StylesGroup
Acoustics & Vibration Consultants

CONSTRUCTION NOISE AND VIBRATION MANAGEMENT PLAN

PINE TREE REMOVAL
WESTERN SPRINGS

PREPARED FOR

Kotahi Projects

DATE

19 March 2021

Construction noise and vibration management plan prepared by Styles Group for Kotahi Projects.

REVISION HISTORY

Rev:	Date:	Comment:	Version:	Prepared by:	Reviewed by:
1	26/02/21		Draft	Kelly Leemeyer, MASNZ Consultant Styles Group	Jamie Exeter, MASNZ, Assoc. NZPI Senior Consultant Styles Group
2	1/03/21		Final Draft	Kelly Leemeyer, MASNZ Consultant Styles Group	Jamie Exeter, MASNZ, Assoc. NZPI Senior Consultant Styles Group
3	19/03/21		Final	Kelly Leemeyer, MASNZ Consultant Styles Group	Jamie Exeter, MASNZ, Assoc. NZPI Senior Consultant Styles Group

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Appendices

1.0 Introduction

Styles Group has been engaged by Kotahi Projects to prepare a Construction Noise and Vibration Management Plan (CNVMP) for the felling and removal of pine trees. The construction works will take place in the reserve to the south of West View Road and west of Western Springs Stadium and Park.

The objective of this CNVMP is to identify, require and enable the adoption of the best practicable option to minimise adverse construction noise and vibration effects.

This CNVMP has been prepared in accordance with the project conditions and Appendix E of NZS 6803:1999 *Acoustics – Construction noise*. It is designed to ensure appropriate management of noise and vibration effects during the construction period.

This CNVMP is a 'living document' that will be updated as the works progress and if changes become necessary. It will be certified by Auckland Council once resource consent has been granted for the works and the construction methodology for the development is confirmed.

A glossary of the acoustical terms used in this document is provided as Appendix A.

2.0 Contacts

The contact for queries or complaints regarding the project, and the manager responsible for implementing this CNVMP is:

Karl McLeod	ph: 0274 440 876

The consultant engaged to provide construction noise and vibration monitoring and advice is:

Styles Group Acoustics & Vibration Consultants	ph: 09 308 9015

3.0 Scope of works

The project will involve the following construction activities:

- Formation of an access road through the site. Crushed aggregate will be delivered to site using trucks and will be spread and track rolled with a 20-25t excavator.
- Formation of a works track through the site. Material will be cut from the uphill side of the track and placed on the downhill side of the track to form the track. 3 culverts will be installed along the length of the track.
- Tree felling. This will be undertaken using a variety of methods depending on the requirements for each tree. Felling may be undertaken manually with chain saws or may be machine (excavator) assisted to push, grapple or pull the

trees. If a tree cannot be felled whole, it will be climbed by an arborist and dismantled in sections using a chainsaw.

- Trees that have been felled will be hauled to a stockpile area using an excavator and will be processed using a wood chipper fed by an excavator. It is anticipated that 40% of the chipper operation will be in staging area 4. The remainder of the time the chipper will be used along the length of the access track and staging areas. Processed material will be dispersed into suitable areas on site using an excavator.
- Once tree felling work has been completed, the track area will be reinstated. Material that was excavated to form the works track will be excavated again and placed back along the alignment to reinstate the track to its original state. The material will be shaped to reinstate the original gradient of the area. Minimal compaction work may be required using the excavator.

The equipment used during each stage of works is set out below in Table 1.

Table 1: Equipment to be used on site

Activity	Equipment used on site
Site establishment	Machines brought to site by truck
Formation of tracks and access roads using excavator	1 excavator
Tree felling, extraction and processing	2 excavators, 3 chainsaws and 1 wood chipper
Reinstatement of track and site disestablishment	1 excavator

4.0 Project conditions

The conditions of consent with respect to construction noise and vibration emissions are set out below. Please refer to Sections 6.0 and 7.0 of this draft CNVMP for interpretation of the construction noise and vibration limits in accordance with the working hours and receiving sites.

