Construction Noise and Vibration Management Plan

Project: Peacockes to Whatukooruru Drive
Contract No: 1298-2022
Downer Job No: DN 1205

Environment ISO 14001

Contract Plan Issue Date	Document Preparation & Control Project Manager	Document Authorisation Project Director
30 Sept 2022	Craig Lingard	Toby Davies

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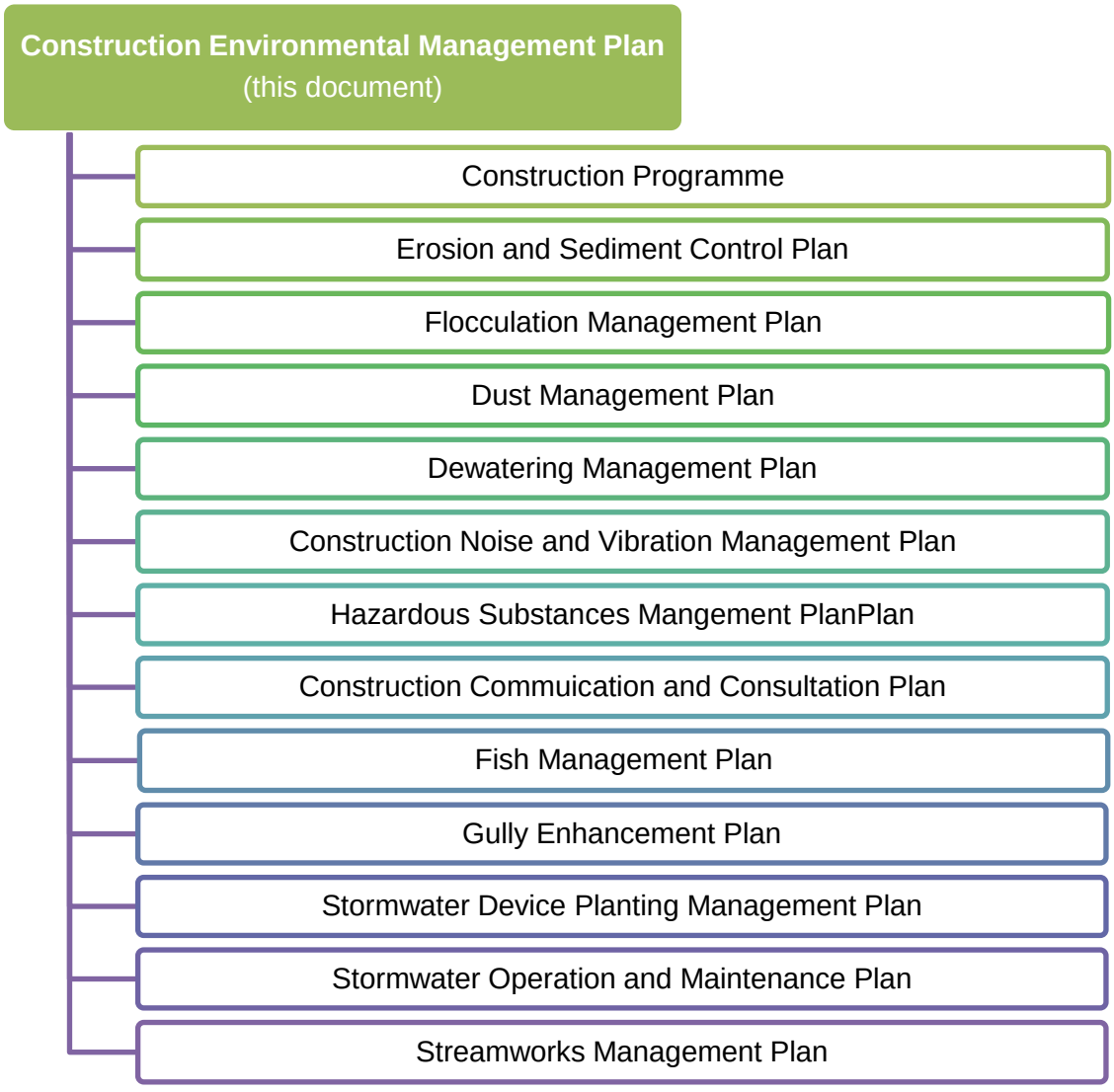
0 Introduction

Downer New Zealand Limited has been awarded a contract by Hamilton City Council (HCC) to undertake construction of Whatukooruru Drive, new major arterial road from Peacockes Road to Hall Road, and an accompanying upgrade of Peacockes Road. Works will be undertaken in Peacocke, a southern suburb of Hamilton.

