parkerjones acoustics

Land Adjacent to Bryngelli Industrial Estate

Meadow Lane, Hirwaun, CF44 9PT

Noise Impact Assessment

19th July 2021
First Issue

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Revision History

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Executive Summary and Conclusions

This document, a Noise Impact Assessment (NIA), has been written to assess the site suitability in terms of the noise impact from the residual noise environment on the amenity of the future occupants of the proposed 35 unit residential development at land adjacent to Bryngelli Industrial Estate, Meadow Lane, Hirwaun, CF44 9PT.

In summary, PJA believes that the noise impact on future occupants at the development can be controlled to an acceptably low level equivalent to the LOAEL (Lowest Observed Adverse Effect Level) defined in National Planning Policy, without unreasonable mitigation measures that would significantly impact residential amenity. External noise levels are not seen to be excessively high in this location to prevent development. In the context of the wider area, there are already many existing residential properties next to the site and next to the roads which constitute the main sources of noise.

Assessing against the criteria of Tan 11, the large majority of the site would fall under Noise Exposure Category B, where "*noise should be taken into account when determining planning applications and, where appropriate, conditions imposed to ensure an adequate level of protection*".

IANL targets can be met with closed windows and standard double glazing, with trickle ventilators used to provide background ventilation as an alternative to open windows. Glazing and trickle ventilators should meet the sound reduction indices outlined in Table 5.1/Figure 5.1 of Section 5.5. The requirements represent a low level of acoustic performance which would be met by most products. This also does not mean windows are not openable – most people will wish to open windows despite slightly elevated noise levels internally, and external noise levels are not excessively high to mean that that opening the windows would be unacceptable. In many areas, internal noise targets *would* be met with open windows, or at least be met if a 5 dB relaxation were applied (for 'reasonable' conditions).

As per Section 5.4, external amenity noise levels are mostly below or within the recommended 50 – 55 dB $L_{Aeq,16hr}$ upper range for the external amenity spaces to be enjoyed as intended, with all dwellings having at least some garden area which is in this range, as recommended by the ProPG.

Therefore, PJA, as suitably qualified acoustic consultants, recommends that noise should not pose a constraint to achieving planning permission for the proposed development, on the basis that the applicant follows the recommendations herein.

Contents

1.0 Introduction

ParkerJones Acoustics Limited (PJA) has been instructed to undertake a Noise Impact Assessment for the proposed erection of 35 residential dwellings with associated parking and access at land adjacent to Bryngelli Industrial Estate, Meadow Lane, Hirwaun, CF44 9PT.

1.1 Scope of Report

This document, a Noise Impact Assessment (NIA), has been written to assess the site suitability in terms of the noise impact from the residual noise environment on the amenity of the future occupants of the proposed development.

The objective is to ensure that the noise impact is being considered and controlled sufficiently to provide suitable living and sleeping conditions for those residing inside. Therefore, where considered necessary, mitigation measures have been suggested to ensure that identified impacts are minimised.

Whilst every attempt has been made to ensure that this report communicates effectively to a reader who might not have much knowledge of acoustics, some parts are necessarily technical. A glossary of acoustic terminology and concepts is provided in Appendix A.

1.2 Assessment Criteria

This report takes national planning policies into consideration including the National Planning Policy Framework (NPPF) and the Planning Practice Guidance on Noise (PPG-N), which outline the purpose and long-term vision of planning policy with respect to noise. More specifically, the assessment has been undertaken with reference to:

- TAN 11 - 'Technical Advice Notes (Wales) 11, Noise – October 1997';
- the Professional Practice Guidance on Planning and Noise (ProPG) (2017);
- BS 8233:2014 *Guidance on sound insulation and noise reduction for buildings*; and
- The World Health Organisation (WHO) '*Guidelines for Community Noise*' (1999) and '*Night Noise Guidelines for Europe* (2009) documents.

2.0 Site and Development Description

The application site relates to a parcel of previously developed land measuring approximately 1.2 hectares (gross), located off Meadow Lane, Hirwaun, CF44 9PT. Hirwaun is located at the northern edge of the South Wales conurbation, which stretches from the Severn Bridges in the east to Swansea Bay in the west and northwards to the A465 Heads of the Valleys Road.

The site is accessed off the A4059 via Rhigos Road and Meadow Lane, which is predominantly a residential area. The northern boundary fronts Meadow Lane, while the southern boundary abuts the A465. The area immediately to the east of the site is characterised by a number of industrial units at the Bryngelli Industrial Estate, as seen in Figure 2.1. Notwithstanding this, the wider surrounding area is predominantly characterised by residential properties.

The existing site comprised a former industrial area with areas of derelict concrete hardstanding and grass. Although there is a disused industrial unit on the application site, all previous structures present from the former bakery have now been demolished, with largely unmade ground to the south and an area of hard-standing.

Figure 2.1 also shows the location of the baseline survey monitoring positions (discussed in Section 4.0).

The proposals (as part of a full planning application) are for the erection of 35 residential dwellings, including a mix of house types including flats, houses and bungalows. The proposal includes a principal estate road leading through the centre of the site, with shared driveways leading from it giving access to houses. The site plan is shown in Figure 2.2.

Figure 2.1 – Aerial view of the site and surrounding area

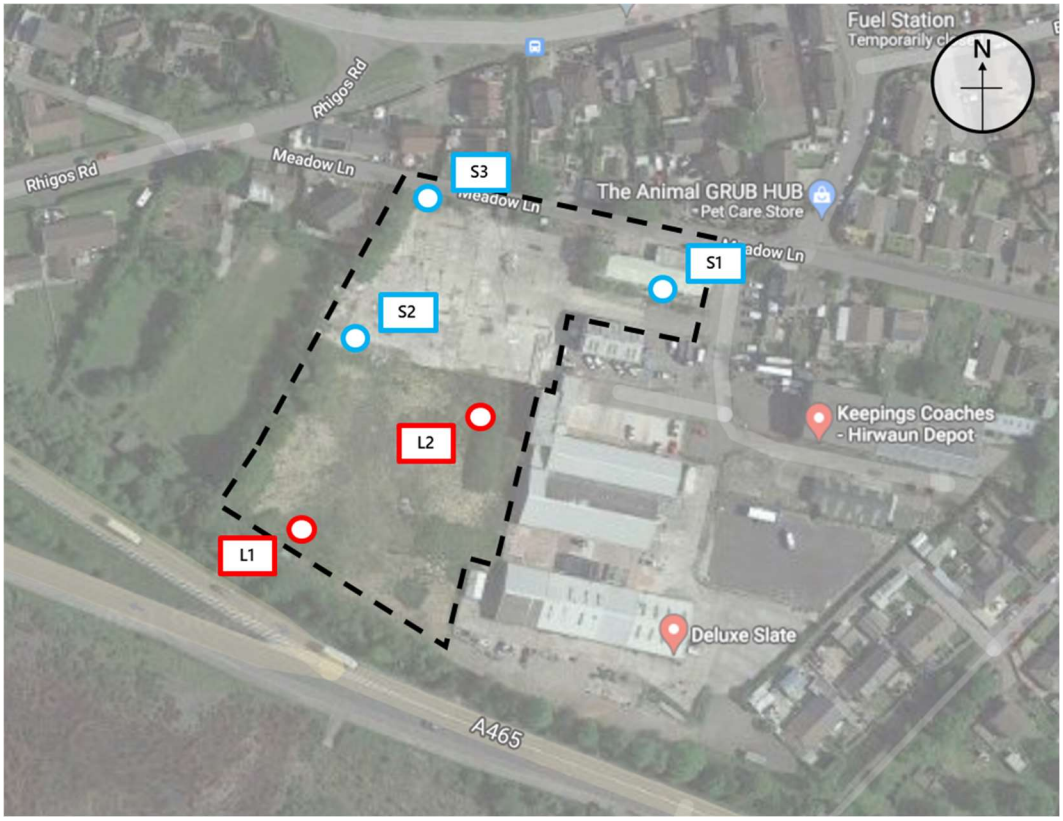


Figure 2.2 – Proposed site plan

3.0 Relevant Guidelines

3.1 Technical Advice Note 11 (TAN 11)

'Technical Advice Notes (Wales) 11, Noise – October 1997' gives guidance on the control of noise to sensitive developments which may be affected by noise and vice versa.

This subsequently states that '*Noise Exposure Categories (NECs) have been derived to assist local planning authorities in their consideration of planning applications for residential development near transport related noise sources.*' '*When assessing a proposal for residential development near a source of noise, local planning authorities should determine into which of the four noise exposure categories (NECs) the proposed site falls, taking account of both day and night-time noise levels. Local planning authorities should then have regard to the advice in the appropriate NEC.*'

The NEC (Noise Exposure Categories) are summarised within Table 3.1 and Table 3.2, indicating levels for road traffic, as this is considered to be the dominant source in this case.

Table 3.1 – TAN 11 noise exposure categories

NEC	Action
A	Noise need not be considered as a determining factor in granting planning permission, although the noise level at the high end of the category should not be regarded as desirable.
B	Noise should be taken into account when determining planning applications and, where appropriate, conditions imposed to ensure an adequate level of protection.
C	Planning permission should not normally be granted. Where it is considered that permission should be given, for example, because there are no alternative quieter sites available, conditions should be imposed to ensure a commensurate level of protection against noise.
D	Planning permission should normally be refused.

Table 3.2 - Noise exposure categories for new dwellings near existing noise sources

Noise Levels corresponding to the Noise Exposure Categories for New Dwellings $L_{Aeq,T}$ dB				
Period	Noise Exposure Category (NEC)			
	A	B	C	D
Daytime (07:00 – 23:00)	<55	55-63	63-72	>72
Night-time (23:00 – 07:00)	<45	45-57	57-66	>66

3.2 WHO Guidelines

The WHO document *Guidelines for Community Noise 1999* ('GCN') sets out guidance as to noise levels at which there will be an unacceptable impact on the occupants of residential developments.

