Styles Group
Acoustics & Vibration Consultants

ASSESSMENT OF CONSTRUCTION AND OPERATIONAL NOISE EFFECTS

ASHBOURNE SOLAR FARM
MATAMATA

PREPARED FOR

Unity Management Ltd.

DATE

26 May 2025

Acoustic assessment prepared by Styles Group for Unity Management Limited.

REVISION HISTORY

Rev:	Date:	Comment:	Version:	Prepared by:	Reviewed by:
1	20/03/25		Final Draft	Daniel Winter, MASNZ Senior Consultant Styles Group	Jon Styles, MASNZ Consultant Styles Group
2	26/05/25		Final		

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Executive summary

Unity Management Limited has engaged Styles Group to predict and assess the noise levels from the construction, operation and maintenance of two solar farms on two sites located approximately 1.8km to the southwest of Matamata.

The solar farms will produce renewable electricity from 47,523 solar panels. Operational noise will be generated from both solar farms operating concurrently. There is a total of 5 Medium Voltage Power Stations and 90 string inverters distributed across the solar farms. The proposal does not include any battery energy storage systems.

We have predicted the worst-case cumulative noise emissions from the operation of the solar farms operating at peak load for comparison with the Matamata Piako District Plan noise limits that control the maximum permitted level of noise at any notional boundary on an adjacent site.

The noise level contours demonstrate that the worst-case noise emissions from the plant will comply with the daytime and night-time noise standards when measured and assessed at any existing notional boundary on another site. Noise levels from all other operational and site maintenance activities will be managed to comply with the District Plan noise limits.

We have assessed the noise levels from the construction of the solar farm in accordance with the permitted construction noise limits prescribed by the Matamata Piako District Plan. Our assessment finds that construction noise levels will marginally exceed the permitted noise limits at one receiver. We have recommended specific construction noise mitigation and a condition of consent requiring the applicant to prepare and submit a Construction Noise Management and Vibration Plan (**CNVMP**).

We consider that the noise emissions from the proposal will be reasonable at all times. We have recommended conditions of consent based on our findings

1.0 Introduction

Unity Management Limited has engaged Styles Group to predict and assess the noise levels from the construction, operation and maintenance of two solar farms on a 125ha site (the **Site**) located approximately 1.8km to the southwest of Matamata.

This report includes:

i. An assessment of the construction and operational noise levels in accordance with the Matamata–Piako District Plan (the **District Plan**) and relevant New Zealand acoustics standards

ii. Recommended conditions of consent.

This report should be read in conjunction with the application site plans and the Assessment of Environmental Effects. A glossary of acoustical terms used within this document is attached as Appendix A.

The assessment has been prepared by Daniel Winter, Senior Consultant, and reviewed by Jon Styles, Director and Principal Consultant. A summary of qualifications and experience can be found in Appendix D.

2.0 The proposal

Unity Management Limited propose to construct, operate and maintain two solar farms on the Site. The solar farms are described as the “Northern Solar Farm” (12.7 ha) and “Southern Solar Farm” (24 ha).

We have used noise modelling software to predict the cumulative noise levels from all noise generating mechanical plant associated with each solar farm.

The project will involve the following noise sources:

- Construction noise over a period of approximately 18-24 months to construct both solar farms.
- Operational noise from the mechanical plant proposed within each solar farm
- Occasional maintenance activities involving quad bike or small, farm utility vehicles. The solar farm will be operated remotely and the land will be grazed by sheep.

The solar farm will produce renewable electricity from 47,523 solar panels. Operational noise will be generated from a total of 5 Medium Voltage Power Stations (**MVPS**) and 90 string inverters distributed throughout both farms. The proposal does not include any battery energy storage systems. The MVPS include a self-contained inverter and transformer unit. Noise is primarily generated from the thermal management systems (cooling fans) that cool the plant.

We understand that the construction of each individual solar farm will take place over a period of approximately 11-13 months. The primary construction noise sources will include all site

clearing and preparation works to prepare the Site for development, delivery of construction materials and installation of piles using driven piling methods.

An assessment of the construction noise levels is provided in Section 8.0.

3.0 The Site and closest receivers

The Site is located in a productive rural environment with a low intensity of existing residential development surrounding the Sites.

A future 328 lot residential subdivision is proposed to the east of the Southern Solar Farm site and a 500-unit retirement village is proposed to the north of the Southern Solar Farm site. Both proposed sites are located in the Rural Zone. A lifestyle block with two sections is proposed south of the northern solar farm, next to the existing dwelling at 172 Station Road.

Figure 1 displays the Northern and Southern solar farm sites and the closest residential dwellings on adjacent sites (receivers).