Roading works include greenfield construction across existing pastoral land with two new bridges across the Mangakotukutuku stream and an unnamed tributary of the Mangakotukutuku stream, and the widening and resurfacing of the existing rural Peacockes Road.

As required by the Contract Documents, Resource Consents and Downer Environmental Management Policy in order to effectively manage the environmental issues on site a number of Environmental Management Plans are required.

These documents are incorporated into the overarching Construction Environmental Management Plan (EMP).



This Construction Noise and Vibration Management Plan (CNVMP) forms Appendix B of the CEMP.

1 CNVMP Purpose

The principal purpose of this CNVMP is to demonstrate to Hamiltion City Council (HCC), and the Waikato Regional Council how Downer will manage the project works to ensure compliance with the requirements of the Contract, Resource Consent and Designation Conditions.

This CNVMP highlights the minimum standards that must be complied with, the nature of the construction activities and machinery associated with the project works as well as best practicable options for management of construction noise and vibration associated with the project works. It is intended as a guide for those undertaking the works.

2 Objectives

The primary objective of the CNVMP plan is to provide a framework for the development and implementation of methodologies to avoid or reduce adverse construction noise and vibration effects on the health and amenity values of residents. In summary, this will be achieved by:

- Compliance with the construction noise and vibration performance standards
- The development of Area Specific Noise and Vibration Management Plans where compliance with these standards cannot practicably be achieved
- Monitoring of noise and vibration levels at locations where there is a risk of the criteria being exceeded
- Pre-construction building condition surveys for houses and other buildings at being subject to levels of vibration above the performance standard
- Implementation of effective temporary noise mitigation measures, e.g. barriers, where appropriate,
- Utilisation of permanent noise control measures (where these can be practically constructed early in the construction programme), and
- Communication and consultation to be undertaken with affected residents.

In order to remain effective, this CNVMP will be updated as appropriate, with the necessary approvals, throughout the course of the Project to reflect any significant changes associated with any construction methodologies or techniques or the surrounding environment.

This CNVMP will be implemented in accordance with the "*State Highway Construction and Maintenance Noise and Vibration Guide*" (NZTA, 2013) information, management tools and standards as specified on the NZTA website for the management of transport noise located at https://www.nzta.govt.nz/roads-and-rail/highways-information-portal/tools/construction-noise-calculator/..

3 Consent Conditions

11.0	CONSTRUCTION NOISE AND VIBRATION
	CONSTRUCTION NOISE AND VIBRATION MANAGEMENT PLAN
11.1	No later than forty (40) working days prior to the commencement of any stage of Construction Works, the Requiring Authority shall submit a Construction Noise and Vibration Management Plan (CNVMP) to the Territorial Authority's Chief Executive Officer or nominee for certification. The CNVMP shall be prepared by a suitably qualified and experienced expert. The objective of the CNVMP is to provide a framework for the development and implementation of identified Best Practicable Options to avoid, remedy or mitigate the adverse effects of noise and vibration during construction and to minimise the frequency, duration and degree of exceedance of the noise and vibration standards set out in Conditions 11.3and 11.4.
11.2	The CNVMP shall be prepared in accordance with the State Highway Construction and Maintenance Noise and Vibration Guide (NZTA, 2013), and include the procedures, methods and measures for the control of noise and vibration associated with all relevant Project Construction Works.
11.3	Construction noise must be measured and assessed in accordance with NZS 6803:1999 'Acoustics Construction Noise' (NZS 6803:1999). The construction noise limits for the purposes of the CNVMP that are to be complied with, as far as practicable, are as given in Table A below:

Day	Time	LAeg(15min)	LAFmax
Weekdays	0630h – 0730h	60 dB	75 dB
	0730h – 1800h	75 dB	90 dB
	1800h – 2000h	70 dB	85 dB
	2000h – 0630h	45 dB	75 dB
Saturday	0630h – 0730h	60 dB	75 dB
	0730h – 1800h	75 dB	90 dB
	1800h – 2000h	45 dB	75 dB
	2000h – 0630h	45 dB	75 dB
Sundays and Public Holidays	0630h – 0730h	45 dB	75 dB
	0730h – 1800h	55 dB	85 dB
	1800h – 2000h	45 dB	75 dB
	2000h – 0630h	45 dB	75 dB
Commercial and Industrial Receivers			
All	0730h – 1800h	75 dB	
	1800h – 0730h	80 dB	

11.4	The CNVMP must describe the measures adopted to seek to meet the Category A vibration criteria set out in Table B below, where practicable. If measured or predicted vibration levels exceed the Category A criteria, then a suitably qualified and experienced person shall be engaged to assess and manage construction vibration to comply with the Category A criteria. If the Category A criteria cannot be practicably achieved, the Category B criteria in Table B below shall be applied. If measured or predicted construction vibration levels exceed the Category B criteria, then construction activity shall only proceed if vibration effects on those buildings at risk of exceeding the Category B criteria are assessed, monitored and mitigated by suitably qualified persons. The criteria are to be applied to either predicted ground vibrations, or measured in accordance with ISO 4866: 2010 and AS 2187-2: 2006.

