Construction Noise and Vibration Assessment

Frank Kitts Park Redevelopment

Wellington City Council

Prepared by:

SLR Consulting New Zealand Limited

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Revision Record

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1.0	10 June 2025	L. Jansen/S. Syman	P. Runcie	

Basis of Report

This report has been prepared by SLR Consulting New Zealand Limited (SLR) with all reasonable skill, care and diligence, and taking account of the timescale and resources allocated to it by agreement with Wellington City Council (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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Acronyms and Abbreviations

'A' weighted	A frequency adjustment which represents how humans hear sounds.
dB	Decibel
dBA	'A' weighted decibel
Hz	Hertz
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.
LAmax	The A' weighted maximum sound pressure level of an event.
Sound Insulation	A reference to the degree of acoustical separation between any two areas.

1.0 Introduction

SLR has been engaged by Wellington City Council to undertake an acoustic assessment of the construction associated with the Frank Kitts Park Redevelopment project in Wellington.

This report seeks to evaluate compliance with the relevant Wellington City Council noise and vibration standards for both the 2000 (operative) and 2024 (appeals) versions of the District Plan. Where necessary, noise and vibration mitigation measures to achieve compliance are identified.

2.0 Site and Project Description

The proposed redevelopment lies within the Central Area Zone in the Operative Wellington City District Plan (ODP), and the Special Purpose Waterfront Zone in the Wellington City District Plan – Appeals Version 2024 (ADP).

The majority of the redevelopment is on Lot 2 DP436892 with a relatively small area that overflows on the footpath on the southern side of the Hunter Street Extension and TSB Arena (Lot 3 DP 436892). The subject area earmarked for redevelopment is shown on Figure 1.

