Styles Group
Acoustics & Vibration Consultants

P. 09 308 9015
E. info@stylesgroup.co.nz
W. www.stylesgroup.co.nz
Saatchi & Saatchi Building,
L2, 125 The Strand, Parnell
PO Box 37857, Parnell,
Auckland 1151

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Title: **Maungarei Exotic Tree Removal: Assessment of Environmental Noise Effects**

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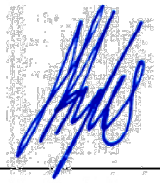
Prepared by:



Jon Styles
Director and Principal

Reviewed by:

Paul Hazard
Consultant

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1. Introduction

Styles Group has been engaged by Auckland Council to assess the likely noise effects arising from the removal of a number of exotic trees from Maungarei (Mt Wellington). It is a requirement that ground disturbance, as a result of the tree removal, is minimised. It is therefore proposed that a helicopter is used to remove sections of each tree as they are cut, and lift them away to avoid impact on the ground. Other machinery to be used includes several wood chippers, chainsaws, excavators, a mobile crane and trucks to carry the trees off site.

To preface this assessment, resource consent is sought to infringe the construction noise limits for a limited period and by up to 5dB only.

2. The Proposal

It is proposed to remove a number of exotic trees (over 100) that are currently established within the boundaries of the Maungarei Reserve. A helicopter will be used to remove the trees that would otherwise cause significant ground disturbance if removed without a helicopter. The trees will then be carried to a processing site where the smaller sections will be mulched and removed from site, either at the summit or at the works depot on the southern side of the mountain.

3. Noise Performance Criteria

The proposed site is located in the Open Space – Conservation Zone with adjacent properties in both Business and Residential Zones. The proposal has been assessed against the noise controls of Rule E25 – Noise and Vibration of the AUP-OP. Rule E25.6.27 sets out the noise limits that apply to construction activities.

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

(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.

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 may 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 may be decreased by 5dB in all cases.

The AUP-OP also states that any construction noise shall be measured and assessed in accordance with *NZS 6803: 1999 Acoustics – Construction Noise*.

The construction works will be undertaken between 7:30am and 6:00pm on Monday to Friday and will take less than 20 weeks to complete. No construction works will be undertaken on weekends or public holidays. 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.

4. Noise Measurements

Noise measurements of the proposed helicopter (an AS350 B3) were undertaken at a different location on the 03 October 2017 while the helicopter was carrying out work of similar nature: lifting using a 45 metre long line. The measurements were used to derive a sound power (source) level for the AS350 B3 for use in the noise model.

The measurements were performed in accordance with NZS 6801:1991 using a Norsonic Type 1 sound level meter. Serial numbers and calibration details are available on request. Meteorological conditions during the measurements were overcast with light winds. The controlling noise source was the operation of the helicopter. A sound power level of 135dBA was calculated based on the noise measurements.

5. Noise Level Predictions

Styles Group has used Brüel & Kjær Predictor computer noise modelling software to prepare noise level predictions, 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.

Terrain contours, land parcels and building footprints for the models were acquired from the Auckland Council GIS service and have been confirmed by site observations. The topographical contours encompass the entire site and the surrounding land. We have ensured the integrity of the noise models by verifying the data during our site visit and by careful scrutiny of the final three-dimensional models. The input parameters for the Predictor noise model is shown in the below.

Parameters/calculation settings	Details
Software	Brüel & Kjær Predictor
Calculation method	ISO 9613.1/2
Meteorological parameters	Single value, C0 = 0
Ground attenuation	General method, ground factor 1
Air temperature	293.15K
Atmospheric pressure	101.33kPa
Air humidity	60%
Source heights (relative)	Helicopter: 45m above load; Chainsaw: 1.5m above ground or at cut level in tree; Chipper: 2m above ground level
Receiver heights (relative)	1.2 - 1.5m above floor level
Building heights (nominal)	Single level: 4m; double level: 7m.

5.1 Noise Sources

A noise model has been prepared for the locations where helicopters will be used to remove trees and also for areas where helicopters are not needed to remove trees i.e. only chainsaws. The noise models also include the noise from the processing sites involving chippers and excavators for handling. The chippers will dominate the noise environment in those areas. The sound power levels that have been used in the models are shown in the table below:

Noise Source	Sound Power Level (dBA)
Chainsaw	112
Log Chipper	114
Excavator	94
Helicopter	135

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.

