MARSHALL DAY Acoustics

MT WELCOME DEVELOPMENT
CONSTRUCTION NOISE AND VIBRATION ASSESSMENT

Rp 001 r01 20260443 | 29 May 2026

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Project: **MT WELCOME DEVELOPMENT**

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SUMMARY

This report assesses the likely construction noise and vibration effects of the proposed Mt Welcome residential development at Pukerua Bay, including earthworks, civil and road works, and the SH59 roundabout construction. The assessment focuses on the noisiest and most vibration-intensive activities which may potentially affect nearby receivers, particularly existing dwellings on and around State Highway 59, Pukemere Way, and Gray Street. The works are expected to extend beyond 20 weeks, so long-term construction noise criteria have been applied.

- **Assessment basis:** Noise has been assessed against NZS 6803:1999 and the Porirua District Plan 2025, with reference to AAAC guidance and the NZTA construction noise and vibration guide. Vibration has been assessed primarily against DIN 4150-3:1999, with additional consideration of vibration amenity effects under BS 5228-2:2009.
- **Noise findings:** Predicted construction noise complies with the applicable guideline noise limit of 70 dB L_{Aeq} at nearby occupied buildings during normal site working hours.
- **Indoor effects:** Internal noise levels are expected to remain below 45 dB L_{Aeq} for most dwellings for typical and most worst-case scenarios. Some short-duration worst-case activities may result in indoor levels of 45–50 dB L_{Aeq} at 434 and 422C State Highway 59 which could be audible with some effect on concentration for limited durations
- **Vibration findings:** There is no predicted risk of cosmetic building damage for most receivers. However, both amenity and cosmetic damage thresholds could be exceeded at the 422C SH59 shed/workshop if a 10-12 tonne vibratory roller is used close to the boundary (worst-case assumption). These risks are expected to be avoidable through equipment selection and work method controls.
- **Overall conclusion and recommendations:** Construction noise and vibration effects are expected to be manageable with best practicable measures. The most effective controls will be selection of quieter and lower-vibration equipment, proactive communication with neighbours, and preparation of a targeted Construction Noise and Vibration Management Plan (CNVMP) before works begin. The CNVMP should include mitigation measures, monitoring, community liaison, complaint response procedures, staff training, and building condition surveys where vibration risk is present and focus on those dwellings where guideline limits are predicted to be exceeded.

** This summary has been prepared with the assistance of AI and reviewed by us*

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1.0 INTRODUCTION

We have been engaged by Pukerua Property Group to prepare an assessment of construction noise and vibration related to the proposed residential development at Mt Welcome, Pukerua Bay (the 'Site').

The full proposal is to be submitted as a fast-track consent application and involves:

- Preparation works, such as earthworks, civil works, construction (including earthworks, civil works, construction of roads, etc.)
- Building and facilities construction, including dwellings, a commercial town centre, parks, and trails/walkways
- Construction of a roundabout to State Highway 59 (the 'SH59 RAB') as the primary Site accessway

Given the scale of the project and current design stage, there is limited information regarding specific construction methodologies, durations, staging, etc. particularly around building construction and works after establishment of on-site roading. Hence, this report focuses on earthworks, civil and road construction, and SH59 RAB construction. In our experience, these construction activities are generally the noisiest and the most potentially intrusive to neighbours compared to building construction and other proposed on-site works.

This report provides our assessment of the potential construction noise and vibration effects that may arise from the proposed works. It establishes the guideline performance standards, provides predictions of the typical and worst-case noise and vibration levels, and sets out the high-level best practicable options (BPO) for construction noise and vibration management.

A glossary of acoustic terminology is included as Appendix A.

2.0 SURROUNDING ENVIRONMENT AND RECEIVERS

The subject site is a large rural area, located along the eastern side of State Highway 59 and south of the Pukerua Bay suburb. The Site is currently used for agriculture and includes existing dwellings, sheds, and other related structures.

The Pukerua Bay receiver buildings closest to the proposed works are located along Pukemere Way and Gray Street. When works are within the northern portion of the Site, these receivers are approximately 150 to 200 metres away. Works will generally be significantly further away from these receivers (in excess of 400 metres).

There are also other rural dwellings located outside the Site and further afield.

Appendix B shows:

- Aerial views identifying the Site, proposed development layout, and the three terraces
- The extent of the work area for the SH59 RAB
- The closest potentially noise and vibration sensitive locations. We note that some addresses may be inaccurate as these could not be confirmed via desktop review
- The identification of buildings that are or contain dwellings (based on desktop review)[1]

The proposal would only occupy the western section of the land parcel in which the Site is contained. We have assumed that all existing buildings and structures within the proposal footprint will be

[1] We should be advised if there are any additional dwellings that have been omitted from this assessment

deconstructed and removed by completion of the works. We have assumed that the dwellings (and their associated structures) to remain based on received plans to date are:

- 434 State Highway 59
- 422C State Highway 59

These will be the closest sensitive receivers to the proposed works

3.0 PROJECT WORKS DESCRIPTION

To carry out our assessment, we refer to the second substantive application documents for the proposal, publicly available here (the 'application documents').

For assessment purposes, we have addressed **Earthworks** and **Civil and Road Works** separately but note that in some cases, these works may be carried out concurrently. Based on the type of proposal, the information received to date, and our experience with similar projects, we have summarised the associated activities below:

- **Earthworks** – Specific methodologies have yet to be confirmed, but earthworks will be required for cut and fill, material removal/import, stabilisation of ground, and preparation of building/roading sites
    - Split into 8 stages across the proposal footprint (see the application documents for further details)
    - We have assumed the following activities: Excavator (up to 20T), loaders, trucks, and vibratory compaction (using a vibratory drum roller up to 12T)
- **Civil and Road Works** – Specific methodologies have yet to be confirmed, but works will include construction of water infrastructure, drainage systems, on-site roads, and the SH59 RAB
    - Split into 20 stages across the proposal footprint, plus the SH59 RAB (see the application documents for further details)
    - We have assumed the following activities: Excavator (up to 20T), loaders, trucks, rattle guns, paving machine, concrete pours, and grader

We have carried out our assessment of construction noise and vibration emissions by:

- Adopting methodologies that have been used on similar projects
- Modelling typical and worst-case construction noise to provide a range of potential construction noise levels at nearby receivers
- Modelling received noise and vibration levels without mitigation measures
- Assuming works will be carried out up to the boundary of the work areas as shown in the application documents
- Assuming sequential order for Earthworks stages (1 to 8) and that Civil and Road Works will follow Earthworks. This is only relevant for determining received levels at existing buildings within the Site, prior to their removal
- Assuming that existing buildings within the footprint for a stage of works would be unoccupied prior to commencement of that stage
- Assuming the total project works duration would exceed 20 weeks

We have assumed the site working hours would be from 7.30am to 6.00pm, Monday to Saturday (the 'site working hours'). Intention to work outside of these hours may warrant a further assessment as more stringent noise and vibration limits would apply.

4.0 ASSESSMENT APPROACH

We understand that as part of the fast-track application process to date, Porirua City Council expect an assessment of construction noise and vibration in accordance with the requirements of the Porirua District Plan 2025 (the 'District Plan').

For the assessment of construction noise and vibration, the District Plan makes reference to New Zealand Standard NZS 6803:1999 "*Acoustics – Construction Noise*" ('NZS 6803:1999') and German Standard DIN 4150-3:1999 "*Structural Vibration – Part 3: Effects of Vibration on Structures*" ('DIN 4150-3:1999') respectively.

The Association of Australasian Acoustical Consultants (AAAC) has prepared guidelines[2] ('AAAC Guidelines') for interpreting and applying NZS 6803:1999. In preparing this assessment, we have adopted these guidelines. The key elements we have adopted are summarised below:

- The NZS 6803:1999 limits should be applied as triggers to adopt BPO management and mitigation measures
- Construction noise predictions should be based on a 15-minute sample time
- Predicted noise levels for a noise assessment should include a typical range of noise levels, as well as realistic worst-case predictions
- When determining indoor noise effects, the following typical sound reduction values should be adopted
    - Partially open windows: 15 dB
    - Closed windows (older buildings): 20 dB
    - Closed windows (modern buildings): 25 dB
    - Sealed non-openable windows (modern apartment or commercial buildings): 30 dB
- We have adopted the indoor noise effects descriptions from the AAAC Guidelines in describing the potential noise effects

For works related to the SH59 RAB, we have referred to the New Zealand Transport Agency document '*State Highway Construction and Maintenance Noise Vibration Guide*' (the 'NZTA Guide') which is typically adopted for any works related to State Highways across New Zealand. The NZTA Guide includes construction noise and vibration criteria.

Additionally, we have included discussion of vibration-related amenity for a more robust assessment of potential vibration effects that could arise from the proposed works.

5.0 RESOURCE MANAGEMENT ACT

Regardless of compliance with any noise or vibration limits, the overarching requirement for the construction activities is to satisfy Section 16 (s16) of the Resource Management Act (RMA).

s16 states that an activity shall adopt the best practicable option (BPO) to ensure that the emission of noise does not exceed a reasonable level. Within the RMA, the definition of noise includes vibration. Additionally, Section 17 of the RMA states there is a duty to avoid, remedy, or mitigate any adverse effect on the environment.

[2] AAAC Guidelines for Interpreting and Applying NZS 6803-1999 v1.0.

6.0 NOISE

6.1 Noise Performance Standards

Rule NOISE-R2 (Noise from construction activities) of the District Plan states that noise from construction activities must be measured, assessed, managed, and controlled in accordance with the requirements of NZS 6803:1999. This is also the standard referenced in the NZTA Guide.

6.1.1 External Noise Levels

We have used Table 2 and Table 3 of NZS 6803:1999 to determine the guideline noise limits that apply to the proposal's construction activities.

We note that the wording of the District Plan does not mean compliance with these noise limits is required, only that an assessment is carried out and that appropriate management measures are adopted during works. This is reflected in the NZTA Guide.

The period over which the Project works are required will exceed 20 weeks. Therefore, we have applied the long-term duration noise limits of NZS 6803:1999.

Full details of the District Plan rule and guideline noise limits of NZS 6803:1999 are included as Appendix C.

In summary, the applicable guideline noise limit for all nearby receivers is **70 dB L_{Aeq}** during the site working hours (7.30am to 6.00pm, Monday to Saturday). Occupied dwellings have an additional limit of **85 dB L_{AFmax}**.

The noise limits apply at 1 metre outside the façade of buildings, and only when they are occupied.

6.1.2 Internal Noise Levels

Neither the District Plan nor NZTA Guide require internal noise assessments of construction noise. However, we have carried out a further assessment on nearby building occupants to provide a greater understanding of the potential indoor noise effects from construction noise.

The noise level received inside a sensitive space (e.g. a bedroom, office, living room) will depend on the external noise level, the façade performance (particularly the glazing) and the acoustics of the room.

NZS 6803:1999 states that, where it is not possible to measure at 1 metre from the façade, an internal assessment can be done instead, assuming a façade sound level difference of 20 decibels.

The responses of building occupants vary, but with effective prior engagement, can be summarised as follows for sustained construction noise, as taken from the AAAC guidelines:

- < 45 dB L_{Aeq} — Unlikely to interfere with daily residential and commercial activities
- 45 – 50 dB L_{Aeq} — May be audible within the building if quiet activities are occurring. Concentration may be affected
- 50 – 55 dB L_{Aeq} — Annoyance for some occupants. Concentration may be affected but residential and office activities can generally continue. Sound levels for television, radio and phone conversations would need to be slightly raised.
- 55 – 60 dB L_{Aeq} — Concentration likely to be affected and phone conversations may become difficult. Television, and radio levels would need to be raised. If noise continues for extended periods, people are likely to seek respite by moving to another room.
- > 60 dB L_{Aeq} — Untenable for residential and most commercial environments.