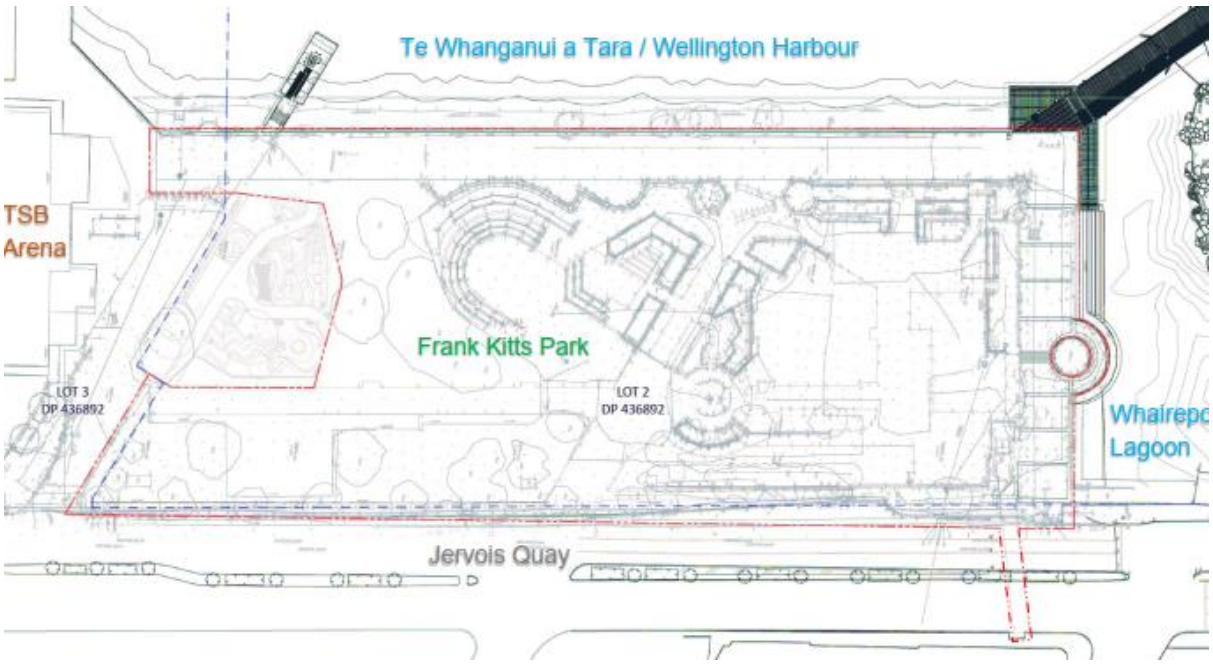

Figure 1 Subject Area of Proposed Redevelopment

The surrounding environment has been characterised as predominantly Special Purpose Waterfront Zone sites to the north, east and south of the park. The TSB Bank Arena and Shed 6 sit to the north, Whairepo Lagoon, Wellington Rowing Club and Wharewaka Function Centre directly to the south, and pedestrian areas of the waterfront and the harbour located to the east. Low to mid-rise commercial office buildings west of Jervois Quay are zoned City Centre with building scale increasing towards central Wellington. The nearest buildings containing residential activity are understood to be the Chews Lane Apartments on Chews Lane near the intersection of Victoria Street and Harris Street.

Jervois Quay is a six-lane arterial road carrying over 40,000 vehicles daily.

The redevelopment of the subject area would involve demolition of the carparking building and limited earthworks. The construction of the Fale building is not covered in this report.

The nearest noise-sensitive receivers are shown on Figure 2 and summarised in Table 1.

Figure 2 Subject Area with Surrounding Noise Sensitive Receivers

Table 1 List of Noise Sensitive Receivers

Receiver	Address	Comment
R1	Shed 6	Venue
R2	TSB Arena	Venue
R3	1 Victoria Street	Westpac Building – multistorey commercial office Building
R4	58 Jervois Quay	Pencarrow House– multistorey commercial office Building
R5	2 Harris Street	WCC Building– multistorey commercial office Building
R6	City Gallery	10 storey municipal Building
R7	Wellington Rowing Club	2 storey recreational building
R8	Wharewaka Function Centre	2 storey function centre
R9	Michael Fowler Centre	Venue
R10	Chews Lane Apartments	12 storey residential apartments atop a 6 storey commercial/retail podium at 50/60 Victoria Street

3.0 Performance Standards

3.1 Construction Noise

Section 12.2.2.4 of the ODP requires construction noise to comply with NZS 6803P:1984 "The Measurement and Assessment of Noise from Construction, Maintenance and Demolition Work", this was a provisional standard and superseded and replaced by a full New Zealand Standard NZS 6803:1999 "Acoustics – Construction Noise" (**NZS 6803**). The limits and provisions of the 1999 standard are similar to those in the 1984 standard.

Section NOISE-S2 of the ADP states that the noise from any construction, maintenance, earthworks and demolition activities must be measured, assessed, managed and controlled in accordance with the requirements of NZS 6803:1999.

The project duration is anticipated to exceed 20 weeks. In accordance with NZS 6803 the long-term duration noise limits would apply. These limits are reproduced in Tables 2 and 3.

These limits apply at 1 m from the facade of any **occupied** building that could be used by activities which may be sensitive to construction noise. These noise limits apply only when buildings are occupied.

Table 2 Construction Noise Limits – Table 2 of NZS 6803 (Occupied dwellings - Long-term Duration)

Time of Week	Time Period	Long-term duration of Construction work (more than 20 weeks)	
		dB L_{Aeq}	dB L_{Amax}
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	6:30 am – 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 3 Construction Noise Limits – Table 2 of NZS 6803 (Occupied Commercial building - Long-term Duration)

Time of Week	Time Period	Long-term duration of Construction work (more than 20 weeks)
		dB L_{Aeq}
All days	7:30 am – 6:00 pm	70
	6:00pm – 7:30 am	75

The relevant noise limits for all nearby receivers during site working hours of 7:30 am – 6:00 pm are therefore 70 dB L_{Aeq} and 85 dB L_{Amax}.

In cases where it is not possible to measure noise levels at 1 metre from the façade of a receiving building, NZS 6803 C7.2.7 provides guidance for internal noise assessment based on an internal limit 20 dB lower than the external limit, in this case giving a daytime internal noise limit of 50 dB L_{Aeq}.