For steady continuous noise, the GCN recommends an indoor guideline value for bedrooms of 30 dB $L_{Aeq,8hr}$ and 45 dB L_{AFmax} for a single sound event to prevent sleep disturbance.

Regarding external noise, the GCN states:

- To protect the majority of people from being seriously annoyed during the daytime, the sound pressure level on balconies, terraces and outdoor living areas should not exceed 55 dB L_{Aeq} for a steady, continuous noise.
- To protect the majority of people from being moderately annoyed during the daytime, the outdoor sound pressure level should not exceed 50 dB $L_{Aeq.}$

3.3 BS 8233:2014

BS 8233:2014 '*Guidance on Sound Insulation and Noise Reduction for Buildings*' suggests appropriate criteria and limits for different situations. It is primarily intended to guide the design of new buildings, or refurbished buildings undergoing a change of use.

This includes internal and external noise criteria for residential developments. The limits with BS 8233:2014 are similar to those in the WHO's *'Guidelines for Community Noise' (1999)* and '*Night Noise Guidelines for Europe' (2009)* documents.

The more recently published ProPG document combines the recommendations of these two guidelines, as discussed in the following section.

Annex G.1 of BS 8233:2014 suggests that "*if partially open windows were relied upon for background ventilation, the insulation would be reduced to approximately 15 dB*".

3.4 The Professional Practice Guidance on Planning and Noise (ProPG)

The ProPG, published in 2017, extends on the guidance and numerical targets within BS 8233:2014 and WHO guidelines, new and extended recommendations where these standards are considered to fall short. Therefore, it is considered to be the most relevant and up to date design standard for assessing the noise impact on new residential developments.

3.4.1 Internal Ambient Noise Levels

The ProPG provides internal ambient noise level targets based upon BS 8233:2014 and WHO guidelines, as shown in the table below. The targets are essentially the same as BS 8233:2014 guidelines but with the addition of an $L_{Amax,F}$ target overnight based on WHO guidelines.

The ProPG indicates that the guidance can be relaxed by up to 5 dB (as does BS 8233:2014) where development is considered necessary or desirable, despite high external noise levels.

Table 3.3 – The ProPG internal ambient noise level (IANL) upper limits

Activity	Location	Daytime (07:00 – 23:00)	Night-time (23:00 – 07:00)
Resting	Living Room	35 dB $L_{Aeq,16hr}$	-
Dining	Dining Room/Area	40 dB $L_{Aeq,16hr}$	-
Sleeping (daytime resting)	Bedroom	35 dB $L_{Aeq,16hr}$	30 dB $L_{Aeq,8hr}$ 45 dB $L_{Amax,F}$ [1]
[1] a threshold by which 'good acoustic design' is achieved by not exceeding this threshold more than 10 times a night			

Whilst it is desirable to achieve the recommended IANLs with windows open, an assessment can be made with closed windows and open ventilators (i.e. trickle vents) which provide *"whole dwelling ventilation"* (as defined by Building Regulations Approved Document F).

Closed windows do not mean sealed shut/un-openable windows, as occupants would favour the ability to open the windows (especially during the hotter months of the year) even if the resultant internal acoustic conditions aren't as satisfactory.

3.4.2 Outdoor Amenity Noise Levels

The ProPG also provides guidance for outdoor amenity noise levels based upon WHO and BS 8233:2014 guidelines. This applies to gardens, balconies, roof terraces, and patio areas.

If outdoor amenity spaces are an intrinsic part of the overall design, the acoustic environment of those spaces should be considered so that they can be enjoyed as intended. Noise levels should ideally not be above the range 50 – 55 dB $L_{Aeq,16hr}$.

It does, however, accept that this can't be achieved in all situations, in which the development should be designed to achieve the lowest practicable noise levels in these outdoor amenity spaces. The impact can partially be offset by the residents having access to a:

- relatively quiet alternative outdoor amenity space as part of the property, group of residential properties, or a public space in the nearby area; and/or
- a relatively quiet facade (containing openable windows to habitable rooms) or a relatively quiet externally ventilated space (i.e. an enclosed balcony) as part of their dwelling.

4.0 Noise Survey

4.1 Methodology

PJA has attended the site and surrounding area to conduct an environmental noise survey between Thursday 1st July and Monday 5th July 2021. The results of the survey have been used to quantify the typical residual noise levels that would be incident on the site and subsequently the proposed development.

Several monitoring positions were employed including one 'long-term' position (measuring over 5 days) and four 'short-term positions' (between 30-minutes and 3-hours). The positions are denoted in Figure 2.1 in Section 2.0.

All of the monitoring positions were at ground floor level, at least 1.5m above ground and away from any vertical reflective surfaces. The sound level meters were set to log noise levels over continuous 5-minute averaging periods with a 1-second time history rate. The shorter-term measurements were conducted with a 2nd and 3rd sound level meter – using synchronised time periods to the 1st sound level meter (position L1), with the surveyor in attendance.

The following noise indices were recorded (amongst others):

- $L_{Aeq,T}$: The A-weighted equivalent continuous noise level over the measurement period T. This parameter is typically considered as a good representation of the average ambient sound level;
- $L_{AFmax,T}$: The maximum A-weighted noise level during the measurement period T and the best representation of short high noise levels 'events' – i.e. emergency services sirens;
- $L_{A90,T}$: The A-weighted noise level that is exceeded for 90% of the measurement period T. This parameter is often considered as the 'average minimum level' and is therefore used in determining the representative background noise level – or noise levels from continuous noise sources such as plant; and
- $L_{A10,T}$: The A-weighted noise level that is exceeded for 10% of the measurement period T. This parameter is often considered as the 'average maximum level' and a good representation of traffic noise contributions.

Appendix C contains further information on the methodology of the survey, including photographs taken from site; the equipment used; and the weather conditions.

4.2 Results

In general the main source of noise at the site is from road traffic along the A465. Vehicle noise in and out of the industrial estate was also evident at the parts of the site close to the estate entrance, but less so across the majority of the open areas. Many of the facilities in the industrial estate appeared to be empty. The surveyor did not note any noisy items of external plant, as also suggested by the night-time results of the survey.

4.2.1 L1 – South Boundary (next to the A465)

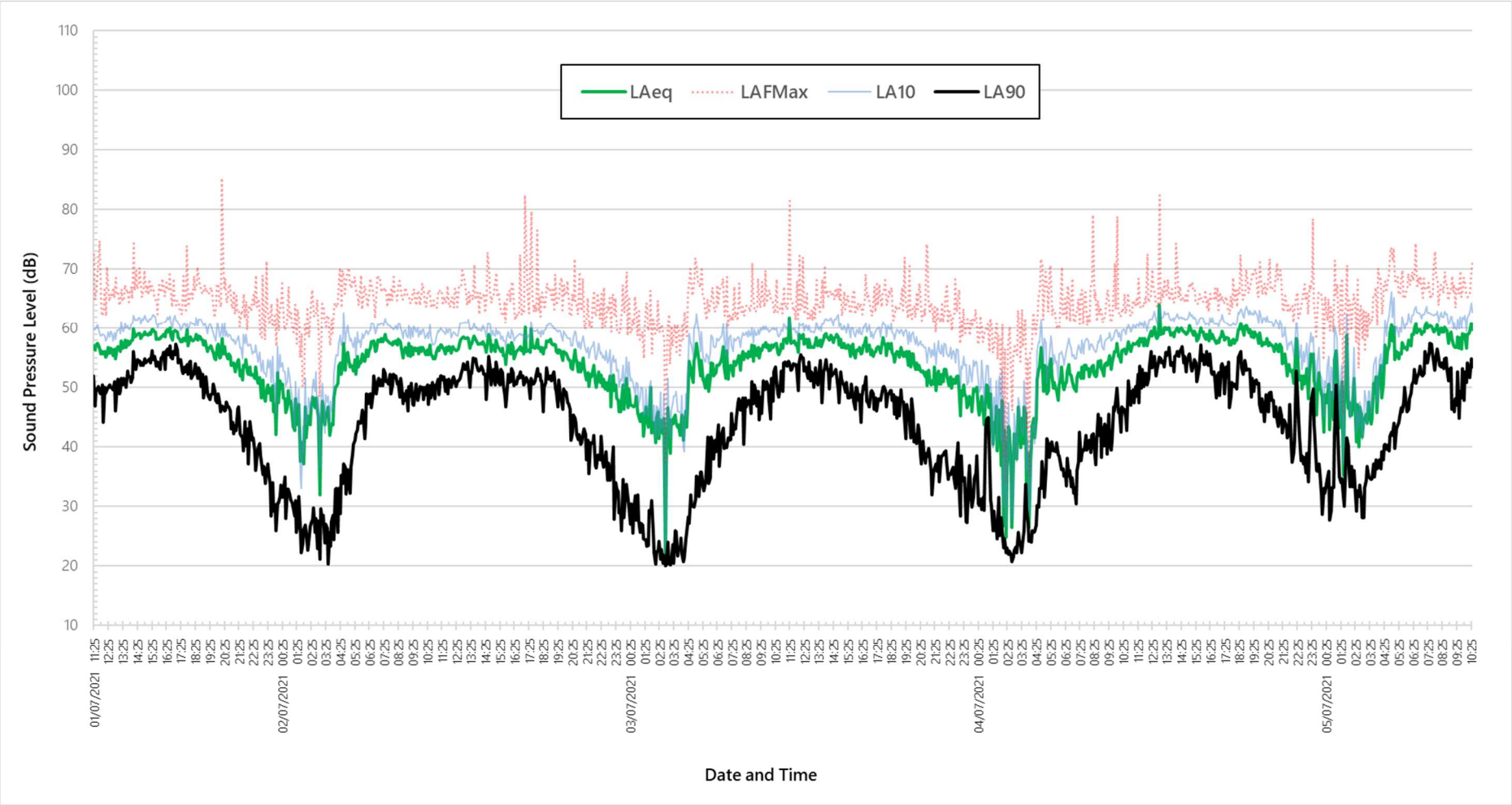
A graph of the measured noise levels across the entire monitoring period at position L1 is given in Figure 4.1 overleaf, with a summary provided in Table 4.1 below.

