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Prepared for: **Tūpuna Maunga Authority**

Date: **7 September 2018**

Title: **Te Pane a Mataaho - Māngere Mountain Exotic Tree Removal: Assessment of Environmental Noise Effects**

Revision Number: 1

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1. Introduction

Styles Group has been engaged by the Tūpuna Maunga Authority to assess the likely noise effects arising from the removal of 158 exotic trees from Te Pane a Mataaho - Māngere Mountain through a range of methods, including helicopter, manual, crane and MEWP assisted dismantling, and manual and machine assisted felling. Machinery will include several wood chippers, chainsaws, excavators, a mobile crane, mobile work platform, helicopter and trucks to remove material off site. To preface this assessment, resource consent is sought to infringe the construction noise limits for a limited period and by up to 10dB for short periods only.

2. The Proposal

The Tūpuna Maunga Authority propose to remove 158 exotic trees that are currently established within the boundaries of Te Pane a Mataaho - Māngere Mountain. The Māngere Mountain Tree Removal Methodology prepared by Treescape Arboricultural Consultants proposes a suite of tree removal and processing methods, developed on the basis of feasibility, effectiveness and cost, whilst seeking to avoid damage or disturbance of archaeological, cultural and historical features of the maunga.

The tree removal methodology includes a range of operating methods for various areas of the maunga, with two designated processing sites for the mulching and removal of material surplus to requirements. Trees removed by helicopter and crane assisted dismantling methods are to be loaded directly onto transport at the processing sites while cuts from all other trees (with the exception of specific logs that may be suitable for carving) will be moved to one of the processing sites for mulching and removal. During helicopter operations, one processing site will be utilised to process removed trees and one as a refuelling site for the helicopter.

Figure 1 depicts the proposed tree removal method by location, and the location of Processing Site 1 (area of flat grass behind the kindergarten) and Processing Site 2 (Sports Field). Table 1 overleaf provides a summary of felling and processing methods by area, with helicopter assisted dismantling proposed for 16 trees within Area A (Summit walkway) and 39 trees within Area B (Tihi and slopes). A range of other tree removal methods is to be employed for other areas.

Table 1: Tree Removal Method by Location and Processing Methods

			Felling/ Dismantling Method								Processing Method			
Area	**Description**	**Number of Trees to be Removed**	**Ring Barking/ Spraying/ drill and fill**	**Manual Felling**	**Machine Assisted Felling**	**Manual Dismantling**	**Manual Rigging**	**MEWP Assisted Dismantling**	**Crane Assisted Dismantling**	**Helicopter Assisted Dismantling**	**PS 1**	**PS 2**	**Processing in Situ**	**Mulch On Processing Site**
A	Summit Walkway	**16**								X	X			X
B	Tihi and slopes	**39**								**X**		**X**		**X**
C	Domain Road	**38**							**X**		**X**	**X**		**X**
D	Playground area	**13**		**X**	**X**	**X**	**X**				**X**			**X**
E	Sports field area	**8**		**X**	**X**	**X**	**X**					**X**		**X**
F	SW Boundary area	**3**		**X**							**X**	**X**		**X**
G	Memorial Hall area	**39**		**X**	**X**	**X**	**X**	**X**					**X**	**X**

Figure 1: Tree Location and Removal Methods (Source: Treescape Arboricultural Operations Plan)

3. Noise Performance Criteria

The site is predominantly located in the Open Space – Conservation Zone, with various Open Space zones applying to the community and recreation facilities (including Māngere Mountain Education Centre, Māngere Bridge Playcentre, Onehunga Māngere Soccer and Softball Club, Māngere Memorial Hall and Bridge Park Bowling Club) within the northern and eastern parts of the site. Figure 2 depicts the relevant zonings across the site, with adjacent sites zoned Residential.

The application site includes all areas zoned Open Space that share a common boundary with the central Maunga area in the Open Space – Conservation Zone. The noise levels and effects are not assessed at any building within the application site.

