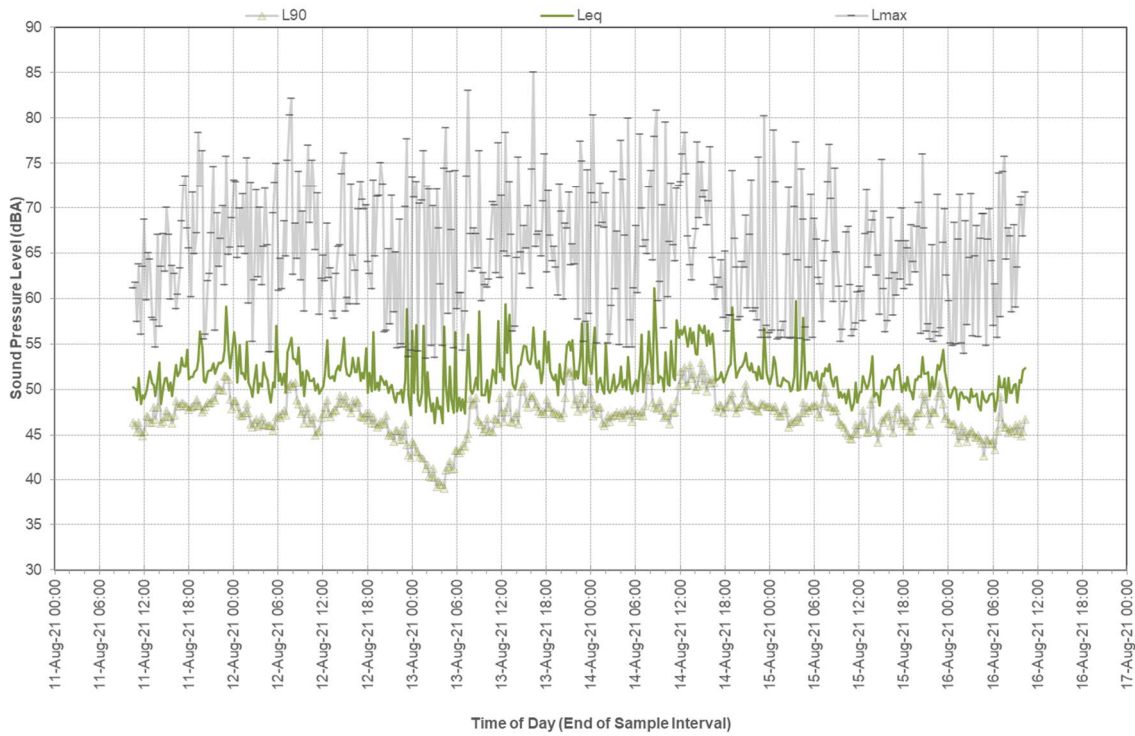
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Measurement Position 2

