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Prepared for: **Whangarei District Council**

Date: **13th March 2012**

Title: **Hikurangi Motorsport Park – Feasibility Investigation**

Revision Number: 3

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1. Introduction

Styles Group has been engaged by Whangarei District Council, (WDC) to undertake feasibility investigations regarding the establishment of a motorsport and outdoor recreation park, (the Park) in Hikurangi. Some of the outdoor activities identified for the proposed development will create a noise impact upon the surrounding environment. We have undertaken predictive computer modelling to quantify the noise impact expected from the Karting and Speedway activities in the Park. This report outlines the methodology utilised for the construction of the model and presents the results of two separate scenarios in which different Park layouts have been proposed for comparison.

This report establishes whether or not the noise emissions generated by the Park will restrict the proposal in terms of the potential adverse noise effects on neighbours, and if so, to what degree.

This assessment should not be used as the basis for preparing a District Plan change or resource consent application. Its sole purpose is to guide the WDC in its decision making process and to assess the viability of the Park, and it should not be used by any other party for any other purpose.

2. Scope of Services

The scope of work is as set out in the brief dated 22nd February 2011. The salient sections are set out below:

Preparation of a preliminary feasibility report to include:

- An assessment of the site's suitability for accommodating the proposed development based on the likely impact on residential properties along Gomez Road including noting opportunities, constraints, and fatal flaws;
- Production of a map highlighting identified opportunities and constraints (including properties which may face an unacceptable impact from the use and development of the site);
- High level assessment of traffic noise to and from the site;
- Any legislative requirements or other approvals likely needed likely through the development of the site; and
- Recommended stakeholders to undertake consultation with.

3. Assessment Methods

Two key activities have been identified as the most significant contributors to the noise environment of the Park and its proximate noise sensitive receivers. These are Karting events and speedway events such as stock cars. At present, a designated circuit is proposed for each of these activities and for the purpose of this assessment two areas within the Park have been allocated for these.

The majority of noise sensitive receivers are residential premises on Marua Road and Gomez Road. In addition however Styles Group has been instructed to address specific concerns regarding the anticipated effects of noise on livestock. The principle focus of these concerns is the proximity of a deer farm adjacent to the northern boundary of the Park.

Scenarios

We have created noise models to determine the noise emissions for each of the two separate scenarios, involving the transposition of the speedway and Kart tracks between the two possible track locations on the site as well as considering the separate and combined use of each. The two possible track locations are understood by Styles Group to be Councils preferred building platforms. The scenario that results in the lowest noise emissions for the neighbouring receivers is considered to be the most suitable layout from an acoustic perspective. The maps in appendices A through D set out the track layouts and receiver positions for each scenario.

In summary, the scenarios involve swapping both the Kart track and the speedway track between the two building platforms preferred by the Council.

As a preface to the remainder of the report, scenario two, (Appendix D) is the least preferred and is not expanded on further than providing the noise contour map and table of individual receiver results. The highest levels for Scenario two are up to L_{Aeq} 71dB, compared to L_{Aeq} 61dB for Scenario one.

For the purpose of this assessment, it has been assumed that there will be no operation of the facility at night time, (being from 2200 – 0700). It may be possible to extend the daytime period until 2230 but this has not been considered in this report.

4. Current District Plan Noise Limits

The area of the site within which the Speedway and Kart tracks are currently proposed is presently zoned Open Space, and all of the surrounding land is currently zoned Countryside under the Whangarei District Plan. Rule 46.3.6 of the District Plan sets out the relevant noise limits applying to the area within the Open Space Zone thus:

Any activity is a permitted activity if: a) Noise generated by the activity, measured at the boundary of a site in a Living Environment or the notional boundary of any residential unit in a Countryside Environment, does not exceed: i. 50 dBA L10 between 0700 - 2200 Monday to Sunday; and ii. 40 dBA L10 at any other time; and iii. 65 dBA Lmax on any day between 2200 – 0700, except for emergency service vehicles and the operation of emergency service call-out sirens; or a) Noise is generated by non-amplified voice noise; and b) Except where expressly provided elsewhere in this Plan, sound levels shall be measured in accordance with the provisions of NZS 6801:1991 Measurement of Sound and assessed in accordance with NZS 6802:1991 Assessment of Environmental Sound.	Any activity that does not comply with a condition for a permitted activity is a restricted discretionary activity. Discretion is restricted to: i. Maximum level of noise likely to be generated; ii. The nature and frequency of the noise, including any special audible characteristics; iii. Effect on nearby residential units; iv. Compatibility within the Environment v. Compatibility with surrounding Environments; vi. Length of time for which specified noise level is exceeded, especially at night; vii. Likely adverse effects on-site and beyond the site; viii. Mitigation measures to reduce noise generation.
Provided always and notwithstanding the noise requirement in this Rule, if the activity under consideration is a mineral extraction activity and it is located within a Mineral Extraction Area then the noise standards for that activity will be determined in accordance with the rules in Chapter 64.	

