

ACOUSTIC ASSESSMENT

Waipu Gateway Centre Development
47 Millbrook Road, Waipu

Prepared for:

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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 Vaco Investments (Waipu Project) Limited (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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1 Introduction

Vaco Investments (Waipu Project) Limited (the Applicant) have engaged SLR Consulting NZ Ltd (SLR) to assess potential noise effects from the proposed Waipu Gateway Service Centre (the Centre) development at 47 Millbrook Road located south of Waipu.

This report considers the noise and vibration levels generated from construction and operation of the proposed centre, while considering the different noise sources such as vehicle movements, deliveries and mechanical plant.

Contained within this report are our assumptions, methodology and the predicted noise levels evaluated against the applicable noise limits of the Operative Whangarei District Plan (the Plan). Where appropriate, management measures and mitigation have been identified to achieve compliance.

A glossary of acoustic terminology is provided in Appendix A.

2 Site and Project Description

The subject site of the planned Centre is in the eastern section of 47 Millbrook Road on Rural Production zoned land, so too all neighbouring properties. The subject site is approximately 4 ha of undeveloped land (currently utilised for stock grazing) and planned at the intersection of State Highway One (SH1) and Millbrook Road.

The nearest existing receivers to the subject site are a veterinary clinic east of the subject site and some dwellings towards the south-east. All identified noise sensitive receivers are on Rural Production zoned land, with the nearest receiver on Rural Village Residential zoned land more than 450 m away from the subject site. All the identified receivers are approximately 14-70 m from SH1. The identified nearest noise sensitive receivers are shown on Figure 1 and listed in Table 1.

Access to the development would be from a proposed round about on SH1 and the Centre would comprise the following:

- A fuel station for light vehicles, with a truck re-fuelling station and truck stop,
- Two (2) Quick Service Restaurants (QSR) with drive through facilities, Five (5) Café or small food outlets,
- A Supermarket,
- A Rural Commercial Services, and
- Automotive Assistance facilities.

The location of the above is shown in the Technitrades Architecture drawing Waipu Gateway Service Centre – 47 Millbrook Road, Waipu, Whangarei District. Proposed Site Plan. Drawing Number: 3096-H01. Revision: B, dated 28 February 2023, see Figure 2.

Figure 1 Aerial imagery with Whangarei District Zoning overlay, subject site boundary and project extent

