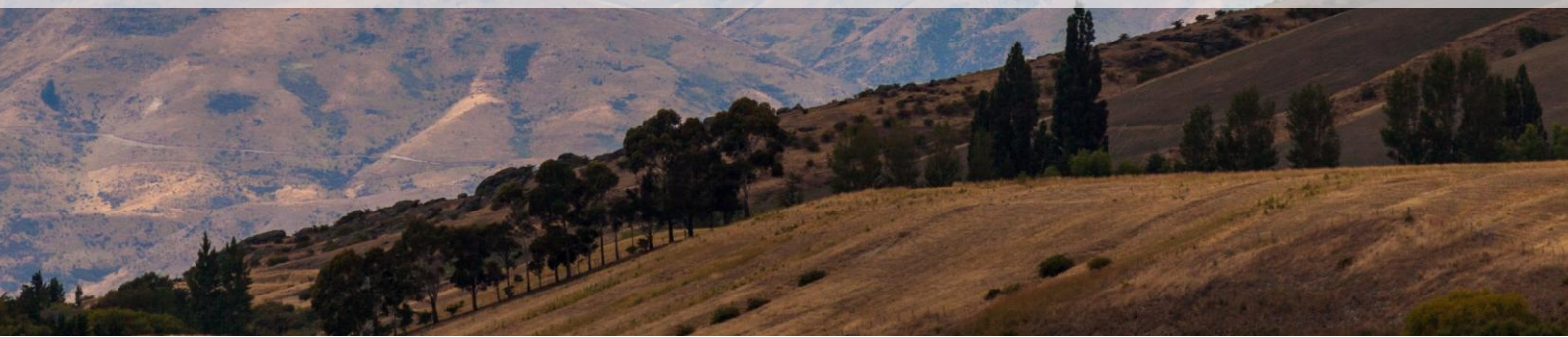


MARSHALL DAY Acoustics

PARKBURN RESIDENTIAL DEVELOPMENT
NOISE ASSESSMENT

Rp 001 R02 20260193 | 23 October 2026



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Project: **PARKBURN RESIDENTIAL DEVELOPMENT**

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Report No.: **Rp 001 R02 20260193**

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APPENDIX D STAGING PLAN INCLUDING SETBACKS FROM INDUSTRIAL ACTIVITY ZONING

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1.0 SUMMARY

We have assessed the potential noise effects arising from traffic noise on State Highway 6 (SH6) on proposed dwellings within 80 m of the carriageway for the proposed Parkburn residential development, at 922 Luggate-Cromwell Road, Cromwell. We have also considered construction noise and vibration effects associated with the civil works associated with establishment of the subdivision, but not individual dwellings as they will be the responsibility of the builder, not the applicant.

This assessment is an updated version to that which was lodged as part of the original Parkburn Substantive Application lodged 4 August 2026. It considers the revised scheme plan and incorporates peer review comments received from Local Authority expert/s to date along with a response to the peer review matters.

The site is currently an active quarry with consented industrial activities in some locations and has recently been rezoned through Private Plan Change 21 (PC21) to the Central Otago District Plan (CODP). PC21 rezoned the site for urban development, with this comprising predominantly Low Density and Medium Density Residential Zones (80 and 10 ha respectively), along with approximately 29 ha of Business Resource Area 3 and Industrial Resource Area 2 and 3 Zones.

Based on the proposed future terrain and the site design we have predicted that vehicle noise from SH6 can be readily controlled to an acceptable internal level in compliance with CODP Standard LRZ-S5.2. We have proposed a condition of consent that also includes a requirement for alternative ventilation and temperature control where windows or doors must be left closed to achieve the required indoor noise levels.

While a detailed civil construction plan has not be developed as yet, based on the indicative methodology and programme made available to us we have predicted the noise levels resulting at the Pisa Moorings interface with the site predicted civil construction noise will comply with the long-term daytime standard in NZS 6803:1999 of 70 dB L_{Aeq}.

Where shoulder period or night-time works are required, we consider that a detailed Construction Noise and Vibration Plan (CNVMP) is required. We have recommended a condition of consent to trigger the development of a CNVMP should this situation arise.

A positive consequence of the proposal is that the existing quarry-to-residential interface will be replaced with a compatible residential-to-residential interface. Any noise effects arising are best addressed via the CODP residential noise standards consistent with the outcome of PC21.

We consider that the overall noise effects of the proposed development are reasonable, reflect the size and nature of the development, and will result in acceptable amenity for noise sensitive receivers both within the proposed development and at Pisa Moorings immediately south of the site.

A glossary of technical terms is included in Appendix A.

2.0 QUALIFICATIONS AND EXPERTISE

My name is Rob Lachlan Hay, and I am an Associate at, and Director of, Marshall Day Acoustics (MDA). MDA is a specialist acoustics consultancy of about 100 professional acoustics consultants, founded in 1981, with offices in New Zealand, Australia, Hong Kong/China, Spain, and France.

I hold a Bachelor of Science and Master of Science degree from the University of Canterbury, majoring in Chemistry. I have worked in the field of acoustics for over 22 years. I joined MDA in 2006 and have been involved in many significant large scale environmental noise assessment projects throughout New Zealand including manufacturing, transportation, retailing, and subdivision.

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3.0 EXPERT WITNESS CODE OF CONDUCT

Although this Project is not being considered before the Environment Court, I confirm that I have read the Code of Conduct for expert witnesses as contained in section 9 of the Environment Court Practice Note 2023. I agree to comply with that Code. I am satisfied that the matters which I address in this Noise Assessment Report are within my area of expertise, except where I state that I am relying on information provided by another person or expert. I have not omitted to consider material facts known to me that might alter or detract from the opinions I express.

4.0 PROPOSED DEVELOPMENT

The proposed development would establish a residential subdivision with supporting community and commercial activities as well as recreational areas.

4.1 The proposed development includes different activities

The Parkburn Development Project (the Project) involves the staged subdivision and development of land at 922 Luggate-Cromwell Road (State Highway 6), Cromwell, located approximately 8 kilometres north of the Cromwell township and adjoining Lake Dunstan / Te Wairere. The site includes part of the existing Parkburn Quarry.

The Project provides for the establishment of a mixed-use urban development, including quarry rehabilitation, residential development, supporting commercial and community activities, open space, and associated infrastructure. Works are also proposed within the State Highway 6 (SH6) road reserve.