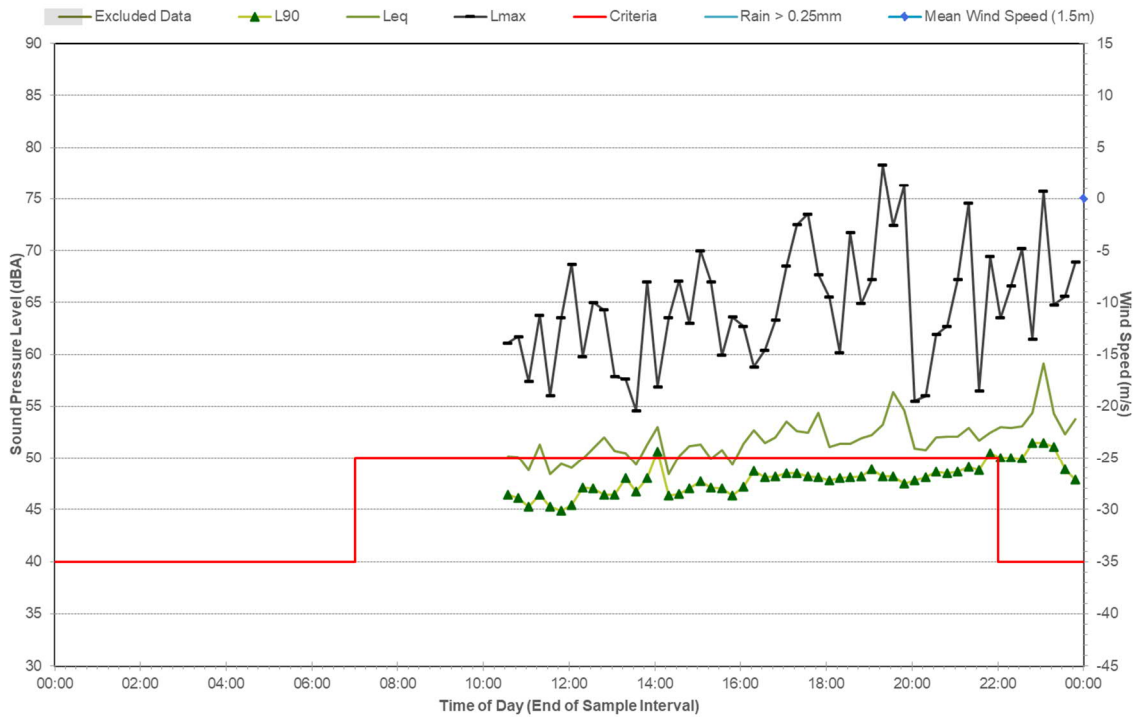
Statistical Ambient Noise Levels

MP2 - Wednesday, 11 August 2021



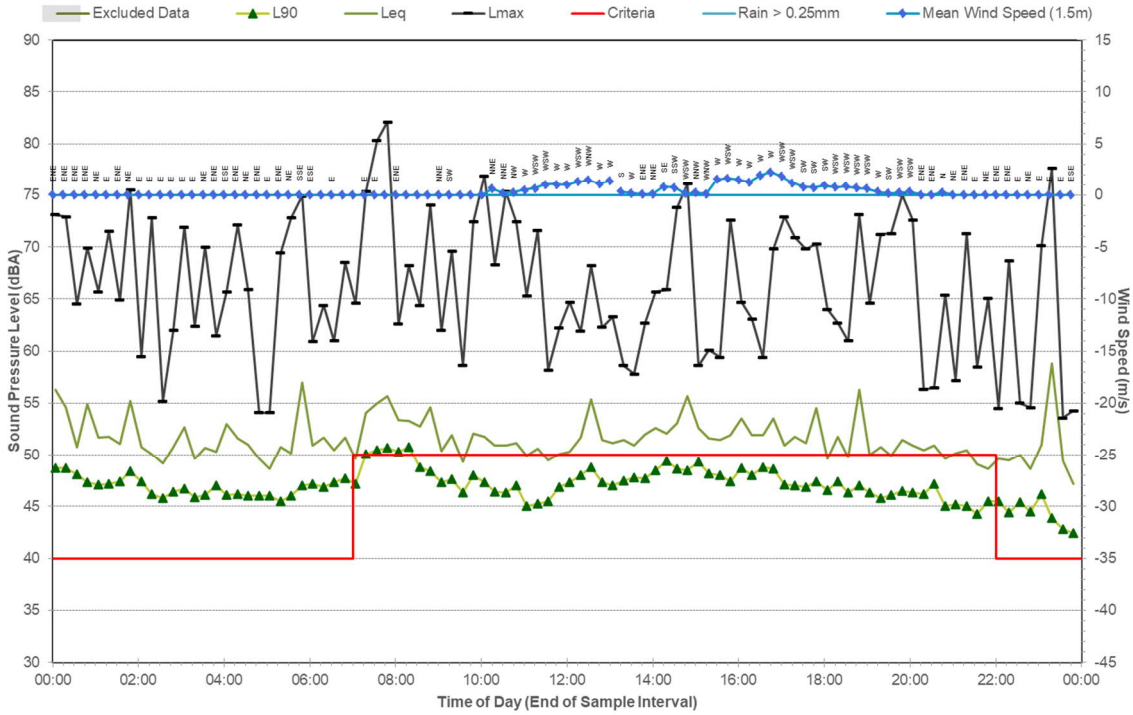
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MP2 - Wednesday, 11 August 2021



