



CONSTRUCTION NOISE AND VIBRATION ASSESSMENT

ASHBOURNE RETIREMENT VILLAGE
STATION ROAD, MATAMATA

PREPARED FOR
Unity Management Ltd.

DATE
4 June 2025

Assessment prepared by Styles Group for Unity Management Ltd.

REVISION HISTORY

Rev:	Date:	Comment:	Version:	Prepared by:	Reviewed by:
1	27/05/25		Draft	Daniel Winter, MASNZ Senior Consultant Styles Group	Jon Styles, MASNZ Director and Principal Styles Group
2	4/06/25		Final	Daniel Winter, MASNZ Senior Consultant Styles Group	Jon Styles, MASNZ Director and Principal Styles Group

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Executive summary

Styles Group has assessed the construction noise and vibration effects of a retirement village development at 127 Station Road.

We have assessed the noise levels from the construction of the retirement village in accordance with the permitted construction noise limits prescribed by the Matamata Piako District Plan. Our assessment finds that construction noise levels will comply with the permitted construction noise limits.

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**).

It is our view that the noise and vibration emissions from the proposed construction works, including the minor infringements of the Matamata Piako District Plan will be reasonable in terms of s16 of the Resource Management Act if our recommended conditions are imposed and complied with.

1.0 Introduction

Unity Management Ltd has engaged Styles Group to assess the construction noise and vibration effects of a retirement village development at Station Road, Matamata (the **Site**).

This report sets out an assessment of the proposal from an acoustics perspective, including:

- i. Construction noise and vibration level predictions at the nearest dwellings (the **Receivers**) that may be occupied during the works based on expected worst-case scenarios.
- ii. An assessment of construction noise and vibration against the permitted standards of the Matamata Piako District Plan (the **MPDP**).
- iii. Recommended noise and vibration mitigation measures and consent conditions for the project.

Our assessment is based on our understanding of the proposal and discussions with the project team. 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 B.

2.0 The Site, the surrounding environment and the nearest receivers

A retirement village is proposed to be developed on a vacant site approximately 1.8km south west of Matamata. The Site comprises an irregular shaped area with a gross area of 45.81ha.

The Site is relatively flat and is currently being used as low-lying farmland.

Figure 1 overleaf shows the location of the retirement village development on Lot 1. The retirement village is part of a wider development that includes a residential subdivision across Lots 4 – 6 and solar farms on Lots 3 and 7.

This report specifically assessed the construction noise and vibration effects of the retirement village development on Lot 1. Styles Group has prepared separate construction noise and vibration assessments for each of the northern and southern solar farms and the residential subdivision.

