

BUNDLE OF TECHNICAL REPORTS

VOLUME 12

Acoustic Assessment

Noise Impact Assessment

Habitat Stage 5

Part Lot 10 DP 271119 and Penny Lane (part of Lot 1 DP 271119). bounded by Wallum Place, Gallager Street, Easy Street and the walkway at the rear of 2-20 Porter Street

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1. Introduction

1.1 Background

On 11 January 2018 *Tim Fitzroy & Associates (TFA)* were engaged by *Bayshore Development Pty Ltd a.t.f Bayshore Property Trust* to prepare an Environmental Noise Impact Assessment (ENIA) to support the existing Barrio café at the Habitat Development, 1 Porter Street, Byron Bay.

The request for an Environmental Noise Impact Assessment was triggered by noise complaints from adjoining residents with respect to mechanical ventilation, air conditioning, cool room operations, patron and café noise and waste collection. It appears that the bulk of complaints relate to night time activities. In recognition of the key issues at hand and at the request of our client the focus of the subsequent ENIA related to the mechanical ventilation system and refrigeration and cool room condensers which were deemed to be the primary source of complaint.

The resultant ENIA, entitled *Environmental Noise Impact Assessment of Mechanical Plant, Habitat Development, Porter Street Byron Bay* (5 February 2018) was prepared in collaboration with Alpha Acoustics. Noise levels were measured continuously at Location No 4 (a location within the locale but unaffected by the Barrio Cafe operation) between Saturday 13th January 2018 and Monday 22nd January 2018 to establish the Rating Background Noise Level (RBL) (without Octave Band Analysis) as calculated in accordance with the NSW Industrial Noise Policy (NSW EPA 2000). On 5 February 2018 the *Environmental Noise Impact Assessment of Mechanical Plant, Habitat Development, Porter Street Byron Bay* (5 February 2018) was provided to the client.

The most recent NIA (*Noise Impact Assessment, Habitat Stage 4 1 Porter Street Byron Bay* (Tim Fitzroy & Associates, 29 January 2020) relates to:

- a mixed-use development, entailing the erection of a part 1 and part 2 level above ground complex, providing business premises, office premises, retail premises, restaurant / café and recreation facilities (indoor) land uses together with 37 car parking spaces.

This current NIA relates to Habitat Stage 5 which comprises:

- a mixed-use development entailing a basement car park and three levels above over 2 Habitat Community Title blocks and part of Penny Lane.
- The mixed use entails commercial premises, light industry, hotel or motel accommodation, serviced apartment, high technology industry, function centre, information and education facility, medical centre, recreation facility (indoor), and food and drink premises. Consent is sought to run the food and drink premises associated with the accommodation as a Licensed Restaurant.

This NIA should be read in conjunction with Environmental Noise Impact Assessment (ENIA) to support the existing Barrio café at the Habitat Development, Porter Street, Byron Bay (Tim Fitzroy & Associates, 11 April 2018), the *Noise Impact Assessment for External Dining, Barrio Restaurant* Habitat Development, Porter Street Byron Bay (3 July 2019) and the *Noise Impact Assessment, Habitat Stage 4, 1 Porter Street Byron Bay* (Tim Fitzroy & Associates, 29 January 2020).

1.2 Purpose

Tim Fitzroy & Associates has been engaged by Bayshore Development Pty Ltd to undertake a Noise Impact Assessment (NIA) to consider:

- a mixed-use development entailing a basement car park and three levels above over 2 Habitat Community Title blocks and part of Penny Lane.
- The mixed use entails commercial premises, hotel or motel accommodation, serviced apartment, high technology industry, function centre, information and education facility, medical centre, recreation facility (indoor), and food and drink premises. Consent is sought to run the food and drink premises associated with the accommodation as a Licensed Restaurant.

The site is located at the Habitat Commercial Precinct, Part Lot 10 DP 271119 and Penny Lane (part of Lot 1 DP 271119). bounded by Wallum Place, Gallagher Street, Easy Street and the walkway at the rear of 2-20 Porter Street.

This report provides details on the noise assessment and modelling carried out by *Tim Fitzroy & Associates and Noise Measurement Services* to investigate noise impacts on surrounding residences.