For the purpose of comparing the modelling results with the currently permitted noise limits, the relevant limit for comparison will be the daytime (0700 – 2200) control of L_{10} 50dBA. For motorsport noise, the difference between L_{10} and L_{Aeq} for the same source of noise will be approximately 3dB, where the L_{10} will be 3dB higher than the L_{Aeq}. Because the modelling has been conducted in L_{Aeq}, (as the preferred descriptor for the latest District Plans) it is therefore appropriate to consider the current noise limit as being L_{Aeq} 47dB.

5. Noise Modelling Methodology

Styles Group has used globally recognised Predictor™ computer noise modelling software to prepare the predictions based on compliance with ISO9613-1/2 *Attenuation of sound during propagation outdoors*. The noise level predictions are based on neutral meteorological conditions in accordance with NZS6802:2008 *Acoustics – Environmental Noise.*

Terrain contours at 2m intervals were acquired using a photogrammetric process. The aerial photography was taken in 2003. Although some scrub is evident over the existing site the ridges

are largely barren and consequently it is expected that natural screening effects will be predicted to a sufficiently accurate degree. Foundation levels for the circuit locations were provided by Opus International Consultants. These were manually merged with the terrain contours.

We have based the levels of noise sources used in the model upon measurements undertaken of the same types of activities during previous projects. Speedway noise emissions were based on data acquired from the Western Springs Speedway facility in Auckland. The noise emissions of Karting activity were based on measurements taken at Whangarei Karting Club. The model represents these activities as a series of closely spaced point sources located along the centrelines of the circuits. The models have been calibrated against the measured levels from major events and the accuracy is +/- 1dB at the calibration points.

The predicted noise levels represent the very loudest 5 minute period during racing. Because racing is not expected to endure for a cumulative duration over a day of greater than 5 hours, a 5dB duration correction should be subtracted from the stated figures to give the effective level over the day.

We consider that if the development were to go ahead, the noise limits would best be termed as a 5 minute L_{Aeq} noise limit, and an overall L_{Aeq} noise limit applying from 0700 to 2200. This method will control the very loudest periods of racing as well as effectively controlling the overall cumulative duration of noise by imposing the longer term limit as well.

The size and shape of the noise models presented in Appendices A to D are restricted to the size and shape of the terrain data required to include the extent of potentially noise-sensitive receivers and terrain areas influencing the propagation of noise to those receivers.

Please refer to Appendix E and Appendix F for the locations of noise sensitive receivers.

6. Assessment Methodology

It is our opinion that if the noise levels generated by the Park can comply with a level of L_{Aeq} 50dB, there would be no further restrictions required for day time operations. That is, a level of L_{Aeq} 50dB is reasonable in terms of s16 of the Resource Management Act[1], (The Act) in this case for day time operations. This is approximates the daytime noise limit in Rule 46.3.6 of the District Plan that requires compliance with a limit of L_{A10} 50dB, (approximately L_{Aeq} 47-48dB in this case). The assessment does not therefore consider the noise effects on those properties where noise levels of $L_{Aeq(15hr)}$ 50dB are complied with[2].

[1] Section 16, Duty to avoid unreasonable noise, ss(1): *Every occupier of land... shall adopt the best practicable option to ensure that the emission of noise from that land or water does not exceed a reasonable level.*

[2] With reference to Appendices A to D, properties subject to noise levels of $L_{Aeq\ (15hr)}$ 50dB are shaded from light green to green

The consideration of the potential noise effects on any property where the predicted noise levels are above $L_{Aeq(15hr)}$ 50dB should, (without limitation) include the number of such occurrences per annum and the duration of each.

The predicted noise levels are set out in the same terms as the suggested noise limit regime, being $L_{Aeq(5min)}$ and $L_{Aeq(15hr)}$.

7. Results – Scenario 1

The modelling results are set out graphically in Appendices A to D and in tabular form for all scenarios in Appendix E. As set out in section 5, the modelled results are equivalent to the loudest 5 minute period of racing, where the noise levels over the entire day will be 5dB less.

Go-kart Racing Alone

For Kart racing alone, the most exposed receiver has been assessed to be Receiver 7, with a 5 minute L_{Aeq} level of 46dB, and a 15hr L_{Aeq} level of 41dB.

These noise levels are compliant with a level of L_{Aeq} 50dB and therefore considered reasonable. There are no receivers that require special consideration or consultation with respect to these predictions.

Speedway Racing Alone

For Speedway racing alone, the most exposed receiver has been assessed to be Receiver 20, with a 5 minute L_{Aeq} value of 61dB and a 15hr L_{Aeq} level of 56dB.