In general accordance with the guidance in New Zealand Standard NZS 6803 and the objectives of both the ODP and ADP, it is common to permit higher noise limits during short-term high noise generating activities provided these are subject to implementation of the best practicable options (**BPO**) to control effects. This is due to the limited duration of such effects and the limited available options to mitigate associated noise effects from necessary construction activities.

3.2 Construction Vibration

The ODP does not contain specific construction vibration limits. However, the ADP specifies in Section NOISE-S2 that vibration from any construction, maintenance, earthworks and demolition activities must be measured, assessed, managed and controlled in accordance with the requirements of DIN 4150-3:2016 “Structural Vibration – Part 3: Effects of Vibration on Structures”.

This standard is commonly used throughout New Zealand to assess construction vibration from sites and received at buildings. This standard provides guideline vibration values that “when complied with, would not result in damage that could have an adverse effect on the structure’s serviceability.” For residential-type 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”.

The DIN 4150-3 guideline values for evaluating short-term and long-term vibration on structures are given in Table 4.

“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. “Long-term” vibrations are all the other types of vibration – that associated and similar to construction activities.

To provide a conservative approach, vibration levels from construction activities have been assessed against the “Long-term Vibration” limits.

Table 4 Guideline Values for Vibration to be Used when Evaluating the Effects of Short-term and Long-term Vibration on Structures (DIN 4150-3)

Line	Type of Structure	Guideline values for vi in mm/s				
		Short-term Vibration				Long-term Vibration
		Vibration at the foundation at a frequency of:			Vibration at horizontal plane of highest floor at all frequencies	Vibration at horizontal plane of highest floor at all frequencies
		1-10Hz	10-50Hz	50-100Hz		
1	Commercial type building	20	20-40	40-50	40	10
2	Residential type building	5	5-15	15-20	15	5
3	Listed buildings and sensitive to vibrations	3	3-8	8-10	8	2.5

4.0 Construction Assessment

4.1 Proposed Construction Works

At the time of writing, a detailed programme of construction works, hours and likely plant items (quantity and size) to be used on site are not finalised. Therefore, the assessment of demolition and construction noise has been based on the draft demolition plan and typically expected plant derived from experience working on similar projects. It is anticipated that the works would occur between 7:30 am and 6:00 pm on Mondays to Saturdays. No high noise generating work is proposed to occur on Sundays and public holidays.

Night work is proposed for a single night for the removal of the overhead pedestrian bridge through concrete cutting and crane removal, as this will require closing Jervois Quay to road traffic.

The estimated extent of works includes:

- Salvage and strip out of Section 1 of the site as shown in Figure 3 including vegetation removal, likely to include the use of chainsaws, a wood chipper, small bobcat and 5-20 ton excavator.
- Demolition of the carpark structure in Section 1 as shown in Figure 3 with a 45 ton excavator with a shear attachment.
- Leveling and backfill of Section 1 of the site with a 20-30 ton excavator with bucket attachment and compaction equipment.
- Separation and removal of the overhead pedestrian bridge over Jervois Quay with concrete cutting and mobile crane, and demolition of the supporting bridge structures on both sides of Jervois Quay with a 20 ton excavator with rock-breaking attachment.
- Following removal of building structures in Section 1, vegetation removal to also occur in Section 2 of the site as shown in Figure 4.

- Demolition of concrete structures within Section 2 with a 20 ton excavator with rock-breaking attachment.
- Leveling and backfill of Section 2 of the site with a 20-30 ton excavator with bucket attachment and compaction equipment.

