WAVE DYNAMICS
ACOUSTIC CONSULTANTS

Proposed Part 8 Residential Development, Kishoge, Lucan

Acoustic Design Statement
31 May 2024

WDA231119RP_09_C_01

www.wdacoustics.com

South Dublin County Council

Notice

This document is intended only for the use of NDFA and South Dublin County Council. The information and document are specifically for Proposed Part 9 Residential Development, Clonburris, Lynch Lane, Kishoge, Lucan, Co. Dublin and should not be reproduced, edited or copied in any form without the permission of Wave Dynamics. This document relates to the acoustic design elements of the project which Wave Dynamics were engaged on, it does not consider any of the other engineering services on the project including but not limited to fire, structural, mechanical and electrical design. Wave Dynamics assumes no responsibility to any other party arising in connection with this document and its contents.

Document Information

Project Name:	Proposed Part 9 Residential Development, Clonburris
Address:	Lynch Lane, Kishoge, Lucan, Co. Dublin
Project Number	WDA231119_9
Report Title	Acoustic Design Statement
Client	NDFA and South Dublin County Council

Document History

Revision	Status	Description	Author	Reviewer	Issue Date
C	Issued	Acoustic Design Statement	James Cousins	Sean Rocks	31/05/2024

Dublin Office

Wave Dynamics

Unit 202 Nesta Business Centre,

Old Airport Road,

Santry, Dublin 9

D09 HP96

Wexford Office

Wave Dynamics

Unit 14 Enterprise Centre,

Gorey Business Park,

Ramstown Gorey, Co. Wexford

Y25 Y2C8

Cork Office

Wave Dynamics

Cube Building,

Monaghan Rd,

Cork,

T12 H1XY

Phone (IRL): +353 (0)1 9125070

Phone (UK): +44 20 8157 2967

Email: info@wdacoustics.com

Web: www.wdacoustics.com

Executive Summary

Wave Dynamics were engaged by NDFA and South Dublin County Council as the acoustic consultants to provide an Acoustic Design Statement including an Inward Noise Impact, Construction Noise Assessment and Operational Noise Assessment for the planning application of the proposed new residential development at Lynch Lane, Kishoge, Lucan, Co. Dublin.

The proposed development includes:

- 118 no. residential units in a mix of two storey houses, 3 storey duplex units and apartment blocks of 4 – 6 storeys comprising 26 no. 1 bed apartments; 42 no. 2 bed apartments; 21 no. 3 bed apartments; 23 no. 3 bed houses; and 6 no. 4 bed houses, with renewable energy design measures (which may be provided externally) for each housing unit;
- Landscaping works including provision of (a) communal open space areas (b) outdoor sports and play areas; (c) new pedestrian and cycle connections; and (d) civic plaza;
- Associated site and infrastructural works including provision for (a) ESB substations and switchrooms; (b) energy centre to the rear of 6 storey block; (c) photovoltaic panels; (e) car and bicycle parking; (f) public lighting; (g) bin storage; (h) temporary construction signage; (i) estate signage; and (j) varied site boundary treatment comprising walls and fencing; and all associated site development works.

Inward Noise Impact Assessment

A Stage 1 and Stage 2 ProPG assessment have been undertaken. As part of the stage one assessment to categorise the site, a baseline noise survey was undertaken to measure the existing noise levels. Following the baseline noise survey a site noise model of the road noise impact was produced and calibrated with the site measurements. A review of the noise levels on the site was conducted, this included the L_{AFmax} and $L_{Aeq,}$ the site has subsequently been characterised as medium risk for night at the southern boundary and medium to low risk for the daytime period across the rest of the site therefore, mitigation measures are not required to control the onset noise levels.

Break-in noise calculations to predict the internal noise levels from road traffic noise were conducted as part of the assessment. Consideration has also been given to the future growth of the roads. Following the assessment, the building envelope performance requirements were determined to achieve adequate internal noise levels. The performance specification for the building envelope has been provided in this report which includes the external walls, glazing, roof and ventilation requirements.

External Amenity Noise Levels

The external amenity spaces on the development include balconies, rear private gardens and a communal amenity space at ground level. Appropriate amenity has been provided on the development for residents using a combination of the balconies on suitable facades, rear gardens for houses and the communal amenity space on ground level. This is in line with element 3(v) of ProPG.

Based on the recommendations in this report it is predicted that the internal and external noise levels will achieve the targeted noise levels in line with BS 82233:2014 and ProPG 2017 guidance.

Construction Noise Impact

The construction noise impact is predicted to exceed the BS 5228 requirements **without any mitigation** measures for all stages of the project.

General and site-specific mitigation measures have been provided in this report to bring the construction noise levels down within the limits of BS 5228. Following **the noise mitigation recommendations in this report, the construction phase is expected to meet the requirements** of BS 5228 based on the information provided to us.

In addition to the mitigation measures, guidance has been provided in this report for construction noise monitoring during the construction period to manage noise levels to manage construction noise.

Vibration Monitoring

Vibration monitors should be erected during the substructure phase of the development between the site and NSL 1 to manage vibration during the construction period.

Operational Noise

An operational noise impact assessment from the noise generated in the communal amenity space, the traffic generated on the development and car parking, and the creche play area. It is predicted that the development will not cause a negative noise impact on the nearby noise sensitive locations. The mechanical plant and equipment specification is not available at this stage of the project, as these projects will be design and build PPP projects the proposed method of heating, cooling and ventilation is not currently available. Specific noise limits have been provided in this report for mechanical plant and equipment, at design development stage once the plant and equipment information is available it should be assessed for compliance with the criteria outlined in this report.

Table of Contents

1 Introduction

Wave Dynamics were engaged by the NDFA and South Dublin County Council as the acoustic consultants to undertake an Inward Noise Impact, Construction Noise Assessment and Operational Noise Assessment for the planning application for the proposed new residential development at Lynch Lane, Kishoge, Lucan, Co. Dublin.

The proposed development includes:

- 118 no. residential units in a mix of two storey houses, 3 storey duplex units and apartment blocks of 4 – 6 storeys comprising 26 no. 1 bed apartments; 42 no. 2 bed apartments; 21 no. 3 bed apartments; 23 no. 3 bed houses; and 6 no. 4 bed houses, with renewable energy design measures (which may be provided externally) for each housing unit;
- Landscaping works including provision of (a) communal open space areas (b) outdoor sports and play areas; (c) new pedestrian and cycle connections; and (d) civic plaza;
- Associated site and infrastructural works including provision for (a) ESB substations and switchrooms; (b) energy centre to the rear of 6 storey block; (c) photovoltaic panels; (e) car and bicycle parking; (f) public lighting; (g) bin storage; (h) temporary construction signage; (i) estate signage; and (j) varied site boundary treatment comprising walls and fencing; and all associated site development works.

Appendix A outlines a glossary of the acoustic terminology used in this report.

1.1 Statement of Competence

This report was completed by Wave Dynamics, an acoustic consultancy that specialises in noise and vibration. Our consultants have completed numerous similar projects in the Ireland the UK and Europe.

This assessment and report were completed by James Cousins, Managing Director | Principal Consultant with Wave Dynamics who has extensive experience in assessing noise and vibration from road and rail infrastructure on commercial and residential developments. James is an experienced consultant. His qualifications include; BSc (Hons) in Construction Management and Engineering, Pg Cert in Construction Law and Diploma in Acoustics and Noise Control (Institute of Acoustics) and an IOA Competence Cert in Building Acoustic Measurements. James is a member of both Engineers Ireland (MIEI) and the Institute of Acoustics (MIOA) and is the current SITRI Chairman.

This report was peer reviewed by Sean Rocks, Director | Senior Consultant, Sean has experience of numerous planning stage assessments. Sean's qualifications include; BEng (Hons) in Mechanical and Manufacturing Engineering, Diploma in Acoustics and Noise Control (Institute of Acoustics), IOA Certificate of Competence in Environmental Noise Measurement and SITRI certified sound insulation tester. Sean is a member of both Engineers Ireland and the Institute of Acoustics.

2 Site Description

The site is located Lynch Lane, Kishoge, Lucan, Co. Dublin. The site is bounded by a residential housing development to the east, Lynch Lane and Kishoge and Griffeen Community Colleges to the north, greenfield site to the west, and the Dublin Heuston - Cork (all intermediate stations) and Grand Canal Dock and Dublin Heuston – Portlaoise rail line to the south.

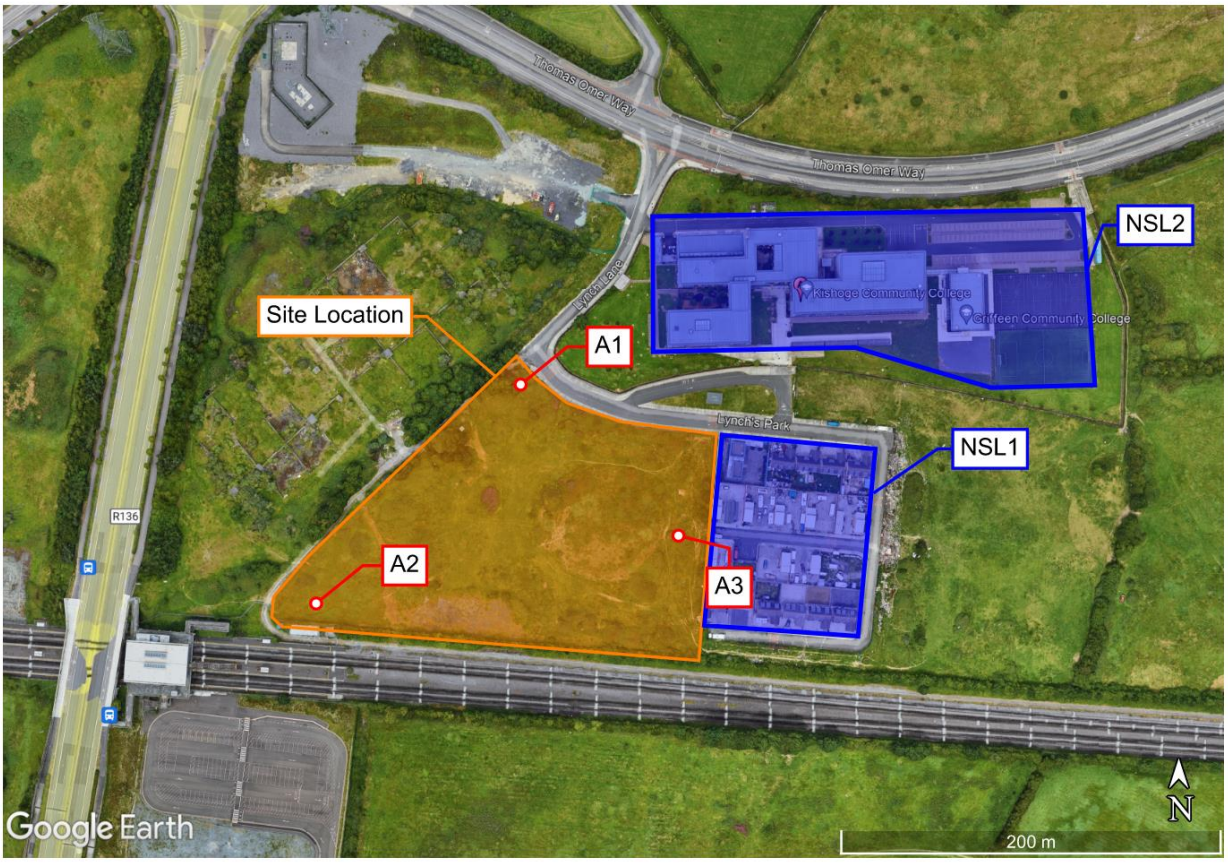


Figure 1: Site Location, noise sensitive locations, measurement locations A1-A3 and the surrounding area.

3 Project Criteria

The acoustic criterion for the project is set out in this section, the purpose of the criteria is to ensure reasonable:

- Internal noise levels,
- Noise in amenity spaces
- Operational noise from the development and;
- Construction noise and vibration from the construction phase.

To provide adequate conditions Wave Dynamics have developed the project criteria for:

- Internal noise levels,
- External amenity noise levels,
- Construction noise and vibration,
- Operational noise.

Assessment Standards

The criteria for the project have been developed based on the following industry standards:

- ✓ BS 8233:2014 Guidance on sound insulation and noise reduction for buildings.
- ✓ BS4142 2014 A1+ 2019 Methods for rating and assessing industrial and commercial sound
- ✓ EPA NG4: Guidance Note for Noise: Licence Applications, Surveys and Assessments in Relation to Scheduled Activities (NG4)
- ✓ Dublin Agglomeration Environmental Noise Action Plan December 2018 – November 2023 Volume
- ✓ ProPG Professional Practice Guidance on Planning & Noise.
- ✓ ISO 1996-1:2016 Acoustics — Description, measurement and assessment of environmental noise — Part 1: Basic quantities and assessment procedures
- ✓ British Standard BS 5228-1:2009+A1:2014 Code of practice for noise and vibration control on construction and open sites – Noise
- ✓ British Standard BS7385: 1993: Evaluation and measurement for vibration in buildings Part 2: Guide to damage levels from ground borne vibration.
- ✓ British Standard BS5228-2: 2009 + A1: 2014: Code of practice for noise and vibration control on construction and open sites – Vibration.
- ✓ British Standard BS 6472-1:2008 Guide to evaluation of human exposure to vibration in buildings.
- ✓ Previous experience on similar projects.

3.1 Inward Noise Impact Assessment Criteria

The internal ambient noise levels requirements have been developed from the following standards:

Dublin Agglomeration Noise Action Plan

The Dublin Agglomeration Environmental Noise Action Plan December 2018 – November 2023 Volume 1: Dublin City Council states the following with respect to assessing the noise impact on new residential development:

"Acoustic privacy is a measure of sound insulation between dwellings and between external and internal spaces. Development should have regard to the guidance on sound insulation and noise reduction for buildings contained in BS 8233:2014. The following principles are recommended for minimising disruption from noise in dwellings:

- *Utilise the site and building layout to maximise acoustic privacy by providing good building separation within the development and from neighbouring buildings and noise sources.*
- *Arrange units within the development and the internal layout to minimise noise transmission*

by locating busy, noisy areas next to each other and quieter areas next to quiet areas

- *Keep stairs, lifts, and service and circulation areas away from noise- sensitive rooms like bedrooms. Particular attention should be paid to the siting and acoustic isolation of the lift motor room. Proposals close to noisy places, such as busy streets may need a noise impact assessment and mitigation plan."*

ProPG: Professional Practice Guidance on Planning & Noise

ProPg 2017 is used to assess airborne noise from transport sources including road, rail and aircraft noise. The aim of the document is to provide a good design process which considers the internal acoustic environment at an early stage in the design process. The guidance was prepared by the Institute of Acoustics, the Association of Noise Consultants and the Chartered Institute of Environmental Health and is based on the findings by the World Health Organisation in relation to noise impact on humans. Its adoption is considered best practice for assessing the potential noise impact on the future occupants for residential developments.

The guidance is primarily designed for residential developments however it can be applied to other development types including developments where people require appropriate noise levels for rest and sleep. This includes residential care homes, hospitals etc. The guidance advocates a holistic design process which considers the site, its location and likely suitability for the development at an early stage.

The two primary stages of the ProPG design approach are summarised as follows:

Stage 1 – The first stage is to undertake an initial high-level noise risk assessment of the proposed site considering the noise levels (measured and or predicted) to identify any noise risks. This would include consideration of the current noise environment, future use and future noise levels ; and,

Stage 2 –The second stage is a full detailed assessment of the proposed development covering the "*Four Key Elements*":

1. *"Good Acoustic Design Process,*
2. *Internal Noise Level Guidelines,*
3. *External Amenity Area Noise Assessment; and*
4. *Assessment of Other Relevant Issues."*

As part of the process an Acoustic Design Statement is produced and submitted to the planning authority. This document sets out the design process used to come to the conclusions and recommendations in the report.

Following the ProPg the following conclusions are recommended by ProPG in relation to the findings of the Acoustic Design Statement based one the recommendations of the Acoustic Consultant:

a. *"Planning consent may be granted without any need for noise conditions;"*
b. *"Planning consent may be granted subject to the inclusion of suitable noise conditions; "*
c. *"Planning consent should be refused on noise grounds in order to avoid significant adverse effects ("avoid"); or, "*
d. *"Planning consent should be refused on noise grounds in order to prevent unacceptable adverse effects ("prevent")."*

Section 3 of the ProPG outlines the recommended approach decision makers should following in coming to their conclusions based on the recommendations of the Acoustic Design Statement. Figure 1 on the next page illustrates the ProPG approach.

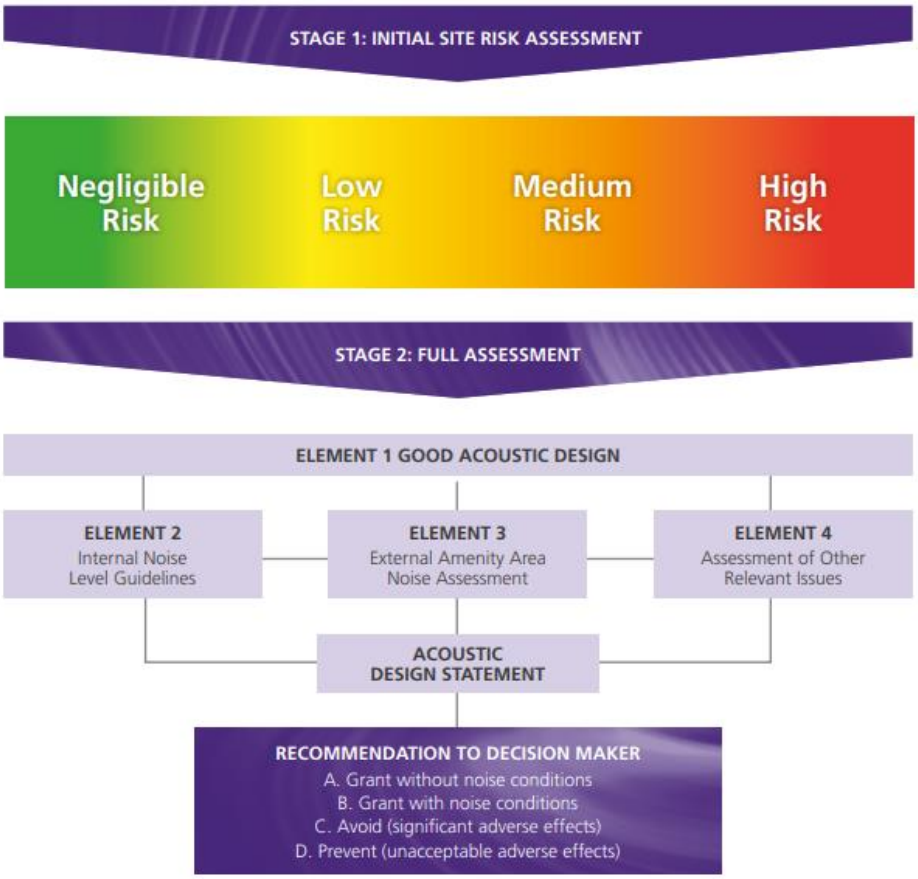


Figure 2: Summary of overall ProPG approach.

Internal Noise Levels

Table 1 below outlines the recommended internal noise levels from BS 8233:2014 within living accommodation for residential buildings for dining, resting and sleeping. These limits are in line with the ProPG and the World Health Organisation Guidelines.

Table 1: BS 8233:2014 internal noise criteria –Residential Buildings.

Activity	Location	07:00 to 23:00 Hrs	23:00 to 07:00 Hrs
Resting	Living Room	35 dB $L_{Aeq,\ 16\ hour}$	-
Dining	Dining Room/Area	35 dB $L_{Aeq,\ 16\ hour}$	-
Sleeping (daytime resting)	Bedroom	35 dB $L_{Aeq,\ 16\ hour}$	30 dB $L_{Aeq,\ 8\ hour}$ 45dB L_{AFmax} (See Note 1)

1: Regular individual noise events (for example, scheduled aircraft or passing trains) can cause sleep disturbance. A guideline value may be set in terms of SEL or $L_{Amax,F}$, depending on the character and number of events per night. Sporadic noise events could require separate values. In most circumstances in noise sensitive rooms at night (e.g. bedrooms) good acoustic design can be used so that individual noise events do not normally exceed 45dB L_{AFmax} more than 10 times a night.

External Amenity Space Noise Levels

With regard to noise levels in external amenity spaces ProPG 2017 refers to the BS8233:2014 guidance which states that:

"*the acoustic environment of external amenity areas that are an intrinsic part of the overall design should always be assessed and noise levels should ideally not be above the range 50 – 55 dB $L_{Aeq,16hr}$".*

It also states that:

"These guideline values may not be achievable in all circumstances where development might be desirable. In such a situation, development should be designed to achieve the lowest practicable noise levels in these external amenity spaces but should not be prohibited."

After mitigation/with mitigation if the adverse noise impacts are still above the recommended noise levels they can be offset by providing an alternative amenity space to partially offset the noise impact by providing access to:

- *"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; and/or*
- *a relatively quiet alternative or additional external amenity space for sole use by a household, (e.g. a garden, roof garden or*
- *a relatively quiet, protected, nearby, external amenity space for sole use by a limited group of residents as part of the amenity of their dwellings; and/or*
- *a relatively quiet, protected, publically accessible, external amenity space (e.g. a public park or a local green space designated because of its tranquillity) that is nearby (e.g. within a 5 minutes walking distance). The local planning authority could link such provision to the definition and management of Quiet Areas under the Environmental Noise Regulations."*

BS 8233:2014 elaborates on this further, it acknowledges that it may not always be necessary or feasible to ensure that noise levels remain within the guideline values. In respect of gardens and patios, BS 8233:2014 states:

> *"however it is also recognized that these guideline values are not achievable in all circumstances where development might be desirable. In higher noise areas, such as city centres or urban areas adjoining the strategic transport network, a compromise between elevated noise levels and other factors, such as the convenience of living in these locations or making efficient use of land resources to ensure development needs can be met, might be warranted. In such a situation, development should be designed to achieve the lowest practicable levels in these external amenity spaces but should not be prohibited."*

Both BS8233:2014 and ProPG 2017 do not advise that development should be restricted in areas with undesirable noise levels. The standards recommend that mitigation measures are put in place where practicable to achieve the recommended noise levels for the external amenity spaces. It notes that this may not be practical in all situations and local or governmental policy should take precedence in these situations.

3.2 Construction Noise Assessment Criteria

There is currently no statutory Irish guidance for construction noise requirements from noise during the construction phase of a project.

In the absence of specific noise limits, the appropriate criteria for the allowable construction noise levels may be found in British Standard BS 5228-1:2009+A1:2014 Code of practice for noise and vibration control on construction and open sites – Noise.

The standard (BS5228-1:2009+A1) provides examples of acceptable limits for construction and/or demolition noise in both subjective and objective form. For example, paragraph E.2 of the standard states:

> *"Noise from construction and demolition sites should not exceed the level at which conversation in the nearest building would be difficult with the windows shut."*

Paragraph E.2 goes on to state:

"Noise levels, between say 07.00 and 19.00 hours, outside the nearest window of the occupied room closest to the site boundary should not exceed:

- *70 decibels (dBA) in rural, suburban areas away from main road traffic and industrial noise;*
- *75 decibels (dBA) in urban areas near main roads in heavy industrial areas".*

Typically, the local councils refer to BS 5228 Part 1 as a method to control construction noise from sites on the local environment. This standard is therefore the de facto appropriate standard in the absence of regulatory guidance.

Based on paragraph E.2 of BS 5228 the following criteria is adopted for this project:

- For residential properties it is considered appropriate to adopt the 70dB(A) criterion for
- non-residential locations it is considered appropriate to adopt the higher category values of 75dB(A) during the day. These will only be assessed as noise sensitive during office hours.

For the purpose of this assessment buildings other than dwellings which have a residential function will be considered for the lower noise limit, this includes Hotels, B&B's, Student Accommodation, Co Living Developments etc. This is in line with the guidance and definition of noise sensitive residences of EPA NG4. Table 2 below outlines the project criteria in tabular form.

Table 2: BS 8233:2014 threshold levels.

Assessment category and threshold value period	Threshold value, in decibels (dB) (L_{Aeq})		
	Category A[1]	Category B [2]	Category C[3]
Daytime (07:00 – 19:00) and Saturdays (07:00 – 14:00)	65	70	75
Evenings and weekends [4]	55	60	65
Night-time (23:00 to 07:00hrs)	45	50	55

1) Category A: threshold values to use when ambient noise levels (when rounded to the nearest 5dB) are less than these values.
2) Category B: threshold values to use when ambient noise levels (when rounded to the nearest 5dB) are the same as category A values.
3) Category C: threshold values to use when ambient noise levels (when rounded to the nearest 5dB) are higher than category B values.
4) 19:00 – 23:00 weekdays, 13:00 – 23:00 Saturdays and 07:00 – 23:00 Sundays.

3.3 Construction Vibration Criteria

Best practice guidance is taken from British Standard BS 5228:2009 + A1 2014 Code of Practice for Noise and Vibration Control on Construction and Open Sites - Part 2 Vibration.

The standard recommends that for a soundly constructed residential property and similar structures (in good repair), the threshold for minor or cosmetic (i.e. non- structural) damage should be taken as a Peak Particle Velocity (PPV) (in frequency range of predominant pulse) of 15mm/s at 4Hz increasing to 20mm/s at 15Hz and 50mm/s at 40Hz and above. Allowable vibration (in terms of peak particle velocity) at the closest part of sensitive property to the source of vibration, at a frequency of:

Table 3: Likely Construction Noise Impact

Allowable vibration (in terms of peak particle velocity) at the closest part of sensitive property to the source of vibration, at a frequency of:			
Building Type	**Less than 15Hz**	**15 to 40Hz**	**40Hz and above**
Light framed structures/ residential buildings	12 mm/s	20 mm/s	50 mm/s

3.4 Operational Noise Criteria

Local authorities can set noise limits from typical residential developments pertaining to noise however there is currently no national policy for operational noise limits from residential developments for planning noise assessments. Noise limits for new developments are typically sought from local council's noise action plan, EPA NG4 or BS4142. On review of the Dublin Agglomeration Noise Action Plan no specific guidance has been outlined for noise limits from commercial premises and therefore the criteria from EPA NG4 and BS4142 has been adopted for the project.

BS 4142:2014+A1:2019

The standard describes a method for the assessment of commercial, industrial and background noise to quantify its impact on persons outside of a residential dwelling. BS 4142 has become the de facto standard for compliance investigation. In addition to the specified broadband noise levels the standards provide objective and subjective methods for the assessment of the impulsivity and tonality of the noise sources. This allows for a penalty/ correction to be applied to the measured noise level of the source (L_{Aeq}) to give the rating level ($L_{Ar,T}$).

It considers the likelihood of complaints by considering the margin by which the noise in source the background noise level.

BS 4142 states that and exceedance of the noise source of the background noise by:

- +10 dB or more indicates that complaints are likely,
- + 5 dB is of marginal significance, and;
- The rating level is more than 10 dB below the measured background noise level, then this is a positive indication that complaints are unlikely.

BS4142 outlines guidance for penalty corrections to be applied to the noise sources in question should the noise source have one of the following characteristics:

- The noise contains a distinguishable, discreet, continuous tone (whine, or hum);
- The noise contains distinct impulses (i.e. bangs),
- The noise is intermittent or:
- The noise is irregular.

EPA NG4

EPA NG4 outlines that noise attributable solely to onsite activities from a licenced premises should not exceed the following limits:

- *Daytime (07:00hrs – 19:00hrs) – 55dB $L_{Ar,T}$*
- *Evening (19:00hrs – 23:00hrs) – 50dB $L_{Ar,T}$*
- *Night time (23:00hrs – 07:00hrs) – 45dB $L_{Aeq,T}$*

During daytime and evening periods rigorous efforts should be made to avoid clearly audible tones and impulsive noise at all sensitive locations. A penalty of 5dB for tonal and/or impulsive elements is to be applied to the daytime and evening measured $L_{Aeq,T}$ values to determine the appropriate rating level ($L_{Ar,T}$). In all cases, an assessment by a competent person will be required.

During the night-time period no tonal or impulsive noise from the facility should be clearly audible or measurable at any NSL.

4 ProPG Stage 1 – Assessment

The stage one risk assessment is used to assess the site for potential risks that may occur in terms of noise impact. The ProPG sets out four categories of risk:1) negligible, 2) low, 3) medium or 4) high risk. Figure 2 below illustrates the ProPG risk assessment and the values associated with each risk category.