6.2 Predicted Noise Levels

Table 1 shows the sound power levels of activities/equipment assumed to be required for the proposed works, including setback distances at which the risk of infringing the guideline noise limits begins with no mitigation implemented.

The sound power levels are sourced from British Standard BS 5228-1:2009 "*Code of practice for noise and vibration control on construction and open sites, Part 1: Noise*", and from measurements of similar equipment, carried out by us.

Table 1: Indicative noise levels at 1m from the building façade[3] with no mitigation or screening from buildings

Equipment	Set of Works	Sound Power Level (dB L_{Aeq})	Noise Level (dB L_{Aeq})			Setback (m)
			10 m	20 m	50 m	70 dB L_{Aeq}
Grader	Civil and Road	111	86	80	71	52
Plate compactor	Both*	108	83	77	68	40
Trucks	Both	106	81	75	66	33
Rattle gun	Civil and Road	106	81	75	66	33
Loader	Both	105	80	74	65	30
Paving machine	Civil and Road	104	79	73	64	28
Excavator (20T)	Both	103	78	72	63	25
Concrete truck and pump	Civil and Road	103	78	72	63	25
Static or vibratory roller	Both	103	78	72	63	25
Generator (150 kVA)	Both	93	68	62	53	8
Pump (150mm dia)/compressor	Both	93	68	62	53	8

*I.e. Earthworks and Civil and Road Works

Appendix D provides our predicted construction noise levels at the dwellings closest to the Site, with no mitigation. Our predictions have been grouped by the three terraces (Lower Terrace, Upper Terrace, and Lucus Block) as the main construction 'blocks'.

We have assumed that the non-dwelling buildings identified (e.g. garages, sheds, agriculture support) are generally not occupied and so we have not included the predicted construction noise levels received at these. If required, it can be assumed that the construction noise levels received at these buildings would be the same as the associated dwelling.

We have predicted that the guideline noise limits would be complied with at all times at all nearby occupied dwellings during the assumed working hours.

Worst-case noise exposure would be plate compaction near the Earthworks boundary closest to this receiver. This would likely only be required for a short duration, and quieter forms of compaction are available.

Appendix E provides worst-case construction noise contours. These provide better resolution for how worst-case Earthworks noise emissions at receivers would change between stages. There is less

[3] In accordance with the requirements of NZS 6803:1999 (Section 6.1.1) inclusive of 3 decibels façade reflection

clarity regarding grouping of Civil and Road Works, so these contours have been presented across the full terraces and the SH59 RAB.

6.3 Potential Noise Effects

In accordance with AAAC Guidelines, we have predicted the internal noise levels for the same dwellings included in Appendix D by assuming an outside-to-inside façade reduction of 20 dB for each building (applied to older buildings with windows and doors closed).

We have calculated that within all dwellings, internal noise levels from construction would be <45 dB L_{Aeq} for:

- Throughout typical case scenarios
- Most of the time during worst-case noise exposure

This level of noise is unlikely to interfere with daily residential activities. Further discussion on what typical and worst-case noise levels represent is also included in Appendix D.

Internal noise levels from construction of 45-50 dB L_{Aeq} have been predicted for:

- 434 State Highway 59 during worst-case of SH59 Earthworks (Stage 2C) and construction
- 422C State Highway 59 during worst-case of Earthworks stage 6A

This level of noise may be audible indoors if quiet activities are occurring, and concentration may be affected.

We emphasise that the predicted worst-case levels will be for limited durations when only the noisiest activities are located at their closest positions to affected receivers. Additionally, our predictions are without any mitigation or management measures, which can be implemented to significantly reduce potential indoor noise effects.

7.0 VIBRATION

7.1 Vibration Performance Standards

Rule NOISE-R2 (Noise from construction activities) of the District Plan states that noise (which includes vibration under the definitions of the District Plan) from construction activities must be measured, assessed, managed, and controlled in accordance with the requirements of DIN 4150-3:1999.

DIN 4150-3:1999 is one of the standards referenced for the assessment of vibration in the NZTA Guide, along with British Standard BS 5228-2:2009 "*Code of practice for noise and vibration control on construction and open sites – Part 2: Vibration*" ('BS 5228-2:2009').

7.1.1 Cosmetic Building Damage

DIN 4150-3:1999 includes vibration limits for avoiding cosmetic building damage, such as cracking in paint or plasterwork. The Standard states: "*Experience has shown that if these values are complied with, damage that reduces the serviceability of the building will not occur.*"

We have summarised the applicable vibration limits below. Further information relating to the Standard can be found in Appendix F.

For this Project, we've applied the long-term vibration limits (DIN 4150-3:1999 Table 3) as a conservative approach. These limits are shown in Table 2.

Table 2: Vibration limits in horizontal plane of highest floor (DIN 4150-3:1999 Table 3)

Building Type	Peak Particle Velocity (mm/s)
Commercial or industrial	10
Residential	5

7.1.2 Vibration Amenity

The main vibration concern of building owners and occupants is usually building damage, but the threshold levels of vibration perception and annoyance are much lower than what would cause damage. While certain vibration events may be comfortably below structurally significant levels, they may be intense enough to cause concern or distress among building occupants.

In-line with the NZTA Guide, we propose that the amenity effects of construction vibration are assessed in accordance with BS 5228-2:2009. The standard provides guidance on the amenity effects of vibration and is widely used in New Zealand. The descriptions are reproduced below, and are supplemented with our own descriptions for 2 mm/s and 5 mm/s (to bridge the gap between 1 and 10 mm/s in the standard):

- 0.14 mm/s PPV Just perceptible in the particularly sensitive environments
- 0.3 mm/s PPV Just perceptible in normal residential environments
- 1 mm/s PPV Typically acceptable with prior notification
- 2 mm/s PPV Clearly perceptible but typically acceptable in dwellings and workplaces if it occurs intermittently, and with effective prior engagement
- 5 mm/s PPV Highly unsettling in dwellings and workplaces. If prolonged, some occupants may want to leave the building. Computer screens will shake, and items could fall off shelves if they are not level
- 10 mm/s PPV Likely to be intolerable for any more than a very brief period

We propose 1 mm/s PPV to be the vibration trigger level at which BPO mitigation and management measure related to vibration must be adopted.

7.2 Predicted Vibration Levels

Table 3 shows the setback distance at which the risks of cosmetic building damage and vibration amenity trigger begin for the potential high vibration activities we have assumed for the proposal.

Our predictions are based on regression analysis of available vibration measurements. Cosmetic damage setbacks include a 100% safety factor as a conservative approach.

Table 3: Predicted vibration setback distances from construction activities to building foundations

	Amenity Setback (m)[4]	Cosmetic Building Damage Setback (m)[5]	
Equipment	1 mm/s PPV	Residential 5mm/s PPV	Commercial 10mm/s PPV
Vibratory roller (10-12T)	38	14	6
Plate compactor (450kg)	12	6	3

[4] Based on regression analysis of available vibration measurements, no safety factor (representative)

[5] Based on regression analysis of available vibration measurements, plus a 100% safety factor (conservative)

While the exact locations where compaction will be required are currently unconfirmed, based on the Earthworks footprint there is a risk that the vibration performance standards could be infringed at some nearby buildings.

Figure 1 shows the area within the Earthworks footprint nearby the 422D State Highway 59 shed/workshop where the amenity trigger level could be exceeded by use of a 10-12T vibratory roller. There is no predicted risk for cosmetic building damage.

Figure 1: Vibration amenity setback within Earthworks footprint for 422D SH59 (10-12T vibratory roller)

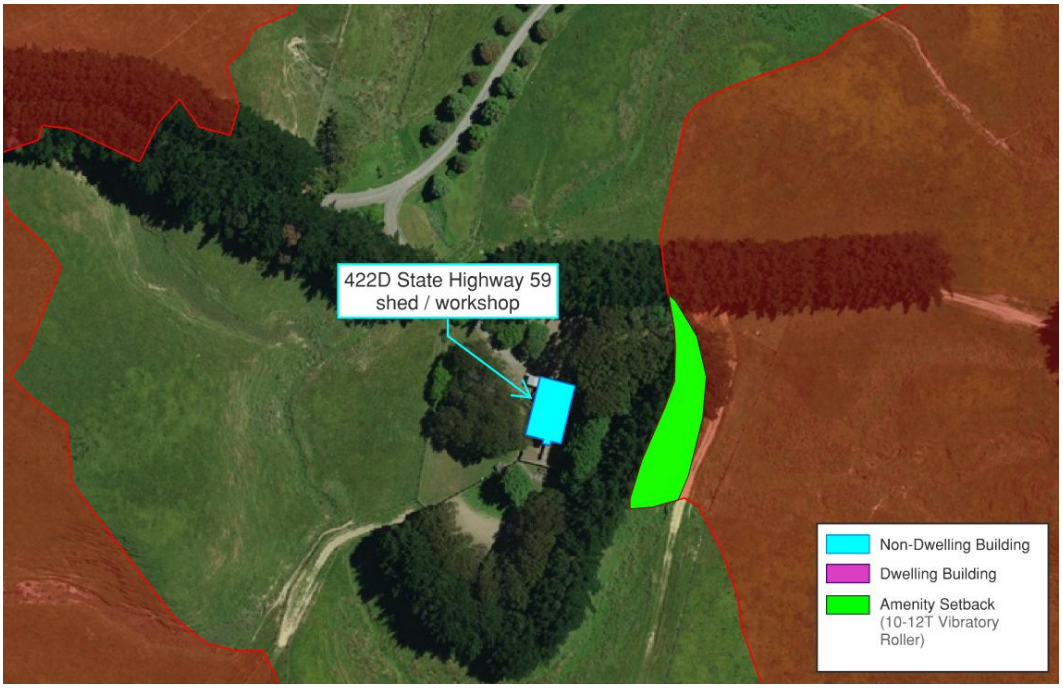
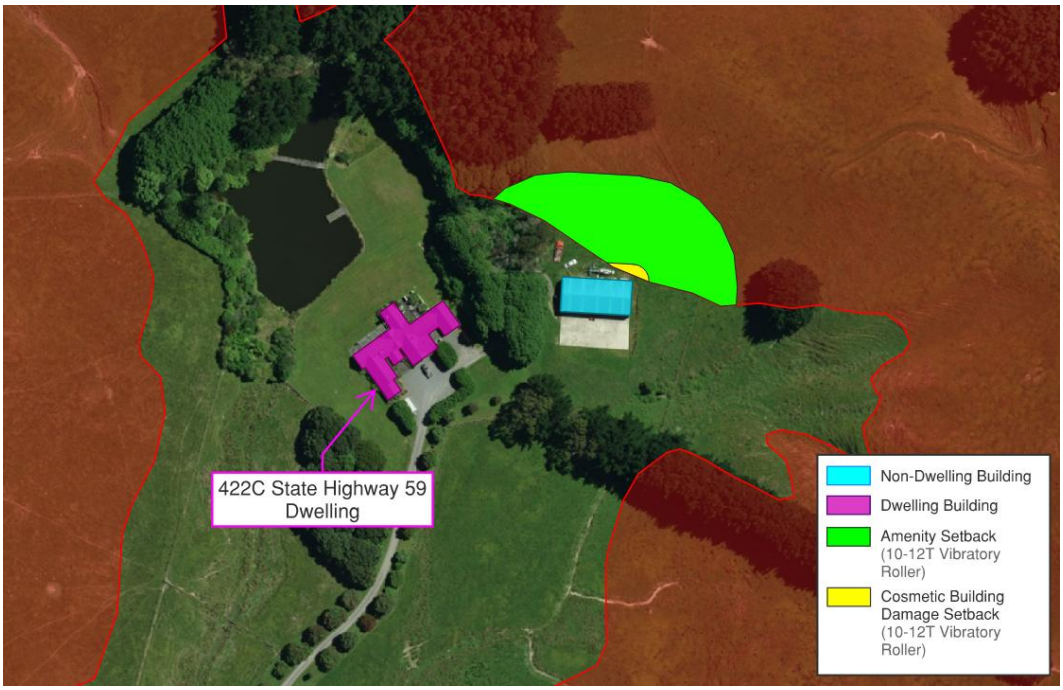


Figure 2 shows the area within the Earthworks footprint nearby the 422C State Highway 59 shed/workshop where both the amenity trigger level and cosmetic building damage limit could be exceeded by use of a 10-12T vibratory roller.

