Styles Group
Acoustics & Vibration Consultants

ASSESSMENT OF NOISE EFFECTS

MANAGED CLEANFILL

362 JONES ROAD, DRURY

PREPARED FOR

Scarborough Bros Limited

DATE

1 November 2024

Assessment of noise effects prepared by Styles Group for Scarborough Bros Limited.

REVISION HISTORY

Rev:	Date:	Comment:	Version:	Prepared by:	Reviewed by:
1	25/07/24		Final Draft	Daniel Winter, MASNZ Consultant Styles Group	Jamie Exeter, MASNZ, Assoc. NZPI Principal Styles Group
1	1/11/24	Revision following updates to the design of the cleanfill operation	Final	Daniel Winter, MASNZ Consultant Styles Group	Jamie Exeter, MASNZ, Assoc. NZPI Principal Styles Group

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Executive summary

Styles Group has assessed the potential noise effects of the proposed operation of a managed cleanfill at 362 Jones Road within the Rural – Rural Production Zone of the Auckland Unitary Plan. This report has been prepared to accompany the resource consent application and Assessment of Environmental Effects for the proposal.

We have prepared noise level predictions for the proposal using computer noise modelling software. Our assessment demonstrates that the operation of the cleanfill will comply with the permitted noise limits at the notional boundaries of the nearest neighbouring sites.

Noise sources at the proposed cleanfill include trucks delivering fill to the Site and machinery spreading the fill material. The earthmoving plant will include a 21 ton excavator, a bulldozer (Caterpillar D6 or similar) and a 18 ton sheepsfoot roller.

A number of proposed noise mitigation and management measures form part of the application. These have been included in our calculations of the noise emissions from the site and our assessment of the potential noise effects.

The level, character, timing, frequency, and duration of the noise emissions from the site will be consistent with the permitted standards for the Rural – Rural Production Zone. It is our opinion that the noise will not cause unreasonable disturbance at any neighbouring notional boundary.

We have recommended conditions of consent based on our findings.

1.0 Introduction

Scarborough Bros Limited has engaged Styles Group to prepare an assessment of the potential noise effects of the proposed managed cleanfill operation at 362 Jones Road, Drury (the **Site**).

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. Recommended noise management measures and conditions of consent

iii. An assessment of the noise in accordance with the Auckland Unitary Plan (the **AUP**) and the relevant New Zealand acoustics standards.

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

The applicant proposes to operate a managed fill operation at the Site. The fill operation will be split into two areas, as set out below:

- North area cleanfill: 10ha with approximately 720,000m^3 of material
- South area cleanfill: 2ha with approximately 70,000m^3 of material.

The areas will be filled over a period of approximately ten years.

The proposed cleanfill will operate between the hours of 7:00am and 6:00pm, Monday to Friday and 7:00am and 1:00 pm on Saturdays. There will be no works on Sundays or public holidays. We understand that there will be periods when the managed fill operates at a much lower level of intensity or does not operate at all due to the seasonal nature of fill supply.

Vehicle access to the proposed cleanfill will be via a new access way from Hunua Road on the southern boundary. Truck movements to service the proposed cleanfill will be restricted to a maximum of 96 deliveries (192 truck movements) per day.

Works will be undertaken using a 21 ton excavator, a bulldozer (Caterpillar D6 or similar) and a 18 ton sheepsfoot roller. Only the excavator will be used within 90m of the boundary of 332 Jones Road or within 80m of the boundary of 353 Jones Road.

Figure 1 below illustrates the locations of the proposed two fill areas:

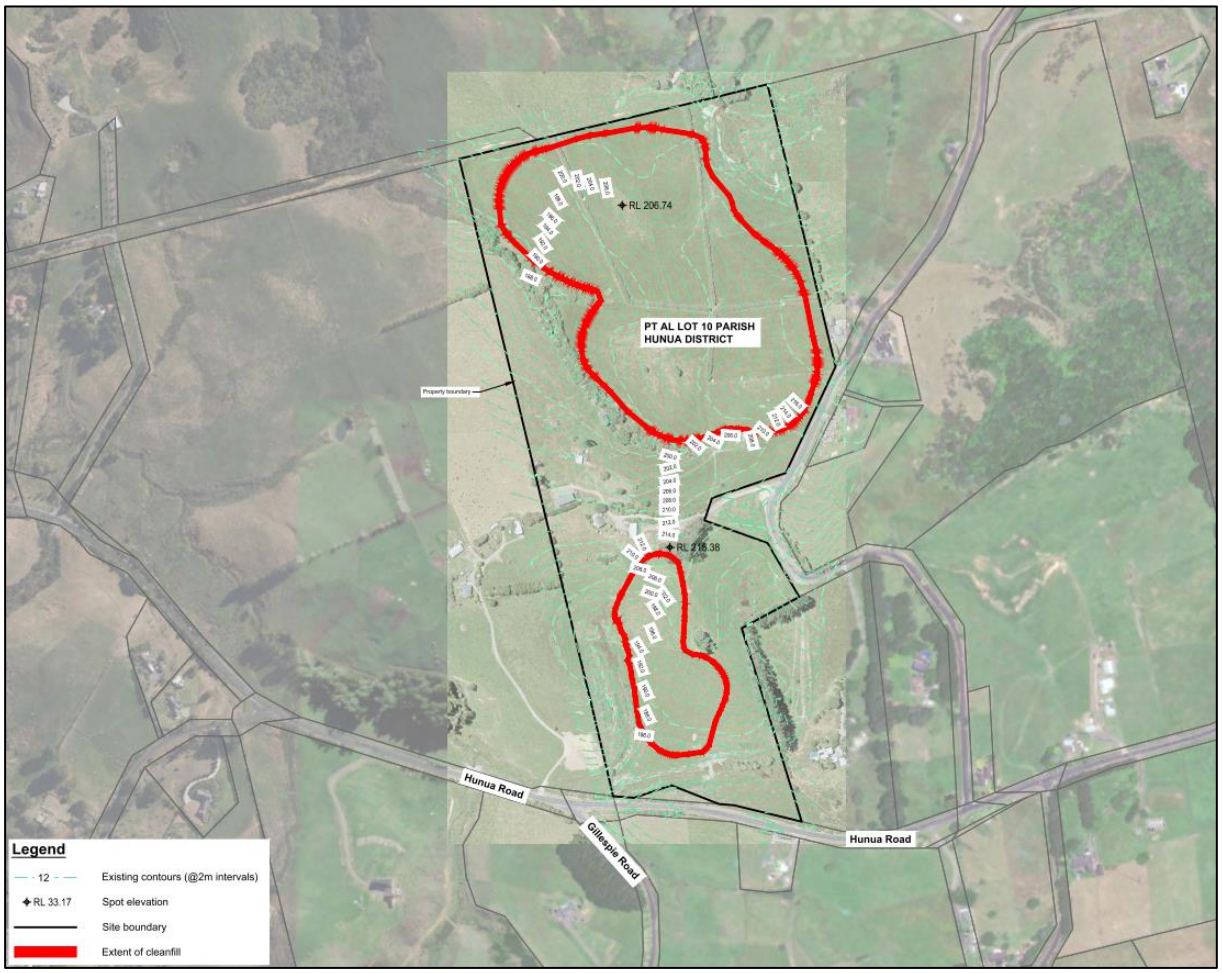


Figure 1: Site plan showing the north and south fill areas

3.0 The Site and surrounding environment

This section sets out a description of the site, the surrounding area and the AUP zoning.

3.1 The proposed cleanfill and the nearest sites

The cleanfill site (red line) and the neighbouring sites are shown in Figure 2 below:

Figure 2: The Site (red) and closest receivers

The nearest dwellings to the cleanfill site and the approximate distances from their notional boundaries to the cleanfill area or accessway are set out below:

- 332 Jones Road (25m)
- 353 Jones Road (40m)
- 345 Jones Road (70m)
- 380 Jones Road (80m)
- 363 Jones Road (100m)
- 1821 Hunua Road (250m).

The highest levels of noise from the operation of the cleanfill will be experienced at the notional boundaries of the dwellings at 332 Jones Road and 353 Jones Road.

3.2 Zoning

The site is located within the Rural – Rural Production Zone of the AUP. The sites to the west, south and east are also zoned Rural – Rural Production Zone. The sites to the north are zoned Rural – Mixed Rural Zone.

Figure 3 illustrates the AUP zoning of the Site and surrounding sites.

