REPORT

Tonkin+Taylor

Harania Flood Resilience Works - Tennessee Bridge

Construction Noise and Vibration Management Plan

Prepared for
Auckland Council
Prepared by
Tonkin & Taylor Ltd
Date
October 2024
Job Number
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30/10/24	1	Draft	L Leitch	S Yung	C Bauld

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Auckland Council	1 electronic copy
Tonkin & Taylor Ltd (FILE)	1 electronic copy

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1 Introduction

Tonkin & Taylor Ltd (T+T) has prepared a draft Construction Noise and Vibration Management Plan (CNVMP) for flood resilience works at Tennessee Bridge by Auckland Council.

This CNVMP identifies the likely construction noise levels for the project and sets out the best practicable options (BPO) for noise management that will be implemented to mitigate and minimise any adverse noise effects. It also outlines community engagement with surrounding residents in relation to the noise and vibration aspects of the project.

This CNVMP relies on information around the draft construction methodology as set out in the AEE[1].

This CNVMP shall be implemented throughout the construction period. It shall be considered a 'living document' that should be amended and updated as appropriate and is intended to be the primary tool to manage the project's construction noise effects.

1.1 Project contacts

The Project Manager has overall responsibility for complying with the requirements of this CNVMP. Table 1.1 sets out the contact details for key project personnel relevant to the implementation of this CNVMP.

Table 1.1: Contact details

Role	Name	Organisation	Phone	Email
Project manager	TBC	TBC	TBC	TBC
Site manager	TBC	TBC	TBC	TBC
Relationship manager	TBC	TBC	TBC	TBC
Acoustic consultant	TBC	TBC	TBC	TBC
Council Compliance & Advice Manager	TBC	TBC	TBC	TBC

[1] Assessment of Environmental Effects by Beca, November 2024

2 Project overview

2.1 Site location and description

The Tennessee culvert is located in Mangere, between the Lenore Foreshore Reserve and Blake Road Reserve. The embankment supports the existing sewer connection across the creek gully which leads out to Manukau harbour to the north of the embankment. There is open space reserve to the north and east of the site, with residential dwellings to the southeast and west of the site.