Figure 2: Vibration setbacks within Earthworks footprint for 422C SH59 (10-12T vibratory roller)



For both cases, use of smaller and lower-vibration compaction equipment would enable acceptable received vibration levels in respect of both amenity and avoiding cosmetic building damage.

There are no other predicted construction vibration risks at other receiver buildings.

8.0 MITIGATION AND MANAGEMENT

8.1 High-level Recommendations

Given that compliance with the NZS 6803:1999 noise limits has been predicted at all receivers throughout the proposed works, we expect equipment selection and communication with neighbours to be the most effective measures to reduce the risk of any potential construction noise effects. We recommend such management is implemented as even when compliance with noise limits is achieved, noise complaints may still arise.

Selection of equipment suitably sized for the work would help to ensure construction noise is no louder than necessary, and prior notification to neighbours that construction noise may at times be audible generally eases undesirable responses.

The same measures can be adopted for construction vibration, but with strict avoidance for risk of cosmetic building damage. This is readily achievable with selecting appropriately sized equipment.

8.2 Construction Noise and Vibration Management Plan

The most effective way of managing noise and vibration from the site would be to prepare and implement a Construction Noise and Vibration Management Plan (CNVMP) once methodologies have been confirmed.

The CNVMP can be targeted to address only those dwellings where the construction noise guideline limits or the vibration damage/amenity limits are predicted to be exceeded which can change/be verified with monitoring.

The overarching intent of such a CNVMP should be s16 of the RMA which, in summary, states that an activity shall adopt the BPO to ensure that the emission of noise does not exceed a reasonable level. Within the RMA, the definition of noise includes vibration. Section 17 of the RMA also states that there is a duty to avoid, remedy or mitigate any adverse effect on the environment.

The emphasis of the CNVMP should be on managing noise and vibration effects on occupants of surrounding buildings. A CNVMP would provide project-specific mitigation, management, and contingency measures to enable the minimisation of any potential noise effects to the greatest possible extent.

In respect of construction vibration, the CNVMP could provide guidance on pre-condition building surveys if risk of cosmetic building damage is expected, and establish vibration amenity trigger levels as complaints may still arise despite compliance with building damage limits.

The CNVMP could also provide guidance on monitoring, complaints response, and staff training procedures.

We recommend a CNVMP is prepared by a suitable qualified person and submitted to Porirua City Council for certification, prior to the commencement of any works.

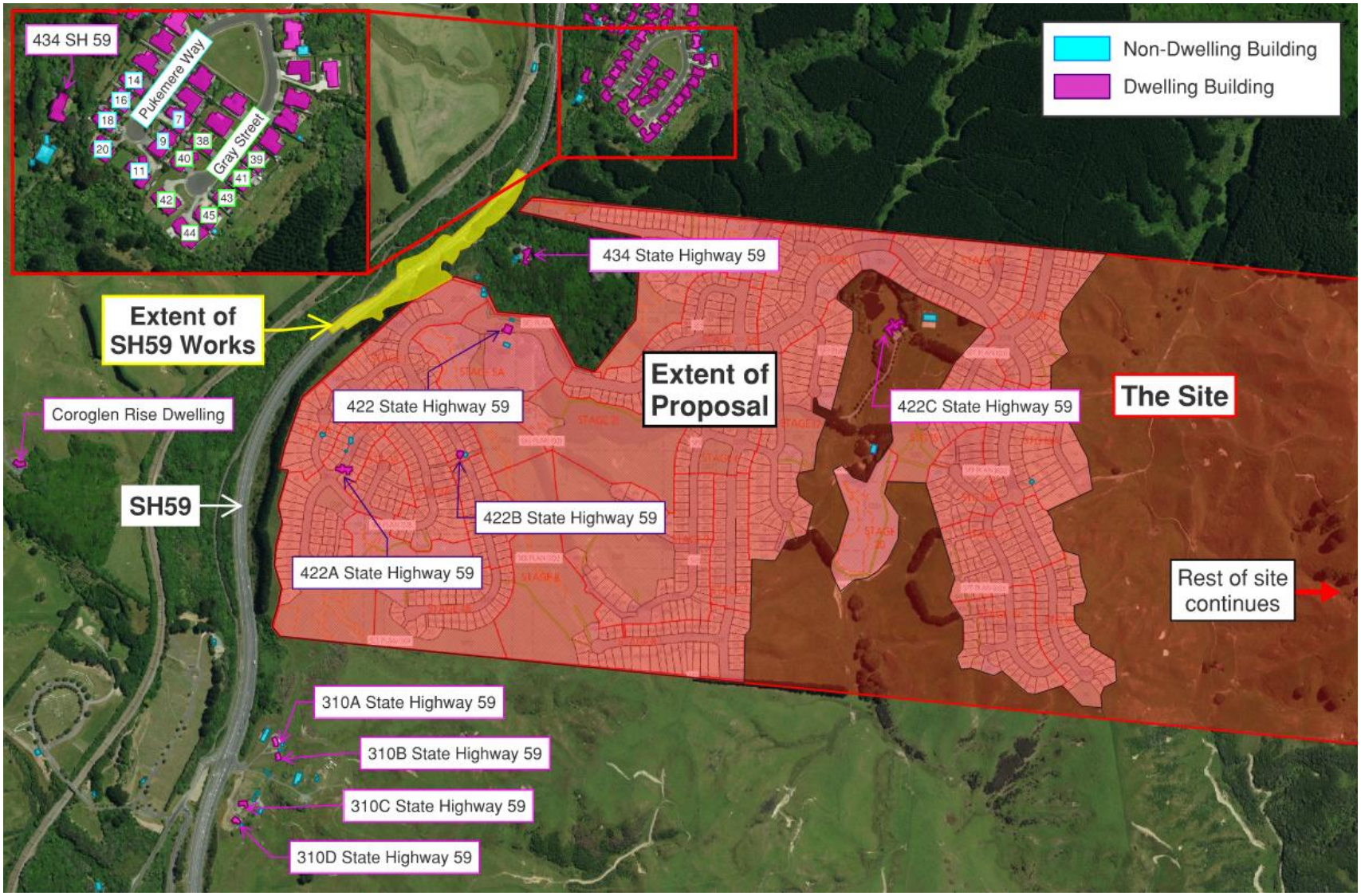
Appendix G shows general descriptions of items that should be included in the CNVMP.

APPENDIX A GLOSSARY OF TERMINOLOGY

Noise	A subjective term used to describe sound that is unwanted by, or distracting to, the receiver.
A-weighting	A set of frequency-dependent sound level adjustments that are used to better represent how humans hear sounds. Humans are less sensitive to low and very high frequency sounds. Sound levels using an "A" frequency weighting are expressed as dB L_A. Alternative ways of expressing A-weighted decibels are dBA or dB(A).
dB	Decibel. The unit of sound level.
L_{Aeq}	The equivalent continuous A-weighted sound level. Commonly referred to as the average sound level and is measured in dB.
L_{Amax}	The A-weighted maximum sound level. The highest sound level which occurs during the measurement period. Usually measured with a fast time–weighting i.e. L_{AFmax}
L_w	Sound Power Level. The calculated level of total sound power radiated by a sound source. Usually A-weighted i.e. L_{WA}.
PPV	Peak Particle Velocity. The measure of the vibration aptitude, zero to maximum. Used for building structural damage assessment.
Vibration	When an object vibrates, it moves rapidly up and down or from side to side. The magnitude of the sensation when feeling a vibrating object is related to the vibration velocity. Vibration can occur in any direction. When vibration velocities are described, it can be either the total vibration velocity, which includes all directions, or it can be separated into the vertical direction (up and down vibration), the horizontal transverse direction (side to side) and the horizontal longitudinal direction (front to back).

APPENDIX B SITE AND SURROUNDING ENVIRONMENT

B1 Aerial overview of Site and surrounding environment **[Base image: Land Information New Zealand]**



B2 **Proposal footprint and layout showing separation of terraces [Base image: Classic Developments document '*Mt Welcome Masterplan Concept_*']**

B3

APPENDIX C CONSTRUCTION NOISE LIMITS

Rule NOISE-R2 in the Porirua District Plan 2025 specifies the requirements for construction noise and vibration and is reproduced below:

> "***Noise-R2*** ***Noise from construction activities***
>
> *[…]*
>
> *Where:*
> *a. The noise from construction activities must be measured, assessed, managed and controlled in accordance with the requirements of NZS 6803:1999 Acoustics – Construction noise and DIN 4150-3:1999 Structural Vibration – Part 3: Effects of Vibrations on Structures."*

The noise limits of NZS 6803:1999 depend on the duration of construction works. Construction projects which are of a shorter duration have a higher allowable noise limit than those of a longer duration. The long-term duration limits apply for this project.

The noise limits from NZS 6803:1999 for long-term durations are shown in Tables C1 and C2. These are the same as the airborne noise criteria from Table 1 of the NZTA Guide.

C1 Construction noise limits for activities sensitive to noise (e.g. occupied dwellings)

		Long-term duration[6]	
Time of week	**Time period**	**dB L_{Aeq}**	**dB L_{AFmax}**
Weekdays	0630 – 0730	55	75
	0730 – 1800	70	85
	1800 – 2000	65	80
	2000 – 0630	45	75
Saturdays	0730 – 1800	70	85
	1800 – 0630	45	75
Sundays and public holidays	0730 – 1800	55	85
	1800 – 0630	45	75

C2 Construction noise limits for noise affecting any other activity (e.g. occupied commercial building)

		Long-term duration
Time of week	**Time period**	**dB L_{Aeq}**
All days	0730 – 1800	70
	1800 – 0730	75

[6] Construction work at any one location with a duration exceeding 20 weeks

APPENDIX D PREDICTED RECEIVED NOISE LEVELS

Tables D1 and D2 summarise the predicted noise levels of Earthworks and Civil and Road works received at nearby receivers respectively. The predicted noise levels are without mitigation measures or site hoardings implemented. Expected infringements of the guideline noise limits are indicated by red highlight.

The worst-case (WC) scenario is when activities are closest to a receiver, and the typical (Typ) levels being what might be expected over the duration of the set of works when activities are being carried out in the closest stage (e.g. Earthworks stages 1 – 8). Received noise levels would be lower than the presented typical levels for works in stages further away.

This means that for the majority of the project, the worst-case scenario would not occur as these represent relatively small working areas, and presented typical levels would also be limited in duration.

Note that for the Earthworks, we have included columns for the noisiest stage (NS) – this is what the typical and worst-case levels are representative of. This was not done for the Civil and Road Works, but it can be assumed that generally, the noisiest stage is the one closest to each receiver.