Construction Noise and Vibration Management Plan

17. The consent holder shall prepare a Construction Noise and Vibration Management Plan (CNVMP). The CNVMP shall identify the best practicable option for management and mitigation of all construction noise and vibration. The CNVMP shall as a minimum include but not be limited to the following information:

a. Construction noise and vibration limits;

b. Identification of the most affected premises where there exists the potential for noise/vibration effects;

c. Description and duration of the works, anticipated equipment and the processes to be undertaken;

d. Hours of operation, including specific times and days when construction activities causing noise/vibration would occur;

e. Mitigation options where noise/vibration levels are predicted or demonstrated to approach or exceed the relevant limits. Specific noise/vibration mitigation measures must be implemented which may include but are not limited to; acoustic screening, time management procedures and alternative works method technologies;

f. The erection of temporary construction noise barriers where appropriate;

g. Schedule and methods for monitoring and reporting on construction noise/vibration;

h. Details of noise/vibration monitoring to be undertaken or in the event of any complaints received. The results of such monitoring shall be submitted to council within one week of receiving the complaint;

i. Implementation of a complaint management system with contact numbers for the community liaison person and key construction staff responsible for the implementation of the CNVMP and complaint investigation. This system should include procedures for maintaining contact with stakeholders, notifying of proposed construction activities and handling of noise/vibration complaints, including through the project website;

j. Notification shall be provided to the owners and occupiers of adjacent buildings prior to construction activities commencing on the site;

k. Training procedures for construction personnel; and

l. The completion of before and after external building condition surveys with respect to dwellings at 14, 16, 18, 20, 22, 24, 26 and 28 Westview Road (unless the owner of one of those properties has confirmed they do not require a survey or a reasonable attempt has been made to contact the owner to carry out a survey, and agreement has not been obtained), such surveys:

- To be undertaken by a suitably qualified independent engineering professional or suitably qualified independent building surveyor; and
- To be provided to the Council's Team Leader Monitoring (Central)
- To include:
    - a description of the type of foundations,
    - existing levels of damage considered to be aesthetic or superficial in nature;
    - existing levels of damage considered to affect the serviceability of the building where visually apparent without recourse to intrusive or destructive investigation;
    - an assessment as to whether existing damage may or may not be associated with actual structural damage and an assessment of the

susceptibility of the buildings/ structures to further movement and damage;

- photographic evidence of existing observable damage

18. The CNVMP shall be submitted to the Council's Team Leader Monitoring (Central) for certification prior to commencement of the works. The consent holder shall implement the approved CNVMP for the duration of the construction works and keep an updated copy at the site.

Construction hours, noise and vibration

50. The consent holder shall ensure that the tree felling and processing activities are only undertaken between the hours of 7.30am – 6pm Monday to Friday (excluding Public Holidays).

51. Construction works shall not exceed 75 dB LAeq and 90 dB LAFmax measured or assessed at 1m from any occupied building located on any other site. An occupied building is where people occupy the space whilst the works are in progress.

52. The consent holder shall ensure that prior to the use of any chainsaw within 18 metres of the facade of any dwelling:

    i. Consultation with the occupier of the dwelling is carried out to agree upon a suitable date/time that the works within 18 metres can be undertaken when the dwelling is vacant; or

    ii. Alternative noise mitigation or works methodology shall be implemented in order to achieve compliance.

53. Construction works shall not be undertaken within 50m of the Western Springs Stadium site western boundary when the site is being used for any noise sensitive activity but does not include motorsports, concerts or music events where the receivers are more than 50m away from the western boundary of the stadium.

54. Where works on the site are creating vibrations, that in the opinion of the Council's Team Leader Monitoring (Central), constitute an unreasonable disturbance beyond the boundaries of the subject site that may exceed the AUP(OP) permitted vibration standard, the consent holder shall cease works until a suitably qualified expert has been engaged to undertake monitoring of the works and provide confirmation that peak particle velocities measured on any foundation or uppermost full storey of any building not located on the subject site, do not exceed the limits set out in Table 1 of German Standard DIN 4150 Part 3:1986 "Structural Vibration in Buildings – Effects on Structures."

5.0 Duration of works and hours of construction

Construction works are expected to take 4 to 6 weeks to complete.

The indicative programme for the works is set out in Table 2.

Table 2: Indicative programme of works

Activity	Time frame
Site establishment	5 hours
Formation of tracks and access roads using excavator	5 working days
Tree felling, extraction and processing	15 working days, including 5 days with a wood chipper
Reinstatement of track and site disestablishment	2 days

Noisy construction works will be undertaken on Monday to Friday, between 7.30 am and 6.00 pm only. Quieter activities may be undertaken outside of these hours. There will be no noisy works in the evening, on public holidays or on the weekend.

In accordance with Condition 53, works will not be undertaken within 50 m of the Western Springs Stadium site western boundary when the site is being used for any noise sensitive activity. This does not include motorsports, concerts or music events where the receivers are more than 50 m away from the western boundary of the stadium.

