



ASSESSMENT OF NOISE EFFECTS

PUKETEPAPA EXOTIC TREE REMOVAL
PUKETEPAPA – MT ROSKILL

PREPARED FOR
Tūpuna Maunga Authority

DATE
29 September 2019

Assessment of noise effects prepared by Styles Group for the Tūpuna Maunga Authority.

REVISION HISTORY

Rev:	Date:	Comment:	Version:	Prepared by:	Reviewed by:
1	23/09/19	Submitted for review	Final Draft	Jon Styles, MASNZ Director and Principal Styles Group	Gemma Sands Consultant Styles Group
2	29/09/19		Final	Jon Styles, MASNZ Director and Principal Styles Group	Gemma Sands Consultant Styles Group

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1.0 Introduction

The Tūpuna Maunga Authority has engaged Styles Group to assess the noise effects arising from the removal of 160 exotic trees on Puketepapa (Mt. Roskill) in order to determine compliance with the construction noise levels of the Auckland Unitary Plan (AUP).

This report sets out an assessment of the proposal from an acoustics perspective, including:

- i. Noise level predictions at the surrounding sites prepared using Brüel & Kjær Predictor computer noise modelling software;
- ii. An assessment of the noise levels in accordance with the AUP construction noise levels and the relevant New Zealand acoustics standards.
- iii. Recommended conditions of consent to ensure potential adverse effects on proximate residential receivers are adequately avoided or mitigated.

Our report has been prepared following our involvement with a considerable number of related tree removal projects and meetings with the project team and arborists. This report should be read in conjunction with the application site plans and the AEE. A glossary of acoustical terms used within this document is attached as Appendix A.

2.0 The proposal

As part of the Tūpuna Maunga Vegetation Restoration Project, the Tūpuna Maunga Authority proposes to remove up to 160 exotic trees that are established within the boundaries of Puketepapa (Mt Roskill). The project will be undertaken over 24 days.

Treescape Arboricultural Consultants have prepared a tree removal methodology which identifies the proposed removal method for each tree, taking into account project factors including feasibility, effectiveness, health and safety, noise effects and cost, while seeking to avoid damage or disturbance of archaeological, cultural and historical features of the maunga.

Proposed tree removal methods include manual removal, mobile elevated work platform (MEWP) and crane assisted tree removal. Processing machinery will include several wood chippers, chainsaws, excavators, a mobile crane and trucks to remove material off site.

Figure 1 identifies the trees identified for removal, and the proposed removal method. The areas shaded green identify those sites owned by Housing New Zealand (HNZ). We understand that the sites 3-9, 11 and 55 Roseman Avenue are in the process of being cleared, and during the time period following the removal of existing buildings, and prior to redevelopment, HNZ will facilitate access and use of the sites for a crane which will assist with the removal of trees established on the southern slopes of Puketepapa. The extent of the crane reach is shown by each radius identified on Figure 1.

Figure 1 identifies the archaeological constraints of the Site, which will guide the location of mobile processing equipment (trucks, wood chippers, transporters and excavators) which will follow tree removal operations throughout the Site. The car park area at the Dominion Road entrance will also be used as a processing area.