D1 Predicted received noise levels from Earthworks without mitigation

	Predicted received noise levels (dB L_{Aeq})										
	Lower Tce (1, 2A, 2B)			Upper Tce (3, 4, 5, 6B)			Lucus Block (6A, 7, 8)			SH59 RAB (2C)	
Address	**Typ**	**WC**	**NS**	**Typ**	**WC**	**NS**	**Typ**	**WC**	**NCS**	**Typ**	**WC**
38 Gray Street	50-55	50-55	**1**	50-55	55-60	**5**	45-50	50-55	**6A**	45-50	50-55
39 Gray Street	45-50	45-50	**1**	50-55	50-55	**5**	45-50	45-50	**6A**	45-50	50-55
40 Gray Street	50-55	50-55	**1**	50-55	55-60	**5**	45-50	50-55	**6A**	50-55	50-55
41 Gray Street	45-50	45-50	**1**	50-55	50-55	**5**	45-50	45-50	**6A**	45-50	50-55
42 Gray Street	50-55	50-55	**1**	50-55	55-60	**5**	45-50	45-50	**6A**	50-55	55-60
43 Gray Street	45-50	45-50	**1**	50-55	55-60	**5**	45-50	50-55	**6A**	45-50	50-55
44 Gray Street	50-55	50-55	**1**	50-55	60-65	**5**	45-50	45-50	**6A**	45-50	50-55
45 Gray Street	45-50	45-50	**1**	50-55	55-60	**5**	45-50	45-50	**6A**	40-45	50-55
7 Pukemere Way	50-55	50-55	**1**	50-55	55-60	**5**	45-50	45-50	**6A**	50-55	50-55
9 Pukemere Way	50-55	50-55	**1**	50-55	55-60	**5**	45-50	45-50	**6A**	50-55	55-60
11 Pukemere Way	50-55	50-55	**1**	50-55	55-60	**5**	45-50	45-50	**6A**	50-55	55-60
14 Pukemere Way	50-55	50-55	**1**	50-55	50-55	**5**	45-50	45-50	**6A**	50-55	55-60
16 Pukemere Way	50-55	50-55	**1**	50-55	55-60	**5**	45-50	45-50	**6A**	50-55	55-60
18 Pukemere Way	50-55	50-55	**1**	50-55	50-55	**5**	45-50	45-50	**6A**	55-60	60-65
20 Pukemere Way	50-55	50-55	**1**	50-55	50-55	**5**	45-50	45-50	**6A**	50-55	55-60
Coroglen Rise Dwelling	45-50	45-50	**1**	35-40	35-40	**4**	35-40	35-40	**6A**	45-50	45-50
434 State Highway 59	55-60	55-60	**1**	50-55	60-65	**5**	40-45	40-45	**6A**	55-60	65-70
468 State Highway 59	50-55	50-55	**1**	50-55	50-55	**5**	40-45	45-50	**6A**	55-60	60-65
310A State Highway 59	45-50	45-50	**2A/B**	35-40	40-45	**4**	30-35	30-35	**6A**	35-40	35-40
310B State Highway 59	45-50	45-50	**2A/B**	35-40	40-45	**4**	30-35	30-35	**6A**	30-35	35-40
310C State Highway 59	45-50	45-50	**2A/B**	35-40	40-45	**4**	35-40	35-40	**6A**	35-40	40-45
310D State Highway 59	45-50	45-50	**2A/B**	35-40	40-45	**4**	30-35	30-35	**6A**	35-40	40-45
422A State Highway 59*	60-65	60-65	**1**	-	-	**-**	-	-	**-**	-	-
422C State Highway 59	40-45	40-45	**1**	55-60	60-65	**3**	60-65	65-70	**6A**	30-35	30-35

* Assumed to be unoccupied following completion of Stage 1

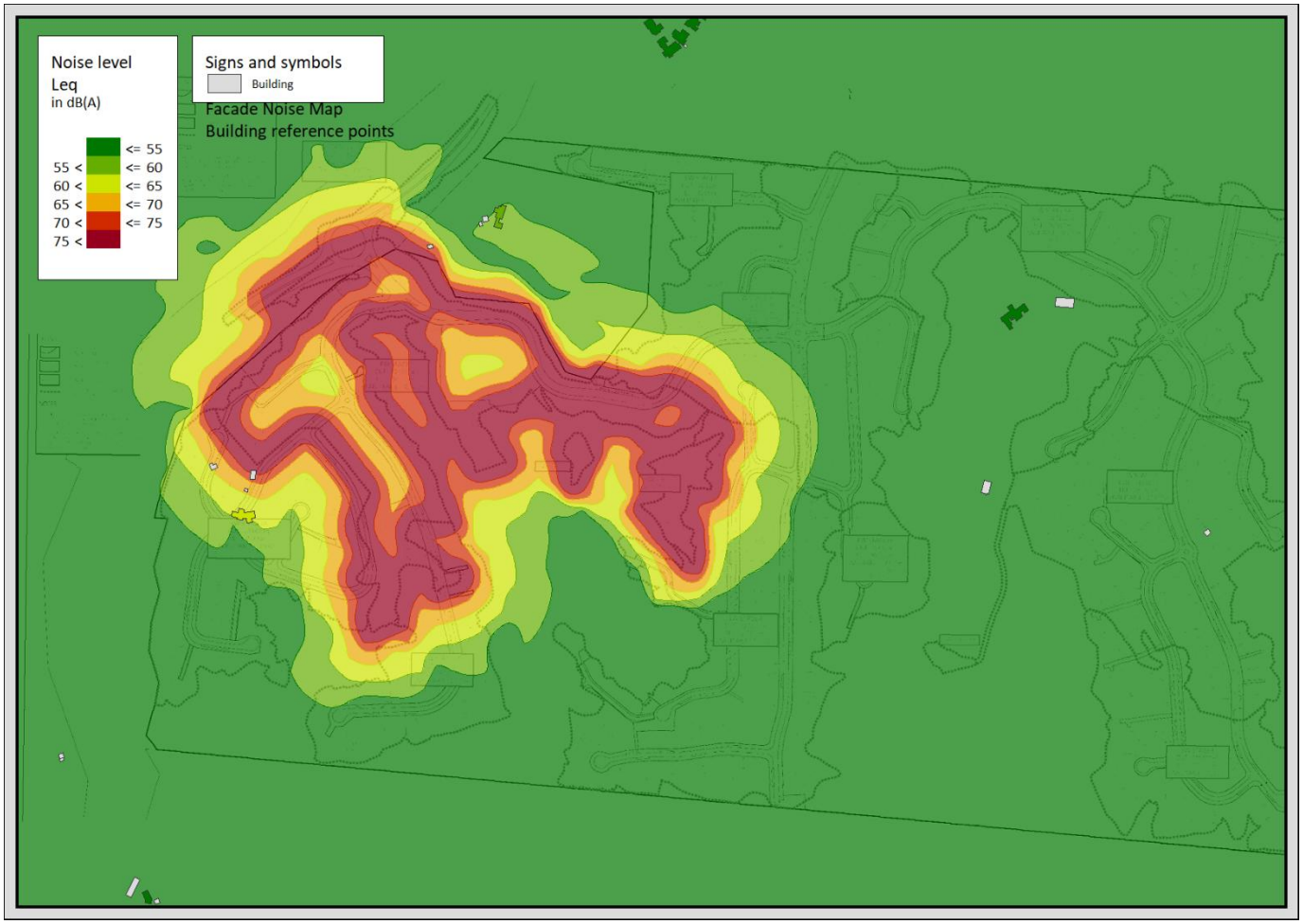
D2 Predicted received noise levels from Civil and Road Works without mitigation

	Predicted received noise levels (dB L_{Aeq})							
	Lower Terrace		Upper Terrace		Lucus Block		SH59 RAB	
Address	Typ	WC	Typ	WC	Typ	WC	Typ	WC
38 Gray Street	45-50	45-50	50-55	55-60	40-45	50-55	45-50	55-60
39 Gray Street	40-45	45-50	45-50	50-55	40-45	45-50	45-50	55-60
40 Gray Street	45-50	50-55	50-55	55-60	45-50	50-55	50-55	55-60
41 Gray Street	40-45	45-50	45-50	50-55	40-45	45-50	45-50	50-55
42 Gray Street	45-50	50-55	45-50	55-60	40-45	40-45	50-55	55-60
43 Gray Street	40-45	45-50	50-55	55-60	40-45	45-50	45-50	55-60
44 Gray Street	45-50	50-55	45-50	55-60	40-45	45-50	50-55	55-60
45 Gray Street	40-45	45-50	45-50	50-55	40-45	45-50	45-50	50-55
7 Pukemere Way	45-50	50-55	45-50	55-60	40-45	45-50	50-55	55-60
9 Pukemere Way	45-50	50-55	45-50	55-60	40-45	45-50	50-55	55-60
11 Pukemere Way	45-50	50-55	45-50	55-60	40-45	45-50	50-55	60-65
14 Pukemere Way	45-50	50-55	45-50	55-60	40-45	45-50	50-55	60-65
16 Pukemere Way	45-50	50-55	45-50	55-60	40-45	45-50	50-55	55-60
18 Pukemere Way	45-50	50-55	45-50	50-55	40-45	45-50	55-60	60-65
20 Pukemere Way	45-50	50-55	45-50	50-55	40-45	45-50	50-55	60-65
Coroglen Rise Dwelling	40-45	45-50	35-40	40-45	30-35	35-40	45-50	45-50
434 State Highway 59	50-55	60-65	45-50	60-65	35-40	35-40	55-60	65-70
468 State Highway 59	45-50	50-55	45-50	55-60	40-45	40-45	55-60	60-65
310A State Highway 59	45-50	45-50	35-40	40-45	30-35	30-35	35-40	40-45
310B State Highway 59	45-50	45-50	35-40	40-45	30-35	30-35	30-35	40-45
310C State Highway 59	45-50	45-50	35-40	40-45	30-35	35-40	35-40	40-45
310D State Highway 59	40-45	45-50	35-40	40-45	30-35	35-40	35-40	40-45
422C State Highway 59	35-40	35-40	55-60	60-65	50-55	60-65	30-35	35-40
422D State Highway 59	30-35	30-35	50-55	60-65	50-55	60-65	25-30	30-35