6.0 Project noise performance criteria

The noise criteria for the project (prescribed by condition 51) is set out in Table 3 below:

Table 3: Applicable noise criteria for the works

Receiver	Noise limit L_{Aeq}	Noise limit L_{AFmax}
All receivers	75 dB	90 dB

All construction noise shall be measured and assessed at 1m from the facade of any occupied building in accordance with the New Zealand Standard NZS 6803:1999 Acoustics – Construction Noise.

The noise limits only apply at the facades of any buildings that enclose rooms that are occupied at the time of the work. For example, the noise limits do not apply to a building that may be vacant during the day when its occupants are at work or school

7.0 Project vibration performance criteria

In accordance with Condition 54, all construction works on site must comply with the guideline vibration limits set out in DIN 4150-3:1999.

The DIN 4150-3:1999 Standard is for the avoidance of building damage. The Standard uses a three-tiered classification system for buildings according to their susceptibility to vibration damage, as follows:

Category 1: Buildings used for commercial purposes, industrial buildings and buildings of similar design (Line 1);

Category 2: Dwellings and buildings of similar design and/or occupancy (Line 2);

Category 3: Structures that, because of their particular sensitivity to vibration, cannot be classified under lines 1 and 2 and are of great intrinsic value e.g. buildings listed buildings under preservation order (Line 3).

The DIN Standard is specifically concerned with the structure of the building, not the effect of the vibration on the people within the building. Assessment is in terms of a reduction in 'serviceability' as defined in the DIN standard, which includes minor cosmetic damage such as cracked plaster.

The DIN standard vibration limits for short-term vibration are reproduced below in graphical form as Figure 1. Line 2 of the DIN criteria is very typically applied to residential dwellings unless the receiving structure is particularly sensitive to vibration. A suitably qualified structural expert should be consulted: where there are concerns about a building's susceptibility to vibration; or where the appropriate assessment classification under DIN 4150–3:1999 requires confirmation.

Importantly, the DIN standard includes many other recommendations and prescribes more stringent limits for long-term vibration (which may induce fatigue or resonant movement). The DIN standard should therefore be referred to in full when being applied.