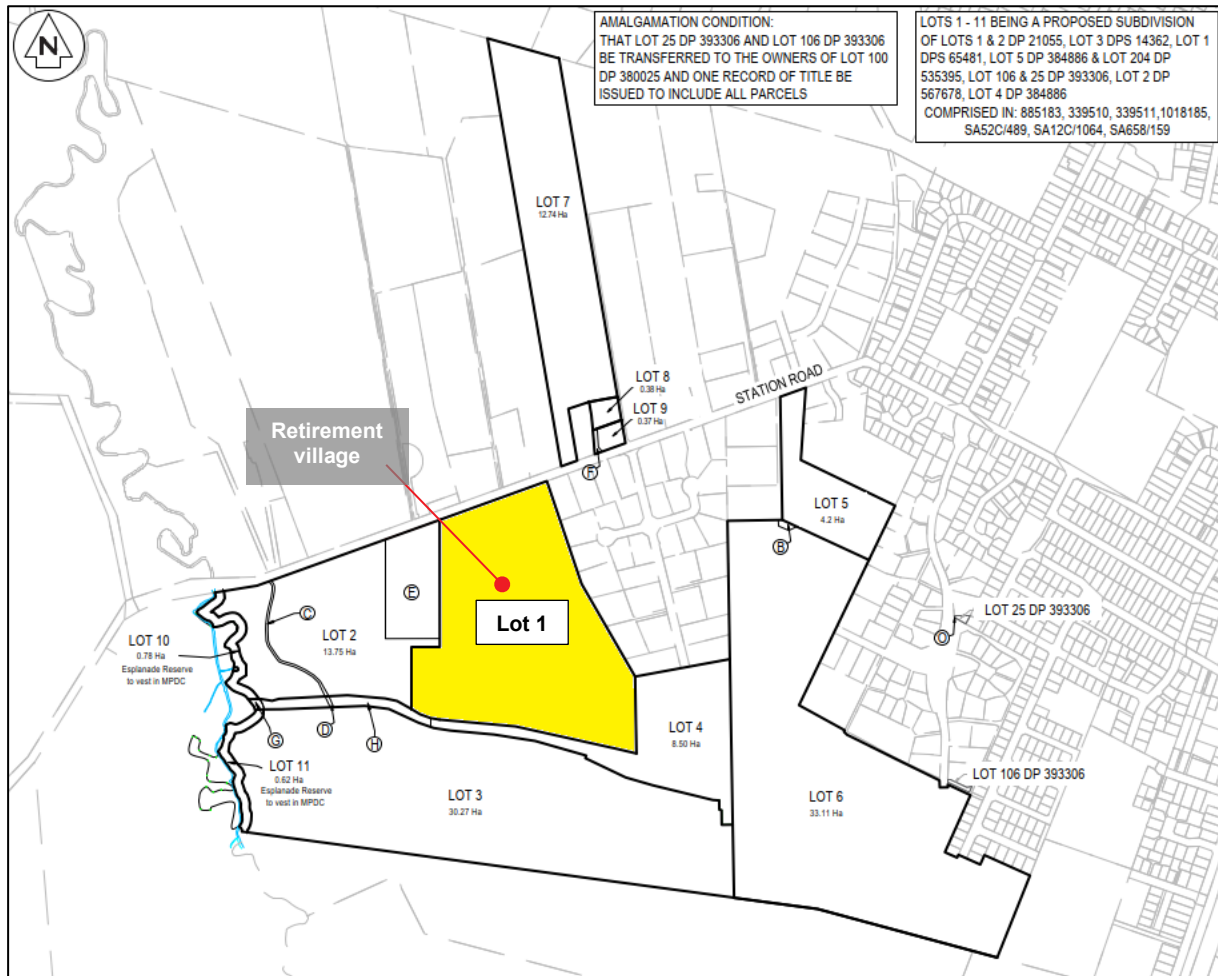


Figure 1: Retirement village (yellow) Lot 1

The retirement village and the surrounding sites are all located in the Rural Zone.

The residential dwellings nearest to the Site that may be occupied during the works are illustrated in Figure 2 overleaf:

The majority of the adjacent dwellings are single level, but there are three sites that contain two-storey dwellings. These are:

- 1 Chestnut Lane
- 4 Chestnut Lane
- 18 Eldonwood Drive

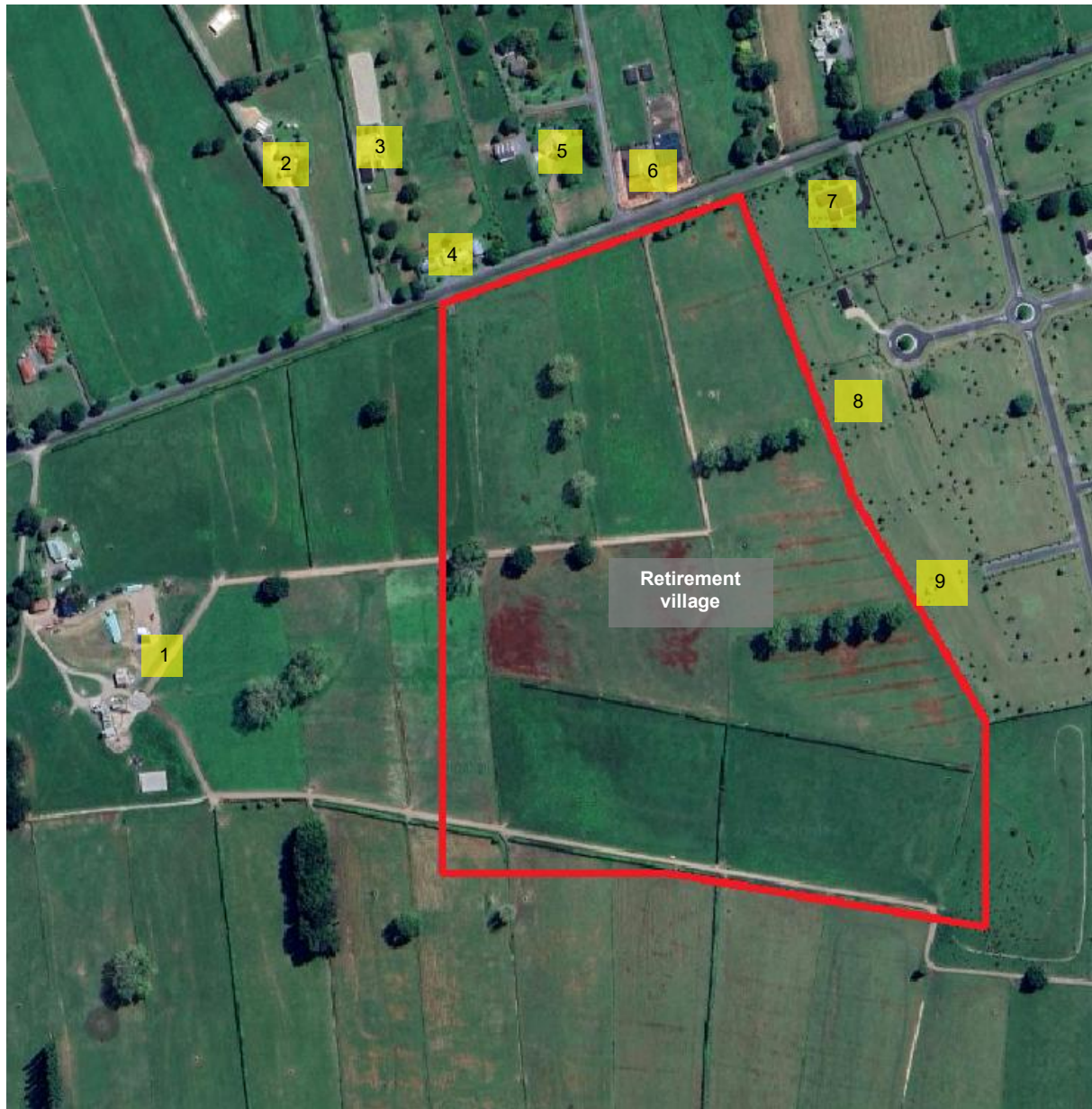


Figure 2: The Site (red) nearest dwellings (yellow)

The nearest receivers to the works are:

1. 247A Station Road*	2. 218 Station Road	3. 214 Station Road
4. 206 Station Road	5. 200A Station Road	6. 190 Station Road
7. 173 Station Road	8. Olive Place (vacant)	9. Highgrove Ave (vacant)

*site owned by the applicant

3.0 The proposal

Unity Management Ltd are proposing to develop a 20.0 hectare site to provide a retirement village comprising of 218 units (villas), an aged care hospital and other supporting facilities.