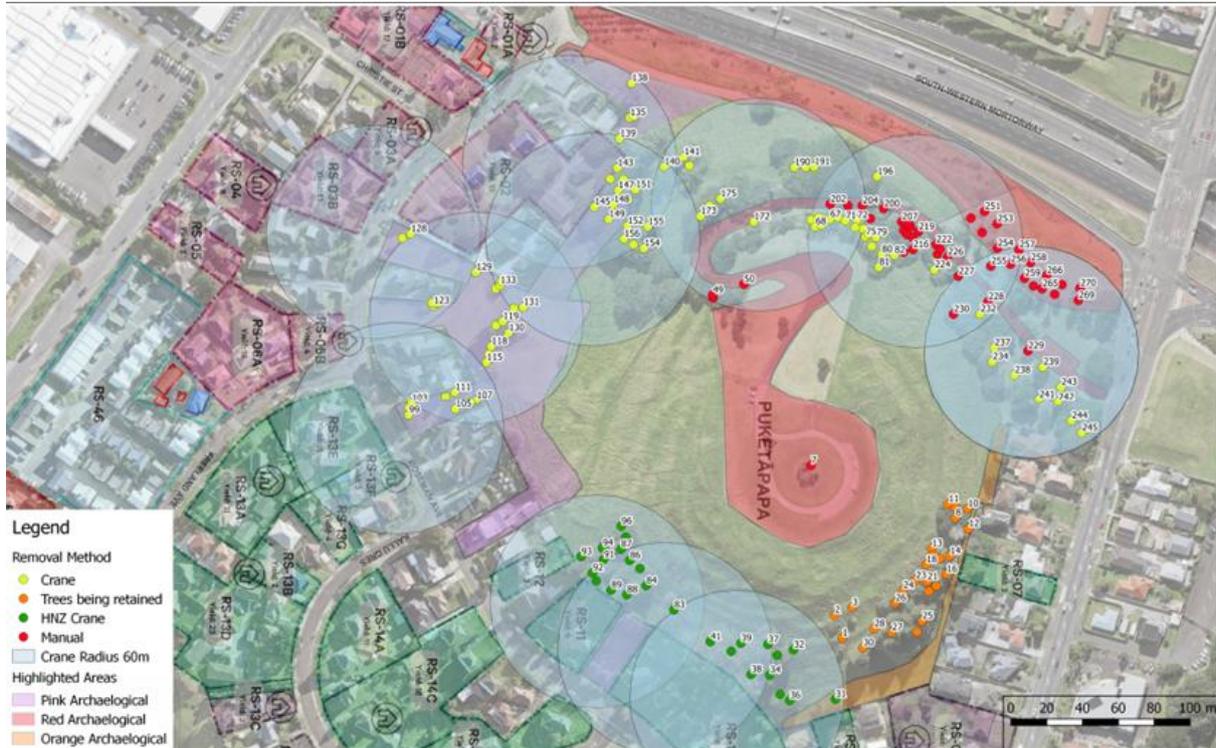


Figure 1 Tree Removal Methods

Source: Arborlab Tree Removal Methodology (August 2019)

3.0 The Site and surrounding environment

3.1 The Site, proximate receivers and AUP zoning

Figure 2 identifies the Puketepapa maunga (the Site) is located within the Open Space-Conservation Zone of the AUP. The northern site boundary adjoins the State Highway 1 corridor, while all other boundaries adjoin the Residential- Mixed Housing Urban Zone.

‘Noise receivers’ include all potentially occupied buildings on other adjacent sites at which construction noise levels must be assessed. The receivers directly adjoining the Site are residential and are defined as *Activities sensitive to noise* under Chapter J1 Definitions of the AUP¹.

¹ The AUP defines ‘activities sensitive to noise’ as “any dwelling, visitor accommodation, boarding house, marae, papakāinga, integrated residential development, retirement village,



Figure 2 AUP Zoning of Site and surrounding environment

4.0 Regulatory framework

This section sets out the framework for the management of construction noise effects under the Auckland Unitary Plan, relevant New Zealand acoustics standards for the measurement and assessment of noise and the Resource Management Act 1991 (the Act).

4.1 Auckland Unitary Plan

The proposal has been assessed against the construction noise limits prescribed under E25.6.27 of the AUP. The relevant time period for the proposed construction activity is highlighted in the reproduced rule below:

supported residential care, care centres, lecture theatres in tertiary education facilities, classrooms in education facilities and healthcare facilities with an overnight stay facility”.

E25.6.27. Construction noise levels in all zones except the Business – City Centre Zone and the Business – Metropolitan Centre Zone

- (1) Noise from construction activities in all zones except the Business – City Centre Zone and the Business – Metropolitan Centre Zone must not exceed the levels in Table E25.6.27.1 Construction noise levels for activities sensitive to noise in all zones except the Business – City Centre Zone and the Business – Metropolitan Centre Zone when measured 1m from the façade of any building that contains an activity sensitive to noise that is occupied during the works.