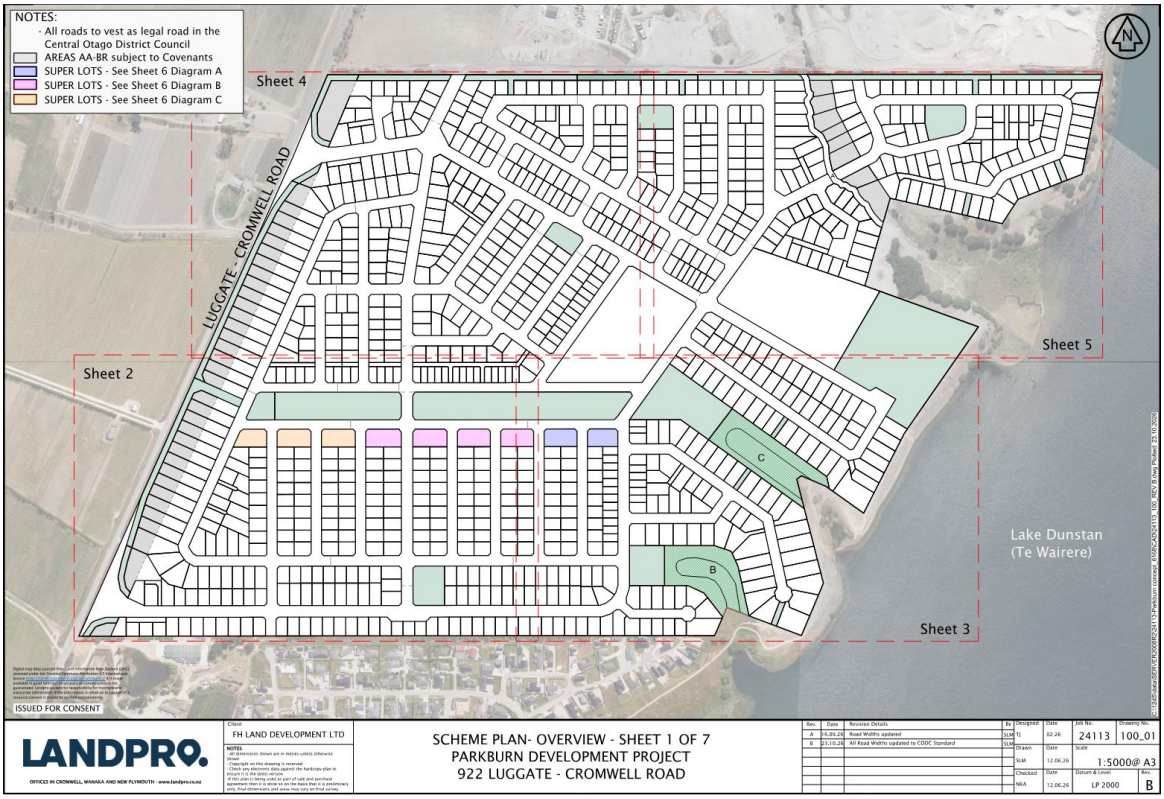
The project comprises the following components:

- Bulk earthworks to backfill and rehabilitate part of the existing Parkburn Quarry.
- Subdivision and development to enable approximately 1,000 residential allotments, supporting the construction of approximately 1,000 residential units across a range of housing densities.
- Subdivision and development to establish a neighbourhood centre, including retail, commercial, medical, and early childhood education activities, together with land for a primary school.
- Landscaping and development of an open space network, including recreation reserves, esplanade reserves, and restoration along the margins of Parkburn Stream and Lake Dunstan / Te Wairere.
- Formation of two coves extending into Lake Dunstan / Te Wairere.
- Construction of associated infrastructure, including three waters infrastructure, internal transport networks, and external access works connecting the site to SH6.

Figure 1 shows the masterplan indicating the key areas of the development.

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Figure 1: Proposed development masterplan

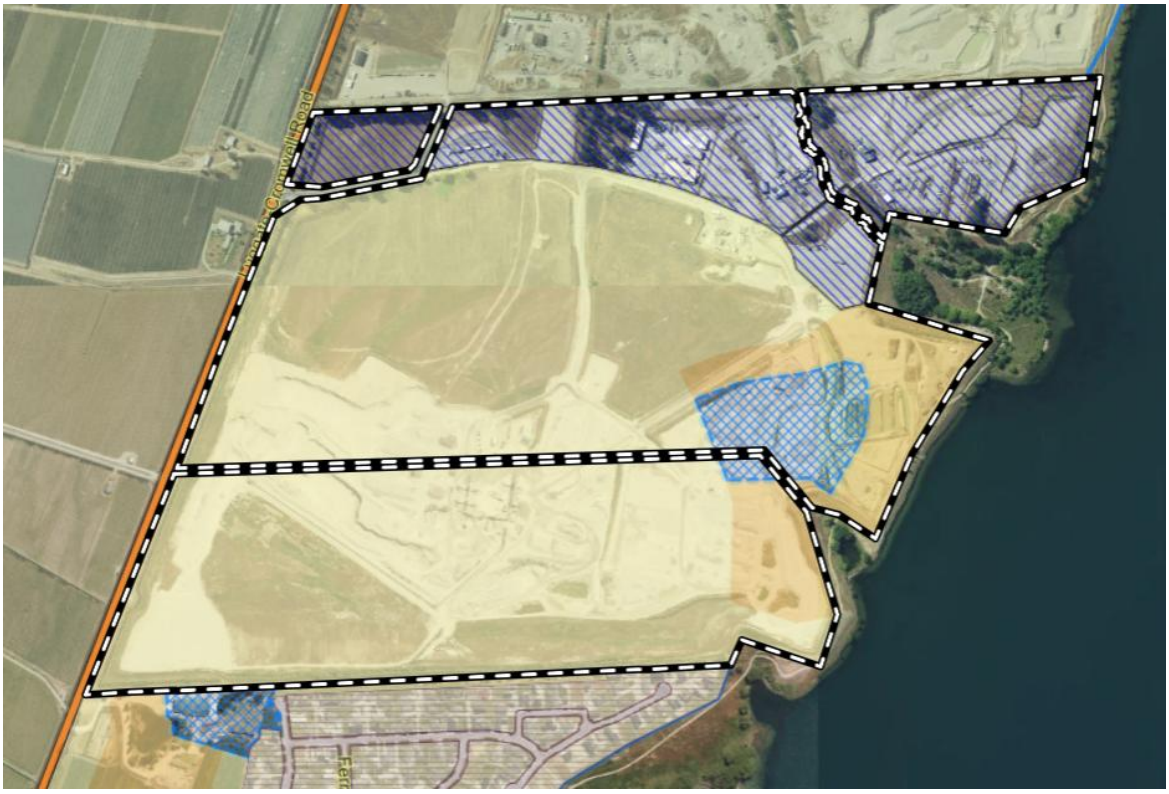


4.2 The existing rural, quarry and industrial site is zoned largely for future residential

The land for the proposed development is currently used for quarry and industrial activity - parts of which have already been rehabilitated to a rural appearance. However, the site (indicated by black and white dashed line in Figure 2) and surrounding area are zoned largely as Low Density Residential (pale yellow), and Medium Density Residential (pale orange) in the operative Central Otago District Plan (CODP) (Figure 2). Industrial 2 and 3, and Business 3 Zones are indicated by cross hatching.