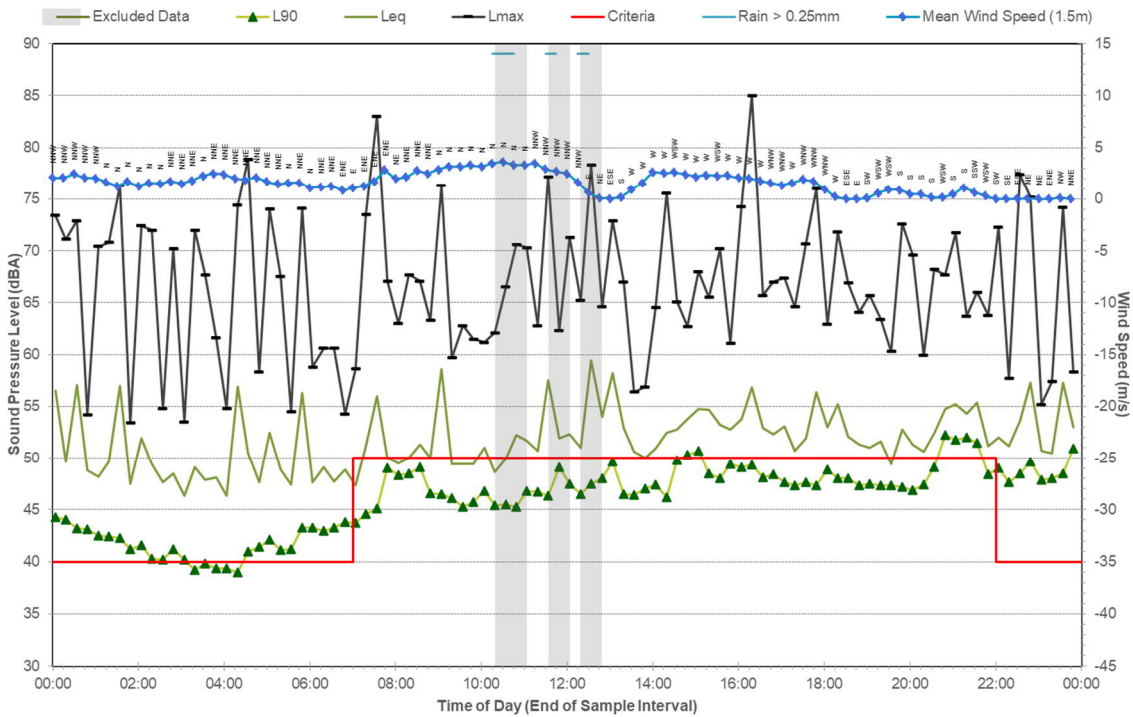
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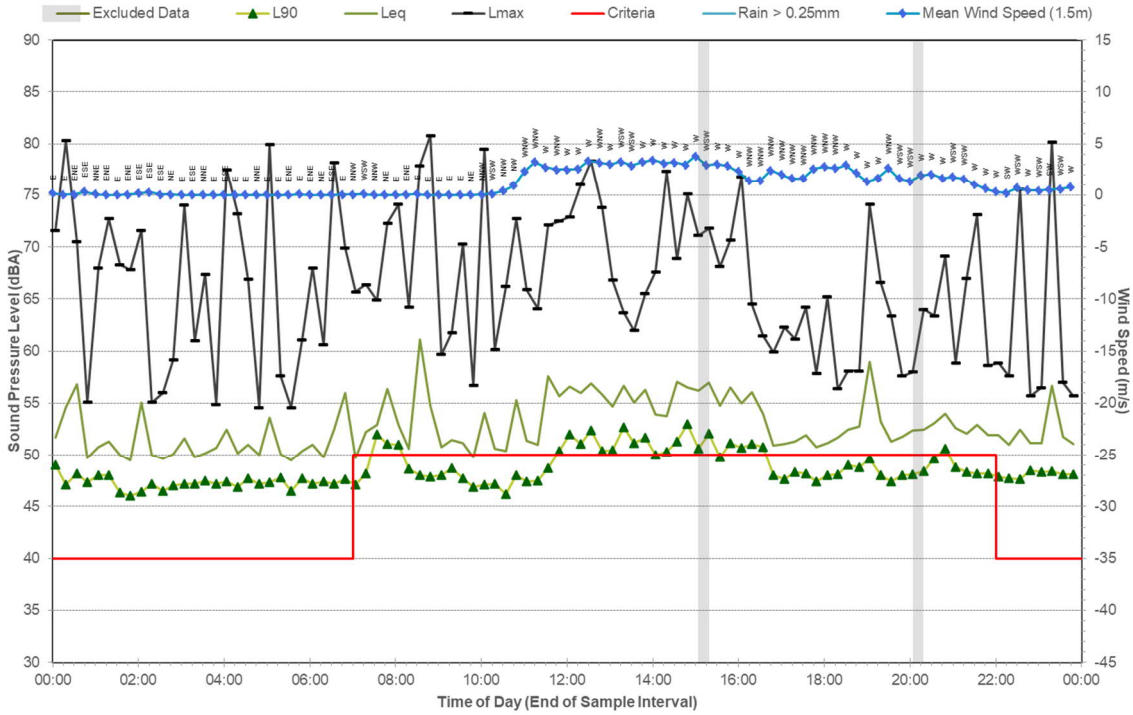
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