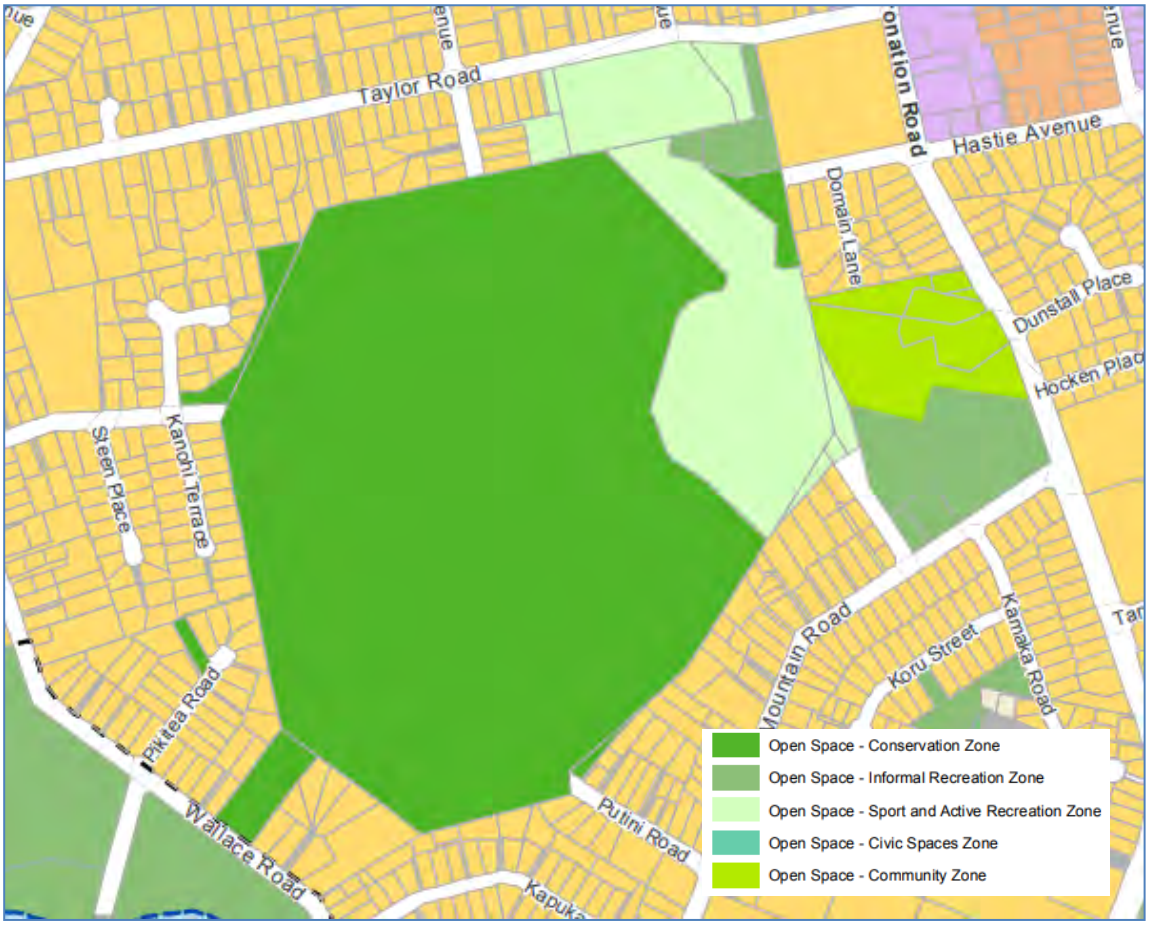


Figure 2: AUP Zoning of Site and Surrounding Environment

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, which is the appropriate control[1] for the tree removal proposed under this application.

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

[1] The tree removal proposed in this application is a one off, temporary construction event, and does not seek to authorise ongoing helicopter movements on the Maunga. The application of construction-related rules to the use of helicopters for construction activities is common and traditional. This interpretation was accepted in the resource consent for exotic tree removal from Maungarei / Mt Wellington.

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 for the various phases of the lifting operation (to reflect the emissions over a typical 15min period).

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 table overleaf.

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 overleaf:

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	95	4m
Helicopter	135	200m

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.

To derive noise level predictions over a representative 15 minute period as required by NZS6803:1999, we have assumed that the helicopter operation will comprise a 66% 'on-time' over each tree, 30% on-time over the processing area and the remaining time (approximately 4%) travelling between the areas. We understand from the helicopter operator that this represents the expected operating scenario.

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, (such as the south-eastern corner of Area E). All other plant and machinery is assumed to have a 100% on-time.