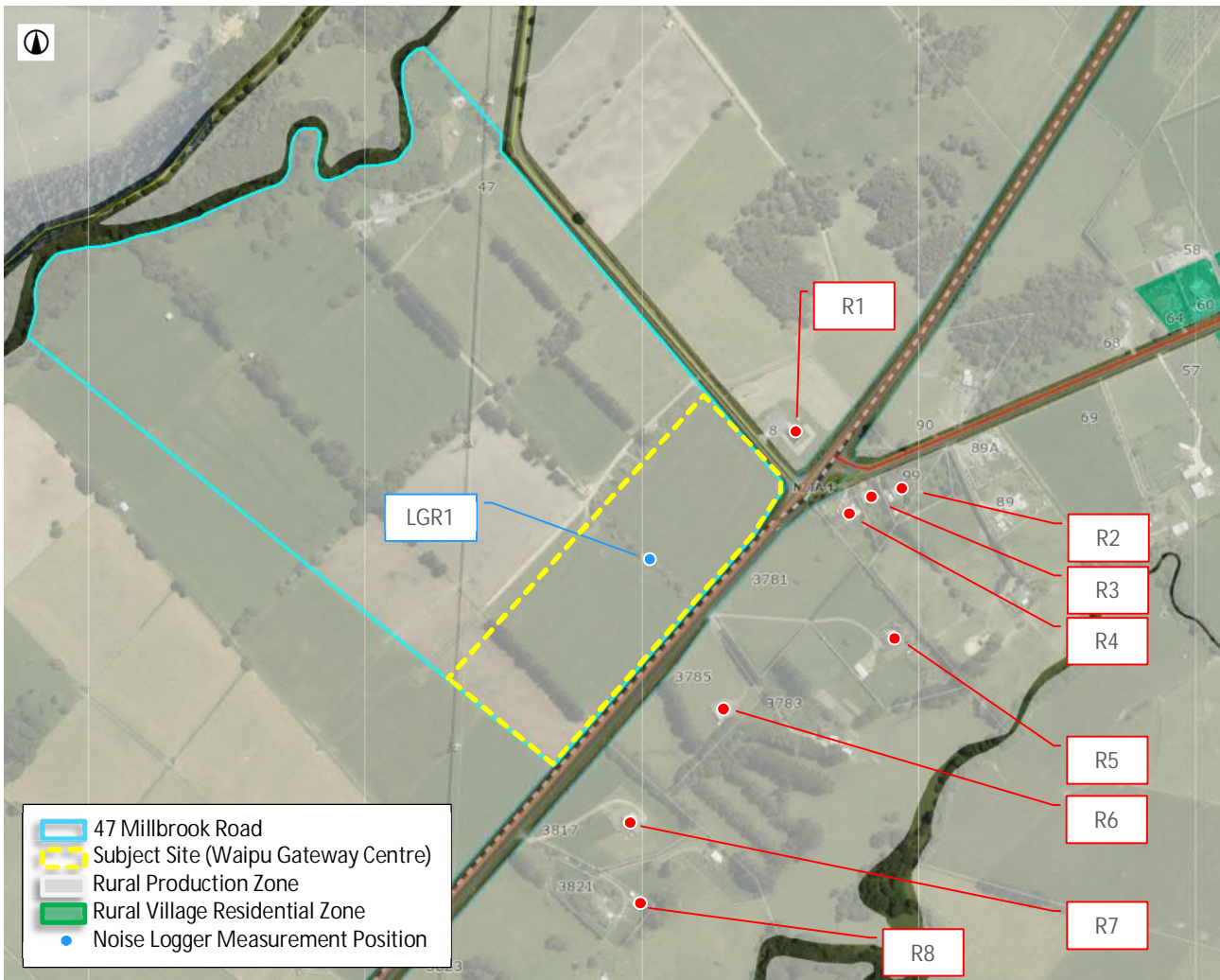
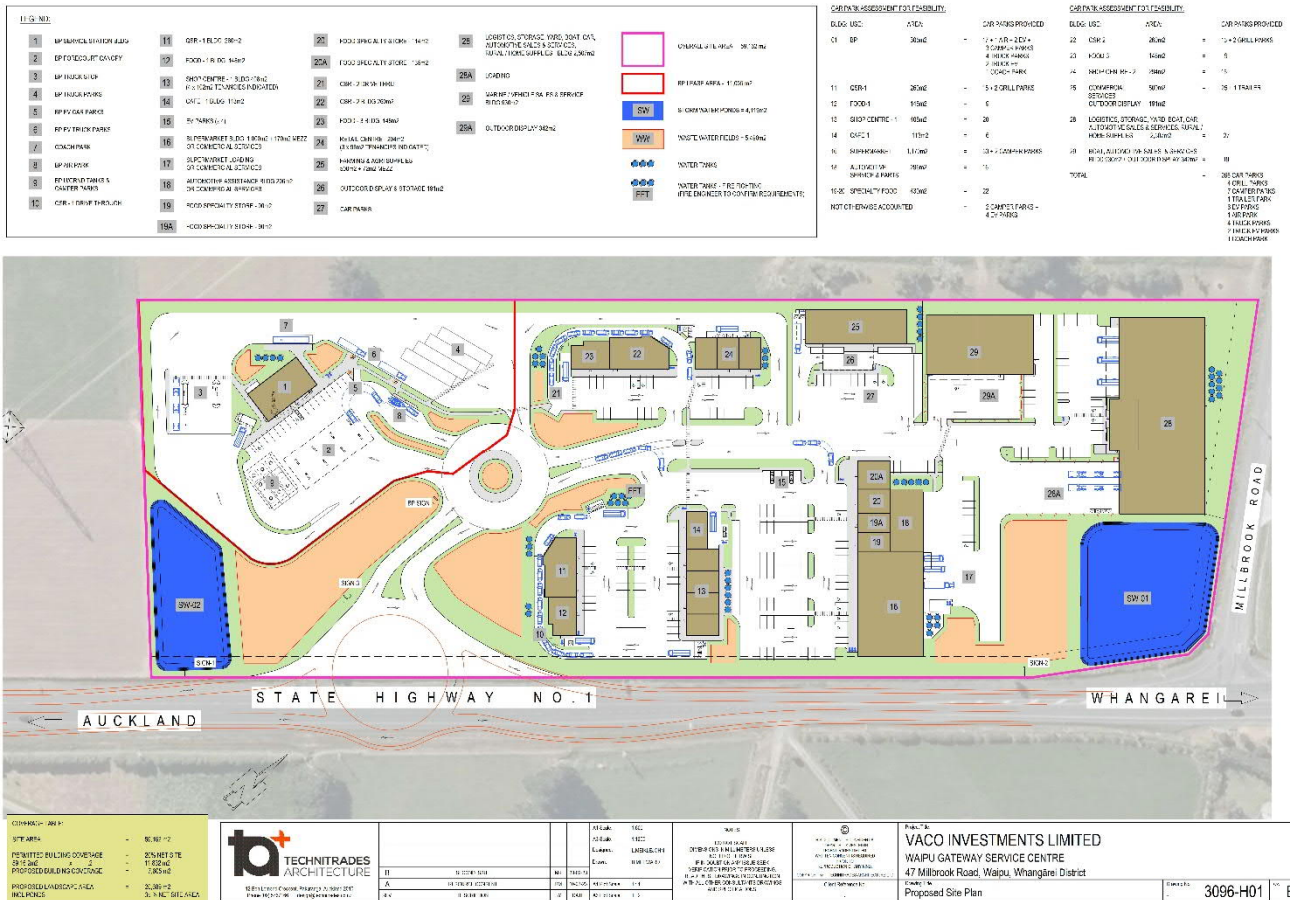