The risk assessment also considers the risk based on the number of L_{AFmax} events per night as follows;

- A site should not be considered a negligible risk if more than 10 L_{AFmax} events exceed 60 dB during the night period and;
- A site should be considered a high risk if the L_{AFmax} events exceed 80 dB more than 20 times per night.

Paragraph 2.9 of ProPG states that,

> *"The noise risk assessment may be based on measurements or prediction (or a combination of both) as appropriate and should aim to describe noise levels over a "typical worst case" 24 hour day either now or in the foreseeable future."*

To assess the noise impact with the ProPG risk categories a baseline noise survey was undertaken on the site to quantify the existing noise environment.

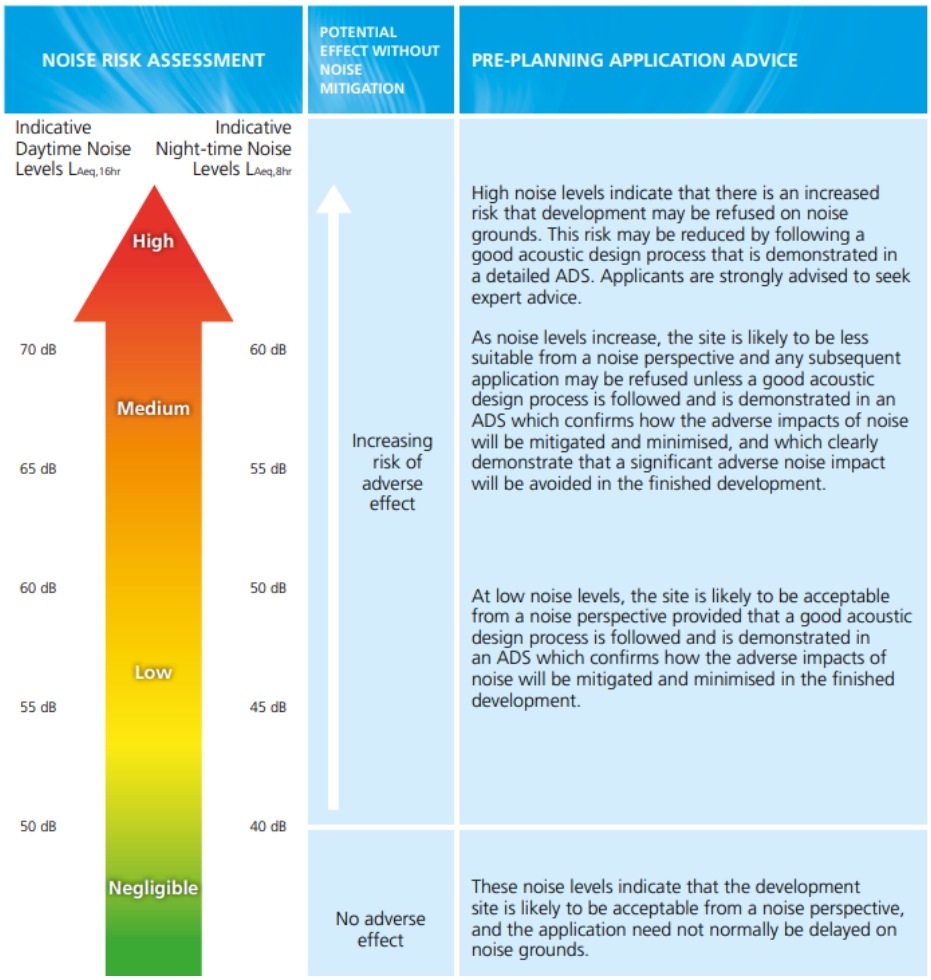


Figure 3: ProPG Risk Analysis

4.1 Baseline Noise Survey

An attended noise survey was conducted to quantify the existing noise environment. The attended measurement survey included measurements across the site and attended sound exposure level measurements of train noise from the train tracks located to the south of the site. The purpose of the measurements was to quantify the existing noise environment to assess the break in noise.

4.1.1 Site Description and Measurement Locations

The site is located Lynch Lane, Kishoge, Lucan, Co. Dublin. The site is bounded by a residential housing development to the east, Lynch Lane to the north, greenfield site to the east, and the Dublin Heuston - Cork (all intermediate stations) and Grand Canal Dock and Dublin Heuston – Portlaoise rail line to the south.

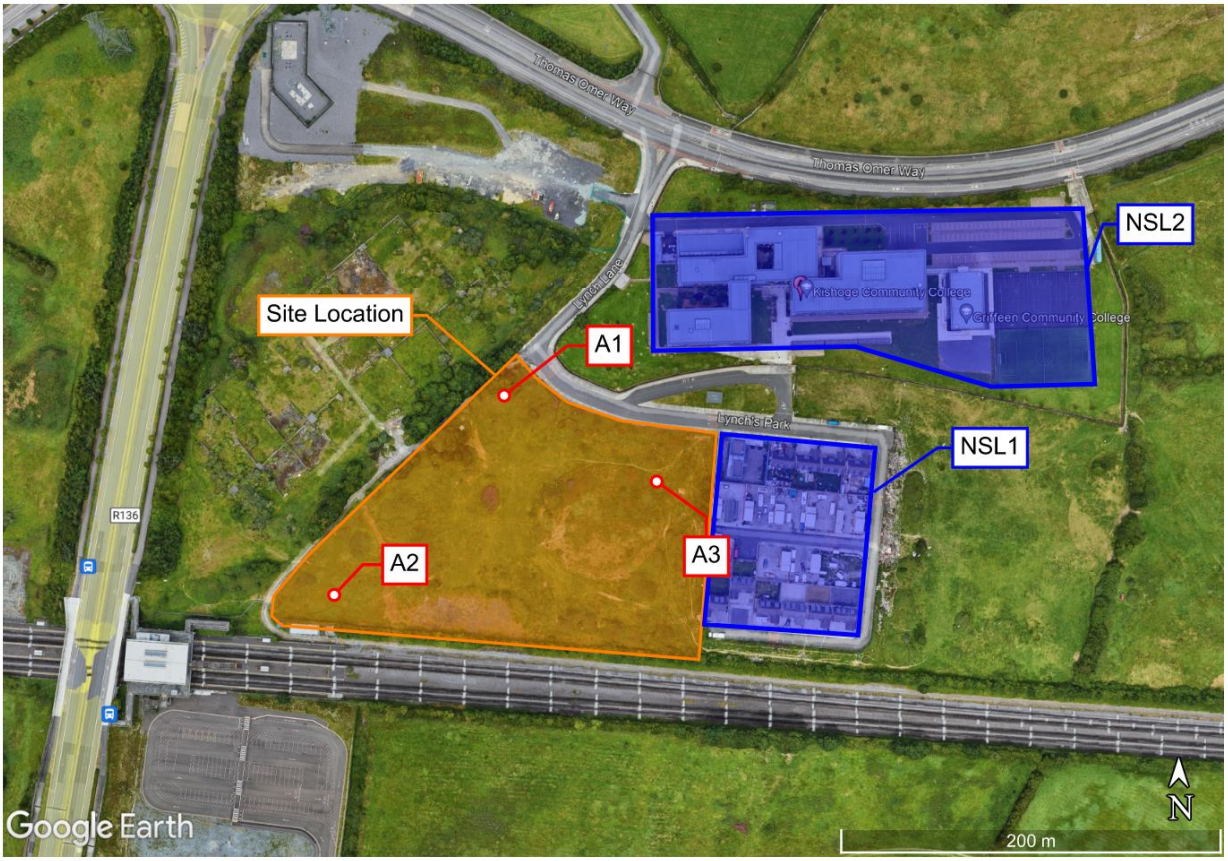


Figure 4: Site location, noise sensitive locations and measurement locations A1-A3.

4.1.2 Survey Methodology and Personnel

The attended survey was completed by Cathal Reck (Technical Engineer) and Daniel Cousins (Field Engineer) on the 21st of March 2024.

Attended Noise Measurements

Noise measurements were undertaken in general accordance with ISO 1996-1:2016 using ISO Class 1 sound analysers. Attended measurements were taken for a duration of 15 and 60 minute periods in various locations as noted in Figure 4. Care was taken to avoid any effect on the measurement of extraneous noise, acoustic vibration, or interference. During the attended noise measurements, the sound level meter was positioned at approximately 1.5m above the ground level. The weather conditions were calm (wind less than 5m/s) with no rain, a wind shield was used for the duration of the attended surveys. The noise logger was calibrated before and after the survey and no significant drift was noted.

Figure 5: Attended Measurement Setup.

4.1.3 Survey Period

The attended noise measurements were undertaken on the 21st of March 2024. Due to security concerns, it was agreed that the best approach was to undertake attended site measurements and to model the site based on these calibration points.

4.1.4 Noise Measurement Equipment

A Class 1 sound level meter/noise logger in general accordance with IEC 61672-1:2013 was used for the attended measurements. Table 4 below summarises the measurement equipment used.

Table 4: Noise Measurement Equipment

Description	WD Asset Number	Model	Serial No.	Calibration Certificate No.	Calibration Due Date
Sound Level Meter	SLM3	Nor 140	1403082	SLM230219	27/09/2025
Sound Level Meter	SLM2	NOR140	1406532	SLM230218	27/09/2025
Calibrator	CAL1	Nor 1251	31056	AC230226	16/10/2024

4.1.5 Subjective Noise Environment

During the attended noise survey, the following noise sources were identified:

- Road traffic from R136 which was the most dominant source of noise in the area,
- Rail noise from train passbys.
- Birdsong,
- Occasional noise from Kishoge Community College,

4.2 Noise Measurement Results

Attended measurements were taken to measure the noise levels across the site. This section outlines the results of the attended noise measurements.

Attended Measurement Results

Table 5 outlines the results of the attended measurement survey.

Table 5: Attended Noise Measurement Results

Measurement					Measured Noise Levels		
Location	Date	Time (hrs)	Period	Duration (mins)	L_{Aeq} dB	L_{AFmax} dB	L_{A90} dB
A2	21/03/2024	04:34	Night	15	48	65	43
A2	21/03/2024	05:06	Night	15	50	61	46
A3	21/03/2024	05:24	Night	15	50	66	46
A1	21/03/2024	05:43	Night	15	54	72	49
A2	21/03/2024	06:03	Night	15	59	81	51
A3	21/03/2024	11:14	Day	15	55	73	52
A2	21/03/2024	11:45	Day	15	57	75	54
A3	21/03/2024	12:17	Day	15	56	85	51
A3	21/03/2024	12:38	Day	60	56	80	51
A1	21/03/2024	05:05	Night	15	48	59	45
A2	21/03/2024	05:29	Night	15	53	76	47
A3	21/03/2024	05:54	Night	15	53	66	49
A2	21/03/2024	11:12	Day	15	57	75	52
A2	21/03/2024	11:31	Day	15	56	69	52
A3	21/03/2024	11:59	Day	15	55	80	51
A2	21/03/2024	12:31	Day	15	58	75	54
A3	21/03/2024	12:56	Day	15	55	78	50
A2	21/03/2024	13:18	Day	15	54	65	52
A1	21/03/2024	13:39	Day	15	58	77	52

4.2.1 Sound Exposure Level Measurements

This section outlines the instances where a there was a train pass on the rail line to the south of the site. The following rail routes are serviced on this line:

- Dublin Heuston Intercity to Cork (all intermediate stations)
- Dublin Heuston Intercity to Limerick Junction (all intermediate stations)
- Dublin Heuston Intercity to Athlone and beyond (all intermediate stations)
    - Including Galway Ceannt and Westport
- Dublin Heuston Intercity to Waterford (all intermediate stations)
- Dublin Heuston Commuter to Portlaoise (all intermediate stations)
- Dublin Heuston Commuter to Newbridge (all intermediate stations)

To calculate the impact of the train pass on the façade of the proposed building it is possible to predict the noise impact using the measured L_{Aeq} from the train pass and calculating the sound exposure level using the following equation:

$$L_{AX} = LAeq + 10*\log_{10}(d1/d2) - 10*\log_{10}(N) + 10*\log_{10}(T)$$

Where:

L_{Aeq} is the measured level of the event
N number of vehicle movements
T time (seconds)
d1 distance from the source to the receiver
d2 distance from the source to the measurement

Train Passes

Table 6 below outlines the sound exposure levels for train passes on the rail line to the south of the proposed development.

Table 6: Measured SEL Data for train passes

Type	Date	Location	Time	Duration (seconds)	L_{Aeq} dB	L_{AFmax} dB	SEL dB
Iarnrod Eireann Intercity Fleet							
Train	21/03/2024	A2	11:34	13	63	77	74
Train	21/03/2024	A2	11:42	11	64	69	74
Train	21/03/2024	A2	11:47	12	69	72	80
Train	21/03/2024	A2	11:48	15	66	71	77
Train	21/03/2024	A2	12:05	10	67	82	77
Train	21/03/2024	A2	12:09	15	64	74	76
Train	21/03/2024	A2	12:18	12	67	79	78
Train	21/03/2024	A2	12:29	13	61	75	72
Train	21/03/2024	A2	12:32	12	66	76	77
Train	21/03/2024	A2	12:43	17	61	67	74
Train	21/03/2024	A2	12:51	19	68	75	81
Train	21/03/2024	A2	12:53	16	61	73	73
Train	21/03/2024	A2	12:53	11	60	67	70
Train	21/03/2024	A2	12:57	17	72	85	84
Train	21/03/2024	A2	13:07	17	65	75	77
Train	21/03/2024	A2	13:09	10	70	78	80
Train	21/03/2024	A2	13:23	13	68	74	79
Train	21/03/2024	A2	13:33	9	62	65	71
Train	21/03/2024	A2	13:39	10	71	84	81
Train	21/03/2024	A2	13:51	11	72	77	82
Iarnrod Eireann Commuter Fleet							
Train	21/03/2024	A2	12:52	16	65	70	77
Train	21/03/2024	A2	13:12	10	79	87	89

Discussion of Measurement Results

The measurements were taken on a weekday period to provide an accurate understanding of the noise climate during busier times. From the noise levels recorded, the dominating noise sources included passing traffic along the R136, occasional traffic movements on Lynch Lane, and train noise on the southern located train tracks.

Based on the ProPG risk assessment of the L_{AFmax} noise levels, the site is not considered high risk as there are not typically more than 20 occurrences exceeding 80dB L_{AFmax}.

Wave Dynamics conducted the assessment using attended measurements only, as there were security and access concerns when attempting to deploy an unattended noise logger. As the area was a large open site with nowhere to securely deploy a noise logger, only attended measurements were conducted. L_{AFmax} events recorded during the attended survey have been applied to the night-time model and estimated in order to ensure compliance with the ProPG criteria.

4.3 Weather Conditions for Monitoring Period

Good weather conditions were noted in general during the deployment and collection during the attended survey, with winds of less than 5 m/s and no rain during the attended surveys.

4.4 Future Noise Levels

Road Noise

Based on data from the TII (2017) the average rate of growth on Irish roads is 3.9%. Assuming linear growth of 3.9% over the next 10 years an increase in noise levels from road traffic of 2dB would be expected. WDA have allowed for this growth in our assessment.

We understand it is proposed to construct a new distributer road in Clonburris, the information on the new road is not currently available at the time of planning. It is recommended that any new infrastructure projects seeking planning following the submission of this planning report consider the impact of the proposed development.

Rail Noise

The existing rail line to the south of the site is used to service the following routes:

- Dublin Heuston Intercity to Cork (all intermediate stations)
- Dublin Heuston Intercity to Limerick Junction and beyond to Cork Kent (all intermediate stations)
- Dublin Heuston Intercity to Limerick Colbert (all intermediate stations)
- Dublin Heuston Intercity to Athlone and beyond (all intermediate stations)
    - Including Galway Ceannt and Westport
- Dublin Heuston Intercity to Carlow and beyond to Waterford (all intermediate stations)
- Dublin Heuston Commuter to Portlaoise (all intermediate stations)
- Dublin Heuston Commuter to Newbridge (all intermediate stations)

The earliest pass occurs at approximately 06:15 hrs and the latest at 23:40hrs. The train passes approximately 11 times during the night-time period (11pm-7am).

Based on the information in Appendix D of the Iarnrod Eireann Public Consultation Brochure the number of proposed trains that will transit the rail line adjacent the proposed site is not currently available. An allowance of up to 100% increase in train passes has been allowed for in the assessment.

Kishoge station is to the South of the site, it is currently unused and will be opening soon, it is not anticipated that this station will lead to an increase of the rail traffic on the line however there is potential for trains to blow their horn as they enter and exit the station. This will need to be considered as part of the assessment.

4.5 ProPG Stage 1 – Initial Risk Assessment

The measured noise levels on the site and future noise levels have been predicted for road traffic noise to assess the probability of an adverse impact.

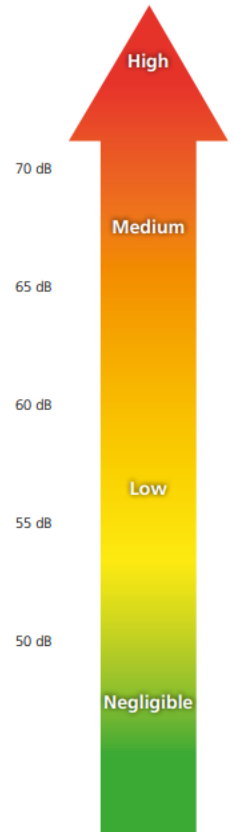
Table 7 below identifies the Noise Risk Categorisation of the site based on the predicted free field façade noise levels. The site has been categorised as medium to high risk in accordance with the ProPg risk assessment. Considering

this risk categorisation of the development mitigation measures will be required to mitigate the noise risk in following with ProPG guidance and good acoustic design process.

It should be noted that the ProPG 2017 states the following with regard to how the initial site noise risk is to be used:

"2.12 It is important that the assessment of noise risk at a proposed residential development site is not the basis for the eventual recommendation to the decision maker. The recommended approach is intended to give the developer, the noise practitioner, and the decision maker an early indication of the likely initial suitability of the site for new residential development from a noise perspective and the extent of the acoustic issues that would be faced. Thus, a site considered to be high risk will be recognised as presenting more acoustic challenges than a site considered as low risk. A site considered as negligible risk is likely to be acceptable from a noise perspective and need not normally be delayed on noise grounds. A potentially problematical site will be flagged at the earliest possible stage, with an increasing risk indicating the increasing importance of good acoustic design."

Table 7: ProPG Stage 1 Risk Assessment of Existing Noise Levels

Noise Risk Assessment		**Risk Assessment Rating**	
Indicative Daytime Noise Levels $L_{Aeq,16hour}$	**Indicative Night-time Noise Levels $L_{Aeq,8hour}$**	**Daytime Noise Levels**	**Night-time Noise Levels**
		**High Risk**	**High Risk**
		N/A	N/A
		Medium Risk	**Medium Risk**
		The majority of the site is within the medium risk contour for daytime noise levels.	The majority of the site is in the medium risk contour for nighttime noise levels.
		Low Risk	**Low Risk**
		Some of the northern area of the site is in the low risk contour for daytime noise levels.	Some of the northern area of the site is in the low risk contour for nighttime noise levels.
		Negligible Risk	**Negligible Risk**
		N/A	N/A

5 ProPG Stage 2- Full Assessment

This section outlines the full acoustic design assessment in line with ProPG guidance.

5.1.1 Element 1: Good Acoustic Design Process

ProPg States the following in relation to Good Acoustic Design Process:

"A good acoustic design process takes a multi-faceted and integrated approach to achieve optimal acoustic conditions, both internally (inside noise-sensitive parts of the building(s)) and externally (in spaces to be used for amenity purposes)."

"Good acoustic design should avoid "unreasonable" acoustic conditions and prevent "unacceptable" acoustic conditions (these terms are defined in Element 2). Good acoustic design does not mean overdesign or gold plating of all new development but seeking to deliver the optimum acoustic outcome for a particular site"

The following considerations are recommended by ProPG:

- *"Check the feasibility of relocating, or reducing noise levels from relevant sources.*
- *Consider options for planning the site or building layout.*
- *Consider the orientation of proposed building(s).*
- *Select construction types and methods for meeting building performance requirements.*
- *Examine the effects of noise control measures on ventilation, fire regulation, health and safety, cost, CDM (construction, design and management) etc.*
- *Assess the viability of alternative solutions.*
- *Assess external amenity area noise."*

5.1.2 Discussion of Good Acoustic Design

Mitigation of Sources

The development is located close to the road and rail noise sources which are not on or part of the development therefore it is not possible to reduce or relocate the relevant noise sources.

Site Layout and Orientation

The southern elevation is the most exposed to road traffic noise. The R136 is at a higher elevation than the proposed site and therefore little screening will be provided with the upper levels having direct line of site to the road. Similarly with the rail line to the south there is currently no boundary wall between the site and the rail line and therefore little screening will be achieved at any façades which directly face the line.

Construction Methods

Section 5.2.3 considers the construction methods required to meet the building performance control measures. The construction measures are in general robust, providing standard external wall and façade details to meet thermal, fire and weathertightness requirements will in general provide adequate performance to achieve good levels of sound insulation.

Impact of Noise Control Measures

The effects for noise control measures on other building elements including ventilation are considered in Section 5.2.3. It is generally impractical to provide ventilation via openable windows in urban/built up areas. An open window will provide 10-15dB of attenuation which in built-up urban and suburban areas is not practical. ProPG makes reference to specific cases in suburban areas where the development is beside a transport link, in this case the development is adjacent to the rail line In general, the good acoustic design process in these areas is to provide ventilation via attenuated natural vents or mechanical ventilation. This allows the occupants to have adequate ventilation with adequate noise levels.

External Amenity

ProPG states the following with regard to external amenity spaces:

"The acoustic environment of external amenity areas that are an intrinsic part of the overall design should always be assessed and noise levels should ideally not be above the range 50 – 55 dB LAeq,16hr."

The external amenity source noise levels are considered in section 5.3.

5.2 Element 2 – Assessment of Internal Noise Levels

This section outlines the assessment of the building envelope including the façade noise modelling, and specification of the glazing requirements.

A noise intrusion assessment for the proposed development has been completed in accordance with the methodology outlined International Standard *ISO EN 12354-3:2017 Building acoustics — Estimation of acoustic performance of buildings from the performance of elements — Part 3: Airborne sound insulation against outdoor sound*. The standard provides a method for calculating the indoor noise levels due to for instance Rail Traffic Noise.

The calculation method accounts for multiple factors including:

- The external noise level at the affected building façade.
- The frequency characteristics of the specific noise source (i.e. Railway Noise).
- The sound insulation performance of each façade element (i.e. Windows, Walls, Roof…).
- The area of each façade element.
- Direct and flanking transmission paths.

5.2.1 Noise Prediction Modelling

Following the survey, a computational noise model of the development using SoundPLAN 9.0 modelling software was developed to establish the noise levels from the development in a worst-case scenario. The software implements the algorithms contained in ISO 9613-1 and ISO 9613-2. The noise model considers:

- Distance attenuation,
- Source and receptor locations,
- Barrier effects (buildings, walls etc)
- Topographical elevations,
- Ground effects and absorption,
- Source sound power levels,
- Directivity and orientation of the source,
- Atmospheric attenuation and meteorological effects,

The noise model has been calibrated against the attended and unattended noise measurements. SoundPLAN 9.0 software predicts road traffic noise levels in accordance with *Calculation of Road Traffic Noise* (UK Department for Transport, 1998). This is the recognised appropriate standard for road traffic noise prediction as per TII (Transport Infrastructure Ireland).

The following information was input into the model:

- Development layout provided by architect's drawings.
- Google Maps terrain and elevation data of surrounding area.
- Traffic speed of 60km/hr as per local signage and onsite observation.
- Percentage of HGV assumed at 4% based on assessment of similar local roads.
- Annual traffic growth rate of 3.9%.
    - This has been assessed based on pre-covid traffic growth data.

5.2.2 Predicted Road Noise Levels

Incident road traffic noise levels have been predicted across all facades of the development for both the day and nighttime period.

Daytime Noise Levels

Figure 6, Figure 7 and Figure 8 below outline the predicted road traffic noise levels across the proposed site for the day time period at 1.5m, 4.5m and 6.5m height respectively.

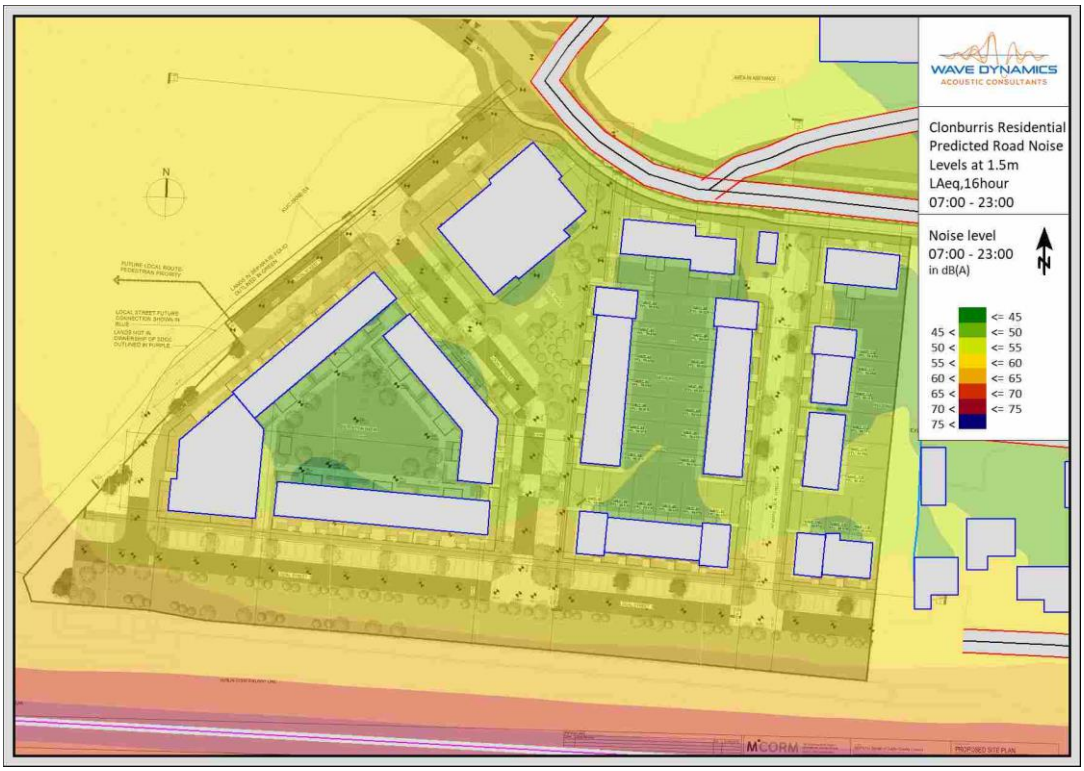


Figure 6: Predicted $L_{Aeq,16hour}$ (07:00Hrs – 23:00Hrs) at 1.5m height for the future development.

Figure 7: Predicted $L_{Aeq,16hour}$ (07:00Hrs – 23:00Hrs) at 4.5m height for the future development.

Figure 8: Predicted $L_{Aeq,16hour}$ (07:00Hrs – 23:00Hrs) at 6.5m height for the future development.

Nighttime Noise Levels

Figure 9, Figure 10 and Figure 11 below outline the predicted road traffic noise levels across the proposed site for the nighttime period at 1.5m, 4.5m and 6.5m height respectively.