The retirement village development is part of a wider development that includes the northern and southern solar farms and a residential subdivision. Figure 3 below shows the location of the retirement village in the overall staging plan.

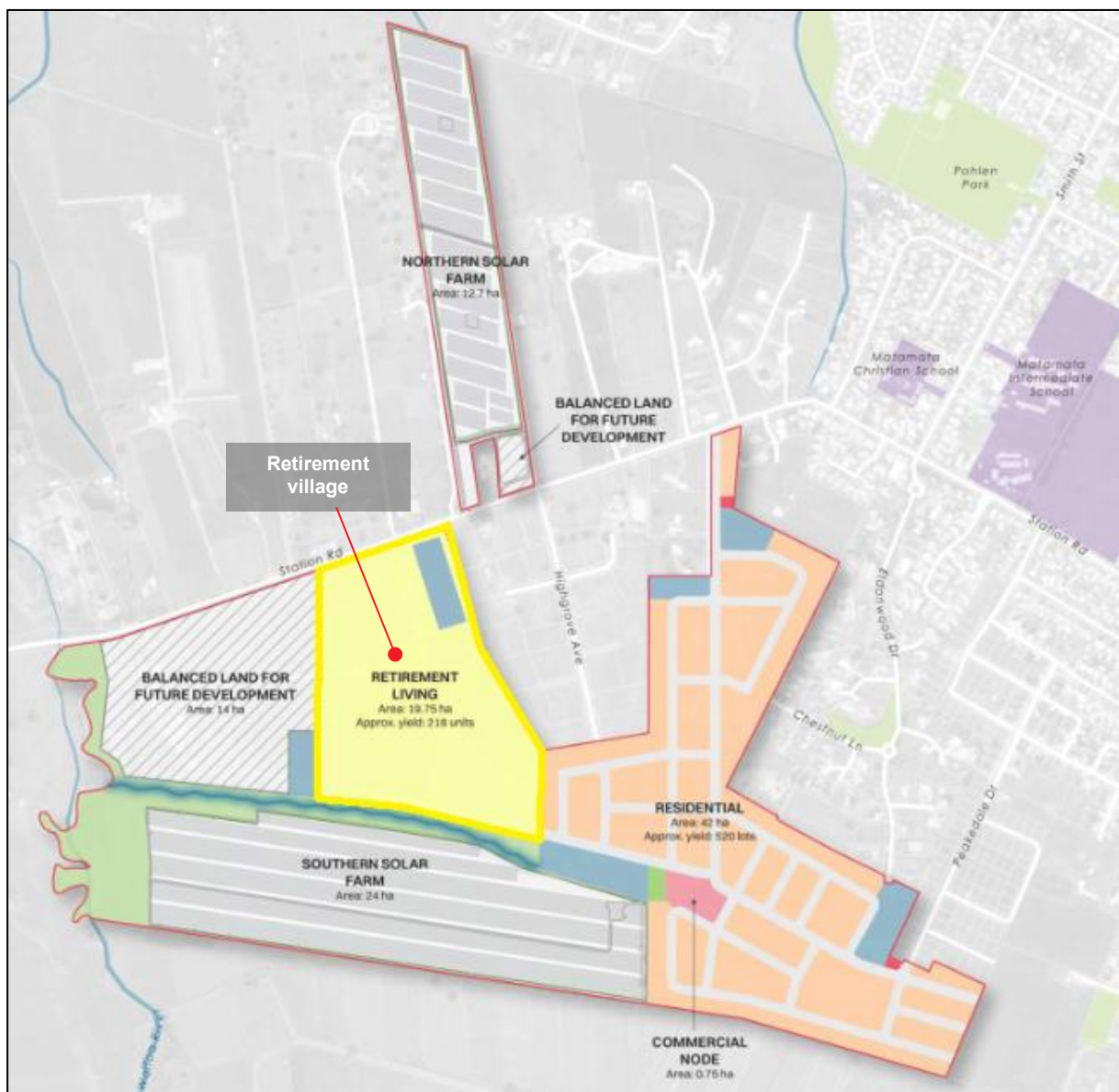


Figure 3: The overall staging plan showing the retirement village (yellow)

Figure 4 below shows the retirement village development and the construction staging plan with Stages 1 - 10.