Table 1 Summarised list of receivers identified in the area surrounding the proposed centre

Fig. 1 ref.	Physical Address	Shortest Distance from Subject Site to Nearest Façade	Comment / Notes
R1	8 Millbrook Road	35 m	Commercial business – Yourver Limited No residence identified onsite.
R2	99 The Braigh	115 m	Residential dwelling
R3	105 The Braigh	85 m	Residential dwelling
R4	107 The Braigh	65 m	Residential dwelling
R5	3781 State Highway 1 (SH1)	175 m	Residential dwelling
R6	3785 State Highway 1 (SH1)	100 m	Residential dwelling
R7	3817 State Highway 1 (SH1)	100 m	Residential dwelling
R8	3821 State Highway 1 (SH1)		Residential dwelling

Figure 2 Proposed site layout



The fuelling stations would be open 24-hours a day, 7 days a week. SLR anticipates that fuel deliveries may occur during the night-time period (10:00 pm to 7:00 am).

The food outlets may also be open 24-hours per day, 7 days a week. SLR anticipates that the supermarket would be open between 7:00 am and 10:00 pm and the other tenancies during 7:00 am to 5:00 pm.

It is understood that deliveries to the supermarket and the food outlets may occur outside the above operational hours, starting from 5:00 am. It is unlikely that deliveries would occur after 10:00 pm at the supermarket or at the other food outlets.

3 Measured Ambient Noise Levels

SLR deployed an unattended noise logger in the vicinity of the subject site (approximately 80 m from SH1 road edge) to establish the existing noise levels in the area. The noise measurements were undertaken from Friday 11 March 2022 to Tuesday 14 March 2022 using a Svantek 957 Type 1 sound level meter. Measurements were undertaken in general accordance with New Zealand Standard NZS 6801:2008 Acoustics – Measurement of environmental sound (NZS 6801). The weather conditions during the survey were appropriate throughout the duration of deployment with no rainfall recorded in the area and the wind speed not exceeding 5 m/s.

The measurements were undertaken at a distance from SH1 that is similar to the setback distance of residential dwellings south of SH1, see Figure 1. The measurement position was selected to be representative of the noise environment at the nearest receivers of the Centre.

The results of the ambient noise survey are summarised in Table 2 and 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.

Table 2 Existing Noise Levels – LGR1 (dB)

Date	Daytime (7:00 am to 10:00 pm)		Night-time (10:00 pm to 7:00 am)		
	L _{Aeq,T} Average	L _{Aeq(15minute)} Range	L _{Aeq,T} Average	L _{Aeq(15minute)} Range	L _{AFmax} Range
11 March 2022 (Fri)	61	56 - 62	55	46 - 60	69 - 76
12 March 2022 (Sat)	56	51 - 61	54	47 - 60	61 - 75
13 March 2022 (Sun)	59	52 - 62	58	48 - 64	62 - 86
14 March 2022 (Mon)	58	54 - 64	57	55 - 59	64 - 88

During the survey it was observed that vehicle movements on SH1 controlled the ambient noise levels in the area. Occasional noise was audible from bird calls and insects were also observed to contribute to the ambient environment. The measured daytime average noise level was 58 dB L_{Aeq(day)}. The measured night-time noise levels ranged between 46 – 64 dB L_{Aeq(15minute)} (an average of 56 dB L_{Aeq(night)}).