Receiver	Details	Cat A	Cat B	Location

	Occupied Dwellings	Monday to Friday 0630h – 2000h	1.0 mm/s ppv	5.0 mm/s ppv	Inside the building
		All hours Sunday and Monday to Saturday 2000h – 0630h	0.3 mm/s ppv	1.0 mm/s ppv	
	Other Occupied Buildings	At all times	2.0 mm/s ppv	10.0 mm/s ppv	Inside the building
	All Buildings	Transient vibration	5.0 mm/s ppv	BS 5228.2 Table B2 values	Building foundation
		Continuous vibration		50% of BS 5228.2 Table B2 values	
	Underground Services	Transient vibration	20.0 mm/s ppv	30.0 mm/s ppv	On pipework
		Continuous vibration	10.0 mm/s ppv	15.0 mm/s ppv	
11.5	In addition to those matters detailed in the State Highway Construction and Maintenance Noise and Vibration Guide, the CNVMP shall address the following aspects with regard to managing the adverse effects of construction noise and vibration: a) Identification of affected dwellings and other sensitive locations where vibration criteria apply, which shall include all houses located within 50 metres of general road construction activities, and 100 metres of piling, where those activities are undertaken on peat; b) Predicted noise levels set out as minimum compliance distances for key activities and items of plant and identification of any dwellings or other sensitive locations where works will be required within those minimum compliance distances; c) Mitigation options, including alternative strategies where full compliance with the noise criteria in Table A above and/or the vibration criteria in TableB above cannot practicably be achieved; d) Requirements for building condition surveys of critical dwellings, prior to and after completion of construction works and during the works if required (including all buildings measured or predicted to exceed the Category B vibration criteria contained in Table B above) and processes for repair of any damage caused by the works.				
11.6	Where noise or vibration predictions made in accordance with the CNVMP show that levels from a particular activity or at a specific location might exceed the limits set out in Condition11.3and/or 11.4, or where measurements show that compliance is not being achieved, the Requiring Authority shall prepare Schedules to the CNVMP. These Schedules shall; a) be prepared in accordance with the State Highway Construction Noise and Vibration Guide and include the relevant details specified in the Guide, including activity specific and/or location specific noise and vibration predictions and mitigation; b) include noise limits for the activity and an overview of mitigation options that have been considered, identifying which of those options are practicable; and c) be provided to the Territorial Authority Chief Executive or nominee at least five (5)working days in advance of the relevant works being carried out and implemented, for certification.				
11.7	In the event that either: a) the Territorial Authority certifies the Schedule, or b) fails to advise the Requiring Authority of any concerns it has with the Schedule, within the five (5)working days period following receipt, then the activities covered by the Schedule may be carried out.				
11.8	If the Territorial Authority advises the Requiring Authority of a concern it has with the Schedule, then no activity related to that concern shall be carried out until the matter has been addressed by the Requiring Authority to the satisfaction of the Territorial Authority.				

5 Key Construction Noise and Vibration Effects

The primary effects of construction noise relate to annoyance and disturbance of people. The primary effect of construction vibration relates to structural damage of dwellings, private structures such as garages or swimming pools and infrastructure assets such as roads and pipes. Secondary vibration effects relate to nuisance and disturbance of people, and the possible damage of property inside dwellings.

Responding to, and mitigating primary vibration risks often alleviates the secondary (nuisance) effects, and communication and prior warning of any high-vibration activities can mitigate the effects on residents and internal property.

A list of the predominant noise and vibration generating activities are outlined in Table 1.1 below:

Table 1.1: Noise and Vibration Generating Activities

Noise generating activities	Vibration generating activities
Clearing and vegetation removal	Tree felling
Earthwork Operations	Off-road fill transport Operation of large earthmoving plant Vibratory rollers for fill compaction
Drainage Construction	Operation of large excavation plant Vibratory rollers for fill compaction
Pavement Works	Vibratory rollers for road base course and surfacing works
Bridge construction and piling	Piling associated with bridge construction
Local road realignment and resurfacing	Vibratory rollers for road base course and surfacing works

Other construction machinery and activities, not outlined above, may produce noise and ground vibration also, but generally to a lesser degree.

6 Timeframes

The project works are planned to commence in October 2022 and continue until January 2025.

The project works will not occur continuously in the vicinity of individual receivers. Each receiver will be subject to varying noise and vibration levels throughout the construction period.