Table E25.6.27.1 Construction noise levels for activities sensitive to noise in all zones except the Business – City Centre Zone and the Business – Metropolitan Centre Zone

Time of week	Time Period	Maximum noise level (dBA)	
		L _{eq}	L _{max}
Weekdays	6:30am – 7:30am	60	75
	7:30am – 6:00pm	75	90
	6:00pm - 8:00pm	70	85
	8:00pm - 6:30am	45	75
Saturdays	6:30am – 7:30am	45	75
	7:30am – 6:00pm	75	90
	6:00pm - 8:00pm	45	75
	8:00pm - 6:30am	45	75
Sundays and public holidays	6:30am – 7:30am	45	75
	7:30am – 6:00pm	55	85
	6:00pm - 8:00pm	45	75
	8:00pm - 6:30am	45	75

- (2) Noise from construction activities in all zones except the Business – City Centre Zone and the Business – Metropolitan Centre Zone must not exceed the levels in Table E25.6.27.2 Construction noise levels for noise affecting any other activity when measured 1m from the façade of any other building that is occupied during the works.

Table E25.6.27.2 Construction noise levels for noise affecting any other activity

Time Period	Maximum noise levels L _{eq} (dBA)
7:30am – 6:00pm	75
6:00pm – 7:30am	80

- (3) For a project involving a total duration of construction work that is less than 15 calendar days, the noise levels in Table E25.6.27.1 Construction noise levels for activities sensitive to noise in all zones except the Business – City Centre Zone and the Business – Metropolitan Centre Zone and Table E25.6.27.2 Construction noise levels for noise affecting any other activity above shall be increased by 5dB in all cases.
- (4) For a project involving a total duration of construction work that is more than 20 weeks the noise limits in Table E25.6.27.1 Construction noise levels for activities sensitive to noise in all zones except the Business – City Centre Zone and the Business – Metropolitan Centre Zone and Table E25.6.27.2 Construction noise levels for noise affecting any other activity above shall be decreased by 5dB in all cases.

4.2 New Zealand acoustics standards

Rule E25.6.1(3) *General Standards* requires that the noise from any construction work activity must be measured and assessed in accordance with the requirements of New Zealand Standard NZS6803:1999 Acoustics – Construction noise. Styles Group has adhered to the requirements of the NZS6803:1999 throughout this assessment.

4.3 Summary of project construction noise limits

The project will be undertaken between 7:30am and 6:00pm on Monday to Saturday and will take 24 days to complete. The permitted noise limits for these times are 75 dBA L_{eq} and 90 dBA L_{max} for all neighbouring buildings while occupied.

The noise limits are applicable at 1m from the most exposed façade of any surrounding occupied building. We have assumed that all neighbouring buildings may be occupied during the proposed works. We understand that the Housing New Zealand properties identified in Figure 1 will be vacant during the project.

5.0 Noise modelling and predictions

To understand the spatial propagation of noise across and beyond the site, a combination of noise measurements and predictions are necessary. Noise level predictions are undertaken using sophisticated noise modelling software to enable the accurate prediction of noise levels across large areas of land, at multiple receivers and under a wide range of meteorological and operational conditions. The computer noise models are three-dimensional and take into account the topography, buildings, ground coverage, the physical attributes of the sound sources and receivers and many other physical factors.

Styles Group has used Brüel & Kjær Predictor computer noise modelling software to prepare noise level predictions of the tree removal operation, based on the International Standard ISO 9613-1/2. The noise level predictions assume meteorological conditions that slightly

enhance propagation in all directions in accordance with NZS 6802:2008. The Brüel & Kjær Predictor software is globally recognised and has been successfully implemented on a large number of projects throughout New Zealand.

This section sets out the information which has been integrated into the project noise model, including the noise sources, cadastral data, mitigation measures, model input parameters and any calculation adjustments applied to the predicted noise levels in accordance with the relevant New Zealand acoustics standards.

5.1 Noise sources

Noise sources associated with the tree removal project will include chainsaw noise, and the machinery noise from processing sites (wood chipper and excavators) and noise from the mechanical plant used to assist with tree removal, including the use of crane and MEWP.

The sound power levels that have been used in the noise models are shown in the table below. The highest sound power level is attributed to the log chipper, which will dominate the noise environment in the processing areas while in use. The project arborist proposes to locate any processing equipment a minimum distance of 25m from any occupied residential dwelling in order to minimise noise effects to nearby dwellings.