Receivers 2 & 19 are predicted to receive noise levels over $L_{Aeq(15hr)}$ 50dB, and Receivers 7, 17 & 18 are predicted to receive exactly $L_{Aeq(15hr)}$ 50dB.

Speedway & Go-kart Racing Combined

Although unlikely to occur in reality due to a number of factors, we have modelled the noise effects arising from having both the Kart track and the Speedway track in operation at the same time. The most exposed receiver has been assessed to be Receiver 20, with a 5 minute L_{Aeq} value of 61dB and a 15hr L_{Aeq} level of 56dB.

Receivers 2, 7 & 19 are predicted to receive noise levels over $L_{Aeq(15hr)}$ 50dB, and Receivers 17 & 18 are predicted to receive exactly $L_{Aeq(15hr)}$ 50dB.

8. Results – Scenario 2

Appendix D depicts the noise levels resulting in locating the Speedway track to the north of the site and for the operation of Karts and Speedway combined. It can therefore be compared with

Appendix C to give a clear indication of the difference in noise levels between the two scenarios. Scenario 2 would clearly expose the neighbouring properties to more noise than Scenario 1 and is therefore not preferred. Consequently, Scenario 2 is not considered further in this assessment.

9. Noise Effects on Livestock

Noise effects on animals are greatest for those that live naturally in the wild where unusual or unexpected noise sources can frighten or startle through confusion or as an instinctive reaction to what might be a predator.

For farmed animals, including deer, the reaction to noise is often much less noticeable as noises that do not occur in the wild are much more common on farms, especially those near roads. The animals will be much more accustomed to vehicle noise, aircraft noise and people noise than their counterparts in the wild.

Styles Group are aware of existing motorsport activities that operate in close proximity to livestock where no problems arise. Auckland Zoo is a very good example of where large exotic animals brought from the wild into captivity live in very close proximity to Western Springs Speedway without problems. We are aware that the only noise source at Western Springs that sometimes startles the animals is fireworks, due to the impulsive nature of the sound. The noise of motorsport is not a problem for the staff or the zoo animals. We are aware of numerous other motorsport venues in other parts of New Zealand that operate in very close proximity to farms without issue.

Given the results of the noise modelling, we do not anticipate that the proximity of livestock, (in particular deer) to the proposed facility will hinder the ongoing operation with respect to noise.

10. Affected Dwellings

WDC must observe its duties under section 16 of The Act that require it to adopt the Best Practicable Option, (BPO) to ensure that the use of the land does not give rise to unreasonable levels of noise. The BPO may comprise many aspects of the proposal such as the hours of operation, noise levels, frequency and duration of events, physical noise mitigation measures and consultation (without limitation).

If compliance with the current District Plan noise limits could be met, it would be likely that the proposal would operate with relatively few restrictions related to noise. However, as the modelling undertaken shows, compliance for Speedway activities is not possible and so some form of mitigation is necessary. Although the District Plan limit is not being taken as the baseline in this case, the limit does happen to be at a noise level where compliance with it

would result in less than minor noise effects. It is useful therefore to consider a noise level of $L_{Aeq(15hr)}$ 50dB as the level at which motorsport activities would be unrestricted during the day.

This section of the report assumes that the earthworks proposed comprise the extent of physical screening that will be undertaken if the proposal goes ahead.

Commonly, the next most practicable mitigation method is to sacrifice a number of days where little or no activity will occur for a smaller number of days where noisy events may occur at a higher level.

Speedway

For the purpose of this report, 1 event = 1 day and a two-day event, (Saturday & Sunday) would be 2 events.

Styles Group understands that the Whangarei Saloon and Stock-car Club presently holds around 15 events per annum, with typically 60-70 cars per event and up to 500 for large events. As well as the number of events and cars, other factors included in the consideration of noise adverse effects on neighbouring properties include:

i) That the events endure for no longer than 3-4 hrs each, (warm-up to last race);
ii) That the events conclude by 2200 – 2230;
iii) That there are no more than 3 weekends out of 4 used for racing;
iv) That the events calendar is in some way notified to the nearby residents in advance of the season so that they can plan around the activities;
v) That noise generated by the PA system is limited to L_{Aeq} 50-55dB at the receivers; and
vi) That racing on certain public holidays is restricted

It is our opinion that up to 15 events would be possible without generating unreasonable noise levels at the nearest receivers, notwithstanding that based on predictions, the $L_{Aeq(15hr)}$ 50dB will be exceeded at up to 3 receivers, and exactly $L_{Aeq(15hr)}$ 50dB at a further 3. Furthermore, Styles Group considers that up to 20 events per annum may be reasonable if restrictions (i) – (vi) above are observed.

At a minimum, we recommend that the Receivers 1, 2, 6, 7 & 14-22 are consulted with, (being the properties that are predicted to receive noise levels over $L_{Aeq(15min)}$ 50dB). Ideally however, it would be prudent to consult with all surrounding properties as set out in Appendices E and F.