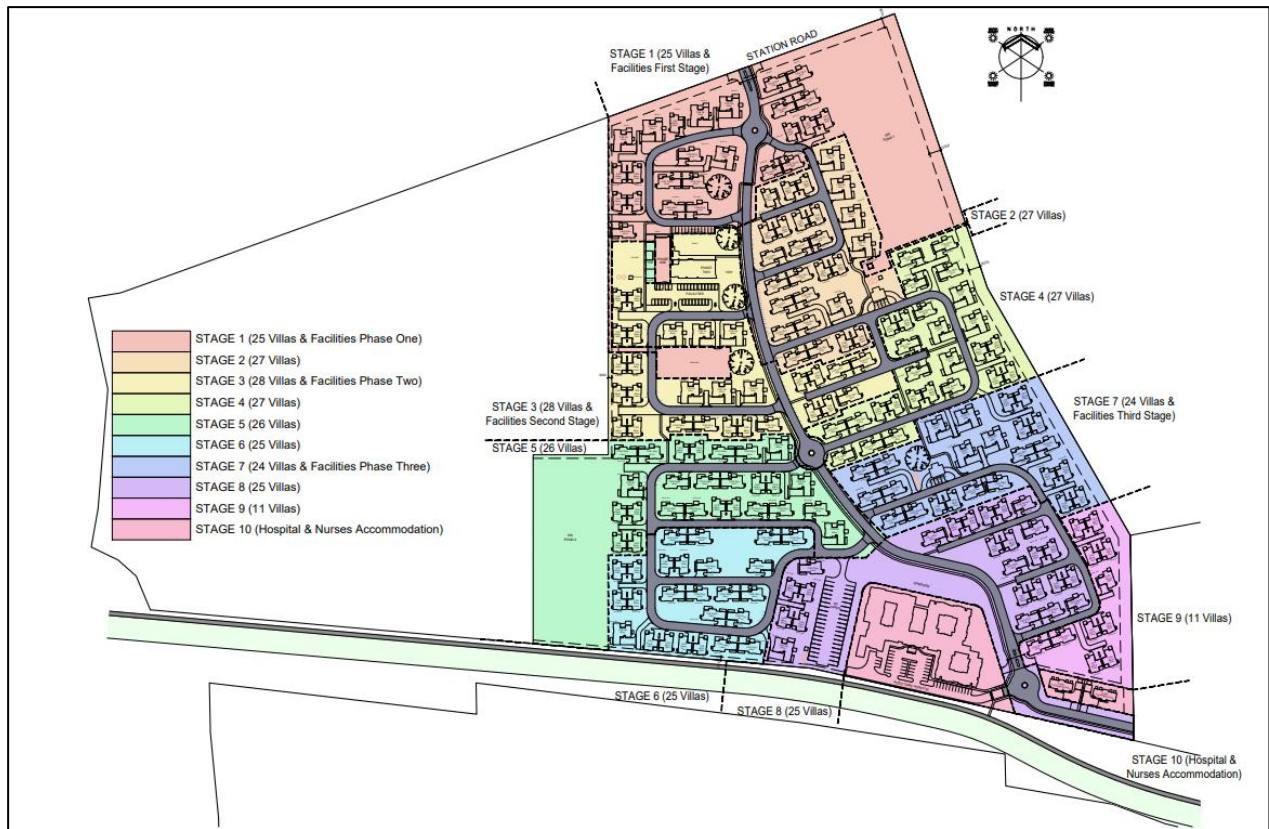


Figure 4: Ashbourne retirement village

4.0 Proposed construction activities

The proposal includes tree work, earthworks, civil infrastructure works, the construction of the accessway and driveways, above ground construction and landscaping. The construction stage will involve the following construction activities:

- Removal of trees with chainsaws and excavators, wood chipping and stump grinding
- Install drainage systems
- Cut and fill work using excavators
- Loading dump trucks for removal of material using excavators
- Concrete pours
- Vibratory compaction for foundations, driveways, and roads
- Construction of reinforced concrete slab foundations
- Delivery of materials to site

- General construction work for the above-ground construction of the buildings.

The proposed construction works do not include high noise and vibration activities such as blasting, rock-breaking or driven piling. There are no retaining walls required.

We have not assessed the noise effects of the accessway construction as the works are at least 200m to the closest receiver.

The construction works will be undertaken in 10 stages (1 – 10).

The total cut and fill volume for the site development

- Total volume of cut 43,500 m³
- Total volume of fill 77,300 m³

Figure 5 below shows the cut and fill overview plan.