7 Hours of Works

B). Working Hours

The hours of construction work are limited by compliance with Construction Noise Limits and Traffic Management restrictions. Typically as follows:

- 7:00am to 7:00pm Monday to Saturday
- No work on Sundays
- No works after 1600h on the day prior to New Zealand Public Holidays.

Isolated works may require works outside the normal working hours to avoid traffic disruptions etc. These works will be approved by the Engineer prior to commencement.

In addition, there will be occasions where construction activities will be required outside of these hours that will exceed the noise limits defined in NZS 6803. These activities will typically be nightworks that are required due to traffic management constraints.

Where it is predicted (in particular nightworks) that the noise levels from a particular activity will or will likely exceed the limits an Activity Specific Construction Noise Vibration Management Plan (ASCNVMP) shall be prepared and submitted to the relevant territorial authority for approval prior to commencement of the activity.

8 Responsibility of the CNVMP

The Downer Project Manager, Craig Lingard, has the overall responsibility for meeting the requirements of this CNVMP. The Downer Environmental Manager will implement the plan, including all required monitoring and lead the review of results with appropriate communication to Local Authorities. Refer to the Environmental Management Plan (EMP) for more detail on the roles and responsibilities.

9 Management Plan Review

Commitment and continuous improvement to the Environmental culture by management is critical to its success and continuation. As part of continuous improvement changes to the CNVMP may be appropriate during the course of the project.

These changes may be a result of:

- *Any significant changes to construction activities or methods*
- *Key changes to roles and responsibilities within the Project*
- *Changes in industry best practise standards or recommended dust controls*
- *Changes in legal or other requirements (social and environmental legal requirements, consent conditions, NZTA objectives and relevant policies, plans, standards, specifications and guidelines)*
- *Results of inspection and maintenance programmes, logs of incidents, corrective actions, internal or external assessments*
- *The outcome of investigations into discharges of contaminants.*

Reasons for making changes to the CNVMP will be documented. A copy of the original CNVMP document and subsequent versions will be kept for the Project records, and marked as obsolete. Each new/updated version of the CNVMP documentation will be issued with a version number and date to eliminate obsolete CNVMP documentation being used.

In addition, Downer QA-PR007 Audits and Assessments requires an annual review of the Project Management Plan and subplans.

Any relevant revisions to the CNVMP will be submitted to the Engineer for review and approval at least 10 days before becoming operational.

10 Proposed Works

10.1 Project Overview

The Contract Works include the following activities:

a) Two new bridge (approx. 85m long each) carrying two lanes of traffic over the Mangakotukutuku Stream and an associated tributary ephemeral gully;

b) A new, greenfield section of arterial road extending over a distance of around 1.3km from Hall Road in the west to Peacockes Road in the east. The road carriageway will comprise a two lane road with a flush median strip, separated cycle lanes and pedestrian footpaths on either side;

c) The installation of service infrastructure including a stormwater management network extending along the road and into adjacent areas of drainage reserve with specific stormwater management devices including 1 x's stormwater wetland, 3 x's rain gardens, 1 x's attenuation basin and lengths of roadside swales;

d) Upgrade of an existing section of Peacockes Road comprising a 450m stretch of existing rural road carriageway extending northward from the planned intersection with the new Whatukooruru Drive carriageway, back towards Hamilton City..

e) Approximate volume of earthworks for road formation is described as 30,000m3 including a topsoil strip of around 22,000m3 , cut/fill of around 8,000m3 and importation of around an additional 40,000m3 of structural fill material.

f) Relocation of utility services;

g) Landscaping and landscape planting and maintenance;

10.2 Construction Activities

The construction activities required by the project are typical of large roading projects and includes:

- General enabling works including demolition and removal of structures, fencing, tree felling and removal, relocation of underground and overhead services, and the establishment of site entrances;
- Environmental controls along the route including sediment ponds, diversion bunds etc;
- Vegetation removal, site clearance; fencing, service relocations and other accommodation works;
- Topsoil Stripping and stockpiling;
- Cut to fill, cut to waste and import to fill to form the design alignment;
- Culvert installation within farm drains and streams;
- Bridge construction;
- Retaining Wall construction;
- Stream diversions;
- Stormwater drainage;
- Pavement Construction;
- Pavement Sealing;
- Pavement Marking, lighting and signage;
- Landscaping.

10.3 Noise and/or Vibration Sensitive Receptors

The Noise and Vibration Sensitive Receptors are those properties located along and near the project alignment. The sensitivity of each property is typically determined by the distance from the construction activity and the nature of the construction activity. The use of each property also influences the sensitivity; schools, rest homes, hospitals are considered more sensitive to dust, certain infrastructure, power pylons and telecommunication facilities are also considered sensitive.