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Figure 2: Nearby receivers



The Pisa Moorings subdivision lies to the immediate south of the site, representing the closest noise sensitive receivers for any civil construction works, as indicated in Figure 2. Most of this subdivision is zoned Large-lot residential, although there is a Business 3 zone close to the boundary with the application site and Low Density Residential along the SH6 boundary. SH6 itself is indicated as an orange line.

4.3 The application modifies the land use compared to the underlying zoning

The application does not change the underlying zoning within the site. However, the applicant has proposed conditions requiring any site development to be in accordance with the proposed development plan and a development matrix, which outlines specific rules that would be applicable. The development plan area definitions will be used to determine any other relevant rules in the District Plan. Any proposals that are not in accordance with the development plan and matrix would require resource consent.

The Applicant is prepared to offer a condition of consent to prevent incompatible development (such as utilising the underlying industrial zoning) within the proposed residential development areas.[1]

5.0 EXISTING NOISE ENVIRONMENT

While we have not assessed the existing noise environment quantitatively, from previous visits to the site and nearby sites we are familiar with the subjective experience of the noise environment. Within approximately 80-100 m of SH6, the ambient noise level is dominated by traffic noise, which in the absence of mitigation measures remains clearly audible at greater distances in still conditions. Along the southern boundary of the application site quarry noise can be expected to be clearly audible and potentially dominant at times, while complying with the applicable CODC noise limits. At other

[1] Subdivision condition 4, combined with the new addition to condition 13 described below.

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locations within Pisa Moorings general residential suburban noise (people, vehicles, air-conditioning, etc) noise will be present, as well as natural sounds.

6.0 NOISE PERFORMANCE STANDARDS

We have reviewed the noise performance standards that relate to activity on the site.

6.1 District Plan noise limits set out what is generally permitted in the area

CODP Rule 12.7.4i requires that noise is assessed in accordance with NZS 6802:1991 *Assessment of Environmental Sound*. We note that the 1991 version of NZS 6802 was superseded in 2008 and is no longer considered best practice.

In addition, the National Planning Standards 2019 require that as District Plans are updated, the 2008 version of both NZS 6801 and 6802 are adopted, along with the 1999 version of NZS 6803.

The CODP does not currently appear to specify noise limits for sound both produced and received within residential zones. This may be because PC19, which replaces the old Section 7 - Residential Resource Area of the CODP with three new chapters covering Large Lot, Low and Medium Density Zones, is only partially operative.

We can however look to other CODP chapters for an indication of appropriate noise standards. Sections 4, 8, and 9 of the CODP provide for noise received in Residential Resource Areas from Rural, Business, and Industrial Zones respectively. These standards are summarised Table 1.

Table 1: CODP residential noise limits for sound originating in rural, business, and industrial zones.

Time period	Noise level received at or within the site boundary of a dwelling In a Residential Zone dB L_{A10} / dB L_{AFmax}		
	Rural (4.7.6E.a)	**Business (8.3.6vi)**	**Industrial (9.3.6iiia)**
Daytime (0700 – 2200)	55	55	55
Night-time (2200 – 0700)	40 / 70	45 / 70	45 / 70

These noise limits are generally consistent with the upper range of guidance provided by NZS 6802:2008, other than that NZS 6802 requires noise limits be expressed as an L_{Aeq} noise rating level.[2] Even if these levels change when the CODP plan review is resolved, as the Parkburn and Pisa Moorings residential areas are likely to have the same internal noise standards any change would be neutral in effect.

6.2 Construction noise limits are standard and appropriate

Rule 12.7.4 ii requires that construction noise shall be measured and assessed in accordance with NZS 6803P:1984 *The Measurement and Assessment of Noise from Construction, Maintenance, and Demolition Work.* Similar to the situation with NZS 6802:1991 described above, NZS 6803P:1984 is a draft standard that was superseded by the final version of NZS 6803 in 1999. The numerical guidelines provided in the 1999 version of NZS 6803 are similar to the 1984 draft, but greater guidance on construction noise assessment and management is provided. A copy of the relevant limits in NZS 6803:1999 is provided in Appendix B.

[2] The noise rating level includes adjustments for time averaging and special audible characteristics, where appropriate.

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6.3 Sound insulation against State Highway traffic noise

Standard LRZ-S5.2 requires that new residential buildings shall be designed and constructed to meet noise performance standards for noise from traffic on the State Highway that will not exceed 35 dB $L_{Aeq\ (24hr)}$ in bedrooms and 40 dB $L_{Aeq\ (24hr)}$ for other habitable rooms in accordance with the satisfactory sound levels recommended by Australian and New Zealand Standard AS/NZS 2107:2000 *Acoustics – Recommended design sound levels and reverberation times for building interiors*[3]. This shall take account of any increases in noise from projected traffic growth during a period of not less than 10 years from the commencement of construction of the development.

This is a standard and appropriate form of reverse sensitivity rule designed to both protect the health and amenity of residents of dwellings close to State Highways and avoid the State Highway operator facing unreasonable pressure arising from complaints about their network.

6.4 Summary of proposed noise standards to be applied to the proposal

In accordance with current best practice, we recommend the following noise standards to ensure that future occupants of the Parkburn subdivision and current and future occupants of the Pisa Moorings subdivision have an appropriate standard of amenity that also ensures that road transport on SH6 is able to function adequately and that construction works are enabled when best practicable options are executed:

- That standards NZS 6801:2008 and NZS 6802:2008 are respectively used for the measurement and assessment of noise
- That standard NZS 6803:1999 is used for the measurement, assessment, and management of construction noise
- That LRZ-S5.2 is applied to any new dwelling constructed within 80 m of the seal edge of SH6 in the Parkburn development.

Note that we will discuss specific resource consent conditions below, which we recommend enhancing the certainty of the application of the latter two matters.

We are not recommending specific intra residential zone noise standards as this is a matter to be addressed by the CODP as it moves through the Plan review process. Additionally, as already mentioned, the residential zones in Parkburn and Pisa Moorings would logically have the same noise limit and so no cross boundary differential analysis is required.

7.0 PREDICTED SH6 NOISE LEVELS

We have modelled vehicle traffic noise from SH6 across the adjoining 80 m strip of residential land within the Parkburn development. The purpose of this assessment is to establish the noise exposure for proposed dwellings within the SH6 interface.

[3] Also a superseded Standard.