Relative to the noise limits of the Plan, SLR notes that the existing measured noise levels at the Rural Production zoned land were:

- At least 3 dBA higher than the relative daytime noise limit (58 dB L_{Aeq} average of the daytime measured noise levels vs a limit of 55 dB L_{Aeq}); and
- At least 6 dBA higher than the night-time noise limit (46 dB L_{Aeq} lowest 15-minute measured noise level during the night-time period vs a limit of 40 dB L_{Aeq}).

4 Performance Standards

4.1 Construction Noise

Rule NAV 6.2 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 would last more than 20 weeks, therefore the long-term duration construction noise limits for receivers in residential zones (Table 3) and industrial or commercial buildings (Table 4) are applicable.

In summary, the relevant “long-term” duration limits for daytime (7:30 am to 6:00 pm) construction are 70 dB LAeq / 85 dB LAmax at the residential dwellings and 70 dB LAeq at industrial or commercial buildings, Monday to Saturday (excluding Sundays and public holidays).

Table 3 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 4 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 NAV 6.15.2 of the Plan states that vibration from construction and demolition activity is a permitted activity if it does not exceed the levels in Table 5 when measured at the point of effect.

- a. For human annoyance, vibration should be assessed at the location of the affected person inside the building, typically on the appropriate floor. Vibration should be measured in three orthogonal directions orientated to the axes of the building and assessed in the single axis in which vibration is greatest.
- b. For building damage, vibration should be assessed at the horizontal plane of the highest floor of the building. Vibration should be measured in two horizontal orthogonal directions orientated to the axes of the building and assessed in the single axis in which vibration is greatest. Note that for the building damage criteria in NAV 6.15.2 Note 2 an alternative measurement location is defined.

Table 5 Construction Vibration Limits

Effect	Affected Occupied Building	Activity	Time	Maximum Vibration Level mm/s PPV
Annoyance	Occupied noise sensitive activity or visitor accommodation in any Environment	General construction activity	10:00 pm –7:00 am	0.3
			7:00 am - 10:00 pm	1.0
	Occupied commercial or industrial activity in any Environment	General construction activity	10:00 pm –7:00 am	5.0
			7:00 am - 10:00 pm	1.0
Building Damage	Unclassified structures of great intrinsic value such as historic buildings	All activity	All times	2.5
	Non-occupied dwellings and buildings of similar design	All activity	All times	5.0
	Non-occupied commercial and industrial buildings	All activity	All times	10.0

The building damage limits in Table 5 above represent the most stringent values in the standard DIN 4150-3 (1999): Structural vibration – Part 3 Effects of vibration on structures, relating to avoidance of cosmetic damage from continuous vibration sources (i.e., vibratory rollers). The limits do not represent the variety of potential construction activities; DIN 4150-3 (1999) has more relaxed frequency dependent guideline values for individual vibration events such as associated with impact piling.

Table 2 of rule NAV 6.15.2 of the Plan identifies alternate building damage vibration limits (see Table 6) “permitted maintenance or utility works undertaken within the road carriageway”. These guideline values represent the levels contained within BS 5228-2: 2009 Code of practice for noise and vibration control on construction and open sites – Part 2: Vibration.

The reasoning behind which the Plan assumes the same works undertaken for different purposes may be less likely to result in building damage is unclear – whether a building may be damaged by vibration is not influenced by whether the works are within the road or located on private land rather the level and frequency of the vibration. SLR therefore propose to assess potential building damage effects against the limits in Table 6.

Table 6 Construction Vibration Limits for Building Damage

Type of Building	Peak Component Velocity (PPV) in Frequency Range of Predominant Pulse	
	4 to 15 Hz	15 Hz and above
Reinforced or framed structure Industrial and heavy commercial buildings	50 mm/s	50 mm/s
Unreinforced or light framed structures Residential and light commercial buildings	15 mm/s at 4 Hz increasing to 20 mm/s at 15 Hz	20 mm/s at 15 Hz increasing to 50 mm/s at 40 Hz

- 1 All values referred to in Table 6 are at the base of the building.
- 2 For unreinforced or light framed structures and residential and light commercial buildings at frequencies below 4 Hz a maximum displacement of 0.6 mm (zero to peak) is not to be exceeded.