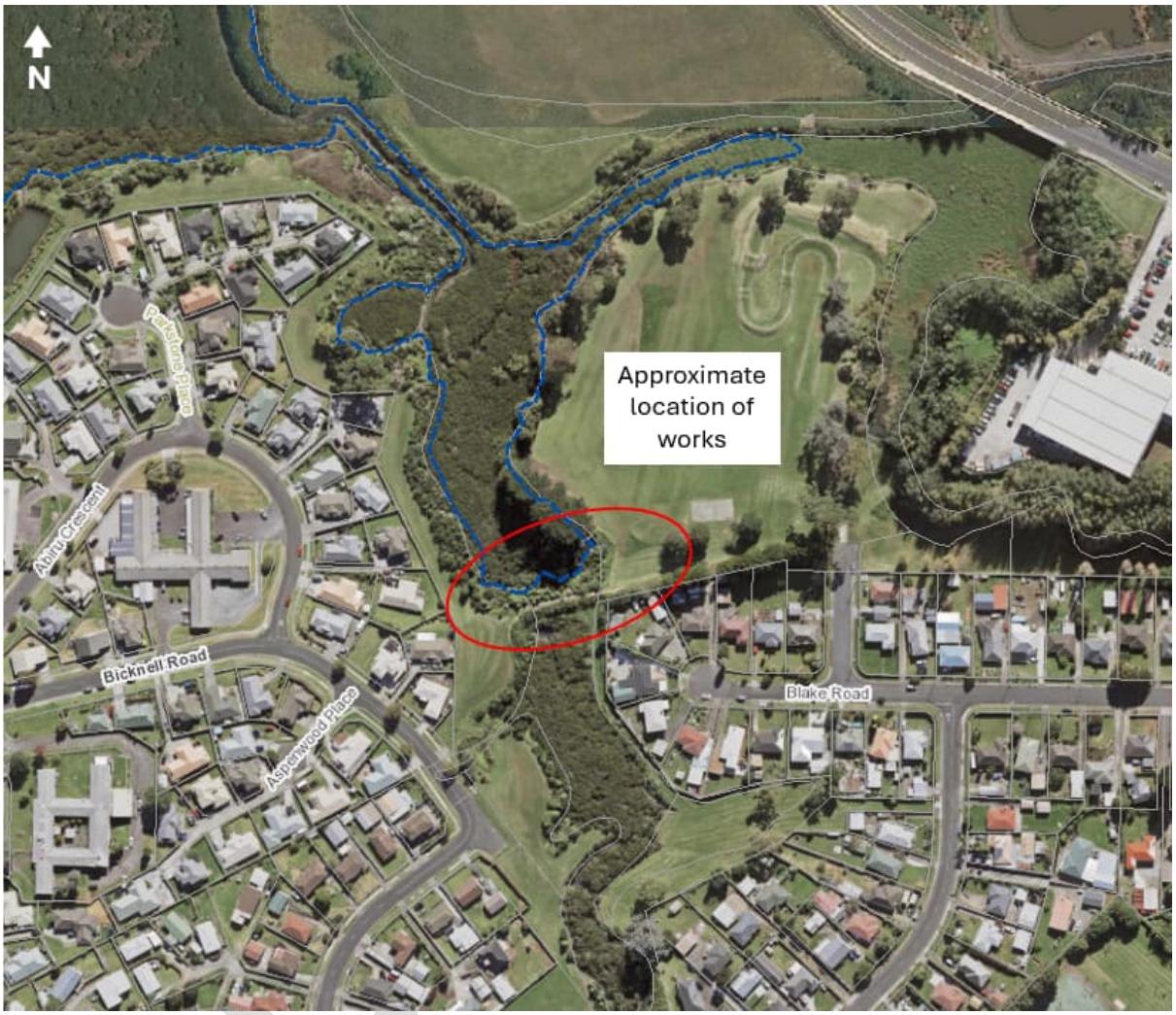

Figure 2.1: Site location and surrounding area

2.2 Proposed works

A detailed description of the proposed work is provided in the Assessment of Effects on the Environment (AEE) prepared for the application.

The flood resilience works will include the following:

- The formation and operation of two construction laydown / compound areas. The laydowns/ compounds will be used for the storage of materials, machinery, construction related activities, site offices (e.g. portacom and containers), ablutions and carparking.

- Installation of an approximately 2700 mm internal diameter wastewater pipe parallel to the Eastern Interceptor and associated pipe bridge within the CMA. This will require piles and piers within the CMA.
- Installation of two chambers (upstream and downstream) which tie the new pipe into the Eastern Interceptor.
- Demolition and removal of the embankments, culverts and section of existing Eastern Interceptor between the two chambers.
- The construction and use of a temporary staging platform within the CMA. This will require piles within the CMA, of which will remain permanently below the bed of the CMA.
- Temporary damming and diversion of water required for construction.
- Construction of new pedestrian bridge on top of the pipe bridge to maintain walking access between Lenore Foreshore Reserve and Blake Road Reserve.
- Vegetation clearance, including within the coastal and riparian margins, and the removal of trees.
- Earthworks associated with temporary and permanent works, including within the coastal and riparian margins.
- Landscaping.

An overview of the Tennessee bridge works is shown below in Figure 2.2.

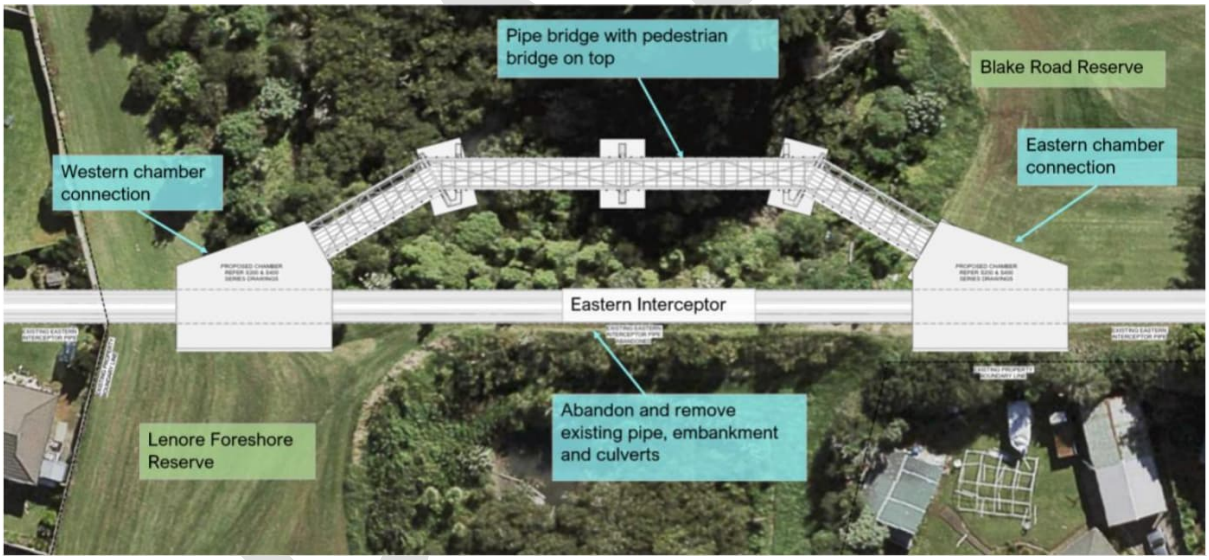

Figure 2.2: Overview of Tennessee bridge works (taken from draft description of the work dated 21/10/24)

2.3 Construction methodology

The construction methodology is detailed in the AEE. The main activities which are of relevance to this assessment are set out below.