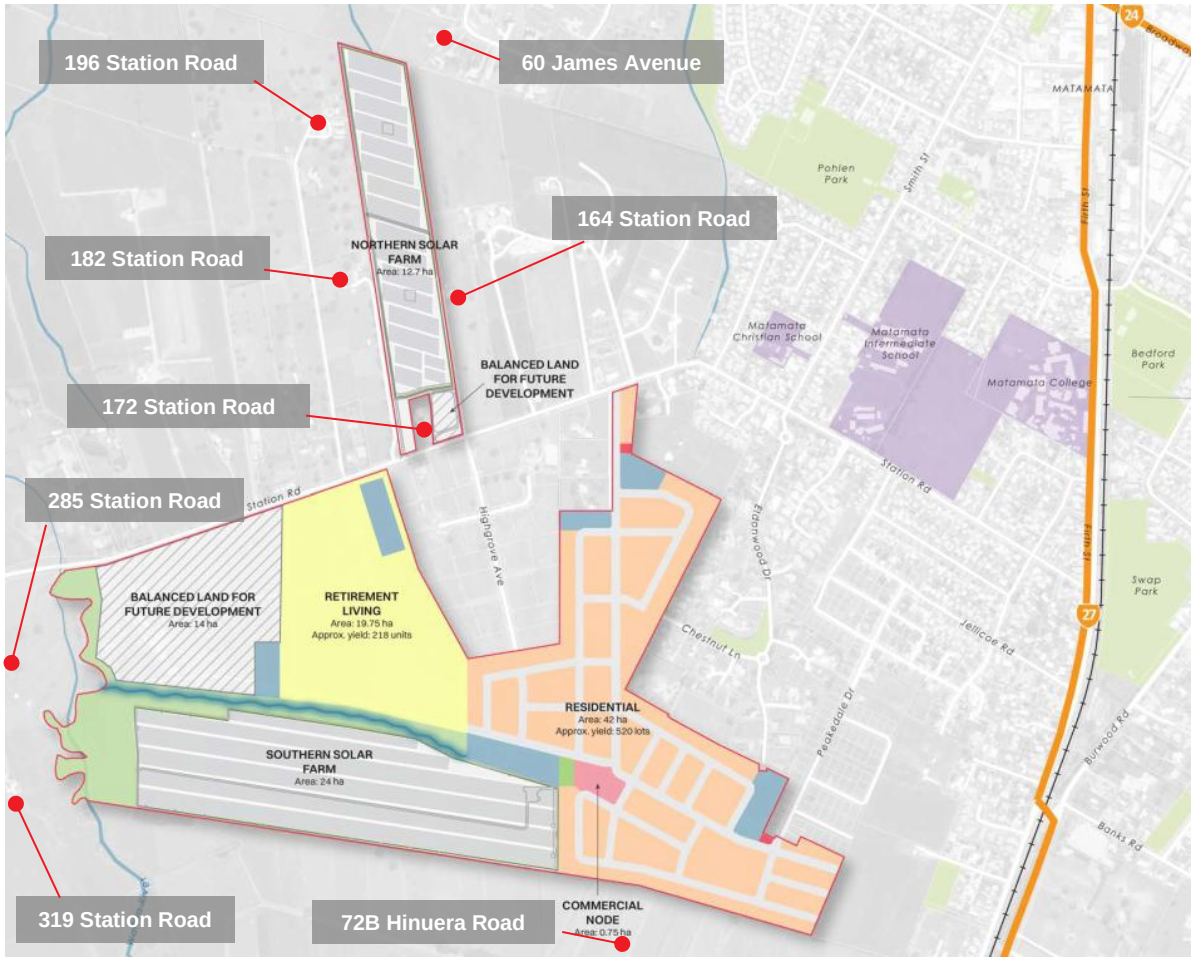


Figure 1: The Northern and Southern Solar Farms and adjacent dwellings (receivers).

The District Plan operational noise limits control the noise levels received at the notional boundary. The District Plan construction noise limits control the noise levels received at the facades of occupied buildings.

The closest receivers (notional boundaries and building facades) are set out below in Table 1 and Table 2.

Table 1: Closest receivers to Northern Solar Farm

Receiver address	Operational noise: Approximate distance from notional boundary to closest MVPS or inverter	Construction Noise: Separation distance from closest panel to building façade
164 Station Road	40m	22m
182 Station Road	60m	60m
Lifestyle block subdivision	70m	40m
172 Station Road	75m	44m
196 Station Road	130m	92m
60 James Avenue	180m	85m

Table 2: Closest receivers to Southern Solar Farm

Receiver address	Operational noise: Approximate distance from notional boundary to closest MVPS or inverter	Construction Noise: Separation distance from closest panel to building façade
Residential subdivision	35m	33m
Retirement village	180m	70m
319 Station Road	300m	300m
74A Hinuera Road	570m	500m
72A Hinuera Road	630m	560m

4.0 Operational noise standards and district plan zoning

The Site and surrounding land is in the Rural Zone of the District Plan. Rule 5.2.6 of the District Plan provides noise performance standards for all activities in the Rural Zone.

The District Plan controls the noise levels received at the notional boundary[1] of any residential dwelling in a Rural Zone. The construction noise standards apply when measured and assessed[2] 1m from the façade of any occupied building.

The operation of both solar farms are proposed to comply with the District Plan noise limits

The rule requires that the noise level must not exceed the following noise levels for activities in the rural zone, when measured within any residentially zoned boundary or within the notional boundary of any rural dwelling:

Timeframe	Noise limit
7:00am to 8:00pm	50dBA L_{10}
8:00pm to 7:00pm	40dBA L_{10}

Rule 5.2.1 requires that the noise levels are measured and assessed in accordance with the requirements of NZS6801:1991 *Measurement of Sound* and NZS6802:1991 *Assessment of Environmental Sound*.

The General Noise standards in Rule 5.2.1 require that:

iii. For any noise with special audible characteristics as defined by NZS6802:1991 the L_{10} noise level standards shall be reduced in accordance with the standard.

v. The noise levels shall be measured and assessed in accordance with the requirements of NZS6801:1991 Measurement of Sound and NZS6802:1991 Assessment of Environmental Sound.

5.0 Operational noise modelling and predictions

We have used DGMR iNoise V2024 computer noise modelling software to predict the cumulative operational noise emissions from all plant operating in each solar farm. The predictions are based on the methods in International Standard ISO 9613-1/2 *Acoustics – Attenuation of sound during propagation outdoors*. The calculations assume meteorological conditions that slightly enhance propagation in all directions in accordance with NZS 6801:2008. The DGMR software is globally recognised and has been successfully implemented on many projects throughout New Zealand.

[1] Defined by the ODP as - A line 20 metres from the wall of a habitable building used for residential purposes. If the site boundary is closer than 20 metres to the building at any point, the site boundary is to be treated as the notional boundary at that point.

[2] In accordance with New Zealand Standard NZS 6803:2008 Acoustics - Construction Noise

5.1 Noise model parameters

The noise model has been prepared using aerial photographs, building footprint data, topographical contour data and parcel boundaries from Land Information New Zealand. The Project Team has provided us with an electronic file of the proposed site layout.

The combined solar farms will consist of 47,523 solar panels attached to a solar tracking system. The panels will be installed in rows of up to 110m in length. The rows will have a proposed height of 2.5 m above ground when fully tilted (morning and evening). Each row is approximately 2.4m in width with a gap between rows of approximately 3.0m.

The input parameters for the noise model are set out in Table 3 below:

Table 3: iNoise model input parameters

Parameters/calculation settings	Details
Software	DGMR iNoise V2024
Calculation method	ISO 9613.1/2
Meteorological parameters	Single value, C0 = 0
Ground attenuation over land	General method, ground factor: 0.8 (grazed pasture)
Air temperature	293.15 K
Atmospheric pressure	101.33k Pa
Air humidity	60%
Source heights (relative)	Inverters 1.5m
Receiver heights (relative)	1.5 m above ground
Building heights (nominal)	4 m
MVPS (self-contained inverter and transformer unit). 3 units distributed across the northern solar farm and 2 units distributed across the northern solar farm	65 dBA at 10m
Inverters x 90	Daytime (100%) 87 dB L_{WA} Night-time (10%) 70 dB L_{WA}

Table 4 provides the frequency spectrum data for all plant operating. The frequency spectrum data is based on the manufacturers sound power level specifications provided to us by the Project Team.

Table 4: Frequency spectrum data

	Octave band sound power levels (dB LwA)								
	63 Hz	**125 Hz**	**250 Hz**	**500 Hz**	**1 kHz**	**2 kHz**	**4 kHz**	**8 kHz**	**dBA**
MVPS *MV Power Station Cabinets (MVPS) (self contained inverter and transformer unit)*	82	84	81	81	79	77	79	68	88 dB
Inverter (Daytime) *Operating at 100% during the daytime period*	62	69	76	80	80	83	78	74	87 dB
Inverter (Night-time) *Operating at 10% during the night-time*	45	52	59	63	66	63	60	56	70 dB

5.2 NZS6802:1991 adjustments for Special Audible Character and Averaging

Rule 5.2.1 requires that noise levels are measured and assessed in accordance with the requirements of NZS6801:1991 *Measurement of Sound* and NZS6802:1991 *Assessment of Environmental Sound*. We have applied the provisions of these standards but we also note that these standards have been superseded by the current (2008) versions of the NZS6801 and NZS6802.