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. 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 82dB L_{Aeq} which will be generated by the operation of the helicopter on the northwest-facing slope for a small number of trees (approximately 6-8). Noise levels between 75dB L_{Aeq} and 82dB 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 3 days, depending on meteorological conditions and the availability of the helicopter.

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 subsequent 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 in any one area, the work should be limited to only 3 consecutive days per week, and for the same 3 days in the subsequent weeks. 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 82dB L_{Aeq} will be greater by a noticeable or appreciable amount (but noticeably less than twice as loud) 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 3 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. The duration of the project works that will generate noise levels over 75dB L_{Aeq} is no greater than approximately 3 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 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 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 7dB at the closest residential receivers. The subjective difference in effects between the permitted noise level of 75dB L_{Aeq} and the predicted noise levels of up to 82dB L_{Aeq} will be greater by a noticeable or appreciable amount (but noticeably less than twice as loud) compared to a compliant situation. The infringements are expected to last for no more than approximately 3 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.*

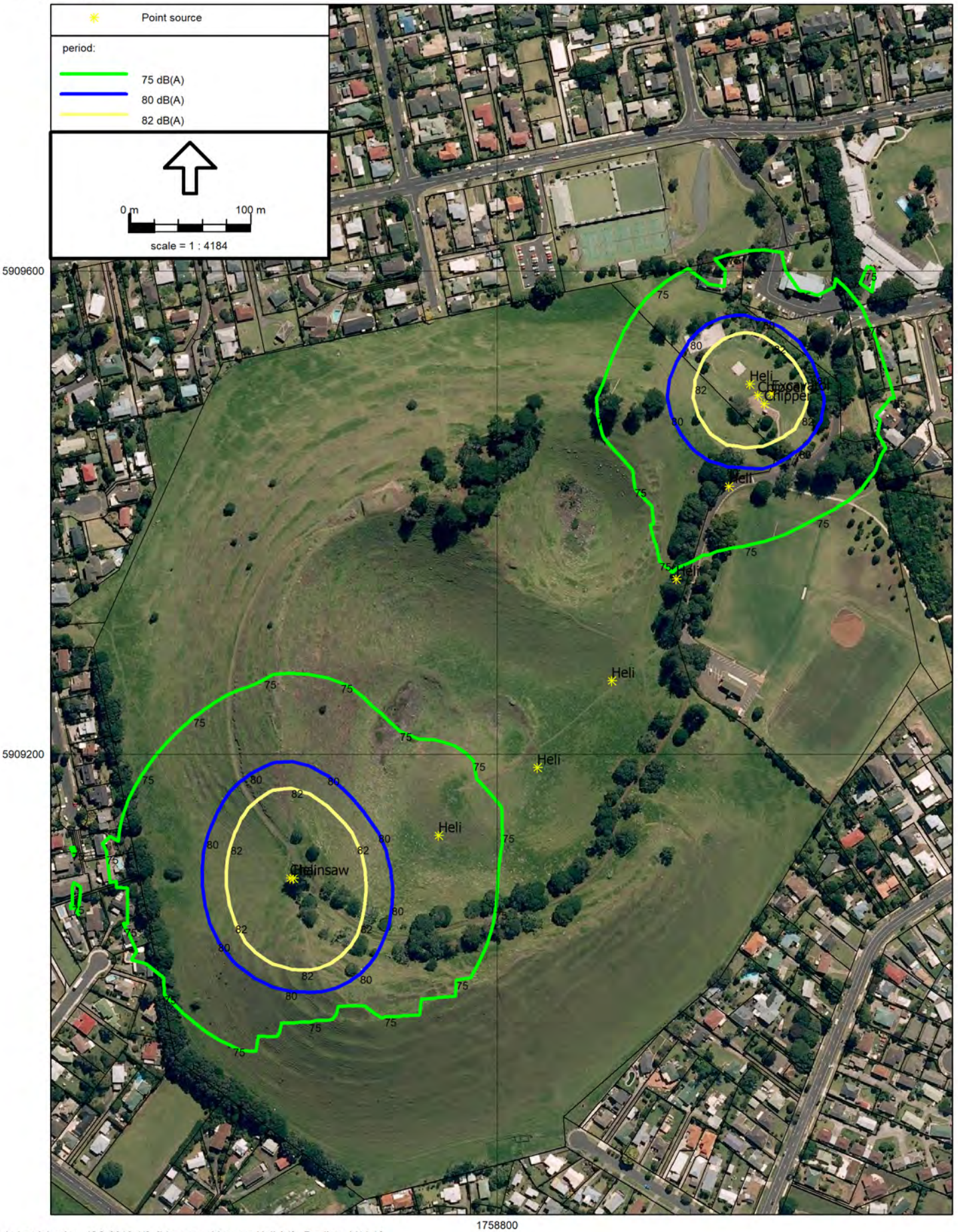
(2) The noise from the use of the helicopter shall comply with a noise limit of 85dB L_{Aeq} when measured 1m from the facade of any occupied building in accordance with NZS6803:1999 *Acoustics – Construction Noise.*