- Site establishment – some vegetation removal will be required. Laydown areas will have 300 mm of aggregate place over geotextile cloth and will require compaction with a 14 t roller for 10 days in total (both compounds). 71 truck and trailer movements will be required to deliver the aggregate to the eastern compound and 16 movements to the western compound.
- Preparatory works will require vegetation clearance within the works area including chipping.

- Construction of the access staging will be constructed progressively by vibro piling the first two 900 mm diameter steel casings, then lifting into place and installing the steel headstocks, beams and deck panels. The crane will then move onto the completed section and repeat the piling and crane lifts until the full four bays have been installed. A small amount of impact piling may be required at the end of each pile installation.
- Installation of the coffer dam is expected to take place during low tide, i.e. in minimal water depth. Sheet piles will be vibro driven for the first coffer dam. Works will continue on the first coffer dam (excavation, installation of whaler beams and casting of prop slab) while sheet piles are driven for the second coffer dam, similarly for the third. The construction staging will be extended at each end to allow the piling and future lift positions for the crane.
- The permanent screw piles for the pipe bridge support will be installed and the material within the casings cleaned out to a depth of 4 m using a pendulum augur mounted on an excavator.
- Excavation of the western connection chamber will be undertaken from both sides, with battered slopes such that retention is not required on western edge at property boundary. Estimated 50 6-wheel truck movements to remove material from site during this phase.
- 19 screw piles installed for foundation of western connection chamber.
- Pile three pile cap and western chamber construction underway.
- Excavation for eastern connection chamber. Retention may be required adjacent to property boundary if battering is not practicable. This retention will consist of augered holes, with universal columns inserted and concreted into place with either timber cladding or steel plates and is not expected to be particularly noisy. The column nearest the sewer will be installed in a hydro-excavated hole to reduce vibration.
- 19 screw piles installed for foundation of eastern connection chamber.
- Preparation of pipe assembly bed. Welding of each joint will take 4-5 days and will be enclosed in a welding tent.
- Substructure construction complete, eastern chamber works continue, pipe assembly underway.
- Coffer dams removed and remediation around new foundations completed.
- Installation of pipe sections, chamber end walls completed around new pipe and pipe cut-over which will require concrete cutting of the old pipe at night prior to completion of the chambers. Backfill / reinstatement will require a small amount of plate compaction.
- Access staging removed.
- Removal of redundant pipe and underlying embankment. Excavation of pipe, disposal of material via 6-wheel trucks via western entrance. Removal of pipe, reinstatement (landscaping, scour protection etc).
- Works complete and site de-mobilisation complete.

The noisiest activities are expected to comprise:

- Chipping of vegetation;
- Compaction of the laydown areas;
- Vibro piling for the access staging;
- Small amount of impact driving for access staging;
- Vibro driving of sheet piles for the coffer dams;
- Connection chamber works:
  - excavation and transport of material offsite;

  - hydro excavation;
  - concrete cutting for removal of old pipe at night;
- Truck movements for transporting material from site; and
- Plate compaction of backfill around connection chambers.

2.4 Duration of works

Overall construction of the flood resilience works is expected to take approximately 15 months. The duration of the noisiest activities (as identified in Section 2.3) that are expected to be required is summarised in Table 2.1 below.

Table 2.1: Duration of specific noisy activities

Stage of works	Activity	Duration (days)	Comments
Site establishment	Wood chipping	As required	Noise can be controlled through location, i.e. further from dwellings
Laydown compaction	Compaction	10	14 t roller
Access staging	Vibro driving of 900 mm steel casings	27 (not continuous)	Casing installed with vibro hammer for majority of length. Driving completed using a top mounted drop hammer
Coffer dams	Vibro driving of sheet piles	9-10	Vibrated into position using excavator mounted vibro hammer
Connection chambers	Excavation and transport of material offsite	6 each location	Bulk excavation
Connection chambers	Hydro excavation	6 each location	Detailed excavation
Connection chambers	Concrete cutting	5 nights	Required at night due to operational requirements
Connection chambers	Plate compaction	As required	A small amount of compaction is anticipated once the connection chambers have been backfilled
Embankment excavation	Truck movements	Max 6 trucks (12 movements) per hour	Approximately 420 truck movements per 10h day during excavation of embankment

2.5 Hours of operation

Normal hours of operation will be Monday to Saturday, 7.30 am to 6 pm.