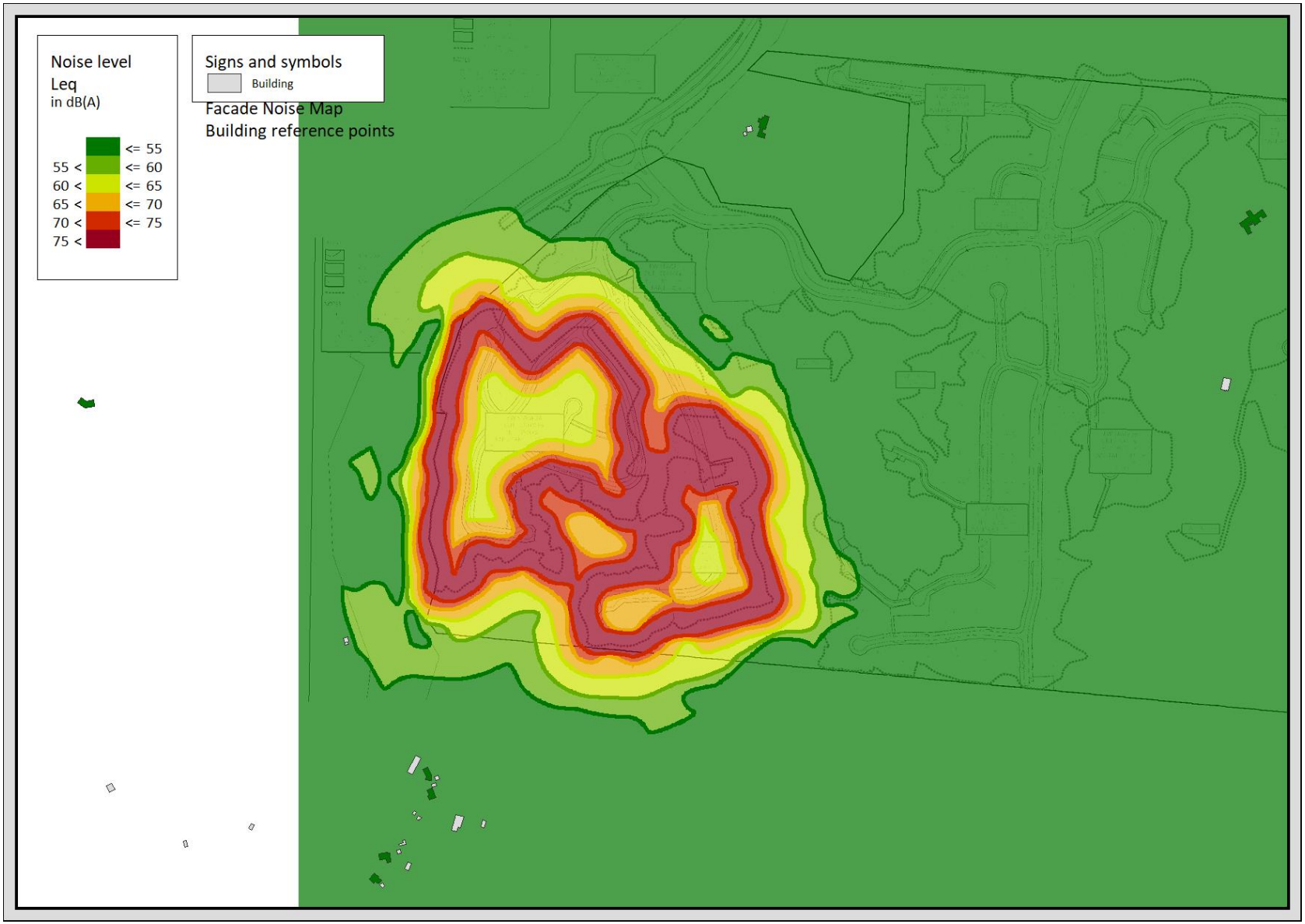
APPENDIX E WORST-CASE CONSTRUCTION NOISE CONTOURS

The following construction noise contours are representative of when the noisiest activity of the specified stage of works is being carried out at their expected extents. Note that the noise contours within the working area of each stage shown are not representative as the model is for construction activities up to the stage boundary, i.e. noise levels are likely to be higher within the working areas. Additionally, only occupied buildings/dwellings have been shaded in as per the noise level colour key, and any sheds, garages, etc. have been left unshaded (grey)