Figure 3 Section 1 Demolition Plan

Figure 4 Section 2 Demolition Plan

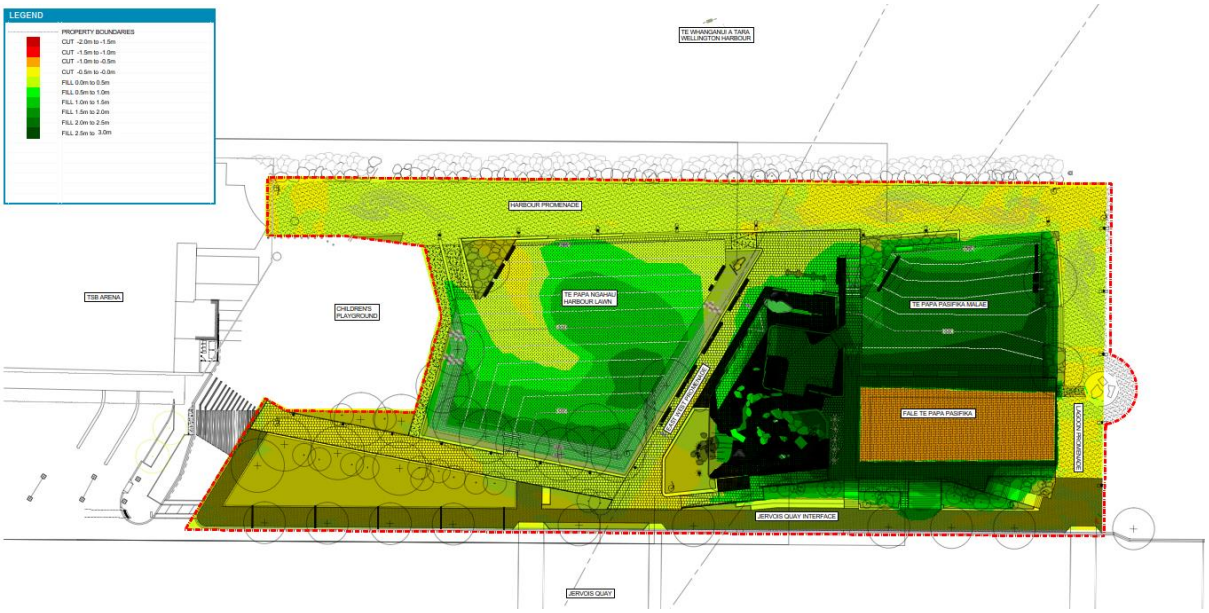

Figure 5 Cut and Fill Plan

The approximate plan view distances from the identified construction activities relative to each identified receiver in Figure 2 are provided in Table 5. These distances do not consider screening from other buildings and structures and are therefore conservative.

Table 5 Approximate Shortest Distance from Receivers to Construction Activity

Receiver	Address	Approximate distance to Construction Activity (m)			
		Section 1	Section 2	Overbridge Removal	Cut and Fill
R1	Shed 6	150 m	85 m	230 m	40 m
R2	TSB Arena	120 m	60 m	200 m	5 m
R3	1 Victoria Street	97 m	75 m	185 m	26 m
R4	58 Jervois Quay	26 m	54 m	63 m	26 m
R5	2 Harris Street	26 m	60 m	5 m	26 m
R6	City Gallery	100 m	165 m	66 m	100 m
R7	Wellington Rowing Club	66 m	130 m	95 m	66 m
R8	Wharewaka Function Centre	130 m	195 m	150 m	130 m
R9	Michael Fowler Centre	140 m	220 m	120 m	140 m
R10	Chews Lane Apartments	210 m	220 m	180 m	180 m

4.2 Noise

A summary of equipment and their reference sound pressure levels has been provided in Table 5. These sound pressure levels are based on measurements undertaken of similar activities across New Zealand. The noted setback distances to compliance have been calculated in accordance with the methodology in NZS 6803 and include facade corrections.

Location of Noise Sources

Generally, construction work are internalised within the site boundary (located away from the boundary) due to accessibility and safety. It is assumed that the body of an excavator is typically 5 metres or greater inward from the excavation location due to the reach of the excavator arm.

For compaction works, the main noise source can be located at the edge of the compaction locations. These setbacks are in addition to the distances provided in Table 4.