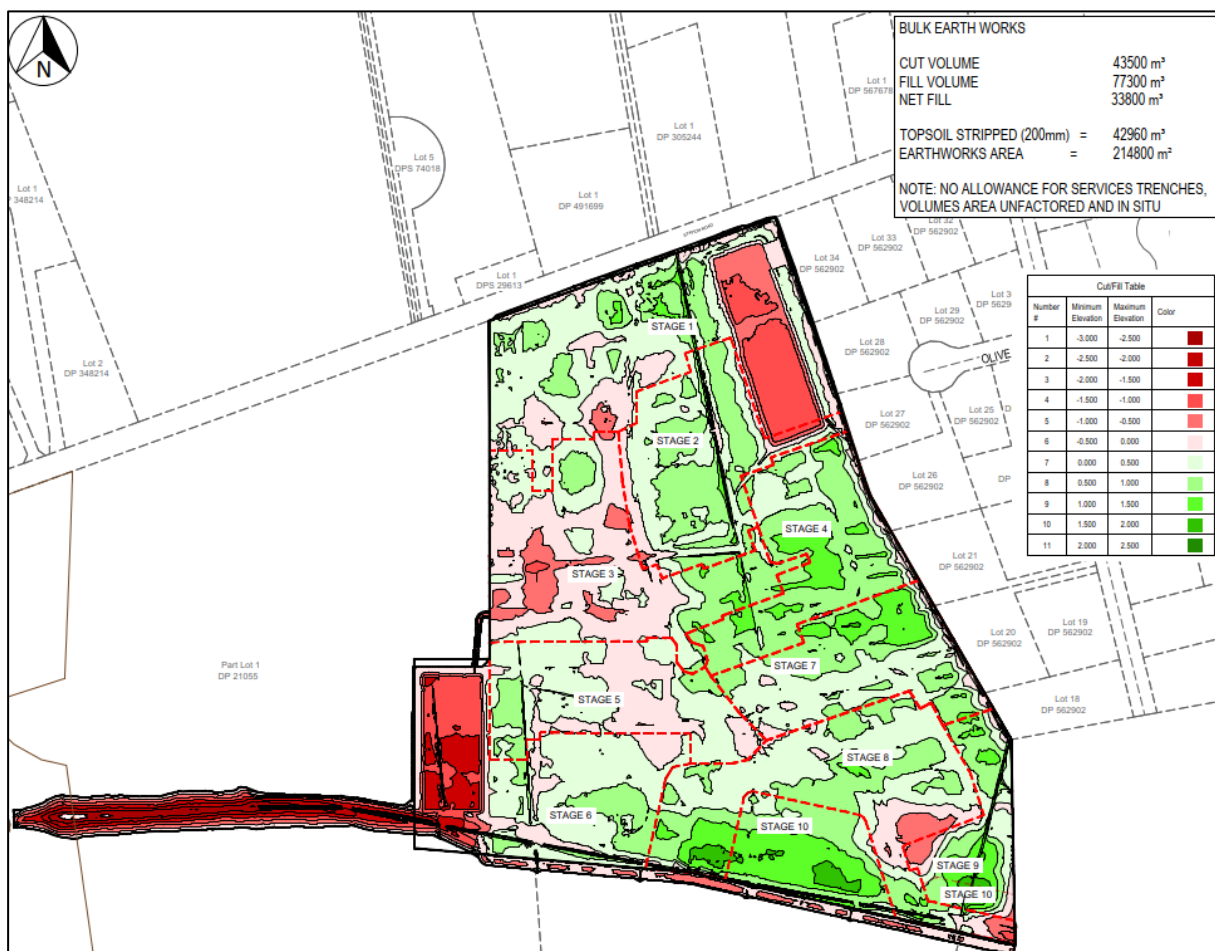


Figure 5: Cut and fill overview plan

5.0 Timing and duration of construction works

All noisy construction works will be undertaken between the hours of 07:30 – 18:00, Monday to Saturday. Quiet activities such as painting, fit outs and landscaping may be undertaken outside of these hours.

The anticipated total duration of the construction works under this proposal will be staged over approximately 10 years. We understand that the works will be intermittent over this period and certainly not continuous for 10 years.

Tree work, site clearing, earthworks and civil works will take places in stages over 4 - 5 years. The remaining works on the Site will be the above ground construction of the dwellings and landscaping. Our experience is that the above-ground works for low-rise residential-style construction is considerably quieter than earthworks and civil works.

6.0 Construction noise and vibration standards

This section sets out the MPDP permitted construction noise and vibration limits and the relevant standards for the measurement and assessment of construction noise and vibration.

6.1 Matamata Piako District Plan permitted construction noise limits

The MPDP permitted limits for construction noise are set out in Rule 5.2.1 of the District Plan, which 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:1984¹.

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;

¹ 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.

NZS6803P:1984 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 5 dB if the duration of the construction work exceeds 18 weeks.

The staged construction of the retirement village will take up to 10 years to complete and each stage will be likely to take more than 18 weeks. Table 1 sets out NZS6803P:1984's recommended limits for long term (exceeding 18 weeks) construction noise in residential areas².

Table 1 - 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	**	**	**
Sundays and public holidays	0630-0730	**	**	**
	0730-1800	**	**	**

² 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 but we consider that they would include rural dwellings.

Time of Week	Time Period	Noise level (dBA)		
		L ₁₀	L ₉₅	L _{max}
	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 L₁₀ and 85 dB L_{max} applies at any occupied dwelling.

6.2 Matamata Piako District Plan permitted construction vibration limits

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

There are no specific rules or assessment criteria for construction vibration in the MPDP.

In the absence of any specific construction vibration limits in the MPDP, we recommend that 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.

DIN 4150-3:2016 uses a three-tiered classification system for buildings according to their susceptibility to vibration damage, as follows:

- Line 1: Buildings used for commercial purposes, industrial buildings and buildings of similar design (Line 1);*
- Line 2: Dwellings and buildings of similar design and/or occupancy (Line 2);*
- Line 3: Structures that, because of their particular sensitivity to vibration, cannot be classified under lines 1 and 2 and are of great intrinsic value e.g. buildings listed buildings under preservation order (Line 3).*

The DIN 4150-3:2016 guideline values are also determined by the frequency and the nature of the vibration (short-term or long-term). The short-term vibration limits of the Standard should be applied unless measurements demonstrate that the vibration is producing resonance in the structure, or it is occurring often enough to cause structural fatigue.

The applicable limits also depend on whether the vibration is measured and assessed at the foundations of the building or at the upper level. The Standard should therefore be referred to in full when being applied. A suitably qualified structural expert should be consulted if there are

concerns about a building being particularly sensitive to vibration, or where the DIN 4150–3:2016 classification of the building or the nature of the vibration requires confirmation.

The DIN 4150–3:2016 frequency-dependant guideline values for short-term vibration measured at the foundations of the building are illustrated in Figure 6. Construction vibration measured in residential, commercial, and industrial buildings is typically less than 50 Hz. It occurs for a limited duration, and it does not often produce resonance in low rise structures.