Noise levels follow a typical diurnal pattern associated with road traffic along the A465, which is by far the dominant noise source. It is seen that background noise levels reach exceptionally low levels overnight in the early hours of the morning when there is minimal traffic. This also demonstrates that there is not any continuously operating plant at the industrial estate to east which can be heard at this position (or other positions based on the subjective observations of the site). Traffic levels appear to be at their highest on Monday morning.

Table 4.1 – Summary of measured noise levels at position L1

Period	Logarithmic Average $L_{Aeq,T}$ (dB)	10th Highest $L_{AFmax,5min}$ (dB)	Modal $L_{A90,5min}$ (dB)	Median $L_{A10,5min}$ (dB)
Daytime (07:00 – 23:00) **T = 16-hours**				
Thursday 1st July; 11:25 - 23:00	57	70	54	60
Friday 2nd July; 07:00 - 23:00	56	70	51	59
Saturday 3rd July; 07:00 - 23:00	56	70	48	59
Sunday 4th July; 07:00 - 23:00	58	71	53	61
Monday 5th July; 07:00 - 10:45	59	69	53	62
Night-time (23:00 – 07:00) **T = 8-hours**				
Thursday 1st July / Friday 2nd July; 23:00 - 07:00	52	69	26	53
Friday 2nd July / Saturday 3rd July; 23:00 - 07:00	50	68	26	51
Saturday 3rd July / Sunday 4th July; 23:00 - 07:00	49	67	35	51
Sunday 4th July / Monday 5th July; 23:00 - 07:00	54	70	36	55

Figure 4.1 – Graph of measured noise levels at position L1



4.2.2 L2 – East Boundary (behind Industrial buildings)

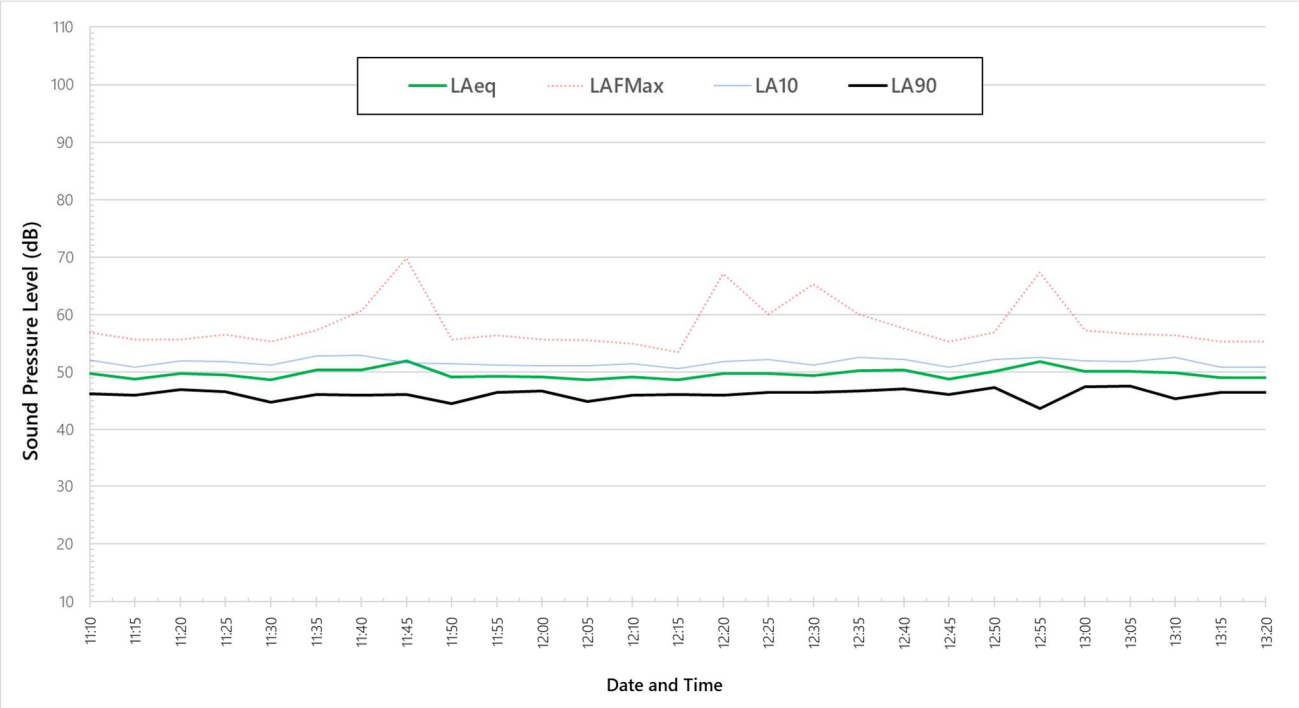
A graph of the measured noise levels across the entire monitoring period at position L2 is given in Figure 4.2, with a summary provided in Table 4.2 below.

Average/background noise levels are relatively consistent throughout, predominantly due to the A-road. Industrial noise was observed to be sporadic and not particularly loud at this location, around 20m behind the industrial buildings to the east. No external noise generating plant was observed.

Table 4.2 – Summary of measured noise levels at position L2

Period	Logarithmic Average $L_{Aeq,T}$ (dB)	Mean $L_{AFmax,5min}$ (dB)	Modal $L_{A90,5min}$ (dB)	Median $L_{A10,5min}$ (dB)
Thursday 1st July; 11:10 - 13:20	50	58	46	52

Figure 4.2 – Graph of measured noise levels at position L2



4.2.3 S1, S2, S3 – Spot Measurements

The recorded values from the shorter attended monitoring positions are shown in Table 4.3 below. These short-term positions have been used to quantify the variance/spread in noise levels across the site and used to 'calibrate' the results of the noise model. It is seen that position S1 is more exposed to traffic in and out of the industrial estate, given its position next to the entrance.

Table 4.3 – Summary of measured noise levels at the short-term monitoring positions

Position	Start Time (on 1st July)	Levels at Spot Position	
		$L_{Aeq,5min}$ (dB)	$L_{AFmax,5min}$ (dB)
S1	11:30	58	83
	11:35	60	83
	11:40	53	70
	11:45	50	59
	11:50	50	57
	11:55	52	81
	12:00	52	59
	12:05	53	63
	12:10	54	75
	12:15	58	80
	12:20	52	76
	12:25	55	74
	Mean Average	54	72

Position	Start Time (on 1st July)	Levels at Spot Position	
		$L_{Aeq,5min}$ (dB)	$L_{AFmax,5min}$ (dB)
S2	12:35	49	58
	12:40	49	66
	12:45	47	54
	12:50	50	66
	12:55	49	63
	13:00	49	55
	13:05	51	66
	13:10	50	65
	13:15	48	55
	13:20	49	61
	Mean Average	49	61

Position	Start Time (on 1st July)	Levels at Spot Position	
		$L_{Aeq,5min}$ (dB)	$L_{AFmax,5min}$ (dB)
S3	13:30	53	78
	13:35	51	68
	13:40	53	68
	13:45	55	70
	13:50	52	64
	13:55	51	62
	14:00	52	68
	14:05	49	60
	14:10	51	63
	14:15	54	73
	Mean Average	52	67

5.0 Assessment

5.1 Methodology

This section details the impact the existing noise environment would have on the proposed development, including the implications this has on the ventilation strategy and the construction types required within the façade to reduce external noise ingress to an acceptable level for future occupants.

The following summarises the main steps of action in the assessment method:

- Firstly, the existing ambient noise environment at the site is assessed with the support of an environmental noise survey (Section 4.0).
- A 3D noise map model is constructed of the existing site and 'calibrated' to closely match the results of the noise survey;
- The model is updated to include the proposed development and therefore accurately predict external noise levels outside of all facades and in external amenity areas;
- Noise levels in external amenity areas are assessed in line with the ProPG, BS 8233:2014 and WHO targets;
- Noise ingress into living spaces is then assessed against the IANL limits of the ProPG (and local planning policy), to determine the sound reduction requirements of the building envelope and determine whether background ventilation can be provided by open windows, trickle ventilators, or mechanical ventilation (to meet IANL limits);
- An assessment against the criteria of TAN 11 is also made.

5.2 External Noise Levels

A noise model/map for the existing site and proposed development has been constructed using the CadnaA® software package, a commonly used 3-D noise modelling software that implements a wide range of national and international standards, guidelines and calculation algorithms, including those set out in ISO 9613-2:1996.

The intention of noise modelling/mapping for this assessment is to accurately determine the noise levels across the entire site, in each garden, and at each façade and each floor of the building(s) associated with the proposed development. This is considered more accurate than simply applying the results from the discrete noise monitoring positions to the whole development, as the different elevations have varying levels of exposure to noise.

The model is based upon the results of the environmental noise survey, by placing receptor points at the survey monitoring positions and adjusting the model parameters to match these results as closely as possible, in terms of the highest $L_{Aeq,16hrs}$ and $L_{Aeq,8hrs}$, and the 10th highest night-time $L_{AFmax,5min}$ values. Therefore, effectively the noise map for the existing site is 'calibrated'.

The proposed development has then been added. The model has been used to predict the façade exposure levels at 1m outside of all the residential windows across the proposed development for each floor in terms of the $L_{Aeq,16hr}$ for the daytime and the $L_{Aeq,8hr}$ and L_{AFmax} for the night-time periods respectively, and to predict the $L_{Aeq,16hrs}$ in external amenity areas.