Table 6 Plant Items and Typical Noise Emission Levels

Activity	Plant Item	Plant Noise Level at 10m	Approximate Setback Distance to Compliance with daytime limit (m)	
			Without Mitigation	With Mitigation [A]
Demolition	Excavator (20-30 ton) with bucket attachment	70 dB L_{Aeq}	14 m	6 m
	Excavator (45 ton) with shear attachment	80 dB L_{Aeq}	45 m	20 m
	Excavator (>20 ton) with rock-breaking attachment and acoustic shroud fitted	83 dB L_{Aeq}	63 m	28 m
Overbridge Removal	Concrete cutting	91 dB L_{Aeq}	158 m	71 m
	Mobile tracked crane	73 dB L_{Aeq}	15 m	6 m
Excavation	Excavator (5-20 ton) with bucket attachment	70 dB L_{Aeq}	14 m	6 m
Compaction	Vibratory plate compactor (<100 kg)	70 dB L_{Aeq}	14 m	6 m
	Vibratory 3 ton compaction roller	80 dB L_{Aeq}	45 m	20 m
General works	Chainsaw	75 dB L_{Aeq}	25m	11m
	Mobile Woodchipper	85 dB L_{Aeq}	79m	35m
	Onsite Generator	65 dB L_{Aeq}	8 m	4 m
Notes: (A) Based on the use of 2-metre high acoustically effective localised screening to block the line of sight between noise source and a receiver.				

Predicted Noise Levels

Construction noise levels have been predicted in accordance with NZS 6803 (including facade correction) and the calculation methods detailed in ISO 9613-2:1996 “Acoustics – Attenuation of sound during propagation outdoors – Part 2: General method of calculation”.

The following assumptions have been considered in the model:

- Maximum sound levels (L_{Amax}) during instant events in the order of 10 to 15 dB higher than those presented in Table 6.
- Temporary acoustically effective screening at least 2 metres high at the site boundary for the duration of the works. Figure 6 provides an indicative location for the minimum extent of site boundary acoustic screening, which may be required to

be repositioned based on changes to the demolition plan and any recommendations in the CNVMP.

- Localised acoustically effective screening at least 2 metres high to be provided as close as is practical to the following equipment:
  - Compaction activity (including compaction work along the waterfront promenade)
  - Overbridge Removal including use of mobile crane, concrete cutting and excavator mounted rockbreaking
  - Excavators used for demolition in Section 1 and 2 with either shear or rockbreaking attachments
  - Mobile woodchipping
- Please note that any acoustic barriers must be fitted with no gaps between panels or planks or between the barrier and the ground. The barrier material must typically at least 7 kg/m^2, such as plywood with a thickness of 12 mm or mass-loaded blanket products attached to a mesh fence/scaffolding.

Figure 6 Indicative Location of Acoustic Screening (yellow)

Based on the distances outlined in Table 5, the typical machinery in Table 6 and the mitigation measures described in Section 5.0, compliance with the noise criteria of 70 dB L_{Aeq} is predicted to be achieved at most surrounding receivers during most of the activities.

Noise levels above the external limits in NZS 6803 are anticipated at the *upper levels* of the following surrounding receivers during the following identified construction and demolition activities. This is due at least in part to the fact that localised screening will not provide fully effective mitigation due to the overlooking nature of the receivers. As these are locations where external measurements are impractical (being too high to measure at 1m from the façade) it is appropriate to assess compliance against the NZS 6803 internal noise limit for daytime activity of 50 dB L_{Aeq}. Internal noise levels are based on a 25-30 dB reduction across the façade of commercial buildings.

Section 1 Demolition works

- 58 Jervois Quay and 2 Harris Street
  - Worst case external noise levels of approximately 75 dB L_{Aeq} during demolition works with 45 ton excavator. Predicted internal noise levels of approximately 45 dB L_{Aeq} – **compliant** with NZS 6803 internal noise limits.
- 58 Jervois Quay and 2 Harris Street
  - Worst case external noise levels of approximately 80 dB L_{Aeq} during woodchipping activity. Predicted internal noise levels of approximately 50 dB L_{Aeq} – **compliant** with NZS 6803 internal noise limits.

Section 2 Demolition works

- 58 Jervois Quay
  - Worst case external noise levels of approximately 75 dB L_{Aeq} during woodchipping activity. Predicted internal noise levels of 45 dB L_{Aeq} – **compliant** with NZS 6803 internal noise limits.
- 58 Jervois Quay, 2 Harris Street and TSB Arena
  - Worst case external noise levels of approximately 70 dB L_{Aeq} during demolition works with excavator mounted rock breaking. Predicted internal noise levels of approximately 40 dB L_{Aeq} – **compliant** with NZS 6803 internal noise limits.