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7.1 We have predicted SH6 noise levels using SoundPLAN

We have used the noise modelling package SoundPLAN to predict noise levels. Calculations in SoundPLAN are based on the implementation of the procedures outlined in "Calculation of Road Traffic Noise" (CRTN), developed by the UK Department of Transport in 1988. Adaptions have been made for New Zealand road conditions as described in NZTA *Guide to assessing road-traffic noise* 2024. This methodology represents current industry best practice. This method has the scope to consider a range of factors affecting noise levels including:

- The number of vehicles (AADT)
- The percentage of heavy vehicles
- Vehicle speed
- The road surface
- The distance between source and receiver
- The presence of obstacles such as screens or barriers in the propagation path

7.2 State Highway 6 noise to residential receivers

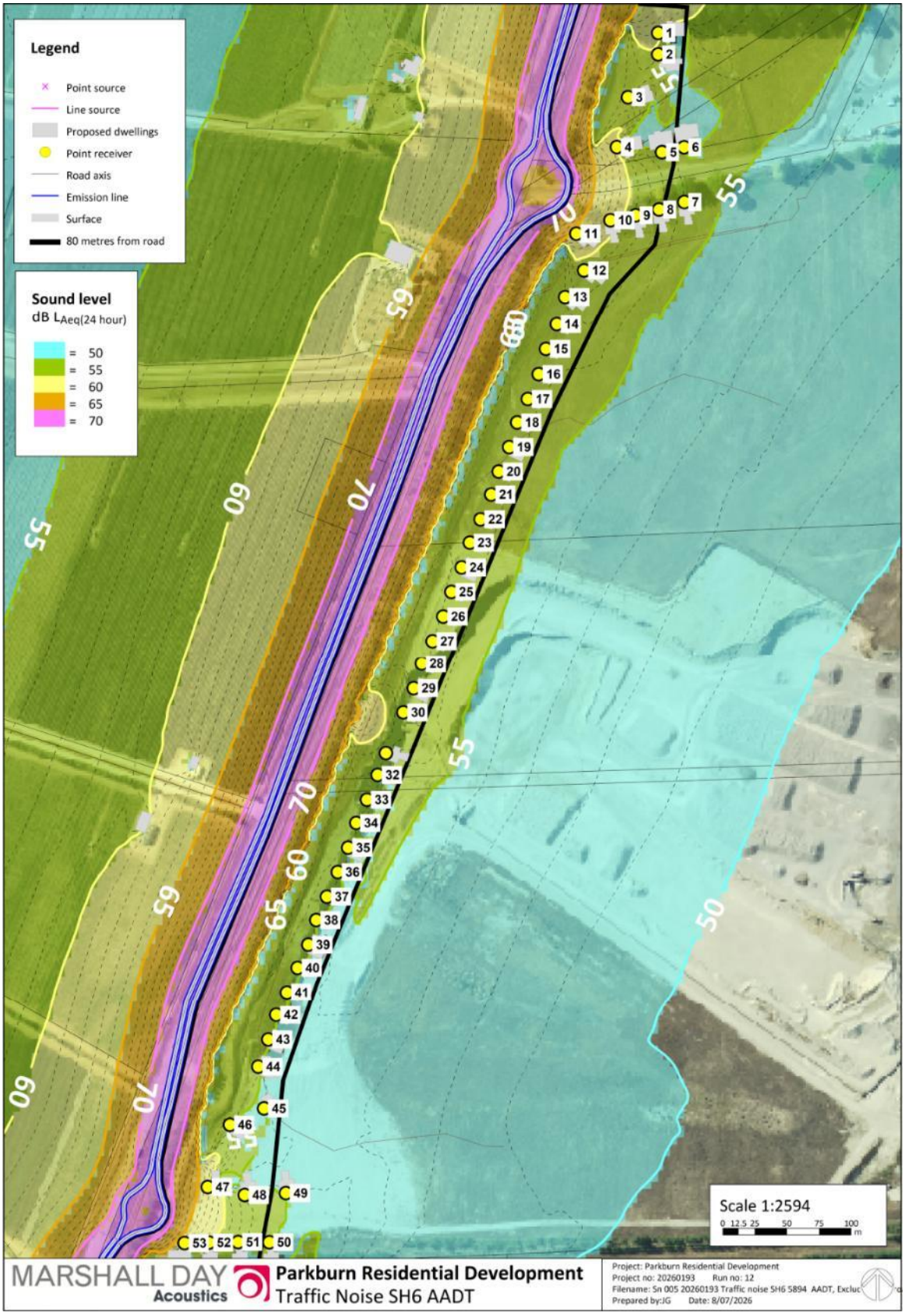
We have predicted the future noise of vehicles using SH6 based on traffic assumptions provided to us by Carriageway Consultants[4], and proposed future terrain contours and land parcels as shown in Landpro drawing *Parkburn_24113_112_REV A_Design_Contours_IssuedForconsent_20260925*.

The predicted noise contours are provided in Figure 3, with predicted noise levels summarised in Table 2. Assumptions about geometric bulk and location of future dwellings have been made in accordance with the master plan.

[4] Carriageway Consulting, 13 March 2026 (Appendix C).

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Figure 3: Predicted SH6 Noise (future)



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The noise levels in Table 2 are equivalent free-field values, calculated at the position of the closest building elements to the road.

Table 2: Predicted SH6 incident noise levels for adjoining noise sensitive receivers

	SH6 Noise Level dB $L_{Aeq\ (24\ hr)}$			SH6 Noise Level dB $L_{Aeq\ (24\ hr)}$	
Receiver	**Ground**	**Floor 1**	**Receiver**	**Ground**	**Floor 1**
1	58	62	**28**	63	64
2	58	61	**29**	63	64
3	60	63	**30**	63	64
4	60	63	**31**	63	64
5	54	58	**32**	63	64
6	54	58	**33**	63	64
7	56	58	**34**	63	64
8	57	59	**35**	63	64
9	58	61	**36**	62	63
10	60	62	**37**	62	63
11	64	66	**38**	62	63
12	59	61	**39**	62	63
13	62	63	**40**	61	63
14	62	63	**41**	61	63
15	62	63	**42**	61	63
16	61	63	**43**	60	62
17	61	63	**44**	59	62
18	61	63	**45**	57	60
19	60	62	**46**	62	64
20	60	62	**47**	64	65
21	60	63	**48**	57	61
22	62	63	**49**	53	58
23	62	64	**50**	56	59
24	63	64	**51**	58	60
25	63	64	**52**	61	63
26	63	64	**53**	63	65
27	63	64			

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8.0 CONSTRUCTION NOISE AND VIBRATION

We have assessed the likely noise and vibration from earthworks activity for the major civil works that will occur on site developing the subdivision. Details of the construction methodology and timeframes have not yet been developed in any detail. However, we anticipate that typical construction activities can comfortably comply with appropriate noise and vibration standards.

8.1 Recommended construction noise criteria are in NZS 6803:1999

Construction noise is recommended to be measured and assessed according to New Zealand Standard NZS 6803:1999 *"Acoustics – Construction Noise"* (NZS 6803). The noise criteria apply at 1m outside the façades of buildings, and only while buildings are occupied.

The construction noise criteria from NZS 6803 are 70 dB L_{Aeq} and 85 dB L_{AFmax} during the daytime works period. Full tables of noise criteria from NZS 6803 are included in Appendix B.

8.2 A detailed construction methodology has not yet been confirmed

Details of the construction program and methodology have not yet been fully developed. However, the anticipated construction works are summarised in Table 3.