Works outside standard working hours are expected to be limited to the tie-in works to the eastern interceptor sewer. The work will need to take place during low flow period (i.e. night-time) to enable the pump stations to be turned off and the storage within the pipe network to be utilised to prevent sewer overflow. A high-level estimate is five nights at each tie-in location.

Occasional works may be required outside these times, for example working around tides, to complete a concrete pour or deliveries to site. Piling work will not take place outside normal daytime hours.

3 Criteria

The relevant permitted activity standards for noise and vibration for the proposed hours of operation (Monday to Saturday 7:30 am to 6 pm) are:

- 70 dB LAeq and 85 dB LAmax (daytime)
- 45 dB LAeq and 75 dB LAmax (night-time)
- 2 mm/s PPV, 5 mm/s for up to three days

Resource consent conditions TBC

4 Noise sensitive receivers

All surrounding receivers are residential dwellings which are classed as a noise sensitive activity under the AUP. If dwellings are not occupied at the time of works there will be no noise sensitivity. The nearest surrounding receivers with direct line of sight to the site are shown in Figure 4.1 and listed in Table 4.1, together with the approximate distance to the nearest part of site.

Figure 4.1: Location of receivers

Table 4.1: Nearest receivers

Receiver	Distance to works, m				
	Compounds (compaction)	Access staging	Coffer dam	Western connection chamber	Eastern connection chamber
32 Bicknell Road	3	35	40	15	80
34 Bicknell Road	2	55	55	30	90
46 Abiru Crescent	65	85	90	95	130
48 Abiru Crescent	55	75	85	85	120
52B Abiru Crescent	35	55	65	65	110
58 Abiru Crescent	10	40	50	40	100
60 Abiru Crescent	5	30	40	20	90
76 Archboyd Avenue	25	110	110	90	130
79 Archboyd Avenue	60	140	130	120	150
80 Blake Road	35	55	50	60	35
87 Blake Road	20	65	65	100	40
89 Blake Road	10	45	50	85	25
91 Blake Road	15	40	40	65	20

5 Predicted noise and vibration levels

5.1 Plant list

Sound power levels are provided in Table 5.1 below for the anticipated equipment for each stage of works. These are taken from NZS 6803 (reproduced from BS5228-1) or from T+T's library of measured levels.

Table 5.1: Construction equipment noise levels without mitigation

Equipment	Sound power level dB LWA	Noise level dB LAeq					Set back distance to achieve 70 dB LAeq (m)
		10 m	20 m	30 m	40 m	50 m	
45 t bore pile	111	86	80	76	73	71	52
Vibro piles	114	89	83	79	76	74	69
10 t hydraulic hammer piles	117	92	86	82	79	77	91
6-wheeler tipper truck	106	81	75	71	68	66	35
Concrete truck	103	78	72	68	65	63	30
Concrete boom pump	106	81	75	71	68	66	35
Chain saw	96	71	65	61	58	56	15
Woodchipper	118	93	87	83	80	78	100
Welding machine	93	68	62	58	55	53	10
Drill rig	111	86	80	76	73	71	55
Crawler crane (120 t)	101	76	70	66	63	61	20
Vibro hammer	114	89	83	79	76	74	70
Excavator (20 t)	102	77	71	67	64	62	25
Roller (14 t)	112	87	81	77	74	72	60
Plate compactor	108	83	77	73	70	68	40
Hydro excavator	101	76	70	66	63	61	20

Hand tools can produce relatively high noise levels but have not been included specifically as these activities are typically short-term and can often be screened from noise sensitive receivers.

5.2 Predicted noise levels

Tables 5.2 and 5.3 summarise the predicted worst-case noise levels from the modelled scenarios on surrounding properties, together with the anticipated durations for these stages of work. Results greater than 70 dB LAeq (the permitted noise level) are shown in bold and results over 75 dB LAeq are highlighted.

Table 5.2: Predicted façade noise levels at receivers (daytime)

Receiver	Predicted façade noise level, dB LAeq					
	Access staging - vibro	Access staging - impact	Coffer dam	Western connection chamber	Eastern connection chamber	Trucks
32 Bicknell Road	73	76	77	77	62	58
34 Bicknell Road	69	72	73	70	58	58
46 Abiru Crescent	64	67	67	60	58	41
48 Abiru Crescent	65	68	68	61	58	42
52B Abiru Crescent	69	72	71	64	59	42
58 Abiru Crescent	74	77	74	68	61	45
60 Abiru Crescent	76	79	77	73	61	49
76 Archboyd Avenue	61	64	65	60	57	59
79 Archboyd Avenue	59	62	64	58	56	55
80 Blake Road	68	71	74	65	68	46
87 Blake Road	67	70	63	43	59	53
89 Blake Road	71	74	74	61	73	52
91 Blake Road	72	75	77	64	76	51

There is also the potential for noise levels above 70 dB LAeq from woodchipping and compaction when these occur within the setback distances in Table 5.1, i.e. woodchipping within 100 m (unscreened), compaction with a 14 t roller within 60 m or with a plate compactor within 40 m of dwellings.