Noise source	Sound power level (dBA)	Min separation distance (to comply with 75dB L _{Aeq})
Chainsaw	112	12m (at 33% on-time)
Log Chipper	114	25m
Excavator	96	4m
Crane	98	4m

These sound power levels are based on measurements undertaken by Styles Group in the past, including some specific to this project. The sound power level for the chippers has been provided by the project arborist.

We have assumed that the chainsaws will have an on-time of no greater than 50% each generally, and no greater than 33% in areas where there is only one tree being removed at a time.

It is anticipated that the overall use of the chipper in any one location will be up to 20-30 minutes over a one hour period, or 3-4 hours over an eight hour period, (although for the purpose of noise level predictions the on-time is 100%). All other plant and machinery is assumed to have a 100% on-time.

5.2 Noise model parameters

Noise predictions have been calculated based on the International Standard ISO 9613-1/2 Attenuation of sound during propagation outdoors. The Predictor software is globally recognised and has been successfully implemented on a large number of projects throughout New Zealand. Terrain contours, building footprints and parcel boundaries were imported from the Auckland Council 'Geomaps' Public Data. The topographical contours encompass the entire site and a large area of the surrounding land. We have ensured the integrity of the noise model by careful scrutiny of the final three-dimensional model.

The input parameters for the noise model are set out in Table 1.

Table 1 Predictor Noise Model Input Parameters

Parameters/calculation settings	Details
Software	Brüel & Kjær Predictor
Calculation method	ISO 9613.1/2
Meteorological parameters	Single value, C0 = 0
Ground attenuation over land	General method, ground factor: 1
Air temperature	293.15K
Atmospheric pressure	101.33kPa
Air humidity	60%
Receiver heights (relative)	1.2 - 1.5m above floor level
Source heights (relative)	Chainsaw: 1.5m above ground or at cut level in tree; Chipper: 2m above ground level
Building heights (nominal)	Single level: 4m; double level: 7m

5.3 Noise modelling results

5.3.1 Tree removal noise

Due to the separation distances to adjacent dwellings, the majority of the tree removals within the Site will readily comply with the noise limits at all occupied dwellings surrounding the maunga. However, a number of trees on the outer perimeter are located in close proximity to residential boundaries, and these properties may be occupied while chainsaws and equipment are working on the trees.

Appendix B provides the noise modelling results for the removal of the trees at the closest potentially occupied residential dwellings adjacent to the maunga. The results include a

noise level contour for where the 75dB L_{Aeq} noise limit is achieved and an 80dB L_{Aeq} contour. The trees selected in the noise model represent those closest to the boundaries of the Site so they show the loudest of the potential noise levels expected during tree removal operations.

We have also applied point receivers to the noise model to accurately identify the noise levels that will be experienced at each of the closest dwellings while chainsaws are operating in close proximity. Figure 3 identifies the predicted level of chainsaw noise when a tree is being removed close to an occupied dwelling. The noise levels at the closest dwellings range from 75-91 dB L_{Aeq} . These noise levels will only be generated during the period while the closest tree is being worked on. Therefore, only 1-2 dwellings at any one time will be likely to experience noise levels above the project noise limit of 75dB L_{Aeq} . Noise levels over 75dB L_{Aeq} will be received at any dwelling for only a very short period.