4.3 Operational Noise

Rule NAV 6.1 of the Plan states that noise levels emitted from all activities and received at the notional boundary of residential dwellings on Rural Production zoned land, shall comply with the limits set out in Table 7. Rule NAV 5 of the plan state that noise shall be measured in accordance with NZS6801 and assessed in accordance with NZS6802.

Table 7 Noise Limits applicable at the notional boundary of dwellings on Rural Production zoned land

Time Period	Noise Limit
Daytime (7:00am to 10:00pm)	55 dB LAeq
Night-time (10:00pm to 7:00am)	40 dB LAeq
	70 dB LAFmax

5 Construction Noise and Vibration 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 levelling the site, foundation piling, paving and general construction of the buildings. 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 data (BS 5228-1:2009 Code of practice for noise and vibration control on construction and open sites – Part 1; Noise).

The noted approximate setback distances to compliance have been calculated in accordance with the methodology in NZS 6803 and include façade corrections. Construction equipment are not normally operated continuously (with periods of down time between the higher noise generating activities where equipment 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 been allowed for in the assessment. It should be noted that the acoustic centre of equipment is often more than a metre set 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	70 dB LAeq	10 m
Vibratory Compaction Roller (≤20 t) ²	75 dB LAeq	20 m
Non-vibratory Compaction Roller (<5 t)	60-65 dB LAeq	5 m
Small Rotary Piling Rig	75 dB LAeq	20 m
Driven Impact Piling	85 dB LAeq	55 m

Notes to Table:

1. NZS 6803 compliance level is 70 dB LAeq, representative of the day-time limit (7:30 am to 6:00 pm).
2. 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.

Compliance with the 70 dB LAeq construction noise limit is expected at approximately 55 m from the noisiest activity (impact piling) without mitigation measures. The nearest existing dwelling to where this source could occur is approximately more than 150 m from the works. Therefore, compliance is expected during the noisiest construction works.

Based on the above construction noise assessment, it is anticipated that construction of the centre would comply with the relevant limits of NZS 6803.

5.2 Vibration

Table 9 presents the predicted setback distances to comply with the vibration criteria during the construction phase, to avoid human annoyance (Table 5) and cosmetic damage to buildings (Table 6). 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	Compliance distance setback with human annoyance (mm/s PPV) (Table 5)	Compliance distance setback to avoid building damage (mm/s PPV) (Table 6)
Excavation	Large Tracked Excavator (<20 tonnes)	5 m	<1 m
Compaction	Vibratory Compaction Roller (≤20 tonnes)	15 m	<1 m
	Non-vibratory Compaction Roller (<5 tonnes)	<1 m	<1 m
Impact Driven Piling	5 tonnes hammer weight with up to 1 m drop height	18 m	<1 m

Compliance with the vibration guideline criterion, human annoyance, is anticipated at a distance of up to 18 m from the proposed works. Compliance with the vibration criterion on building damage is anticipated at a distance of up to 1 m from the proposed works.

With the exception of formation of the access road, the nearest receiver to the works is over 35 m from the subject site boundary. Therefore, the surrounding receiver buildings are located at sufficient distances from the works so that vibration levels generated by the construction works would be below the guideline values.

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 Assessment

6.1 Sound Propagation Methodology and Assumptions

SLR have predicted operational noise levels generated by the proposed centre 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.

6.2 Operational Noise Sources

6.2.1 Vehicle Movements

Based on the information provided by TPC, it is estimated that approximately 3,000 vehicles would enter and exit the centre in a 24-hour period, with up to approximately 460 vehicle movements during the peak hour. TPC have advised that the peak hour is likely to occur during the afternoon, between 4:00 pm and 5:00 pm, this is within the daytime period and it is unlikely that the peak hour would occur during the night-time period.