1.3 Applicable Noise Criteria

Protection of the Environment Operations Act 1997 (POEO Act) and the Protection of the Environment Operations (Noise Control) Regulation 2008 (Noise Control Regulation)

The *Protection of the Environment Operations Act 1997 (POEO Act)* and the *Protection of the Environment Operations (Noise Control) Regulation 2008 (Noise Control Regulation)* provide the main legal framework and basis for managing unacceptable noise.

The POEO Act:

- identifies the authority responsible for regulating noise (s. 6 of the Act)
- defines 'noise' and 'offensive noise' (Dictionary in the Act)
- provides a range of regulatory tools to manage noise, including Noise Control Notices, Prevention Notices, Noise Abatement Directions and Noise Abatement Orders.

Depending on the circumstances, the Noise Control Regulation may require an assessment of a noise's audibility, time of occurrence, duration or offensiveness.

The POEO Act does not always require noise to be measured to determine whether it is offensive. However, noise measurement can help in deciding what action, if any, is necessary.

1.2.1 Liquor Administration Board Standard Conditions

The Liquor Administration Board standard conditions for licenced premises are as follows:

- a) The LA10 noise level emitted from the premises shall not exceed the background noise level in any Octave Band Centre Frequency (31.5Hz–8kHz inclusive) by more than 5dB between 7:00 am and 12:00 midnight at the boundary of any affected residence.
- b) The LA10 noise level emitted from the premises shall not exceed the background noise level in any Octave Band Centre Frequency (31.5Hz–8kHz inclusive) between 12:00 midnight and 7:00 am at the boundary of any affected residence.

- c) Notwithstanding compliance with the above, the noise from the premises shall not be audible within any habitable room in any residential premises between the hours of 12:00 midnight and 7:00 am.
- d) For the purpose of this standard, the LA10 can be taken as the average maximum deflection of the noise emission from the premises.

Note: The standards specified above have been obtained from the Noise Guide for Local Government published by the NSW Environmental Protection Authority.

1.22 Offensive Noise

Depending on the type of noise under consideration, noise can be considered as offensive in three ways according to it's:

- audibility
- duration
- inherently offensive characteristics.

Given the nature of the noise complaints, it will be necessary for Council to consider a range of factors to determine whether the noise is offensive, including the following:

- the loudness of the noise, especially compared with other noise in the area
- the character of the noise
- the time and duration of the noise
- whether the noise is typical for the area
- how often the noise occurs
- the number of people affected by the noise.

1.23 Intrusive Noise

Noise is identified as 'intrusive' if it is noticeably louder than the background noise and considered likely to disturb or interfere with those who can hear it.

1.24 Sleep disturbance

Specific provisions relate to sleep disturbance and the World Health Organization recommends that a maximum level of 45 dB (A) should not be exceeded inside a bedroom. For practical purposes this is equivalent to a maximum level of 55 dB (A) outside a residence, with an open window to the bedroom (Guidelines for Community Noise WHO 1999).

1.25 Industrial Noise Policy

In accordance with the NSW Noise Policy for Industry (NSW EPA 2017), a Café/Restaurant, hotel or motel accommodation, function centre, information and education facility, medical centre, recreation facility (indoor), and food and drink premises are classified as an industrial/commercial noise source. The assessment procedure for an industrial noise source should comprise of:

- Controlling intrusive noise impacts in the short term for surrounding residences; and
- Maintaining noise level amenity for particular land uses for residences and other land uses.

In assessing the noise impact of the Café/Restaurant on the surrounding existing land use, both components must be taken into account for rural receivers, but, in most cases, only one will become the limiting factor forming the project-specific noise level. The intrusiveness of an industrial noise source may be generally considered to be acceptable if the equivalent continuous A-weighted level of noise from the source, measured over a 15 minute period, does not exceed the background noise level by more than 5dB. Therefore, the limiting criteria for the control of intrusive noise impacts is if the $L_{Aeq,15 \text{ minute}}$ descriptor is $< RBL + 5 \text{ dB}$.

In accordance with the INP (EPA, 2000) the surrounding land use in question is considered to be of suburban nature. The INP describes suburban noise as *an area*

that has local traffic with characteristically intermittent traffic flows or with some limited commerce or industry. This area often has the following characteristics:

- ❖ *decreasing noise levels in the evening period (1800–2200); and/or*
- ❖ *evening ambient noise levels defined by the natural environment and infrequent human activity.*

This area may be located in either a rural, rural-residential or residential zone, as defined on an LEP or other planning instrument.