6. Modelling Results

The noise modelling results are shown in Appendix A. The results include a noise level contour for where the 75dB L_{Aeq} noise limit is achieved and also a noise level contour which just touches the closest receiver to determine the level they are exposed to. For some scenarios the 75dB L_{Aeq} noise level contour runs midway through some properties, but is still compliant with the 75dB L_{Aeq} standard. This is because of the very elevated nature of the primary noise source. On those instances, the 76dB L_{Aeq} noise level contour would be well into the subject site. The 75dB L_{Aeq} standard is only infringed where a higher noise level contour is shown in the appendices.

The highest level for any residential receiver is 79dB L_{Aeq} which will be generated by the operation of the helicopter on the southwest-facing slope and a small area east of the main quarry face. Noise levels between 75dB L_{Aeq} and 79dB L_{Aeq} will be received at approximately 20-25 dwellings in the areas as shown in Appendix A. We understand that the duration of works in this area which might generate noise levels this high will be no greater than approximately 10 days, depending on meteorological conditions and the availability of the helicopter.

The works on the northeast-facing slope will generate noise levels between 75dB L_{Aeq} and 79dB L_{Aeq} at approximately 3 commercial buildings as shown in Appendix A. As above, we understand that the noisy works in this area will be no greater than 10 days on the same basis.

At all other receivers and for all other works the noise levels will be below the relevant noise limit of 75dB L_{Aeq}.

7. Assessment of Effects

From our experience on other helicopter projects, there is little, if anything that can be done to reduce the noise levels. Whilst a quieter machine could be used, it would have a lower lifting capacity and would therefore take longer (likely to be greater than twice as long) to complete the work due to the segments of tree needing to be smaller and lighter, generating more lifts and a concomitant increase in the duration of chainsaw noise (twice the number of cuts required)

We consider that the primary mitigation measures should include advising the neighbours of the works including the timeframes, durations and the details of a contact person on site should issues arise, as well as getting the helicopter lifting work completed as quickly as practicable.

We consider that all those buildings within the 75dB L_{Aeq} noise level contour as shown in Appendix A should be advised in writing prior to the works commencing. We also understand that the applicant has proposed a communications strategy which would satisfy the matters set out above.

Additionally, we recommend that for works which are predicted to exceed a level of 75dB L_{Aeq} and are proposed to occur for more than 3 days, the work should be limited to only 3 consecutive days per week, and for the same 3 days in the subsequent weeks. For example, where the use of the helicopter is expected to generate noise levels between 75dB and 79dB on the south-western slopes for a total of up to 10 days, those works should be scheduled to occur on the Mondays, Tuesdays and Wednesdays only of each week for the 3-4 weeks it would take to finish those works. The helicopter may be used for work on other slopes remote from that area on the Thursday and Friday, subject to the same daily constraint in respect of those receivers.

We have assessed the effects of the construction noise infringement based on noise levels of up to 75dB L_{Aeq} being permitted by the AUP-OP for a project affecting any receiver for up to 20 weeks. The subjective difference in effects between the permitted noise level of 75dB L_{Aeq} and the predicted noise levels of up to 79dB L_{Aeq} will be generally noticeable or perceptible. The additional 4 dB which is predicted (over the permitted noise level) may be noticed by the receivers will be greater by only a just noticeable or slightly noticeable amount compared to a compliant situation. As above, we understand that such noise levels are likely to be generated at any receiver for a duration of no more than 10 days each over the course of the project.

It is also relevant to note that the project is only expected to take 40 days (8 weeks) in total to complete, with approximately 4 weeks of work on either side of the Maunga. The duration of the project works that will generate noise levels over 75dB L_{Aeq} is no greater than 10 days at any receiver, and the noise levels at any particular receiver will be between 55-65dB where works are undertaken at other areas of the site for the remaining 30 days. In our opinion, this constitutes a considerably lower degree of effect overall than what is permitted by the AUP-OP, being up to 100 days (20 weeks) at a level of 75dB L_{Aeq} at any receiver.

8. Summary and Recommendations

Our assessment of the proposal has shown that the noise levels generated by all activities except for the use of the helicopter will be readily compliant with the permitted noise limits in Rule E25.6.27 of the AUP-OP. The use of the helicopter will infringe this rule by approximately 4dB at the closest residential and commercial receivers. The difference between the predicted levels and a compliant situation is that the predicted levels will be greater by only a just noticeable or slightly noticeable amount. The infringements are expected to last for no more than 10 days over the course of the project at any receiver. The remainder of the works will be compliant with the relevant construction noise controls at all receivers and in our opinion, this

proposal constitutes a considerably lower degree of effect overall than what is permitted by the AUP-OP, being up to 100 days (20 weeks) at a level of 75dB L_{Aeq} at any receiver.