Table 5.3 shows the predicted façade noise levels at the closest receivers during concrete cutting. This will be undertaken at night due to operational requirements when the 45 dB LAeq noise limit is applicable. Received levels over 45 dB LAeq are in bold and those over 55 dB LAeq (potential for sleep disturbance, see Section 6) are highlighted. Screening of 10 dB is assumed, which is readily achievable when line of sight is lost between noise source and receiver.

Table 5.3: Predicted façade noise levels at receivers during concrete cutting (night-time)

Receiver	Predicted façade noise level, dB LAeq			
	Western connection chamber		Eastern connection chamber	
	Unscreened	Screened	Unscreened	Screened
32 Bicknell Road	69	59	54	44
34 Bicknell Road	62	52	50	40
46 Abiru Crescent	52	42	50	40
48 Abiru Crescent	53	43	50	40
52B Abiru Crescent	56	46	51	41
58 Abiru Crescent	60	50	53	43
60 Abiru Crescent	65	55	53	43

Receiver	Predicted façade noise level, dB LAeq			
	Western connection chamber		Eastern connection chamber	
	Unscreened	Screened	Unscreened	Screened
76 Archboyd Avenue	52	42	49	39
79 Archboyd Avenue	50	40	48	38
80 Blake Road	57	47	60	50
87 Blake Road	35	25	51	41
89 Blake Road	53	43	65	55
91 Blake Road	56	46	68	58

5.3 Predicted vibration levels

Table 5.4 summarises the predicted worst-case vibration levels for receivers. Exceedances of the DIN 4150-3:2016 criterion (5 mm/s PPV for residential buildings) are highlighted, with exceedances of the AUP amenity limit of 2 mm/s PPV identified in bold.

Table 5.4: Maximum predicted vibration levels at nearest receivers

Address	PPV mm/s					
	Compounds (compaction)	Access staging - vibro	Access staging - impact	Coffer dam - vibro	Western connection chamber	Eastern connection chamber
32 Bicknell Road	4 – 6*	2	5 - 7	2	1 - 2	0 - 1
34 Bicknell Road	5 – 7*	1 - 2	4 - 6	1 - 2	1	0 - 1
46 Abiru Crescent	1	1	3 - 4	1	0 - 1	Negl.
48 Abiru Crescent	1	1 - 2	3 - 5	1	0 - 1	Negl.
52B Abiru Crescent	1	1 - 2	4 - 6	1 - 2	0 - 1	Negl.
58 Abiru Crescent	2 – 3*	2	5 - 7	2	0 - 1	Negl.
60 Abiru Crescent	3 – 4*	2 - 3	5 - 8	2	1	0 - 1
76 Archboyd Avenue	1 – 2	1	2 - 3	1	0 - 1	Negl.
79 Archboyd Avenue	1	1	2 - 3	1	Negl.	Negl.
80 Blake Road	1	1 - 2	4 - 6	2	0 - 1	0 - 1
87 Blake Road	1 - 2	1 - 2	3 - 5	1 - 2	Negl.	0 - 1
89 Blake Road	2 – 3*	2	4 - 6	2	0 - 1	1
91 Blake Road	2	2	5 - 7	2	0 - 1	1

* Vibratory function to be turned off within 10 m

Vibratory compaction within 10 m of dwellings is predicted to exceed the amenity limit of 2 mm/s and potentially the DIN 4150-3 limit of 5 mm/s and it is recommended that the vibratory function on the roller is switched off within 10 m as best practice to reduce vibration to a reasonable level for residents.

A small exceedance of the amenity limit (up to 3 mm/s PPV) is predicted at 60 Abiru Crescent during vibro piling for the access staging.

During impact piling for the access staging, where piles are driven to refusal there is the potential for the DIN 4150-3 limit (5 mm/s PPV) to be exceeded within 85 m which would affect approximately 17 houses. There is the potential for the AUP amenity limit (2 mm/s PPV) to be exceeded within approximately 170 m. Dwellings within these buffer zones are listed in Appendix B. If piles are not driven to refusal, vibration is predicted to exceed 5 mm/s between 30 m and 60 m from the piling (pile toe being driven through stiff or very stiff cohesive soils).