NZS6802 sets out the procedures for the adjustment of measured or predicted noise levels, taking into account special audible character and averaging of sound levels.

Our adjustments to the predicted noise levels are described below.

5.2.1 Special Audible Character

NZS6802 sets out the procedures for the adjustment of noise levels based on the presence of "special audible character". The adjustment procedure recognises that "*noise that has special audible characteristics, such as tonality or impulsiveness, is likely to arouse adverse community response at lower levels than noise without such characteristics*" (Section 4.3 of NZS6802:1991).

NZS 6802:1991 requires the application of a -5 dB adjustment to the noise limit where a sound exhibits special audible character. This requirement is referred to in Rule 5.2.1 of the District Plan.

We have not applied any SAC adjustment as our review of the plant noise emission specifications do not indicate the presence of any tonal character that would quality for an adjustment.

5.2.2 Averaging

We have not applied any adjustments for averaging given that the plant may occur at varying levels for all or the majority of the daytime period.

5.3 Noise level predictions and contours

Table 5 and Table 6 below set out the predicted daytime and night-time operational noise levels at the closest receivers, including the future receivers that will be established within the residential subdivision and retirement village. The predicted noise levels for all receivers are based on the cumulative noise levels from the operation of the Northern and Southern Solar Farms.

5.3.1 Daytime noise level predictions

The predicted daytime noise levels indicate the cumulative noise emissions from all plant operating within the Northern and Southern Solar Farm between the hours of 07:00am and 8:00pm when the permitted noise standard of 50 dBA L_{10} applies at the notional boundary of any adjacent dwelling.

The daytime noise level contours are provided in Appendix B.

Table 5: Predicted daytime operational noise levels

Receiver address	District plan daytime noise limit	Highest predicted noise level
164 Station Road	50 dB L_{A10}	47 dB L_{A10}
196 Station Road	50 dB L_{A10}	46 dB L_{A10}
Proposed southern subdivision	50 dB L_{A10}	45 dB L_{A10}
182 Station Road	50 dB L_{A10}	42 dB L_{A10}
Proposed retirement village	50 dB L_{A10}	37 dB L_{A10}
62 James Avenue	50 dB L_{A10}	35 dB L_{A10}
68 James Avenue	50 dB L_{A10}	34 dB L_{A10}
60 James Avenue	50 dB L_{A10}	33 dB L_{A10}
Proposed northern subdivision	50 dB L_{A10}	33 dB L_{A10}
172 Station Road	50 dB L_{A10}	32 dB L_{A10}
190 Station Road	50 dB L_{A10}	30 dB L_{A10}

Receiver address	District plan daytime noise limit	Highest predicted noise level
319 Station Road	50 dB L_{A10}	30 dB L_{A10}
74A Hinuera Road	50 dB L_{A10}	24 dB L_{A10}
72A Hinuera Road	50 dB L_{A10}	23 dB L_{A10}

5.3.2 Night-time noise level predictions

The predicted night-time noise level contours indicate the cumulative noise emissions from all plant operating (with invertors operating at 10%) between the hours of 8:00pm and 7:00am when the permitted noise standard of 40 dBA L_{10} applies at the notional boundary of any adjacent dwelling.

The night-time noise level contours are provided in Appendix C.

Table 6: Predicted night-time operational noise levels

Receiver address	District plan night-time noise limit	Highest predicted noise level
164 Station Road	40 dB L_{A10}	36 dB L_{A10}
196 Station Road	40 dB L_{A10}	31 dB L_{A10}
Proposed southern subdivision	40 dB L_{A10}	30 dB L_{A10}
182 Station Road	40 dB L_{A10}	30 dB L_{A10}
Proposed retirement village	40 dB L_{A10}	24 dB L_{A10}
62 James Avenue	40 dB L_{A10}	23 dB L_{A10}
Proposed northern subdivision	40 dB L_{A10}	23 dB L_{A10}
68 James Avenue	40 dB L_{A10}	22 dB L_{A10}
60 James Avenue	40 dB L_{A10}	21 dB L_{A10}
172 Station Road	40 dB L_{A10}	20 dB L_{A10}
190 Station Road	40 dB L_{A10}	18 dB L_{A10}
319 Station Road	40 dB L_{A10}	15 dB L_{A10}

Receiver address	District plan night-time noise limit	Highest predicted noise level
74A Hinuera Road	40 dB L_{A10}	<10 dB L_{A10}
72A Hinuera Road	40 dB L_{A10}	<10 dB L_{A10}

5.4 Noise effects across vacant land

Activities are typically vulnerable to encroachment where vacant land surrounding the site is used as a buffer for noise levels that exceed the permitted standards.

The proposed northern solar farm could be vulnerable to encroachment if a dwelling is constructed on the vacant land within 40m from the east boundary of the northern solar farm in line with the closest inverters. The noise contour map in Figure 2 overleaf shows the potentially affected area.