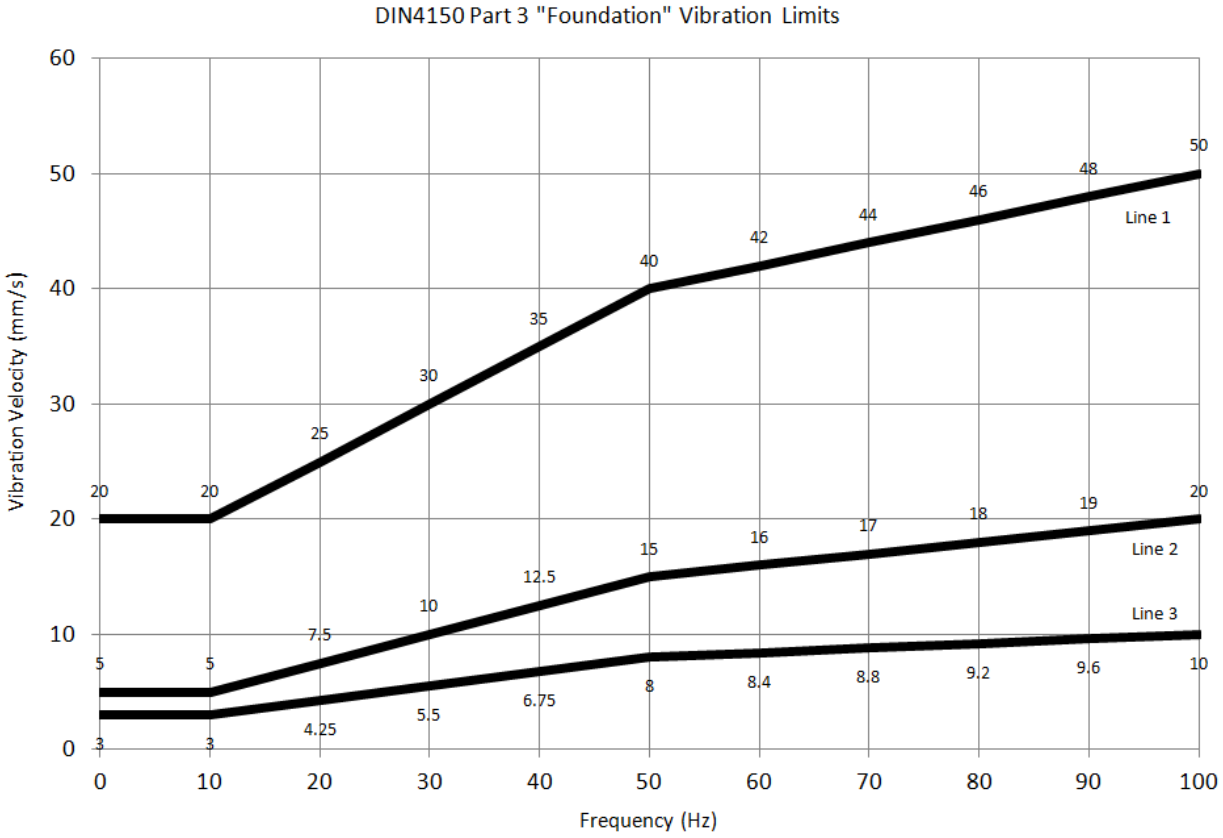


Figure 1: Curves for guideline values (short-term vibration) specified in DIN 4150-3:1999

All construction vibration will be measured and assessed in accordance with DIN 4150-3:1999 Structural Vibration – Part 3 Effects of vibration on structures.

8.0 Closest receivers

The nearest properties where construction noise and vibration will be experienced (receivers) are the Auckland Zoo, and 14, 16, 18, 20, 22, 24, 26 and 28 West View Road.

These properties in proximity to the works will experience the highest levels of construction noise and vibration (compared to more distant buildings). These receivers are identified in the attached Appendix B. Those more distant will be deemed to comply where the noise levels at the closest receivers are compliant.

Potential noise and vibration emissions are discussed in Section 10.0 *Likely Noise Emissions* and Section 12.0 *Activities Likely to Generate Vibration*. The separation distances detailed in Section 10.0 will be used at each stage of the works to identify where mitigation measures are required to allow compliance with the project limits at the nearest receivers.

9.0 Community liaison

The requirements for community liaison are set out in this section.

9.1 Before works start

At least 5 working days before works commence on site, all receivers within 100 m of the works area will be informed of the following information by letter drop:

i. A brief overview of the works

ii. The expected start date of works

iii. The expected duration of the works

iv. The days and hours of the week when works may be undertaken

v. The noise and vibration mitigation to be implemented

vi. The availability of noise and vibration monitoring to address any concerns

vii. Contact details for the receipt of any noise or vibration complaints or concerns.

A complaints register will be kept and maintained on site to record the details of any noise and vibration complaints received and the action taken in response to the complaint. The complaint management system is discussed in further detail in Section 15.0.

9.2 Before use of a chainsaw within 18 m of any dwelling

Where works with a chainsaw are required within 18 m of the facade of a dwelling, the occupiers of the dwelling shall be consulted. The purpose of the consultation is:

1. To agree upon a suitable date/time that the works within 18 metres can be undertaken when the dwelling is vacant; or

2. Determine any alternative noise mitigation measures or works methodologies that can be implemented in order to achieve compliance.

9.3 Additional liaison with Auckland Zoo

The project team has been in contact with Auckland Zoo to determine acceptable construction noise levels at the Elephant House. This has been undertaken in addition to the requirements of Section 9.1.

Ambient noise measurements and further consultation with Auckland Zoo will be undertaken before works start on site.

10.0 Likely noise emissions and separation distances

Table 4 sets out the minimum separation distances for noise sources on site that may require additional mitigation when used in close proximity to any occupied building. These are the shortest distances that the activities can be undertaken from the most exposed ground-level facade of the nearest occupied building whilst remaining compliant with the consented noise limits.

These separation distances have been calculated taking into account the location of the access track and chipping areas, local topography and the porous ground under the trees.

If works are required closer to an occupied building than the separation distances stated in the tables below, further noise mitigation measures, such as localised screening, will be required (see Section 11.0).

Table 4: Noise sources and calculated separation distances

Construction activity	Reference noise level 10 m from plant	Minimum distance for compliance (unmitigated)
Excavation with 20 - 25t excavator	71 dB	7 m
20 – 25t excavator loading wood chipper	91 dB	47 m
Petrol chain saw	79 dB	18 m
Electric chain saw	68 dB	<5 m

Where it is predicted or measured that any activity will exceed the noise limits for the project, Sections 11 and 15 of this CNVMP will be referred to and mitigation implemented wherever practicable to reduce the noise effects at the nearest occupied sites.