We understand that noisy works will be undertaken during daytime hours (from 0730 to 1900, Monday to Friday, and 0730 to 1800 on Saturdays).

Table 3: Summary of anticipated civil construction activities

Activity	Equipment
Phase 1: preparation and stockpiling of pea gravel	Mobile crusher, excavators, truck movements
Phase 2: blending pea gravel with in-situ material from north of site, contouring and compaction	Excavators, truck movements (full trucks for compaction)
Phase 3: Drain laying, services, road construction	Excavators, truck movements, bulldozers

8.3 Construction activity will be staged

The development and associated construction will be completed in stages beginning at 1A and 1B but then proceeding based on demand and the ability to meet relevant conditions of consent.

8.3.1 Stages 1A and 1B

We understand that major civil works to complete rehabilitation of the quarry, create final landforms, and place underground services etc will start adjacent to the southern site boundary adjoining Pisa Moorings.

We are advised that the process will begin in the areas marked stages 1A and 1B in drawing Landpro drawing *Parkburn_24113_105_REV B_Staging_IssuedForConsent20261023* (Appendix D) and will proceed in the following phases[5]:

Phase 1

Crushing and stockpiling of pea gravel on site. This will be undertaken on the quarry floor ~10 m below the existing southern boundary in the quarry pit and the existing 3 m bund on the southern boundary will be left in place. This process will take approximately 12 months. Equipment used will be excavators, dump trucks and a mobile crusher. This work will be ~40 m from the Pisa Moorings boundary.

[5] Note that the description of phases is MDA's own term to separate the construction steps out from the development stages.

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Phase 2

In situ material will be excavated from the northern half of the block and mixed with crushed pea gravel to lift the floor of the quarry cavity to final design floor levels. This will take in the order of 18 months. Equipment will be excavators, dump trucks, and compaction via loaded dump truck. Work will remain ~20m or greater from the southern boundary. The existing bund will stay in place while this work is undertaken.

Phase 3

Civil construction will start at the southern boundary and will include drain laying, road and services construction. The existing 3 m bund will be removed towards the end of this work to allow for final trimming and grassing along the boundary.

8.3.2 Stages 6, 7, 12, 13, 14, and 15

Parts of stages 12-15 (and a minor part of two sites within Stages 6) are currently used for industrial activities. The applicant is volunteering to accept a condition that they cannot receive a s224(c) certificate for any site within 100 m of the industrial activity boundary. This includes parts of stages 6 and 7 in addition to the industrial activity area. Both the industrial activity area boundary and the 100 m setback are shown in Appendix D. This means that noise sensitive development will not be able to occur nearby any ongoing Industrial activities.

The HW Richardson Group (HWR) site sits immediately north of the application site bordering stages 7 and 11-15. Extraction of quarry material has ceased on the HWR site, with only some tidying up and remediation to be completed. The applicant is undertaking this work and, as it is under their control, they will ensure that this is completed prior to being ready to uplift the s224(c) certificate.

8.3.3 Stages 7 & 11 – HWR Site other activities

Immediately north of stage 11 and the northern most extent of stage 7, the HWR site has two yards occupied by tenants (Downers and SouthRoads). The applicant understands that HWR in the near future intend to lodge a plan change for the redevelopment of their site into a residential development and CODC are aware of the same. As a result, the current Downer's yard will be closed and the existing SouthRoads yard will be occupied by the contractor undertaking the HWR development and then replaced with residential development.

8.4 Equipment noise levels and unmitigated setback distances for compliance

Table 4 provides indicative construction noise levels for typical activities anticipated on the site. They are considered representative of the activities proposed. However, in practice, construction noise levels are inherently variable due to factors such as equipment selection, methodology and operator skill/care.

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Table 4: Sound power levels at compliance setback distances at 1m from a building façade[6] (no barrier)

Equipment	Sound power level	Setback to achieve compliance[7]	
	(dB L_{wA})	70 dB L_{Aeq} (daytime)	45 dB L_{Aeq} (night-time)
Excavator (45 t)	106	33 m	>200 m
Excavator (20 t)	103	25 m	>200 m
Mobile crusher (47 t)	110	48 m	>200 m
Full haul truck (39 t)	108	40 m	>200 m
Bulldozer (41 t)	108	40m	>200 m

8.5 Noise levels will be significantly lower than 70 dB most of the time

For all activities except final trimming at the boundary towards the end of Phase 3, we have assumed that the combination of ground elevation difference and existing earth bunds will provide at least 10 dB of screening. Based on the anticipated noise sources on site and the site layout, we predict that construction activities can comply with the daytime construction noise criteria of 70 dB L_{Aeq} at all nearby noise sensitive receivers. Night-time construction activity is not currently proposed.

In the final stages of works along the boundary the use of localised/temporary noise barriers when undertaking earthworks in close proximity of an occupied dwelling may be desirable where smaller/quieter equipment cannot be practicably used. The use of a 20 t excavator along with temporary barrier would reduce the setback for compliance with the daytime guidance of 70 dB L_{Aeq} from 25 m to 8 m and for the bulldozer from 40 m to 14 m[8]. These are matters than can be addressed through the construction noise and vibration management plan required by land use condition (h).

However, it is anticipated that noise levels would be significantly lower than 70 dB for most of the time. This is due to the setback distances typically being greater than those indicated in Table 4. As the civil works extends further north into the site and setback distances increase noise levels are anticipated to decrease.

8.6 A management plan will be developed if night works are required

The applicant does not envision undertaking night-works at this time (see land use condition 12), however if construction activity is required during shoulder periods or at night for any reason, a construction noise management plan will be developed to ensure that the best practicable option is adopted to reduce noise. This may include selection of alternative equipment, increased setbacks, localised/temporary noise barriers, and engagement with potentially affected neighbours.

Any construction noise and vibration management plan would be submitted to Council for certification prior to works commencing.

8.7 Vibration criteria consider amenity and cosmetic building damage

We recommend that construction vibration is measured and assessed in accordance with German Standard DIN 4150-3:2016 "*Vibrations in buildings – Part 3: Effects on structures*".

[6] In accordance with the requirements of NZS 6803:1999, inclusive of 3 dB façade reflection.

[7] Based on weekday noise limits, without barrier shielding.

[8] Assessed 1 m from the façade of buildings which may be affected by construction noise.

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Relevant criteria to protect buildings from the risk of any, including cosmetic, damage are 15 mm/s Peak Particle Velocity (PPV) for short term (transient) vibration and 5 mm/s PPV for long term (continuous) vibration. (Note that vibration levels needed to cause structural damage are magnitudes higher.)