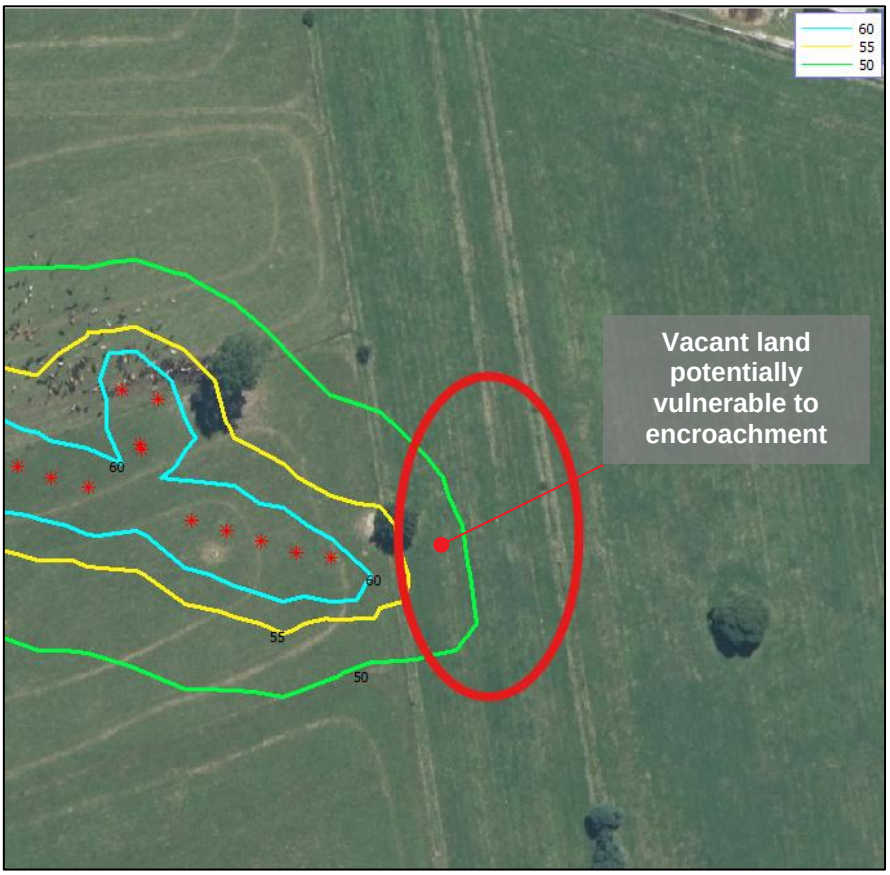


Figure 2: Adjacent vacant land potentially affected

The noise level contours show that the extent of adjacent vacant land affected by the daytime 50 dBA L_{10} noise contours is relatively small and the potential risk of encroachment is likely to be very low.

There are no areas of potentially affected vacant land around the south solar farm.

6.0 Assessment of operational noise effects

We understand that the National Policy Statement for Renewable Electricity Generation 2011 (**NPS-REG**) provides for the development, operation, maintenance, and upgrading of new and existing renewable electricity generation activities, including solar. It is generally recognised that utility-scale solar farms rely on rural land to establish and operate, and that mechanical plant is an expected feature of solar farms.

Part 2.3.8 *Renewable electricity generation* recognises that the District Plan needs to give effect to the NPS-REG to enable the development, operation, maintenance and upgrading of renewable energy generation activities. The District Plan identifies this as a significant resource management issue.

We understand that the District Plan's noise performance standards for all activities in the Rural Zone have been prescribed at a level that generally seeks to give effect to the amenity outcomes set out in Section 3.5.3 of the District Plan. The key Objectives and Policies from Section 3.5.3 that are relevant to noise amenity outcomes are set out below:

3. Nuisance effects			
O1	To ensure that residences are free from the effects of unreasonable and excessive noise, odour, dust, glare and vibration.	P1	To protect residential and rural amenity by the use of performance standards for noise, glare, odour, particulates and vibration control which generally ensure that generated effects do not exceed background or ambient levels.
O2	To provide healthy and safe working, living and recreational environments by avoiding and mitigating the effect of excessive noise, vibration, odour and dust.	P2	To ensure that activities in business, rural, industrial and recreational areas avoid, remedy or mitigate generated effects to maintain and enhance a healthy, safe and pleasant environment and take all reasonable steps to internalise any nuisance effects.
O3	To recognise the existing character of rural areas and acknowledge that some adverse effects will arise from rural activities that may require management.	P3	To reinforce existing mitigation measures, and to encourage those who generate the nuisance effect to maintain and enhance those measures, including separation between industry, public or designated works or intensive farming operations and Residential zones and the notional boundaries about rural residences.
O4	To ensure that lawfully established activities which generate minor nuisance effects are not unreasonably compromised by the proximity or action of neighbouring land-users or non-rural activities.	P4	To avoid, remedy or mitigate significant adverse noise, odour, dust, glare and vibration effects generated by rural activities and other activities in rural areas.

General noise standard 5.2.1(ii) stipulates that Council may require the submission of an acoustic design report from a suitably qualified Acoustic Engineer confirming that the

anticipated noise levels of any noise activity in any zone will be in accordance with the requirements for the zone.

We consider that the permitted noise levels for the Rural Zone are generally appropriate to control the noise levels from the activity.

The MVPS and inverters have been located to achieve ample separation distances from existing dwellings. This assessment demonstrates that the operational noise emissions can comply with the noise performance standards that apply at the notional boundary of all dwellings in the Rural Zone.

During peak production, the noise from the solar plant operating may be audible at the closest receivers from time to time. The closest receivers may hear the solar plant operating when high energy production coincides with periods when the ambient noise environment is very low, and meteorological conditions are calm.

Noise from all other operational noise sources such as ongoing general site operation, maintenance activities (including vehicle movements) will be intermittent and generate only a low level of noise. These noise sources will readily comply with the District Plan noise standards.

We consider that the noise effects will be consistent with the expectations set by the relevant objectives and policies and District Plan standards for noise, and that the noise will be reasonable.

7.0 Assessment of construction noise effects

Rule 5.2.1 of the District Plan requires that construction noise from the site must meet the limits recommended in Table 1 of NZS6803P:1984. *The Measurement and Assessment of Noise from Construction, Maintenance and Demolition Work* and shall be measured in accordance with NZS6803P:1984[3].

NZS6803P:1984 defines construction work as:

> CONSTRUCTION WORK (as defined in Section 2 of the Construction Act 1959) means any work in connection with the construction, erection, installation, carrying out, repair, maintenance, cleaning, painting, renewal, removal, alteration, dismantling, or demolition of:
>
> a) Any building, erection, edifice, structure, wall, fence or chimney, whether constructed wholly or in part above or below ground level;
>
> b) Any road, motorway, harbour or foreshore works, railway, cableway, tramway, canal or aerodrome;
>
> c) Any drainage, irrigation or river control work;
>
> d) Any electricity, water, gas or telecommunications reticulation;

[3] NZS6803P:1984 has been superseded by New Zealand Standard NZS6803:1999 Acoustics – Construction noise

e) Any bridge, viaduct, dam, reservoir, earthworks, pipeline, aqueduct, culvert, drive, shaft, tunnel or reclamation; or

f) Any scaffolding.

And includes any work in connection with any excavation, site preparation, or preparatory work, carried out for the purpose of construction work; and also includes use of any plant, tools, gear or materials for the purpose of any construction work.

NZS6803 prescribes recommended noise limits to control construction noise levels and sets out procedures for the measurement and assessment of noise from construction work. The standard prescribes more stringent noise limits for longer projects. Section 6.1.2 of NZS6803P:1984 requires the construction noise limits in Table 1 of the Standard to be reduced by 5dB if the duration of the construction work exceeds 18 weeks.

The construction of both solar farms will take approximately 18-24 months to complete. Each solar farm will be constructed separately and at different times. The approximate duration of each solar farm construction is set out below:

- Northern Solar Farm: 9 – 12 months
- Sothern Solar Farm: 10 – 13 months

Table 7 sets out NZS6803P:1984's recommended limits for long term (exceeding 18 weeks) construction noise in residential areas[4]

Table 7 - NZS6803P:1984 long term recommended upper limits for construction noise received in residential areas

Time of Week	Time Period	Noise level (dBA)		
		L_{10}	L_{95}	L_{max}
Weekdays	0630-0730	**	**	**
	0730-1800	**70**	**55**	**85**
	1800-2000	**	**	**
	2000-0630	**	**	**
Saturdays	0630-0730	**	**	**
	0730-1800	**70**	**55**	**85**
	1800-2000	**	**	**
	2000-0630	**	**	**

[4] The 1999 version of the Standard refers to "residential zones and dwellings in rural areas". The 1984 version of the Standard does not refer to rural dwellings, however the noise limits in Table 1 of the Standard are designed for noise sensitive activities. Noise sensitive activities are not defined in the standard however would include rural dwellings.