(3) The owners and occupants of all neighbouring buildings within a minimum of 50 m of the site shall be advised of the works in writing at least ten (10) days prior to the commencement of works on site. The written advice 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.

(4) Where the use of a helicopter is required for a period of more than 3 days in any work area which would result in noise levels exceeding 75dB L_{Aeq} at any receiver, the use of the helicopter shall be limited to 3 consecutive days per week, and may only be continued on the same 3 consecutive days in the subsequent weeks until the work in that area is complete.

(5) The use of helicopters for lifting is only permitted between the hours of 9am to 5pm from Monday to Friday.

Appendix A – Noise Level Contour Maps



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Mangere Heli A2

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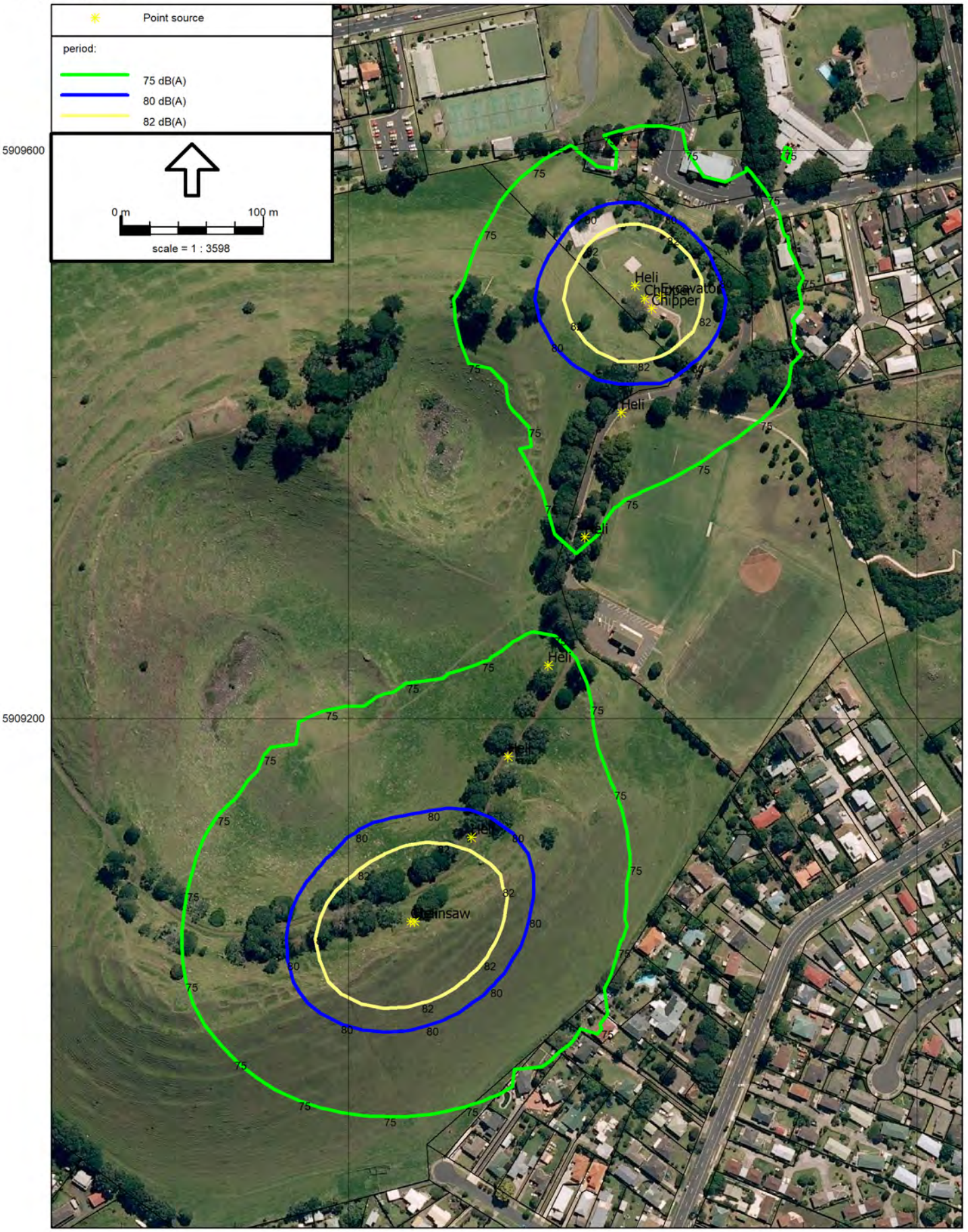