6 Noise management and mitigation

6.1 General mitigation measures

- Plant selection to minimise noise levels, such as:
  - Prioritising electric motors over diesel engines where practicable.
  - Using equipment suitably sized for the proposed task.
  - Maintaining equipment.
  - Fitting equipment with exhaust silencers and engine covers.
- Turning off plant when not in use.
- Minimising shouting on site.
- Good practice such as not banging equipment unnecessarily.

6.2 Specific noise mitigation measures

For daytime / general site works:

- Install 2 m high acoustic barriers along the eastern property boundaries of 32 and 34 Bicknell Road.
- Consider 2 m high acoustic barriers along northern boundaries of 87, 89 and 91 Blake Road.
- No vibratory compaction within 10 m of dwellings – vibratory function should be turned off when roller is compacting within 10 m of 32 and 34 Bicknell Road.
- If woodchipping is required on site, the woodchipper should be located away from noise sensitive receivers, with the hopper oriented away from properties and screened if practicable.
- Maintain access routes / haul roads for trucks and promptly repair potholes or corrugation of the surface.
- Considerate driving of trucks transporting material to / from site along residential roads.

6.2.1 Night works

For concrete cutting at night as part of the tie-in works, it will be important to screen works such that there is no line of sight to dwellings. Reflections / reverberation from the connection chamber will contribute to the overall noise level and should be reduced as much as practicable, for example by lining the connection chamber with absorptive material such as acoustic blankets. Localised screening of the concrete cutter should be implemented if practicable. If a generator is required to operate the concrete wire saw this should be fully enclosed and located further from dwellings where practicable.

Noise levels during concrete cutting at night are expected to cause sleep disturbance for nearby residents. The offer of temporary accommodation should be considered for the worst-affected residents. Eligible dwellings / residents may be identified through a combination of engagement and prediction of noise levels once more details are known regarding the methodology.

6.3 Vibration mitigation

A hierarchy of vibration mitigation measures should be adopted through the CNVMP as follows:

- Managing times of activities to avoid night works and other sensitive times where practicable (communicated through community liaison);

- Liaising and consultation with neighbours prior to commencing works for vibration generating activities;
- Selecting equipment and methodologies to minimise vibration;
- Monitoring of vibration during activities predicted to exceed the 5 mm/s PPV and at heritage buildings; and
- Where vibration levels are predicted to exceed the applicable DIN 4150-3:2016 limit (5 mm/s for residential) then building condition surveys shall be undertaken in general accordance with the parameters set out in Section 6.4.

Mitigation will therefore focus on effective communication with neighbours, and selection of appropriate equipment and methods.

6.4 Building condition surveys

A pre-construction building condition survey is recommended to be undertaken at all of the identified buildings exceeding the applicable DIN 4150-3:2016 limit detailed in Appendix B before the main construction works begins.

The building condition surveys will generally be undertaken as follows:

- The building surveys will be undertaken by a suitably qualified and experienced practitioner;
- Seek permission from the owner of a building, structure or service for a suitably qualified and experienced practitioner to prepare a report that:
  - describes any information about the type of foundations;
  - the existing levels of damage (cosmetic, superficial, affecting levels of serviceability);
  - any observed damage is associated with structural damage;
  - identifies the potential for further damage to occur and describes actions that will be taken to avoid further damage; and
  - photographic evidence.
- The Project team will provide the building condition survey report to the property owner; and
- A post condition survey will be undertaken after construction works has been completed, unless the landowner agrees otherwise, or if monitoring determines the post condition survey is unnecessary (i.e. below the DIN4150-3:2016 threshold).

During construction if complaints are made about vibration or if monitoring determines it necessary, further building condition surveys may be undertaken. Where further surveys identify damage has been encountered, relevant suitably qualified specialists will be engaged to investigate the cause. This may include the vibration specialist, building inspector and building condition author. The outcome of the investigation will be shared with the complainant/affected receiver. If it is determined that the Project is responsible for the damage, a plan will be made to rectify it at the consent holder's cost.

6.5 Staff briefing and training

Training of site personnel regarding noise will be incorporated into the site induction. This will include:

- Overview of this CNVMP;
- Team roles and responsibilities;
- Noise mitigation and management procedures – both specific mitigation for identified activities and good practice on site in general;

- The importance of reducing noise levels as low as reasonably practical when working near residential areas;
- Complaints management process; and
- Any specific training required e.g. for machine operators.

Any current noise issues, for example complaints received, can be addressed in site meetings and /or toolbox talks.

6.6 Documentation

All documentation relating to noise will be stored so that it can easily be accessed by site personnel. Documentation will include:

- This CNVMP, together with any updates.
- Record of stakeholder engagement, e.g. site visits and communications with local residents / occupiers.
- Results of noise or vibration monitoring, including site survey sheets and summary of what activities were underway at the time.
- Complaints register.