British Standard BS 5228-2:2009 "*Code of practice for noise and vibration control on construction and open sites – Part 2: Vibration*" provides guidance on the amenity effects of vibration. The descriptions are reproduced below, and are supplemented with our own descriptions for 2 mm/s and 5 mm/s (to bridge the gap between 1 and 10 mm/s in the Standard):

- 0.14mm/s PPV Just perceptible in the particularly sensitive environments
- 0.3 mm/s PPV Just perceptible in normal residential environments
- 1 mm/s PPV Typically acceptable with prior notification
- 2 mm/s PPV Clearly perceptible but typically acceptable (during daytime only) in dwellings and workplaces if it occurs intermittently, and with effective prior engagement.
- 5mm/s PPV Highly unsettling in dwellings and workplaces. If prolonged, some occupants may want to leave the building. Computer screens will shake, and items could fall off shelves if they are not level.
- 10 mm/s PPV Likely to be intolerable for any more than a very brief period

To protect people's amenity, we recommend a criterion of 2 mm/s PPV.

8.8 We predict that construction vibration will be insignificant

We predict that vibration from the proposed construction activities may be just perceptible at the closest receivers (less than 1 mm/s PPV) for heavy earthmoving equipment in close proximity to the boundary. However, as no vibratory compaction or piling is proposed during civil construction works, we consider the potential for regularly intrusive vibration to be minimal.

Predicted levels from all activity would comfortably comply with building protection criteria contained in DIN 4150-3 and also the recommended amenity level.

8.9 Assessment of construction noise and vibration for individual dwellings is not required

It is premature to assess the construction noise and vibration effects of individual dwellings at this time. The location and design of future dwellings on each site are not known to the applicant; neither is the construction methodology future site owners, and their builders will select or whether there will be occupied dwellings or noise sensitive activities within the area of potential effects at the time of construction.

Standard practice is to defer this matter to the future as site owners/builders must comply with the requirements of the District Plan at that time when the relevant matters for assessment can be properly assessed.

9.0 NOISE ASSESSMENT

We have assessed the proposed development against the relevant noise rules and the existing noise environment in the area.

9.1 Protection of noise sensitive receivers from SH6 noise

CODP Standard LRZ-S5.2 requires that bedrooms and habitable rooms of dwellings within 80 m of State Highways are provided with sound insulation sufficient to achieve 35 dB $L_{Aeq\,(24\,hr)}$ and 40 dB $L_{Aeq\,(24\,hr)}$ respectively. While not explicitly required by LRZ-S5.2, were this cannot be achieved with windows open for ventilation an alternative means of providing fresh air into the dwelling

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complying with the requirements of New Zealand building Code G4 would also be required. Best practice suggests that a means of temperature control, in particular cooling, is also available.

The predicted noise levels for proposed dwellings adjoining SH6 in Figure 3 and Table 2 suggest incident noise levels of between 54 to 64 dB $L_{Aeq\,(24\,hr)}$ depending on location and whether the receiver location is for a ground level or first floor receiver. In many cases a standard building construction will be capable of achieving the required indoor noise level provided windows and doors are closed. However, given the range in dwelling construction techniques and window sizes/styles used in the region, it would be appropriate to specify a noise condition applying to any dwelling within 80 m of the carriageway edge.

We have provided a recommended condition below.

9.2 Proposed boat ramp

We understand that a public boat ramp is proposed as part of the application. Whilst there is some uncertainty regarding the likely use of the proposed boat ramp, our experience is that most activity occurs during the peak Christmas/New Year and other holiday periods. Outside this time, regular activity is mainly limited to weekends and public holidays throughout the year. These usage patterns indicate that peak noise impacts would be concentrated over relatively short periods, followed by extended periods of relatively low noise activity.

Early morning boat launches have the greatest potential for noise effects. It is not clear how many launches may occur during the earlier morning period before 0700, which is considered as night-time in the District Plan. However, in our experience acceptable night-time and daytime residential amenity can be achieved in close proximity to public boat ramps. We also note that there is a 5 knot speed limitation applying to boats in both the channel and along the lake shore, meaning that boats will be well away from dwellings before applying full power.

Further, because this is a new development there is the opportunity for 'self-selection' to occur. People less likely to find the ramp activity acceptable will be less likely to buy sites adjoining the ramp and channel.

9.3 Construction can comply with appropriate noise and vibration criteria

We have predicted that civil construction noise and vibration can comfortably comply with the relevant criteria during daytime. Should shoulder period or night-time works be required on limited occasions, a construction and vibration management plan will be required, and the activity would need to be carefully managed to achieve compliance. However, we understand that no shoulder or night-time works are proposed.

9.4 Noise effects will be reasonable and have been mitigated as far as practicable

We anticipate that road traffic noise from SH6 will be clearly audible at times at the nearest dwellings and are likely to dominate the receiving environment. However, the combination of proposed setback and lowering of terrain below the level of SH6 makes compliance with LRZ-S5.2 readily achievable. This will ensure that an appropriate indoor noise environment will be maintained that is supportive of both general residential and sleep amenity.

The additional requirements in the proposed sound insulation condition for provision of alternative ventilation and temperature control means that dwelling occupants need not choose between acoustic amenity and fresh air or a comfortable temperature.

Noise from civil construction works such as quarry rehabilitation, contouring final elevations, and establishing underground services and roading is expected to occur over a number of years commencing at the southern boundary adjoining Pisa Moorings. While a detailed construction plan has not been developed at this time, our initial calculations based on the indicative methodology

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demonstrates that compliance with the long-term daytime noise limits of NZS 6803:1999 which we propose should apply.

While we have not considered the future residential-to-residential interface in any detail, we note that these would be natural and compatible activities. The appropriate means of addressing noise effects within residential zones would be via appropriate standards in the CODP. In any event, future interface noise effects are more likely to be compatible than the current quarry-to-residential interface.

Overall, we consider the noise effects on noise sensitive receivers both within the proposed Parkburn development and the adjoining existing Pisa Moorings to be reasonable and acceptable.

10.0 RECOMMENDED CONDITIONS

We recommend the following conditions of consent should the Panel consider granting approval.

SH6 Sound Insulation

That any new residential buildings within 80 m of the edge of the State Highway shall comply with proposed land use condition 8 and subdivision conditions 16g and 16i.

Construction Noise and Vibration

That a construction noise and vibration management plan (CNVMP) is to be provided to Council for certification in compliance with proposed land use conditions 5(b) iv and 18 at least 10 days prior to any works commencing.