Additionally, the type of construction of each dwelling or structure will also affect its sensitivity to vibration.

As the construction methodology is confirmed in each area an assessment will be made of those properties that are likely to or may receive construction noise or vibration in excess of the defined standards (refer sections 8 & 9).

As an initial assessment, those properties within 60m of the designation have the potential to receive construction noise in excess of the defined limits.

Additionally, those properties within 20m of the designation may also receive construction vibration in excess of the defined limits.

This initial assessment is considered conservative (i.e. less properties are expected to be actually affected) as in most locations, construction activities do not extend to the designation. This assessment is also based on 'typical' construction activities.

Based on the above assessment as the nearest dwelling is approximately 65m from the nearest construction activity (440 Peacockes Road), it is not anticipated that residents will be adversely affected by noise or vibration as a result of the works.

Figure 1: Sensitive Recievers Map (SP1)

11 Construction Noise

11.1 General

The works will meet the State Highway Construction and Maintenance Noise and Vibration Guide (NZTA, 2013) and include procedures, methods and measures for the control of noise associated with all relevant Project construction works, specifically complying with the limits below.

Construction Noise Criteria

Day	Time	LAeg(15min)	LAFmax
Weekdays	0630h – 0730h	60 dB	75 dB
	0730h – 1800h	75 dB	90 dB
	1800h – 2000h	70 dB	85 dB
	2000h – 0630h	45 dB	75 dB
Saturday	0630h – 0730h	60 dB	75 dB
	0730h – 1800h	75 dB	90 dB
	1800h – 2000h	45 dB	75 dB
	2000h – 0630h	45 dB	75 dB
Sundays and Public Holidays	0630h – 0730h	45 dB	75 dB
	0730h – 1800h	55 dB	85 dB
	1800h – 2000h	45 dB	75 dB
	2000h – 0630h	45 dB	75 dB
Commercial and Industrial Receivers			
All	0730h – 1800h	75 dB	
	1800h – 0730h	80 dB	

The shaded cells reflect when the majority of activities will take place and associated compliance noise levels. The key compliance indicators for the prediction and measurement of noise will be the assessment of the L_{10} and L_{max} noise levels as these are associated with annoyance or nuisance noise.

Construction noise will be monitored and assessed in accordance with the requirements of NZS 6803:1999 "Acoustics - Construction Noise". Methods are set out in detail in NZS 6801:2008 "Acoustics – Construction Noise", and summarised:

With a sound level meter of at least Class 2 (but preferably class 1)
At 1 metre from the most exposed façade of a receiving building and at 1.5m above ground
Where this is not possible, measurement at a representative position at a similar distance to construction, and
Shall be measured by suitably trained Project staff and external experts as required.

11.2 Construction Noise Emissions

The likely noise emissions are expected to be relatively consistent along the length of the works, with the same or similar plant and equipment and methodologies utilised.

The table below sets out 'activity' noise levels based on data obtained from other similar projects. Activity levels take into account (for example) that water carts are a transient source relative to a stationary receiver and therefore not audible for the full 30 minute sample period. The same may be expected for earthmoving trucks and/or scrapers, depending on the distance from the source of the material to the placement or fill area.

Construction Noise Indicative Minimum Compliance Distances

Plant/Machinery	dBA L_{eq} (at 10m)	Min Compliance Distance for Plant with no Mitigation (m)	Min Compliance Distance for Plant with 8dB Mitigation (screening)
D6 Bulldozer	91	108	43
Soilmec drilling rig (Auger)	78	24	10
140H Cat Grader	89	86	34
30T excavator	78	24	10
20T excavator	74	16	7
12T excavator	72	13	5
Truck & trailer	71	11	5
10,000 water cart	67	7	3
Cat 740 40T ADT	88	76	31

If works are required closer to the façade of any occupied dwelling that then distances outlined in the "Minimum Compliance Distance for Plant with no Mitigation" column of Table 3.2, where no natural or existing screening is available, then noise dampening measures and/or methodologies shall be implemented where practicable. Where the compliance levels can't be achieved, an Activity Specific Construction Noise Vibration Management Plan (ASCNVMP) shall be prepared.

11.3 Noise Mitigation Measures and Controls

11.4 Noise Barriers and Enclosures

In areas where the Project noise criteria may be exceeded, noise barriers shall be used where they provide effective mitigation (i.e. break acoustic line-of-sight and are close to either the source (preferable) or the receiver). In some cases it may be suitable to construct permanent noise barriers to mitigate effects from temporary noise, although due to the anticipated location of permanent barriers it is expected that the opportunity for this is limited.