Further information on the configuration of the noise model and screenshots/results from it are provided in Appendix C.

The model has first been set up to reflect the noise climate at the existing site:

- Figure C.1 – shows 3D views of the model setup for the existing site;
- Figure C.2 – shows the spread of noise in terms of the daytime ambient noise level $L_{Aeq,16hr}$;
- Figure C.3 – shows the night-time $L_{Aeq,8hr}$;

The proposed development has then been added to the model:

- Figure C.4 – shows 3D views of the model setup for the proposed development;
- Figure C.5 – shows the daytime ambient noise level $L_{Aeq,16hr}$ in external amenity areas;
- Figure C.6 – shows the predicted façade exposure levels outside of windows in terms of the daytime $L_{Aeq,16hr}$;
- Figures C.7 shows the predicted façade exposure levels outside of windows in terms of the night-time $L_{Aeq,8hr}$.
- Figures C.8 – shows the predicted façade exposure levels outside of windows in terms of the 10th highest maximum noise level L_{AFmax} at night.

5.3 TAN 11 – Initial Assessment

Figures C.2 and C.3 in Appendix C show the daytime $L_{Aeq,16hr}$ and night-time $L_{Aeq,8hr}$ levels across the existing site.

Comparing the levels in these plots to the criteria in Section 3.1 that the site sits within Noise Exposure Category B, where "*noise should be taken into account when determining planning applications and, where appropriate, conditions imposed to ensure an adequate level of protection*".

5.4 Outdoor Amenity Noise Levels

WHO Guidelines and the ProPG imply that noise levels in outdoor amenity spaces should ideally not be above the range 50 – 55 dB $L_{Aeq,16hr}$ for the spaces to be enjoyed as intended.

Figure C.5 in Appendix C shows the predicted daytime levels in the gardens of the development.

It is seen that the large majority of the site falls within levels of between 40 and 55 dB $L_{Aeq,16hr}$, except for the southern-most line of properties which back on to the A465) albeit only slightly above at around 55 – 59 dB, and with potentially some patio areas by the back doors which are just under 55 dB.

The site already has a 1.8m closed boarded fence the southern boundary which is the most effective way of reducing noise into gardens. PJA has looked at the possibility of increasing the height of this fence in its current position, but due to the slight elevation of the road, the fence would need to be significantly tall at around 4m high to reduce levels in *all* areas to beneath 55 dB, unless, it could be moved closer to road.

The ProPG does accept that <55 dB $L_{Aeq,16hr}$ can't be achieved in all situations. The impact can partially be offset by the residents having access to a relatively quiet alternative outdoor amenity space as part of the property, group of residential properties, or a public space in the nearby area; and/or a relatively quiet facade (containing openable windows to habitable rooms) or a relatively quiet externally ventilated space (i.e. an enclosed balcony) as part of their dwelling. Each house would have a small front garden which could serve this purpose.

Therefore, on this basis, PJA do not believe that any further mitigation would necessarily be required.

5.5 External Noise Ingress

5.5.1 Internal Ambient Noise Levels

The criteria for internal ambient noise levels (IANLs) are based upon guidance from BS 8233:2014 and the ProPG. In summary, the proposed development should seek to control IANLs from external noise sources to no greater than:

- Daytime – 35 dB $L_{Aeq,16hr}$; and
- Night-time – 30 dB $L_{Aeq,8hr}$ and 45 dB L_{AFmax} (no more than 10 times per night).

The criteria apply to bedrooms, the most sensitive room type. The daytime target applies to living rooms (no night-time target is applied to living rooms). A 5 dB relaxation to the daytime target is applied to dining rooms/kitchens.

5.5.2 Building Envelope

The weakest elements of a façade in terms of sound reduction are the windows/glazing. This is particularly true when windows are open (as an open window will typically provide around a 15 dB reduction). Alternative forms of natural background ventilation (such as trickle vents) are also a weak point but can be treated to achieve a much higher level of sound reduction than an open window – so that IANL targets *can* be met with natural ventilation in areas where the targets would be exceeded when opening the windows. Alternatively, mechanical ventilation could be implemented.

In this case, it is seen that at many of the facades in the centre of the site or parts of the site that are away from the road and industrial estate, that IANL targets could be met with open windows.

Façades on the southern boundary with the A-road, and those closer to the industrial estate, would require IANL targets to be met with closed windows.

It is not uncommon for external noise levels to mean that internal targets are exceeded with open windows. It should also not be assumed that windows need to be sealed shut, as many occupants will favour the ability to open their windows at will, particularly during the hotter months of the year, and external noise levels are certainly not excessively high to prevent doing so.

What it does mean, is that an alternative form of background ventilation (i.e. trickle vents – or a mechanical ventilation system) should be provided so that IANL targets can be met whilst providing background ventilation to the dwellings with the windows closed (but openable at the occupants' discretion, rather than through necessity).

Therefore, Table 5.1 provides the *minimum* sound reduction indices for glazing and ventilators (the weakest elements acoustically) across the whole development.

These are based upon the worst-case facades facing the A-road and based upon the most onerous internal noise requirements for bedrooms. They still, however, represent fairly standard constructions, hence it would not be impractical in PJA's opinion to install the same specification throughout, even in those areas which are thought to be in quiet pockets of the site – to help protect against any potential future intensification of use in the industrial estate.

The requirements are not seen to be particularly high, and a non-exhaustive list of example glazing constructions and ventilator products such as trickle vents and air bricks have been provided in Appendix D, which are capable of achieving the required $R_w + C_{tr}$ and $D_{n,e,w} + C_{tr}$ indices.

PJA recommend that glazing which has two panes of glass that are the same thickness are avoided where possible unless the manufacturer has test data that proves its performance can meet the required $R_w + C_{tr}$ – as these can resonate together and are usually worse performing than two panes of different thicknesses, even if the second pane is slightly thinner than the first. This is especially true with triple glazing.

Table 5.1 – Minimum sound reduction requirements of the building envelope

Exposure Category	External Noise Level @ 1m outside of a window			Minimum sound reduction indices/construction examples	
	Daytime average (07:00 – 23:00) dB $L_{Aeq,16hr}$	Night-time average (23:00 – 07:00) dB $L_{Aeq,8hr}$	Night-time maximum [1] (23:00 – 07:00) dB L_{AFmax}	Glazing [2] See Appendix D.1	Ventilators [3] see Appendix D.2
All elevations	43 - 60	38 – 56	53 - 72	27 dB $R_w + C_{tr}$ Standard double glazing, i.e. - 4mm standard float - 12mm air cavity - 6mm standard float	33 dB $D_{n,e,w} + C_{tr}$ i.e. Titon SF 3300 EA Vent
Internal Noise Target [4]	<35	<30	<45	-	-

1. Estimated 10th highest value per night
2. A non-exhaustive list of suitable glazing products is given in Appendix D.1. Standard double glazing will usually achieve a minimum sound reduction of 26 dB $R_w + C_{tr}$.
3. A non-exhaustive list of suitable ventilator products is given in Appendix D.2. The acoustic performance should meet these values when the vent is open. They may not be required if the development uses mechanical ventilation. Low-performance trickle vents will usually achieve a minimum sound reduction of 25 dB $D_{n,e,w} + C_{tr}$.
4. Based on the criteria for bedrooms (the most noise-sensitive room type).

5.6 Summary

In summary, PJA believes that the noise impact on future occupants at the proposed development can be controlled to an acceptable level. External noise levels are not seen to be excessively high in this location to prevent development. In the context of the wider area, there are already many existing residential properties near the site and next to the roads which constitute the main sources of noise.

Assessing against the criteria of Tan 11, the large majority of the site would fall under Noise Exposure Category **B,** where "*noise should be taken into account when determining planning applications and, where appropriate, conditions imposed to ensure an adequate level of protection*".

IANL targets can be met with closed windows and standard double glazing, with trickle ventilators used to provide background ventilation as an alternative to open windows. Glazing and trickle ventilators should meet the sound reduction indices outlined in **Table 5.1/Figure 5.1** of **Section 5.5.** The requirements represent a low level of acoustic performance which would be met by most products. This also does not mean windows are not openable – most people will wish to open windows despite slightly elevated noise levels internally, and external noise levels are not excessively high to mean that that opening the windows would be unacceptable. In many areas, internal noise targets *would* be met with open windows, or at least be met if a 5 dB relaxation were applied (for 'reasonable' conditions).

As per **Section 5.4**, external amenity noise levels are mostly below or within the recommended 50 – 55 dB $L_{Aeq,16hr}$ upper range for the external amenity spaces to be enjoyed as intended, with all dwellings having at least some garden area which are in this range, as recommended by the ProPG.

Appendix A – Acoustic Terminology and Concepts

A.1 – Glossary

Table A.1 – Glossary of acoustic terminology

Term	Description
dB (decibel)	The scale on which sound pressure level is expressed. It is defined as 20 times the logarithm of the ratio of the root-mean-square pressure of the sound and a reference pressure (2x10-5 Pa).
dB(A)	A-weighted decibel. This is a measure of the overall level of sound across the audible spectrum with a frequency weighting (i.e. 'A' weighting) to compensate for the varying sensitivity of the human ear to sound at different frequencies.
C_{tr}	A weighting curve applied to level differences to account for low-frequency noise, typically associated with traffic noise. This is often applied as an addition to $D_{nT,w}$ and R_w ratings used to describe levels of sound insulation.
Frequency	Sound is generally assessed over the frequency range of 63 Hz to 4000 Hz (4 kHz), although humans can potentially hear between 20 Hz and 20 kHz. Frequency is often divided into ('first') octave bands for analysis, with the range above considered within 7-octave bands with centre frequencies at 63 Hz, 125 Hz, 250 Hz, 1 kHz, 2 kHz and 4 kHz. 'Third' octave bands split this further into smaller frequency bands.
$L_{Aeq,T}$	L_{Aeq} is defined as the notional steady sound level which, over a stated period of time, would contain the same amount of acoustical energy as the A-weighted fluctuating sound measured over that period. This parameter is typically considered as a good representation of the 'average' overall noise level. It is referred to technically as the A-weighted equivalent continuous sound level and is a dB(A) as defined above.
$L_{A90,T}$	The A-weighted noise level that is exceeded for 90% of the measurement period T. This parameter is often considered as the 'average minimum level'.
$L_{AFmax,T}$	The maximum A-weighted noise level during the measurement period T.
R_w	Weighted sound reduction index. A single number rating of the sound insulation performance of a specific building element. R_w is measured in a laboratory. R_w is commonly used by manufacturers to describe the sound insulation performance of building elements such as plasterboard and concrete.