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. A condition requiring written advice to those affected by the noise from the works has not been included as we understand that such advice will be provided as part of the wider communications strategy for the project.

(1) The noise from all works (except the use of the helicopter) shall comply with noise limits of 75dB L_{Aeq} and 90dB L_{AFmax} when measured 1m from the facade of any occupied building in accordance with NZS6803:1999 *Acoustics – Construction Noise.*

(2) The noise from the use of the helicopter shall comply with a noise limit of 80dB L_{Aeq} when measured 1m from the facade of any occupied building in accordance with NZS6803:1999 *Acoustics – Construction Noise.*

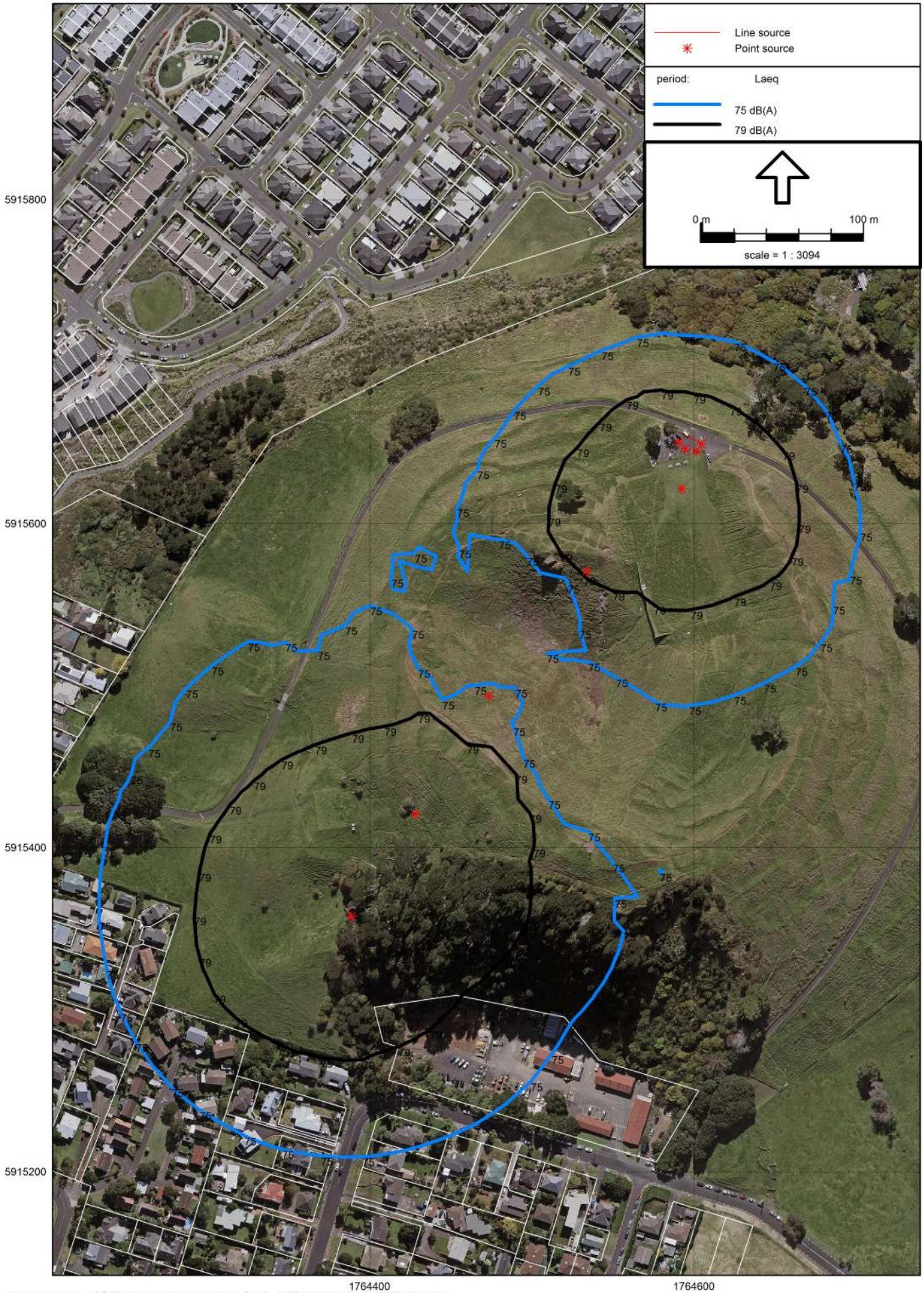
Appendix A – Noise Level Contour Maps

Notes:

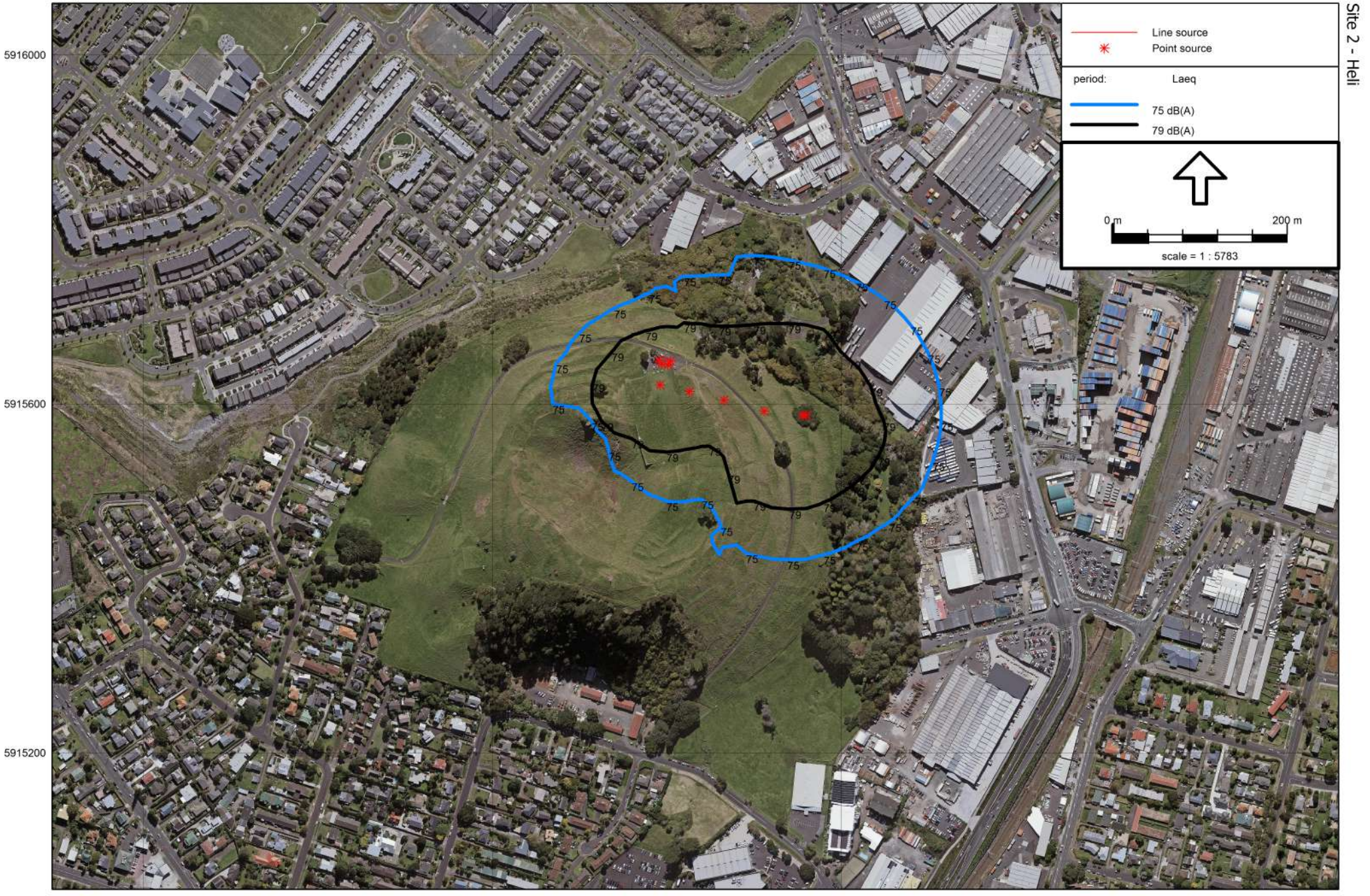
(1) 'Manual' refers to the manual removal of trees using excavators, trucks and/ or a crane where avoiding disturbance of the ground is not critical.

(2) 'Heli' refers to the use of a helicopter for lifting tree segments away from the area and to the processing site at the summit.