Permanent (traffic) noise barriers will be:

- Implemented where practicable
- Installed early during construction where appropriate, and
- Constructed in their final form, but may utilise temporary materials such as plywood (this can then be replaced with permanent materials prior to opening of the project).

Temporary noise barriers will be:

- Utilised for those areas where no permanent noise barriers are required or where these cannot be practicably implemented early during construction
- Constructed of suitable material, typically plywood. Alternative barrier construction may include, but not limited to, fibre cement, shipping containers or mass-loaded vinyl
- Constructed so that they contain no gaps between boards, and
- Of sufficient height to interrupt line-of-sight between the receiver and the source.

Enclosures shall be used on generators (muff boxes) and pumps:

- When a noise barrier is not sufficient to achieve compliance with the Project noise criteria; and
- Where most appropriate, e.g. stationary plant such as generators or pumps.

12 Vibration

12.1 Performance Standards

The works will be formulated to comply with the Category A criteria in the following table, and where this is not practicable, to meet the Category B criteria as a minimum. The criteria are to be applied to either predicted ground vibrations, or measured in accordance with ISO 4866, 2010 and AS 2187-2:2006.

Construction Vibration Criteria

Receiver	Details	Cat A	Cat B	Location
Occupied Dwellings	Monday to Friday 0630h – 2000h	1.0 mm/s ppv	5.0 mm/s ppv	Inside the building
	All hours Sunday and Monday to Saturday 2000h – 0630h	0.3 mm/s ppv	1.0 mm/s ppv	
Other Occupied Buildings	At all times	2.0 mm/s ppv	10.0 mm/s ppv	Inside the building
All Buildings	Transient vibration	5.0 mm/s ppv	BS 5228.2 Table B2 values	Building foundation
	Continuous vibration		50% of BS 5228.2 Table B2 values	
Underground Services	Transient vibration	20.0 mm/s ppv	30.0 mm/s ppv	On pipework
	Continuous vibration	10.0 mm/s ppv	15.0 mm/s ppv	

*** 'Other occupied buildings' includes daytime workplaces such as offices, community centres etc. but not industrial buildings. Educational facilities, hospitals, rest homes etc. would fall under the occupied dwellings category.**

Vibration levels shall be measured in accordance with standards above by trained project Environmental Advisors and vibration specialists as required.

12.2 Vibration Category A

The Category A vibration performance standards identify the levels at which vibration tends to create an 'annoyance' effect for humans which may then result in a response such as a complaint to the Project. At these levels, the vibration will not result in damage to buildings or fixtures, although residents may perceive this as possible.

The standard addresses human response for dwellings will be undertaken during both daytime and night time whereas occupied workplaces (excluding industrial) will only be undertaken at daytime.

Criteria for unoccupied buildings are given in relation to building damage, not annoyance.

If measured or predicted vibration levels exceed the Category A criteria, then a suitably qualified and experienced person shall be engaged to assess and manage construction vibration to comply with the Category A criteria.

If the Category A criteria cannot be practicably achieved, the Category B criteria shall be applied.

12.3 Vibration Category B

Category B is designed to protect buildings against damage, but retains a higher degree of protection for dwellings at night-time to manage annoyance.

12.4 Vibration levels higher than Category B

If measured or predicted construction vibration levels exceed the Category B criteria, then construction activitiy shall only proceed if vibration effects on those buildings at risk of exceeding the Category B criteria are assessed, monitored and mitigated by suitably qualified persons. The criteria are to be applied to either predicted ground vibrations, or measured in accordance with ISO 4866:210 and AS 2187-2: 2006.

12.5 Vibration Mitigation Measures and Controls

12.5.1 Vibration barriers and isolators

Vibration barriers can provide limited attenuation for ground-borne vibration. Accordingly, the practicability of implementing vibration barriers shall be assessed on a case-by-case basis by a suitably qualified and experienced specialist.

Vibration barrier options include, but are not limited to; open trenches, backfilled trenches, concrete-filled trenches, sheet pile walls, concrete pile walls and grout curtains.

The required depth of the barrier is based on the frequency characteristics of the vibration source.

Vibration isolators (such as suitably specified rubber pads) can provide limited attenuation for items of fixed plant, including stationary excavators.