To limit continuing increases in noise levels, the maximum noise level within an area from industrial noise sources should not normally exceed the criteria in Table 2.1 of the NSW EPA Industrial Noise Policy. These levels represent current best practice for assessing industrial noise sources, based on research and a review of assessment practices used overseas and within Australia. In accordance with Table 2.1 (NSW EPA, 2000) the amenity criteria for a “suburban receiver” are presented in **Table 1.1** below:

Table 1.1 Amenity Criteria for Suburban Receiver

<i>Time Period</i>		<i>Amenity Criterion</i>
Daytime	(7am-6pm Mon-Sat; 8am-6pm Sun)	55-60 dB(A)
Evening	(6pm-10pm)	45-50 dB(A)
Night	(remaining periods)	40-45 dB(A)

The Industrial Noise Policy (NSW EPA 2000) provides guidance on the controls and measures to manage industrial noise and the potential impacts on suburban receivers.

The acoustic environment within Habitat represents a mixed use environment which is not clearly defined in the existing noise classifications. The noise environment includes a mix of urban, commercial and urban/commercial noise environments. Whilst there is residential accommodation within Habitat the abodes are located within a specifically designed, approved and constructed mixed business zone and development and it is our considered view that it is not appropriate that residents in the subject development be afforded the same level of acoustic amenity as residents within a purpose built residential development.

Proposed Precinct No 2 comprising 56x one bedroom units and 4x two bedroom units would be classified as *Urban Residential Amenity Criteria* while the location of residences, within Precinct 4 for example, residing amongst Retail / Business / Café / Community Recreation Facilities are located in an area which would be best described as a *Urban/Commercial Interface* noise environment. It may be appropriate to apply a limited proportional increase in the *Urban Amenity Residential Criteria* within the mixed use Habitat precincts to better reflect the approved land use. With that in mind an amenity criteria of 65/55/50 for the day/evening/night period is proposed for residences within Habitat’s mixed use precincts No 1, 3 and 4. By way of comparison the Urban residential, Commercial and proposed Commercial Interface Amenity Criteria (for application in Precinct 1, 3 and 4) are summarised in **Table 1.2**.