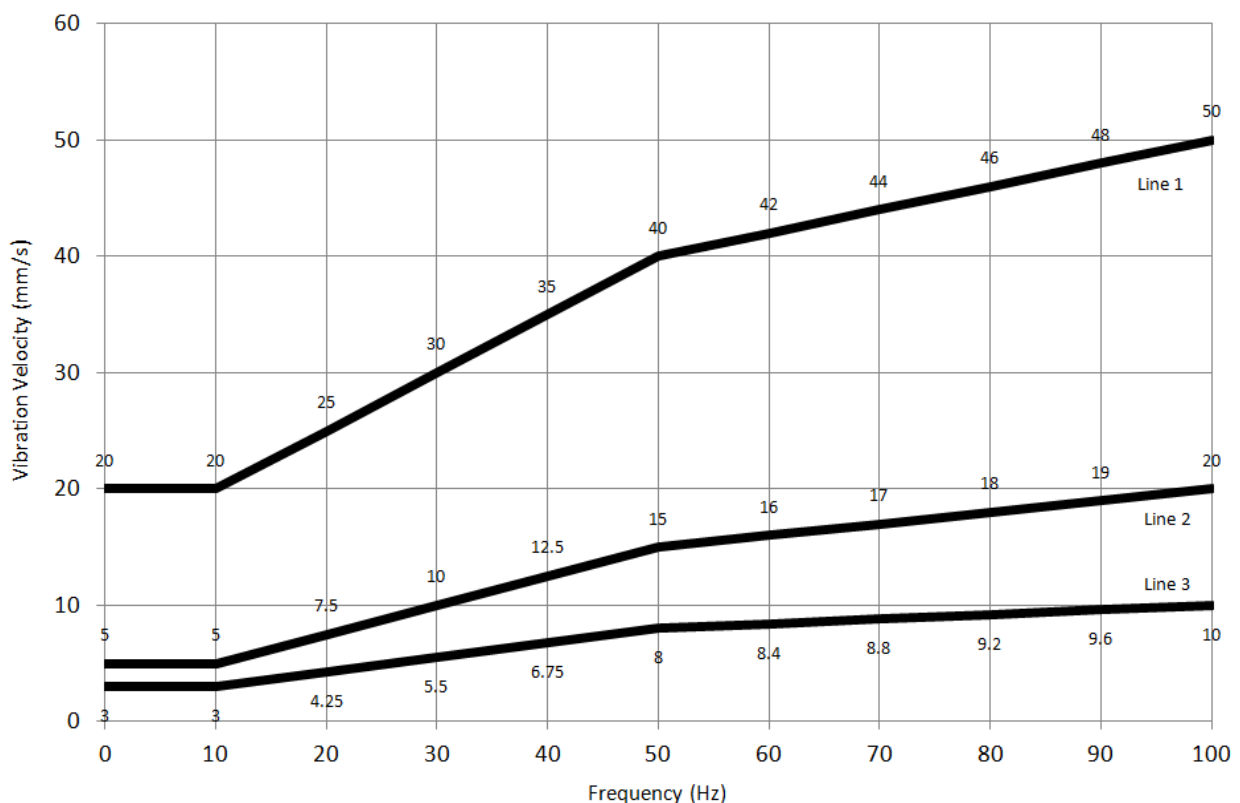


Figure 6: DIN 4150–3:2016 guideline values for short-term vibration

Activities that may generate vibration during the construction phase include the operation of tracked excavators, other heavy plant and vehicles. There is no rock breaking or driven piling proposed.

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.

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.

7.0 Reference noise levels and minimum separation distances

The reference sound pressure levels used in our calculations are displayed in Table 2 overleaf. These are derived from:

- Numerous measurements undertaken by Styles Group on similar projects
- NZS 6803:1999 Appendix C *Guide to Sound Level Data on Site Equipment and Site Activities*
- The DEFRA *Noise Database for Prediction of Noise on Construction Sites and Open Sites*.

Our reference levels are based on typical plant and operations to assume a worst-case scenario. Good plant selection, regular maintenance, and experienced operators can further reduce noise emissions.

Table 2 also displays the minimum separation distance for each activity to comply with the permitted noise limits of 70 dB L_{A10} and 85 dB L_{Amax} from 07:30 to 18:00, based on the following assumptions:

- The minimum distance stated is that from the noise generating plant to the assessment position at 1 m from the most exposed façade of the building
- The plant is being used continuously at the reference distance over a 15-minute sample period (i.e., 100% on-time) unless otherwise stated
- An adjustment of +3 dB for reflections from the façade
- The mitigated distance is based on temporary acoustic barriers blocking the line of sight from the noise generating plant to the façade of the dwelling. The barriers will be 2.0 m high and constructed from 18 mm plywood or a proprietary construction noise barrier. The reduction from the barrier will be approximately -8 dB to -12 dB, depending on the height and nature of the noise source and the position of the barrier. We have assumed -10 dB in our mitigated compliance distance calculations in Table 2 overleaf. We have assumed no reduction for the upper level of two-storey dwellings that will have direct line of site to the construction works.

Table 2: Reference levels and minimum separation distances for compliance with project limit of 70 dB L_{A10}

Construction activity	Reference noise level 10 m from plant	All receivers without mitigation	All receivers including acoustically effective screening
Woodchipper	89 dB L _{A10}	120 m	50 m
Petrol chainsaw felling trees (33% on-time) used at ground level	86 dB L _{A10}	90 m	35 m
Petrol chainsaw felling trees (33% on-time) used above 2.0m	86 dB L _{A10}	90 m	--
Excavator mounted stump grinder	85 dB L _{A10}	80 m	30 m
Excavation with 30 t excavator	77 dB L _{A10}	30 m	12 m
Grader*	77 dB L _{A10}	30 m	12 m
Vibratory compaction roller*	75 dB L _{A10}	25 m	10 m
Bulldozer	75 dB L _{A10}	25 m	10 m
Excavation with 14 t excavator	75 dB L _{A10}	25 m	10 m
Static compaction roller*	75 dB L _{A10}	25 m	10 m
Concrete pump and truck discharging	74 dB L _{A10}	22 m	9 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	68 dB L _{A10}	11 m	< 5 m
Idling dump truck	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.

The L_{Amax} noise levels from the proposed construction activities will generally be 5-15 dB louder than the L_{A10} noise levels. Where the 70 dB L_{A10} noise limit is complied with, the 90 dB L_{AFmax} noise limit will also be complied with.

8.0 Proposed construction noise and vibration mitigation measures

This section sets out the proposed noise and vibration mitigation measures for the construction works on the Site.

The following mitigation measures are designed to reduce noise and vibration emissions from the Site by as far as practicable and to avoid any unnecessary effects on the surrounding receivers.