A.2 – Subjective Changes in Sound Level

Table A.2 – Subjective loudness from an increase or decrease in sound pressure level

Change in sound pressure level	Relative change in sound power energy (multiplier)		Change in apparent subjective loudness (for mid-frequency range)
	Decrease	Increase	
3 dB	1/2	2	'Just perceptible'
5 dB	1/3	3	'Clearly noticeable'
10 dB	1/10	10	'Half or twice as loud'
20 dB	1/100	100	'Much quieter, or louder'

Appendix B – Noise Survey Details

B.1 – Survey Equipment

The monitoring equipment used for the baseline noise survey is detailed in the table below. The sound level meter was calibrated before and after the survey, with no significant drifts of greater than 0.5 dB observed. The sound level meter has been calibrated to a traceable standard within the 24 months preceding the survey, and the calibrators have been calibrated to a traceable standard within the 12 months preceding the survey. The equipment complies with the standards of as BS EN 60942:2003 Class 1 device.

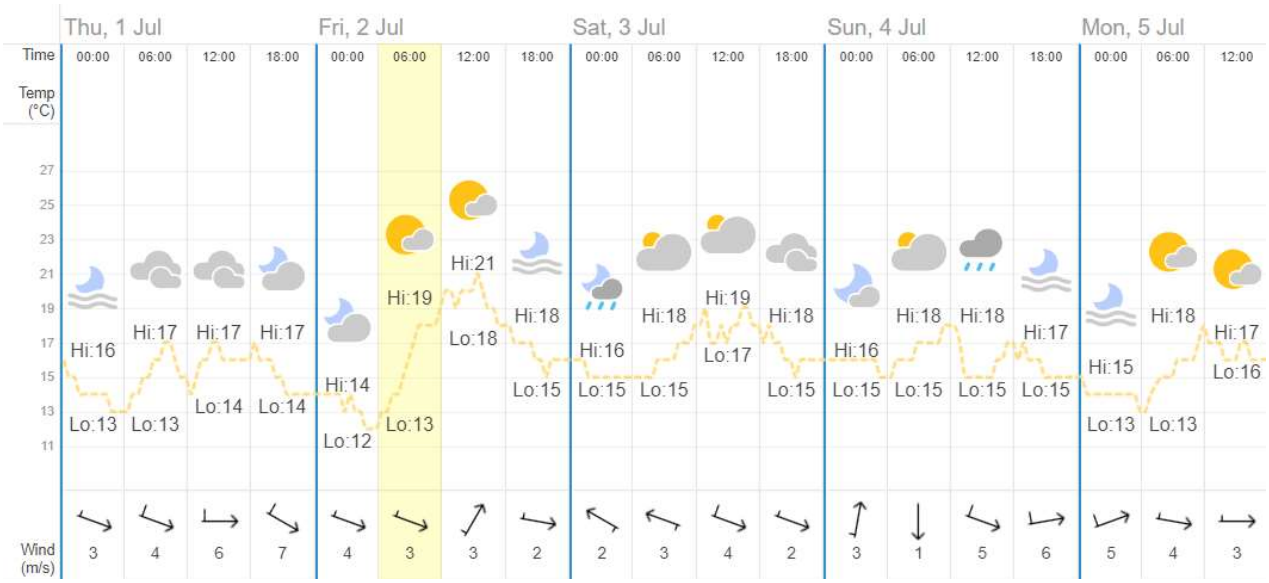
Table B.1 – Equipment used for the noise survey

Name	Serial Number	Last Calibrated	Calibration Due
SVAN 949 Class 1 Sound Level Meter	9720	Oct-19	Oct-21
SV22 Class 1 Microphone	4012386	Oct-19	Oct-21
SVAN 949 Class 1 Sound Level Meter	9719	Oct-19	Oct-21
SV22 Class 1 Microphone	4011862	Oct-19	Oct-21
Pulsar Quantifier 95 Class 1 Sound Level Meter	B21270	Oct-20	Oct-22
Pulsar MK:244 Class 1 Microphone	20043748	Oct-20	Oct-22
Pulsar 105 Acoustic Calibrator	53698	Oct-20	Oct-21

B.2 – Meteorological Conditions

During the survey, weather conditions were mostly dry and mild with wind speeds to a maximum of 7 ms^{-1}. The microphone was fitted with a weather protection kit/windshield. These weather conditions are suitable for the measurement of environmental noise in accordance with BS 7445 '*Description and Measurement of Environmental Noise*'. However, the weather over the last 24 hours of the survey was strongly affected by gale-force winds and rain, and hence the results from this period have not been considered in the assessment. The weather data below has been sourced from https://www.timeanddate.com/weather/@7297062/historic?month=7&year=2021.

Figure B.1 – Meteorological conditions during the survey



B.3 – Photographs

Appendix C – Noise Mapping

The noise predictions within this report have been undertaken using the proprietary software CadnaA® by DataKustik, a 3-D noise mapping package that implements a wide range of national and international standards, guidelines and calculation algorithms, including those set out in ISO 9613-2:1996.

The noise model accounts for the topography of the land based on data available from the Ordnance Survey. All of the objects within the model (buildings, roads, barriers, foliage, etc) have been imported from OpenStreetMap. The heights of the buildings and roads have been based upon Google Earth Pro, using the 3D view to be able to measure the elevation heights at the tops of objects, and then inserting this manually into the model. Lastly, the scaled site plan, floor plan, and elevation for the proposed development have been accounted for in the model.

The noise model has been used to predict the resulting daytime (16-hour) and night-time (8-hour) L_{Aeq} and 10th highest L_{AFmax} noise levels across the site.

The noise map model has assumed:

- downwind propagation, i.e. a wind direction that assists the propagation of sound from source to receptor, as a worst-case.
- a ground absorption factor of 0 on roads, buildings, and tarmacked areas, and 0.5 elsewhere;
- a maximum reflection factor of three where buildings and barriers are assumed to have a 'smooth' reflective façade, as a worst-case;
- façade receptor points representing the worst-case floor – placed at 0.05m from the façade (and not accounting for the sound reflection off that façade);
- receptor heights of 1.5m when assessing noise in external amenity spaces/grid height of 1.5m for the noise contour plots;
- receptor points in the plots of the existing site based on the position and height of the survey positions;
- atmospheric sound absorption based upon a temperate of 10°C and a humidity level of 70%, as per Table 2 of ISO 9613-2:1996.

The images on the following pages contain the results of the mapping.

C.1 – Existing Site

Figure C.1 – Views of the model setup – existing site

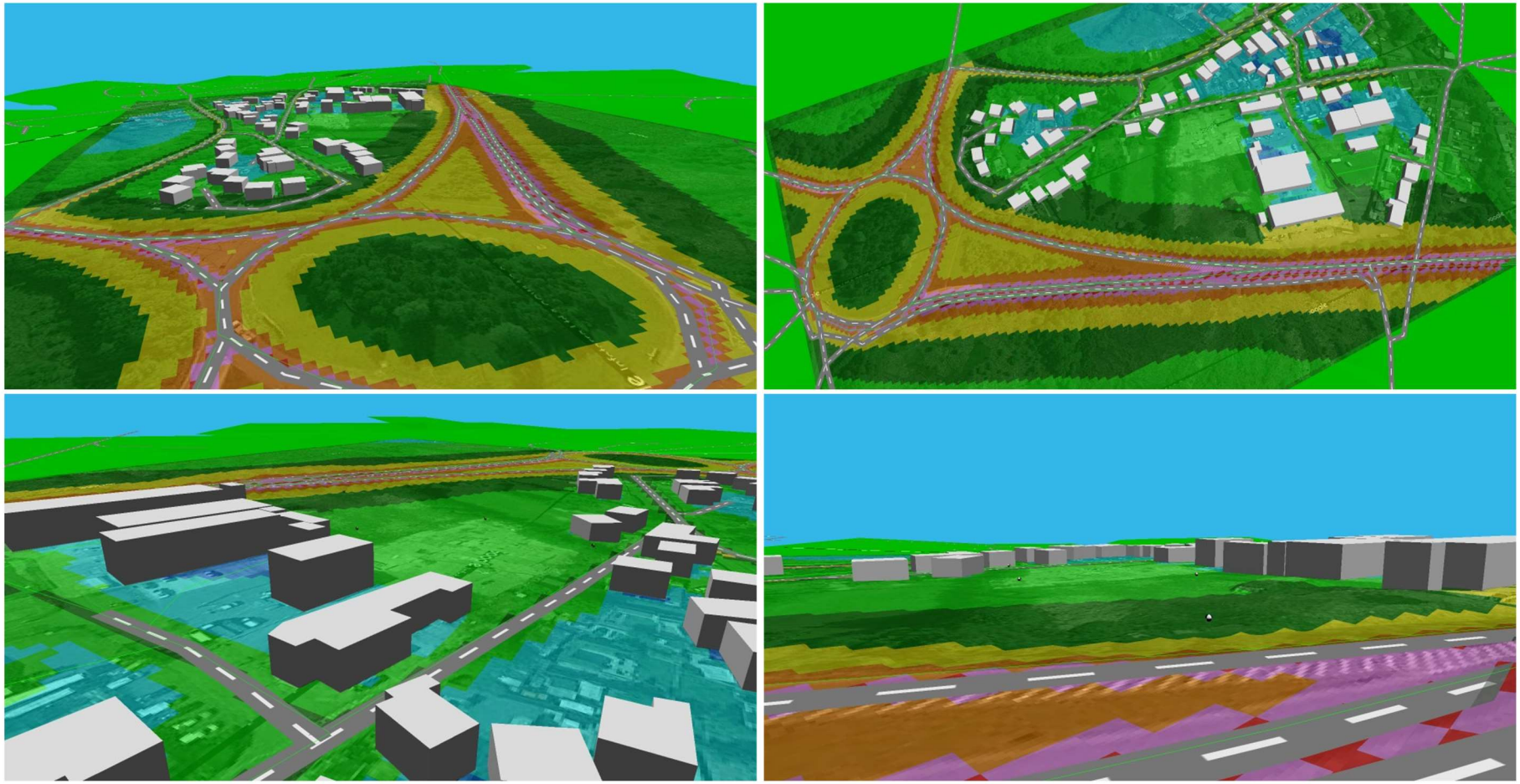


Figure C.2 – Existing site - Predicted dB $L_{Aeq,16hr}$ external ambient noise levels – Daytime (07:00 – 23:00)