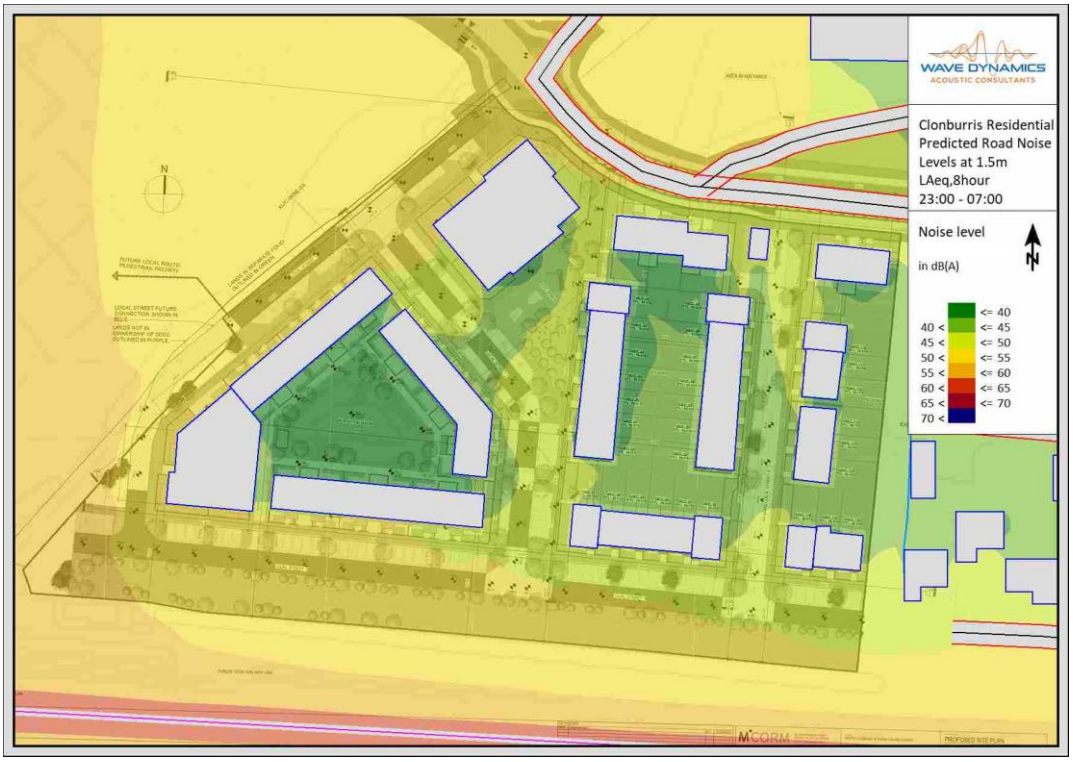


Figure 9: Predicted $L_{Aeq,8hour}$ (23:00Hrs – 07:00Hrs) at 1.5m height for the future development.

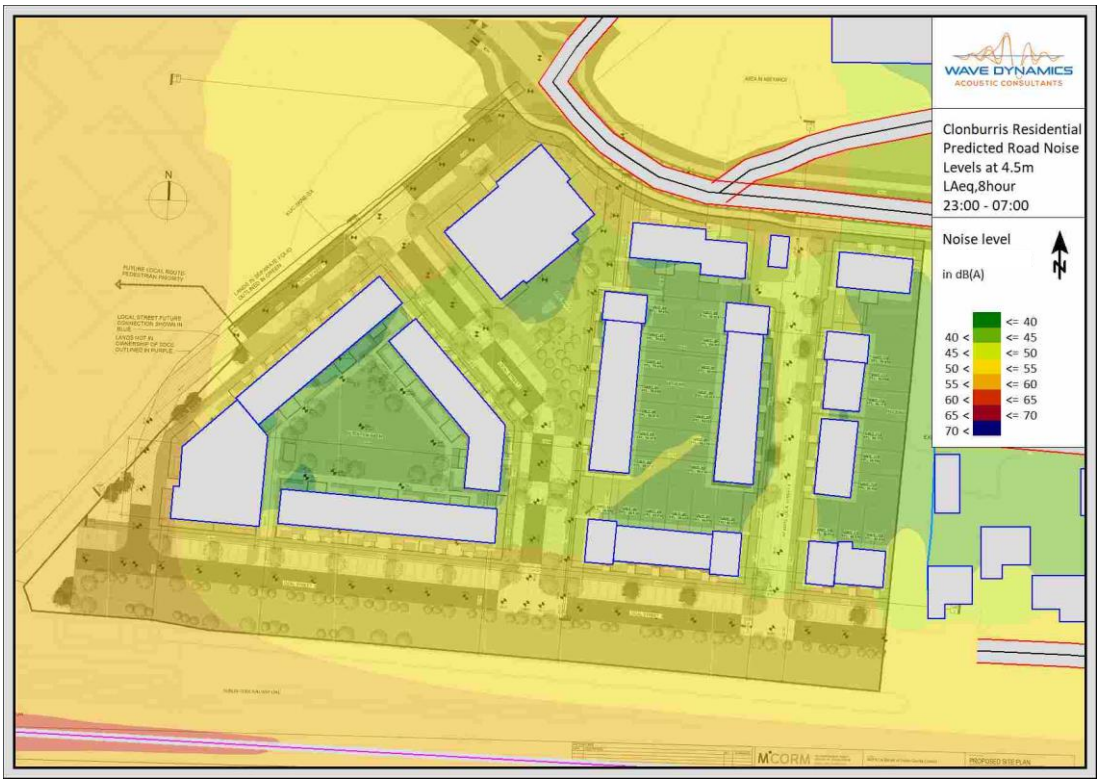


Figure 10: Predicted $L_{Aeq,8hour}$ (23:00Hrs – 07:00Hrs) at 4.5m height for the future development.

Figure 11: Predicted $L_{Aeq,8hour}$ (23:00Hrs – 07:00Hrs) at 6.5m height for the future development.

Local Access Roads

It should be noted that the development has a local access roads from the proposed entry road onto the site at Lynch Lane. Break in noise through the façade has been considered as part of this assessment for vehicles entering and leaving the site via the local access roads.

5.2.3 Building Envelope Specification

This section outlines the building envelope requirements based on the measurements outlined in Section 3. Facade, wall, glazing, roof and ventilation specifications have been determined to achieve the internal noise level criteria for the development. The specification has been determined in accordance with EN ISO 12354-3: 2017 based on the predicted façade day and night noise levels, the room and facade dimensions from the drawings provided.

The building envelope specification should be confirmed by the acoustic consultant at design stage once the internal layouts and building envelope design development has been completed. Any changes to the assumed ventilation strategy and glazing requirement should be considered as part of the review and it should be based on the internal noise levels cited in this report.

Glazed Elements and Ventilation

The glazed elements and ventilation openings are typically the acoustically weakest elements of any façade. The required sound insulation performance of façade glazed elements and ventilation openings is outlined in Table 8 below.

It is required that the glazing, frame and seals as a whole achieve the performance when the window is in the closed position. The performance requirements outlined in Table 8 below are considered to provide adequate sound insulation to achieve the relevant day and night internal design goals respectively. A markup outlining the performance requirements for each façade are included in Appendix B.

Table 8: Sound Insulation performance requirements for glazed elements and ventilation.

Façade	Glazed Elements (Frame & Glazing) Sound Insulation Requirements (Indicative requirements equal or approved)							Façade Ventilation Requirement[2]
	Octave Band Frequency Requirements[1] R dB						Glazing Acoustic Performance dB R_w	
	125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz		
RED	30	28	36	40	51	34	39dB R_w	42dB $D_{n,e,w}$ (1) Natural Ventilation
BLUE	23	26	29	35	41	29	34dB R_w	37dB $D_{n,e,w}$ (1) Natural Ventilation

(1) Natural ventilation assumed throughout, the performance cited for the ventilator is in the open position. Should this change to mechanical ventilation the above specification may be reduced. An acoustic consultant should be engaged to assess the level of reduction appropriate to maintain the internal noise level criteria.

(2) The calculation assumes a maximum of 1 ventilation opening per bedroom at the above specification.

It is important to note that the requirements outlined above are minimum requirements for the glazed element as a whole. The octave band values are indicative and specific to the assessed glazing type, equal or approved to meet the minimum project requirements is acceptable.

We understand the ventilation strategy is proposed as a natural ventilation system. Based on the information provided to us on the ventilation system. Should the ventilation strategy change to a mechanical ventilation strategy an Acoustic Consultant should be engaged to provide an appropriate mechanical ventilation sound insulation performance requirement for any sealed systems. Typically, the use of a mechanical ventilation strategy will lead to a reduced glazing specification compared to a naturally ventilation system. This assessment is based on the windows in closed position.

It is recommended that the facade supplier provide laboratory tests confirming the airborne sound insulation performance in the absence of suitable laboratory data a composite sound reduction index calculation undertaken by a suitably qualified acoustic consultant can be used to demonstrate compliance.

External Wall Construction

The façade wall construction has been assumed to achieve a minimum sound insulation performance of 56dB R_w. Typical façade construction such as concrete, blockwork, timber frame and brick offer high levels of sound insulation and will meet this requirement.

Roof Construction

The roof construction has been assumed to achieve a minimum sound insulation performance of 50dB R_w. Any skylights and glazing in the roof system to corridor or communal areas should be of standard double-glazed construction to meet a performance of minimum 29 dB R_w. If there are any skylights to habitable bedrooms Wave Dynamics should be informed to provide specific guidance in each case.

Consideration of Openable Windows

From a review of predicted noise contours across the site there are a number of facades which benefit from screening from the building layouts. The areas facing into the courtyard are provided with natural shading from the proposed buildings themselves. In some locations the screening provided by the proposed buildings is adequate to allow for consideration of openable windows to provide ventilation during the daytime period.

Figure 12 below shows the facades of the development which have low enough onset noise levels to achieve the internal noise levels with windows in the half-open or tilted position in the daytime period.

Figure 12: Locations of façades suitable for ventilation via openable windows in the daytime period.(Reference: SHB5-CSD-DR-MCORM-AR-P3-1002-PROPOSED SITE PLAN-)

5.3 Element 3- External Amenity Spaces

The external amenity spaces on the development include external amenity in the form of private balconies for the apartments, rear gardens to the houses, a communal amenity space at ground level and playground. All external amenity spaces have been assessed and it can be concluded that all rear gardens of the houses, the communal amenity space and the majority of balconies and terraces across the site are predicted to achieve the desirable external amenity noise levels.

The balconies on the western and southern elevation of Block A, the northwestern elevation of Block B, the southern elevation of Duplex wing 3 and the western elevation of Duplex wing 2 are predicted to have noise levels in the range 55-60dB $L_{Aeq,16hour}$. This is an expected exceedance of the ProPG and BS8233 criteria of up to 5dB. However, alternative appropriate amenity has been provided on the development for these residents in the form of communal ground level amenity space and a playground within the development. These large open spaces are predicted to comply with the recommended external amenity noise criteria as outlined in ProPG and BS8233 as it benefits from screening of the apartment block and duplex blocks. This is in line with element 3(v) of ProPG which states:

"Where, despite following a good acoustic design process, significant adverse noise impacts remain on any private external amenity space (e.g. garden or balcony) then that impact may be partially off-set if the residents are provided, through the design of the development or the planning process, with access to:" ….

"a relatively quiet, protected, nearby, external amenity space for sole use by a limited group of residents as part of the amenity of their dwellings; and/or

a relatively quiet, protected, publicly accessible, external amenity space (e.g. a public park or a local green space designated because of its tranquillity) that is nearby (e.g. within a 5 minutes walking distance)".

Based on the measured noise levels at the site it is predicted that the external noise levels in both the ground level amenity space, and all balconies on the eastern elevation of block A, and southeast elevation of block B will achieve the ProPG recommendations for desirable external amenity noise levels of 50-55dBA $L_{Aeq,16hour}$.

Figure 13 below highlight the proposed external amenity spaces.

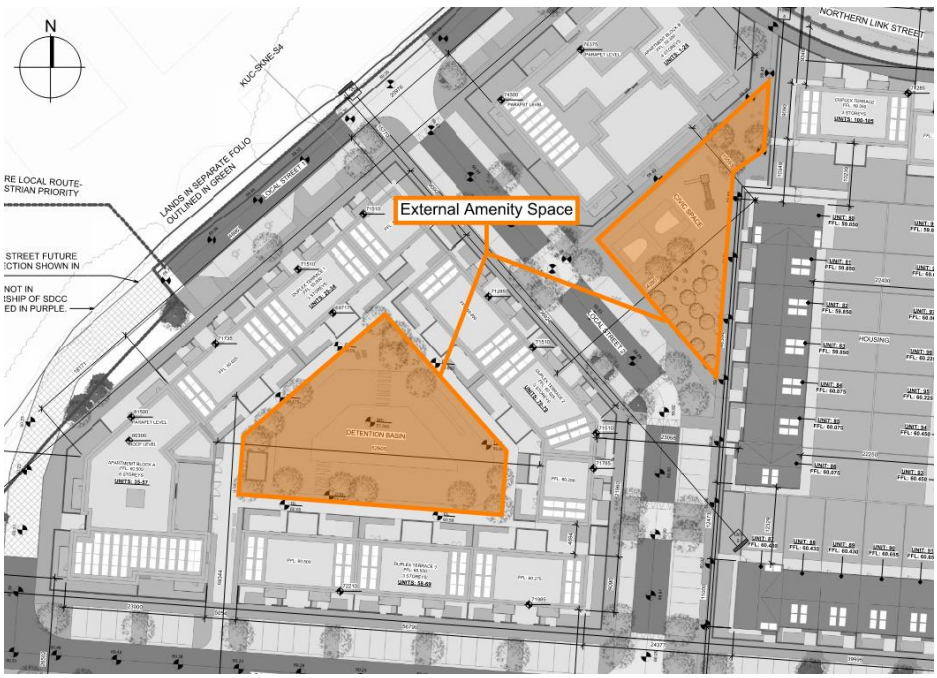


Figure 13: Communal Amenity Space at Ground Floor Level (Reference: SHB5-CSD-DR-MCORM-AR-P3-1002-PROPOSED SITE PLAN-)

5.4 Element 4- Assessment of Other Relevant Issues

This section of the acoustic design report considered the other relevant issues. Element 4 considers other issues which may remain relevant to the assessment, these issues are as follows:

- 4(i) compliance with relevant national and local policy.
- 4(ii) magnitude and extent of compliance with ProPG .
- 4(iii) likely occupants of the development.
- 4(iv) acoustic design v unintended adverse consequences and;
- 4(v) acoustic design v wider planning objectives.

5.4.1 Compliance with Relevant National and Local Policy

There are no specific noise guidance or policy documents for residential developments. The Dublin Agglomeration Noise Action Plan refers to the ProPG as the relevant document for assessment of the noise impact on new residential developments as followed in this acoustic design statement.

5.4.2 Magnitude and Extent of Compliance with ProPG

This report demonstrates that all dwellings will meet the specified internal noise level requirements provided the guidance in this report is followed. External amenity spaces have been provided in line with the guidance set out in ProPG. Based on this the development is in general compliance with the ProPG requirements.

5.4.3 Likely Occupants of The Development

Additional needs of the future occupants are not known at this stage however the needs of all potential occupants have been considered with the assessment of adequate internal noise levels and provision of adequate external amenity spaces to meet the needs of potential occupants.

5.4.4 Acoustic Design v Unintended Adverse Consequences

The design has considered the impact of adverse consequences, mitigation has been provided by specification of the sound insulation and ventilation requirements.

5.4.5 Acoustic Design v Wider Planning Objective

Where possible the wider planning objectives have been considered including the need for residential housing with good transport links. It is assumed that the winder planning objectives have been adhered to by following the ProPG guidance.

5.5 Stage 2 Assessment Conclusion

The stage 2 assessment considers all four (4) elements, the principals of good acoustic design have been followed.

The element 2 assessment has considered the measures required to provide an adequate acoustic environment with appropriate noise levels for internal spaces. The sound insulation and ventilation requirements have been specified based on the predicted façade noise levels.

The element 3 assessment of external amenity spaces has considered the noise impact on the development and the external amenity spaces. The appropriate provision of external amenity space has been provided through the use of balconies and the ground level communal amenity space in line with the ProPG guidance.

Other relevant issues have been considered including, local policy, unintended consequences and the wider planning objectives.

6 Construction Noise Assessment

6.1 Noise Sensitive Locations and Noise Limits

Based on the location of the site, the construction works and its proximity to the residential receptors the following noise sensitive receptors have been identified:

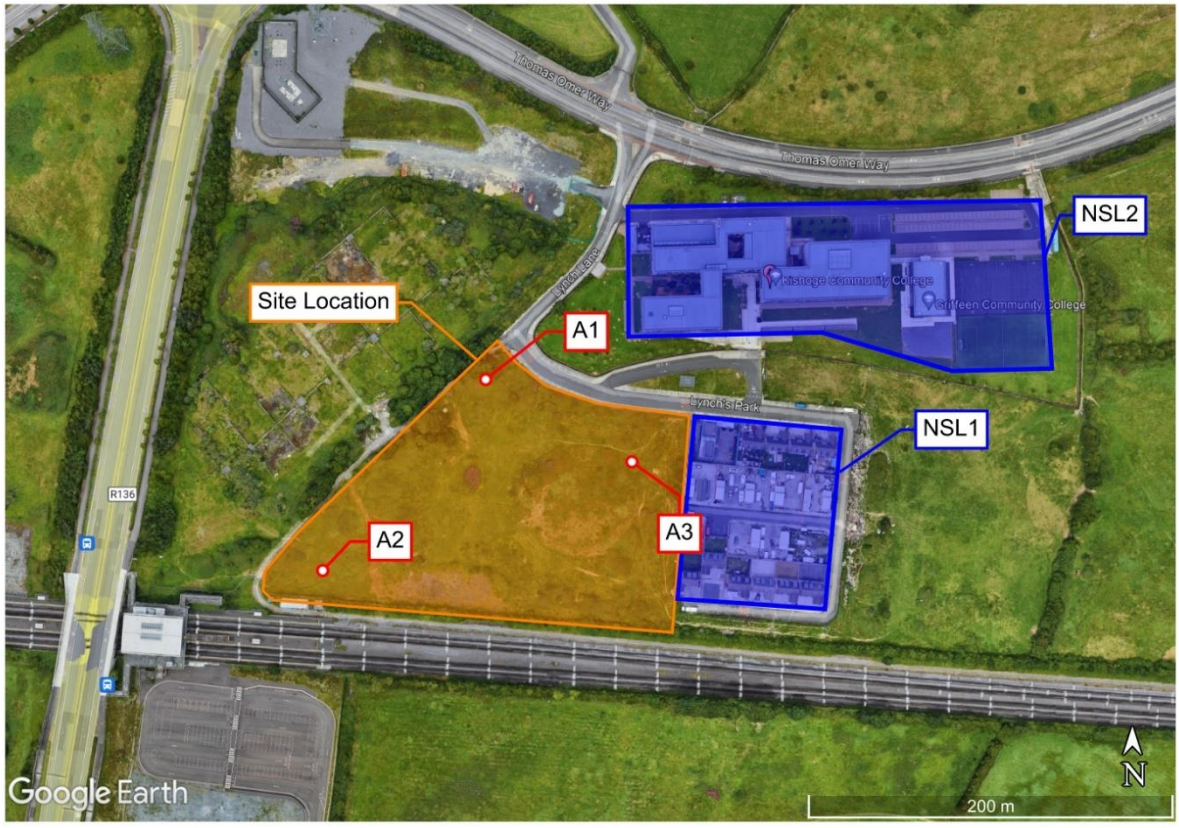


Figure 14: Site location and noise sensitive locations 1-3

Noise Limits

The criteria for the project based on the criteria outlined in section 3 and the background noise in the area the project criteria for construction noise is outlined below in Table 9. Reference to the baseline survey results and guidance contained in BS 5228 Part 1 for construction noise levels threshold for significance affect from constriction activities is set as follows for the closest noise sensitive locations:

Table 9: Project Criteria

Construction Noise Limits			
Noise Sensitive Location	**Distance To the Centre of The Site**	**Ambient Noise dB(A) L_{Aeq}**	**Noise Limit dB(A) [1] L_{Aeq}**
NSL1	100	55	65
NSL2	130	54	65

(1) 65 dB (A) lower threshold limit

For the appropriate assessment period (i.e. daytime in this instance) the ambient noise level is determined and rounded to the nearest 5dB. If the noise generated by construction activities exceeds the appropriate category value, then a significant effect is deemed to occur.

For large infrastructure projects a limit of 75dB(A) is set as the appropriate the upper limit for construction noise within urban areas near main roads in heavy industrial areas. This is considered an appropriate upper limit for construction noise.

6.2 Construction Noise Predictions

Construction noise for the site has been predicted based on the information provided. A summary of the expected equipment, durations and operating times are provided in Table 10. The noise sources are assumed to be located at the centre of the development site. The prediction methodology in BS5228 has been used to calculate the noise level over a typical day for each of the main construction stages.

The closest noise sensitive locations have been identified as the residential dwellings to the east and the school Kishoge Community College, along with Griffeen Community College to the North.

Table 10: Proposed construction equipment, noise levels and duration.

Construction Phase	Item of Plant (BS 5228-1:2009+A1:2014 Ref)	Noise Level (L_{Aeq} at 10m dB(A))	Approximate Timeline (Weeks)	On Time of 10 hr day
Site Setup	Digger Carpentry tools Skill saw	77 78 84	1-3	4 hours 3 hours 2 hours
Substructure	Excavators Con saws Rail saw Drills Dumper 7t Cement Mixer Lorry Idling Telescopic Handler	77 84 85 89 81 75 80 71	4-18	2 Hours 3 Hours 2 Hours 1 Hours 2 Hours 4 Hours 2 Hours 5 Hours
Superstructure	Drills Power tools Impact steel Hammer Dumper 7t Cement Mixer Lorry Idling Telescopic Handler	89 70 69 69 81 75 80 71	19-39	2 Hours 3 Hours 2 Hours 0.5 Hours 3 Hours 2 Hours 2 Hours 5 Hours
External finishes	Tools Con saw	70 84	40-52	5 hours 2 hours
Internal finishes	n/a	n/a		n/a

Table 11 summarises the predicted construction noise level at the noise sensitive locations. Examination of the results indicate the construction noise without mitigation is predicted to exceed the noise limits during all stages of the development.

*Table 11: Predicted noise levels **without** mitigation for each stage.*

Location	Noise Limit	Predicted noise level (construction noise + ambient) with no mitigation L_{Aeq}, dB			
		Site Set Up	Substructure	Superstructure	External finishes
NSL1	65	70	75	74	68
NSL2	65	69	74	73	66

The calculations set out above are based on assumed site construction works and a combination of the plant operating at the same time i.e. worst-case scenario.

Table 12 Attenuation required based on the construction noise predictions.

Location	Noise Limit	Noise reduction required at each stage of works to meet criteria (dBA)			
		Site Set Up	Substructure	Superstructure	External finishes
NSL1	65	5	10	9	3
NSL2	65	4	9	8	1

Noise mitigation measures will be required at all stages of construction. A combination of the mitigation measures outlined in section 6.3 should be used to reduce the levels of construction noise by the values listed in Table 12 above.

6.3 Noise Mitigation Recommendations

Best practice control measures for noise from construction sites are found within BS 5228 (2009 +A1 2014) part 1. Construction noise impacts are expected to vary during the construction phase of the project, this impact will depend on the distance between the construction activities and noise sensitive receptor. The contractor will ensure that all best practice noise and control methods will be used, to ensure any negative noise impacts at off-site noise sensitive locations are minimised.

The best practice measures set out in BS 5228 (2009) Part 1 includes guidance on several aspects of construction site mitigation measures, this includes the

- selection of quiet plant and equipment;
- noise control at source of the noise;
- screening, and;
- public liaison.

6.3.1 General Recommendations

This section of the report sets out noise mitigation options and detailed comment on each one specifically for this site.

Selection of Plant and Equipment

The noise impact of all plant and equipment should be assessed prior to selection of plant for the project. Where an item of plant is identified as noisy with the potential to cause a negative noise impact it should be reviewed to check if there is an alternative quieter version of the same plant to undertake the same construction task.

Noise Control at Source

Where replacing a noisy item of plant is not viable or practical, consideration should be given to control that noise at source. This includes modifying the piece of plant or equipment to generate less noise, using dampening to control vibration induced noise or rattling. Example best practice mitigation measures to be considered are as follows:

- All plant and equipment to be switched off when idling.
- The use of white noise reversing alarms.
- Restriction on the dropping and loading of materials to less sensitive hours.
- The use of local screening for noisy activities or works with hand tools
- Not dropping materials onto hard surfaces and using rubber mats etc for the dropping of materials.
- Ensure all plant and equipment is well maintained and cleaned, all lubrication should be in line with manufacturers guidelines.

Screening

Screening when used correctly can be an effective method of reducing the construction noise impact on the NSL's. The use of site hoarding and careful selection of areas for noise works, using buildings on the site, site offices and the building being constructed to screen noise from the works.

Local screening of noisy works with the use of temporary acoustic barriers, examples are provided below:

- https://ventac.com/acoustic-products/noisebreak-acoustic-barrier/
- https://echobarrier.com/

Figure 15: Temporary Construction Noise Barrier © Ventac

Public Engagement

It is recommended that a public liaison officer should be put forward by the contractor to liaise with the local residents on matters relating to noise. Residents should be informed of any noise works scheduled where there is the potential to generate high levels of construction noise or if specialist works etc need to be conducted out of the working hours. This person should also be the point of contact for all complaints and be responsible for reviewing the noise monitoring results and exceedances.

Construction Noise Monitoring

Construction noise monitoring should be undertaken at periodic sample periods on the boundary with the nearest noise sensitive receptors.

Noise monitoring should be conducted in accordance with the International Standard ISO 1996: 2017: Acoustics – Description, measurement and assessment of environmental noise.

6.3.2 Site Specific Recommendations

Table 13 below outlines the recommended site-specific noise mitigation measures based on the attenuation required in Table 12.

Table 13: Attenuation required based on the construction noise predictions.

Construction Stage	Recommended Noise Mitigation Measure
Site Setup	Erect a minimum 2.4m high site hoarding that blocks the line of sight between noise source and receiver. Example construction for the site hording would be as follows: • A 2.4m high and 9mm plywood (4.5 kg/m^2). Barrier must be solid and not contain gaps at the bottom or between adjacent panels. Local screening using the examples provided in General Recommendations section 6.3.1 are required around hand tools in addition to hoarding. An absorptive lining should be considered for screening around hand tools will need to have an absorptive lining to avoid reflections increasing noise at other receivers. On this project 3 NSL's have been identified it is recommended that a noise monitor should be placed on the boundary with each of nearest noise sensitive locations closest to the works i.e. NSL's 1-2 are the most appropriate locations.
Substructure	Site hoarding to block line of sight. Local screening around noisy plant and equipment. Noise monitoring as above
Superstructure	Local screening around saws/hammers where possible. Use external new building to screen noise from works where possible. Noise monitoring as above
External finishes	Local screening around hand tools. Noise monitoring as above

6.4 Vibration

Prediction of vibration levels at receptors is complex and dependent on several variables including the excavation method, the nature of the used equipment, the properties of the subsoil, the heterogeneity of the soil deposit, the distance to the receptor and the dynamic characteristic of the adjacent structures. Therefore, limits or threshold criteria as set out in BS5228-2 are applied for buildings and humans. As noted above, specific manufacturer limits will apply to sensitive equipment.

BS5228-2 provides some historic data on vibration levels measured on sites from different types of piling equipment under specific conditions e.g. soil type, however there is no data for other types of equipment. Taking account of the distances to bridge from the works and notwithstanding ground conditions present, it is not anticipated that the vibration criteria outlined above will not be exceeded. However, it is recommended, precautionary vibration monitoring at the boundary with the nearest sensitive receptors is undertaken during construction (for vibration generating works).

6.4.1 Vibration Monitoring

Vibration monitors should be erected during the substructure phase of the development between the site and NSL 1 as these are closest vibration sensitive locations on the boundary of the site.

The Vibration monitoring stations should continually log vibration levels using the Peak Particle Velocity parameter (PPV, mm/s) in the X, Y and Z directions, in accordance with BS ISO 4866: 2010: Mechanical vibration and shock – Vibration of fixed structures – Guidelines for the measurement of vibrations and evaluation of their effects on structures.

Vibration Limits

The recommended vibration limits to avoid cosmetic damage to buildings, as set out in:

- British Standard BS7385: 1993: Evaluation and measurement for vibration in buildings Part 2: Guide to damage levels from ground borne vibration, and;
- British Standard BS5228-2: 2009 + A1: 2014: Code of practice for noise and vibration control on construction and open sites – Vibration.

The standards note that minor structural damage can occur at vibration magnitudes which are greater than twice those presented in Table 14 and major damage to a building structure is possible at vibration magnitudes greater than four times the values set out in Table 14. Definitions of the damage categories are presented in BS 7385-1:1990.

Table 14: Transient vibration guide values for cosmetic damage

Vibration PPV at the closest part of sensitive property to the source of vibration Frequency		
4 to 15 Hz	15 to 40Hz	40Hz and above
15 mm/s	20 mm/s	50 mm/s

Note 1: At frequencies below 4 Hz, a maximum displacement of 0.6 mm (zero to peak) is not to be exceeded
Note2: It should be noted that these values are at the base of the building.

7 Operational Noise Impact

The operational noise sources from the development include plant noise, traffic noise from cars entering and exiting the ground level car parking.