The acoustic assessment is based on the following traffic information and assumptions:

- Light vehicles
 - Approximately 2,600 light vehicles could arrive and depart the Centre during a 24-hour period, with approximately 2,300 movements occurring in the daytime period (7:00 am - 10:00 pm), with an approximate peak of 350 light vehicle movements during the busiest hour.
 - Approximately 300 movements could occur in the night-time period (10:00 pm - 7:00 am), with the calculated night-time rating level based on 10 movements during the busiest 15-minutes (equating to 40 vehicles per hour).
- Heavy vehicles
 - Approximately 450 heavy vehicles (such as rigid and semi-trailer trucks) could arrive and depart the Centre during a 24-hour period, with approximately 400 movements occurring in the daytime period (7:00 am - 10:00 pm), with a peak of 60 heavy vehicle movements during the busiest hour.
 - Approximately 50 movements could occur in the night-time period (10:00 pm - 7:00 am). The calculated night-time rating level is based on three (3) movements during the busiest 15-minutes (equating to 12 vehicles per hour), that comprises:
 - one delivery truck either to or from the supermarket loading bay area,
 - one fuel delivery truck either to or from the service station,
 - one truck arriving or departing the truck stop, and
 - one truck arriving or departing the truck stop service station.

Light vehicle (customer and staff cars) noise has been modelled as a moving point source with a sound power level of 87 dB L_{WA}. An overall sound power level of 103 dB L_{WA} represent the sound power level from heavy vehicles that comprises a mixture of rigid, semi-trailer and B-train trucks. These source levels are based on SLR in-house measurement library data from other comparable projects.

Based on SLR measurements of similar activities, characteristic L_{Amax} noise levels generated in the car parking area (such as car doors slamming) has a sound power level of 98 dB L_{WA} . Similarly, the measured loudest L_{Amax} event associated with the service vehicles are typically truck airbrake releases, with a sound power level of 113 dB L_{WA} . The typical heavy vehicle L_{Amax} events are anticipated to occur at the loading bay area (LBA) and the general trucks stop.

6.2.2 Loading Bay Area

SLR understands that unloading of delivery trucks by forklift would only occur at the supermarket LBA. It is expected that the forklift would primarily be used to assist in unloading the semi-trailer large trucks. SLR has been advised that large delivery trucks may enter the LBA within the night-time period.

SLR recommends the use of LPG forklifts, fitted with broadband reverse alarms in order to avoid the need for a penalty to account for SAC.

Based on in-house library data of LPG forklifts, SLR has adopted a sound power level of 95 dB L_{WA} as a moving point source in the LBA (with up to five lifts per truck delivery).

6.2.3 Mechanical Ventilation

Mechanical plant services associated with the Centre's buildings are anticipated to be heating, ventilation and air conditioning plant (HVAC), refrigeration and kitchen exhaust fans. This plant has the potential to generate noise that could be audible at surrounding receivers.

Details regarding the different plant are not available at the time of writing the report. However, mechanical ventilation plant could readily be controlled with standard mitigation measures (noise reduction screening, in-duct attenuators, careful plant selection and positioning, etc.) to meet the established criteria. Design of this acoustic mitigation is recommended to be confirmed during the detailed design stage when the specific plant has been selected and locations within the Centre are known.

6.3 Predicted Operational Noise

The predicted rating noise levels from the proposed development are summarised in Table 10.

Table 10 Predicted Operational Rating Noise Level

Receiver Number and Floor Level ⁵	Predicted Rating Noise Level (dB, LAeq)				Maximum Event Noise Level (dB, LA _{Fmax})		Expected Outcome
	Daytime Period ¹		Night-time Period ¹		Night-time Period ¹		
	Predicted ²	Criteria	Predicted ³	Criteria	Predicted ⁴	Criteria	
R1 – GF	46	55	39	40	64	70	Compliance
R2 – GF	41	55	34	40	62	70	Compliance
R3 – GF	42	55	35	40	64	70	Compliance
R4 – GF	45	55	37	40	66	70	Compliance
R5 – GF	43	55	36	40	63	70	Compliance
R6 – GF	49	55	41	40	67	70	Compliance with infringement of night-time noise limit.
R7 – GF	48	55	41	40	63	70	Compliance with infringement of night-time noise limit.
R8 – GF	45	55	37	40	59	70	Compliance

Notes to Table 10:

- Daytime and Night-time Period timeframes as described in Section 4.3
- Daytime activity levels have been calculated for the busiest hour vehicle movements.
- Night-time activity levels have been calculated for the busiest 15-minute period.
- LA_{max} criteria applies only during the night-time period 10:00 pm and 7:00 am.
- Ground Floor Level is abbreviated to "GF".