Go-karting

Styles Group understands that the Whangarei Kart Club presently hold around 18 events per annum, with typically 60 Karts per event and up to 120 for large events. As well as the number

of events and Karts, other factors included in the consideration of adverse noise effects on neighbouring properties include:

i) That the events endure for no longer than 6-7 hrs each;
ii) That the events calendar is in some way notified to the nearby residents in advance of the season so that they can plan around the activities;
iii) That the noise generated by the PA system is limited to L_{Aeq} 45dB at the receivers; and
iv) That racing on certain public holidays is restricted

The number of events possible for Kart racing can be higher than for Speedway as it will be able to comply with a noise limit of L_{Aeq} 50dB at all receivers. Below this noise level the effects could be deemed to be less than minor if the Kart racing was undertaken in isolation. The Karting will however be undertaken at a facility that generates other noise effects on its neighbours so the cumulative effects must be taken into account.

In light of the noise modelling results, 15 events is considered to be well within what is reasonable in this case and there is scope to increase this up to 20-25 if restrictions (i) – (iv) above are observed.

11. Other Activities

Styles Group understands that the Park may host other activities, including mountain biking, four-wheel driving, motocross and shooting. There are no defined locations proposed within the Park for these activities yet so it is not possible to undertake noise level predictions.

When considering the possible locations for these facilities, it would be prudent to ensure that they are further away from noise-sensitive dwellings than the Speedway and Karting tracks, and to ensure that the noise levels arising from each would be less than L_{Aeq} 50dB for motocross, and below L_{Amax} 50dB for shooting. Once the nature and location of the proposed uses are confirmed noise level predictions can be undertaken to further inform the assessment.

12. Traffic Noise

Styles Group has undertaken a preliminary assessment of road traffic noise in accordance with New Zealand Standard NZS6806:2010 *Road traffic noise – new and altered roads,* (NZS6808:2010) for receivers along Gomez and Marua Roads.

Section 8 of the Preliminary Traffic Engineering Feasibility Study (dated May 2011) undertaken by Engineering Equilibrium sets out the traffic predictions for a range of scenarios including the Average Annual Daily Traffic, (AADT) values.

Sections 6 and 8 of the Engineering Equilibrium report state that the highest existing AADT values for Gomez and Marua Roads are 50 and 678 vehicles per day respectively, and that the Park will generate its own AADT generation of 106. This gives post-development AADT values of 156 for Gomez Rd and 784 for Marua Road.

Section 1.3 of NZS6808:2010 states that the Standard does not apply to roads, either altered or new, that carry less than 2000 AADT for the design year. The Standard states in Clause C1.3.1 that conditions controlling hours of operation and the number of vehicles may be more appropriate. We agree that such controls are more appropriate, and that in this case the limitations on Karting and Speedway events due to their own inherent noise generation will be sufficient to control the potential traffic noise effects also.

The other activities that may be undertaken on the site, (see section 11) should be controlled such that the majority of vehicles are off the site before 2230 at the latest and not on the site earlier than 0700. This is based on Gomez Road remaining unsealed. Should the road be sealed, the reduction in traffic noise may afford some relaxation on this recommendation.

With such controls in place, it is considered that the potential effects of traffic noise on Marua and Gomez Roads will be adequately controlled.

13. Conclusion

Styles Group has undertaken a study to determine the feasibility of establishing a motorsport and outdoor recreation park whose major noise generating components include a Kart track and Speedway track. A computer noise model has been used to determine the noise levels at the nearest receivers as set out in the project brief.

We have identified that Speedway racing would not be able to comply with a noise limit that would result in relatively unrestricted use during the day. It is therefore necessary to consider what mitigation might be most appropriate to 'offset' the higher levels of noise during racing. We consider that restricting the number of Speedway events to no more than 15-20 per annum to be a reasonable solution.

Although Kart racing would be able to comply with a much lower noise limit of L_{Aeq} 50dB, when considering that it will generate noise along with Speedway activities on the same site, we consider it appropriate to restrict the number of Karting events to no more than 25 per annum. The assumptions upon which these figures are predicated are set out in the body of the report.

The number of events and assumptions are provisional at this stage. There may be scope to increase the number of events and/or relax the associated restrictions depending on the contribution from other as-yet unknown sources of noise on the site, (such as PA systems, vehicle noise and other activities). Once a full assessment has been undertaken the possible

number of events and also what other mitigation measures may be incorporated, such as further physical screening, (from bunds or further earthworks) or restrictions on the hours of operation can be refined.