This section includes an assessment of the operational noise impacts for noise from the amenity spaces and noise from the car park movements. The plant and equipment for the project has not been determined at this time. The heating and cooling methodology will be developed as part of the developed design for the D&B delivery team, therefore plant noise limits have been set out in this section of the report. As part of the building design an acoustic consultant should be engaged to review the plant noise emissions from the development to ensure that the upper noise limits outlined in this report are achieved.

Following the survey a model of the development using SoundPLAN 9.0 modelling software was developed to establish the noise levels from the development in a worst-case scenario. The software implements the algorithms contained in ISO 9613-1 and ISO 9613-2. The noise model considers:

- Distance attenuation,
- Source and receptor locations,
- Barrier effects (buildings, walls etc)
- Topographical elevations,
- Ground effects and absorption,
- Source sound power levels,
- Directivity and orientation of the source,
- Atmospheric attenuation and meteorological effects,

The acoustic model for the new building has been developed based on attended noise survey and the proposed site location and predicted noise sources. As the site has potential to create noise impact at both day and nighttime, a worst-case scenario has been developed for both predicting the noise impact at the nearest noise sensitive locations. The assessment considers the noise impact of the communal space on the nearby residential receptors.

Figure 16: Screenshot from the model showing the playground area, communal amenity space and onsite parking.

7.1 Assessment of The Operational Noise Impact

This section outlines the operational noise impact from the residents using the communal outdoor space.

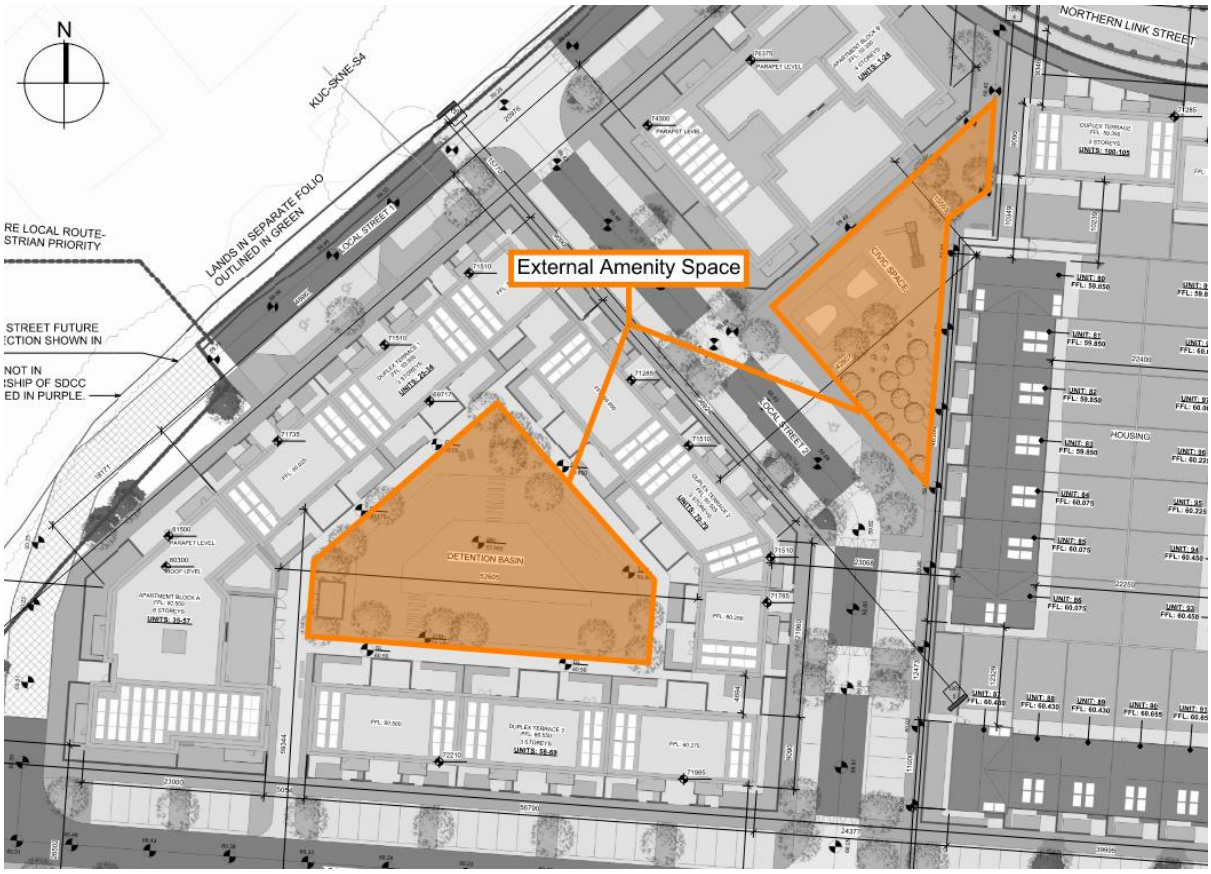


Figure 17: Roof plan showing the location of the external amenity spaces (Reference: SHB5-CSD-DR-MCORM-AR-P3-1002-PROPOSED SITE PLAN-)

The proposed plans include for a communal open space at ground floor level along with a play area, the assessment has been conducted to include both spaces. The operational noise impact also considers the noise impact from the car parking on the nearest noise sensitive receptors.

7.1.1 Daytime Scenario

As the new development has the potential to generate noise with different characteristics for both the day and nighttime, a model has been undertaken for both the day and nighttime operations of the proposed development.

The daytime situation assumes the following noise sources:

- 8 carpark movements per hour per parking space during daytime hours of 07:00-23:00hrs
- Use of the ground level external amenity spaces during the hours of 16:00-23:00hrs.
- Assumed occupancy of 60 persons in amenity space, of which 1 in 3 are talking at once with raised voices, as per Table 15 below.

Table 15: AAAC Patron noise levels at 1m distance for the outdoor communal space.

Description	Source Sound Pressure Level L_{eq} (dB) at Octave Band Centre Frequency, Hz							Overall dBA
	125	250	500	1000	2000	4000	8000	
1 male talker with normal voice	47	56	58	52	48	44	39	58
1 male talker with raised voice	56	63	65	62	57	52	46	66

Noise Impact (BS 4142 Assessment) for Daytime Hours

The noise impact at the nearest noise sensitive location (NSL1-NSL4) has been assessed in accordance with BS 4142. The predicted noise from the development is worst case at NSL1 due to its proximity to the development, car parking entrance/exit and communal area. NSL1 is also representative of lower background noise levels than other noise sensitive locations and therefore has the most stringent criteria. The BS4142 at NSL1 is outlined in Table 16 below.

Table 16: BS4142 Assessment for daytime period

Results		Relevant BS 4142 Clause	Commentary
Predicted specific sound level (daytime)	$L_{Aeq(15min)}$ = 23dB	7.3.6	As the new development is not yet existing, the noise levels have been predicted using SoundPlan modelling software. Worst case specific sound predicted at NSL1 as this is closest to the proposed development.
Residual sound level (daytime)	$L_{Aeq(60min)}$ = 56dB	7.3.2	The residual sound level was dominated by road traffic noise. Background location A3 assessed as this is representative for worst case receptor (NSL1).
Background sound level (daytime)	$L_{A90(60min)}$ = 51dB	8.1.2 8.4	The L_{A90} sound level was measured at the noise sensitive location with the source absent.
Assessment made during the daytime, so the reference time interval is 1 hour		7.2	
Specific sound level as predicted	$L_{Aeq(15min)}$ = 23dB	7.3.6	The specific sound has been predicted by calculation alone as the new development was not existing at the time.
Acoustic feature correction	+0dB	9.2 9.3.2	It is not anticipated that the specific sound will have any impulsive, tonal or intermittent characteristics.
Rating level	(23 + 0) dB = 23dB	9.2	
Background sound level	$L_{A90(60min)}$ = 51dB	8	
Excess of rating over background sound level	(23 - 51) dB = -28dB	11	Assessment indicates that no adverse impact is likely on the noise sensitive locations as the specific sound is 28dB below the background levels and is lower than the residual sound. Context has also been considered.

Results		Relevant BS 4142 Clause	Commentary
Uncertainty of the assessment	Not significant	10	The specific sound is a worst-case prediction as the assessment assumes multiple carpark movements every hour, large groups of persons occupying the amenity space during evening hours and one in three speaking with raised voice.

Based on the review of the noise sources and the BS 4142 assessment it is predicted that the noise emanating from the proposed development will not have any adverse impact on the surrounding noise sensitive locations.

NG4

NG4 recommends a daytime criteria of (07:00hrs – 19:00hrs) 55dB $L_{Aeq,T}$, the predicted noise emissions from the development are 23 dBA, with no tonality or impulsivity, therefore the NG4 criteria is expected to be achieved.

7.1.2 Night-time Scenario

The proposed development has potential to generate noise impact at nighttime.

The daytime situation assumes the following noise sources:

- 4 carpark movements per space per hour during nighttime hours of 23:00-07:00
- Use of the ground level external amenity spaces and playing courts during the hours of 23:00-01:00.
- Assumed occupancy of 40 persons in amenity space, of which 1 in 3 are talking at once with raised voices, see Table 15 above.

BS4142 Nighttime Assessment

The noise impact at the nearest noise sensitive location (NSL1) has been assessed in accordance with BS 4142.

Table 17: BS4142 Assessment for daytime period

Results		Relevant BS 4142 Clause	Commentary
Predicted specific sound level (nighttime)	$L_{Aeq(15min)}$ = 20dB	7.3.6	As the new development is not yet existing, the noise levels have been predicted using SoundPlan modelling software. Worst case specific sound predicted at NSL1 as this is closest to the proposed development.
Residual sound level (nighttime)	$L_{Aeq(15min)}$ = 53dB	7.3.2	The residual sound level was dominated by road traffic noise on the nearby Richmond Road. Background location A3 assessed as this is representative for worst case receptor (NSL1).
Background sound level (nighttime)	$L_{A90(15min)}$ = 49dB	8.1.2 8.4	The L_{A90} sound level was measured at the noise sensitive location with the source absent.
Assessment made during the daytime, so the reference time interval is 15 minutes		7.2	

Results		Relevant BS 4142 Clause	Commentary
Specific sound level as predicted	$L_{Aeq(15min)}$ = 20dB	7.3.6	The specific sound has been predicted by calculation alone as the new development was not existing at the time of the survey.
Acoustic feature correction	+0dB	9.2 9.3.2	It is not anticipated that the specific sound will have any impulsive, tonal or intermittent characteristics.
Rating level	(20 + 0) dB = 20dB	9.2	
Background sound level	$L_{A90(15min)}$ = 49dB	8	
Excess of rating over background sound level	(20 - 49) dB = -29dB	11	Assessment indicates that no adverse impact is likely on the noise sensitive locations at nighttime as the specific sound is 29dB below the background levels and is lower than the residual sound. Context has also been considered.
Uncertainty of the assessment	Not significant	10	The specific sound is a worst-case prediction as the assessment assumes multiple carpark movements every hour, large groups of persons occupying the amenity space during night time hours and one in three speaking with raised voice.

Based on the review of the noise sources and the BS 4142 assessment it is predicted that the noise emanating from the proposed development will not have any adverse impact on the surrounding noise sensitive locations.

NG4

NG4 recommends a night time criteria of 45dB $L_{Aeq,T}$, the predicted noise levels from the new development are 20 dBA, with no tonality or impulsivity, therefore the NG4 criteria is expected to be achieved.

Impact of Traffic Movements on Communal Outdoor Spaces

The impact of noise from cars entering/leaving the site via local access roads and parking at the various car parking spaces onsite were assessed with regard to ensuring the noise levels in the outdoor amenity spaces are recommended to achieve <50-55dBA. Based on the modelling and assessment the predicted noise levels from the car park movements are expected to achieve <50 dBA when considered over the full day time period ($L_{Aeq,16hr}$).

7.1.3 Modelling Assumptions

The following assumptions were made throughout the modelling and assessment:

- Assessment based on the noise measurements undertaken on 21st of March 2024.
- Noise source data for the assessment was based on the measurements undertaken onsite.
- Model assumes a worst-case operating scenario as outlined in Section 7 above.
- Modelling based on the drawings, layouts and information provided.
- Assessment based on proposed new development only.

7.1.4 Mechanical Plant & Equipment

As the proposed development is currently at planning stage, the mechanical plant and equipment information is not available for the project. It is currently understood that specific mechanical plant and equipment will not be further developed and specified until further in the design process as this is a design and build project. The acoustic consultant at design stage for the project should ensure that the above criteria outlined in Section 3 of this report is achieved.

8 Conclusion

Wave Dynamics were engaged by NDFA and South Dublin County Council as the acoustic consultants to provide an Acoustic Design Statement including an Inward Noise Impact, Construction Noise Assessment and Operational Noise Assessment for the planning application for the proposed new residential development at Lynch Lane, Kishoge, Lucan, Co. Dublin.

The proposed development includes:

- 118 no. residential units in a mix of two storey houses, 3 storey duplex units and apartment blocks of 4 – 6 storeys comprising 26 no. 1 bed apartments; 42 no. 2 bed apartments; 21 no. 3 bed apartments; 23 no. 3 bed houses; and 6 no. 4 bed houses, with renewable energy design measures (which may be provided externally) for each housing unit;
- Landscaping works including provision of (a) communal open space areas (b) outdoor sports and play areas; (c) new pedestrian and cycle connections; and (d) civic plaza;
- Associated site and infrastructural works including provision for (a) ESB substations and switchrooms; (b) energy centre to the rear of 6 storey block; (c) photovoltaic panels; (e) car and bicycle parking; (f) public lighting; (g) bin storage; (h) temporary construction signage; (i) estate signage; and (j) varied site boundary treatment comprising walls and fencing; and all associated site development works.

Inward Noise Impact Assessment

A Stage 1 and Stage 2 ProPG assessment have been undertaken. As part of the stage one assessment to categorise the site, a baseline noise survey was undertaken to measure the existing noise levels. Following the baseline noise survey a site noise model of the road noise impact was produced and calibrated with the site measurements. A review of the noise levels on the site was conducted, this included the L_{AFmax} and $L_{Aeq,}$ the site has subsequently been characterised as medium risk for night at the southern boundary and medium to low risk for the daytime period across the rest of the site therefore, mitigation measures are not required to control the onset noise levels.

Break-in noise calculations to predict the internal noise levels from road traffic noise were conducted as part of the assessment. Consideration has also been given to the future growth of the roads. Following the assessment, the building envelope performance requirements were determined to achieve adequate internal noise levels. The performance specification for the building envelope has been provided in this report which includes the external walls, glazing, roof and ventilation requirements.

External Amenity Noise Levels

The external amenity spaces on the development include balconies and a communal amenity space at ground level. Appropriate amenity has been provided on the development for residents using a combination of the balconies on suitable facades and the communal amenity spaces. This is in line with element 3(v) of ProPG.

Based on the recommendations in this report it is predicted that the internal and external noise levels will achieve the targeted noise levels in line with BS 82233:2014 and ProPG 2017 guidance.

Construction Noise Impact

The construction noise impact is predicted to exceed the BS 5228 requirements **without any mitigation** measures for all stages of the project.

General and site-specific mitigation measures have been provided in this report to bring the construction noise levels down within the limits of BS 5228. Following **the noise mitigation recommendations in this report, the construction phase is expected to meet the requirements** of BS 5228 based on the information provided to us.

In addition to the mitigation measures, guidance has been provided in this report for construction noise monitoring during the construction period to manage noise levels to manage construction noise.

Vibration Monitoring

Vibration monitors should be erected during the substructure phase of the development between the site and NSLs 1 & 2 to manage vibration during the construction period.

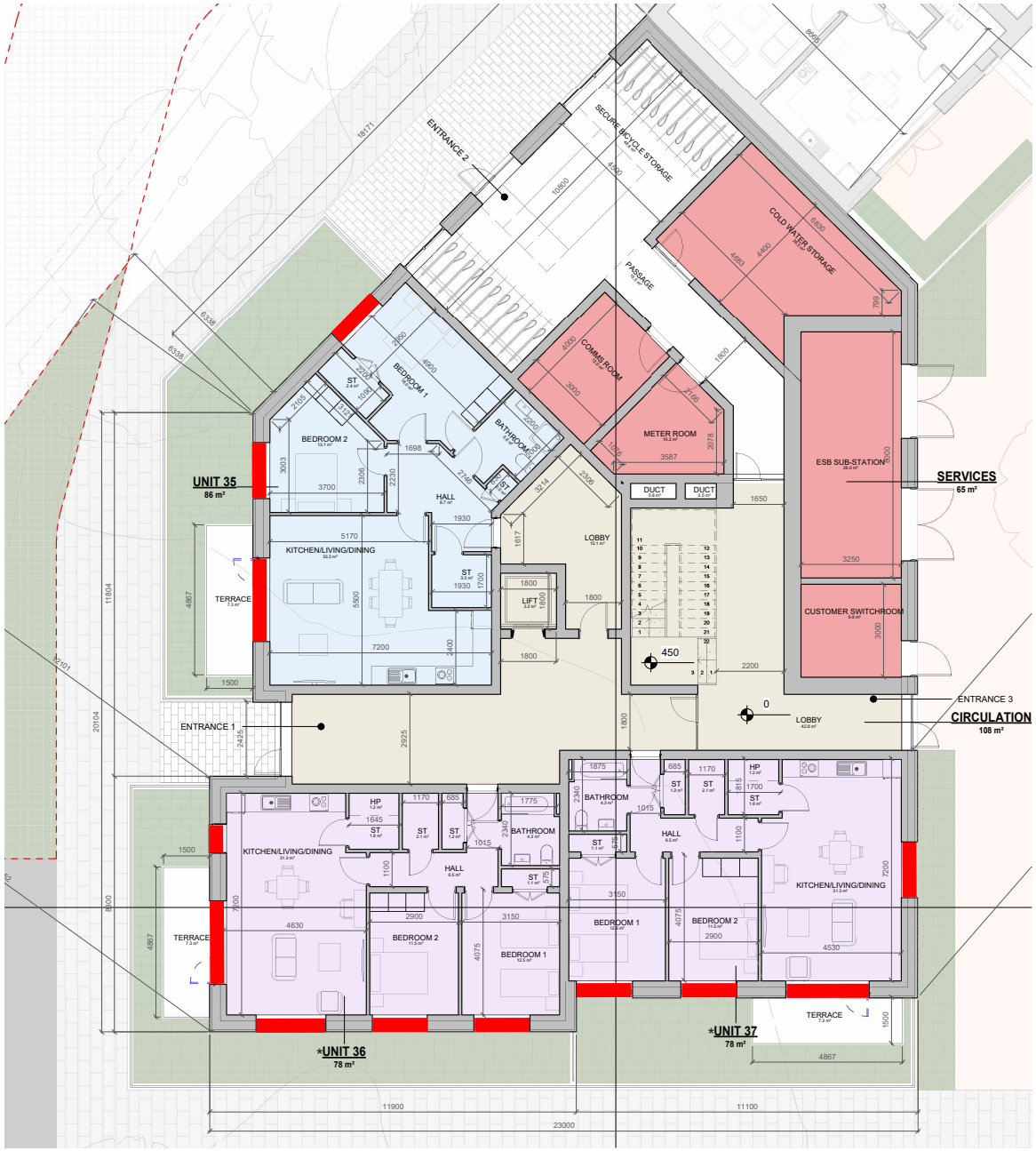
Operational Noise

An operational noise impact assessment from the noise generated in the communal amenity space, the traffic generated on the development and car parking, and the creche play area. It is predicted that the development will not cause a negative noise impact on the nearby noise sensitive locations. The mechanical plant and equipment specification is not available at this stage of the project, as these projects will be design and build PPP projects the proposed method of heating, cooling and ventilation is not currently available. Specific noise limits have been provided in this report for mechanical plant and equipment, at design development stage once the plant and equipment information is available it should be assessed for compliance with the criteria outlined in this report.

Appendix A- Glossary of Terms

Ambient Noise	The totally encompassing sound in a given situation at a given time, usually composed of sound from all the noise sources in the area.
Background Noise	The steady existing noise level present without contribution from any intermittent sources. The A-weighted sound pressure level of the residual noise at the assessment position that is exceeded for 90 per cent of a given time interval, T ($L_{AF90,T}$).
dB	Decibel - The scale in which sound pressure level is expressed. It is defined as 20 times the logarithm of the ratio between the RMS pressure of the sound field and the reference pressure of 20 micro-pascals (20 μPa).
dB(A)	An 'A-weighted decibel' - a measure of the overall noise level of sound across the audible frequency range (20 Hz – 20 kHz) with A-frequency weighting (i.e. 'A'–weighting) to compensate for the varying sensitivity of the human ear to sound at different frequencies.
Hertz	The unit of sound frequency in cycles per second.
L_{A90}	A-weighted, sound level just exceeded for 90% of the measurement period and calculated by statistical analysis. See also the background noise level.
L_{Aeq}	A-weighted, equivalent continuous sound level.
L_{AFmax}	A-weighted, maximum, sound level measured with a fast time-constant - maximum is not peak
L_{den}	day-evening-night noise level, the A-weighted, Leq (equivalent noise level) over a whole day, but with a penalty of 10 dB(A) for night-time noise (23:00-07:00) and 5 dB(A) for evening noise (19:00-23:00), also known as the day evening night noise indicator

Appendix B- Façade Mark Ups

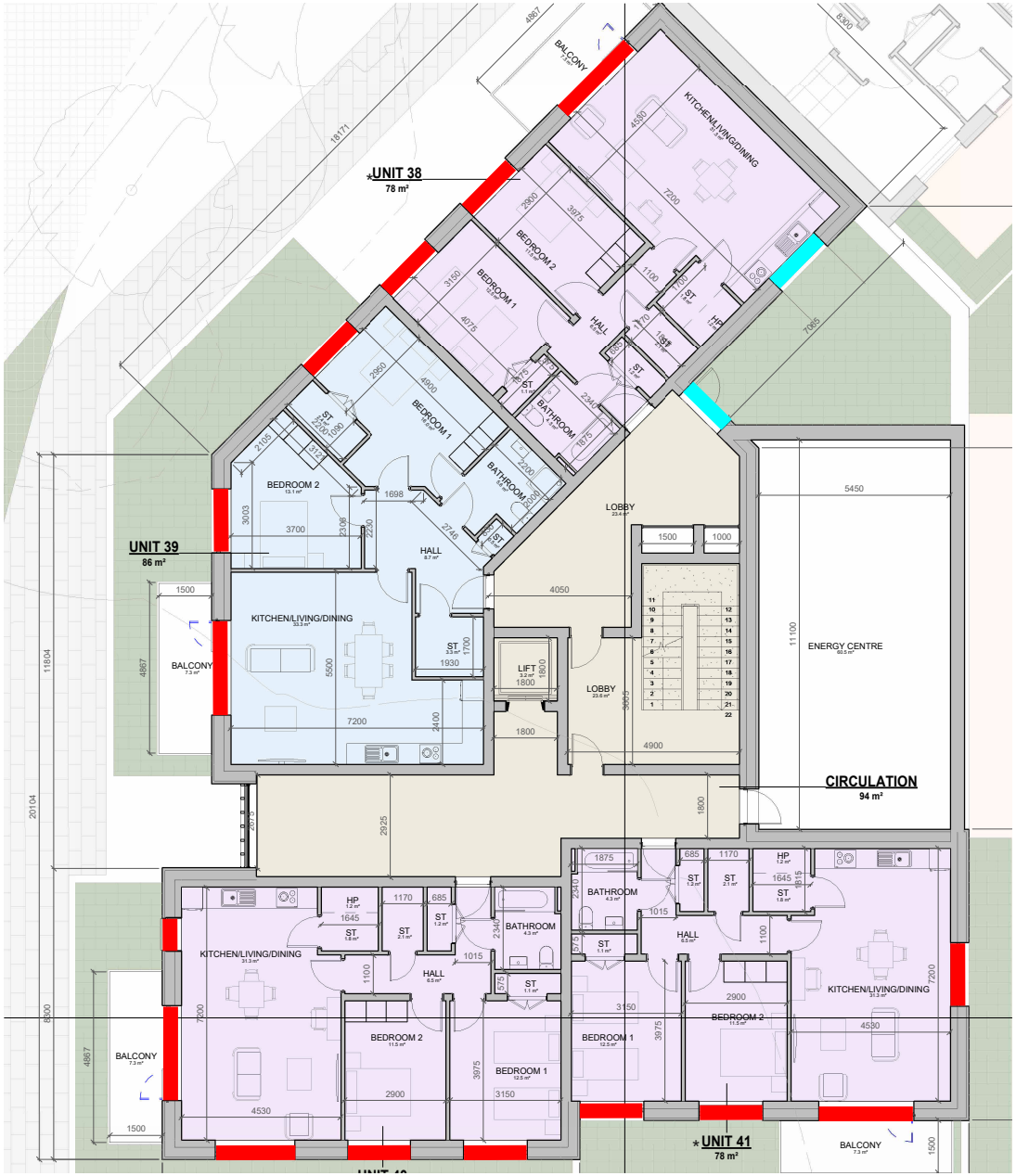


Glazed Elements Specification

- 39 dB R_w
- 34 dB R_w

WAVE DYNAMICS
ACOUSTIC CONSULTANTS

Project:	Clonburris Apartment Block A
Title:	Glazing Markup Ground Floor
Prepared By:	Saoirse Mulvaney
Reviewed By:	Sean Rocks
Date:	31/05/2024

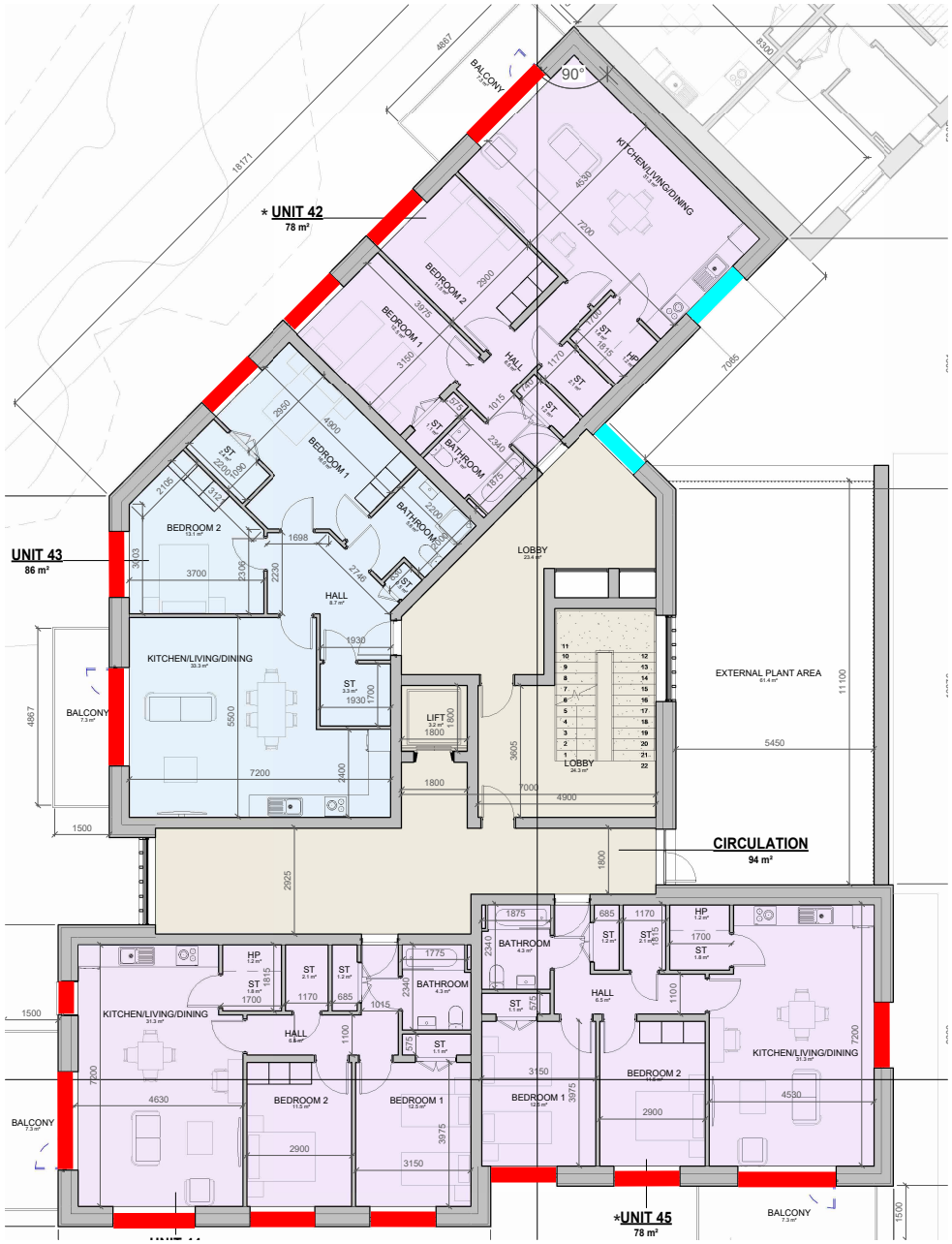


Glazed Elements Specification

- 39 dB R_w
- 34 dB R_w

WAVE DYNAMICS
ACOUSTIC CONSULTANTS

Project:	Clonburris Apartment Block A
Title:	Glazing Markup First Floor
Prepared By:	Saoirse Mulvaney
Reviewed By:	Sean Rocks
Date:	31/05/2024