1758800

1759200

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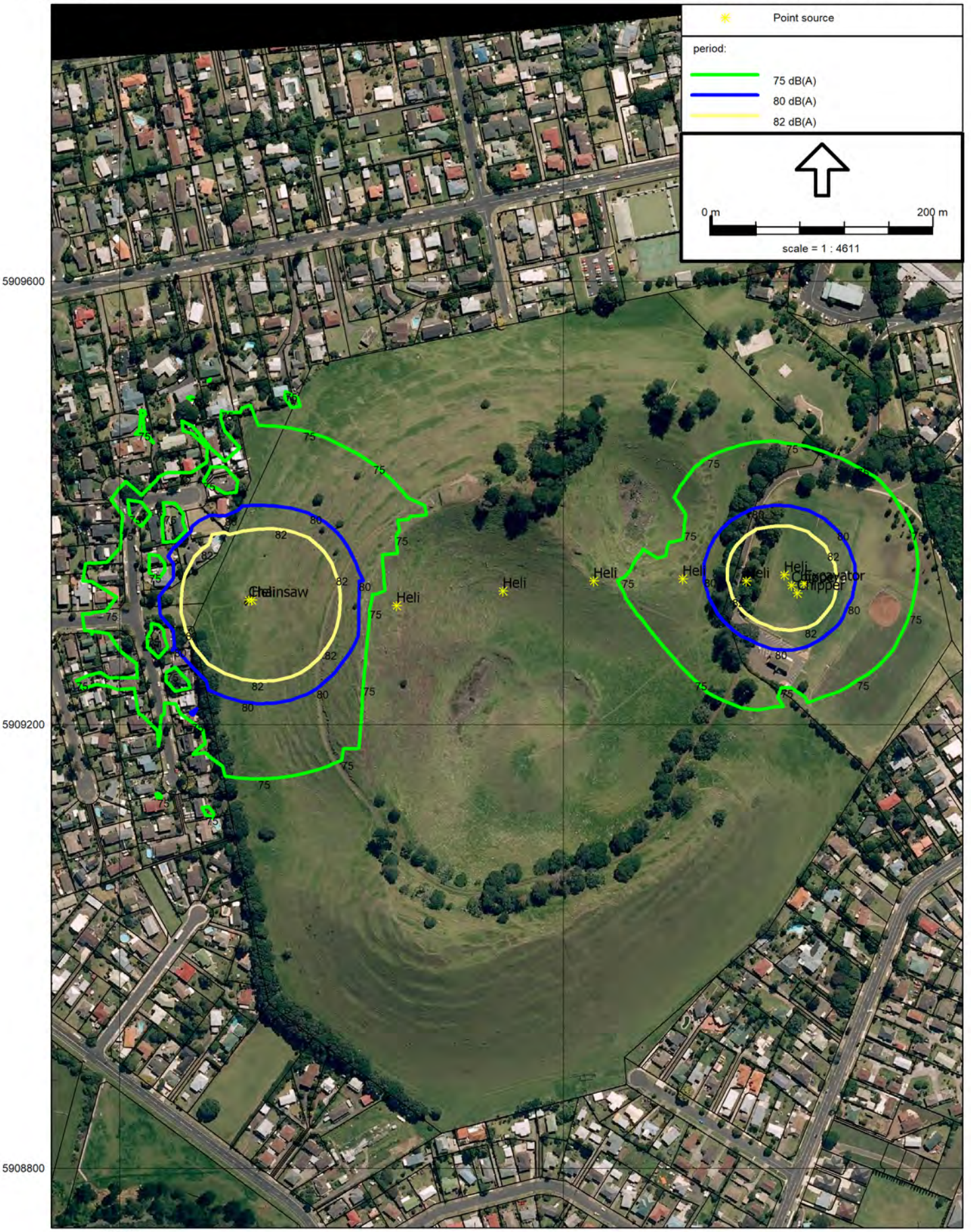
Mangere Heli B1