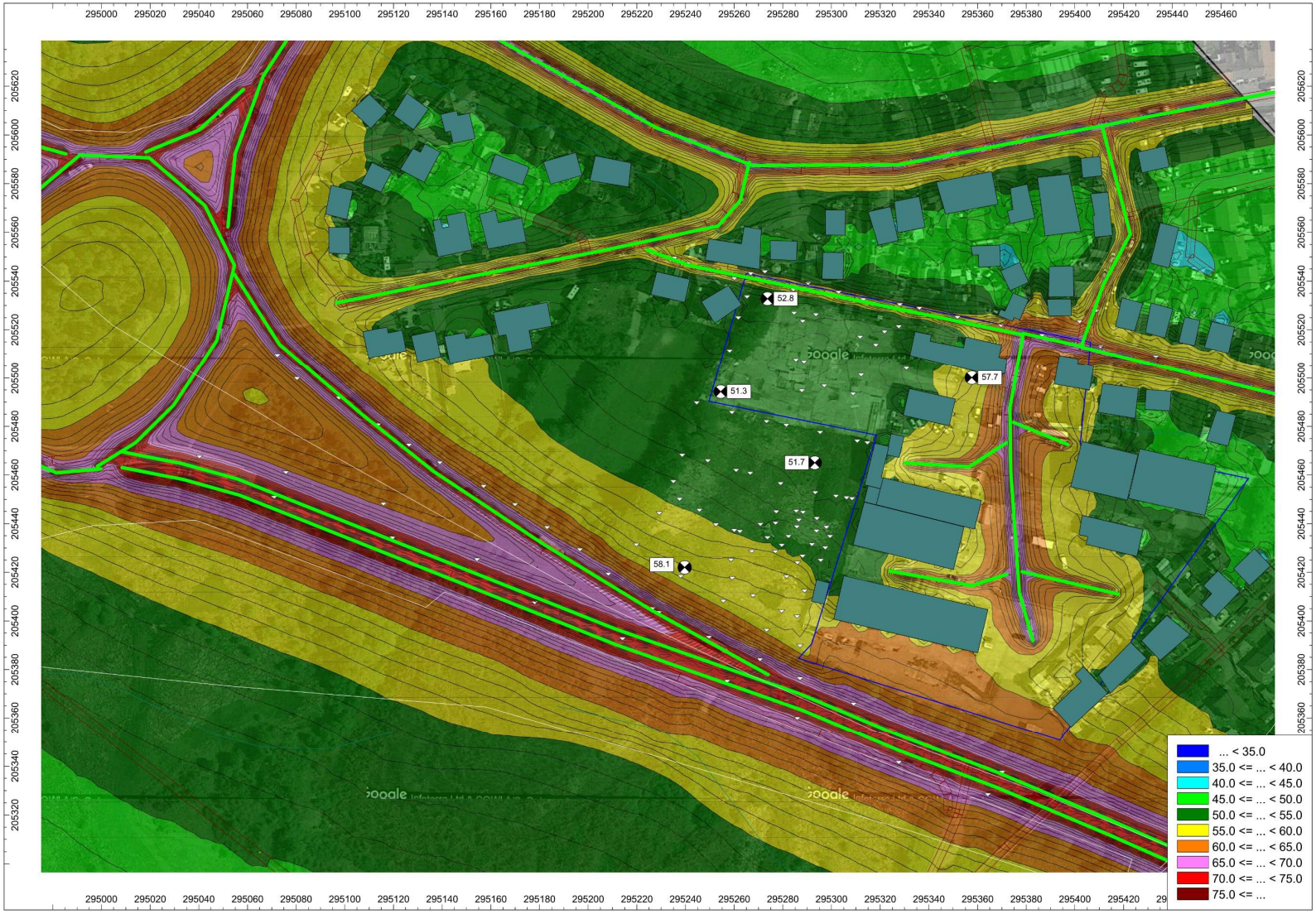
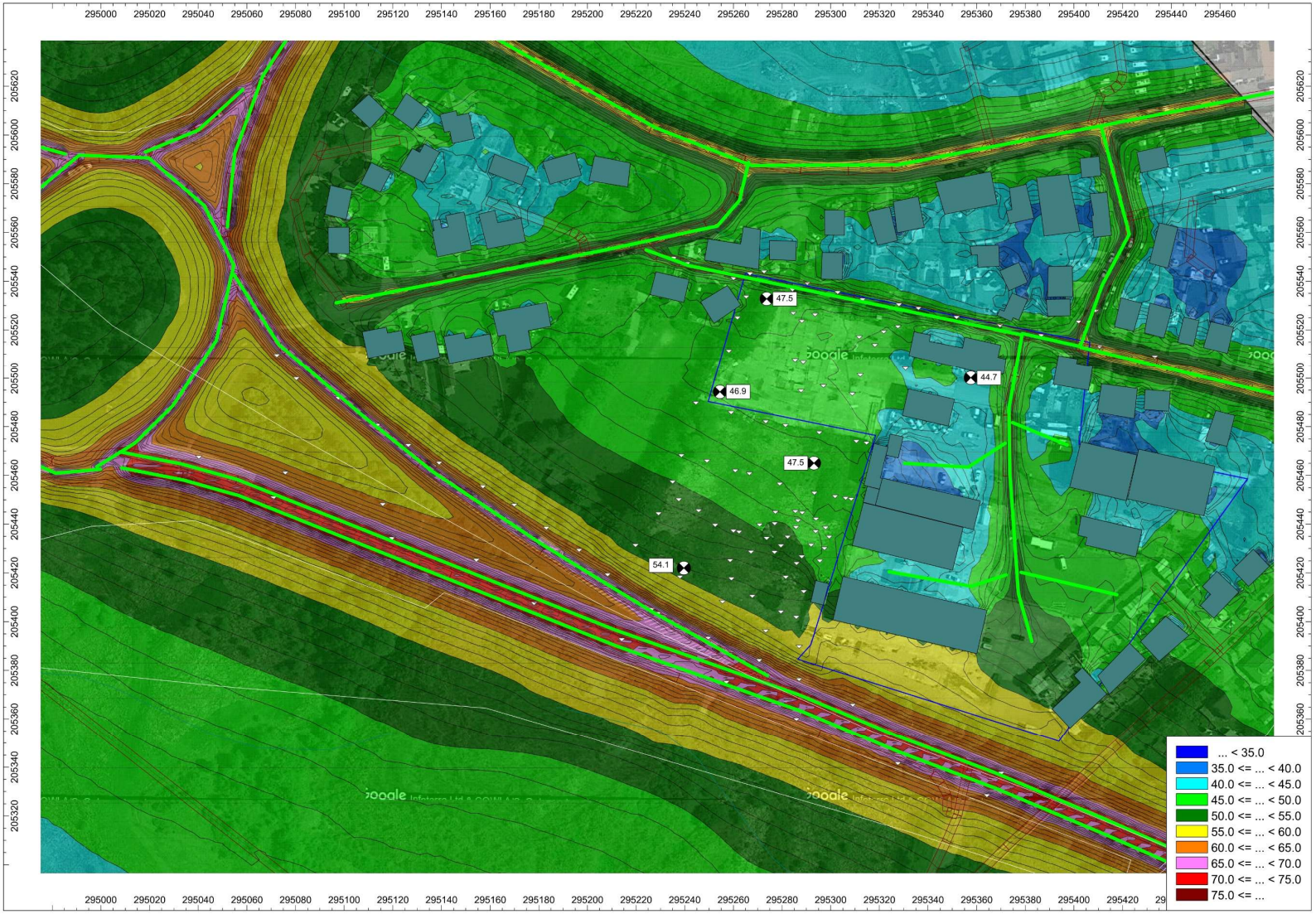


Figure C.3 – Existing site - Predicted dB $L_{Aeq,8hr}$ external ambient noise levels – Night-time (23:00 – 07:00)