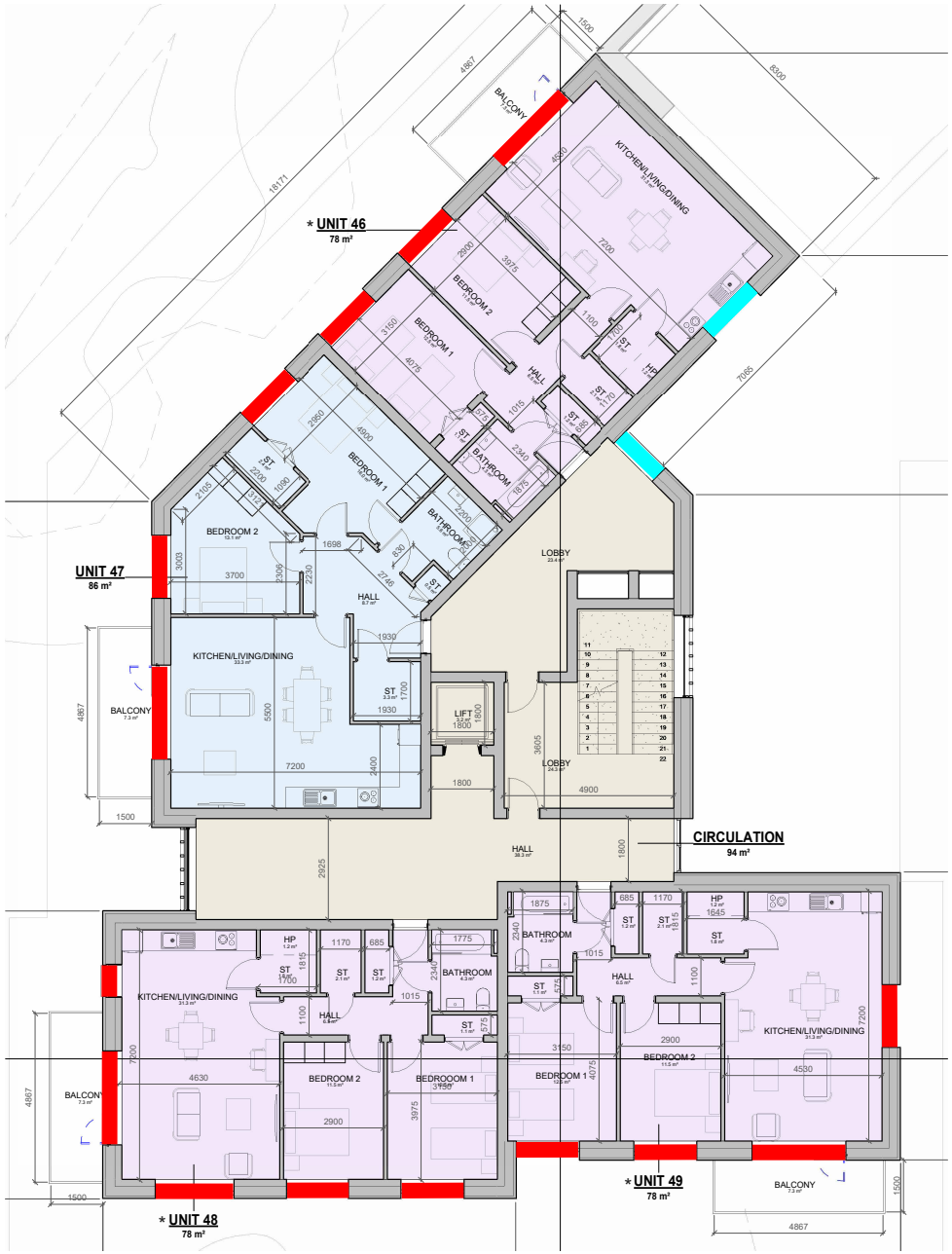


Glazed Elements Specification

- 39 dB R_w
- 34 dB R_w

WAVE DYNAMICS
ACOUSTIC CONSULTANTS

Project:	Clonburris Apartment Block A
Title:	Glazing Markup Second Floor
Prepared By:	Saoirse Mulvaney
Reviewed By:	Sean Rocks
Date:	31/05/2024

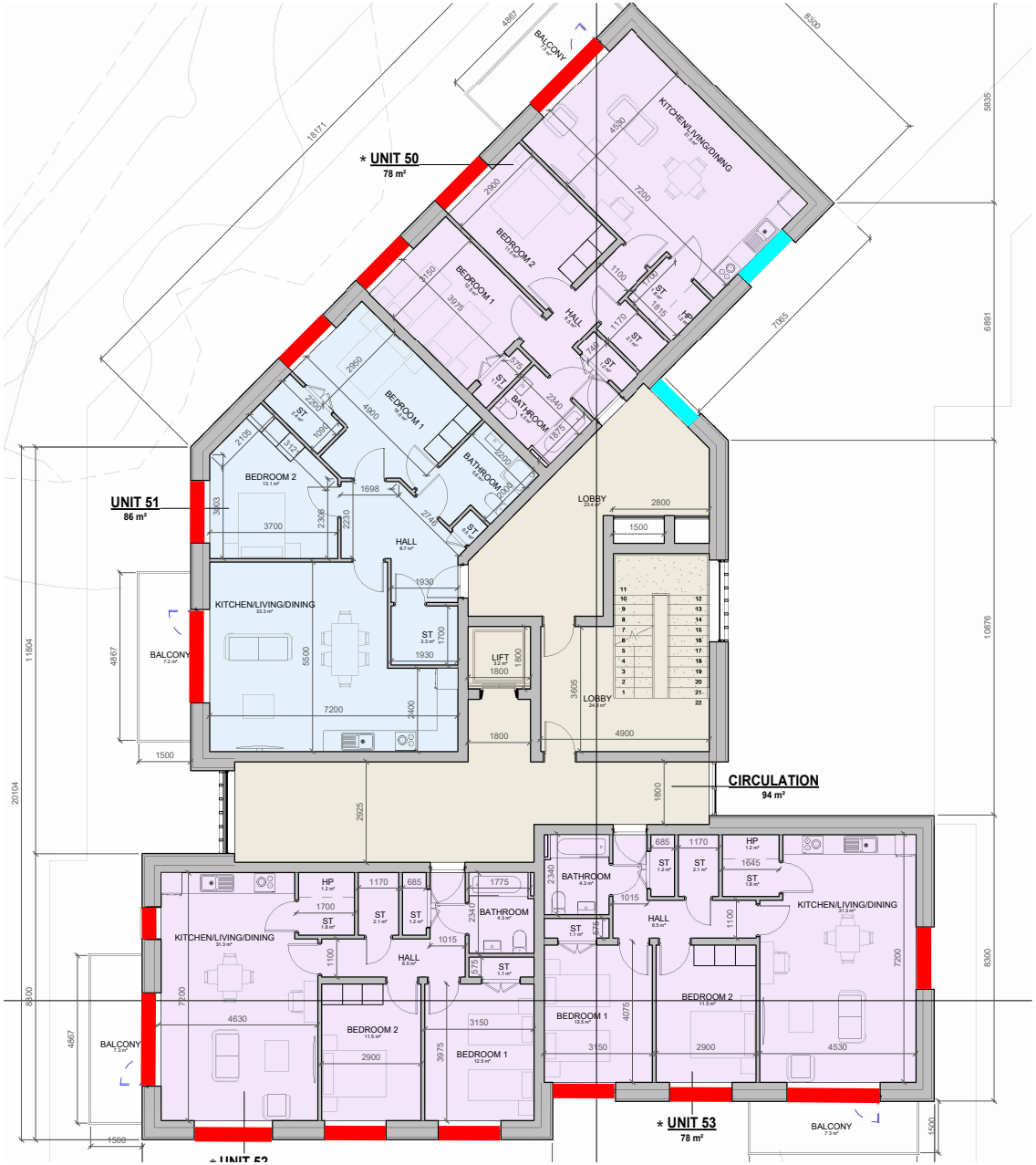


Glazed Elements Specification

- 39 dB R_w
- 34 dB R_w

WAVE DYNAMICS
ACOUSTIC CONSULTANTS

Project:	Clonburris Apartment Block A
Title:	Glazing Markup Third Floor
Prepared By:	Saoirse Mulvaney
Reviewed By:	Sean Rocks
Date:	31/05/2024

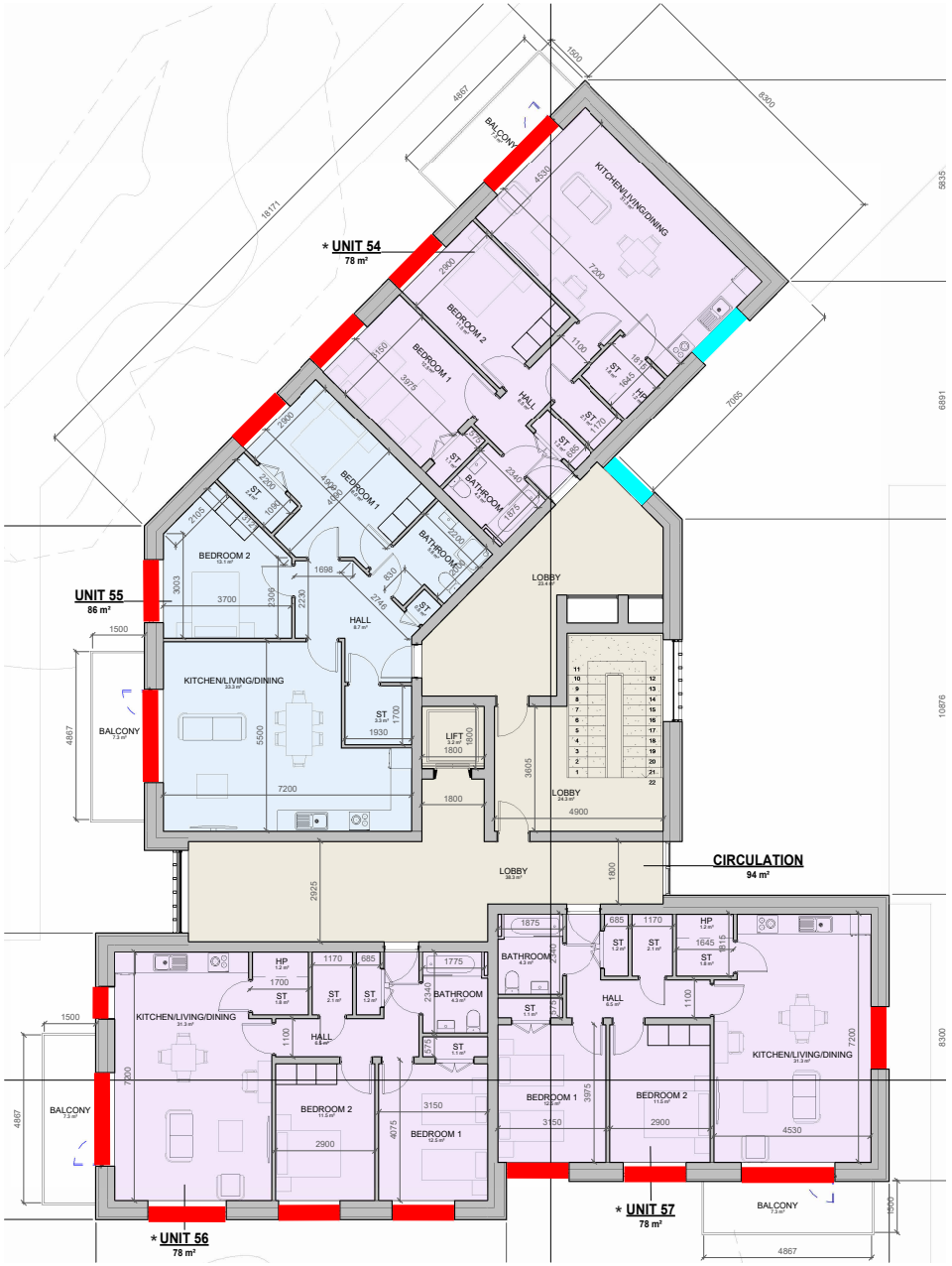


Glazed Elements Specification

- 39 dB R_w
- 34 dB R_w

WAVE DYNAMICS
ACOUSTIC CONSULTANTS

Project:	Clonburris Apartment Block A
Title:	Glazing Markup Fourth Floor
Prepared By:	Saoirse Mulvaney
Reviewed By:	Sean Rocks
Date:	31/05/2024

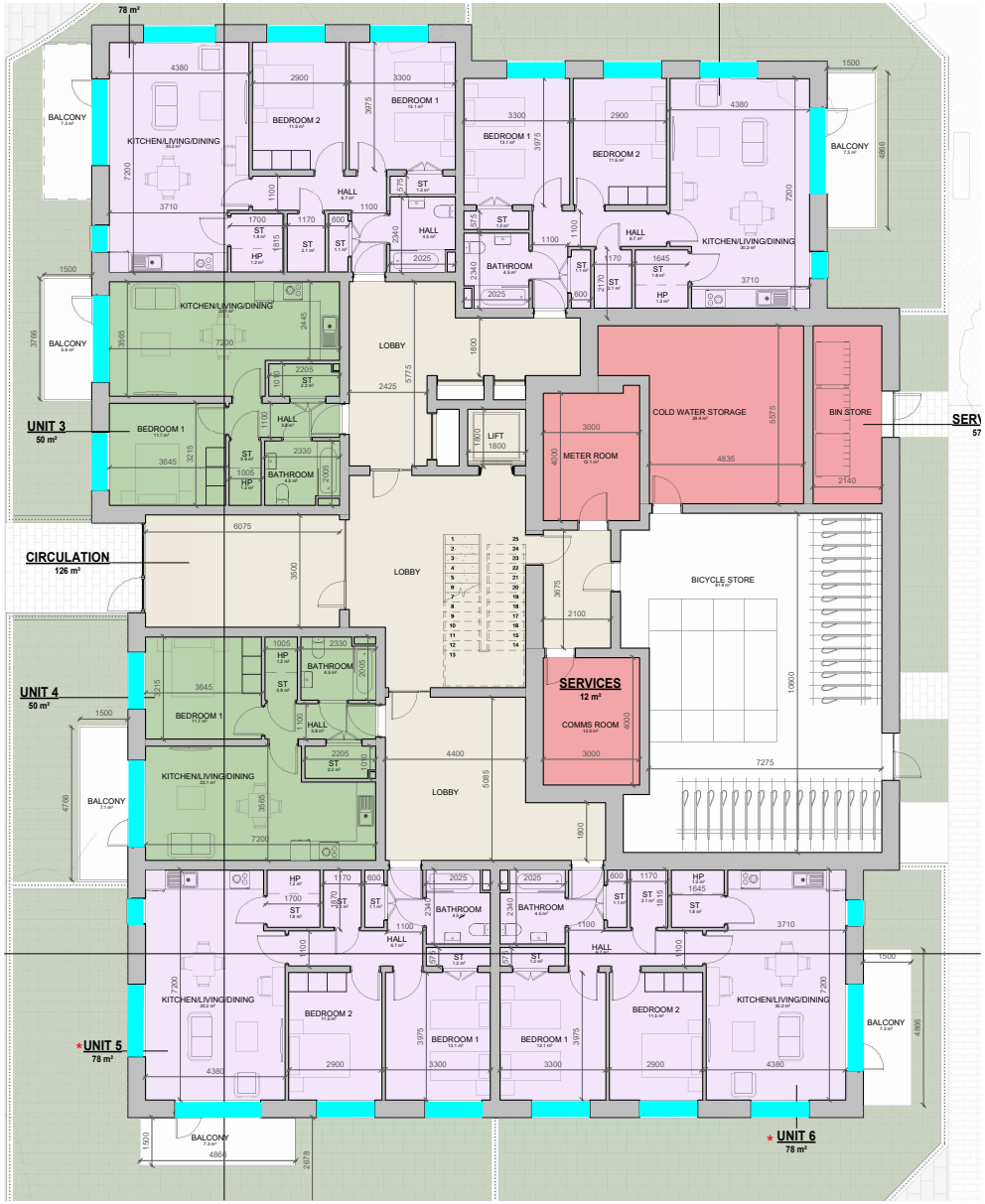


Glazed Elements Specification

- 39 dB R_w
- 34 dB R_w

WAVE DYNAMICS
ACOUSTIC CONSULTANTS

Project:	Clonburris Apartment Block A
Title:	Glazing Markup Fifth Floor
Prepared By:	Saoirse Mulvaney
Reviewed By:	Sean Rocks
Date:	31/05/2024

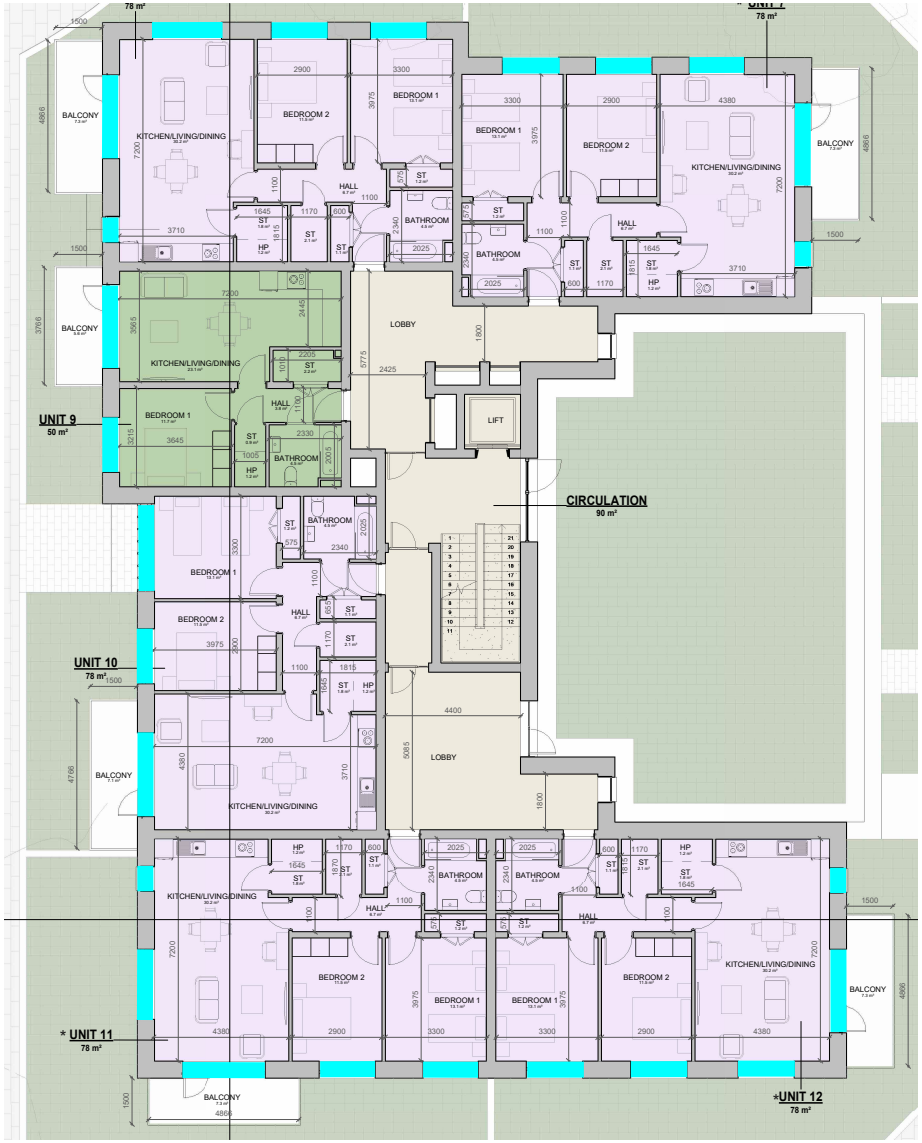


Glazed Elements Specification

- 39 dB R_w
- 34 dB R_w

WAVE DYNAMICS
ACOUSTIC CONSULTANTS

Project:	Clonburris Apartment Block B
Title:	Glazing Markup Ground Floor
Prepared By:	Saoirse Mulvaney
Reviewed By:	Sean Rocks
Date:	31/05/2024

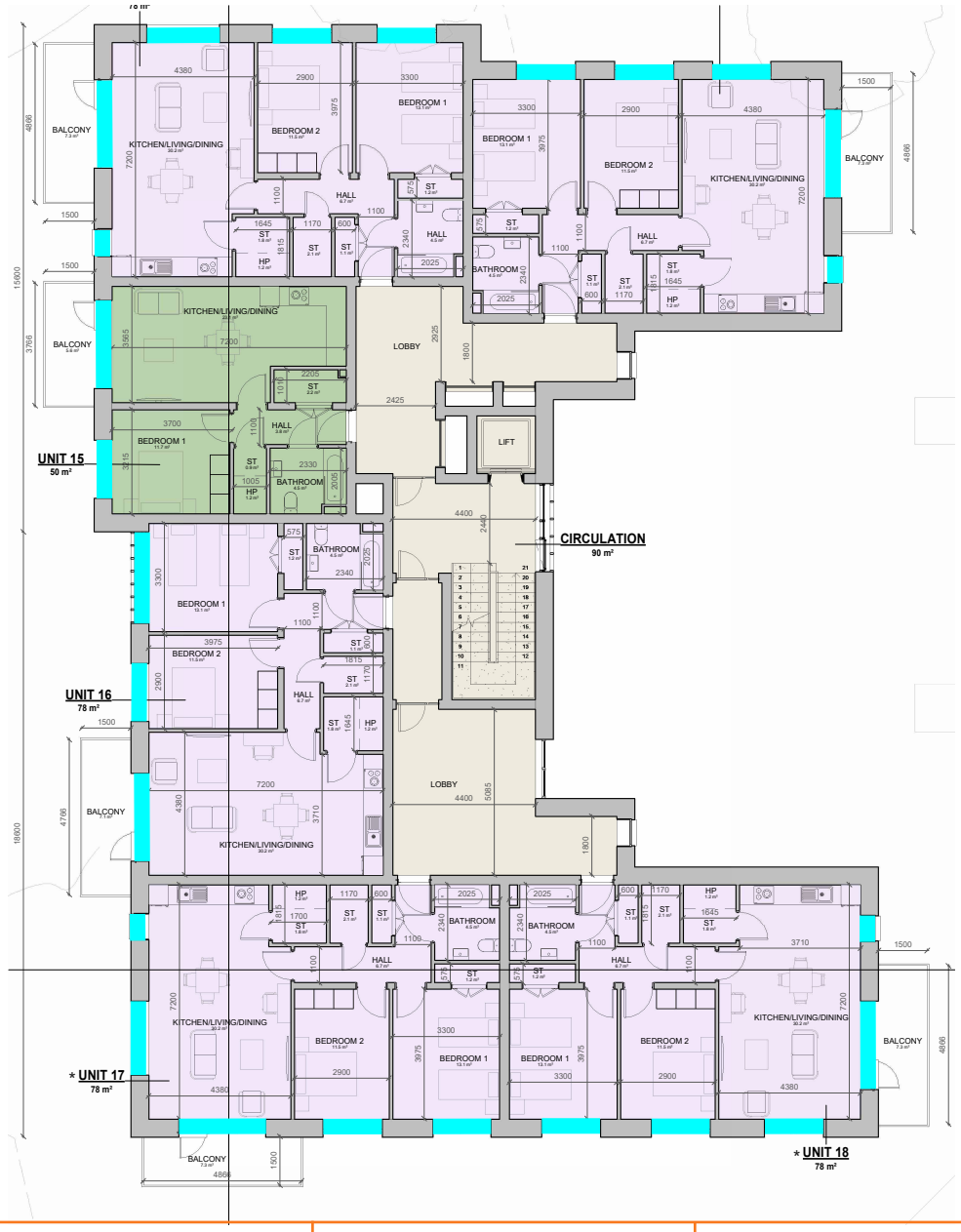


Glazed Elements Specification

- 39 dB R_w
- 34 dB R_w

WAVE DYNAMICS
ACOUSTIC CONSULTANTS

Project:	Clonburris Apartment Block B
Title:	Glazing Markup First Floor
Prepared By:	Saoirse Mulvaney
Reviewed By:	Sean Rocks
Date:	31/05/2024

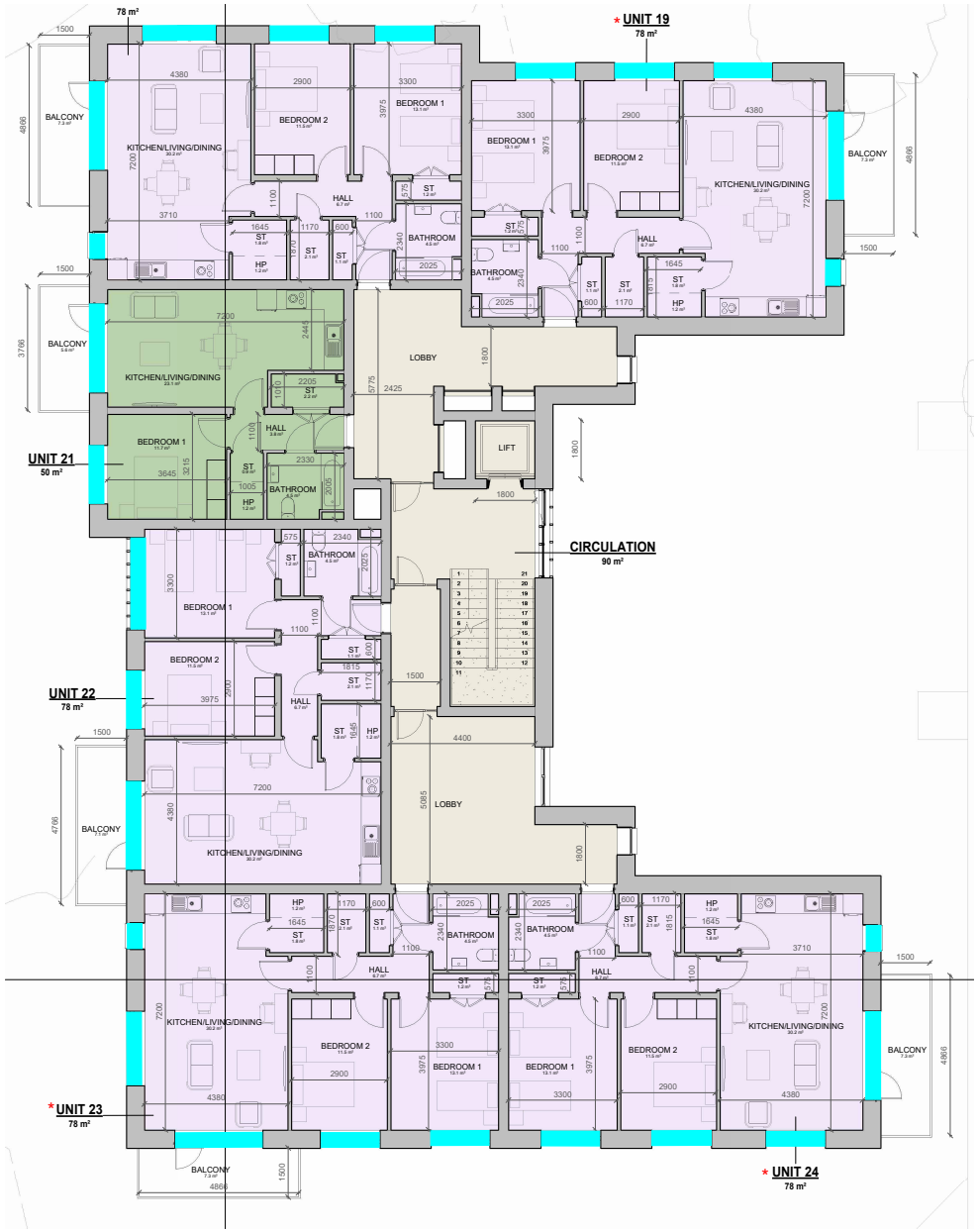


Glazed Elements Specification

- 39 dB R_w
- 34 dB R_w

WAVE DYNAMICS
ACOUSTIC CONSULTANTS

Project:	Clonburris Apartment Block B
Title:	Glazing Markup Second Floor
Prepared By:	Saoirse Mulvaney
Reviewed By:	Sean Rocks
Date:	31/05/2024