11.0 Noise mitigation measures

The contractor will take all practicable steps to reduce the noise associated with the works by implementing the noise mitigation measures listed below:

11.1 Controlling noise at the source

- Where possible, the quietest machinery and methods available will be used where practicable
- All machinery will be either new or in good condition upon its arrival at the site, and will thereafter be maintained in good condition throughout the entire

duration of the project. For example, all tracked plant will be greased to reduce squeaking

- Upon arrival at the site, the machinery and plant will be checked to ensure that it is not generating unnecessary noise, and will be rectified if necessary
- When machinery or plant is not required to be running, it should be switched off and not left idling
- Noisy plant and machinery should be strategically positioned on the site to reduce the effects on neighbours where practicable
- Where practicable, all plant and equipment shall utilise broadband reverse alarms in place of traditional pure tone 'beepers'
- The tail gates of trucks must be closed with care and not slammed or allowed to fall closed causing unnecessary noise
- Horns shall not be used under any circumstances unless in the case of an emergency
- Any radios or music played on site must be inaudible at the nearest dwellings
- All workers on site shall be familiar with the provisions of this CNVMP and made aware of the impacts of noise and the above methods that can be used to minimise noise emissions.

11.2 Acoustic screening of wood chipper

- If use of the wood chipper is required within 47 m of an occupied building, a 2.2 m high acoustic barrier will be constructed to screen the building. The barrier will be at least 10 m long, and will be solid with no gaps and have a surface mass of no less than 10 kg/m^2 (e.g. 20 mm timber)
- The screening should be located as close as practicable to the noise sources to improve its effectiveness.

11.3 Acoustic screening for the Elephant house at Auckland Zoo

- Prior to works commencing with the wood chipper in staging areas 4 or 5 (or the access track in between these areas) a 3 m high acoustic barrier will be constructed to screen the Elephant house at Auckland Zoo. The barrier will be at least 10 m long, and will be solid with no gaps and have a surface mass of no less than 10 kg/m^2 (e.g. 20 mm timber)
- The barrier should be located as close as practicable to the noise sources to improve its effectiveness
- The noisiest part of the chipper should be positioned near the middle of the barrier so there is approximately 5 m of screening either side

- Where possible and appropriate, quiet machinery and structures should be positioned to provide as much screening as possible to noisy equipment working on the site.

11.4 Works with a chainsaw within 18 m of the facade of a dwelling

The following noise mitigation measures can be used to achieve compliance with the consented noise limits if works with a petrol chainsaw are required within 18 m of the facade of a dwelling. These measures will only be required if works cannot be undertaken when the dwelling is vacant.

1. Only one chainsaw should be used within 30 m of the dwelling
2. If chainsaw work is being undertaken near ground level, an acoustic screen can be constructed to block line of sight between the chainsaw and the facade of the dwelling. The screen should be at least 2.2 m high, 6 m wide, solid with no gaps and have a surface mass of no less than 10 kg/m^2 (e.g. 20 mm timber)
3. If chainsaw work is being undertaken at an elevated position and cannot be screened, an electric chainsaw will be used if practicable. Use of an electric chainsaw will not require screening unless within 5 m of an occupied dwelling.

12.0 Activities likely to generate vibration

The vibration received within the nearest buildings will depend largely on the equipment used, the ground conditions, how the plant is operated (Section 11.1), the separation distance, and the response of the building itself.

The wood chipper will only be used in the access track area. The closest building to the access track is 14 West View Road, which is approximately 45 m away. All other receivers are more than 50 m from the access track.

Excavators will be used along the access track, and may be used in different areas of the site and on the slopes if required for tree felling.

The operation of tracked excavators within 20 m of buildings has the potential to generate vibration that may be perceptible within the buildings.

All plant on site will be operated in accordance with Section 13.0 to ensure vibration levels comply with the permitted limits at all times.

The results of any measurements undertaken to quantify vibration emissions from the site shall be used to populate and expand Table 5.

Table 5: Measured vibration values of plant on site

Date of measurement	Equipment measured	Activity	Distance (m)	PPV (mm/s)	Dominant frequency (Hz)
e.g.	*20 t excavator*	*Tracking slowly*	*10*	*0.6*	*30*

Where it is predicted or measured that any activity will exceed the vibration limits for the project, Sections 13.0 and 15.0 of this CNVMP will be referred to and mitigation implemented wherever practicable to reduce the effects at the nearest buildings.

13.0 Vibration mitigation measures

This section sets out general and specific construction vibration mitigation measures.