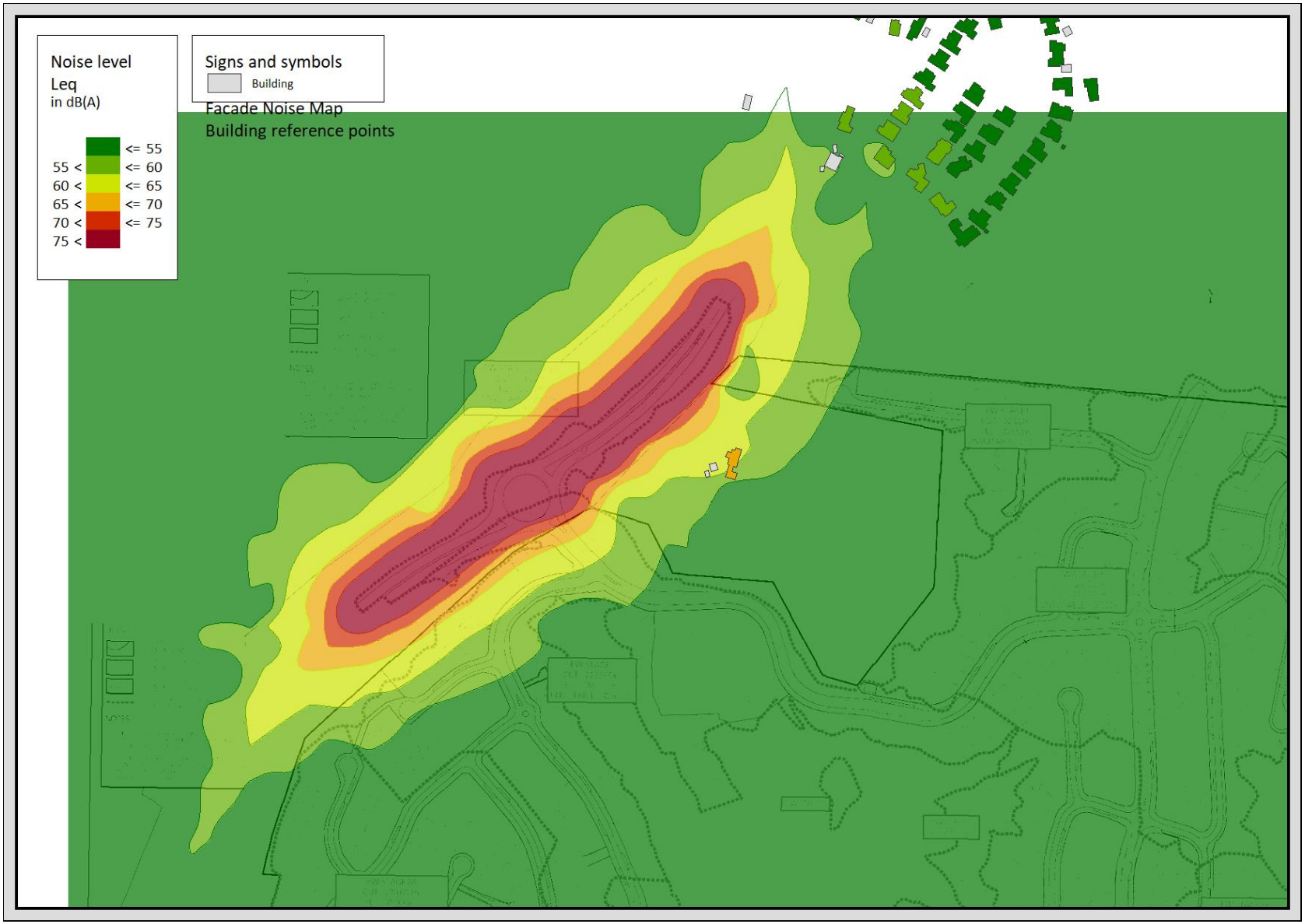
E1 Earthworks – Stage 1



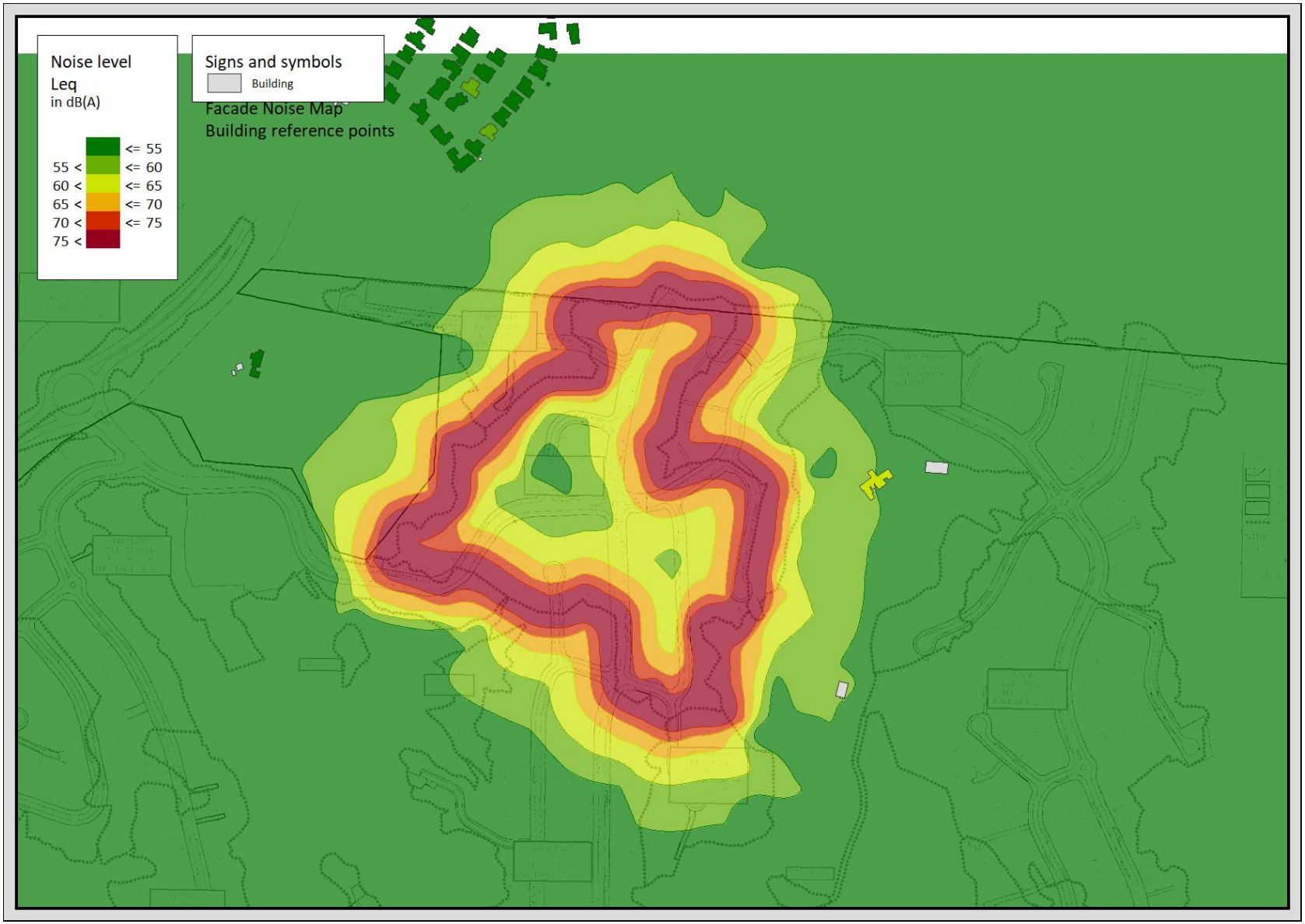
E2 Earthworks – Stage 2A/B



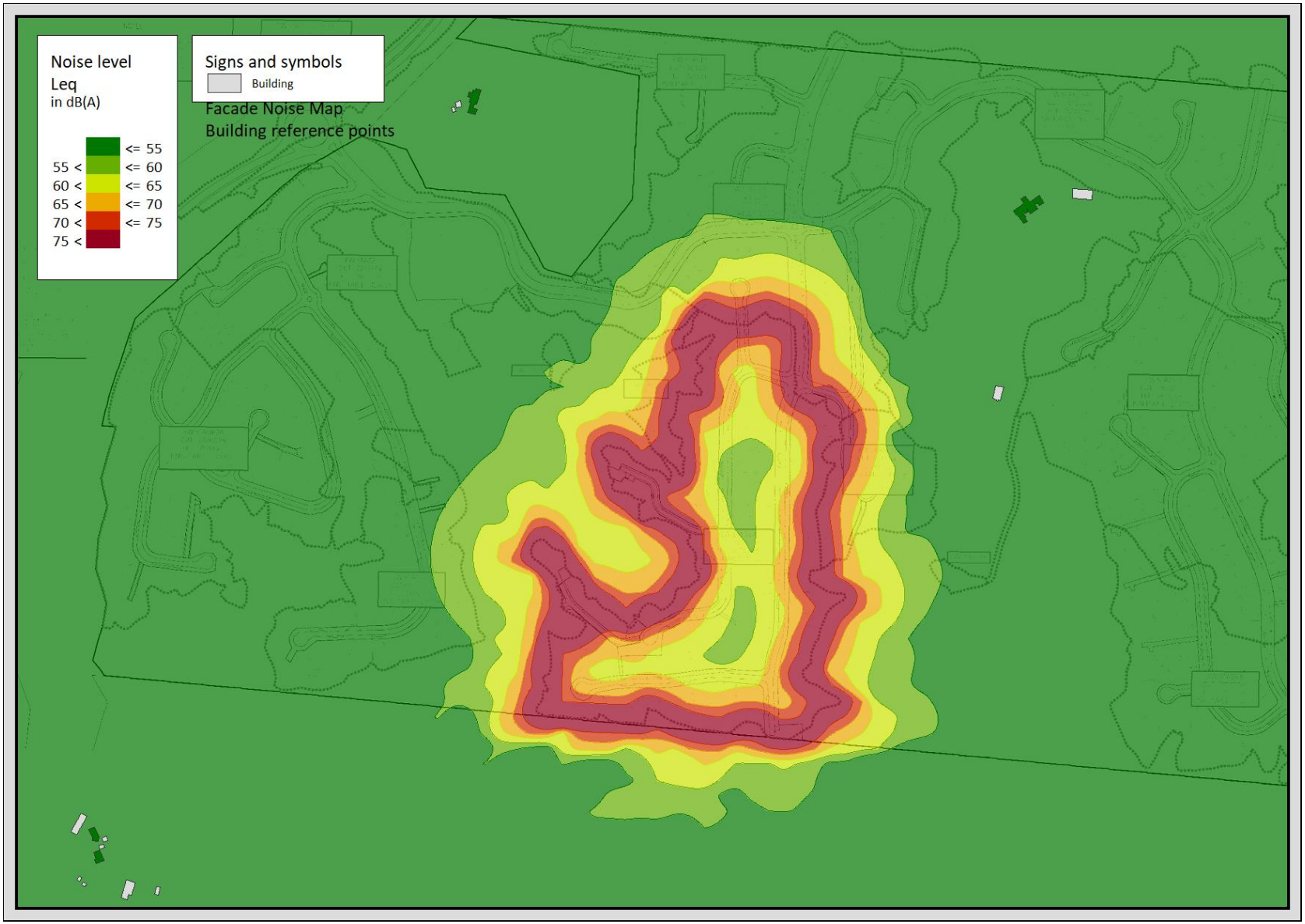
E3 Earthworks – Stage 2C (SH59)