Styles Group Acoustics and Vibration



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Mangere Heli B2

Styles Group Acoustics and Vibration

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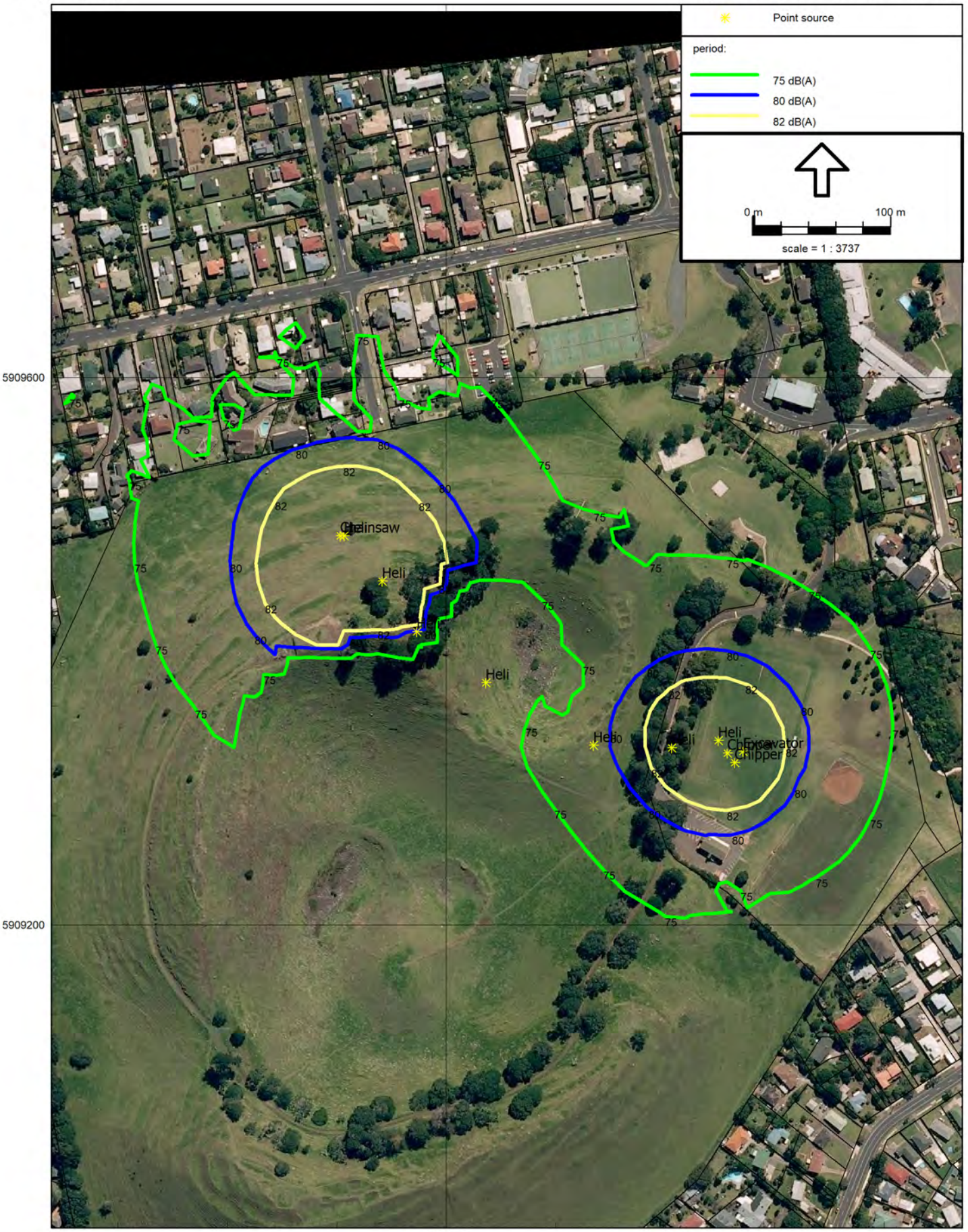