Figure 3: Zoning of the Site and surrounding sites

4.0 Noise criteria for the operation of the cleanfill

This section sets out the framework for the management of noise effects under the AUP and the relevant New Zealand acoustics Standards for the measurement and assessment of noise.

4.1 Auckland Unitary Plan

4.1.1 Permitted noise limits – operational noise

Standard E25.6.3 Noise levels in rural and future urban zones prescribes the following noise levels for noise generated on the Site and received at the notional boundary of a dwelling on another site:

> **E25.6.3 Noise levels in rural and future urban zones**
>
> The noise (rating) level from any activity in the Rural – Mixed Rural Zone, Rural – Rural Production Zone, Rural – Rural Coastal Zone or the Future Urban Zone measured within the notional boundary on any site in any rural zone must not exceed the limits in Table E25.6.3.1 Noise levels in the Rural – Mixed Rural Zone, Rural – Rural Production Zone, Rural – Rural Coastal Zone or the Future Urban Zone below:
>
> **Table E25.6.3.1 Noise levels in the Rural – Mixed Rural Zone, Rural – Rural Production Zone, Rural – Rural Coastal Zone or the Future Urban Zone**

Time	Noise Level
Monday to Saturday 7am - 10pm	55dB L_{Aeq}
Sunday 9am – 6pm	
At all other times	45dB L_{Aeq} 75dB L_{AFmax}

The relevant noise limit is 55 dB L_{Aeq} when assessed at any notional boundary of a dwelling not on the same site.

4.1.2 Permitted noise limits - construction noise

The AUP permitted limits for construction noise are the applicable to the construction of haul roads and an earth bund on the Site (discussed further in this report). The AUP permitted limits for construction noise are set out in E25.6.27:

> 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	70
6:00pm – 7:30am	75

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.

Earthworks will be undertaken before the operation of the cleanfill to construct a haul road and an earth bund. The cumulative duration of this work will be less than 20 weeks.

All construction works will be undertaken between 7.30 am and 6.00 pm, Monday to Saturday.

The nearest buildings on the surrounding sites are rural dwellings. The permitted noise limits for the earthworks are therefore 75 dB L_{Aeq} and 90 dB L_{Amax} when measured 1 m from the façade of any occupied building.

4.2 New Zealand acoustics standards

Rule E25.6.1(1) *General Standards* of the AUP requires that noise levels are measured and assessed in accordance with the New Zealand Standard NZS 6801:2008 Acoustics – Measurement of environmental sound and the New Zealand Standard NZS 6802:2008 Acoustics – Environmental noise except where more specific requirements apply.

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 NZS 6803:1999 Acoustics – Construction noise.

Our assessment has been undertaken in accordance with these Standards.

4.2.1 NZS 6802:2008 Special audible characteristics

Section 6.3 of NZS 6802:2008 states that where the sound being assessed has a distinctive character which may affect its subjective acceptability (for example, it is noticeably impulsive or tonal), the representative sound level shall be adjusted to take this into account.

It is our opinion that an adjustment for special audible characteristics is not required for the character of the noise arising from the operation of the cleanfill provided that tonal reverse alarms are not permitted on machinery that is used daily on the site. Broadband alarms may be used instead. We have recommended this as a condition of consent.

4.2.2 NZS 6802:2008 Duration adjustment

Section 6.4 of NZS 6802:2008 states that if a sound is not present all of the time it is likely to create lesser annoyance than the same sound if it were continuously present. The Standard recommends that an adjustment of up to 5 dB shall be applied to the representative sound level to take this into account. The more the sound under investigation is present, the less the duration adjustment value is. If a sound is continuous then no duration adjustment is warranted.

The activity involves trucks arriving on site, unloading fill and the use of the excavator, a bulldozer and compaction roller.

With reference to Table 2 of NZS 6802:2008, the percentage duration of the specific sounds in the prescribed time frame is less than 80% for use of machinery and truck movements. The duration adjustment is therefore -1 dB. This has been applied to the calculated daytime noise levels.

5.0 Construction works

The construction works required to establish the cleanfill include constructing the earth bund and haul road. There are no particularly noisy construction works required. The earth bunds will be constructed using excavators and the haul road will be constructed using a combination of plant on site (excavators, bulldozer and a sheepsfoot roller if required).