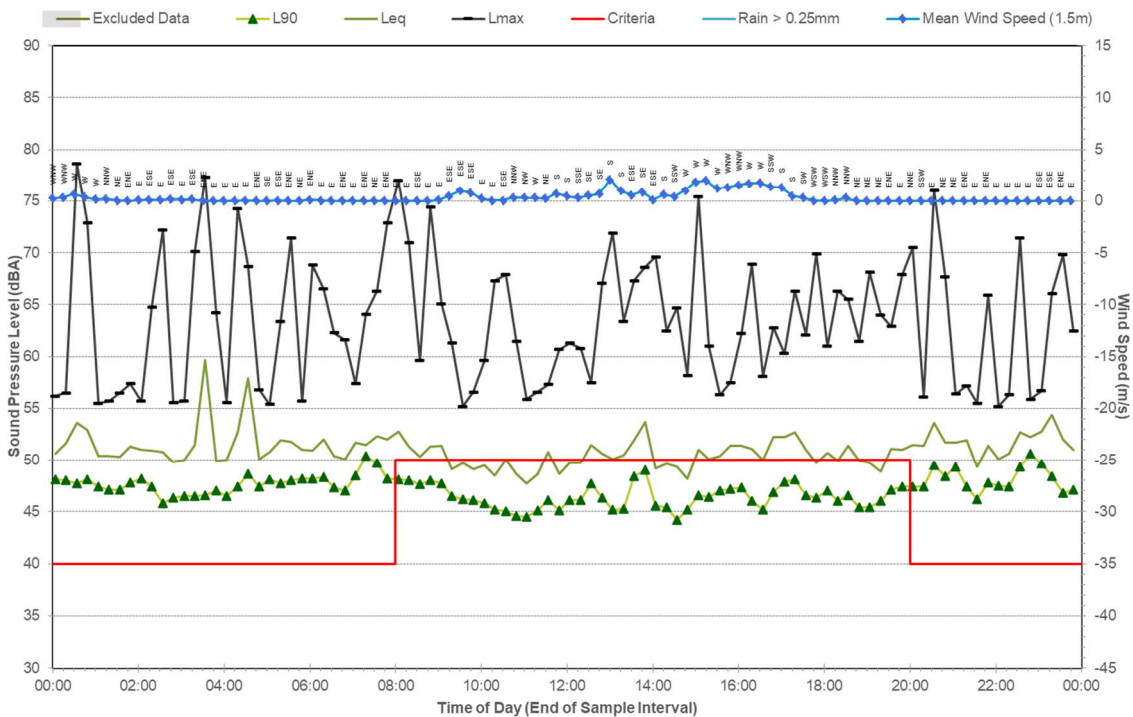
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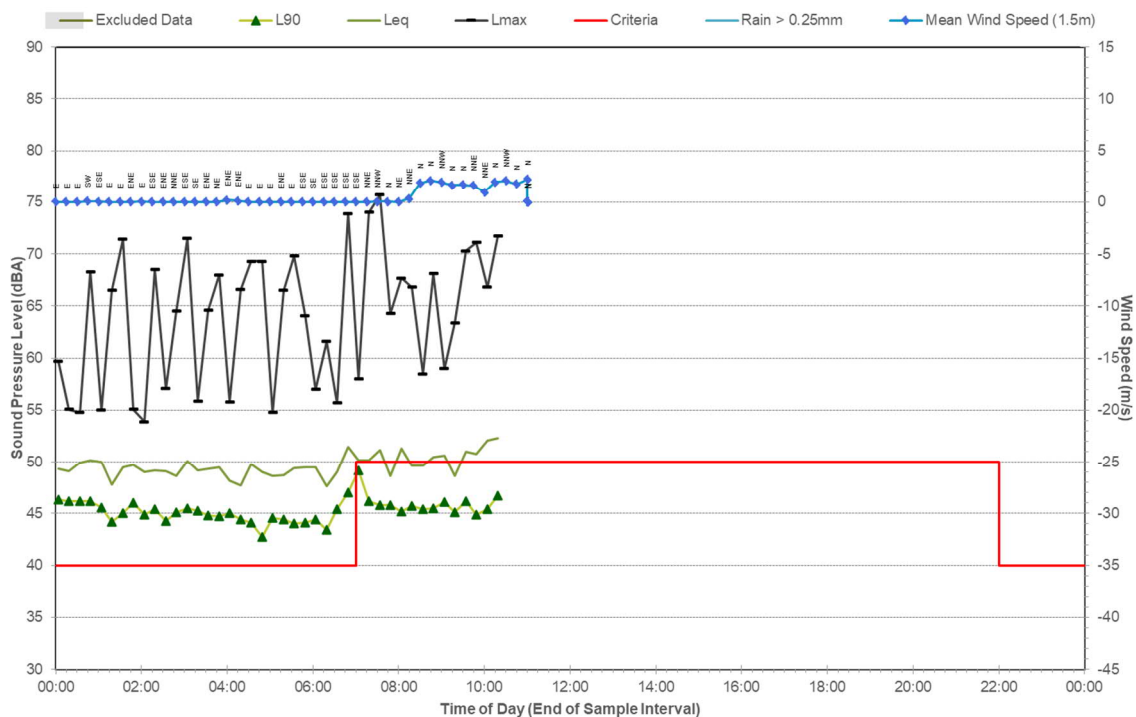
Statistical Ambient Noise Levels