1. A construction noise and vibration management plan (CNVMP) will be prepared for the project. The details of the CNVMP are discussed in Section 9.0.
2. All receivers within 50 m of the site boundary will be advised in writing of the works and the potential construction noise during the day.
3. Before earthworks or civil works begin at any point within 25 m of the façade of an occupied dwelling, temporary acoustic barriers will be constructed on the boundary to block line of sight from the works to the façade of the dwelling. The barriers will be no less than 2.0 m in height, of solid construction with no gaps and have a surface mass of no less than 10 kg/m² (e.g., 18 mm plywood). Alternatively, proprietary construction noise barriers may be used (such as Echo Barrier³, Soundbuffer⁴ or Hushtec⁵). Further details on the locations and specifications for the acoustic barriers will be set out in the CNVMP.

Temporary barriers are not required where the CNVMP demonstrates that compliance with the noise limits in this consent can be achieved by other methods.

Note: There are no existing dwellings that are within the setback distance of 25 m. Temporary acoustic barriers are not required to screen existing dwellings. This mitigation option is specific to any new dwellings that may be constructed and occupied, such as with the proposed subdivisions in Olive Place or Highgrove Avenue.

4. Earthworks undertaken within 10 m of the façade of an occupied dwelling will be undertaken using a 5 - 14-t excavator. Earthworks undertaken further than 10 m from the façade of an occupied dwelling may be undertaken using 20 - 30-t excavators.
5. The woodchipper will be positioned so that it is not within 120 m of any dwelling, unless:
 - a. The dwelling is unoccupied when the chipper is in use.
 - b. Acoustically effective screening is used; or

³ <https://supplyforce.co.nz/echo-barrier>

⁴ <http://soundbuffer.co.nz>

⁵ <https://duraflex.co.nz/hushtec>

- c. Site specific noise measurements show that noise from the woodchipper can comply with the consented noise limits without requiring additional mitigation.
- 6. During felling of the trees, no more than two chainsaws will be used at any one time within 90 m of a dwelling, unless:
 - a. The dwelling is unoccupied.
 - b. Acoustically effective screening is used; or
 - c. Site specific noise measurements show that noise from the chainsaw(s) can comply with the consented noise limits without requiring additional mitigation.
- 7. Chainsaw work and stump grinding when operating within 90m of the façade of an occupied dwelling will not take place outside the hours of 08:30 to 17:00, Monday to Saturday
- 8. The operation of the wood chipper when operating within 120m of the façade of an occupied dwelling will not take place outside the hours of 08:30 to 17:00, Monday to Saturday
- 9. All other noisy construction works will be restricted to take place between 07:30 and 18:00, Monday to Saturday. There will be no noisy works at night or on Sundays and public holidays.

In our view, these measures form part of the best practicable option to ensure the noise emissions do not exceed a reasonable level.

9.0 Construction noise and vibration management plan

9.1 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.

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

⁶ <https://aaac.org.au/resources/Documents.pdf>

- 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.

10.0 Noise modelling methodology and results

This section sets out the methodology and results of our construction noise modelling.

10.1 Methodology

We have calculated the noise levels from the proposed construction works using DGMR iNoise v2024 computer noise modelling software. The computer noise models are three-dimensional and consider physical factors such as topography, buildings, ground coverage, and the physical attributes of the sound sources and receivers.

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.

We have modelled the following scenarios:

- i. Tree work using two chainsaws, one wood chipper and a stump grinder. We have assumed the woodchipper will be located at least 120m. The chainsaws and stump grinder have been assessed at the closest trees to the receivers.
- ii. Site preparation and earthworks. We have assumed that earthworks undertaken within 10 m of the façade of an occupied dwelling will be undertaken using a 14-t (or less) excavator using. Earthworks undertaken further than 10 m from of the façade of an occupied dwelling may be undertaken using a 30-t excavator.

We have created a separate noise model for each of these stages of works because they will not be taking place simultaneously.

The input parameters for the noise model are displayed in Table 3:

Table 3: iNoise model input parameters

Calculation settings	Details
Meteorological parameters	Single value, C0 = 0
Ground attenuation	General method, ground factor 0.8
Air temperature	293.15 K
Atmospheric pressure	101.33 kPa
Air humidity	60 %
Receiver heights (relative)	Ground level: 1.5 m First floor facade: 4.5 m

10.2 Predicted noise levels

This section sets out the predicted worst-case noise levels at the nearest receivers including the proposed mitigation measures.

10.2.1 Predicted noise levels are existing dwellings

The predicted construction noise levels at the existing dwellings that are immediately adjacent to the Site are displayed in Table 4. These are measured at 1 m from the most exposed facade of a receiver and 1.5 m above the floor level of interest.

The noise level predictions displayed in Table 4 are the highest noise levels that are expected during the works when they are nearest to a receiver.

Noise level predictions that exceed the permitted noise standards Rule 5.2.1 of the MPDP are shown in bold.

Table 4: Calculated construction noise levels

Address	Receiver height	Highest predicted construction noise level - tree work (L _{A10})	Highest predicted construction noise - earthworks (L _{A10})
247A Station Road*	1.5 m	47 dB	39 dB
	4.5m	48 dB	40 dB
218 Station Road	1.5 m	48 dB	46 dB
214 Station Road	1.5 m	46 dB	51 dB
206 Station Road	1.5 m	60 dB	57 dB
200A Station Road	1.5 m	52 dB	48 dB
190 Station Road	1.5 m	63 dB	53 dB
173 Station Road	1.5 m	61 dB	49 dB

*site owned by the applicant

Any site not specifically referenced in Table 4 is separated further from the proposed activity than those listed. The noise levels received at the more distant sites will therefore be lower and will readily comply with the permitted noise limits. Noise from all other construction activities will be quieter or further removed from the boundary and fully screened. The noise levels from all other activities will therefore comply with the permitted construction noise limits.