7 Engagement

Stakeholder engagement is a key aspect in the implementation of this CNVMP.

The relationship manager (see Table 1.1) will be the site contact for the public throughout the works. The following communication shall be undertaken with the community regarding potential construction noise matters associated with the proposed works:

- Contact details for the complaint contact / relationship manager will be prominently displayed at the entrance to the site so that they are clearly visible to the public.
- Written communication in advance of works starting. This should include contact details for any complaints, estimated duration of works, and times and days when there may be high noise or vibration levels. As a minimum, this information will be provided to residents at the following nine dwellings:
  - 32 and 34 Bicknell Road
  - 52B, 58 and 60 Abiru Crescent
  - 80, 87, 89 and 91 Blake Road

A record will be kept of which properties have been contacted.

7.1 Complaints response

Any complaints received shall be recorded in the project complaints register, including the following information:

- Full details of the complainant.
- The nature of the complaint.
- The investigation undertaken into the complaint.
- Any remedial actions undertaken to address the complaint.

Where complaints relate to construction noise, the consent holder shall use its best endeavours to respond immediately. As a minimum, complaints shall be responded to within 24 hours.

A copy of the complaints register shall be kept on site and made available to the Council on request.

8 Noise and vibration monitoring

8.1 Noise monitoring

Noise monitoring will be undertaken:

- By a suitably qualified and experienced person (e.g. a Member of the Acoustical Society of NZ);
- In general accordance with NZS 6803:1999, measured at 1 m from the façade of the most affected building or appropriate proxy location. The LAeq and LAmax levels will be recorded over a representative period as a minimum;
- At the start of concrete cutting at night to establish noise levels for residents;
- Continuing through concrete cutting at night as required;
- In response to a reasonable noise complaint near the location of the complainant (if known) or at a location representative of the nearest noise sensitive receiver; and
- At the request of Auckland Council.

Results of the noise monitoring will be readily available to site personnel and made available to Auckland Council on request.

8.2 Vibration monitoring

Vibration monitoring will be undertaken:

- By a suitably qualified and experienced person;
- In general accordance with DIN 4150-3:2016;
- During impact piling at representative locations;
- In response to a reasonable complaint; and
- At the request of Auckland Council.

Results of the vibration monitoring will be readily available to site personnel and made available to Auckland Council on request.

9 Applicability

This report has been prepared for the exclusive use of our client Auckland Council, with respect to the particular brief given to us and it may not be relied upon in other contexts or for any other purpose, or by any person other than our client, without our prior written agreement.

We understand and agree that this report will be used by Auckland Council in undertaking its regulatory functions in connection with the Harania flood resilience works at Tennessee Bridge.

Tonkin & Taylor Ltd
Environmental and Engineering Consultants

Report prepared by:	Authorised for Tonkin & Taylor Ltd by:
.....	.....
Lindsay Leitch Acoustics/Noise Specialist	Chris Bauld Project Director

Technical review by:

.....

Sharon Yung
Acoustics/Noise Specialist

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Appendix A Glossary

Term	Definition
dB	A unit of measurement on a logarithmic scale which describes the magnitude of sound pressure with respect to a reference value (20 µPa)
$L_{Aeq(t)}$	The A-weighted time-average sound level over a period of time (t), measured in units of decibels (dB)
L_{WA}	Sound power level
PPV	Peak particle velocity. This is the instantaneous maximum velocity reached by the vibrating surface as it oscillates about its normal position
Noise	Unwanted sound

Every 10 dB increase in sound level doubles the perceived noise level. A sound of 70 dB is twice as loud as a sound level of 60 dB and a sound level of 80 dB is four times louder than a sound level of 60 dB. An increase or decrease in sound level of 3 dB or more is perceptible. A change in sound level of less than 3 dB is not usually discernible.

As sound level is measured on a logarithmic scale, the following table provides examples of typical sources of noise.