As an advisory, we note that the CNVMP is to address matters contained in Annexure E of NZS 6803:1999, in particular the best practicable options to control noise such as:

- Time of day
- Setbacks
- Barriers or screens
- Staff/operator training and supervision
- Selection of appropriate equipment
- Communication with affected persons
- Noise or vibration monitoring

Uplift of s224(c) certificates

We recommend an addition to subdivision consent 15 (Section 224 Certification) by adding the following:

Residential Amenity Protection

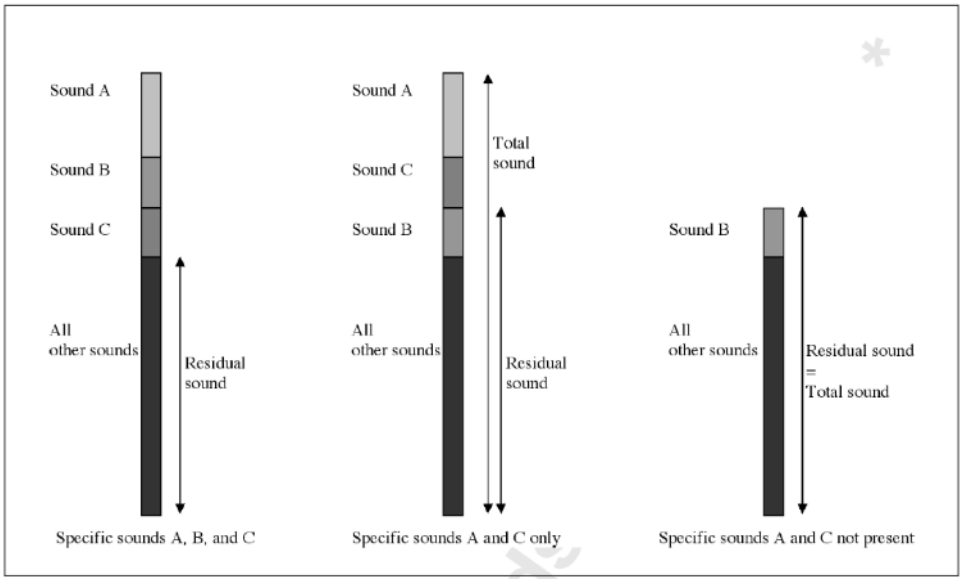
Delay of Development in certain areas

OO. The consent holder must submit evidence to Council that all existing industrial activities within the Industrial Activity Area have ceased before creation of lots within 100m of the Industrial Activity Area boundary. Refer to Appendix Four for a list of the lots subject to this condition.

PP. The consent holder must submit evidence to Council that the Downer yard within the HWR site is no longer in use and that the former SouthRoads yard is being used only as a staging and administrative yard for subdivision development of the HWR site before the creation of any immediately adjoining residential lots within stages 7 and 11.

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APPENDIX A GLOSSARY OF TERMINOLOGY

A-weighting	A set of frequency-dependent sound level adjustments that are used to better represent how humans hear sounds. Humans are less sensitive to low and very high frequency sounds. Sound levels using an "A" frequency weighting are expressed as dB L_A. Alternative ways of expressing A-weighted decibels are dBA or dB(A).
Background sound	The sound that is continuously present in a room our outdoor location. Often expressed as the A-weighted sound level exceeded for 90% of a given time period i.e. L_{A90}.
dB	Decibel. The unit of sound level.
L_{A10}	The A-weighted sound level exceeded for 10% of the measurement period, measured in dB. Commonly referred to as the average maximum noise level.
L_{Aeq}	The equivalent continuous A-weighted sound level. Commonly referred to as the average sound level and is measured in dB.
L_{Amax}	The A-weighted maximum sound level. The highest sound level which occurs during the measurement period. Usually measured with a fast time-weighting i.e. L_{AFmax}
L_P	Sound pressure level. The sound level measured at distance from a source. Distinctly different from sound power level (L_W)
L_w	Sound Power Level. The calculated level of total sound power radiated by a sound source. Usually A-weighted i.e. L_{WA}.
Noise	A subjective term used to describe sound that is unwanted by, or distracting to, the receiver.
Total sound **Or** **Ambient sound**	The totally encompassing sound in a given situation at a given time, from all sources near and far, including the Specific Sound. See also Residual Sound.  This definition is from NZS 6802:2008.

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APPENDIX B CONSTRUCTION NOISE AND VIBRATION STANDARDS

Construction noise must be measured and assessed according to New Zealand Standard NZS 6803:1999 "*Acoustics – Construction Noise*". The noise limits apply at 1m outside the façades of buildings, and only while they are occupied.

The construction noise limits from NZS 6803:1999 are 70 dB L_{Aeq} and 85 dB L_{AFmax} during the daytime works period.

Table 5: Construction noise levels for activities sensitive to noise (e.g. occupied dwellings)

Time of week	Time period	Typical duration[9]		Short-term duration[10]		Long-term duration[11]	
		dB L_{Aeq}	dB L_{AFmax}	dB L_{Aeq}	dB L_{AFmax}	dB L_{Aeq}	dB L_{AFmax}
Weekdays	0630 – 0730	60	75	65	75	55	75
	0730 – 1800	75	90	80	95	70	85
	1800 – 2000	70	85	75	90	65	80
	2000 – 0630	45	75	45	75	45	75
Saturdays	0730 – 1800	75	90	80	95	70	85
	1800 – 0630	45	75	45	75	45	75
Sundays and public holidays	0730 – 1800	55	85	55	85	55	85
	1800 – 0630	45	75	45	75	45	75

Table 6: Construction noise levels for noise affecting any other activity[1] (e.g. occupied commercial building)

Time of week	Time period	Typical duration[9]	Short-term duration[10]	Long-term duration[11]
		dB L_{Aeq}	dB L_{Aeq}	dB L_{Aeq}
All days	0730 – 1800	75	80	70
	1800 – 0730	80	85	75

Vibration Performance Standards - Cosmetic Building Damage

Construction vibration to be measured and assessed in accordance with German Standard DIN 4150-3:2016 "*Vibrations in buildings – Part 3: Effects on structures*".

The short-term (transient)[12] vibration limits in Figure 4 apply at building foundations in any axis.

The long-term (continuous)[13] vibration limits apply at all floor levels, but levels are normally highest in horizontal axes on the top floor.

[9] Construction work at any one location for more than 14 calendar days but less than 20 weeks

[10] Construction work at any one location for up to 14 calendar days

[11] Construction work at any one location with a duration exceeding 20 weeks

[12] Short-term (transient) vibration is "*vibration which does not occur often enough to cause structural fatigue and which does not produce resonance in the structure being evaluated*"

[13] Long-term (continuous) vibration includes types not covered by the short-term vibration definition

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DIN 4150-3 limits are for avoiding cosmetic building damage, such as cracking in paint or plasterwork. Cosmetic building damage effects are deemed 'minor damage' in the Standard and can generally be easily repaired. The Standard states: "*Experience has shown that if these values are complied with, damage that reduces the serviceability of the building will not occur*." Much higher vibration levels (i.e. an order of magnitude higher) would be needed for potential structural damage.