Table 1.2 Amenity Noise Levels*

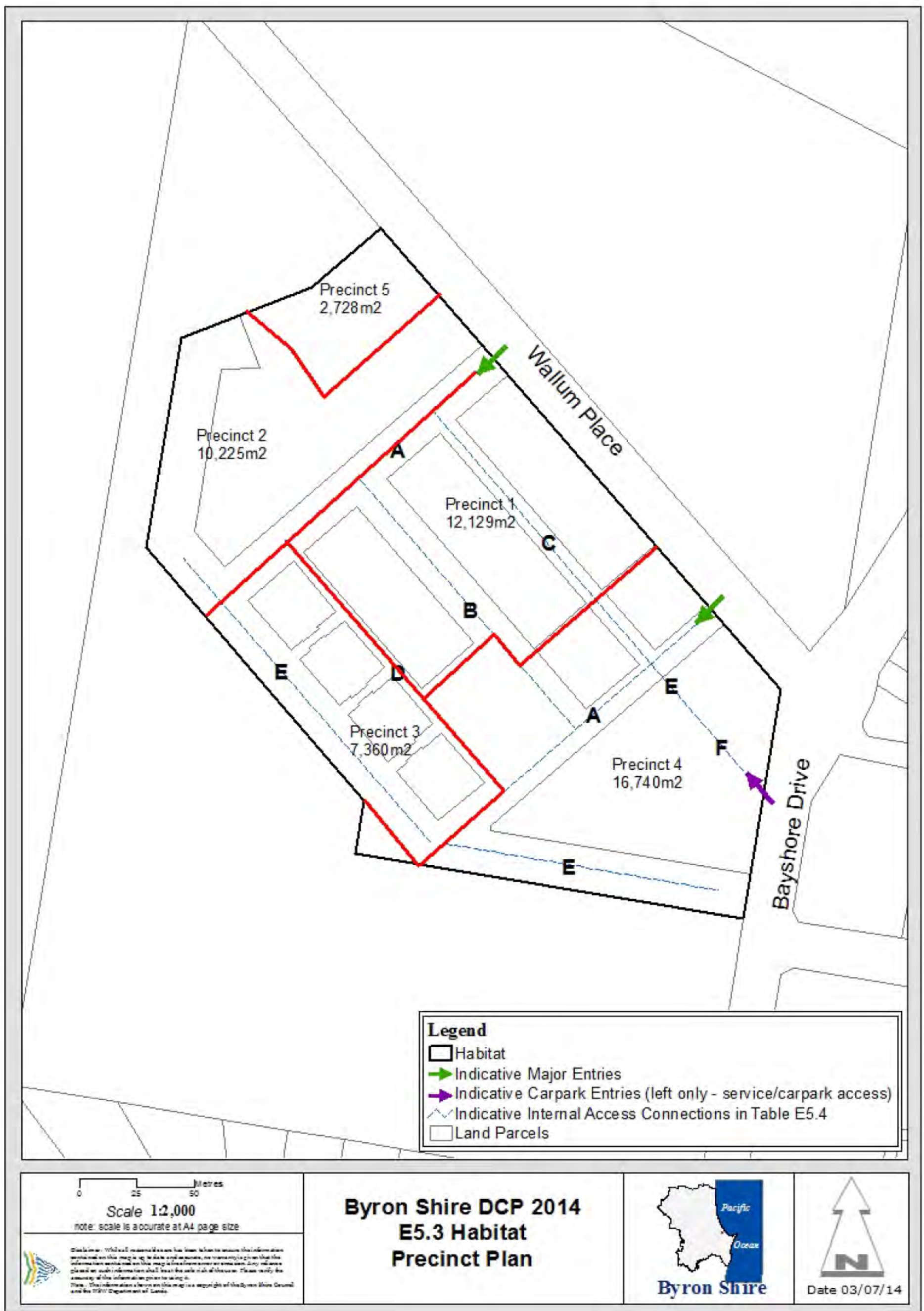
Receiver	Time of Day	Laeq15mins Recommended noise amenity level	Description
Urban residential (Precinct 2)	Day	60	Urban – an area with an acoustical environment that: • is dominated by 'urban hum' or industrial source noise, where urban hum means the aggregate sound of many unidentifiable, mostly traffic and/or industrial related sound sources • has through-traffic with characteristically heavy and continuous traffic flows during peak periods • is near commercial districts or industrial districts • has any combination of the above
	Evening	50	
	Night	45	
Commercial	When in Use	65	commercial – commercial activities being undertaken in a planning zone that allows commercial land uses
Proposed Commercial Interface (for use in Precinct 1, 3 and 4)	Day	65	Add 5db to urban residential amenity criteria
	Evening	55	
	Night	50	

Source: Noise Policy for Industry (NSW EPA 2017)

Note: there are no residences proposed in Precinct No 5.A copy of the existing Precinct Plan is provided in **Plate 1.1**.