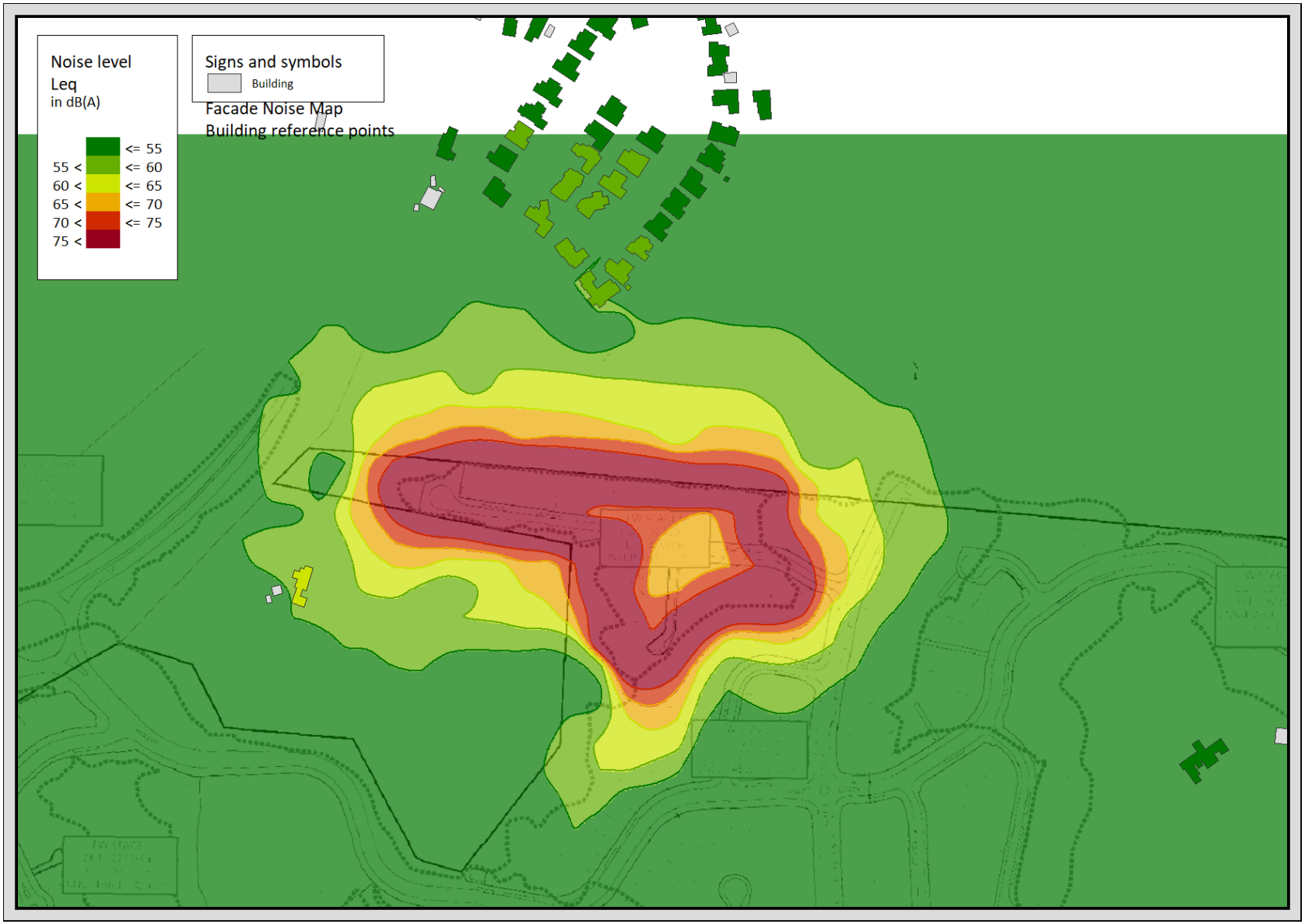
E4 Earthworks – Stage 3



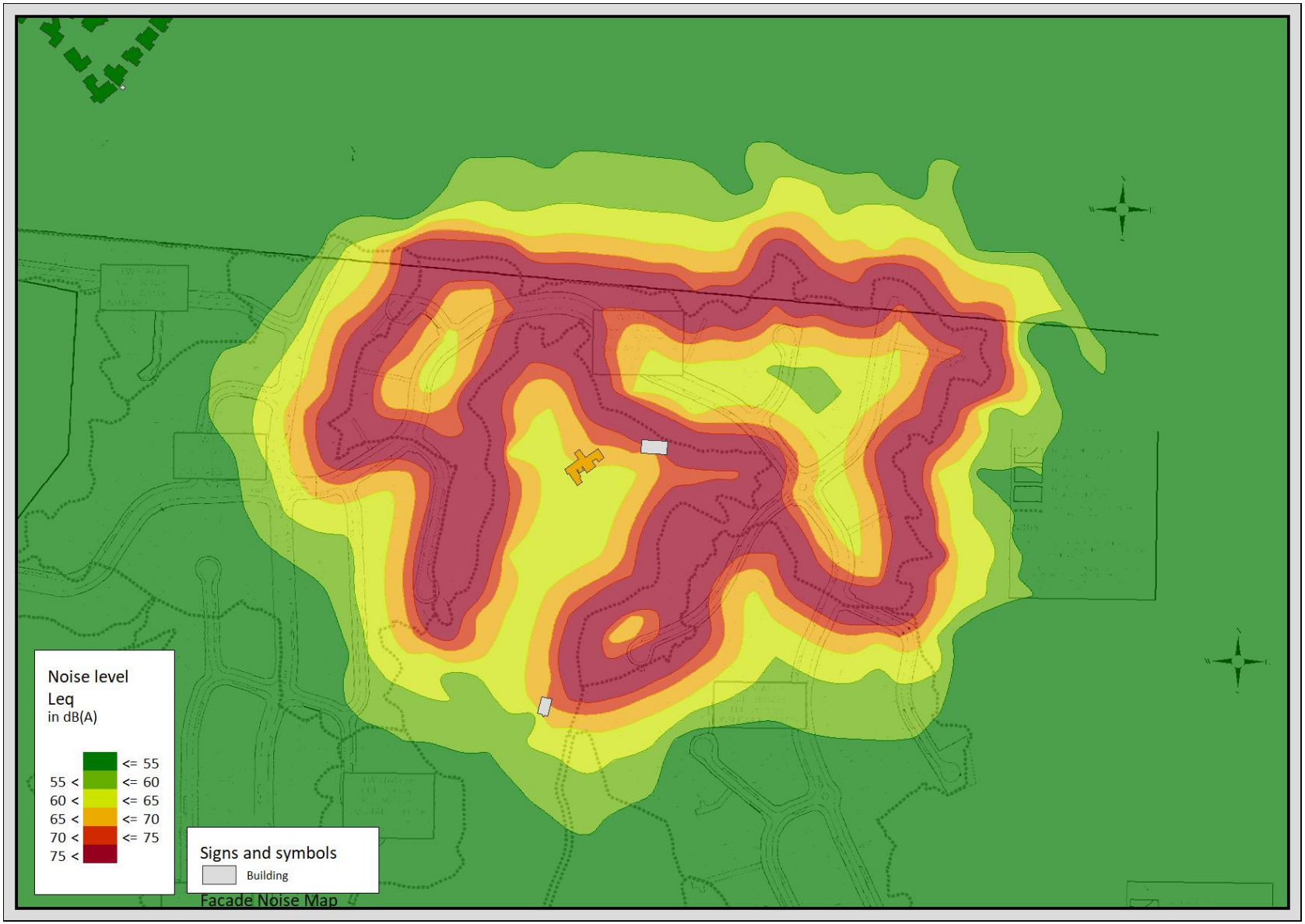
E5 Earthworks – Stage 4



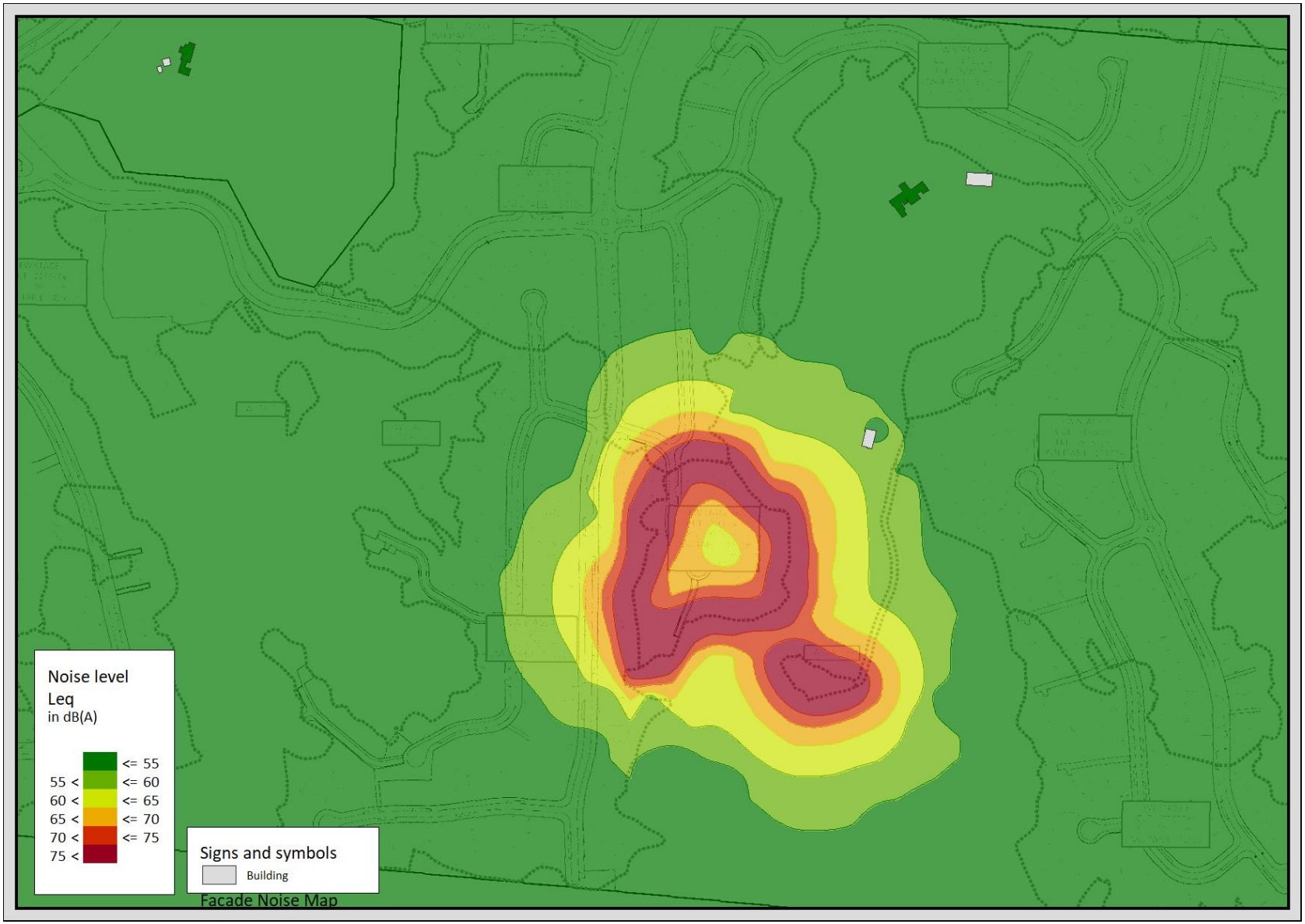
E6 Earthworks – Stage 5



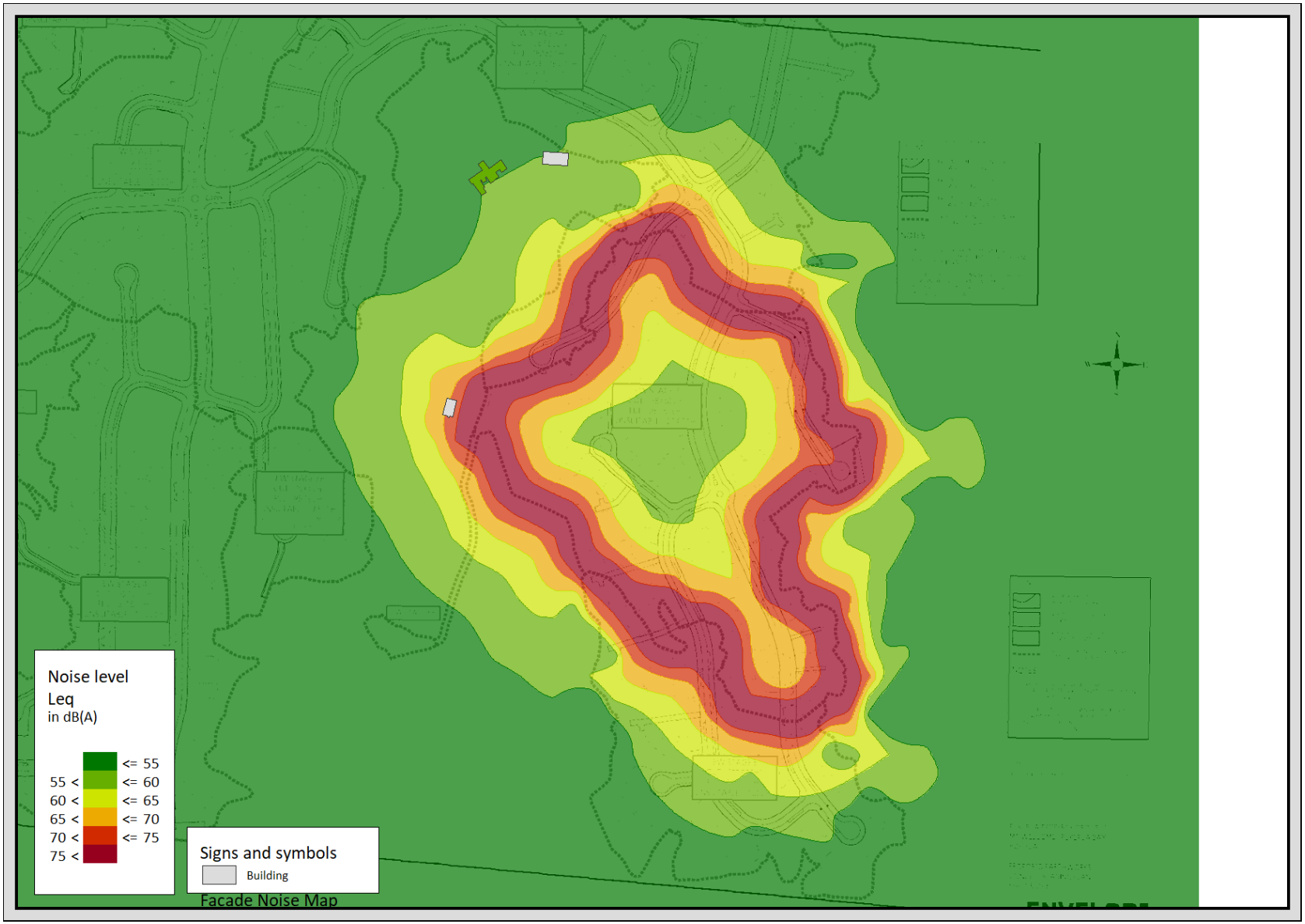
E7 Earthworks – Stage 6A



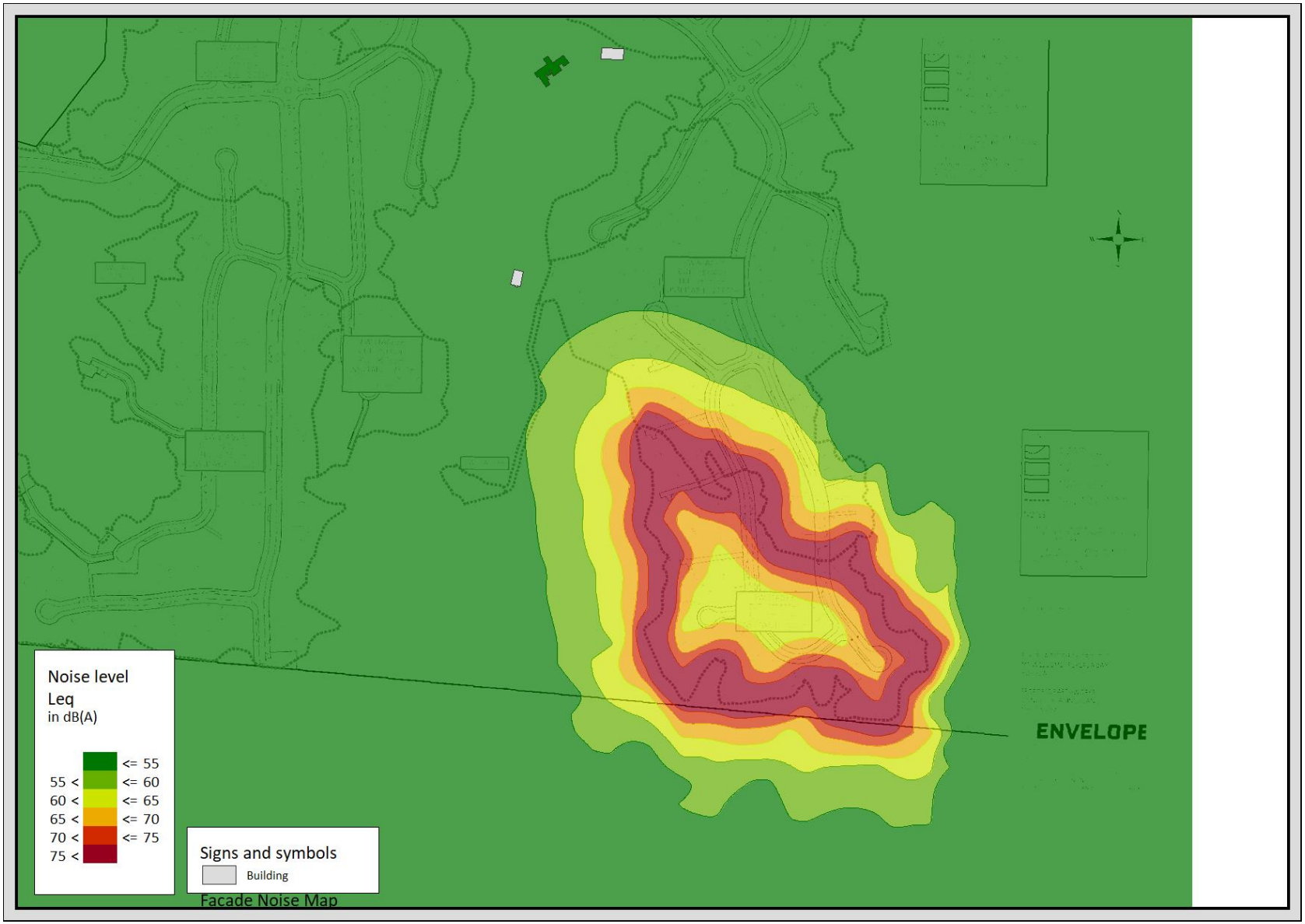
E8 Earthworks – Stage 6B



E9 Earthworks – Stage 7

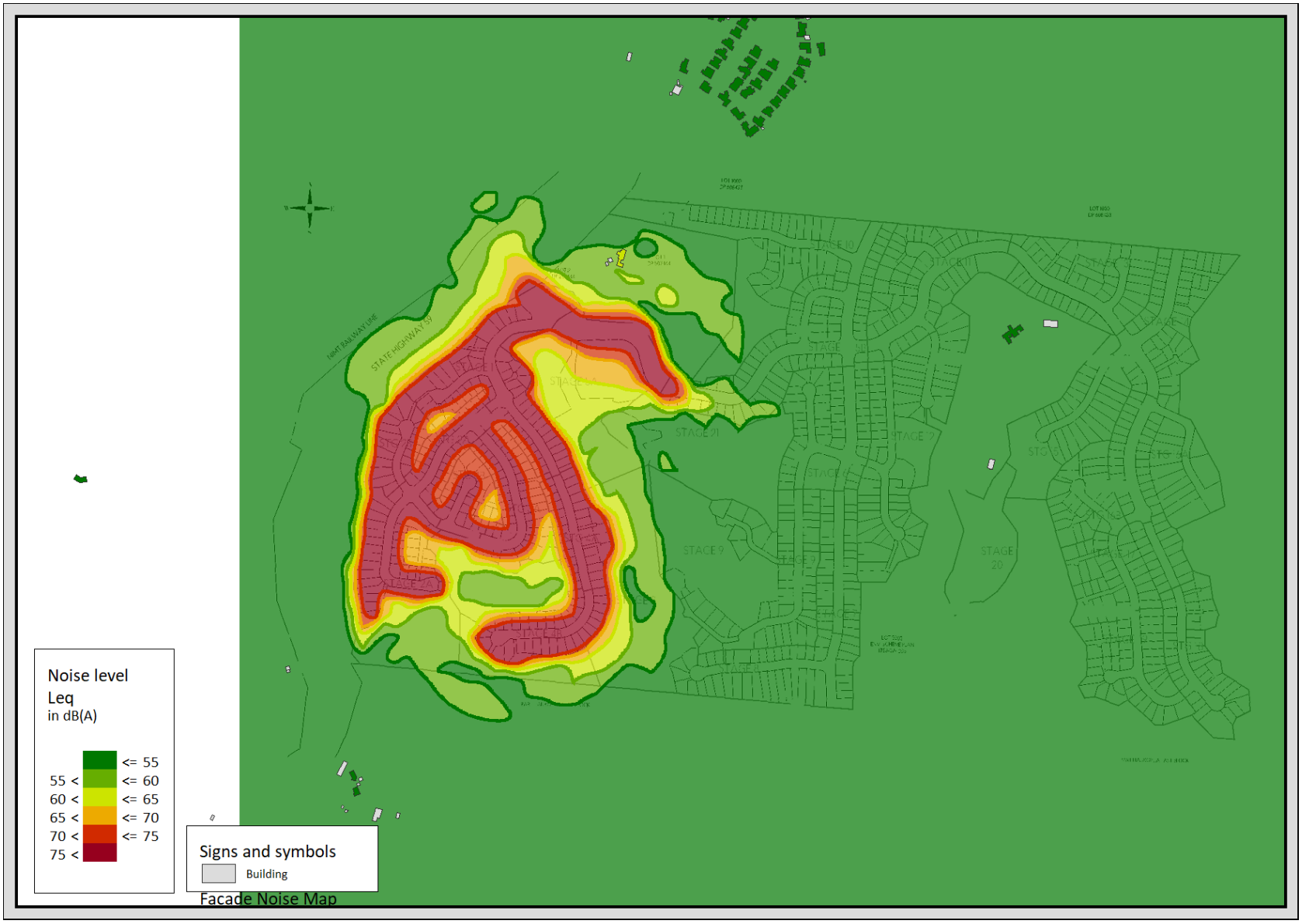


E10 Earthworks – Stage 8



Facade Noise Map

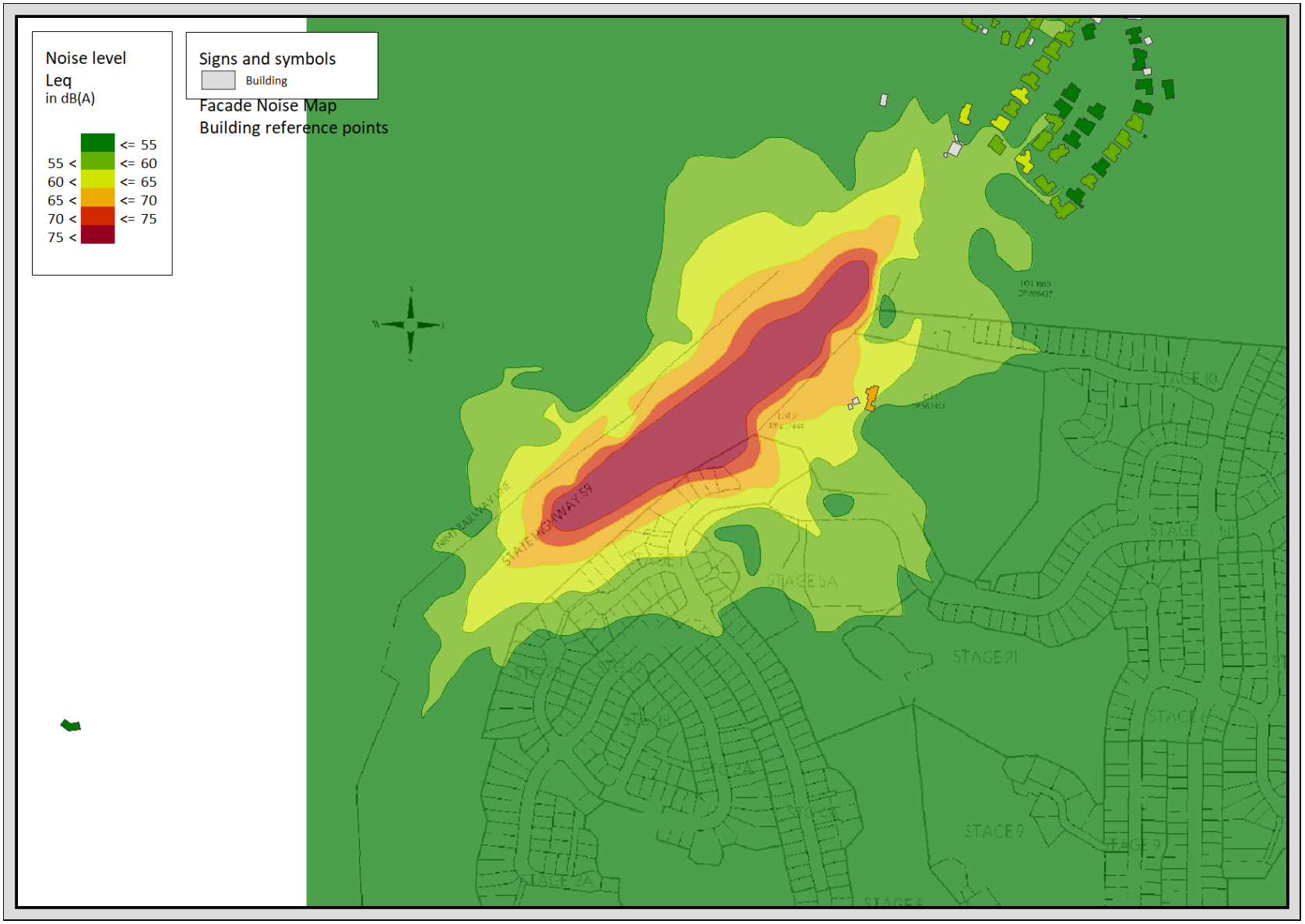
E11 Civil and Road Construction – Lower Terrace



E12 Civil and Road Construction – Upper Terrace

E13 Civil and Road Construction – Lucus Block

E14 Civil and Road Construction – SH59



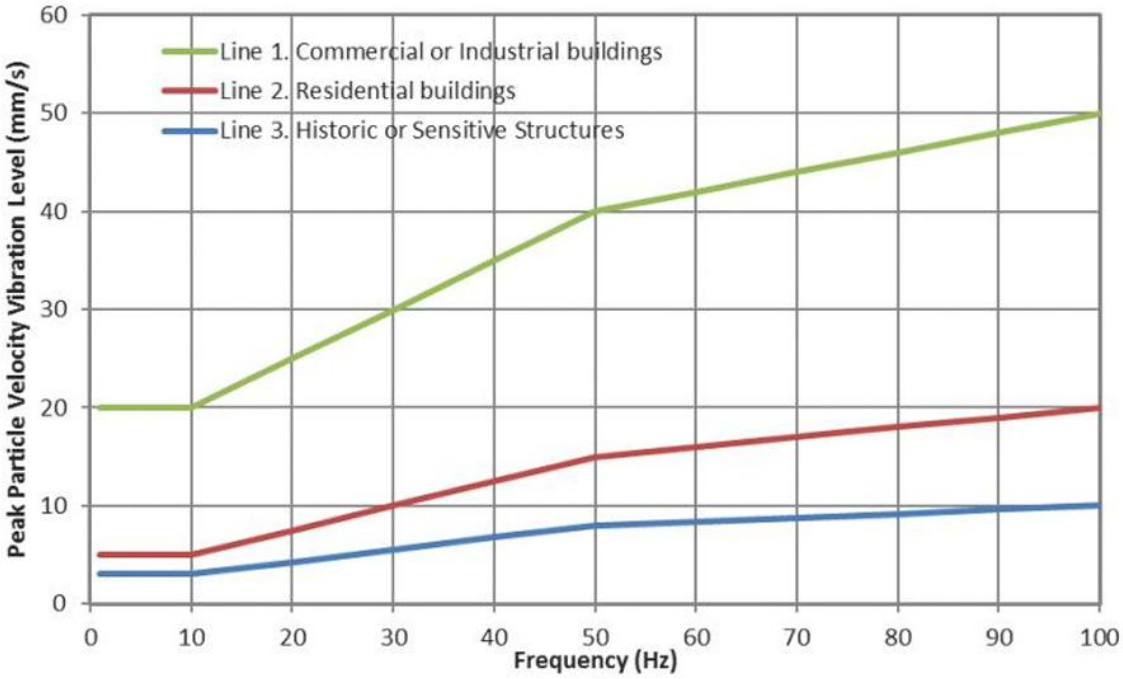
APPENDIX F CONSTRUCTION VIBRATION LIMITS

DIN 4150-3:1999 limits are for avoiding cosmetic building damages, such as cracking in paint or plasterwork. Cosmetic building damage effects are deemed 'minor damage' in the Standard and can generally be easily repaired. The Standard states: "*Experience has shown that if these values are complied with, damage that reduces the serviceability of the building will not occur*." Much higher vibration levels (i.e. an order of magnitude higher) would be needed for potential structural damage.

The short-term (transient) vibration limits from DIN 4150-3:1999 are shown in Figure F1 and apply at building foundations in any axis.

The long-term (continuous) vibration limits from DIN 4150-3:1999 are shown in Table F2 and apply at all floor levels, but levels are normally highest in horizontal axes on the top floor.

F1 Short-term (transient) vibration at building foundations (source: DIN 4150-3:1999: Fig 1)