Figure 4: Short-term (transient) vibration at building foundations (DIN 4150-3 2016: Figure 1)

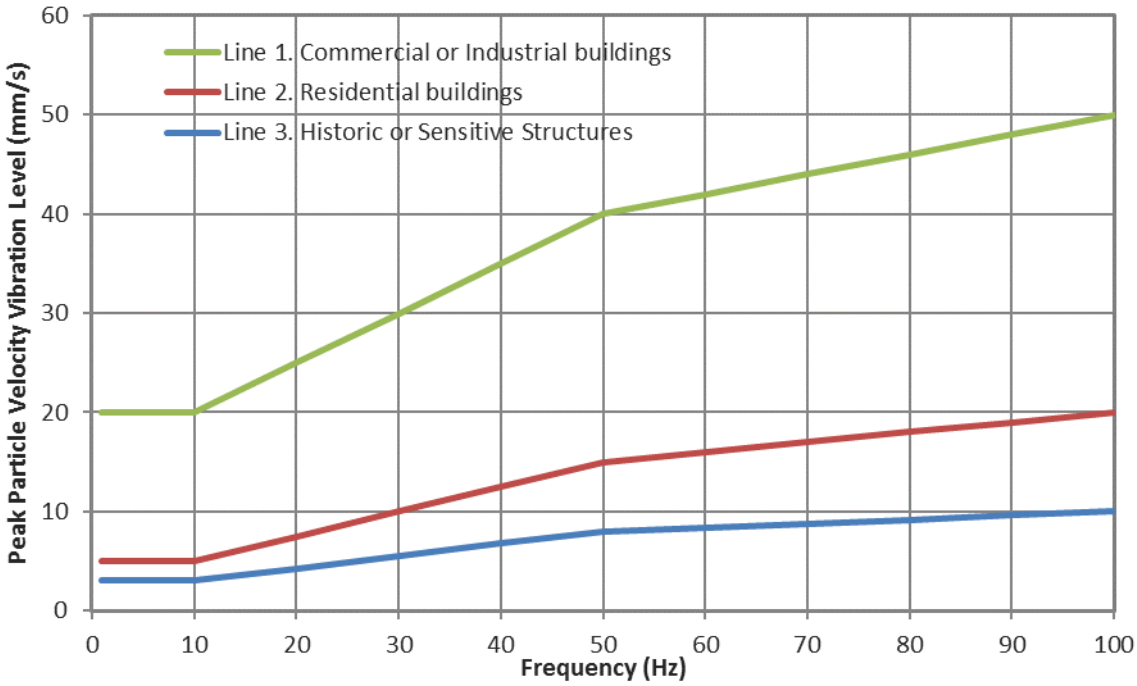


Table 7: Vibration at horizontal plane of highest floor (DIN 4150-3 2016: Tables 1 and 4)

Building Type	Peak Particle Velocity Vibration Level (mm/s)	
	Short-term (transient)[12]	Long-term (continuous)[13]
Line 1. Commercial or Industrial	40	10
Line 2. Residential	15	5
Line 3. Vibration sensitive	8	2.5

DIN 4150-3 states that Line 3 should be used for buildings "*that, because of their particular sensitivity to vibration, cannot be classified under Lines 1 and 2* ***and*** *are of great intrinsic value (e.g. listed building)*".

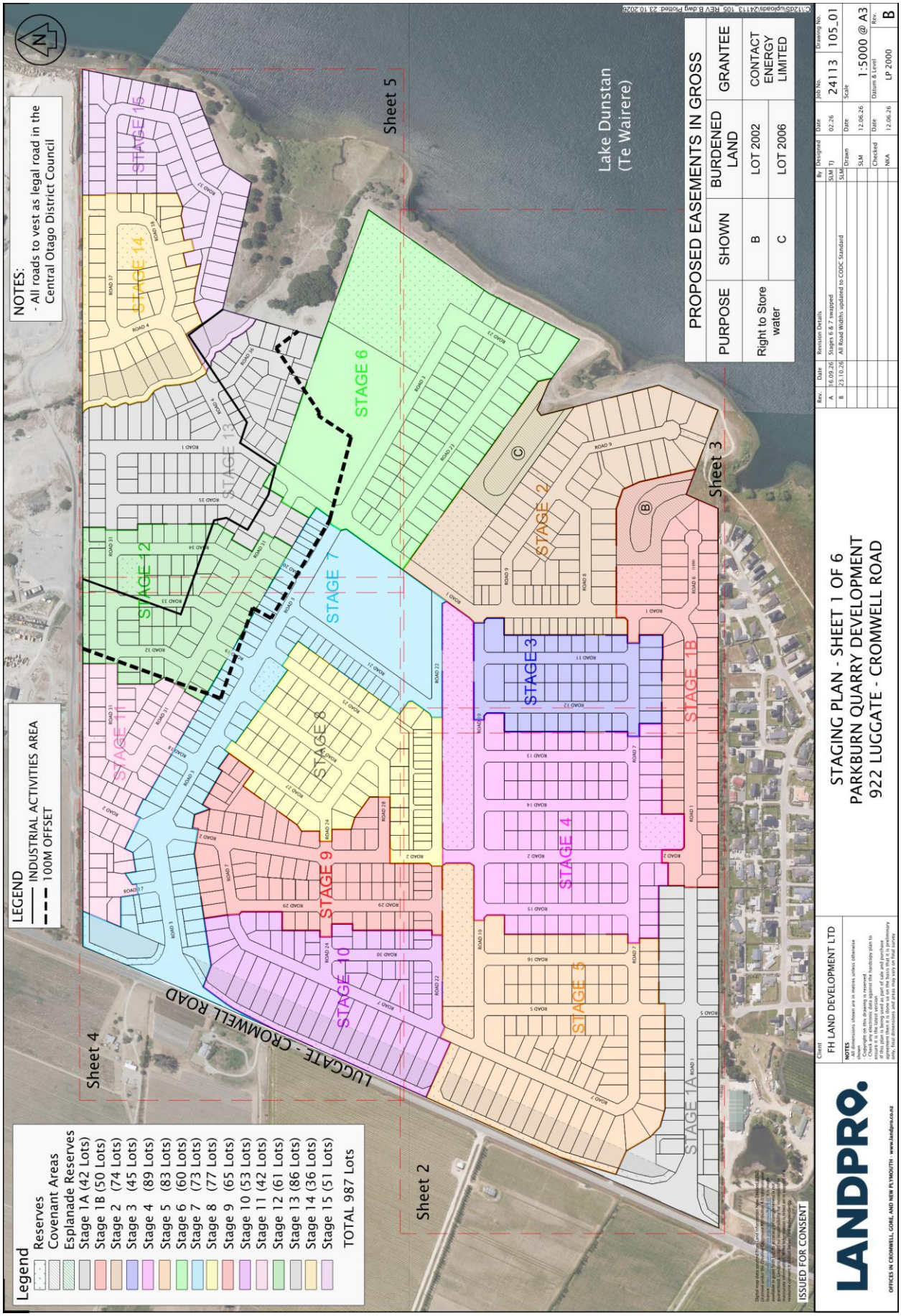
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APPENDIX C CARRIAGEWAY CONSULTING (TRAFFIC) ADVICE

C1 Letter (attached)

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APPENDIX D STAGING PLAN INCLUDING SETBACKS FROM INDUSTRIAL ACTIVITY ZONING



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