13.1 General mitigation measures

The following general vibration mitigation measures shall be observed at all times:

i. Where tracked plant items are to be used within 20 m of an occupied building the lightest model practicable shall be selected for the work to minimise vibration

ii. Excavator operators shall avoid banging buckets on the ground

iii. Excavator operators shall track the machines as slowly as is practicable when working within 20 m of an occupied building, (fast tracking across a site can generate high vibration levels)

iv. Workers shall be informed prior to the works commencing to ensure awareness of the impacts of vibration and the methods that can be used to minimise its generation.

13.2 Before and after external building condition surveys

In accordance with Condition 17l, before and after external building condition surveys must be undertaken at the dwellings at 14, 16, 18, 20, 22, 24, 26 and 28 Westview Road (unless the owner of one of those properties has confirmed they do not require a survey or a reasonable attempt has been made to contact the owner to carry out a survey, and agreement has not been obtained).

We understand that CLC Consulting has been engaged to undertake these building surveys and that the initial surveys will be completed before any works commence on site. Once works on site have been completed, CLC Consulting will undertake their final external building condition survey at the same properties.

14.0 Noise and vibration monitoring and reporting

This section sets out requirements for construction noise and vibration monitoring and reporting.

14.1 Noise monitoring and reporting

Noise measurements will be performed:

i. At the commencement of any activity within the unmitigated distances specified in Table 4 to determine whether further mitigation measures are required

ii. If, in the opinion of the Site Manager or Auckland Council, the noise from any activity on the site appears excessive

iii. Following the receipt of any reasonable complaint

The results of the monitoring will be used to determine what, if any, further mitigation is required. The results shall be used to update and maintain this CNVMP to ensure that minimum compliance distances and mitigation measures are specifically tailored to the equipment used on site. The results of all monitoring will be provided to Council within 1 week of the complaint being received.

Any non-compliance with the noise limits will be addressed by following the corrective action measures in Section 15.0 of this CNVMP and reducing noise levels with reference to Section 11.0.

A noise monitoring form is attached as Appendix C. Measurements will be undertaken in accordance with this document and by observing the following requirements:

i. All noise measurements shall be undertaken using a sound level meter conforming to at least IEC651 Type 2 criteria

ii. All noise measurements and assessments shall be carried out in accordance with NZS 6803:1999 Construction Noise

iii. All noise monitoring and assessment shall be undertaken by a suitably qualified and experienced person.

14.2 Vibration monitoring and reporting

Vibration monitoring will be undertaken:

i. If, in the opinion of the Site Manager or Auckland Council, the vibration from any activity on the site appears excessive

ii. Following the receipt of any reasonable complaint

iii. In accordance with DIN 4150-3:1999 Structural Vibration – Part 3 Effects of Vibration on Structures

iv. By a suitably qualified and experienced person.

15.0 Complaint management system

A complaint management system will be implemented throughout the project. The complaint management system will include:

- Contact numbers for the community liaison person and key construction staff responsible for the implementation of the CNVMP and complaint investigation
- Procedures for maintaining contact with stakeholders
- Procedures for notifying stakeholders of proposed construction activities (detailed in Section 9.0)
- Details for the handling of noise / vibration complaints, including through the project website

The contact for queries or complaints regarding the project, and the manager responsible for implementing this CNVMP is:

Karl McLeod Ph: 0274 440 876 Email: TBA

A complaints register will be kept and maintained on site to record the details of any noise and vibration complaints received and the action taken in response to the complaint. Complaints will be responded to within 24 hours of receipt, and the details recorded in the complaints register.

The results of all noise and vibration monitoring undertaken will be provided to Council within 1 week of the complaint being received. Any non-compliance with the noise limits will be addressed by following the corrective action measures in Section 15.0 and reducing noise levels with reference to Section 11.0.

16.0 Corrective action measures

Should noise or vibration measurements undertaken by either Auckland Council (or Council's representative) or the consent holder's representative identify non-compliance with the limits set out in this CNVMP, the following corrective action measures shall be carried out. The process is illustrated by Figure 2.

i. The activity responsible for the noise or vibration shall cease as soon as practicable and only if safe to do so