12.5.2 Vibration from excavator use

Any particular soft ground conditions in the vicinity of the new bridge mean that the weight-shift associated with vigorous excavator operation can generate significant vibrations. Excavators must be operated smoothly, avoiding the following movements:

- Banging of the ground with the bucket or any other attachment. Any compaction should be carried out by a compactor;
- Sudden changes of direction or quick rotations of the chassis, particularly when on an incline; and
- Load-spreading platforms would also mitigate vibration effects of weight-shifting.
- Restrict plant tracking over services with low cover to minimise displacement risk
- Limit vibration inducing activities near early age / setting concrete

12.6 Building and Structure Condition Surveys

At least 40 working days prior to starting adjacent excavation activities, with the approval of the owner(s) of each property, an independent consultant will be engaged to undertake a pre- excavation condition inspection of necessary structures (inclusive of the dwelling, accessory buildings, retaining walls, sealed driveways (and culverts), tennis courts and swimming pools) on the following properties:

- All properties with structures within 50 metres of the designation boundary where only cut and fill earthworks are proposed; and
- All properties with structures within 100 metres of the designation boundary where piling activities are proposed.

All pre-existing culvert structures within 50m of the project works (cut/fill or piling activities), including where access tracks are provided. In this regard, the Contractor is directed to a pre-existing thin-walled culvert located on the existing driveway (and within the common-shared access location), as shown on the proposed (construction) access track plan (Sheet 146000-002A-0031).

Figure 2: Structures that may require pre and post construction building condition surveys

The pre-excavation condition inspection shall identify, measure and record all exterior cracks (or damage) and other features that may be subject to movement.

With the exception of the pre-existing culvert described above, between 12 and 15 months after completion of the adjacent excavation activities, on the request of the relevant property owner(s), an independent consultant will be engaged to undertake a post-excavation condition inspection of each relevant structure identified above. For the pre-existing culvert, condition inspections (surveys) shall be more regular (no more than 6-monthly and/or immediately upon any apparent evidence of change in condition and/or damage occurring), and immediately upon disestablishment of the access track.

The pre- and post-excavation condition inspections of each property (or structure/culvert) shall be compared, and any differences in the structure's condition shall be identified within a separate Comparison Report. The Comparison Report shall identify any damage that is deemed (by the independent consultant) to be attributable to construction-related movement of the building/structure/culvert (such as cracking, settling, and other vibration/movement related damage).

Copies of the relevant pre- and post-excavation condition inspection reports prepared in accordance with the above shall be provided to the property owner(s) within 10 working days of each inspection being undertaken. A copy of the relevant Comparison Report prepared shall be provided to the property owner(s) within 30 working days of the date of the post-excavation condition inspection.

Any damage to the structure's inspected above, which is identified in the Comparison Report will (subject to property owner(s) approval) be remedied, as soon as reasonably practicable. If

the property owner(s) do not provide such approval, no remedial works are required to be carried out.

13 Utility Assets (WEL)

WEL Networks high voltage underground and overhead cables are located within the works. All works in the vicinity of WEL Networks assets shall be in accordance with the statutory requirements and NZECP 34:2001 and vibration restrictions.

14 Management Procedures and Mitigation Measures

Noise and vibration management and mitigation measures that shall be implemented throughout construction of the Project are outlined below.

Any appropriate management and mitigation measure shall be implemented and installed in the relevant location prior to the construction works commencing that have been identified to cause an exceedance of the performance standards.

14.1 Notification and Consultation

Notification of directly and indirectly affected parties shall be undertaken as per the Construction Communication and Consultation Plan (CCCP), appended to the EMP. In summary, the CCCMP provides a framework to:

- Inform the community of construction progress
- Engage with the community in order to foster good relationships and to provide opportunities for learning about the Project
- Provide early information on key Project milestones, and
- Respond to queries and complaints (Complaints and Compliments procedure).

Specifically relating to noise and vibration issues, notification of and consultation with affected parties shall be carried out at least seven days prior to commencement of work. All occupied buildings within 200m of the construction activities will be notified. The details of such notifications will be confirmed to the Engineer. In addition, Downer will seek face to face meetings with those properties identified as Potentially Affected Sensitive Receptors.

14.2 Training of Personnel

All personnel on site will be made aware of the importance of operating in the least disruptive manner. All personnel working on the Project shall be familiar with, and responsible for, implementing this CNVMP.

Noise risk and mitigation aspects will be outlined in detail in the project induction that all staff and contractors must complete. Noise and vibration matters will also be regular topics at the daily, weekly and monthly tool box meetings.

A training and competency register will be maintained by the Project Team to induced specific training activities regarding Construction Noise and Vibration.

14.3 Mitigation Options

In close proximity to residences, high-noise and/or vibration, activities shall be scheduled for the daytime where practicable, and avoided during the night-time. The specific mitigation measures specifically applicable to vibration and construction noise generating activities are also noted.

14.4 Hierarchy of mitigation options

In the event that potential non-compliance with the construction Project criteria is predicted, or in the event of measurement showing non-compliance with the these criteria, an activity specific management plan will be prepared.