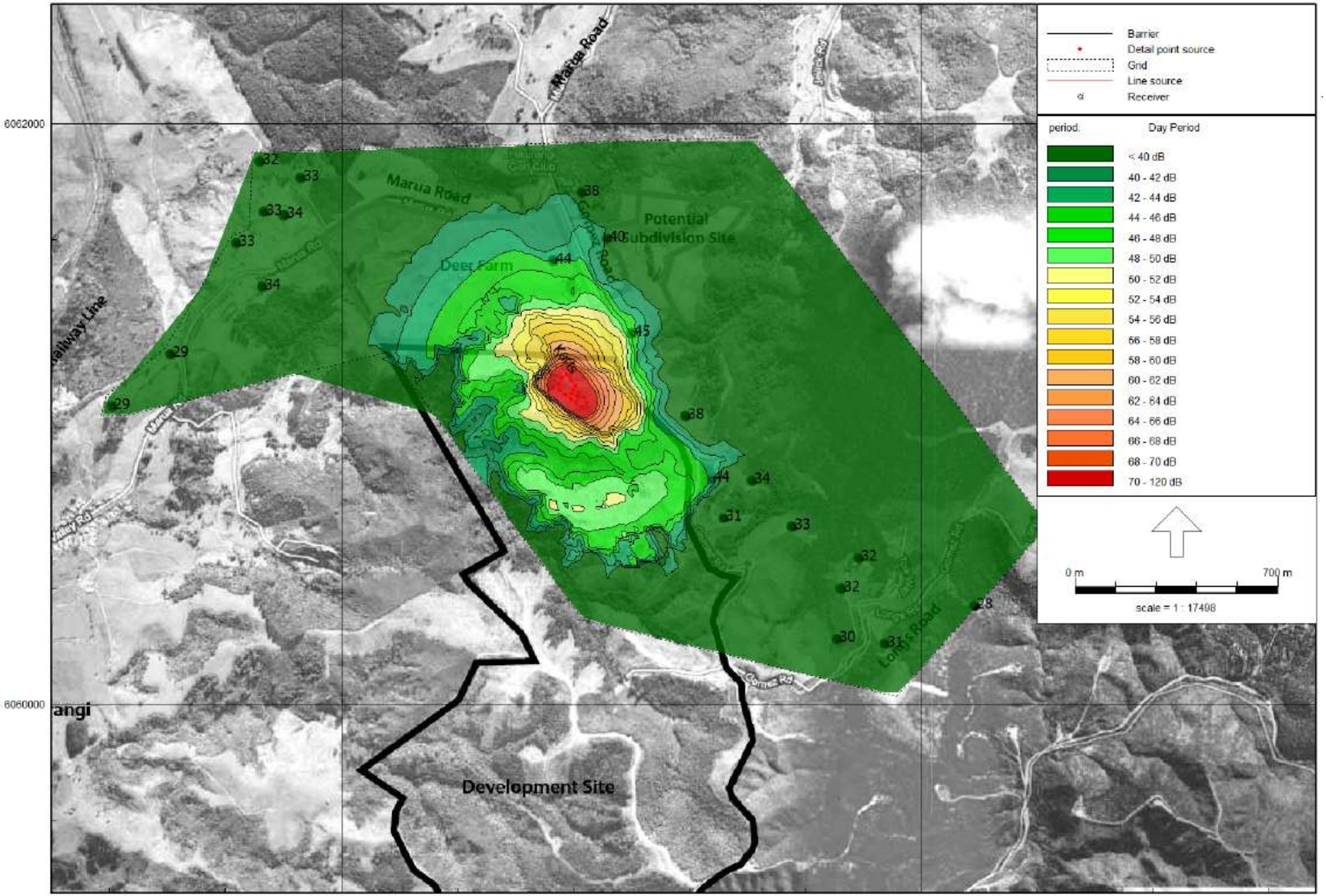
The predicted number of vehicle movements that will be generated on the surrounding road network is low at only 106 additional AADT and a peak level of up to 2300 vehicles per day. Such levels are acceptable without further restrictions other than to control the hours of operation to ensure that the majority of vehicles are off the site between 2230 and 0700.

The potential noise effects received at dwellings over the wider area not covered in Appendices A to D are considered to be less than minor and require no further assessment.