Plate 1.1**Location of External sensitive receptors**

Plate 1.2 Existing Habitat Precinct Plan



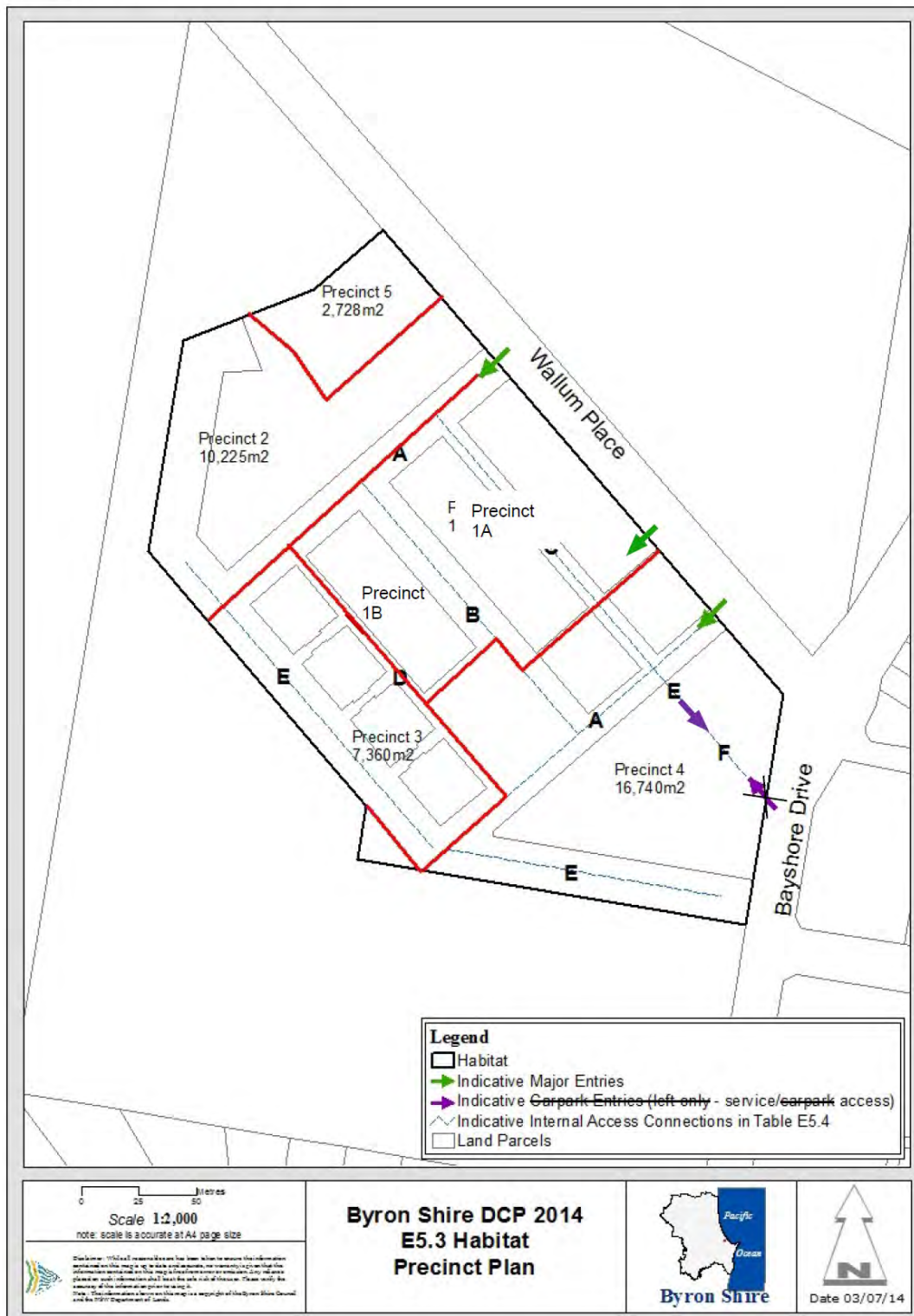
Note: TFA are advised (pers.com Steve Connelly 29.01.2020) as part of the Development Application it is proposed to amend Development Control Plan (BSC 2014) Land Use Definitions in Table E5.1 – Land Uses Consistent with Desired Future Character within Habitat Stage 5 from Tiered Living (current Precinct 1) to Precinct 1A incorporating:

commercial premises, hotel or motel accommodation, serviced apartment, high technology industry, function centre, information and education facility, medical centre, recreation facility (indoor), and food and drink premises.

The proposed changes will not impact on the selected noise criteria for Stage 5. The proposed change to the Habitat Precinct Plan is shown in **Plate 1.3**

Plate 1.3 Proposed Habitat Precinct Plan

Map E5.3 – Habitat Precinct Plan



1.4 Overview of Noise Assessment

This noise assessment utilised the existing background noise levels within the vicinity of the nearest affected sensitive receiver established in ENIA (February 2018).

The noise assessment process included the following components:

- Consideration of noise impacts on surrounding residences; and
- Consideration of what feasible and reasonable noise mitigation measures ought to be considered where the project-specific noise levels are exceeded.

1.5 Site Description

The site located at Part Lot 10 DP 271119 and Penny Lane (part of Lot 1 DP 271119). bounded by Wallum Place, Gallager Street, Easy Street and the walkway at the rear of 2-20 Porter Street.

A site locality diagram is provided in **Illustration 1.1**.

1.5.1 Topography

The site is relatively flat terrain.

1.5.2 Climate

Weather recording data was collected from the official Bureau of Meteorology (BOM) Weather Station at Ballina Airport. Rain fall and wind greater than 18km/hr was excluded from the noise monitoring results.

1.5.3 Surrounding Land use

The site is bounded by a mix of commercial properties to the south and west residential properties to the east.

1.6 Existing Development

Habitat has been progressively developed as summarised below:

Initial Works

The initial construction of roadworks, implementation of utility services and environmental enhancement works was undertaken pursuant to DA consents 2008/360 and 2011/162.