Decibel (dB)	Example
0	Hearing threshold
20	Still night-time
30	Library
40	Typical office room with no talking
50	Heat pump running in living room
60	Conversational speech
70	10 m from edge of busy urban road
80	10 m from large diesel truck
90	Lawn mower - petrol
100	Riding a motorcycle at 80 kph
110	Rock band at a concert
120	Emergency vehicle siren
140	Threshold of permanent hearing damage

Appendix B Vibration buffers

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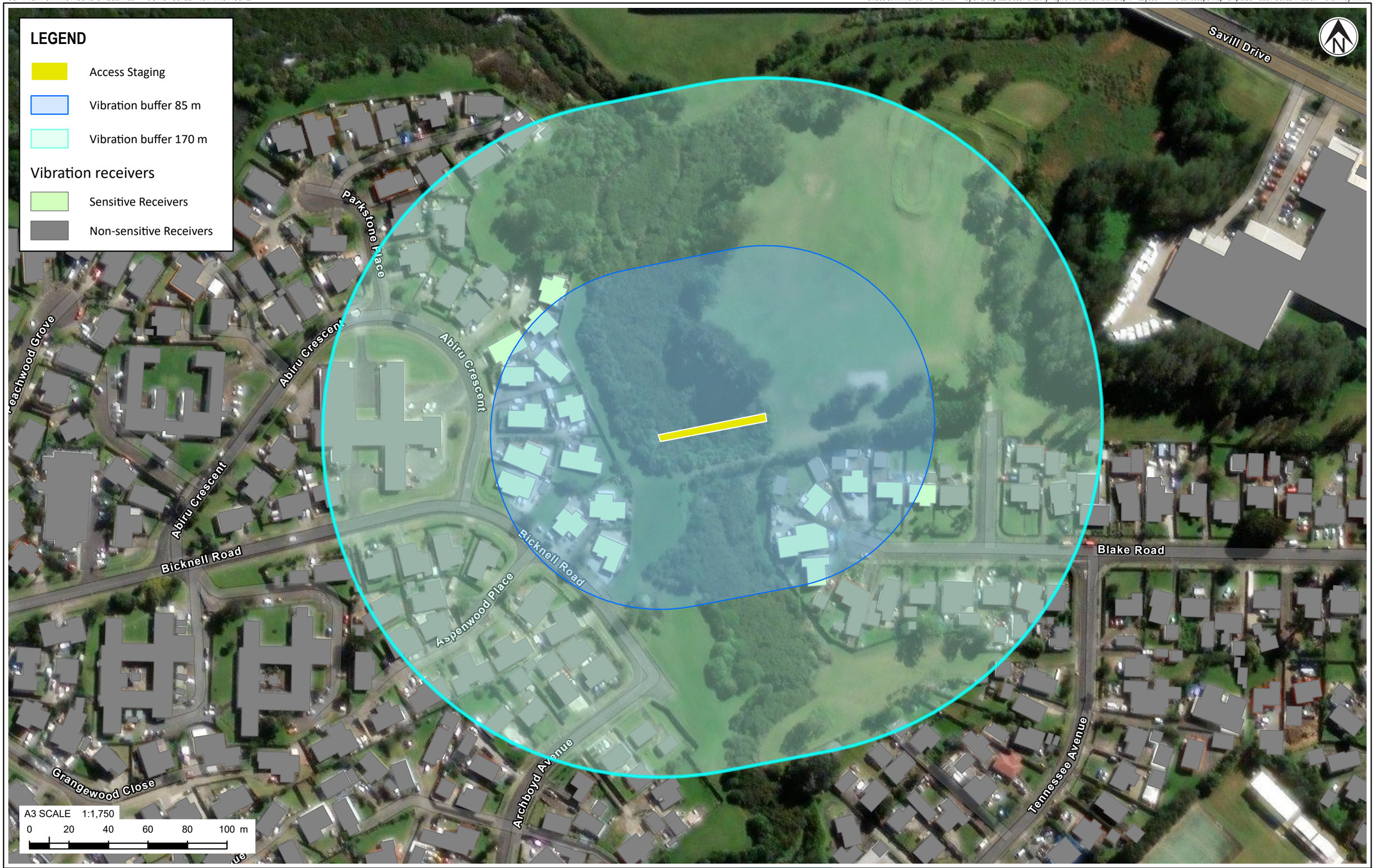

Tonkin+Taylor

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NOTES:

Basemap World Imagery: LINZ. Hybrid Reference Layer: Esri Community Maps Contributors, LINZ, Stats NZ, Esri, TomTom, Garmin, Foursquare, METI/NASA, USGS. NZ Navigation Map: Eagle Technology, LINZ, StatsNZ, NIWA, Natural Earth, © OpenStreetMap contributors.

REV	DESCRIPTION	GIS	CHK	DATE
0	First version	XXXX	YYYY	D/M/Y

LOCATION PLAN

			APPROVED	DATE
PROJECT No.	1017033.2002			
DESIGNED	ANKI	OCT.24		
DRAWN	ANKI	OCT.24		
CHECKED				

CLIENT **AUCKLAND COUNCIL**

PROJECT **HARANIA FLOOD RESILIENCE WORKS**

TITLE ACCESS STAGING WORKS NEARBY RECEIVERS

SCALE (A3) 1:1,750 FIG No. FIGURE 1. REV 0

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