14. Recommendations

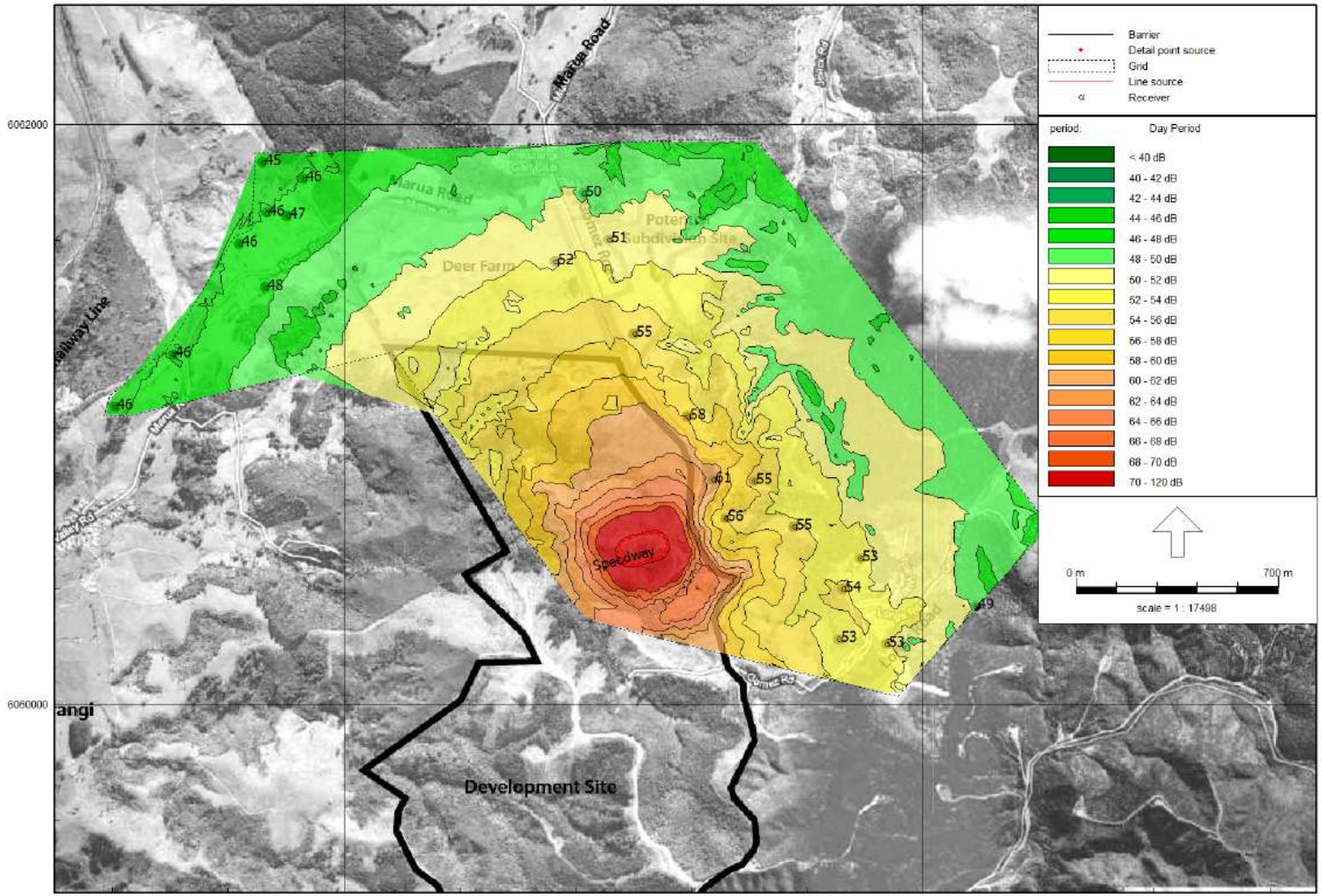
Styles Group recommend that if, based on the results of this feasibility study, the WDC decide to pursue the establishment of the Park, a further assessment should be undertaken to determine, (without limitation) the number of permissible events, degree of adverse effects and the appropriate relevant controls in greater detail. The further assessment can be based on the results of the modelling presented herein, (provided no track layout or site/terrain changes are proposed).