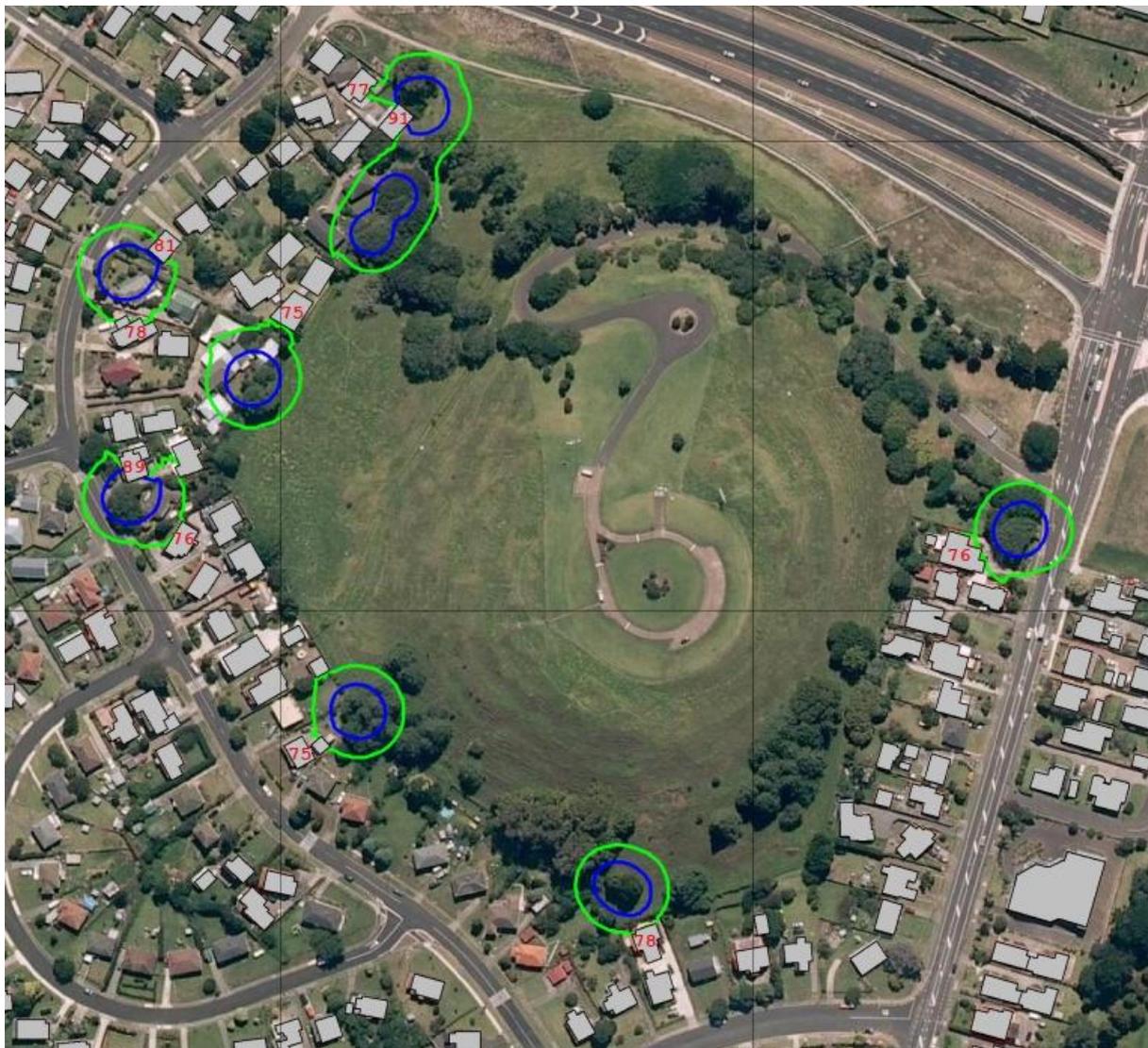


Figure 3 Tree removal noise predictions (dB L_{Aeq})

5.3.2 Noise from processing machinery

Due to the mobile nature of processing operations and numerous locations where processing equipment may be operated on the maunga, we have not developed noise models to depict every potential processing scenario. In our experience on similar maunga restoration projects (including undertaking noise measurements for processing machinery) and noise modelling, we have advised the project team that any processing machinery will need to achieve a minimum separation distance of 25m from any occupied residential dwelling to achieve compliance with the 75 dB L_{Aeq} noise limit. We have recommended a condition of consent to this effect.

Appendix C provides the noise modelling results associated with the operation of processing machinery from the Dominion Road entrance car park. The results include a noise level contour for where the 75dB L_{Aeq} noise limit is achieved and an 80dB L_{Aeq} contour. The noise modelling shows that the noise levels arising from the operation of processing equipment at this site will readily comply with the permitted noise levels at the closest potentially occupied dwellings (i.e. the dwelling on 1131 Dominion Road).

6.0 Assessment of effects

Our assessment has identified that noise levels generated by most of the activities will be compliant with the permitted noise limits in Rule E25.6.27 of the AUP for the majority of the project. The noise levels arising from the operation of processing machinery will comply with the permitted noise levels provided that the equipment achieves a separation distance of 25m or more from any occupied residential dwelling. This requirement has been adopted in the tree removal methodology and is recommended as a condition of consent.