Site 1 - Heli



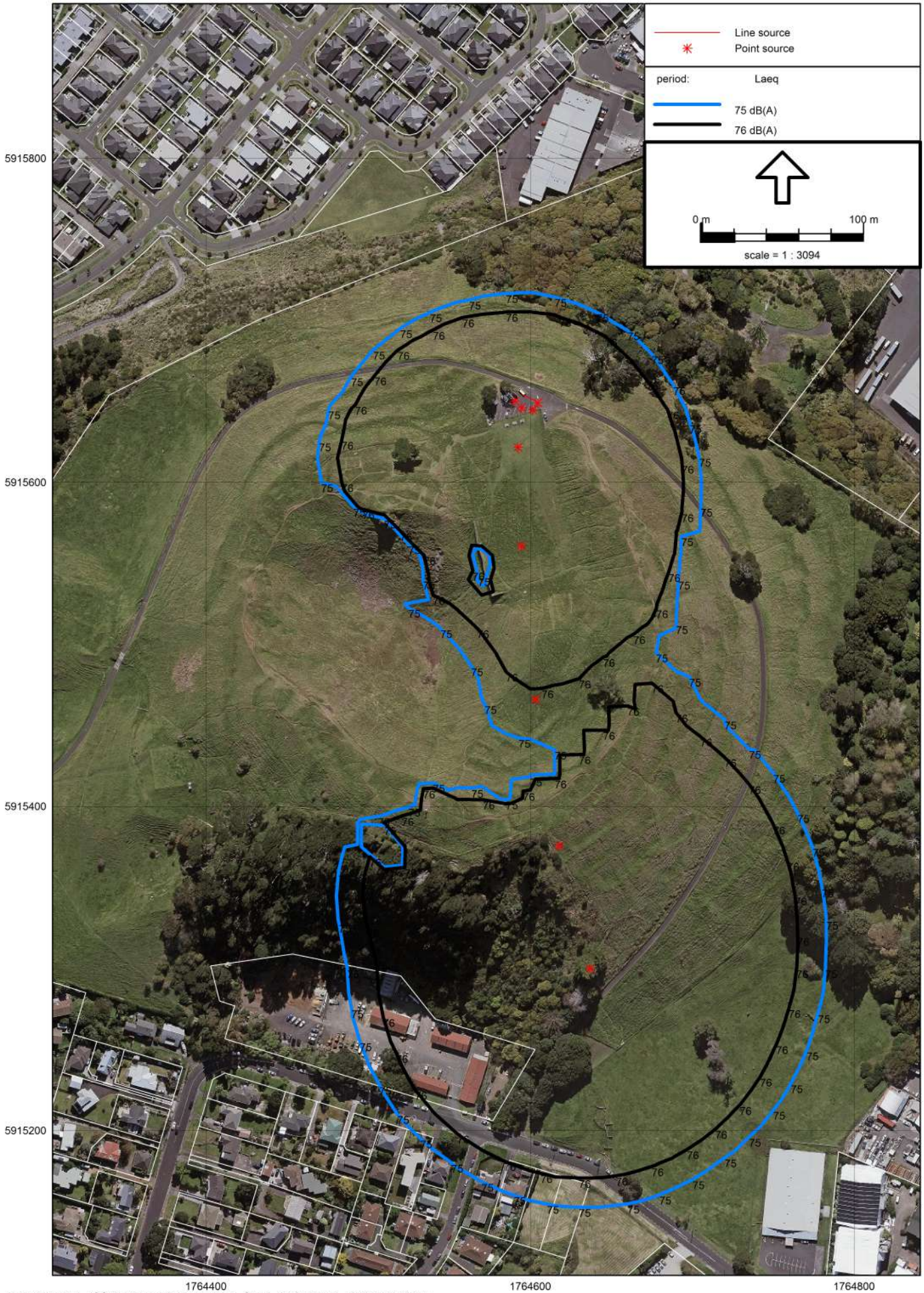
Industrial noise - ISO 9613.1/2, [version of Area - Site 1 - Heli (NW face)] , Predictor V11.10



Site 2 - Heli

Industrial noise - ISO 9613.1/2, [version of Area - Site 2 - Heli (25)] , Predictor V11.10

Site 3 - Heli



Industrial noise - ISO 9613.1/2, [version of Area - Site 4 - Heli (27/28)] , Predictor V11.10

Site 4 - Heli (NE face)

Industrial noise - ISO 9613.1/2, [version of Area - Site 5 - Heli (NE face)] , Predictor V11.10