15. Appendix A Scenario 1 – Go-kart Racing Only



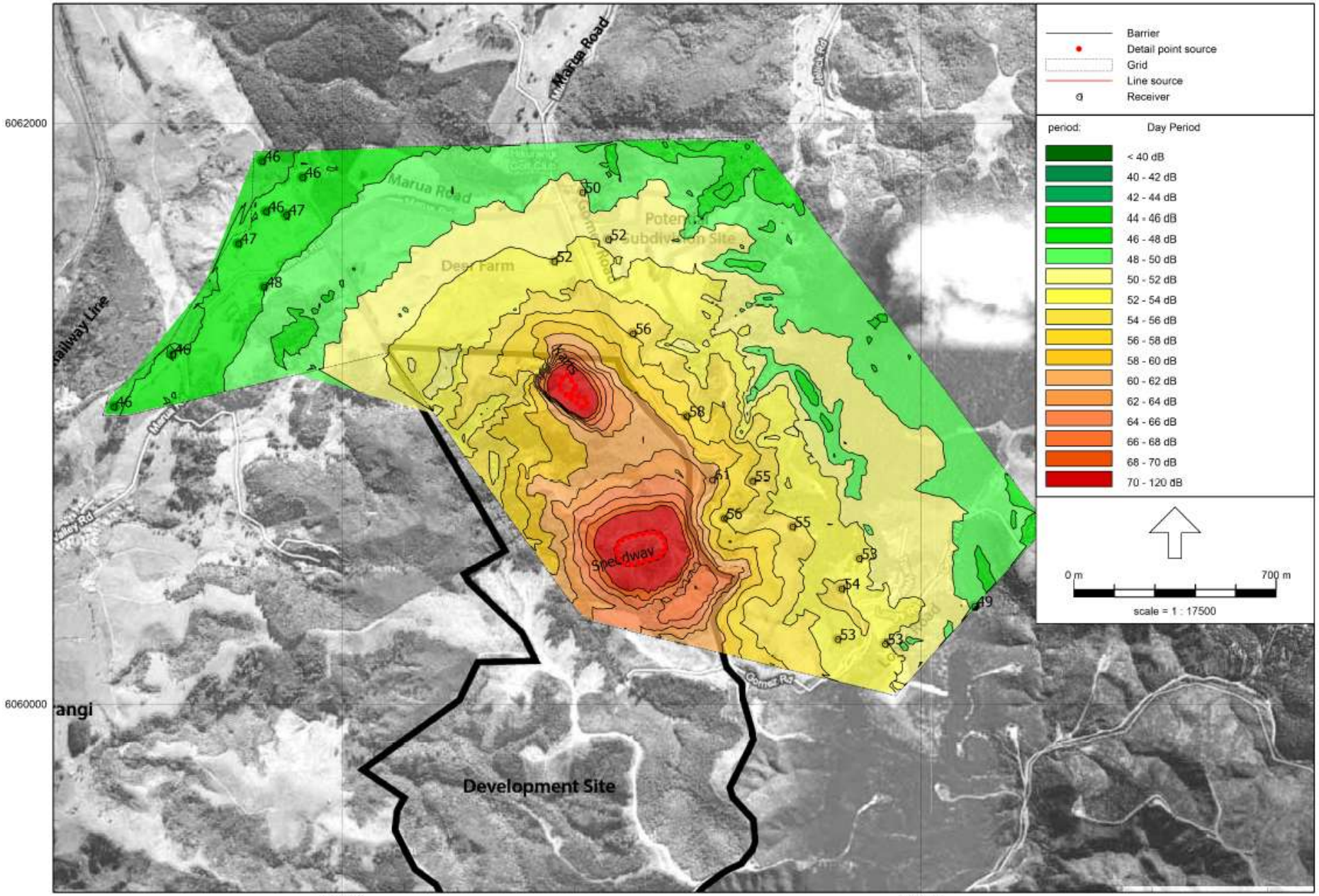
Industrial noise - ISO 9613.1/2 (1/3 Octave), [version of Aerial Survey Info Area Trimmed - Scenario 1 - Just Karts] , Predictor V8.01