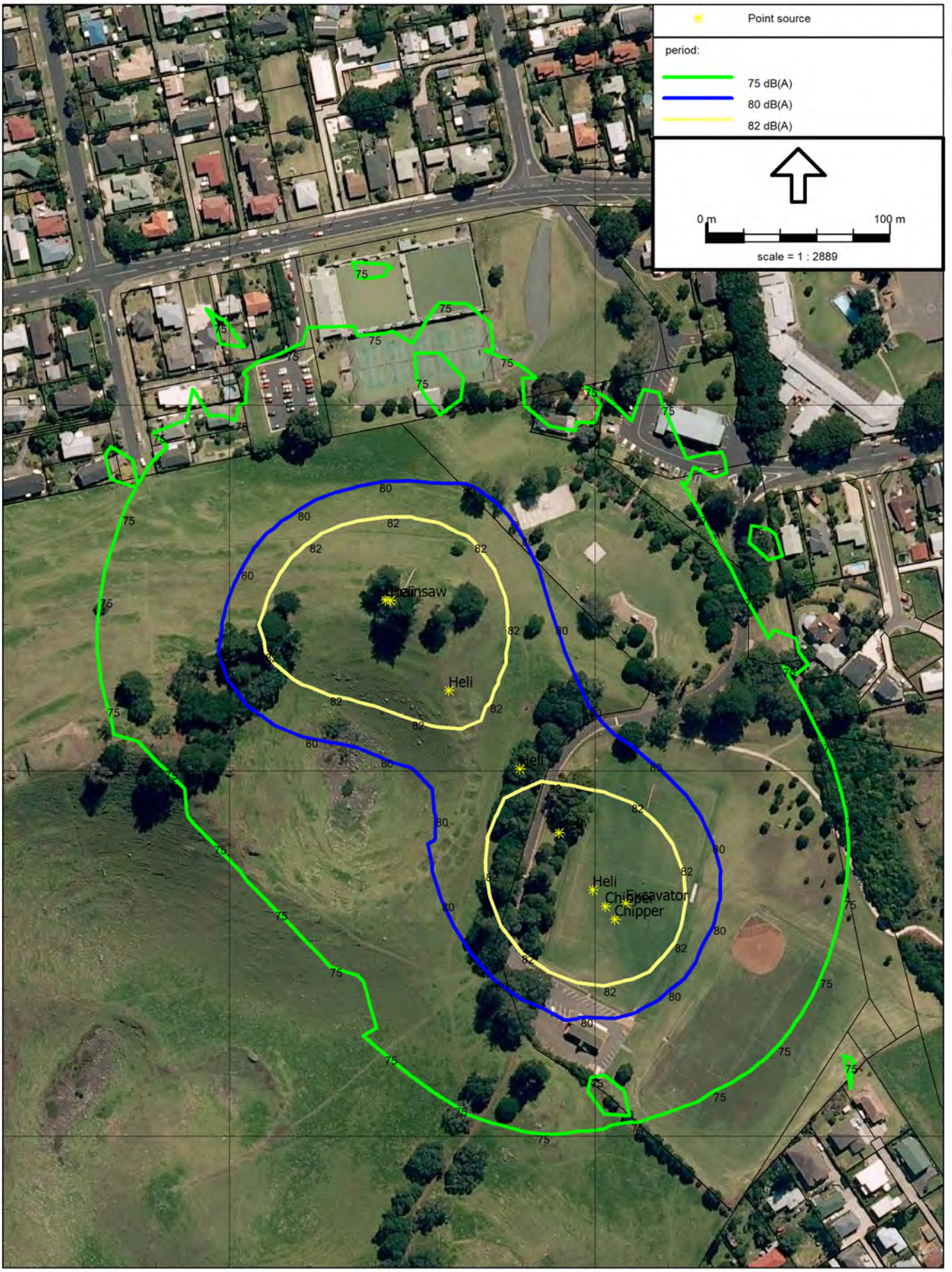

Point source
period:
75 dB(A)
80 dB(A)
82 dB(A)
0 m
100 m
scale = 1 : 3737
5909600
5909200
1758800
Chainsaw
Heli
Heli
Heli
Heli
Heli
Chipper
Excavator