C.2 – Proposed Development

Figure C.4 – Views of the model setup – proposed development

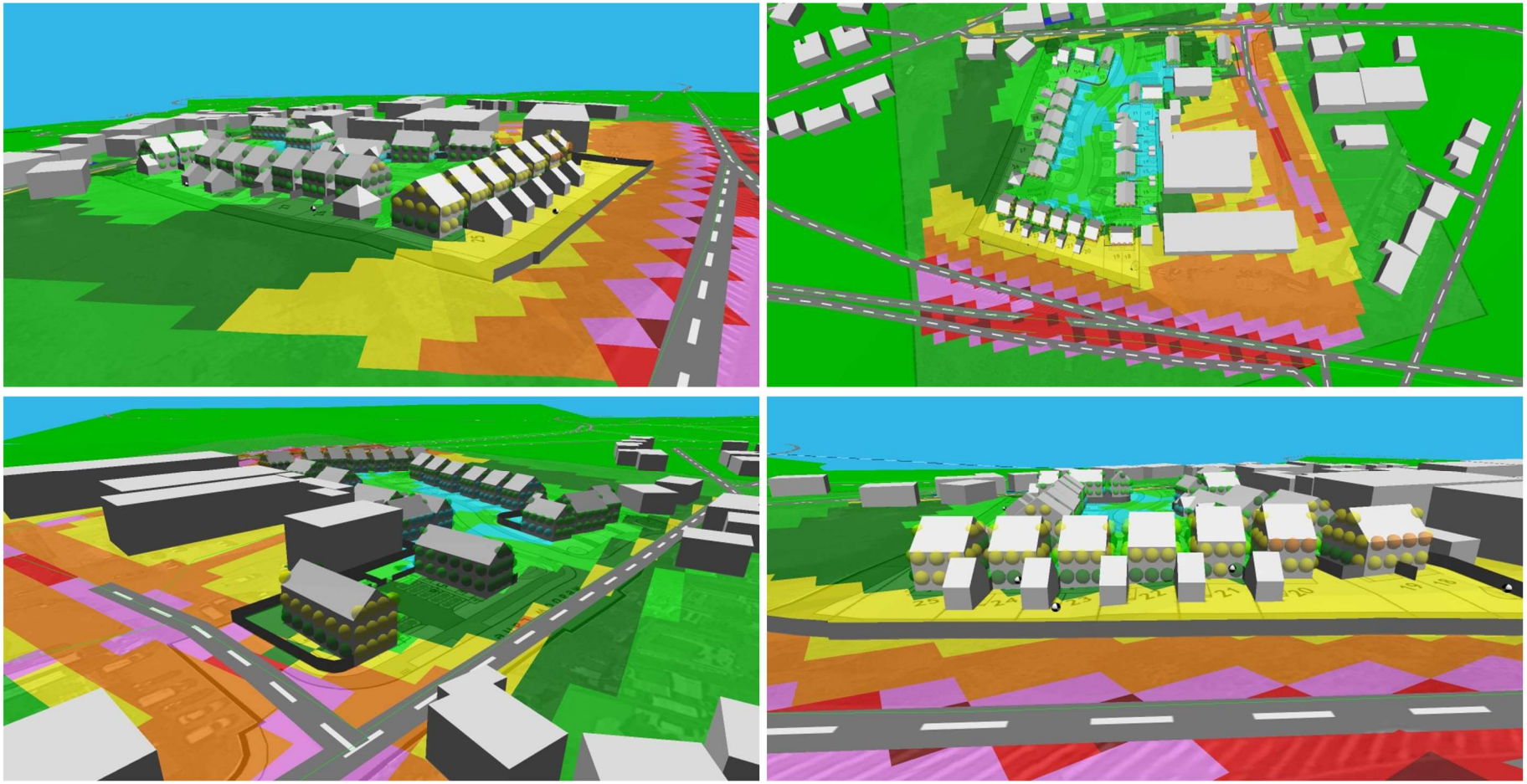


Figure C.5 – Proposed development - Predicted $L_{Aeq,16hr}$ in outdoor amenity areas – Daytime (07:00 – 23:00)

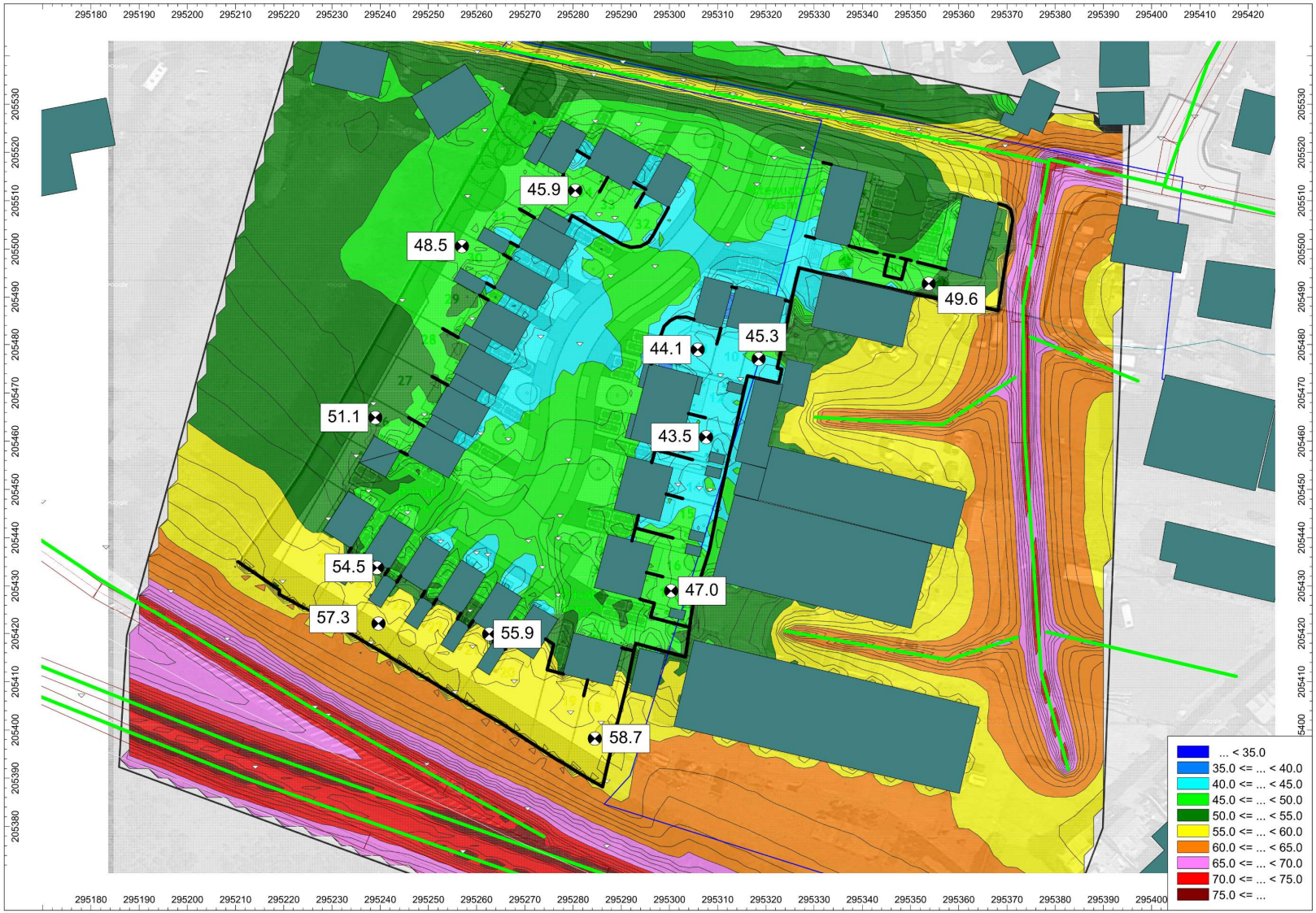


Figure C.6 – Proposed development - Predicted façade dB $L_{Aeq,16hr}$ exposure levels – Daytime (07:00 – 23:00)