Typical reference noise levels for this plant are displayed in Table 1 below.

Table 1: Construction equipment and reference noise levels

Activity on site	Reference noise level at 10 m from plant	Noise level at 30 m including +3 dB for facade reflection	Permitted District Plan construction noise limits at 1 m from the facade of any occupied dwelling
21-t excavator	70 dB L_{Aeq}	63 dB	75 dB L_{Aeq}
D6 bulldozer	81 dB L_{Aeq}	74 dB	75 dB L_{Aeq}

The closest neighbouring building is approximately 30 m from the construction works.

The construction works will readily comply with the AUP permitted construction noise limits of 75 dB L_{Aeq} and 90 dB L_{AFmax} at the nearest occupied buildings when measured in accordance with NZS 6803:1999 *Acoustics – Construction noise*. This is due to the separation distance between the works and the assessment position at the adjacent buildings.

6.0 Operational noise

This section sets out our assessment of the operation noise emissions.

6.1 Noise mitigation

The following noise mitigation measures are proposed to reduce noise emissions from the site and have been included in our calculations.

i. An earth bund no less than 3m in height will be constructed approximately 20 - 25m in from the eastern site boundary to screen 332 Jones Road and 353 Jones Road. Figure 4 overleaf illustrates the approximate location of the proposed earth bund.

Figure 4: Location of earth bund

ii. The bulldozer and sheepsfoot roller will not be operated within 90m of the boundary of 332 Jones Road.

iii. The bulldozer and sheepsfoot roller will not be operated within 80m of the boundary of 353 Jones Road.

iv. The hours of operation will be restricted to 7:00 am to 6:00 pm Monday to Friday, and 7:00 am to 1:00 pm on Saturday. There will be no site activity on Sundays and Public Holidays.

v. The number of truck movements associated with the managed fill on Monday – Friday will not exceed 20 trucks (40 movements) in one hour.

vi. Tonal reverse alarms must not be used on any plant or machinery on site. Broadband reverse alarms may be fitted if reverse alarms are required.

6.2 Operational noise modelling and predictions

We have prepared noise level predictions using Brüel & Kjær Predictor computer noise modelling software to understand the spatial propagation of noise across and beyond the site. This enables the accurate prediction of noise levels at multiple receivers 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. 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 methodology and results of our noise modelling.

6.2.1 Reference noise levels

The noise model is based on a maximum of 20 deliveries per hour and the use of a 21 ton excavator, a D6 bulldozer and a 18 ton sheepsfoot roller in the peak hours.

Tables 2 – 5 below display the sound power (source) level data used in the model for these noise sources.

Table 2: Reference noise spectrum for a D6 bulldozer

63 Hz	125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz	8000 Hz	L_{WA}
82 dB	92 dB	98 dB	101 dB	106 dB	104 dB	98 dB	89 dB	109 dB

Table 3: Reference noise spectrum for a 21t excavator

63 Hz	125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz	8000 Hz	L_{WA}
70 dB	80 dB	86 dB	90 dB	94 dB	92 dB	86 dB	77 dB	98 dB

Table 4: Reference noise spectrum for a truck passing at 15 m at 30 km/hr

63 Hz	125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz	8000 Hz	SEL @ 15m
75 dB	66 dB	61 dB	60 dB	60 dB	58 dB	56 dB	49 dB	79 dB L_{AE}

Table 5: Reference noise spectrum for a 18t sheepsfoot roller

63 Hz	125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz	8000 Hz	L_{WA}
74 dB	87 dB	100 dB	103 dB	102 dB	99 dB	92 dB	82 dB	108 dB

6.2.2 Noise model parameters

Noise predictions have been calculated based on the International Standard ISO 9613-1/2 *Attenuation of sound during propagation outdoors*. Terrain contours, building footprints and parcel boundaries were imported from the Auckland Council GIS service. The topographical contours encompass the entire site and a large area of the surrounding land

The noise levels produced by the model include the effects of the abovementioned factors and assume meteorological conditions that slightly enhance propagation in all directions in accordance with NZS 6802:2008.