MP2 - Sunday, 15 August 2021



Statistical Ambient Noise Levels

MP2 - Monday, 16 August 2021



APPENDIX C

Noise Level Predictions and Contours – Operations

APPENDIX C - 1
DAYTIME NOISE CONTOURS

MAP LEGEND

- Point source
- Receiver
- Noise protection wall
- Line source
- Industrial building; Room
- Site Boundary

NOISE CONTOUR LEGEND

Daytime Operational Noise Levels

Noise Level (L_{Aeq})

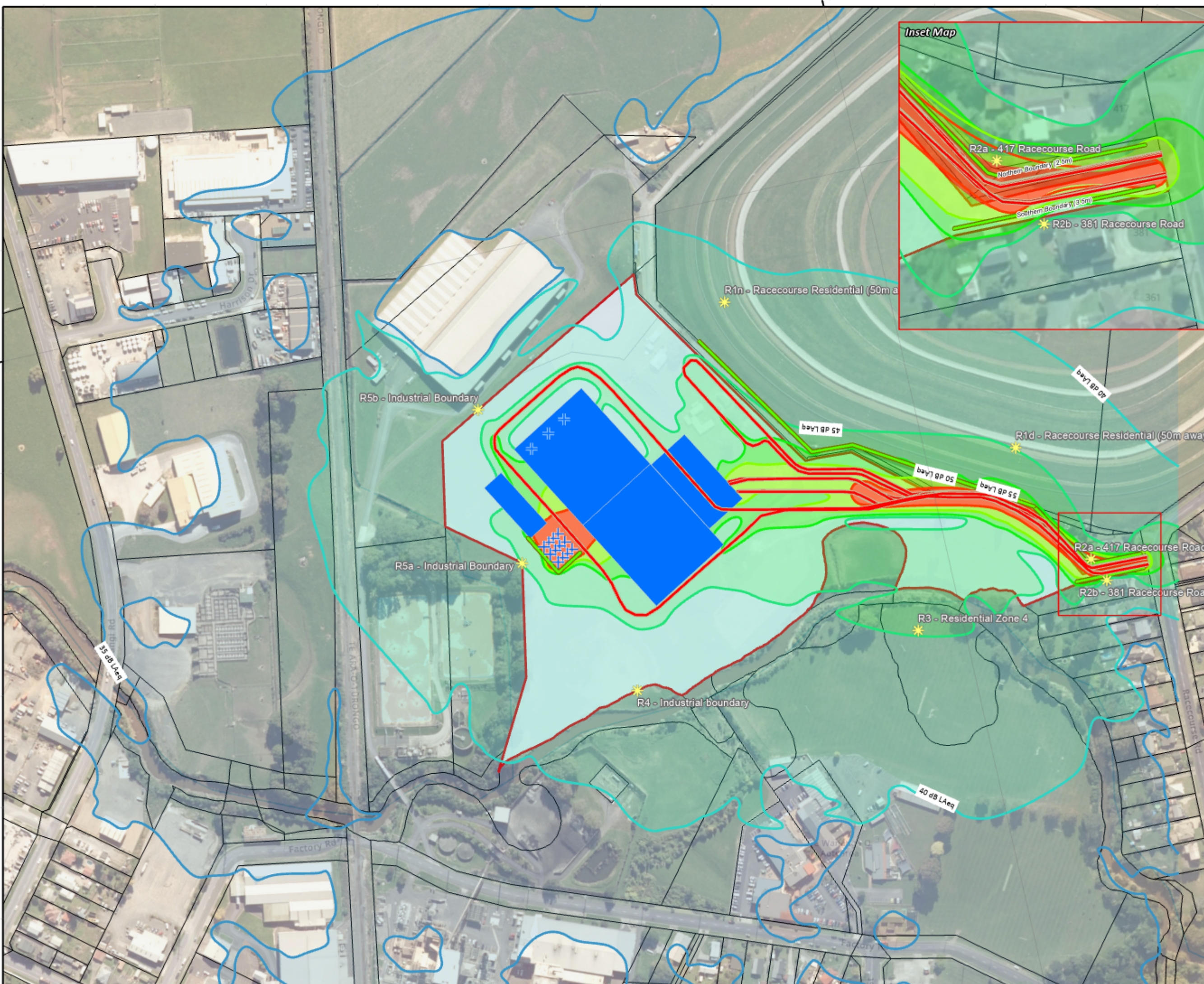
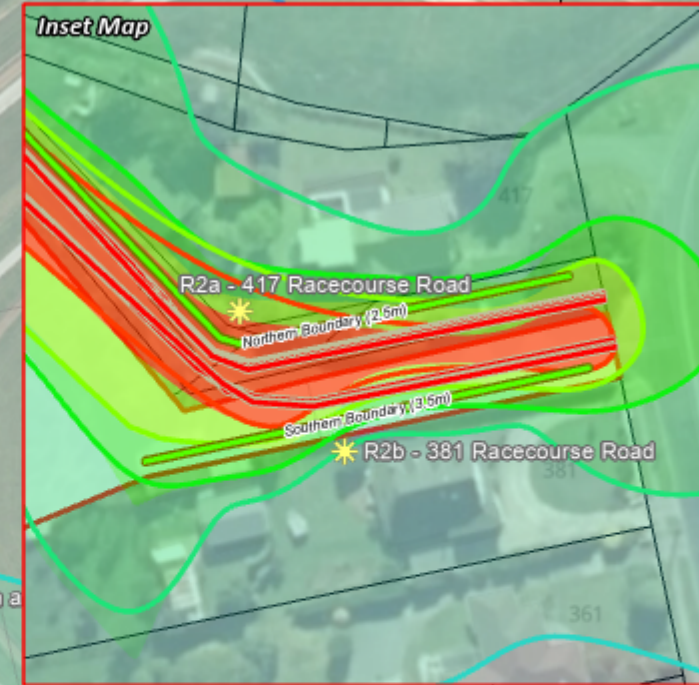
- 35 dB
- 40 dB
- 45 dB
- 50 dB
- 55 dB
- 60 dB



Coordinate System: NZGD 2000 New Zealand Transverse Mercator

Scale: 1:1:3,000
 Project Number: 710.30172
 Drawn by: L. Jansen
 Reviewed by: P. Runcle
 Date: 2/02/2022 10:50 am

Data Sources:
 Point sources, Line sources, Industrial buildings, Noise protection wall, receivers datasets: SLR Consulting (2021).
 Eagle Technology, LINZ, StatsNZ, NIWA, Natural Earth, © OpenStreetMap contributors, Eagle Technology, Land Information New Zealand, Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community.