16. Appendix B Scenario 1 – Speedway Only



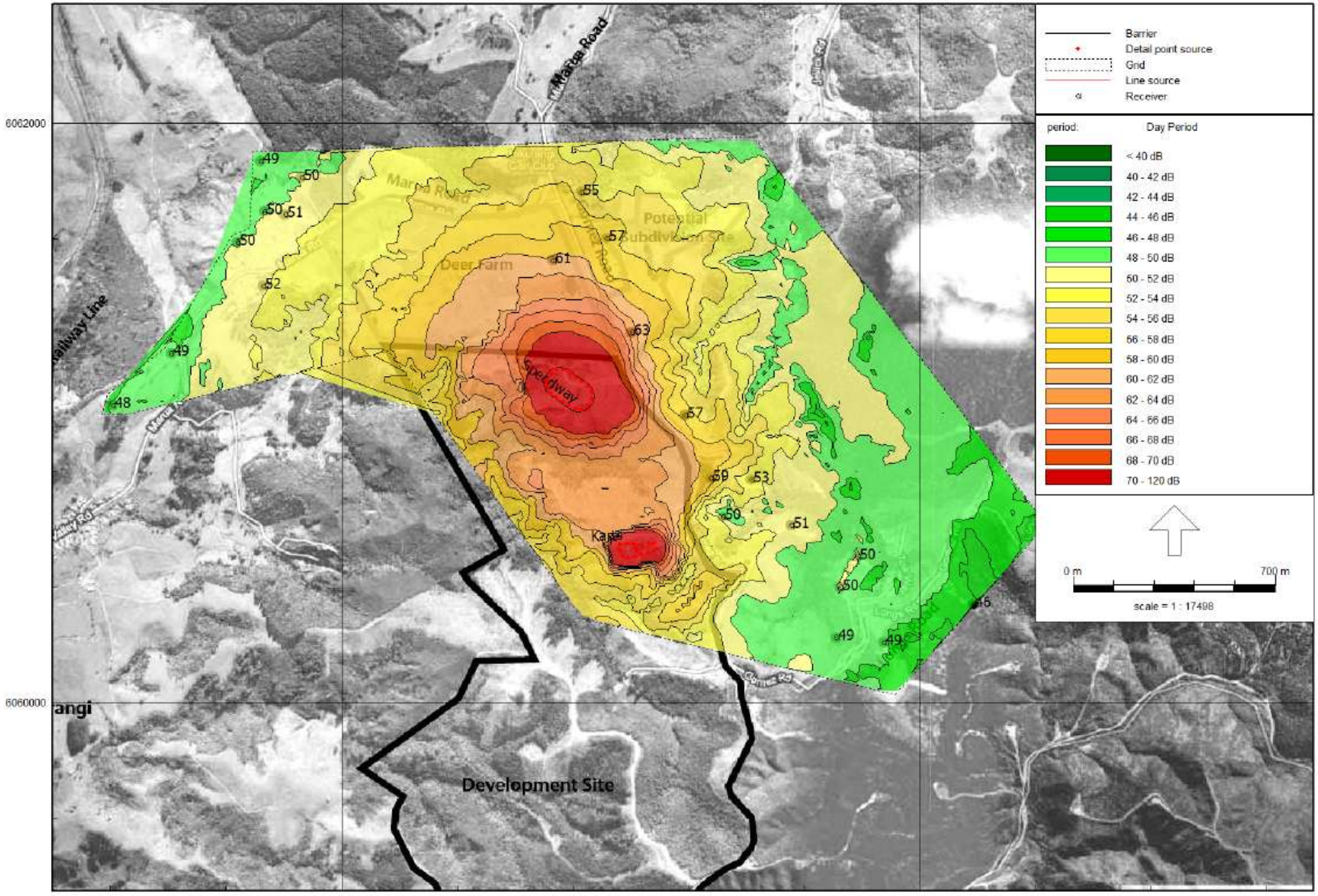
Industrial noise - ISO 9613.1/2 (1/3 Octave), [version of Aerial Survey Info Area Trimmed - Copy of Scenario 1 - All sources] , Predictor V8.01

17. Appendix C Scenario 1 - Kart Track and Speedway Combined



Industrial noise - ISO 9613.1/2 (1/3 Octave), [version of Aerial Survey Info Area Trimmed - Copy of Copy of Scenario 1] , Predictor V8.01

18. Appendix D Scenario 2 – Kart Track and Speedway Combined



Industrial noise - ISO 9613.1/2 (1/3 Octave), [version of Aerial Survey Info Area Trimmed - Scenario 2 - All sources] , Predictor V8.01

19. Appendix E Tabulated Results for all Scenarios

Receiver	Description	Scenario 1 (All) Predicted dB $L_{Aeq(5min)}$	Scenario 1 (Karts Only) Predicted dB $L_{Aeq(5min)}$	Scenario 1 (Speedway Only) Predicted dB $L_{Aeq(5min)}$	Scenario 1 dB $L_{Aeq(15hr)}$ Noise Limit	Scenario 2 (All) dB $L_{Aeq(5min)}$
1*	1 Gomez Rd	50	38	50	50	*55*
2*	101 Gomez Rd	58	38	58	55	*57*
3	125 Marua Rd	46	33	46	50	*50*
4	16/113 Marua Rd	47	34	47	50	*51*
5	21/113 Marua Rd	46	33	46	50	*50*
6*	Lot 1, 29 Gomez Rd	52	40	51	50	*58*
7*	Lot 3, 29 Gomez Rd	56	46	55	55	*63*
8	30/113 Marua Rd	46	32	46	50	*49*
9	53 Marua Rd	46	29	46	50	*48*
10	59 Marua Rd	46	29	46	50	*49*
11	95 Marua Rd	47	33	46	50	*50*
12	98 Marua Rd	48	34	48	50	*52*
13	DP203770	49	28	49	50	*46*
14*	DP377485	53	30	53	50	*49*
15*	DP388940	53	32	53	50	*50*
16*	DP388940	54	32	54	50	*50*
17*	Lot 1	55	33	55	55	*51*
18*	Lot 4	55	34	55	55	*53*
19*	Lot 5	56	31	56	55	*50*
20*	Section 11 Blk XVI Hukerenui SD	61	44	61	60	*59*
21*	Section 14 Blk XVI Hukerenui SD	52	44	52	50	*61*
22*	Secton 52 Blk XI Opuawhanga SD	53	31	53	50	*49*
	Maximum 5min L_{Aeq}	61	46	61		*63*
	Log Average 5min L_{Aeq}	54	38	53		*55*

Note, * indicates properties requiring consultation where the $L_{Aeq(15hr)}$ is predicted to exceed

Appendix F Locations of Receivers