The input parameters for the noise model are displayed in Table 6 below:

Table 6: 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: 0.7
Air temperature	293.15K
Atmospheric pressure	101.33kPa
Air humidity	60%
Receiver heights (relative)	1.5m above ground
Building heights (nominal)	4.5 m

6.2.3 Noise rating level calculation adjustments

No adjustments have been applied to the predicted noise levels for special audible character. As set out in section 4.2.2 a -1 dB duration adjustment has been applied.

6.2.4 Noise rating level predictions

Table 7 overleaf displays the noise level predictions at 1.5 m above the local ground and at the notional boundaries of the nearest dwellings when works are in the closest part of the fill area to each receiver.

The reported noise levels are the highest noise rating levels expected at the notional boundary of the receiving sites. Any other site not specifically referenced is separated further from the noise sources than those listed. The noise rating levels at the more distant sites will be lower due to the additional separation distance.

The predicted noise rating levels displayed in Table 7 overleaf demonstrate that the AUP permitted noise limits will be consistently complied with at all surrounding properties.

Table 7: Noise rating level predictions

Receiver	Predicted noise rating level L_{Aeq}	Permitted noise limit L_{Aeq}
332 Jones Road	54 dB	55 dB
353 Jones Road	54 dB	55 dB
380 Jones Road	54 dB	55 dB
363 Jones Road	53 dB	55 dB
1821 Hunua Road	52 dB	55 dB
345 Jones Road	50 dB	55 dB

The associated noise level contours are provided in Appendix B to illustrate the propagation of the noise from the cleanfill site.

7.0 Assessment of noise effects

It is our opinion that the noise emissions from the operation of the cleanfill will not cause unreasonable disturbance at the nearest notional boundaries.

The construction work will comply with the permitted noise limits of 75 dB L_{Aeq} and 90 dB L_{Amax} at all times during construction works. The operational of the cleanfill site will comply with the permitted daytime noise limit of 55 dB L_{Aeq} at the notional boundary of all neighbouring sites in the surrounding rural zones.

There will be no noise from the site outside the hours of 7:00 am – 6:00 pm, Monday to Friday and 7:00 am – 1:00 pm on Saturdays, or at any time on Sundays and public holidays. Truck movements throughout the day will be intermittent, and earthmoving plant will only be used once the fill material has been delivered to site for the day.

Management-based noise mitigation measures are proposed as part of the application and are offered as conditions of consent. This includes restrictions on the number of truck movements per hour, the total number of trucks on site each day, and where noisy plant can operate.

Permitted activities in the Rural – Rural Production Zone include intensive farming, forestry, farm and forestry quarries, and mineral prospecting or exploration. These activities typically involve the use of heavy machinery and truck movements on private land, similar to the proposed activity. We consider that the level, character, timing, frequency, and duration of the noise emissions from the site will be consistent with the permitted standards for the Rural – Rural Production Zone if our recommended conditions are imposed and complied with.

8.0 Recommended conditions of consent

In addition to the standard condition requiring compliance with the application documents as lodged (including this report) and the noise limits set by the Auckland Unitary Plan, we recommend the following conditions of consent are also imposed:

1. The cleanfill must not operate outside the hours of 7:00 am to 6:00 pm Monday to Friday, and 7:00 am to 1:00 pm on Saturday. There must be no site activity on Sundays and Public Holidays.
2. The number of truck movements associated with the managed fill on Monday – Friday must not exceed 96 trucks per day (192 movements) and 20 trucks (40 movements) in one hour.
3. The number of truck movements associated with the managed fill on Saturday must not exceed 50 trucks per day (100 movements) and 20 trucks (40 movements) in one hour.
4. Tonal reverse alarms must not be used on any plant or machinery on site. Broadband reverse alarms may be fitted if reverse alarms are required.
5. An earth bund shall be constructed to provide acoustic screening to 332 Jones Road and 353 Jones Road to the east of the site. The bund shall be at least 160m long and 3m high.
6. Bulldozers and vibratory compaction rollers must not be operated within 90m of the property boundary of 332 Jones Road or within 80m of the property boundary of 353 Jones Road during the operation of the cleanfill. These restrictions do not apply when the plant is being used for construction works.

9.0 Conclusion

Styles Group has prepared a computer noise model to predict the noise levels arising from the proposed managed cleanfill operation at 362 Jones Road. The noise model inputs are based on 20 trucks using the site each hour and the use of an excavator, bulldozer and a sheepsfoot roller to process, place and compact the fill on site.