Time of Week	Time Period	Noise level (dBA)		
		L_{10}	L_{95}	L_{max}
Sundays and public holidays	0630-0730	**	**	**
	0730-1800	**	**	**
	1800-2000	**	**	**
	2000-0630	**	**	**

** At these times, NZS6803P:1984 requires that the relevant provisions of NZS6802:1997 shall apply.

The proposal is to undertake all noisy construction work between 07:30 and 1800, Monday to Saturday when a construction noise limit of 70 dB L_{10} and 85 dB L_{max} applies at any occupied dwelling.

7.1 Construction noise emissions and compliance distances

This assessment is focussed on the construction noise effects received at 164 Station Road, which is the closest dwelling at the time of this application.

We understand that the construction phase (including site preparation, installation and commissioning) will extend for up to 13 months and will be undertaken between the hours of 0730 – 1800, Monday to Saturday. The construction of the solar farm is therefore subject to a noise limit of 70 dB L_{A10} when measured and assessed at the façade of any occupied building.

Table 8 sets out the minimum mitigated and unmitigated separation distances required between potential construction activities on the Site and the nearest occupied building for compliance with the permitted construction noise standard of 70 dBA L_{10}.

The unmitigated separation distances represent the distances that construction activities can be undertaken from the most exposed ground-level facade of the nearest occupied building whilst remaining compliant with the consented noise limits and with no mitigation in place.

The mitigated separation distances represent the distances that the activities can be undertaken from the most exposed ground-level facade of the nearest occupied building whilst remaining compliant with the consented noise limits and with mitigation in place.

Noise source levels are based on our database of construction noise measurements undertaken by Styles Group on numerous projects nationwide. They are in accordance with best practice and are generally consistent with guideline noise data provided in NZS 6803:1999 Appendix C *Guide to Sound Level Data on Site Equipment and Site Activities*.

Table 8: Noise sources and calculated separation distances for compliance with noise limits

Construction activity	Reference noise level 10 m from plant	Minimum distance for compliance (unmitigated)	Minimum distance for compliance (mitigated)
Driven piling (ramming machine)	86 dB L_{A10}	90 m	28 m
Concrete pump and truck discharging	80 dB L_{A10}	45 m	12 m
Directional drill	80 dB L_{A10}	45 m	12 m
6-t padfoot roller*	76 dB L_{A10}	28 m	9 m
Excavation with 14 t excavator	75 dB L_{A10}	26 m	8 m
Loading trucks with excavator	71 dB L_{A10}	15 m	5 m
Generator	68 dB L_{A10}	11 m	< 5 m
5-t vibratory compaction roller	68 dB L_{A10}	11 m	< 5 m
Use of power tools	67 dB L_{A10}	10 m	< 5 m
Idling dump truck	64 dB L_{A10}	7 m	< 5 m
5-t static compaction roller	64 dB L_{A10}	7 m	< 5 m

* The reference level assumes the plant is making short passes near to the site boundary. When the plant makes longer passes or moves away from the boundary the level will be lower.

7.2 Assessment of construction noise compliance

The noisiest expected construction activity involves the use of a piling rig to install the piles to support the panel structures. Unmitigated noise from the use of a piling rig is predicted to comply with the relevant noise limits where dwellings are more than 90m away.

7.2.1 Southern solar farm construction noise assessment

There are no existing dwellings within 90m from construction of the southern solar farm.

A future 328 lot residential subdivision is proposed to the east of the Southern Solar Farm site and a 500-unit retirement village is proposed to the north of the Southern Solar Farm site. Both proposed sites are in the Rural Zone.

The closest dwellings in the proposed subdivision will be separated by a distance of 35m from the construction of the southern solar farm. If these dwellings are occupied whilst the southern solar farm is constructed, the unmitigated construction noise levels are predicted to exceed the permitted noise limit of 70 dBA $L_{10.}$ The highest unmitigated predicted noise level during the driven pilling is 78 dBA L_{10}. With effective screening place the predicted noise level is 68 dBA L_{10}, which complies with the permitted noise limit of 70 dBA $L_{10,}$

The proposal is to prepare and implement a Construction Noise Management Plan (CNVMP). The CNVMP will be used to specify the noise mitigation methods that must be adopted when construction works are within 90m of any existing dwellings.

Effective noise mitigation methods may include use of alternative piling methods (i.e. auger, screw or bored piling), use of screening or completing the works when the receiving building is not occupied.

Screening may comprise the use of temporary localised barriers to screen the piling rig when it operates within 90m of an existing dwelling. This can be a small temporary "U" shaped screen that is moved along with the piling rig, ensuring that it screens the noise emissions to the receivers.

The facades of the proposed retirement village are greater than 90m from the construction of the southern solar farm. The piling work predicted to comply with the permitted noise limit of 70 dBA L_{10} at the closest buildings of the proposed retirement village.

7.2.2 Northern solar farm construction noise assessment

The following existing dwellings on adjacent sites are separated by a distance of less than 90m from the construction of the northern solar farm:

- 164 Station Road (22m)
- Proposed northern subdivision (40m)
- 172 Station Road (44m)
- 182 Station Road (60m)
- 60 James Avenue (85m)

The receivers listed above have unmitigated predicted noise levels greater than the permitted noise limit of 70 dBA $L_{10.}$ We understand that the duration of the piling work within a distance of 90m from each dwelling is approximately 6 weeks.

The highest predicted northern solar farm construction noise levels are set out in Table 9 below:

Table 9: Predicted construction noise level during piling – northern solar farm

Receiver address	Predicted unmitigated noise level during piling	Predicted mitigated noise level during piling
164 Station Road (22m)	82 dB L_{A10}	**72 dB L_{A10}**
Subdivision (40m)	77 dB L_{A10}	67 dB L_{A10}
172 Station Road (44m)	76 dB L_{A10}	66 dB L_{A10}
182 Station Road (60m)	73 dB L_{A10}	63 dB L_{A10}

Receiver address	Predicted unmitigated noise level during piling	Predicted mitigated noise level during piling
60 James Avenue (85m)	70 dB L_{A10}	60 dB L_{A10}

Our assessment finds that the noise from piling works will require mitigating using physical screens, scheduling[5] or alternate piling methods when operating within 90m of the receivers in Table 9 above.

We have recommended a condition that requires all construction work to be designed, managed and conducted to ensure noise levels comply with the permitted construction noise limits at all receivers except at 164 Station Road.

Noise levels at 164 Station Road are predicted to exceed the permitted standards intermittently by up to 2 dB during piling work. We have recommended a specific noise limit for 164 Station Road of 72 dB L_{A10}.