Mangere Heli B4

Styles Group Acoustics and Vibration



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Mangere Crane C1

Styles Group Acoustics and Vibration

Industrial noise - ISO 9613.1/2, [Mangere - Mangere Crane C1] , Predictor V11.10


Point source
period:
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80 dB(A)
82 dB(A)
0 m
100 m
scale = 1 : 3059
5909600
5909400
5909200
5909000
1758800
1759000
1759200
75
Chipper
Chainsaw


Point source
period:
75 dB(A)
80 dB(A)
82 dB(A)
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100 m
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75
75
75
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Chainsaw
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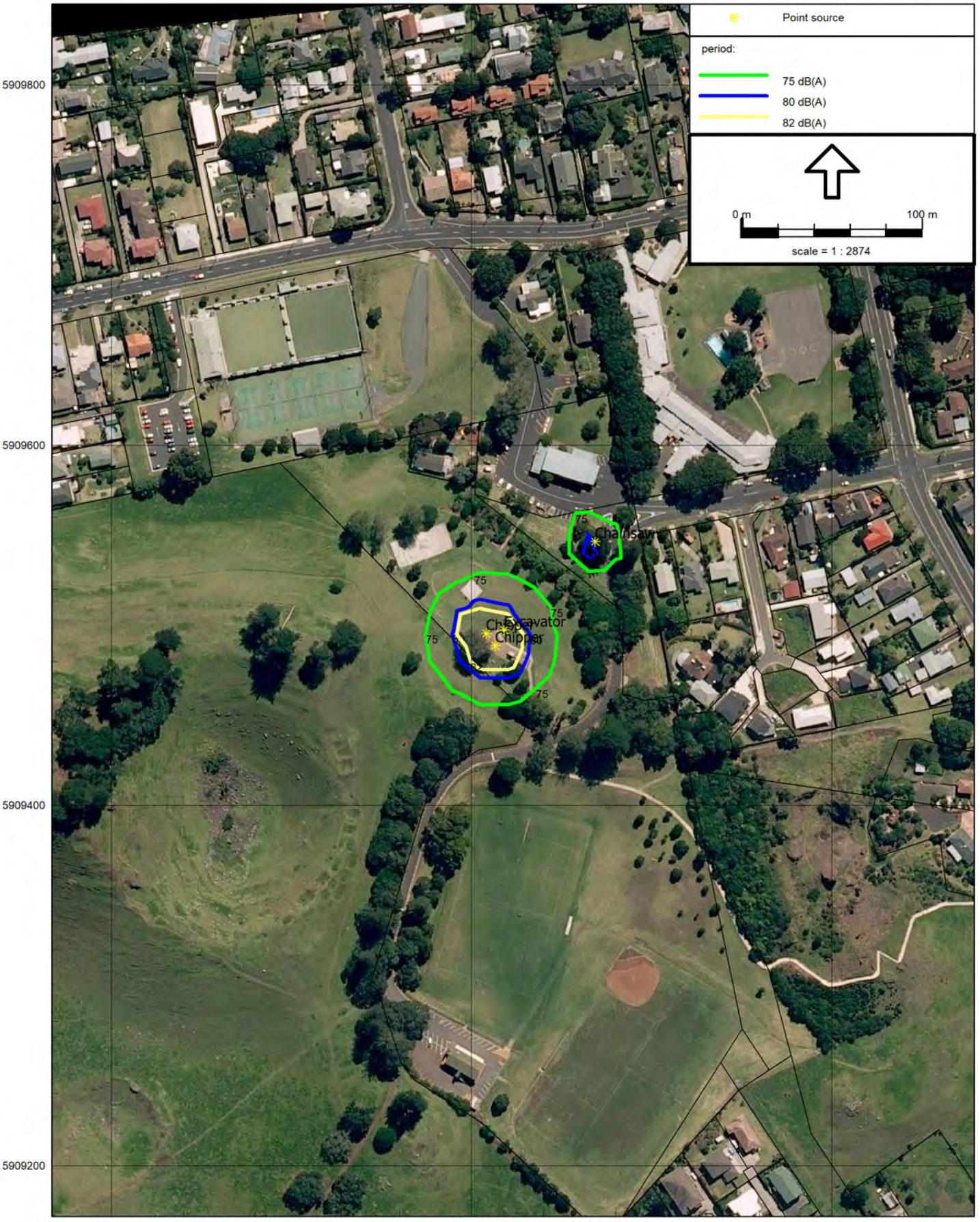

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