Overbridge Removal

Demolition and removal of the overbridge is proposed to occur over a single night. As this adjacent to the commercial building at and adjacent to 2 Harris Street it is recommended to undertake this work when this building is unoccupied and therefore when the noise limits do not apply. This is understood to be feasible due to the nature of the commercial receivers.

The nearest residential dwellings (which are likely to be occupied during night-time periods) have been identified as the Chews Lane Apartments, approximately 180 m away from the overbridge removal. The relevant night-time noise limits for this receiver are 45 dB L_{Aeq} external, and 25 dB L_{Aeq} internal.

Worst case external night-time noise levels of approximately 65 dB L_{Aeq} are predicted at this receiver during concrete cutting during the overbridge removal. This external level corresponds internal noise levels of approximately 35 dB L_{Aeq} – **exceeds** the NZS 6803 internal noise limits.

Compaction Works

- TSB Arena
  - Worst case external noise levels of approximately 90 dB L_{Aeq} during compaction works with a vibratory 3 ton compaction roller at times when works are closest in distance to TSB Arena, expected to last for approximately 3 days. Predicted internal noise levels of approximately 55 dB L_{Aeq} – **exceeds** NZS 6803 internal noise limits.
- 1 Victoria Street, 58 Jervois Quay and 2 Harris Street
  - Worst case external noise levels of approximately 75 dB L_{Aeq} during compaction works with a vibratory 3 ton compaction roller when works are closest to Jervois Quay. Predicted internal noise levels of approximately 50 dB L_{Aeq} – **compliant** with NZS 6803 internal noise limits.

It should be noted that there would be periods between the various activities where noise levels would be much lower. Noise levels during most of the construction period would be below the NZS6803 limits.

Assessment of Construction Noise Effects

Table 6 below describes the potential effects of construction noise levels. Please note that:

a) External noise levels are predicted 1-metre from the facade and include a 3 dB facade correction as per NZS 6803.

b) Internal noise levels assume closed windows, and a typical sound reduction of 25-30 dB expected for the commercial office buildings adjacent to this site and the façade of the dwellings on Chews Lane.

Table 7 Potential Construction Noise Effects

Internal Noise Level (dB L_{Aeq})	Location	Potential Effects Indoors
<45	Most of the time and at most of the surrounding receivers.	Unlikely to interfere with daily residential and commercial activities
45-50	Most of the time and at most of the surrounding receivers.	May be audible within the building if quiet activities are occurring. Concentration may begin to be affected.
50-55	58 Jervois Quay and 2 Harris Street (during wood chipping as part of Section 1, a short duration activity). TSB Arena (during the short duration of compaction nearest the Arena).	Annoyance for some occupants. Concentration may be affected but residential and office activities can generally continue. Sound levels for television, radio, and phone conversations would need to be slightly raised.
55-60	N/A	Concentration likely to be affected and phone conversations may become difficult. Television, and radio levels would need to be raised. If noise continues for extended periods, people are likely to seek respite by moving to another room.

Potential Night-time Effects

External noise levels during concrete cutting are conservatively predicted to reach up to approximately 65 dB L_{Aeq} at the Chews Lane Apartments. This may be able to be reduced if localised screening can safely be used, and our predictions do not account for screening from other buildings and structures. This would result in a worst-case internal noise level of approximately 35 dB L_{Aeq} inside the apartments (with windows closed). Whilst this level of noise may be audible at times it would not be expected to generally impact residents sleeping. Furthermore, effects would be limited as the overbridge removal activity is a short duration and only expected to occur over the course of one night. The resultant noise effects can therefore be considered reasonable.

The effects of the predicted construction noise infringement are considered reasonable and acceptable due to their temporary nature and the adopted BPO mitigation measures and management.

4.3 Vibration

The activities with the potential to generate significant vibration include compaction work and excavator mounted rock breaking for the demolition of concrete structures.