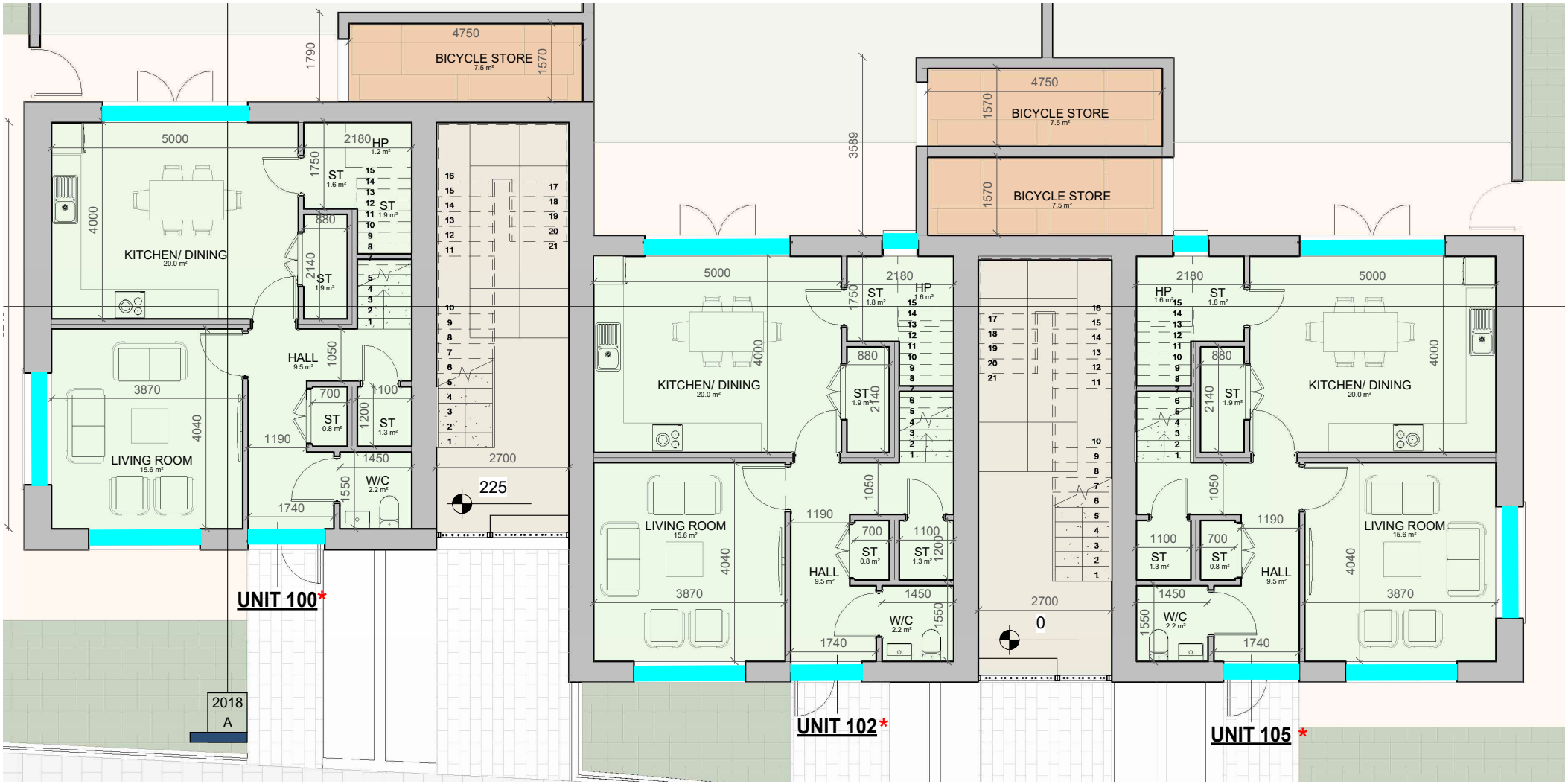


Glazed Elements Specification

- 39 dB R_w
- 34 dB R_w

WAVE DYNAMICS
ACOUSTIC CONSULTANTS

Project:	Clonburris Apartment Block B
Title:	Glazing Markup Third Floor
Prepared By:	Saoirse Mulvaney
Reviewed By:	Sean Rocks
Date:	31/05/2024

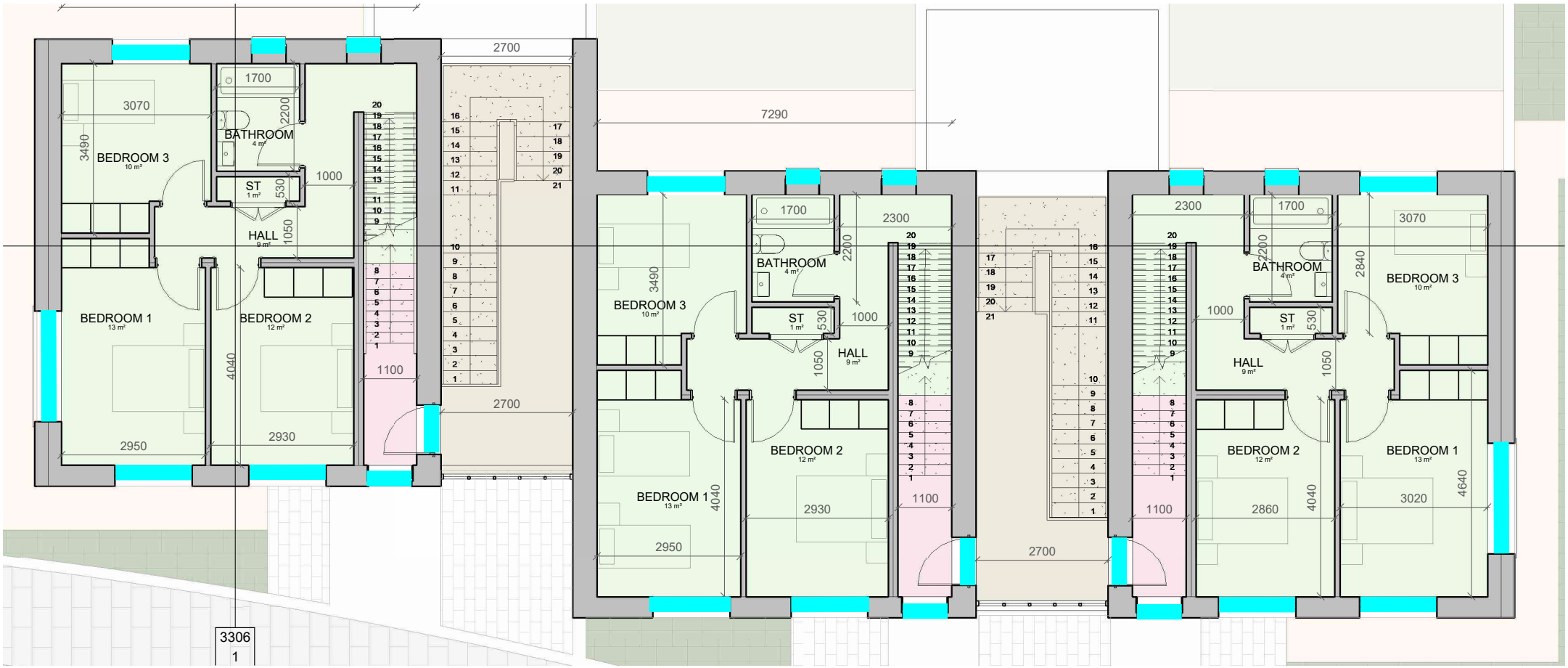


Glazed Elements Specification

- 39 dB R_w
- 34 dB R_w

WAVE DYNAMICS
ACOUSTIC CONSULTANTS

Project:	Clonburris Duplex C1
Title:	Glazing Markup Ground Floor
Prepared By:	Saoirse Mulvaney
Reviewed By:	Sean Rocks
Date:	31/05/2024

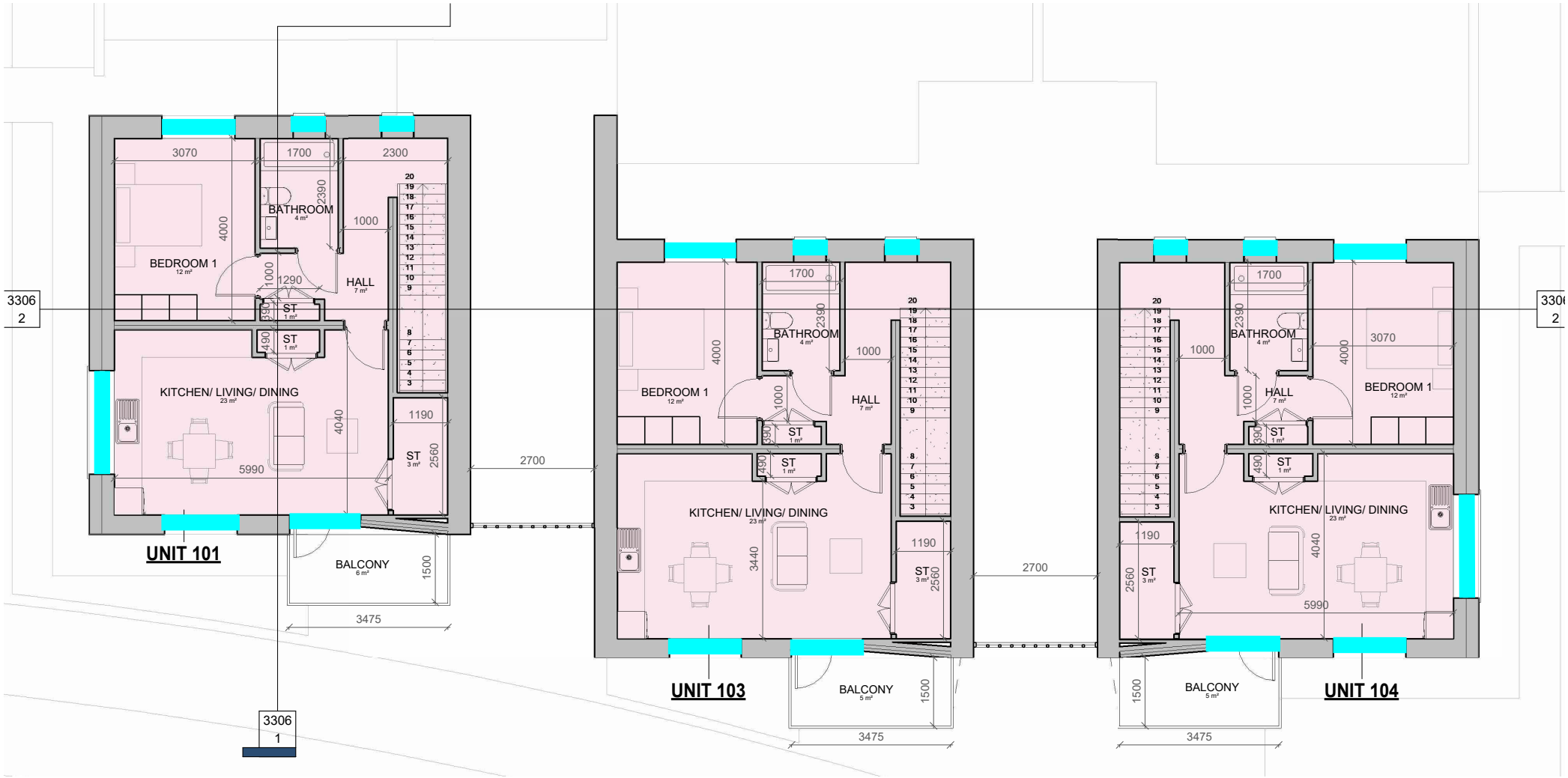


Glazed Elements Specification

- 39 dB R_w
- 34 dB R_w

WAVE DYNAMICS
ACOUSTIC CONSULTANTS

Project:	Clonburris Duplex C1
Title:	Glazing Markup First Floor
Prepared By:	Saoirse Mulvaney
Reviewed By:	Sean Rocks
Date:	31/05/2024

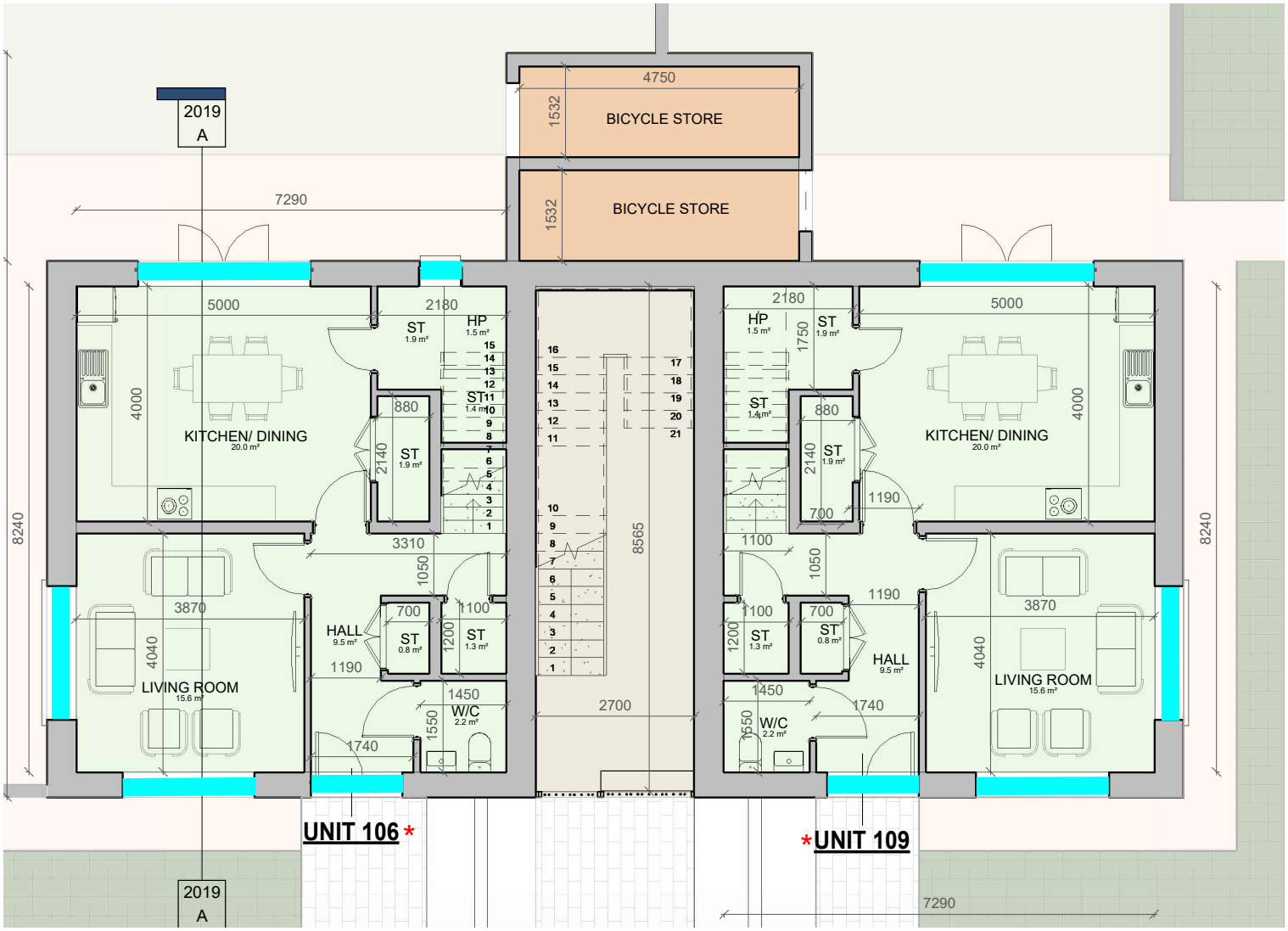


Glazed Elements Specification

- 39 dB R_w
- 34 dB R_w

WAVE DYNAMICS
ACOUSTIC CONSULTANTS

Project:	Clonburris Duplex C1
Title:	Glazing Markup Second Floor
Prepared By:	Saoirse Mulvaney
Reviewed By:	Sean Rocks
Date:	31/05/2024

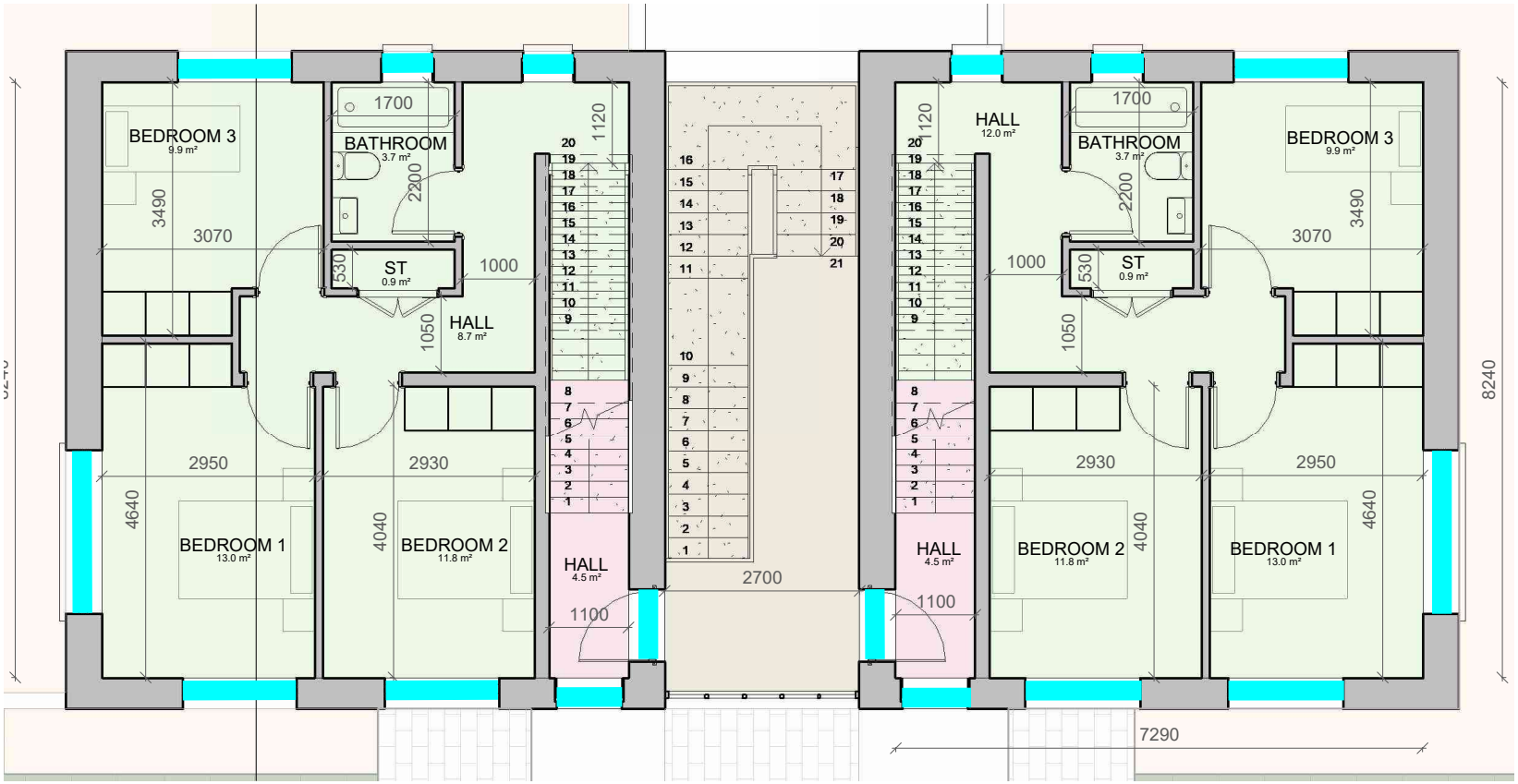


Glazed Elements Specification

- 39 dB R_w
- 34 dB R_w

WAVE DYNAMICS
ACOUSTIC CONSULTANTS

Project:	Clonburris Duplex C2
Title:	Glazing Markup Ground Floor
Prepared By:	Cathal Reck
Reviewed By:	Sean Rocks
Date:	31/05/2024

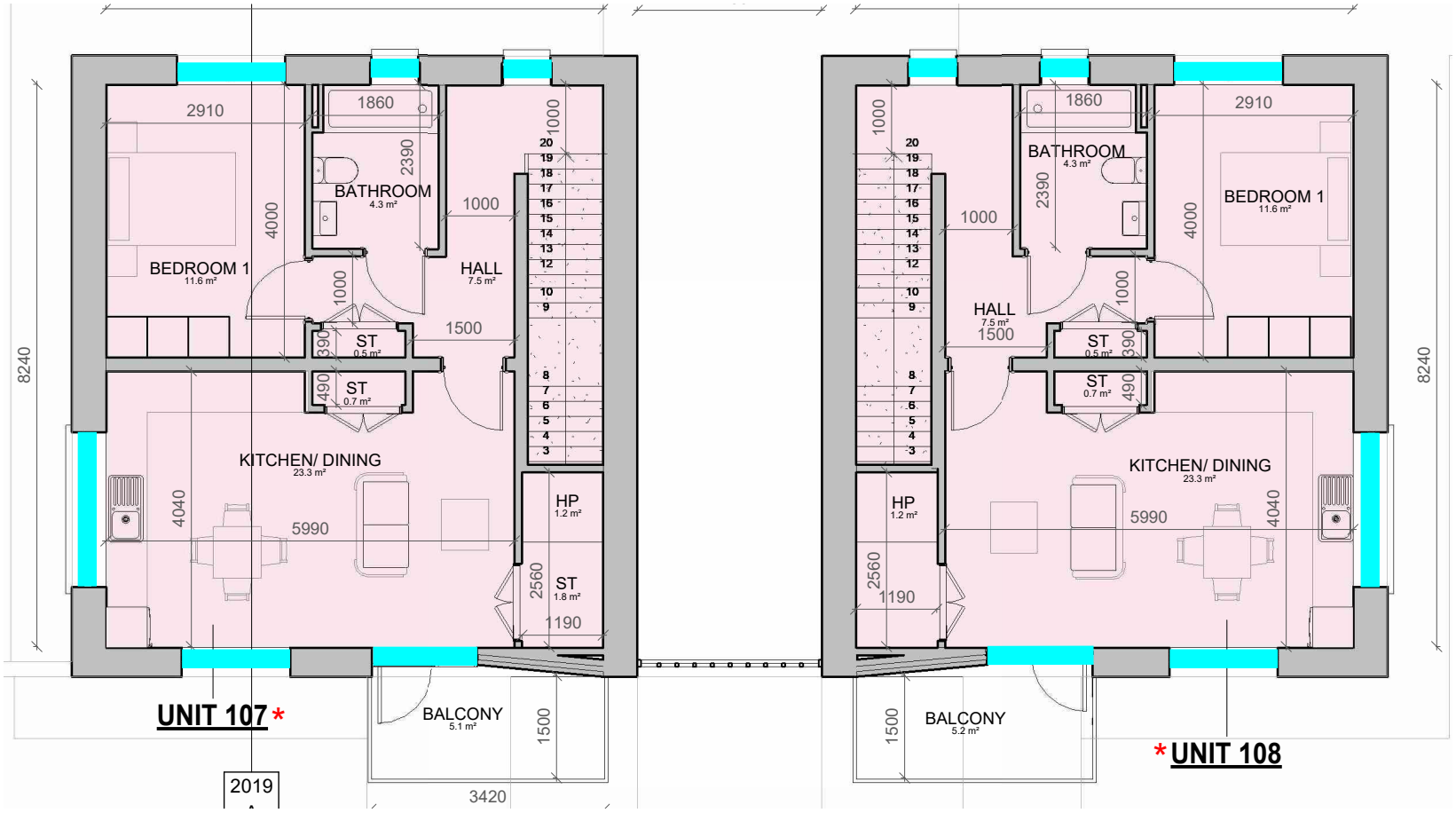


Glazed Elements Specification

- 39 dB R_w
- 34 dB R_w

WAVE DYNAMICS
ACOUSTIC CONSULTANTS

Project:	Clonburris Duplex C2
Title:	Glazing Markup First Floor
Prepared By:	Cathal Reck
Reviewed By:	Sean Rocks
Date:	31/05/2024

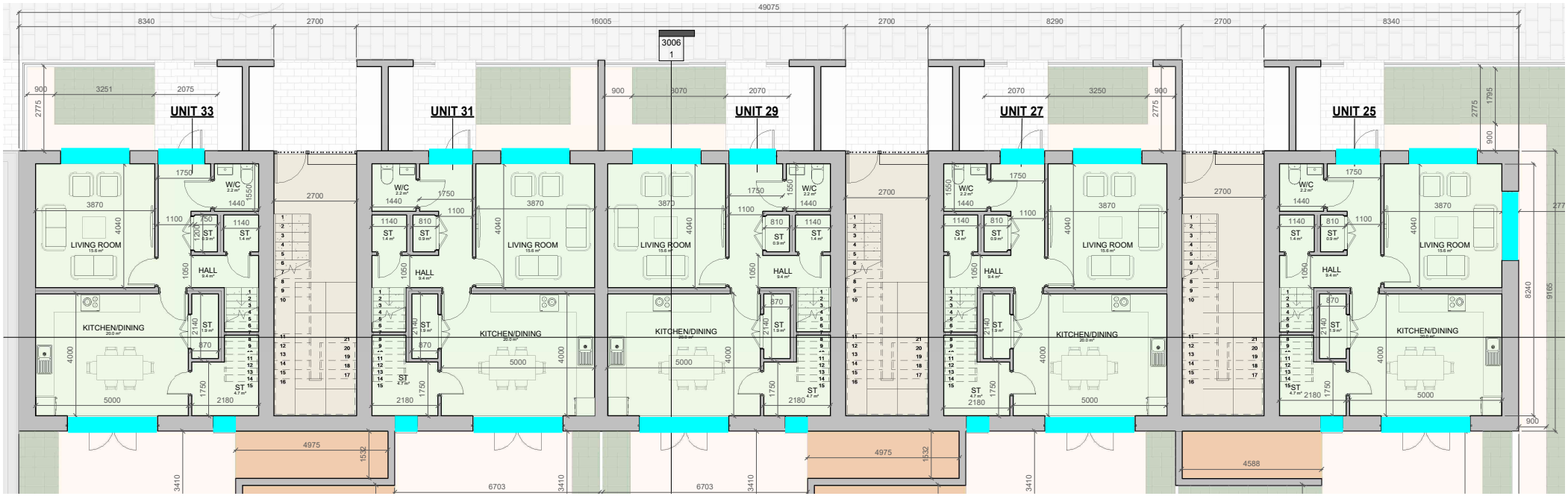


Glazed Elements Specification

- 39 dB R_w
- 34 dB R_w

WAVE DYNAMICS
ACOUSTIC CONSULTANTS

Project:	Clonburris Duplex C2
Title:	Glazing Markup Second Floor
Prepared By:	Cathal Reck
Reviewed By:	Sean Rocks
Date:	31/05/2024