The tree removal noise modelling identifies that the majority of the proposed tree removals will be undertaken in accordance with the permitted activity noise limits. When removal is underway on trees located within the outer perimeters of the maunga (i.e any tree within 25m of a residential dwelling), the noise limits received at the closest dwelling(s) will be temporarily exceeded. For any one receiver, the duration of noise levels above 75 dB L_{Aeq} will be no more than 1- 2 days. When operations progress away from each dwelling and around the maunga, the noise levels experienced by each receiver will reduce with distance.

For the closest dwellings to the proposed tree removals (i.e. those dwellings within 25m of any tree subject to removal), the primary mitigation measures should include advising the neighbours of the proposed works; including the timeframes, durations and the details of a contact person on site should issues arise. We have recommended that all receivers likely to be exposed to noise levels above 75dB L_{Aeq} (all dwellings within 25m of a tree to be removed) should be advised in writing prior to the works commencing. Where noise levels

over 85dB L_{Aeq} might be received, the contractor should endeavour to undertake those works when the house is unoccupied (in which case there would be no effects).

Overall, we consider that the noise levels arising from the works will be reasonable at all receivers. However, opportunities may exist to avoid some of the adverse effects in the closest dwellings if the nearby works can be scheduled to be undertaken when there is no one home. Accordingly, we have recommended a condition that requires that consultation is undertaken with the occupants of two specific dwellings to identify whether it is practicable to undertake the works when no one is home. If this condition can be successfully applied, exposure to the highest of the noise levels will be avoided. If there is no opportunity to complete the works when no one is home, the noise levels will still remain reasonable.

The project is only expected to take 24 days in total to complete. The duration of the project works that will generate noise levels over 75dB L_{Aeq} are likely to be no greater than 1-2 days at any one receiver, and the noise levels at any particular receiver will be between 50-75dB where works are undertaken at other areas of the site for the remaining days. In our opinion, this constitutes a considerably lower degree of effect overall than what is permitted by the AUP, being up to five times the project duration (100 days or 20 weeks) at a level of 75dB L_{Aeq} at any receiver.

7.0 Conclusion

Styles Group has undertaken noise modelling to predict the noise levels arising from the proposed removal of 160 exotic trees on Puketepapa.

With the mitigation that we have recommended, and taking into account the working hours and short duration of the works, we consider that the noise levels will be reasonable.

Should consent be granted, we recommend that the following conditions of consent be imposed and complied with, in addition to the standard conditions controlling hours and days of work in accordance with the application. We understand that the provision of written advice to those affected by the noise from the works will be undertaken as part of the wider communications strategy for the project.

7.1 Recommended conditions of consent

In addition to the standard condition requiring compliance with the application documents as lodged (including this report) we recommend the following conditions of consent are also imposed:

1. The Communications Plan shall require that owners and occupants of all neighbouring buildings within 25 m of tree removal(s) shall be advised of the works in writing at least ten (10) days prior to the commencement of works on site. The Plan shall set out a brief overview of the construction works, its