The predicted noise rating levels for the proposed operation of the cleanfill demonstrate full compliance with the AUP permitted noise limits for the zone.

The construction noise generated by works to build and maintain the proposed haul road and earth bund on the Site will readily comply with the AUP permitted construction noise limits.

We have recommended noise mitigation measures and conditions of consent, including:

- An earth bund along the eastern work site boundary to screen the closest receivers from the filling activity
- Restricting operating hours and truck movements
- Restrictions on where the bulldozer and sheepsfoot roller can be used.

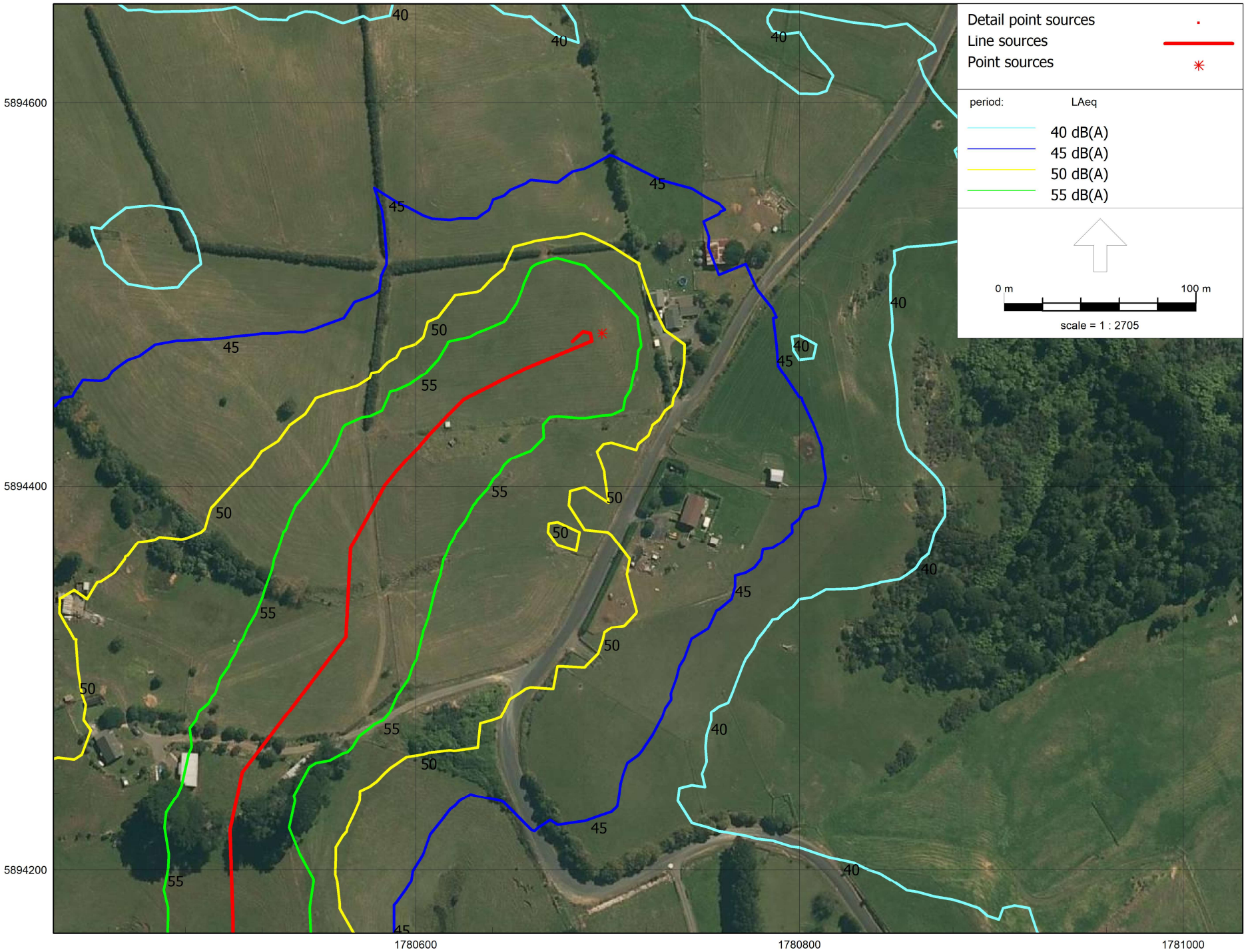
It is our opinion that the potential noise emissions from the operation of the cleanfill will not cause unreasonable disturbance at any neighbouring notional boundary.