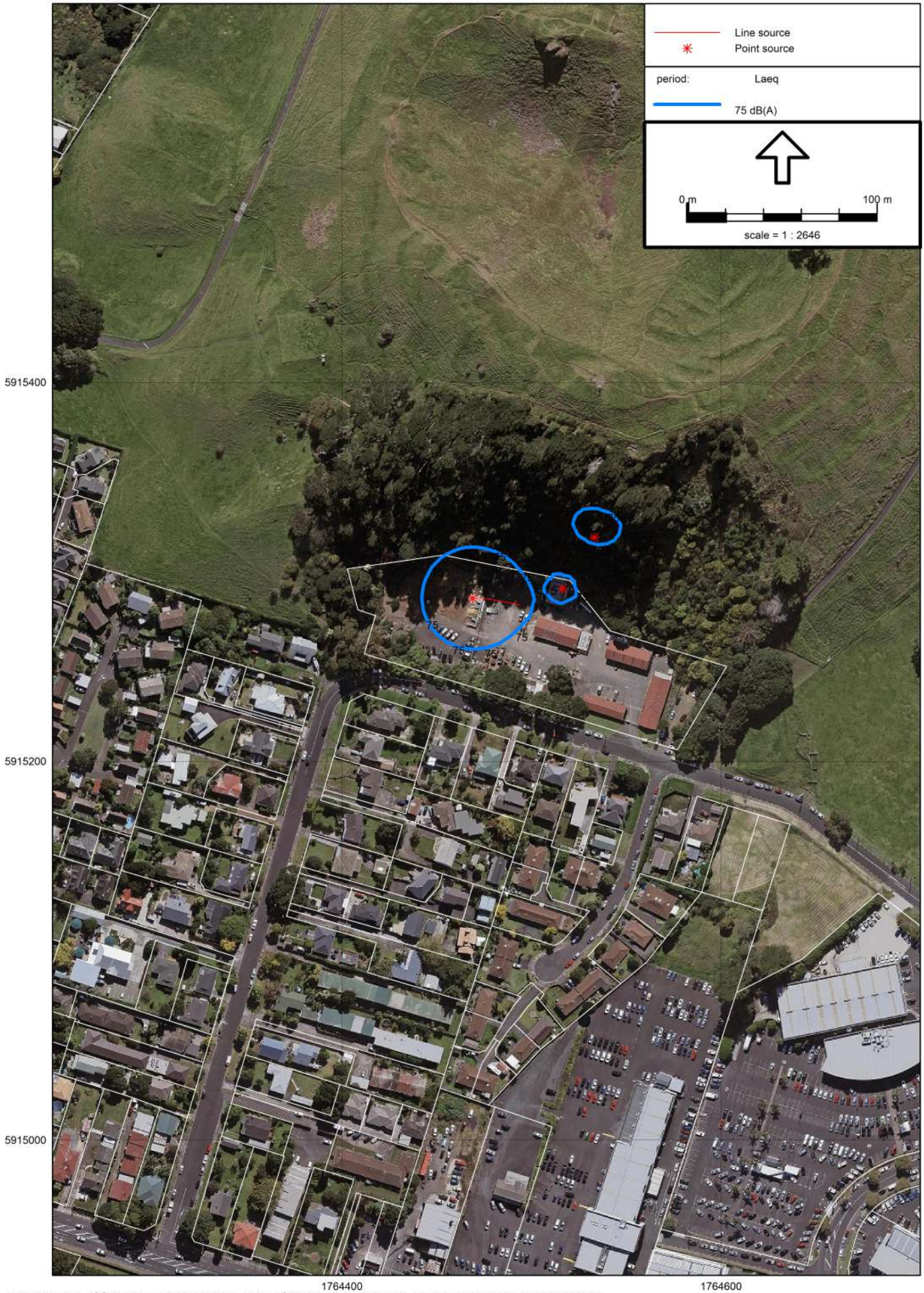
Site 5 - Heli

Industrial noise - ISO 9613.1/2, [version of Area - Copy of Site 2 - Heli (25)] , Predictor V11.10

Manual Sites 1

Industrial noise - ISO 9613.1/2, [version of Area - Manual Sites Individual chainsaws, chipper, excavator] , Predictor V11.10

Manual Sites 2



Industrial noise - ISO 9613.1/2, [version of Area - Manual Sites Individual chainsaws, chipper, excavator 1] , Predictor V11.10

Manual site 3

Industrial noise - ISO 9613.1/2, [version of Area - Site 3 - Heli (5)] , Predictor V11.10