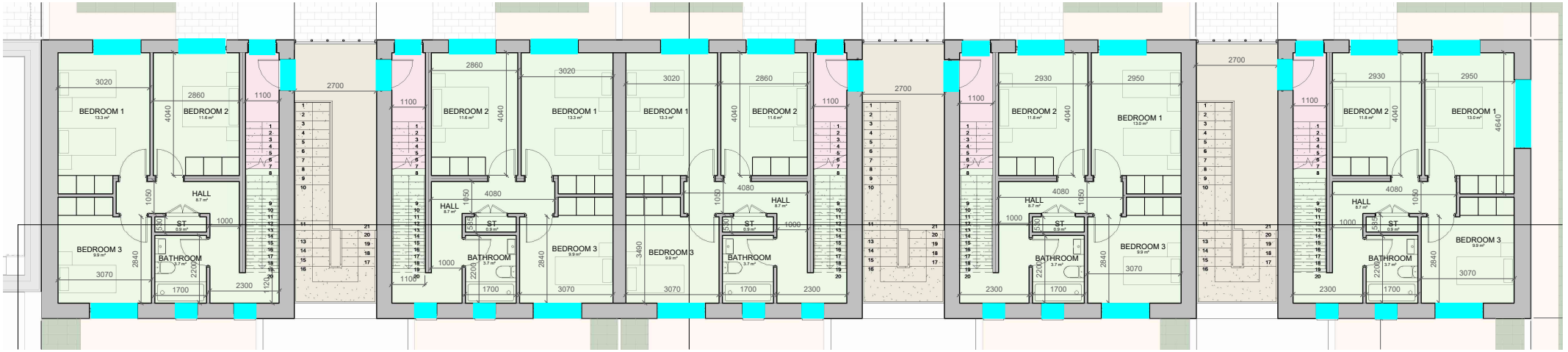


Glazed Elements Specification

- 39 dB R_w
- 34 dB R_w

WAVE DYNAMICS
ACOUSTIC CONSULTANTS

Project:	Clonburris Duplex Wing 1
Title:	Glazing Markup Ground Floor
Prepared By:	Saoirse Mulvaney
Reviewed By:	Sean Rocks
Date:	31/05/2024

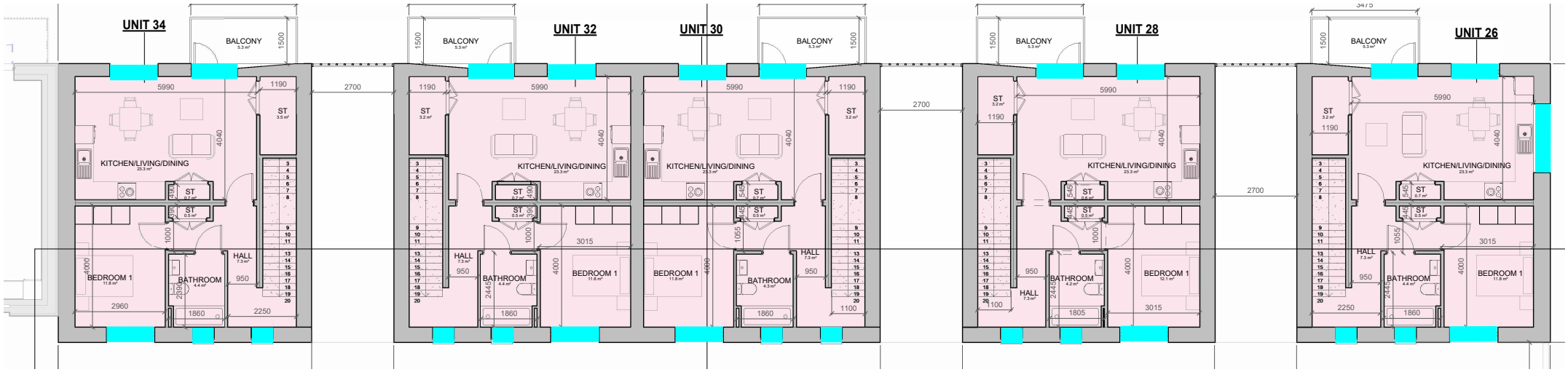


Glazed Elements Specification

- 39 dB R_w
- 34 dB R_w

WAVE DYNAMICS
ACOUSTIC CONSULTANTS

Project:	Clonburris Duplex Wing 1
Title:	Glazing Markup First Floor
Prepared By:	Saoirse Mulvaney
Reviewed By:	Sean Rocks
Date:	31/05/2024

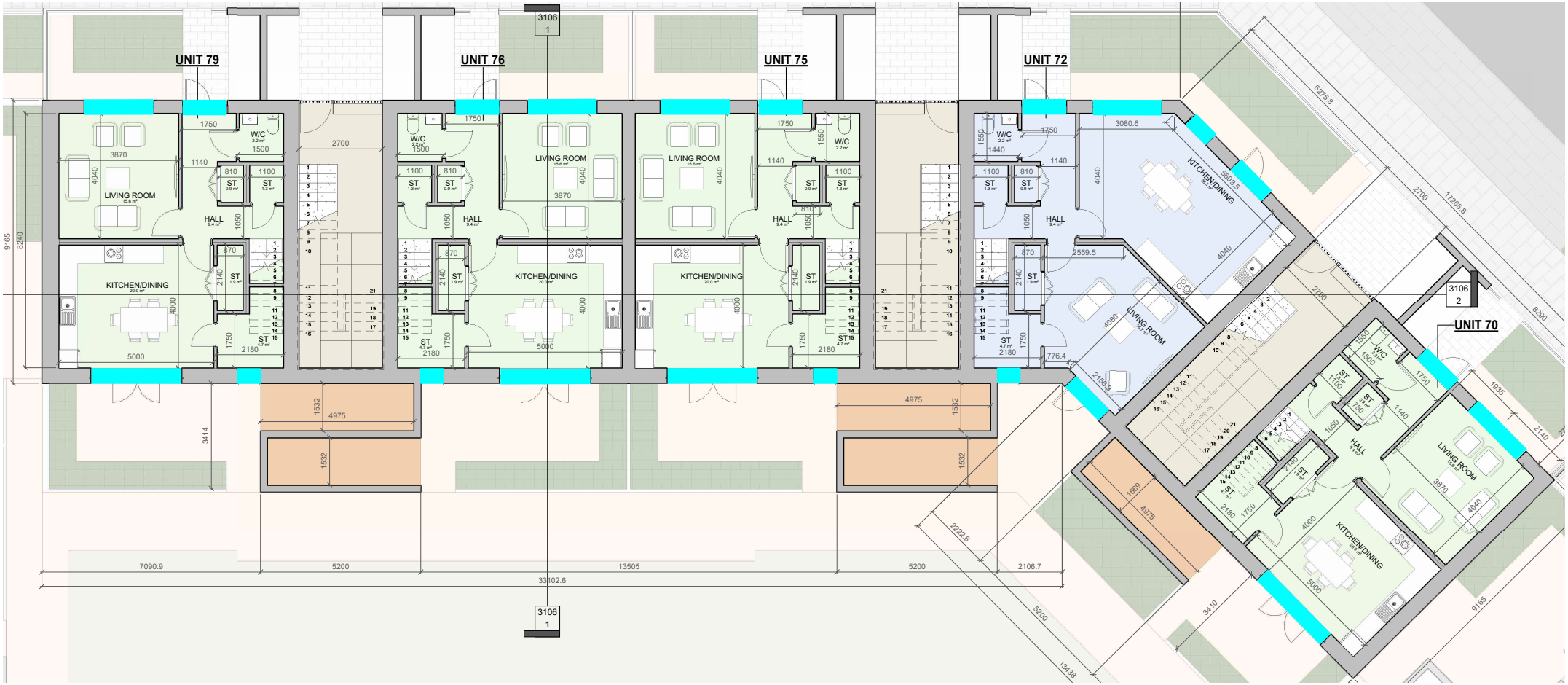


Glazed Elements Specification

- 39 dB R_w
- 34 dB R_w

WAVE DYNAMICS
ACOUSTIC CONSULTANTS

Project:	Clonburris Duplex Wing 1
Title:	Glazing Markup Second Floor
Prepared By:	Saoirse Mulvaney
Reviewed By:	Sean Rocks
Date:	31/05/2024

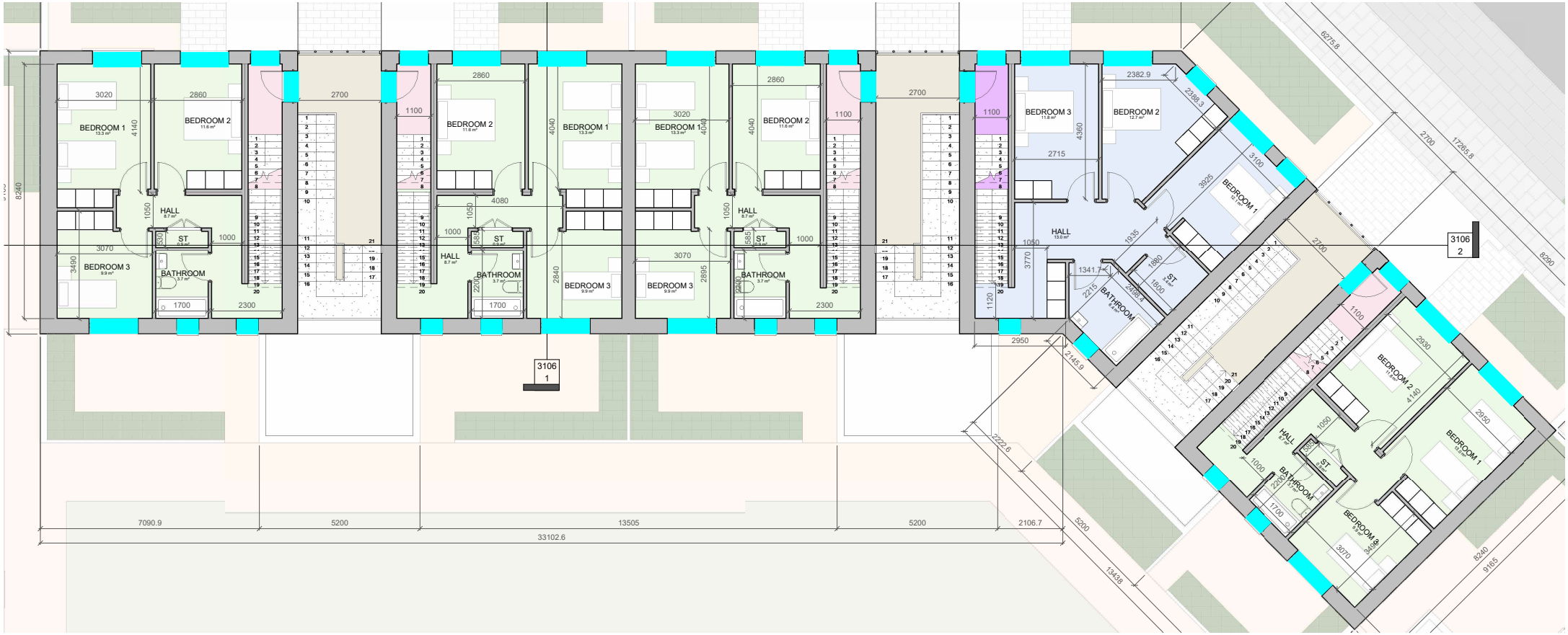


Glazed Elements Specification

- 39 dB R_w
- 34 dB R_w

WAVE DYNAMICS
ACOUSTIC CONSULTANTS

Project:	Clonburris Duplex Wing 2
Title:	Glazing Markup Ground Floor
Prepared By:	Saoirse Mulvaney
Reviewed By:	Sean Rocks
Date:	31/05/2024

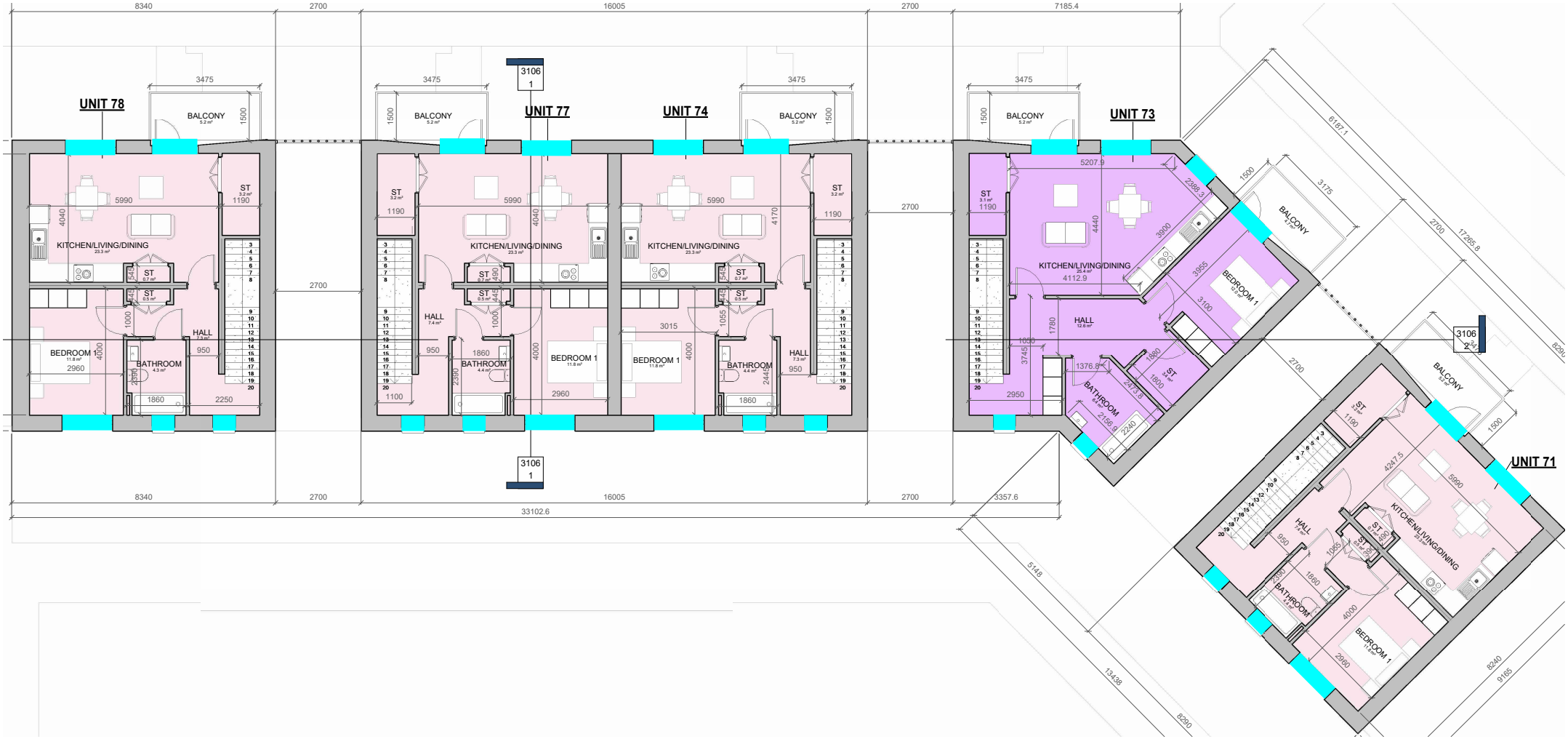


Glazed Elements Specification

- 39 dB R_w
- 34 dB R_w

WAVE DYNAMICS
ACOUSTIC CONSULTANTS

Project:	Clonburris Duplex Wing 2
Title:	Glazing Markup First Floor
Prepared By:	Saoirse Mulvaney
Reviewed By:	Sean Rocks
Date:	31/05/2024

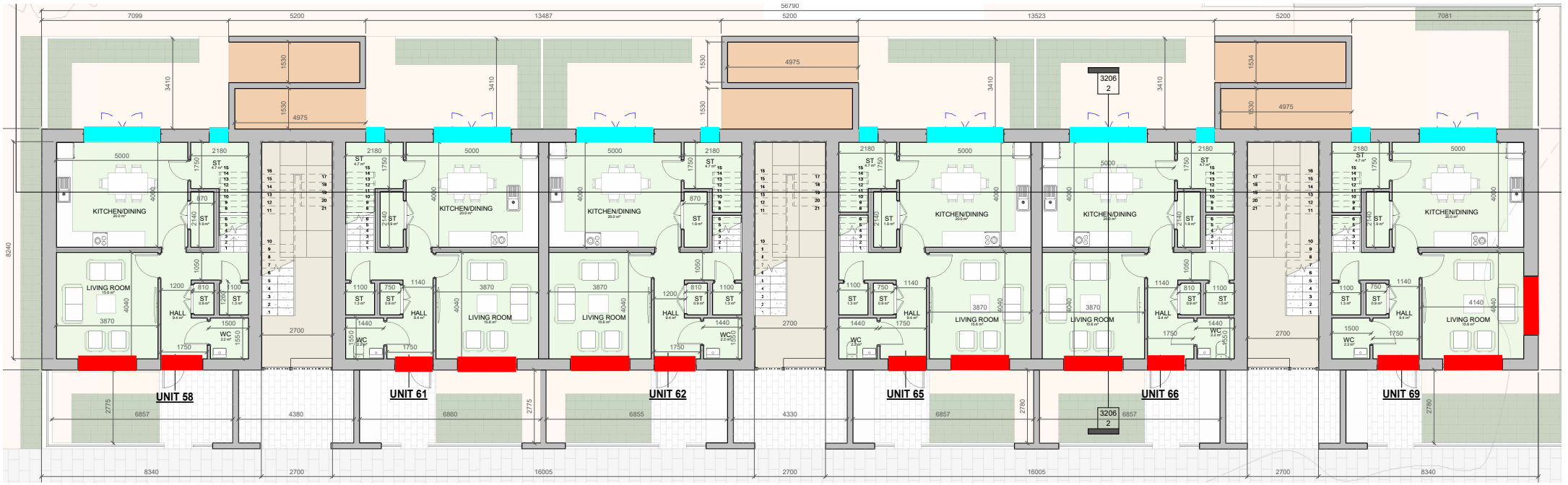


Glazed Elements Specification

- 39 dB R_w
- 34 dB R_w

WAVE DYNAMICS
ACOUSTIC CONSULTANTS

Project:	Clonburris Duplex Wing 2
Title:	Glazing Markup Second Floor
Prepared By:	Saoirse Mulvaney
Reviewed By:	Sean Rocks
Date:	31/05/2024

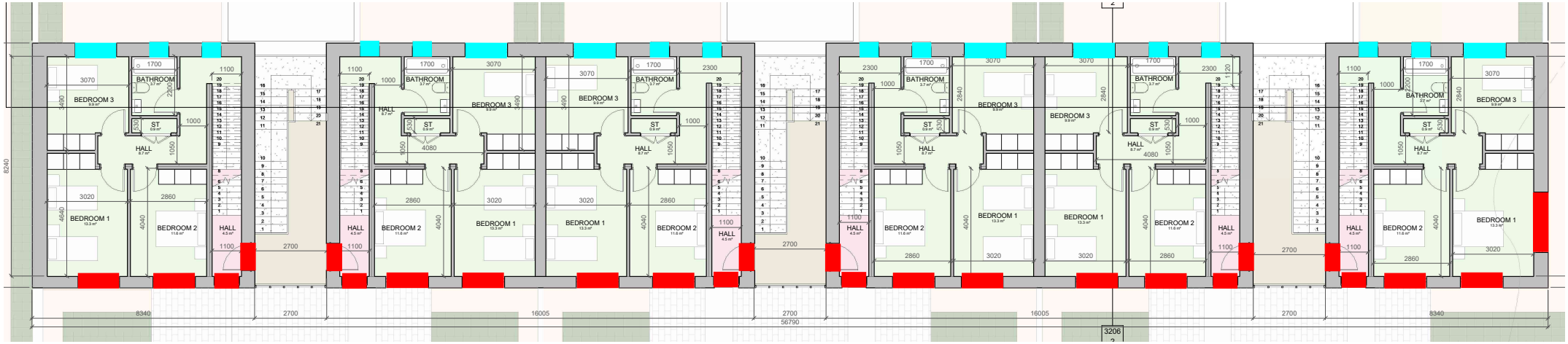


Glazed Elements Specification

- 39 dB R_w
- 34 dB R_w

WAVE DYNAMICS
ACOUSTIC CONSULTANTS

Project:	Clonburris Duplex Wing 3
Title:	Glazing Markup Ground Floor
Prepared By:	Saoirse Mulvaney
Reviewed By:	Sean Rocks
Date:	31/05/2024

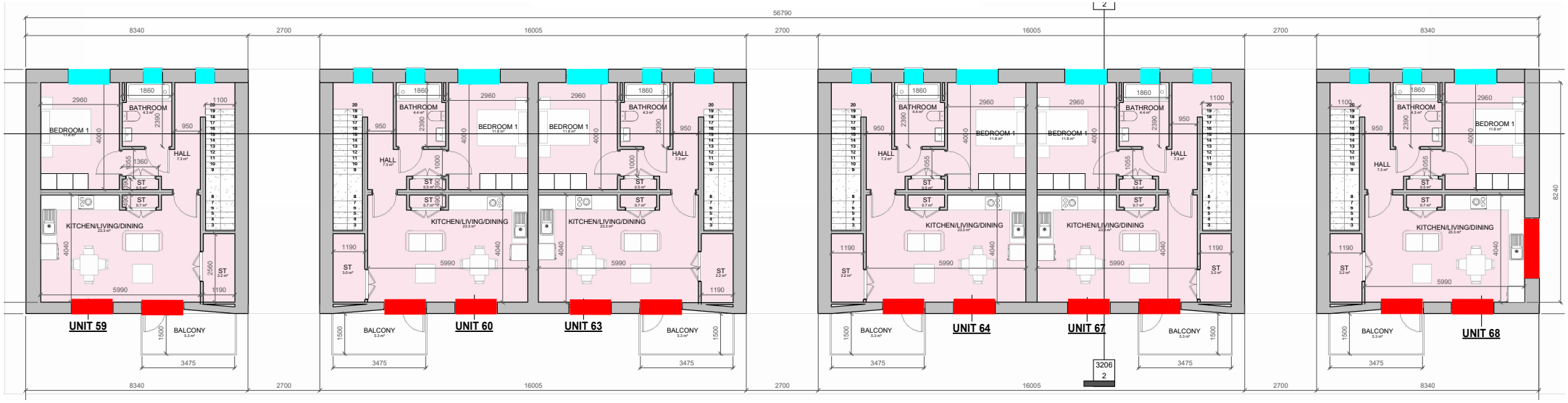


Glazed Elements Specification

- 39 dB R_w
- 34 dB R_w

WAVE DYNAMICS
ACOUSTIC CONSULTANTS

Project:	Clonburris Duplex Wing 3
Title:	Glazing Markup First Floor
Prepared By:	Saoirse Mulvaney
Reviewed By:	Sean Rocks
Date:	31/05/2024

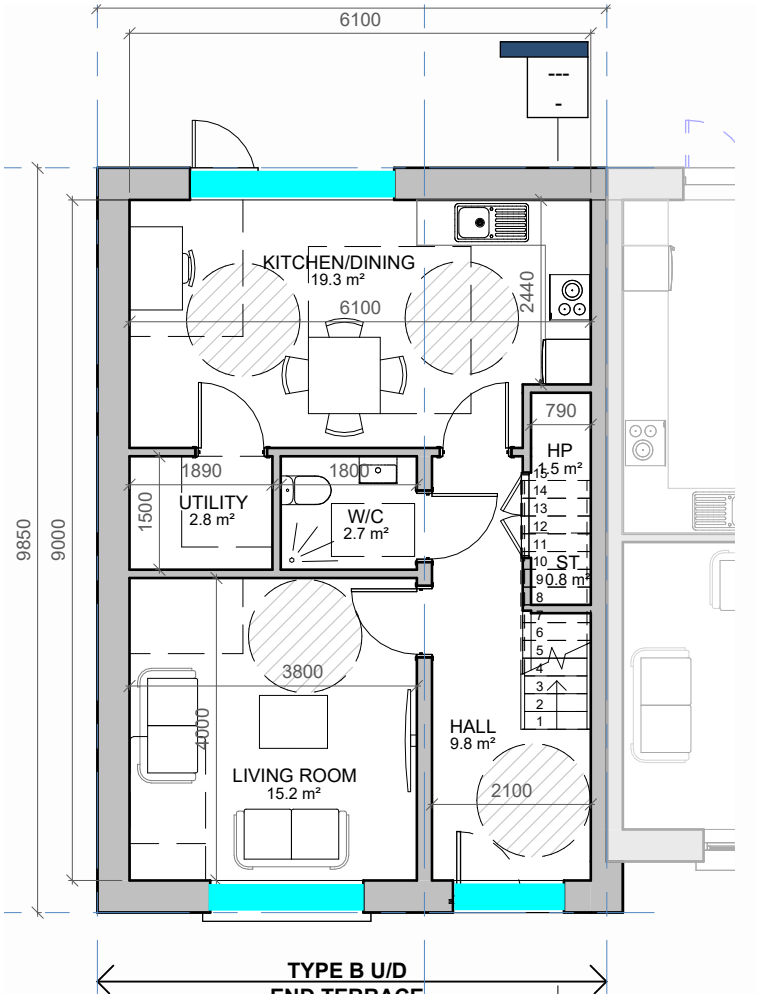


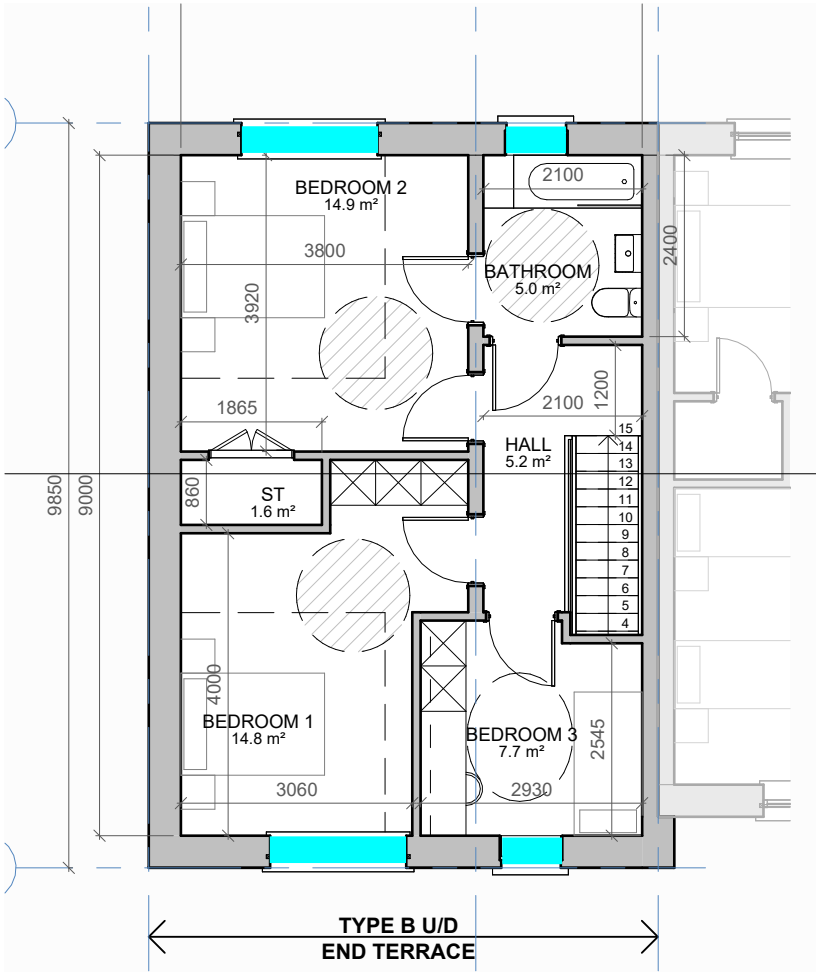
Glazed Elements Specification

- 39 dB R_w
- 34 dB R_w

WAVE DYNAMICS
ACOUSTIC CONSULTANTS

Project:	Clonburris Duplex Wing 3
Title:	Glazing Markup Second Floor
Prepared By:	Saoirse Mulvaney
Reviewed By:	Sean Rocks
Date:	31/05/2024