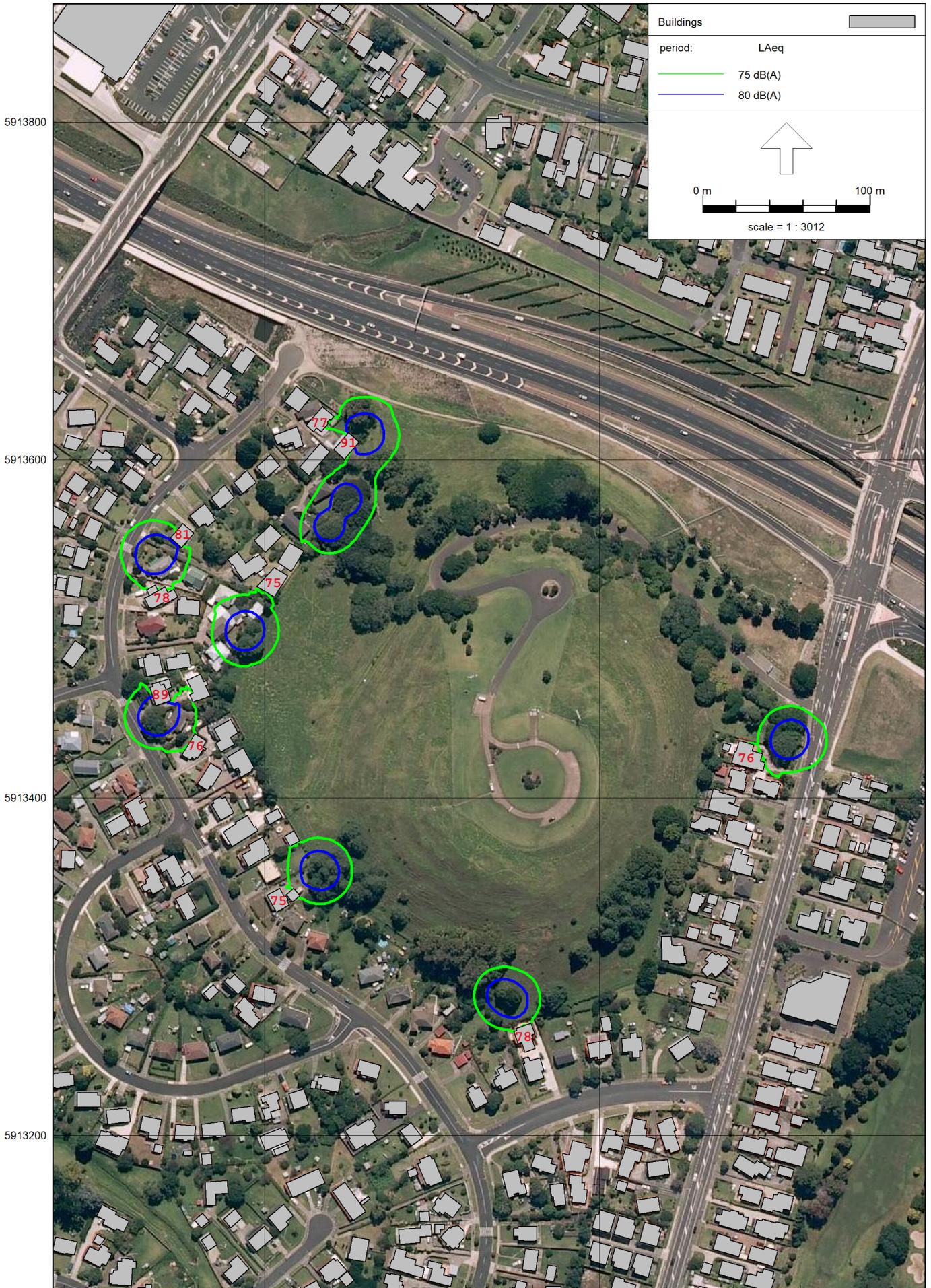
expected duration, the mitigation measures to be implemented, availability of monitoring where concerns about noise are raised, the working hours, and a contact phone number for any concerns regarding noise.

2. In addition to condition 1, at least 5 days prior to the intended removal of trees 135 - 138 adjacent to 59C Roseman Avenue, and trees 99 – 111 adjacent to 31 Roseman Avenue, the contractor shall consult with the occupiers of the dwellings in an effort to schedule the tree removals at a time when the occupiers are not at home, where this can be accommodated within the overall programme schedule.
3. Any processing equipment shall be a minimum of 25m from the facade of any occupied residential dwelling.

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.
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).
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.
Noise rating level	A derived noise level used for comparison with a noise limit.
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 6801:1991	N.Z. Standard NZS 6801:2008 Acoustics – Measurement of environmental sound.
NZS 6802:1991	N.Z. Standard NZS 6802:2008 Acoustics – Environmental noise.
NZS 6803:1999	N.Z. Standard NZS 6803:1999 Acoustics – Construction noise.
The Act	The Resource Management Act 1991.
s16	Section 16 of the Act states that “every occupier of land (including any premises and any coastal marine area), and every person carrying out an activity in, on, or under a water body or the coastal marine area, shall adopt the best practicable option to ensure that the emission of noise from that land or water does not exceed a reasonable level”.

Appendix B Noise rating level contours - tree removal noise



Appendix C Noise rating level contours - processing machinery noise