This infringement, and all other construction noise from the proposed works will be limited to between 7:30 am and 6:00 pm, Monday to Saturday. The maximum period that the noise will exceed the permitted noise limit of 70 dB L_{A10} at 164 Station Road is approximately 6 weeks.

The temporary noise effects associated with the proposed works are typical for developments of this nature. In many cases, it is not practicable for construction works to consistently comply with the permitted construction noise limits.

Respite from the higher noise levels for the occupants is possible by moving to the far side of the dwelling if they are home during the piling works. Alternatively, it may be possible to schedule the noisier works for days when the residents are not home. The noise limits would not apply when the buildings are unoccupied. However, this can only be confirmed following the proposed consultation before the works take place.

Works will only be undertaken during the day. Respite from the noise will be possible in the evenings and on Sundays. There will be no work on public holidays. The receivers will be informed of the proposed scheduling including times for the noisier works. For most of the project, the noise levels will be significantly less than 70 dB L_{A10} at all receivers.

The proposal is to prepare and implement a Construction Noise and Vibration Management Plan (CNVMP). The CNVMP will be used to specify the noise mitigation methods that must be adopted when construction works are within 90m of any existing dwellings.

Effective noise mitigation methods may include use of alternative piling methods (i.e. auger, screw or bored piling), use of screening or completing the works when the receiving building is not occupied.

[5] Scheduling involves completing the work when no one is home. The construction noise limits do not apply if the building is unoccupied.

Screening may comprise the use of temporary localised barriers to screen the piling rig when it operates within 90m of an existing dwelling. This can be a small temporary "U" shaped screen that is moved along with the piling rig, ensuring that it screens the noise emissions to the receivers.

It is our opinion that the noise from the construction of the solar farms will not exceed a reasonable level in terms of section 16 of the Act.

7.3 Construction vibration

Section 5.3 of the District Plan includes standards that are designed to control operational vibration generated from industrial and business activities. The solar farm does not include any sources likely to generate operational vibration.

Activities that may generate vibration during the construction phase include the operation of tracked excavators, and other heavy plant and vehicles, and small-scale piling to install panels.

The operation of heavy plant near to the boundary of the site can generate perceptible vibration within neighbouring dwellings. During the daytime when residents are active, vibration levels above 0.3 mm/s PPV can be perceptible. Vibration levels above 1 mm/s PPV can cause complaints if the vibration is unexpected. The levels will typically depend on the separation distance, the equipment used, the skill of the operator, the subsoil conditions, and the response of the receiving structure.

Driven piling and the operation of heavy plant may result in some perceptible vibration at the closest dwellings but will not exceed the typical standard used to control construction vibration (including DIN4150-3:2016), given the separation distances to all structures on adjacent sites. We consider that compliance with the typical standards used to control construction vibration will be readily achieved without the need for any specific mitigation.

We consider that the mitigation measures recommended in this report form part of the best practicable option to ensure that the construction noise and vibration does not exceed a reasonable level.

7.4 Construction noise and vibration management plan

We recommend that a CNVMP is prepared for the project with reference to Annex E of the construction noise Standard NZS 6803:1999 and the AAAC *Guideline for interpreting and applying NZS 6803 1999*[6]. This should be submitted to the satisfaction of Matamata–Piako District Council before any works start on site.

In our experience, a CNVMP is an important tool for the successful management of noise and vibration effects on receivers in proximity to construction works.

6 https://aaac.org.au/resources/Documents/Public/AAAC%20Guideline%20for%20interpreting%20and%20applying%20NZS%206803-1999%20v1.0.pdf

The objectives of the CNVMP will be to:

i. Provide a framework to identify and adopt the best practicable option (BPO) for managing adverse construction noise and vibration effects on neighbours; and

ii. Define the procedures to be followed to ensure that the consented noise and vibration limits standards are complied with.

The CNVMP will deliver on these objectives by setting out for the contractor (without limitation):

- The construction noise and vibration limits for the project
- Limitations on working hours
- Specifications and requirements for acoustically effective barriers
- Minimum separation distances for compliance
- Procedures for response to neighbours' concerns and dealing with any complaints
- Procedures for noise and vibration monitoring during the works
- Details of any further noise and vibration mitigation measures available
- Details for advising the occupiers of the neighbouring buildings of the works, including when the highest noise levels and perceptible vibration can be expected
- Details for ensuring that contractors and operators on site are aware of the requirement to minimise noise and vibration effects on the neighbouring sites.

8.0 Recommended conditions of consent

We recommend the following conditions of consent are imposed to control construction and operational noise levels from the Site.

1. **Operational Noise limits**

   The operational noise levels from the solar farm shall comply with the permitted noise performance standards for the Rural Zone when measured and assessed at the notional boundary of any dwelling on an adjacent site.

2. **Construction noise limits**

   All construction work shall be designed, managed and conducted to ensure noise levels at the façade of any occupied dwelling on any other site shall comply with the noise limits prescribed in Rule 5.2.1 of the District Plan and NZS6803P:1984, with the following exception:

Receiver address	Noise limits during piling
164 Station Road	72 dB L_{A10} and 87 dB L_{Amax}

3. **(Construction hours)** Construction work and heavy vehicle movements on the site must only take place between the hours of 7:30 am. and 6:00 pm, Monday to Saturday. No noisy works will be undertaken on Sundays or public holidays. This condition does not preclude quiet works from taking place outside of standard construction hours, providing they are generally inaudible at the neighbouring sites.
4. **(Community consultation)** The consent holder must advise the occupants of all dwellings within 90 m of the site boundary about the construction works at least five days before works begin on site. The advice must be provided in writing and include the following information:

    (a) An overview of the construction works including the duration of the project and the working hours on site.

    (b) A contact name and phone number to advise of any sensitive times for high noise levels and for any questions or complaints regarding noise and vibration throughout the project.

    (c) The approximate dates and duration of the noisiest activities on site.

5. **(Construction vibration limits)** All construction works on the site must be designed and conducted to ensure that the construction vibration does not exceed the guideline vibration values set out in the German Standard DIN 4150-3: 2016 *Structural vibration – Effects of vibration on structures* when measured from any surrounding building in accordance with the Standard.
6. **Construction noise management plan (CNVMP)**

    The consent holder must submit a Construction Noise and Vibration Management Plan (CNVMP) to Matamata Piako District Council for certification. The CNVMP must be submitted a minimum of ten working days before starting any construction works authorised by this consent. The objective of the CNVMP must be to identify and require the adoption of the best practicable option to minimise construction noise and vibration effects and ensure compliance with the project noise and vibration conditions.

    The CNVMP must address the requirements of Annex E of NZS 6803:1999 *Acoustics – Construction Noise* and the AAAC *Guideline for interpreting and applying NZS 6803 1999* as a minimum. Construction works must not begin until certification has been received in writing from Matamata Piako District Council. The CNVMP and any amendments must be prepared by a suitably qualified acoustics consultant (e.g., MASNZ). Amendments that include changes to the construction methodology must be

tracked and the revised CNVMP submitted to Matamata Piako District Council for certification.