For the proposed construction works, the L_{Amax} will typically be 10-15 dB higher than the L_{A10}. Compliance with the L_{A10} noise limit of 70 dB will also result in compliance with the L_{Amax} noise limit of 85 dB.

The results of our noise modelling demonstrate that the works can comply with the permitted noise limits at all receivers.

10.2.2 Predicted noise levels at vacant sites that are proposed to be developed

We understand that there are a number of subdivisions planned on sites that share a boundary with the proposed retirement village.

The neighbouring residential subdivisions are located at:

- Olive Place (vacant)
- Highgrove Avenue (vacant)

These above these sites are currently vacant. However, we have included an assessment of the noise effects as these vacant sites could be developed before the earthworks commence on the retirement village site.

We have discussed the future development of the neighbouring sites with the applicant's planner. Although there is limited information available, but we understand that dwellings constructed on the vacant site development will be low-density, the dwellings on these sites are typically stand-alone single-level dwellings.

The predicted construction noise levels displayed in Table 5 are the predicted worst case noise levels based on an assessment point located 2 m within the site boundary and at a height of 1.5m.

The notional assessment point of 2 m represents a worst case scenario. It is likely that the dwellings will be constructed further than 2 m from the site boundary.

The predicted noise levels are based on temporary acoustic barriers blocking the line of sight from the noise generating plant to the façade of the dwelling.

Noise level predictions that exceed the permitted noise standards Rule 5.2.1 of the MPDP are shown in bold.

Table 5: Predicted noise levels at vacant subdivisions

Vacant site location	Assumed height	Highest predicted construction noise level – tree work (L _{A10})	Highest predicted construction noise – earthworks (L _{A10})
Olive Place subdivision	1.5 m	60 dB	69 dB
Highgrove avenue subdivision	1.5 m	61 dB	67 dB

The results of our noise modelling demonstrate that the works can comply with the permitted noise limits at an assessment point 2 m within the boundary of the vacant sites.

11.0 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 retirement village 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. Any perceptible vibration will only be during the daytime on Monday to Saturday when the earthworks and civil works are being completed.

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.

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.

12.0 Construction noise and vibration effects

It is our opinion that the noise from construction of the retirement village will be controlled to a reasonable levels in terms of section 16 of the Act.

The noise levels from all construction activities are precited to comply with the permitted construction noise limits at existing dwellings.

The temporary noise effects associated with the proposed works are typical for a subdivision of this nature. Noise levels are likely to be experienced subjectively as being dominant in the environment and louder than other sounds present when works are close. The construction noise will also be very intermittent over the construction period with the highest noise levels only present when works are close to any receiver. 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 noisiest works.

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 significantly less than 70 dB L_{A10} at all receivers.

We recommend that the occupants of all buildings within 50m of the Site be advised of the works in writing, including a contact name and number for any questions or concerns.

The expected vibration within the nearest buildings will comply with the proposed vibration limits for building damage at all times and will be typical of residential construction projects that require construction work near to a site boundary.

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.

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 50m of any existing dwellings.

13.0 Recommended conditions of consent

We recommend the following conditions for the project:

1. **(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.
2. **(Construction hours)** Construction work and heavy vehicle movements on the site must only take place between the hours of 0730 - 1800, Monday to Saturday. No noisy works may 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.
3. **(Advance notice)** The consent holder must advise the occupants of all dwellings within 50 m of the site boundary about the construction works at least five days before each stage of 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.
4. **(Tree work)** The operation of chainsaws and stump grinder within 90m of the façade of an occupied dwelling and wood chipping within 120m of the façade of an occupied dwelling must only take place between 08:30 and 17:00, Monday to Saturday. All other construction work must only take place between the hours of 07:30 to 18:00, Monday to Saturday.
5. **(Temporary acoustic screens)** Before earthworks, civil works or tree works begin at any point within 25 m of the façade of an occupied dwelling, temporary acoustic barriers must be constructed on or within the site boundary to block line of sight from the area of the works to the façade of the dwelling. The barriers will be no less than 2.0 m in height and must remain in place until these works are outside of the 25 m setback

distance. Temporary barriers are not required where the CNVMP demonstrates that compliance with the noise limits in this consent can be achieved by other methods.

Advice note: There are no existing dwellings that are currently within the setback distance of 25 m. This condition will apply to any new dwellings that are constructed within 25 m of the earthworks.

6. **(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 in accordance with the Standard on any surrounding building.

7. **(Construction noise and vibration 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.

14.0 Conclusion

Styles Group has assessed the noise and vibration effects of the proposed retirement village.

We have assessed the noise levels in accordance with the permitted construction noise limits prescribed by the Matamata Piako District Plan. Our assessment finds that construction noise levels will comply with the permitted construction noise limits at all receivers.

Vibration emissions will comply with the the guideline vibration values set out in the German Standard DIN 4150-3:2016 *Structural vibration – Effects of vibration on structures* .

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.

The construction noise and vibration levels will be no greater than necessary to complete the works. It is our opinion that our recommendations form part of the best practicable option to ensure that noise emissions are reasonable.

We have recommended conditions of consent for the project 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).
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.
NZS6803 :1984	The Measurement and Assessment of Noise from Construction, Maintenance and Demolition Work.
NZS 6803:1999	N.Z. Standard NZS 6803:1999 Acoustics – Construction noise.
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.
PPV	Peak particle velocity, measured in mm/s. The standard metric for the measurement of ground borne vibration in New Zealand. The instantaneous maximum velocity reached by a vibrating element as it oscillates about its rest position.

Appendix B 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 Environment's Making Good Decisions programme. Jon has completed two terms 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.