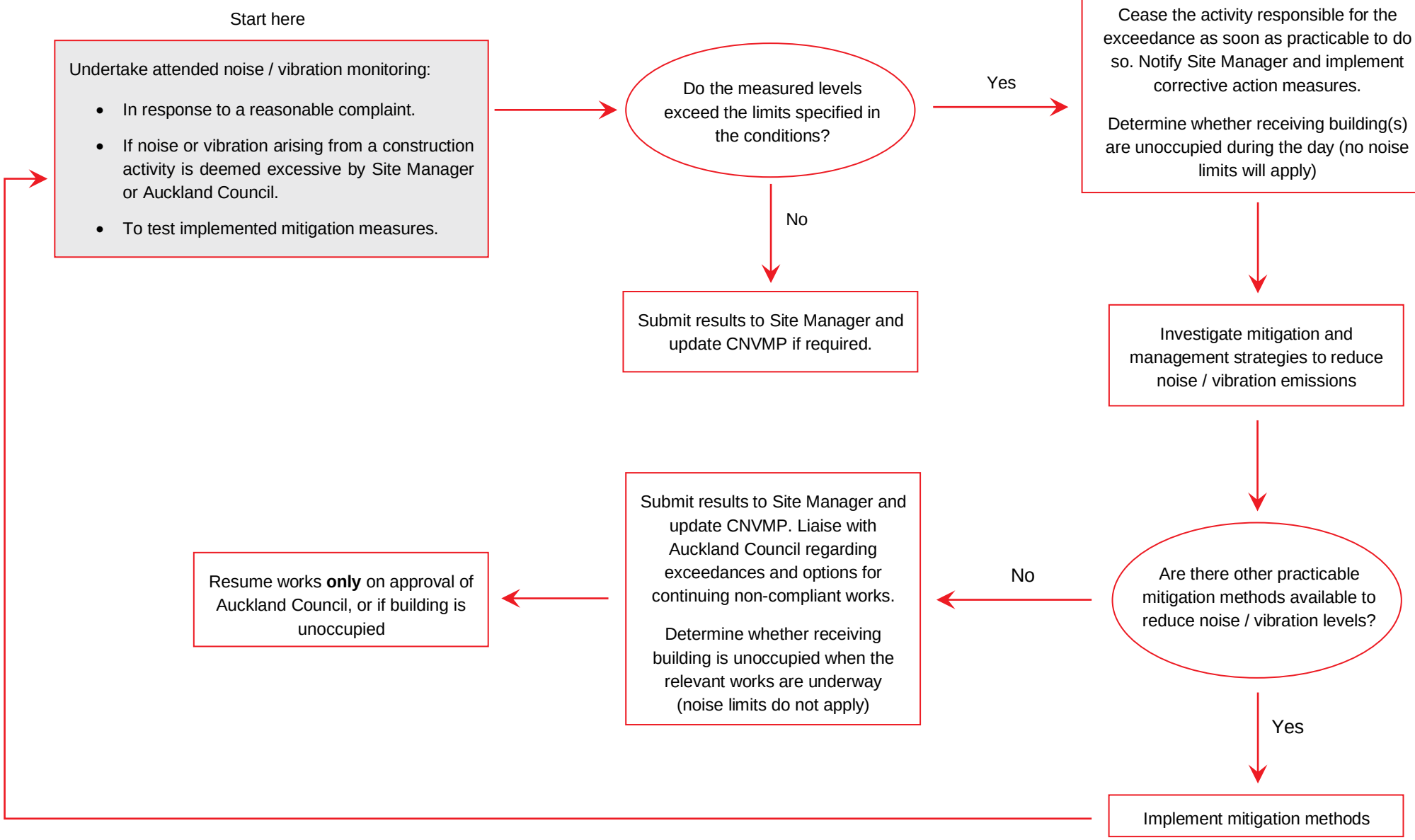
ii. Further mitigation options shall be investigated. Where practicable mitigation measures are available, these shall be implemented and step (iii) followed

iii. Monitoring shall be undertaken to confirm the performance of the mitigation measures

iv. If non-compliance is identified, including the further mitigation measures implemented, the process shall be repeated from step (i)

v. A report detailing steps (i) – (iv) shall be submitted to Auckland Council within 5 working days of the non-compliance being identified.

Figure 2: Process for corrective action measures



17.0 Amendments to CNVMP

The CNVMP is a living document, and it may be updated throughout the works if necessary to adapt to changing work methodologies or a changing receiving environment.

All activities shall be undertaken in accordance with the latest version of the certified CNVMP.

All updates to the initial certified CNVMP shall be clearly marked using underlining for additional text and strikethrough for any deletions. The clear record of amendments must be maintained throughout the life of the CNVMP.