Table 8 summaries the anticipated distance from these activities at which vibration would be expected to comply with the DIN4150-3 vibration criterion for Commercial type buildings as surround the subject suite. These distances are based on measurements of similar activities.

Table 8 Plant Items and Typical Vibration Levels

Activity	Plant Item	Approximate distance to meet DIN 4150 guideline values (10 mm/s PPV)
Compaction	Vibratory plate compactor (<100 kg)	<1
	Vibratory 3 ton compaction roller	<3
Demolition	>20t Excavator with Rock-breaking attachment	<3

Based on the distances outlined in Table 5 the typical machinery in Table 8, compliance with the building damage vibration threshold criteria is predicted to be achieved at all the surrounding receivers.

There is potential for the generation of intermittent vibration by concrete-breaking (demolition works), 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 such as ensuring considered movement of large items and not dropping materials from height.

Notwithstanding that the requirements of the ADP can be met. vibration is likely to be perceptible during some of the works (vibration can be felt at levels as low as 0.3 mm/s PPV – significantly lower than the guideline values for cosmetic damage). This can give rise to concern related to potential damage even though levels are expected to be beneath the guideline values. These potential effects can be managed by way of providing advice before commencing construction (e.g., via letter drop) to avoid unexpected perceivable vibration giving rise to concern about property damage.

5.0 Management and Mitigation of Construction Noise and Vibration Effects

Standard and routinely employed measures are recommended to be implemented to mitigate noise and vibration. Such measures include the selection of plant which generates less noise and vibration, careful maintenance of plant and controlling ‘on-time’ of plant.

The following site-specific mitigation measures which, in combination with advising neighbours prior to commencing works, can be considered BPO and can assist in achieving acceptable construction noise and vibration outcomes:

- Acoustically effective screening at least 2.0m tall at the site boundary during demolition, excavation, rock breaking and compaction activities. The anticipated locations of acoustic screening are shown in Figure 6.

- Localised acoustically effective screening at least 2.0m tall to be implemented between the works and receivers where safe and practical to do so during overbridge removal and compaction activity.
- To reduce the potential noise effects on pedestrians utilising waterfront areas to the east of the site, acoustic screening is also recommended along the western edge of the waterfront promenade, as well as the northern edge of the lagoon promenade.
- The use of equipment no larger than necessary to undertake the works.
- Advise the immediate neighbours in writing, no less than three (3) days prior to demolition and compaction works commencing. The written advice should include details of the location of the works, the duration of the works, a phone number for complaints and the name of the site manager.
- Where practicable, scheduling of the works closest to the neighbouring properties to avoid periods where the buildings are occupied.
- Mitigation and management measures set out and implemented through a Construction Noise and Vibration Management Plan (CNVMP).
- Night works (overbridge removal, including concrete cutting and rock-breaking of the bridge support structures on the western side of Jervois Quay) to be undertaken when the immediate neighbouring commercial properties are likely to be unoccupied. Localised acoustic screening between the works and residential receivers on Chews Lane to be implemented, where safe and practical to do so.

Figure 7 Example of Localised Acoustic Screening (minimum 2.0m high)

6.0 Conclusion

SLR has assessed construction noise and vibration effects associated with the proposed Frank Kitts Park redevelopment in Wellington, including demolition and earthworks activity. Noise and vibration associated with the proposed demolition and earthworks activities have been considered against the Wellington City Plan requirements. The findings of the assessment are as follows.

- Noise and Vibration levels generated by demolition and earthworks are expected to generally comply with the identified permitted construction noise and vibration limits within the Plan.
- The permitted construction noise limits may be temporarily exceeded at the following properties:
    - During compaction works in Section 2, at TSB Arena, for a short duration.
    - At Chews Lane Apartments for one night.

These infringements are anticipated to occur for short periods, noting that the total construction period is more than 20 weeks, and therefore the infringements occur only during a negligible part of the overall works duration. During most of the works, noise levels are expected to be significantly lower than the permitted limits.

With consideration of the limited duration of these infringements, the resultant internal noise levels and the identified mitigation measures, the noise effects are considered to be reasonable.