All construction works on the site must be carried out in accordance with the certified CNVMP. A copy of the CNVMP must be kept on site during construction hours.

9.0 Conclusion

Styles Group has assessed the cumulative noise effects from the construction and operation of two solar farms on rural land located approximately 1.8km to the southwest of Matamata.

We have modelled the noise emissions from the operation of the solar farm to determine the cumulative noise levels from all plant. The noise level contours are based on the plant operating at maximum capacity. These conditions will typically occur in clear, sunny conditions during the middle of the day.

The noise modelling indicates that compliance with the permitted noise levels can readily be achieved at the notional boundaries on all adjacent sites, and in most cases by a significant margin. A condition of consent is proposed that will require compliance with the permitted noise performance standards for the Rural Zone when measured and assessed at the notional boundary of any dwelling on another site.

We have assessed the noise levels from the construction of the solar farm in accordance with the permitted construction noise limits prescribed by the Matamata Piako District Plan. Our assessment finds that construction noise levels will marginally exceed the permitted noise limits at one receiver. We have recommended specific construction noise mitigation and that a CNVMP be prepared to manage the works. The objective of the CNVMP is to identify and require the adoption of the best practicable option to minimise construction noise and vibration effects and ensure compliance with the project noise conditions.

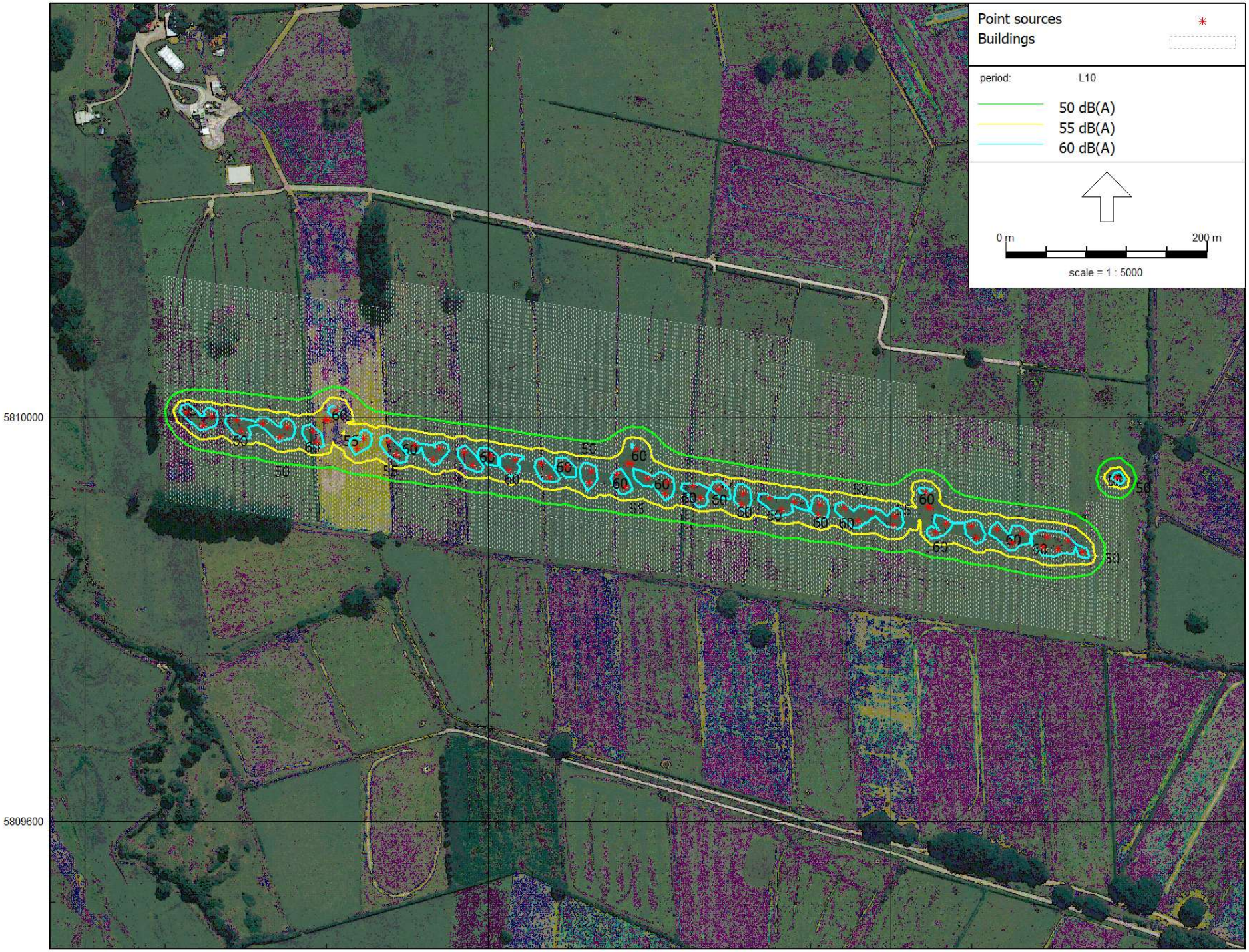
We consider that the noise emissions from the proposal will be reasonable at all times. We have recommended conditions of consent based on our findings

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).
A-weighting	A frequency filter applied to the full audio range (20 Hz to 20 kHz) to approximate the response of the human ear at lower sound pressure levels.
Ambient noise	Ambient noise is the total of all noise within a given environment, comprising a composite of sounds from sources near and far.
L_{A10} (dB)	A statistical noise descriptor. The A-weighted sound level which is just exceeded for 10% of the measurement period (t). Sometimes referred to as the average maximum noise level.
$L_{Aeq(t)}$ (dB)	The A-weighted equivalent sound pressure level with the same energy content as the measured varying acoustic signal over a sample period (t). The preferred metric for sound levels that vary over time because it takes into account the total sound energy over the time period of interest.
L_{AFmax} (dB)	The maximum A-weighted sound pressure level recorded during the measurement period using a fast time-weighting response.
L_{WA} (dB)	Sound power level (LWA) is the acoustical energy emitted by a sound source. It is an absolute value and is not affected by distance or the environment. The LWA is used in computer noise modelling to calculate the sound pressure level (e.g. LAeq) at a given distance.
Noise rating level	A derived noise level used for comparison with a noise limit.
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 6801:1991	N.Z. Standard NZS 6801:1991 Acoustics – Measurement of environmental sound.
NZS 6802:1991	N.Z. Standard NZS 6802:1991 Acoustics – Environmental noise.
NZS 6803:1999	N.Z. Standard NZS 6803:1999 Acoustics – Construction noise.
ISO 9613-1/2	International Standard ISO9613-1/2 Attenuation of sound during propagation outdoors
DIN 4150–3:2016	German Standard DIN 4150-3:2016 Structural Vibration – Part 3: Effects of vibration on structures. Typically adopted for the assessment of structure borne vibration in New Zealand.