F2 Vibration limits at horizontal plane of highest floor (DIN 4150-3:1999: Tables 1 and 3)

	Peak Particle Velocity Vibration Level (mm/s)	
Building Type	**Short-term (transient)**	**Long-term (continuous)**
Line 1. Commercial or industrial	40	10
Line 2. Residential	15	5
Line 3. Vibration sensitive	8	2.5

APPENDIX G CNVMP CONTENTS

The objective of the CNVMP is to set out the procedures to identify and adopt the BPO for minimising adverse construction noise and vibration effects on neighbours.

The CNVMP should include (but not be limited to) details regarding:

- Community liaison and engagement outcomes
    - Letter drops and/or newsletters containing information about upcoming works relevant to construction noise/vibration
    - Scheduling and timing agreements made with engaged receivers
    - Actions to take following the reception of any complaints
- Physical noise and vibration mitigation measures
- Construction noise and vibration monitoring
    - Monitoring would provide the contractor with information regarding construction methodologies; the identification of any processes that are unnecessarily noisy and/or high vibration; confidence to potentially affected receivers that their concerns are being addressed; and assessments of compliance with the relevant limits
    - Vibration monitoring may be necessary to ensure that the cosmetic building damage vibration limits are being complied with
- Contingency measures including, but not limited to, scheduling of activities to mutually agreed times, the review of methodologies, mitigation measures, and management strategies to ensure they represent the BPO
- Staff training