We consider that the level, character, timing, frequency, and duration of the noise emissions from the site will be consistent with the permitted standards for the Rural – Rural Production Zone if our recommended conditions are imposed and complied with.

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.
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.
Notional boundary	A line 20 metres from any side of a residential unit or other building used for a noise sensitive activity, or the legal boundary where this is closer to such a building.
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 6803:1999	N.Z. Standard NZS 6803:1999 Acoustics – Construction noise.
The Act	The Resource Management Act 1991.

Appendix B Noise contours



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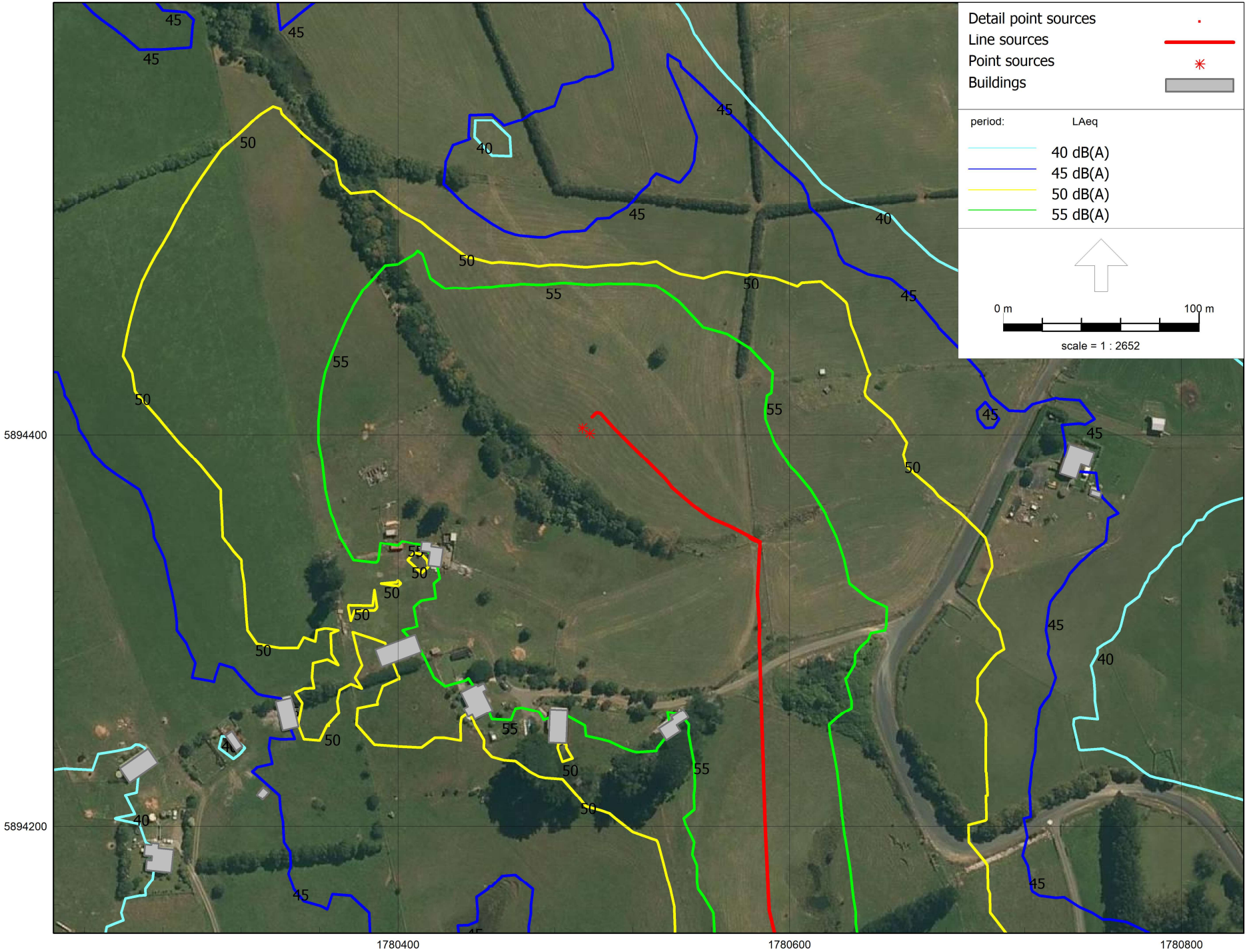