Appendix B Daytime noise rating level contours


Point sources
Buildings
period:
L10
50 dB(A)
55 dB(A)
60 dB(A)
0 m
200 m
scale = 1 : 5105
1842800
1842400
1842000
5811600
5811200



DAY_North and South areas combined

11 Mar 2025, 21:17

Styles Group Acoustics and Vibration - New Zealand

Appendix C Night-time noise rating level contours

NIGHT_North and South areas combined

11 Mar 2025, 21:24

Point sources

Buildings

period: L10

40 dB(A)

45 dB(A)

50 dB(A)

0 m 200 m

scale = 1 : 5119

5811600

5811200

5810800

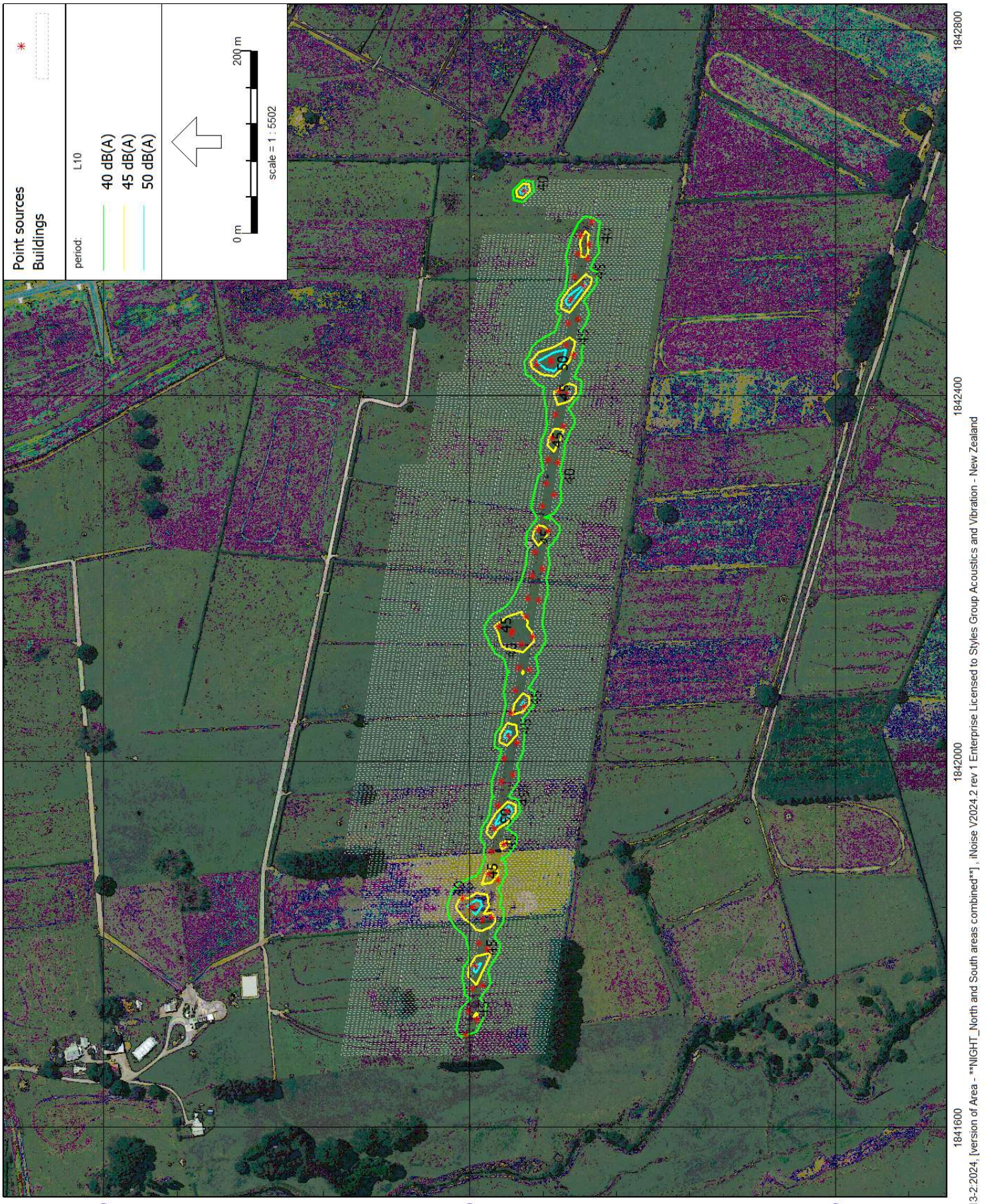
1842000

1842400

1842800

ISO 9613-2:2024, [version of Area - **NIGHT_North and South areas combined**] , iNoise V2024.2 rev 1 Enterprise Licensed to Styles Group Acoustics and Vibration - New Zealand

Styles Group Acoustics and Vibration - New Zealand


Point sources
Buildings
period:
L10
40 dB(A)
45 dB(A)
50 dB(A)
0 m
200 m
scale = 1 : 5502
5810400
5810000
5809600
1841600
1842000
1842400
1842800
ISO 9613-2:2024, [version of Area - **NIGHT_North and South areas combined**] , iNoise V2024.2 rev 1 Enterprise Licensed to Styles Group Acoustics and Vibration - New Zealand

Appendix D Qualifications and experience

Daniel Iain Winter

Daniel is an acoustic consultant at Styles Group Acoustics and Vibration Consultants- a team of seven consultants specialising in the measurement, prediction, and assessment of environmental and underwater noise, building acoustics and vibration.

He holds a BSc. Environmental Health and a Postgraduate Diploma in Acoustics and Noise Control.

He has approximately 20 years' experience in the industry, including 14 years at Auckland Council where he has held positions of Principal Environmental Health Noise Specialist and Team Leader Compliance Response Noise.

He is a full member of the Acoustical Society of New Zealand.

Jon Robert Styles

Jon has approximately 22 years of experience in the industry, the first four as the Auckland City Council's Environmental Health Specialist – Noise, and the latter 16 as the Director and Principal of Styles Group.

He holds a Bachelor of Applied Science majoring in Environmental Health and has completed the Ministry for the Environments' Making Good Decisions programme. He recently concluded his second term as the President of the Acoustical Society of New Zealand (ASNZ). He is currently a Council member and professional member of the ASNZ. Styles Group is a member firm of the Australian Association of Acoustical Consultants.

He has approximately 20 years' experience in environmental acoustics. In that time, he has been involved in the development and administration of numerous District Plan rules, plan changes, general policy development and has assisted a large number of Councils to process a significant number of resource consents and Notices of Requirement. He has prepared and overseen a significant number of assessments of noise and vibration effects reports.