Appropriate mitigation options will be considered and implemented following the hierarchy set out below. Each question shall be considered in sequence before moving onto the next one.

1. Have equipment and methodologies been chosen that reduce the overall noise from the activity? Can quieter alternative equipment or methodologies be practicably implemented?
2. Is it imperative that night-time works be undertaken, or can works be re-scheduled to daytime?
3. Can temporary construction noise or vibration barriers be erected or installed within the designation, which provide effective shielding of the equipment/activity?
4. Can the works be sequenced to avoid sensitive times for neighboring residents/businesses, e.g. can works be scheduled for school holidays?
5. Have potentially affected persons been contacted and implications discussed/feedback taken into consideration in the planning of this activity?
6. When appropriate, have residents been offered temporary relocation to suitable alterative accommodation, and have they accepted the offer?
7. Is the activity of long duration and likely to impact on the same group of residents for an extended time? Is there a justified case for affected houses to be upgraded to provide a suitable internal noise environment during this activity, e.g. by installing alternative ventilation/improved glazing? (Advice from a suitably qualified acoustic engineer required)

14.5 Monitoring Requirements

Monitoring will be undertaken:

- Prior to works occurring to establish baseline noise levels
- During relevant stages of work, i.e. excluding break times but including variations in activities over the measurement period
- At the onset of high noise and/or vibration generating activities, e.g. during piling in close proximity to dwellings or when equipment operates within its risk contour in relation to vibration
- As and when required during critical phases of construction (i.e. when potential exceedance of the Project criteria is predicted, e.g. night works)
- In response to reasonable complaints about noise, vibration or re-radiated noise (due to vibration) being received. Generally, a reasonable complaint involves a complaint from a member of the public in relation to a noise/vibration issue that can be correlated to construction works on the project; and
- By a suitably qualified and experienced acoustic/vibration specialist, or a member of the site Environmental Team with suitable qualifications/experience.

Reporting of the noise and vibration monitoring results will be made available, if required to, in accordance with the project Designation conditions and/or as committed to within the CNVMP or ASCNVMP. These aspects will also be discussed routinely at the monthly compliance meetings.

15 Activity Specific Construction Noise and Vibration Management Plans (ASCNVMPs)

As part of the Downer construction planning procedures a 'Work Pack' methodology is used. This operation utilises a documented iterative procedure to plan the works. This planning includes an assessment of construction activities and methodologies at an initial stage to confirm what subsequent management plans and or approvals are required and or have been completed. These potential additional plans can include:

- Site Specific Erosion and Sediment Control Plans;
- Traffic Management Plans;
- Temporary Work Designs;
- Ecological surveys or mitigation; etc

As part of this process an assessment will be made of the potential construction noise and vibration.

Where it is predicted that the levels from a particular activity will or will likely exceed the limits set out in the noise and vibration standards, or where measurements show that compliance is not being achieved, an Activity Specific Construction Noise Vibration Management Plan (ASCNVMP) shall be prepared and submitted to the Engineer for approval.

Wherever possible the ASCNVMP will be submitted at least 7 working days prior to the proposed works commencing, and works will not commence until approval from the Engineer has been received.

The ASCNVMP will include the following:

1. A description of the activity (including duration), plans and machinery that is expected not to comply with the noise and/or vibration limits
2. Provide predicted levels for all receivers where the levels will not be compliant with the limits in designation conditions (refer Appendix 1)
3. Describe the mitigation measures proposed to reduce the noise and/or vibration levels as far as practicable, including any options that have been discounted due to practicality, cost or any other reason, and
4. Description of alternative mitigation of the impacts that is acceptable to affected parties (e.g. temporary accommodation during the specific activity).

The ASCNVMP will also cover the following matters:

5. Noise and/or vibration sources, including machinery, equipment and construction techniques to be used and their scheduled durations and hours of operation including times and days when work causing construction noise and/or vibration would occur
6. The construction noise and vibration criteria for the project
7. Identification of affected houses and other sensitive locations where noise and/or vibration criteria apply
8. Predicted noise levels set out as minimum compliance distances for key activities and items of plant and identification of any dwellings or other sensitive locations where works will be required within those minimum compliance distances;
9. Mitigation options, including alternative strategies where full compliance with the noise criteria from NZS 6803: 1999 and the vibration criteria cannot practicably be achieved;
10. Methods and frequency for monitoring and reporting on construction noise and vibration;
11. Contact numbers for key construction staff, staff responsible for noise and/or vibration assessment; and
12. Procedures for maintaining contact with stakeholders, notifying of proposed construction activities and handling complaints about construction noise and/or vibration.

16 Complaints

Any Environmental Management System (EMS)-related complaints will be dealt with as detailed in the CCCP.