APPENDIX C - 2
NIGHT-TIME NOISE

- MAP LEGEND**
- + Point source
 - * Receiver
 - * Possible Measurement Positions
 - Line source
 - Noise protection wall
 - Industrial building; Room
 - Site Boundary
 - Cdastral

- NOISE CONTOUR LEGEND**
Night-time Operational Noise Levels
Noise Level (L_{Aeq})
- 35 dB
 - 40 dB
 - 45 dB
 - 50 dB
 - 55 dB
 - 60 dB



0 30 60 metres

Coordinate System: NZGD 2000 New Zealand Transverse Mercator

Scale: 1:1:3,000

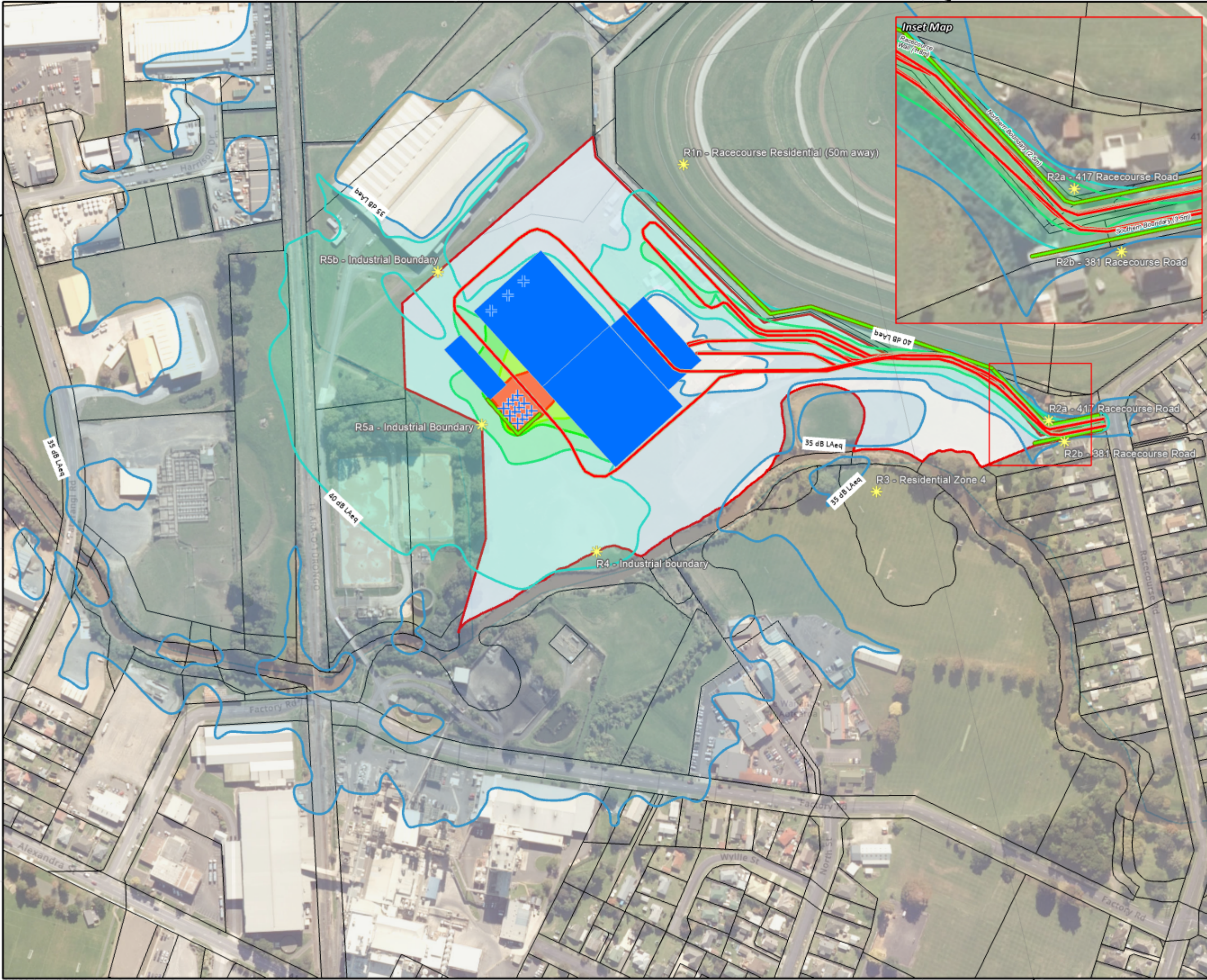
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Drawn by: L. Jansen

Reviewed by: P. Runcle

Date: 2/02/2022 10:52 am

Data Sources:
Point sources, Line sources, Industrial buildings, Noise protection wall, receivers datasets: SLR Consulting (2021).
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