18.0 General requirements

- This CNVMP may be updated throughout the works with the approval of the Site Manager and in consultation with Auckland Council.
- A copy of this CNVMP shall be kept at the work site for the duration of the works.
- All personnel should be informed about the need to reduce noise and vibration to a minimum and about the effects of excessive noise on the neighbouring sites. As part of their training, special attention should be given to:
  i. Proper selection, use and maintenance of tools and plant
  ii. Positioning of machinery on site
  iii. Avoidance of unnecessary noise
  iv. Procedures for receiving, reporting and investigation of noise and vibration complaints.

Appendix A Glossary of terms

Noise	A sound which serves little or no purpose for the exposed persons and is commonly described as 'unwanted sound'. The definition of noise includes vibration under the Resource Management Act 1991.
Best practicable option	Defined in section 2 of the Resource Management Act 1991 as: in relation to a discharge of a contaminant or an emission of noise, means the best method for preventing or minimising the adverse effects on the environment having regard, among other things, to— a. the nature of the discharge or emission and the sensitivity of the receiving environment to adverse effects; and b. the financial implications, and the effects on the environment, of that option when compared with other options; and c. the current state of technical knowledge and the likelihood that the option can be successfully applied.
dB (decibel)	The basic measurement unit of sound. The logarithmic unit used to describe the ratio between the measured sound pressure level and a reference level of 20 micropascals (0 dB).
A-weighting	A frequency filter applied to the full audio range (20 Hz to 20 kHz) to approximate the response of the human ear at lower sound pressure levels.
$L_{Aeq(t)}$ (dB)	The A-weighted equivalent sound pressure level with the same energy content as the measured varying acoustic signal over a sample period (t). The preferred metric for sound levels that vary over time because it takes into account the total sound energy over the time period of interest.
L_{AFmax} (dB)	The maximum A-weighted sound pressure level recorded during the measurement period using a fast time-weighting response.
NZS 6801:2008	N.Z. Standard NZS 6801:2008 Acoustics – Measurement of environmental sound.
NZS 6802:2008	N.Z. Standard NZS 6802:2008 Acoustics – Environmental noise.
NZS 6803:1999	N.Z. Standard NZS 6803:1999 Acoustics – Construction noise.
DIN 4150–3:1999	German Standard DIN 4150-3:1999 Structural Vibration – Part 3: Effects of vibration on structures. Typically adopted for the assessment of structure borne vibration in New Zealand.
PPV	Peak particle velocity, measured in mm/s. The standard metric for the measurement of ground borne vibration in New Zealand. The instantaneous maximum velocity reached by a vibrating element as it oscillates about its rest position.
CNVMP	Construction noise and vibration management plan. A document to help the contractor manage noise and vibration emissions during construction works.

Appendix B The construction site

The works area (red) and nearest noise and vibration receivers (yellow) are illustrated in Figure B.1.

Figure B.1: The construction site and nearest receivers

Appendix C Noise monitoring form

Name: Date:

Notes for noise monitoring

All sections of this form must be completed when undertaking construction noise measurements for the project. Please provide a sketch of the area, sound sources and measurement position on the rear of this form.

Valid measurements cannot be undertaken in persistent rain or in wind speeds greater than 5 m/s.

Measurements are to be undertaken at 1 m from the façade of the receiving building most exposed to the sound under investigation, and 1.2 m to 1.5 m above the relevant floor level. No adjustment to the measured level is to be made for reflected sound from the façade.

If measurements must be undertaken at a proxy location then adjustments to the measured level may be required to correct for distance and façade reflections (+3 dB).

Sound source and instrumentation

Location of works	
Description of construction activity being monitored	
Measurement instrumentation (type and serial number)	
Date of most recent laboratory calibration	
Field calibration check (time and adjustment)	

Meteorological conditions

Cloud cover (octas)	
Rain	
Wind speed and direction	

Methodology

Location/orientation of microphone	
Height of microphone above ground and distance to facade of receiving building	
Distance between microphone and sound source	
Ground conditions between sound source and microphone	
Any barriers or objects between sound source and microphone	
Distance to any reflective surfaces other than receiving facade	
Extraneous noise sources	

Measurement results

Sample start time	Duration of sample	L_{Aeq} (dB)	L_{AFmax} (dB)	Sound source controlling the measured levels	Adjustments required for distance, facade correction or barriers

Do the measurements show full compliance with the project noise limits?

Yes: *The measurement results shall be used to update the site specific noise levels and construction separation distances within the CNVMP.*

No: *The CNVMP shall be referred to for the appropriate corrective action measures and further noise mitigation options*