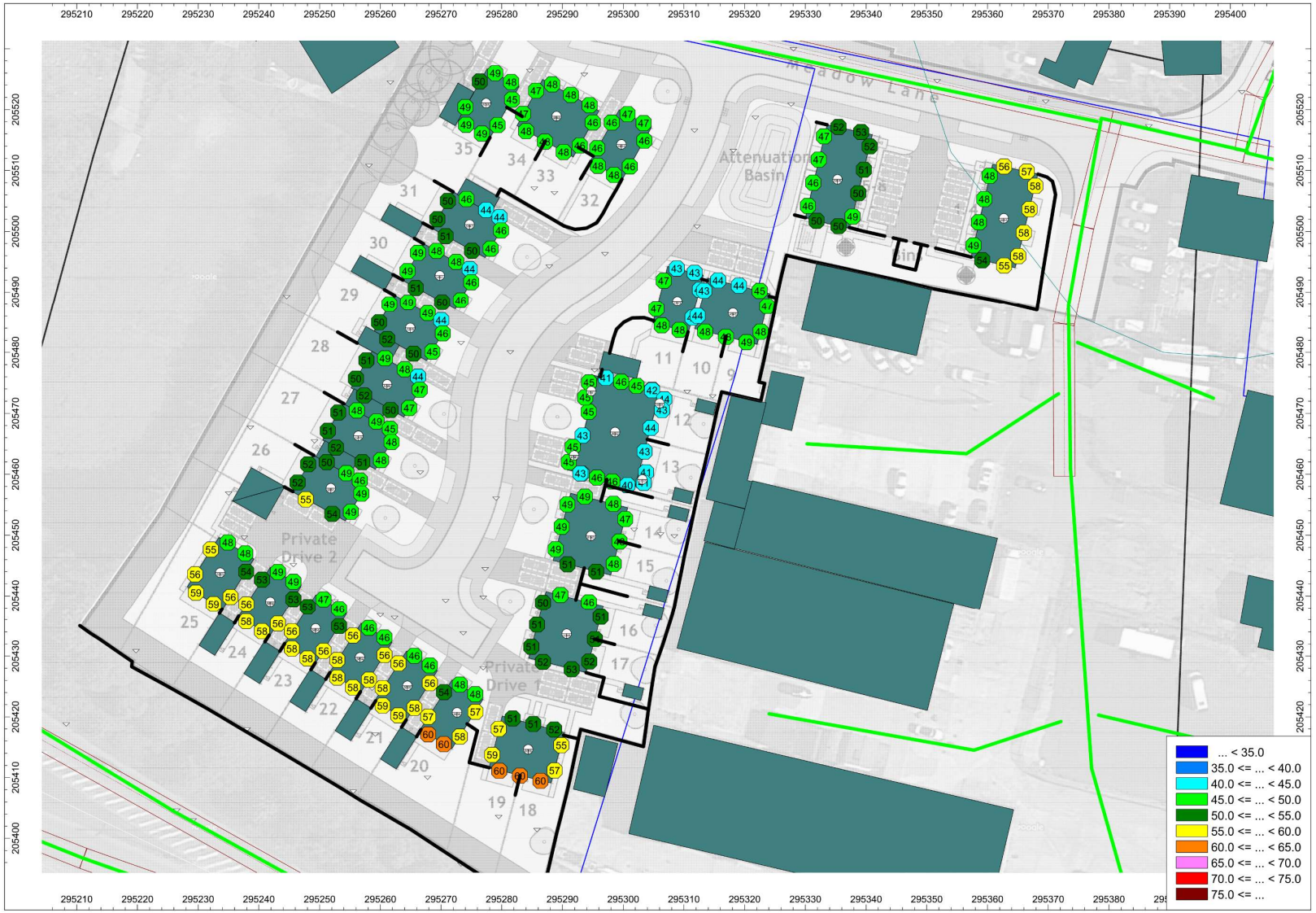


Figure C.7 – Proposed development - Predicted façade dB $L_{Aeq,8hr}$ exposure levels – Night-time (23:00 – 07:00)

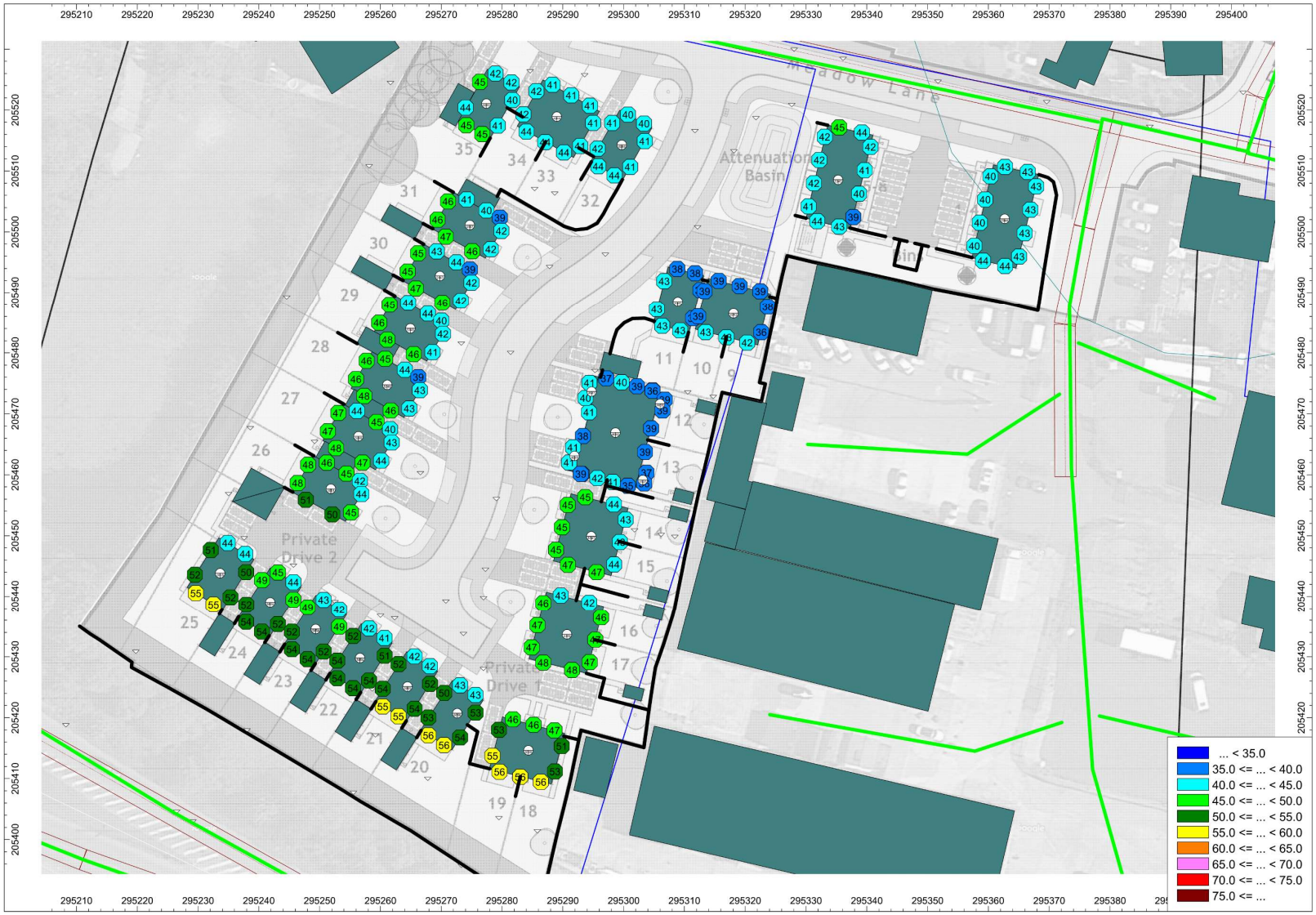


Figure C.8 – Proposed development - Predicted façade dB L_{AFmax} exposure levels – Night-time (23:00 – 07:00)

Appendix D – Example Façade Constructions

D.1 - Glazing

Table D.1 – Example glazing constructions and associated sound reduction indices

Single / Double / Triple	Configuration	Manufacturer	$R_w + C_{tr}$ (dB)
Double	4 (12) 6	Saint Gobain	**29**
Double	5 (12) 4	Saint Gobain	**29**
Double	4 (16) 8	Saint Gobain	**30**
Double	4 (12) 6.8P	Pilkington	**30**
Double	4 (10) 10	Saint Gobain	**31**
Double	6 (25) 4	Saint Gobain	**31**
Double	8 (18) 6	Saint Gobain	**32**
Double	8.8L (12) 8.8P	Pilkington	**32**
Double	4 (6) 10	Saint Gobain	**33**
Triple	4 (12) 4 (12) 8.4S	Saint Gobain	**33**
Double	4 (16) 8.8P	Pilkington	**33**
Double	10 (15) 6	Saint Gobain	**34**
Double	8 (6) 8.8S	Saint Gobain	**34**
Double	6 (16) 8.8P	Pilkington	**34**
Double	10 (6) 8.8S	Saint Gobain	**35**
Double	6 (24) 10	Saint Gobain	**35**
Double	6 (12) 9.5A	Saint Gobain	**35**
Triple	8 (12) 4 (12) 8.8P	Pilkington	**35**
Double	8 (12) 8.8A	Saint Gobain	**36**
Double	10 (12) 8.8A	Saint Gobain	**37**
Double	8.4A (16) 10.4A	Saint Gobain	**38**
Double	8.8P (16) 12.8P	Pilkington	**39**
Double	10 (16) 12.4A	Saint Gobain	**40**
Double	12.8A (15) 12.8A	Saint Gobain	**41**
Double	9.1P (20) 13.1P	Pilkington	**42**
Double	9.1P (20) 17.1P	Pilkington	**43**
Double	16.8A (15) 16.8A	Saint Gobain	**44**
Double	9.1P (20Arg) 17.1P	Pilkington	**44**
NOTATION A = Stadip Silence S = Stadip P = Optiphon L = Optilam Arg = Argon Cavity			
Further data at https://techhub.uk.saint-gobain-building-glass.com/acousticcalculator			

D.2 - Ventilators

For each additional ventilator, the required $D_{n,e,w} + C_{tr}$ should be increased by 10log(n), where 'n' is the number of ventilators. The $D_{n,e,w} + C_{tr}$ must be assessed in the open position.

Table D.2 – Example ventilator products and associated sound reduction indices

Product	$D_{n,e,w} + C_{tr}$ (dB)
Duco DucoTop 60 SR (over window frame) – Corto STD	**25**
Duco DucoTop 60 SR (over window frame) – Corto AK	**26**
Duco DucoTop 60 SR (over window frame) – Grando STD	**27**
Duco DucoTop 60 SR (over window frame) – Corto AK+	**28**
Duco DucoTop 60 SR (over window frame) – Alto AK	**30**
Duco DucoTop 60 SR (over window frame) – Basso AK+	**30**
Titon Invent	**30**
Duco DucoTop 60 SR (over window frame) – Grando AK	**31**
Titon Hit & Miss HM5050	**31**
Duco DucoTop 60 SR (over window frame) – Medio AK+	**32**
Duco DucoStrip Slimline	**32**
Duco GlasMax – Air slot 20mm	**32**
Rytons R2700 Window trickle ventilator (412mm wide)	**33**
Titon SF 3300 EA Vent	**33**
Greenwood Slotvent 3000S	**33**
Duco GlasMax – Air slot 10mm	**34**
Greenwood 2000D	**35**
Duco DucoTop 60 SR (over window frame) – Largo AK+	**35**
Duco DucoMax Corto 15	**36**
Duco DucoTop 60 SR (over window frame) – Grando AK+	**37**
Duco DucoMax Medio 25	**37**
Duco DucoMax Alto 25	**38**
Titon SF Xtra Sound Attenuator	**39**
Willan Fresh 100dB	**40**
Greenwood Airvac Acoustic Air Brick AAB-4000	**40**
Duco DucoMax Corto 10	**41**
Duco DucoMax Medio 15	**42**
Greenwood EHA574	**42**
Duco DucoMax Alto 15	**43**
Duco DucoMax Alto 10	**45**

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