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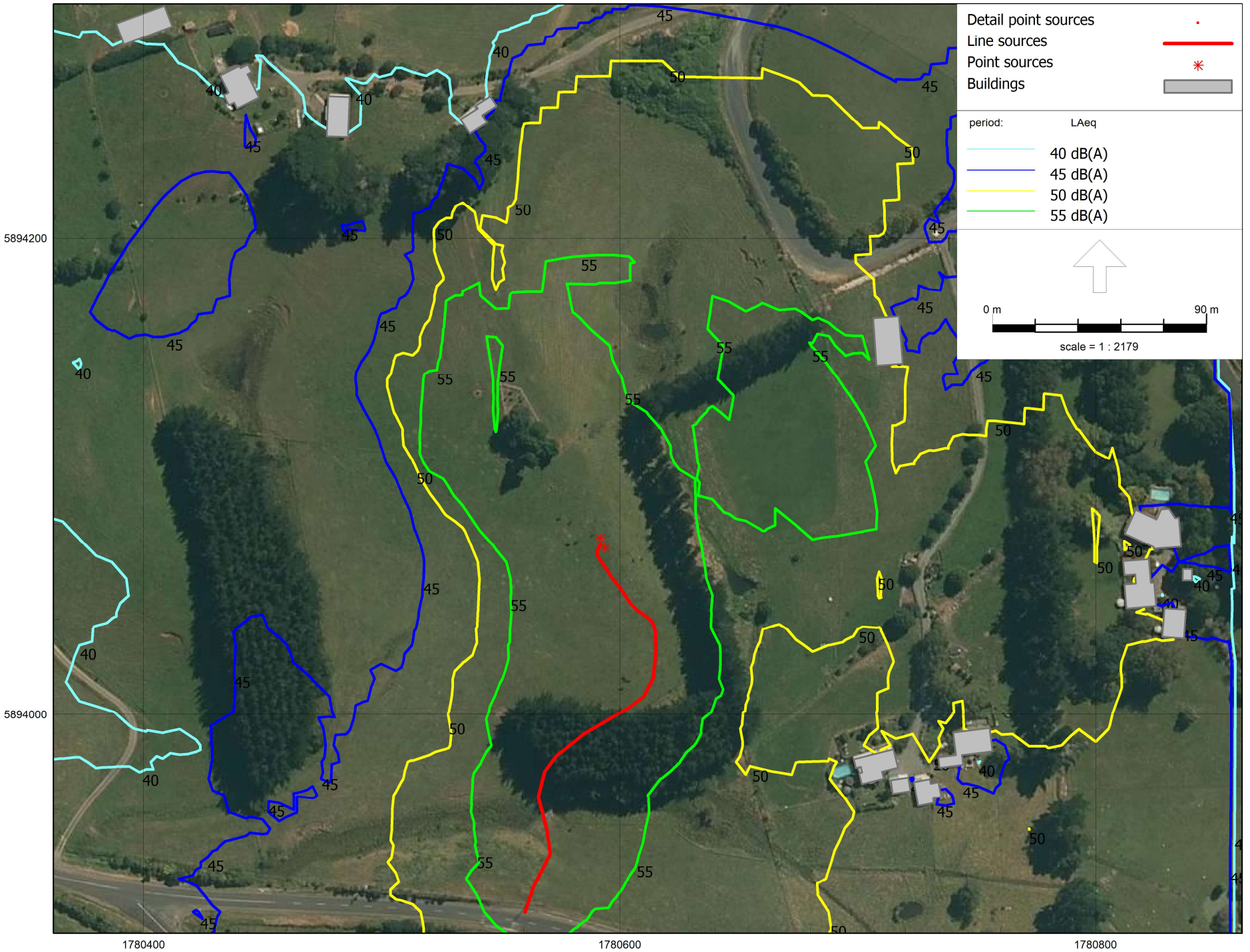

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