The results in Table 10 show that the predicted noise levels from the proposal, comply with the daytime and maximum event noise limits; and practically comply with night-time noise limits at surrounding receivers (levels are within 1 dB of the limit). The largest contributing noise source to the 1 dB infringement, is from trucks accessing the subject site.

6.4 Assessment of Effects

The effect of the predicted 1 dB infringements of the night-time noise limit would be considered negligible as differences of 1 dB in noise levels are considered to be imperceptible. Therefore, there would be no change in noise effects at these receivers when compared 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". Table 4.2 within the NPfI goes on to describe "negligible" as "...would not be discernible by the average listener...".

It is also important to note that the existing ambient environment is controlled by high levels of traffic noise from SH1. The lowest measured ambient noise level during the night-time period was 46 dB LAeq(15minutes) (see Section 3). These levels are generated by traffic, that include heavy vehicles, therefore the noise associated with the proposal would to a certain extent be expected blend in with the existing environment at these receivers.

Furthermore, should occupants of 3785 State Highway 1 (R6) and 3817 State Highway 1 (R7) have their windows open during the night, an internal noise level (based on a typical outside to inside loss of 10-15 dB through a partially open window) from the proposal would be expected to be in the region of 26-31 dB LAeq. This is within the range recommended in AS/NZS 2107:2016 'Acoustics – Recommended design sound levels and reverberation times for building interiors' (AS/NZS 2107) for dwellings in rural areas with negligible transportation, being 25 – 30 dB LAeq.

Noise from the proposal is anticipated to be generally masked at the receivers due to the level of existing traffic from SH1. It is likely that compliance measurements, based on a limit of up to 40 dB LAeq at night, would be unable to be undertaken at the residential dwellings (R6 and R7) due to the high level of ambient noise from SH1. Therefore, SLR recommends a night-time noise limit at the dwellings of 45 dB LAeq at night to result in reasonable noise levels.

SLR consider that the noise effects associated with the limited number of negligible infringements are acceptable in terms of the context in which the proposal would operate. Thus, confirming the suitability of the site for the proposed activities.

7 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, or any such Standard that may replace this standard.
2. Noise generated by the operation of the site shall not exceed the following noise limits:

Receiver	Noise Limit	
	Daytime Period (7:00 am to 10:00 pm)	Night-time Period (10:00pm to 7:00am)
Rural Production Zone (Except 3785 State Highway 1 and 3817 State Highway 1)	55 dB LAeq,T	40 dB LAeq(15minute) 70 dB LAFmax
Rural Production Zone – Noise limit for the following dwellings: 3785 State Highway 1 and 3817 State Highway 1	55 dB LAeq,T	45 dB LAeq(15minute) 70 dB LAFmax

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, or any such Standard that may replace these standards.

8 Conclusion

SLR has assessed the construction and operational effects associated with the proposed Waipu Gateway development in Waipu.

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

The existing ambient environment around the subject site is controlled by road traffic movements on State Highway 1, that passes the subject site and the identified noise-sensitive receivers. The assessment has identified that the operational activities associated with the proposed are expected to comply with the daytime noise limits at surrounding receivers. The predicted levels identify practical compliance with the Whangarei District Plan night-time noise limits (a negligible infringement of up to 1 dB at two dwellings).

This level of infringement would be imperceptible compared to fully compliant levels. Additionally, the predicted levels are the same level or lower than the existing noise environment due to traffic noise generated on the motorway. Furthermore, internal noise levels within the dwellings (due to the proposal) should they chose to have windows open at night would be within the range recommended in AS/NZS 2107.

On the basis of the above, the noise effects are considered to be acceptable and reasonable in terms of the context in which it is proposed to operate, thus confirming the suitability of the site for the proposed activities.

APPENDIX A

Glossary of 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
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.
Hz	Hertz
Intermittent noise	Noise which varies in level with the change in level being clearly audible
L90 , L10, etc.	Statistical exceedance levels, where LN is the sound pressure level exceeded for N% of a given measurement period.
LAeq	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.
LAmaz	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 6801:2008	New Zealand Standard NZS 6801:2008 "Measurement of Environmental Sound"
NZS 6802:2008	New Zealand Standard NZS 6802:2008 "Assessment of Environmental Noise"
NZS 6803:1999	New Zealand Standard NZS 6803:1999 "Acoustics – Construction Noise"
Octave-band	A frequency band where the highest frequency is twice the lowest frequency.
Rating level	A derived level used for comparison with a noise limit.
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.

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