To control noise and vibration effects throughout the construction of the development, it is recommended that a Construction Noise and Vibration Management Plan (CNVMP) be prepared and implemented.

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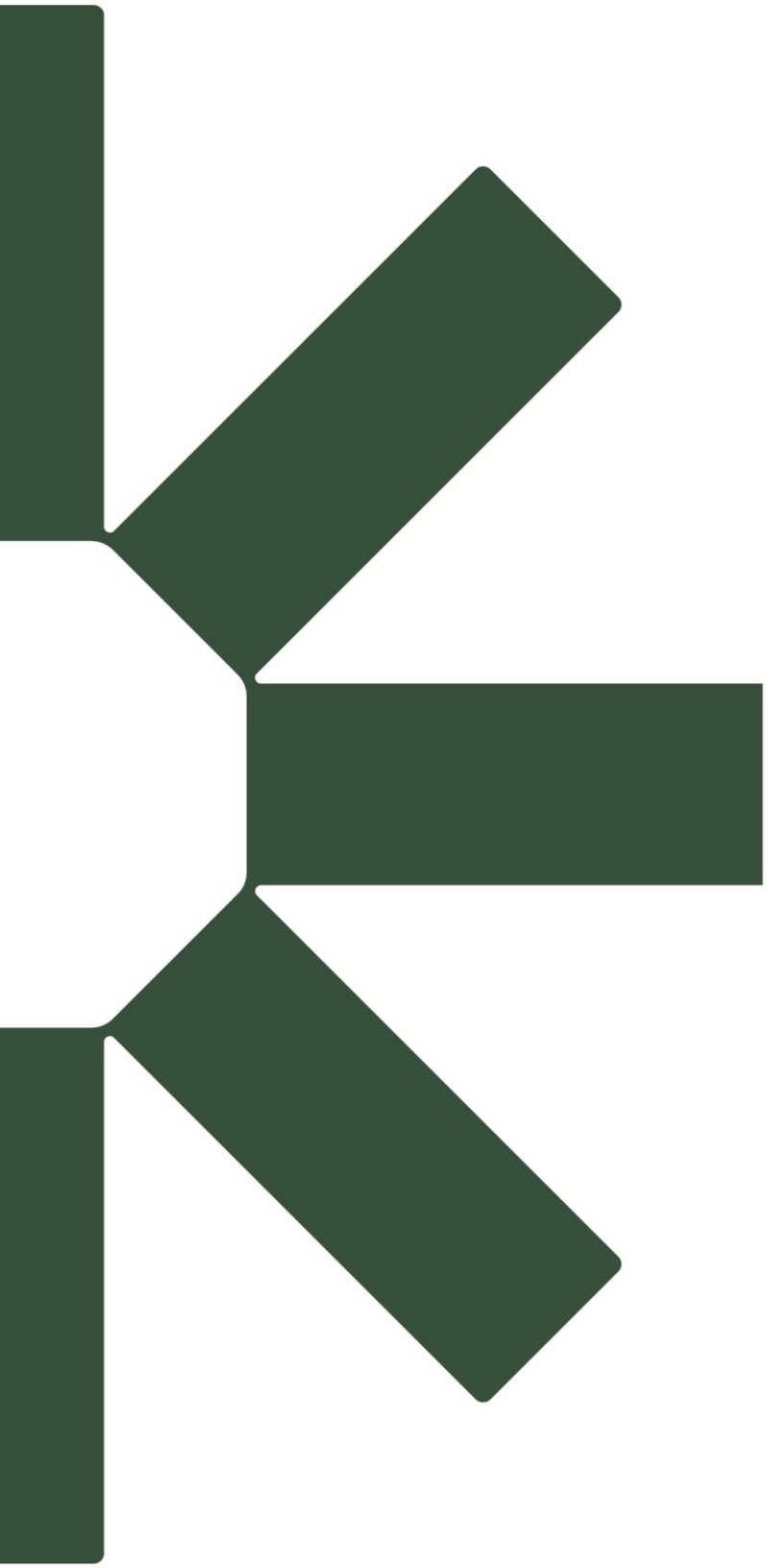

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