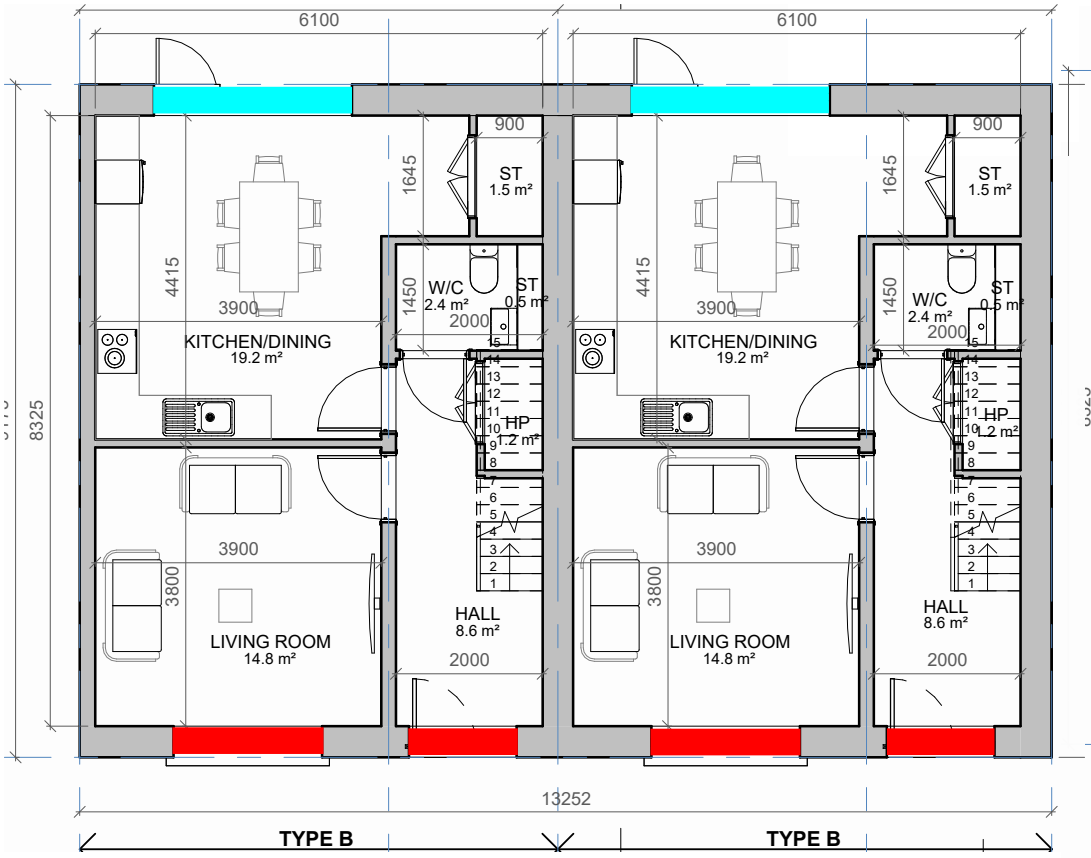


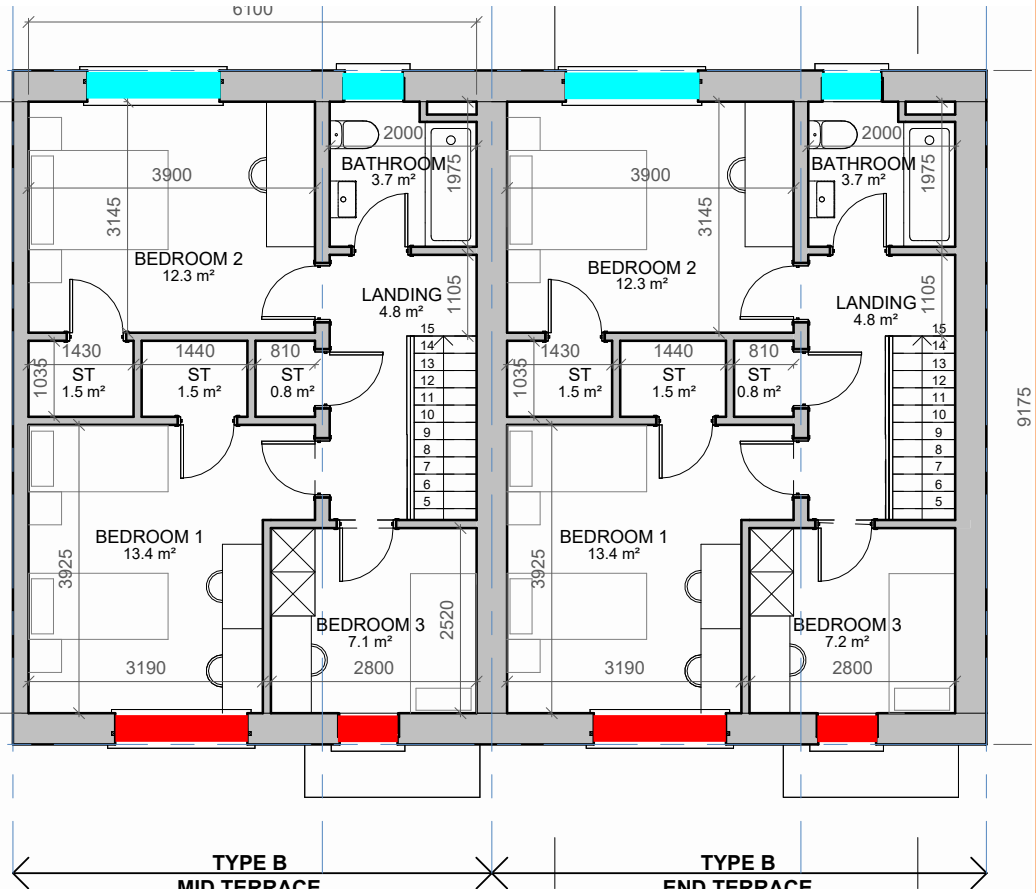
Glazed Elements Specification

- 39 dB R_w
- 34 dB R_w

WAVE DYNAMICS
ACOUSTIC CONSULTANTS

Project:	Clonburris HT B Units 86 & 93
Title:	Glazing Markup Ground Floor & First Floor
Prepared By:	Cathal Reck
Reviewed By:	Sean Rocks
Date:	31/05/2024



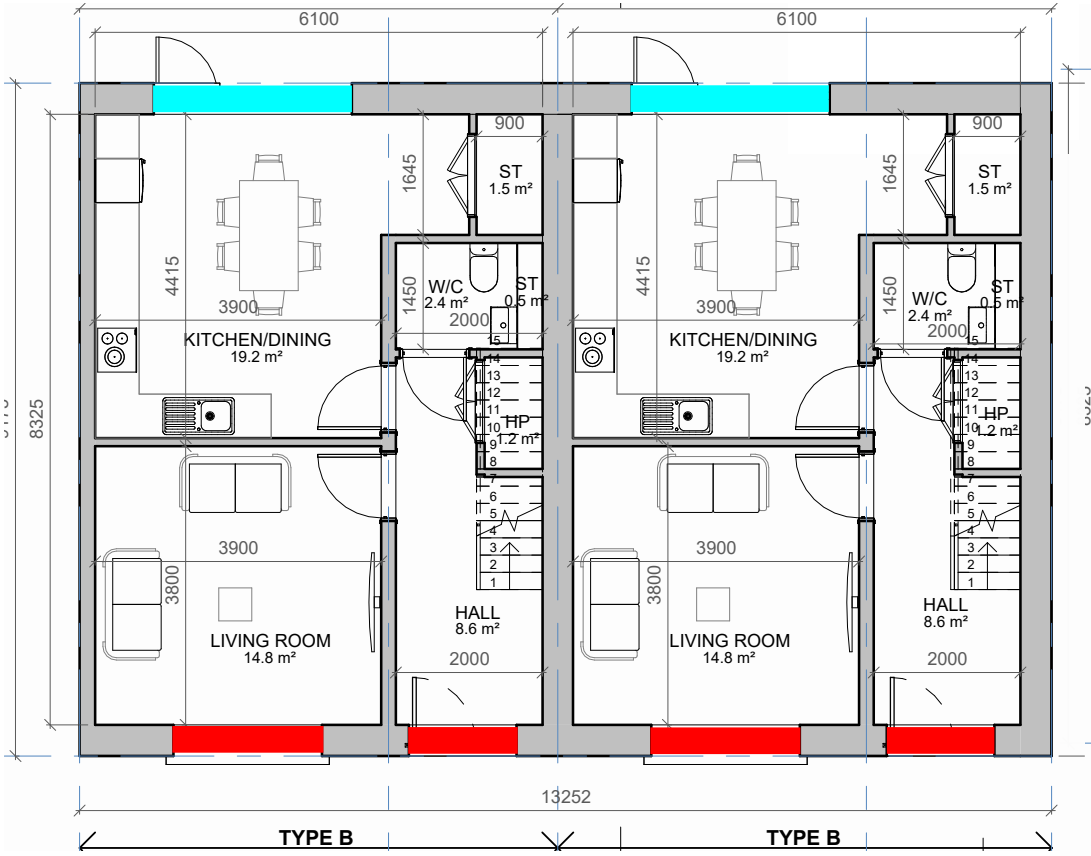


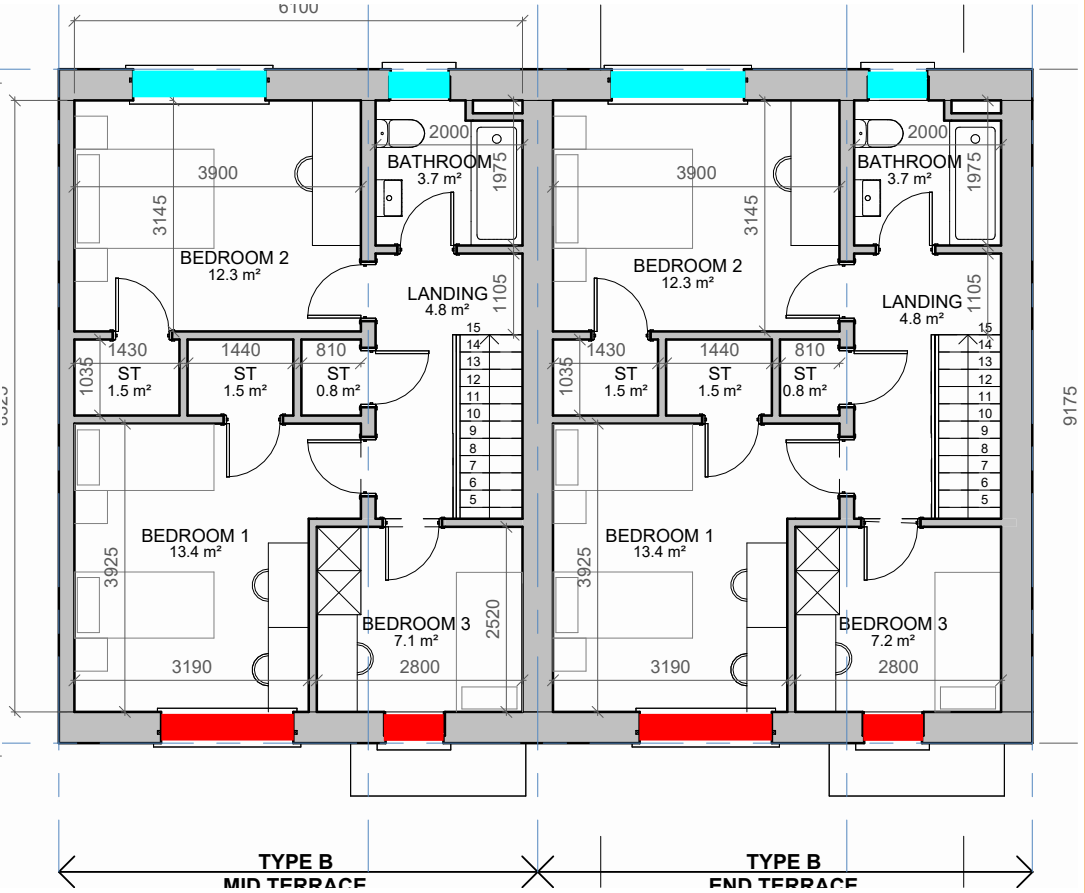
Glazed Elements Specification

- 39 dB R_w
- 34 dB R_w

WAVE DYNAMICS
ACOUSTIC CONSULTANTS

Project:	Clonburris HT B Units 88-91 & 117-118
Title:	Glazing Markup Ground Floor & First Floor
Prepared By:	Cathal Reck
Reviewed By:	Sean Rocks
Date:	31/05/2024



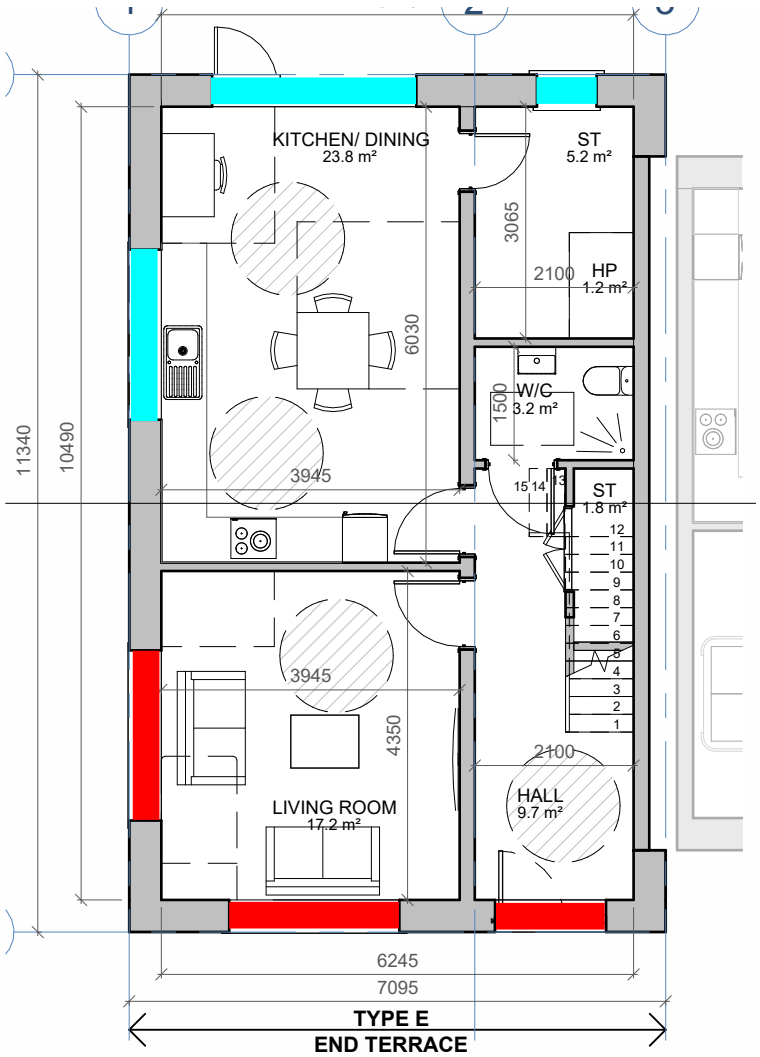


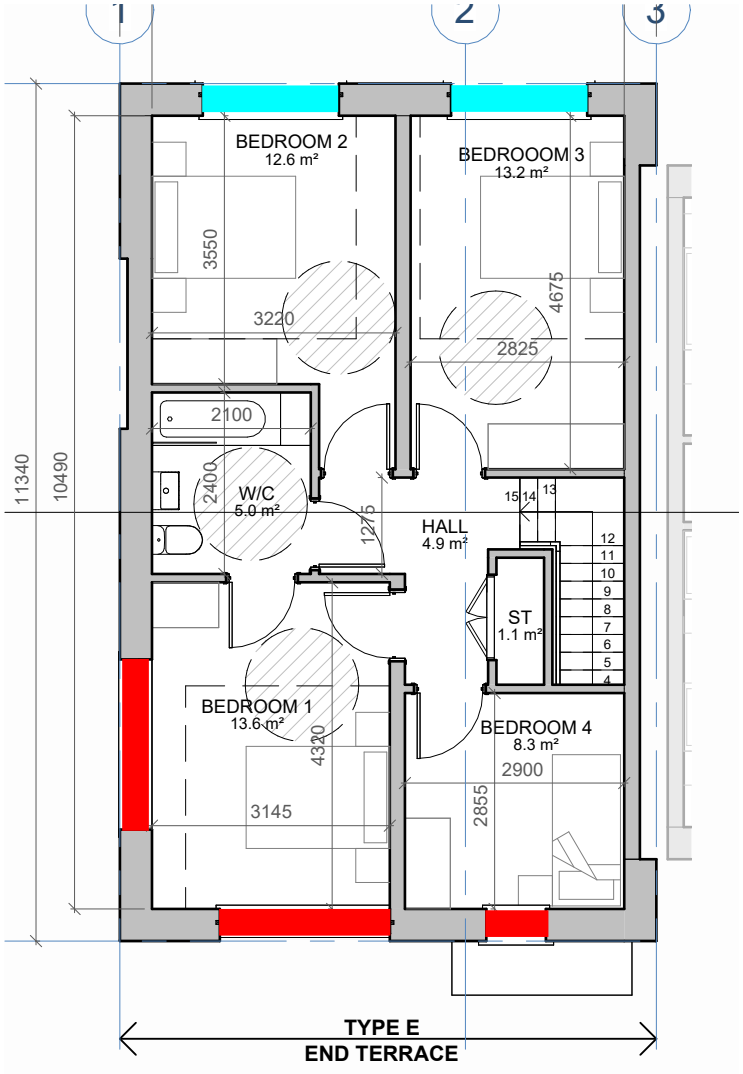
Glazed Elements Specification

- 39 dB R_w
- 34 dB R_w

WAVE DYNAMICS
ACOUSTIC CONSULTANTS

Project:	Clonburris HT B Units 81-85, 94-98 & 111-114
Title:	Glazing Markup Ground Floor & First Floor
Prepared By:	Cathal Reck
Reviewed By:	Sean Rocks
Date:	31/05/2024



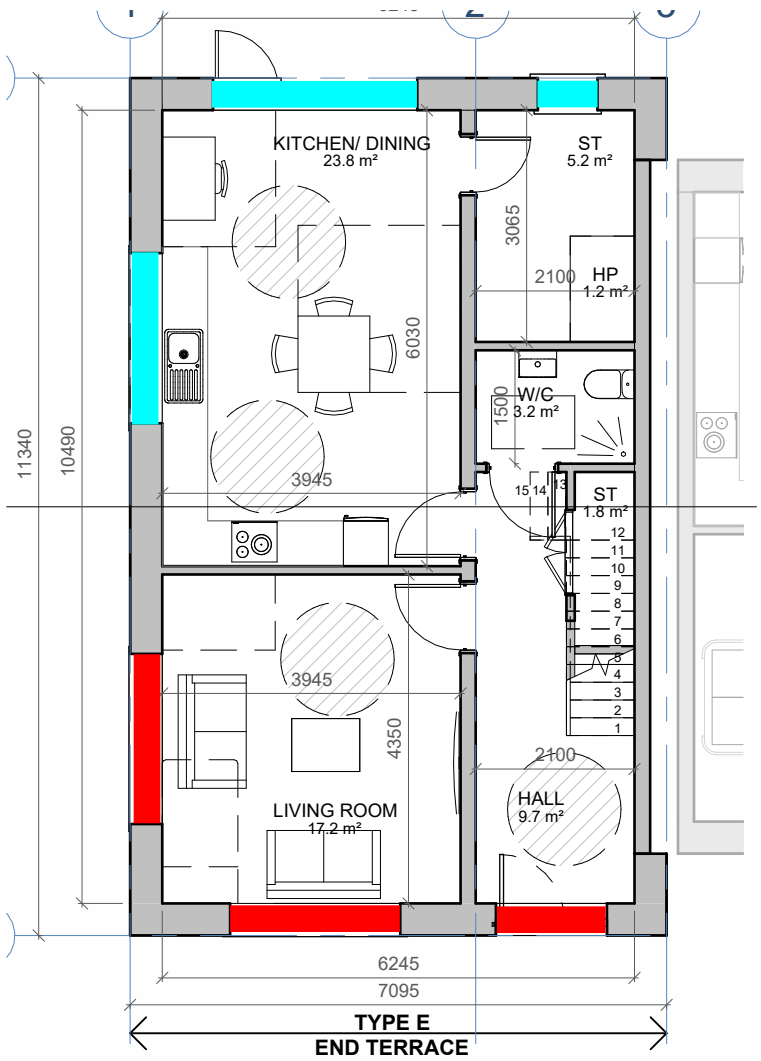


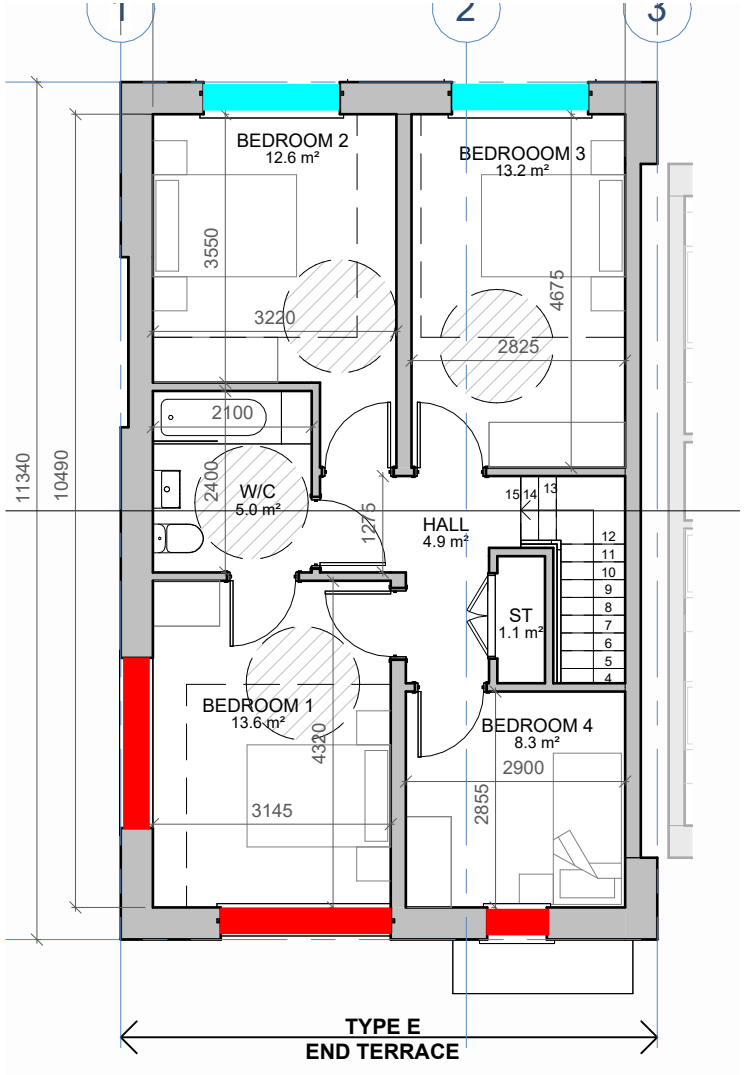
Glazed Elements Specification

- 39 dB R_w
- 34 dB R_w

WAVE DYNAMICS
ACOUSTIC CONSULTANTS

Project:	Clonburris HT B Units 80 & 99
Title:	Glazing Markup Ground Floor & First Floor
Prepared By:	Cathal Reck
Reviewed By:	Sean Rocks
Date:	31/05/2024



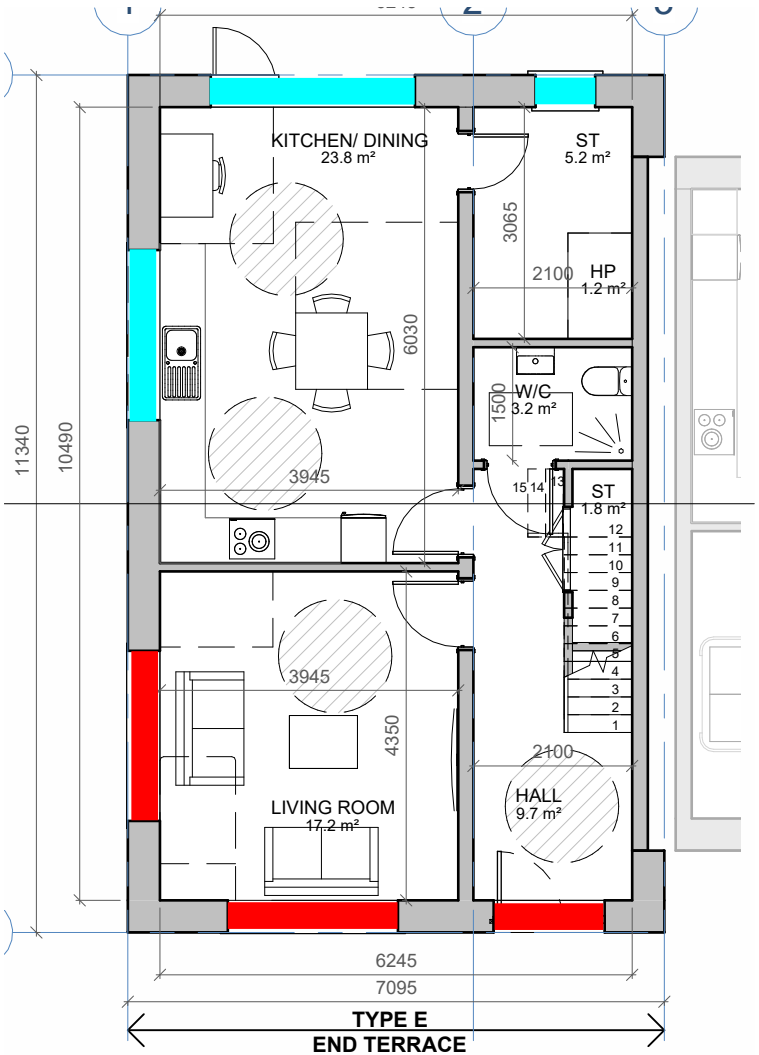


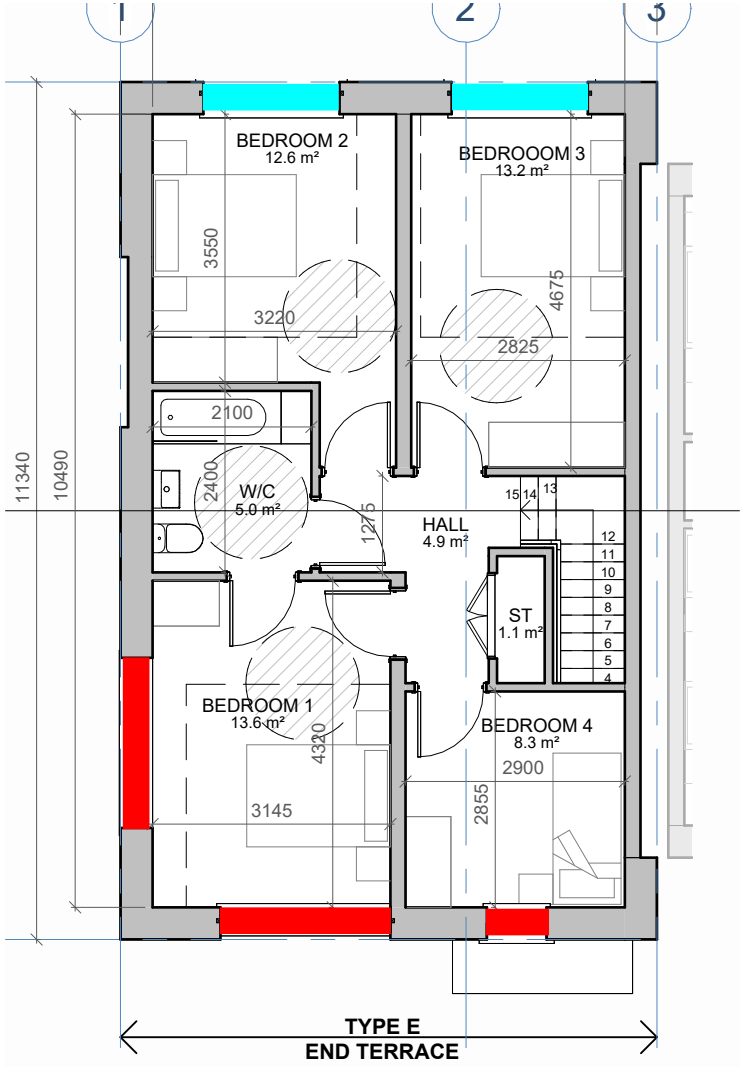
Glazed Elements Specification

- 39 dB R_w
- 34 dB R_w

WAVE DYNAMICS
ACOUSTIC CONSULTANTS

Project:	Clonburris HT B Unit 110
Title:	Glazing Markup Ground Floor & First Floor
Prepared By:	Cathal Reck
Reviewed By:	Sean Rocks
Date:	31/05/2024





Glazed Elements Specification

- 39 dB R_w
- 34 dB R_w

WAVE DYNAMICS
ACOUSTIC CONSULTANTS

Project:	Clonburris HT B Units 87, 92, 116
Title:	Glazing Markup Ground Floor & First Floor
Prepared By:	Cathal Reck
Reviewed By:	Sean Rocks
Date:	31/05/2024