Stage 1

DA 2015/353 provided for the mixed-use development comprising residential dwellings, commercial and retail units, recreation facilities, associated infrastructure and subdivision. Alterations to the physical form of the Stage 1 approval have related mainly to enhancements to the recreation facilities approved pursuant to DA 2016/617 and alterations to the Barrio Cafe and service access under DA 2019/375.

Stage 2

Stage 2 involved the erection of a residential flat building with associated light industry, approved pursuant to DA 2017/4. This Development Application provided for two additional live/work buildings extending on the two buildings approved at Stage 1.

Stage 3

DA 2017/628 provided for the construction of 60 “pocket living” apartments. This stage has recently been completed.

Stage 4

DA 2019/517 was lodged with Council in September 2019. It provides for the erection of a Part 2 and Part 3 storey level complex providing retail premises, restaurant / café and recreation facility (indoor) land uses, together with 37 car parking spaces. The Stage 4 Development Application was undetermined at the time of the lodgement of this application.

A simplified version of the Development Plans is provided in **Appendix A**.

LEGEND:

The works have been divided into 2 Stages; Stage 01 + Stage 02. Currently, all documentation is focussed on works within Stage 01

Please refer drawing: CM_CD 100 SITE PLAN for detailed information on STAGE 01 of the Works

STAGE 01B:

- | Commercial Precinct | |
|---------------------|--------------------------|
| B1 | Retail + Commercial Unit |
| C1. | Retail + Commercial Unit |
| C2. | Retail + Commercial Unit |
| C3. | Retail + Commercial Unit |
| C4. | Retail + Commercial Unit |
| C5. | Retail + Commercial Unit |
| T1. | Shared Amenities |
| T2. | Shared Amenities |
| B. | Shared Amenities |

Illustration 1.1 Site Locality

EQUIPMENT LOCATION

AREA OF COMPLAINTS

CAFE LOCATION

BYRON COUNCIL
SECTION 96 MODIFICATION
CONSENT NO: 10.2015.353.6

DATE: 27/4/2017

Development Officer

2. Instrumentation

2.1 Noise Monitoring Equipment

Tim Fitzroy & Associates utilised the following equipment in the Addendum to the Environmental Noise Impact Assessment (April 2018):

- A Type 1 Bruel & Kjaer 2260 Noise Analyser

Calibration of the noise monitoring equipment was undertaken prior to use. To ensure no significant tonal drift occurred over the monitoring period, the calibration was checked before and after each measurement period.

2.2 Monitoring Methodology

Consistent with the purpose of the acoustic assessment, the aim of the noise monitoring process was to establish:

- the existing background and ambient noise at the site;
- consideration of potential noise impacts on surrounding residences; and
- consideration of what feasible and reasonable noise mitigation measures ought to be considered where the project-specific noise levels are exceeded.

Long term noise monitoring was undertaken to establish the existing background noise with Octave Band Analysis at the boundary of the nearest affected residence to Barrio. Ambient sound pressure levels were measured generally in accordance with Australian Standard AS1055.1:1997 - 'Acoustics-Description and measurement of environmental noise - Part 1: General procedures'.

Attended noise measurement was undertaken with a Bruel & Kjaer 2260, type 1 noise analyser which was placed at a measurement location No 5 to monitor the ambient noise levels, from 8pm Wednesday 14 March to 12:34am Thursday 15 March 2018 to gather information of background noise with Octave Band Analysis as per Council's prevention notice.

Note: As part of the *Environmental Noise Impact Assessment of Mechanical Plant, Habitat Development, Porter Street Byron Bay (5 February 2018)* long term background noise monitoring was undertaken with a Rion Type 1 (without Octave Band Analysis) Saturday 13th January 2018 and Monday 22nd January 2018 at a site on Porter Street that is not impacted by noise from the Barrio Café.

Illustration 2.1 shows combined noise monitoring locations.

LEGEND:

The works have been divided into 2 Stages; Stage 01 + Stage 02. Currently, all documentation is focussed on works within Stage 01

Please refer drawing: CM_CD 000 SITE PLAN for detailed information on STAGE 01 of the Works

The works have been divided into 2 Stages; Stage 01 + Stage 02. Currently, all documentation is focussed on works within Stage 01

Please refer drawing: CM_CD_100 SITE PLAN for detailed information on STAGE 01 of the Works

Commercial Precinct	
B1	Retail + Commercial Unit
C1.	Retail + Commercial Unit
C2.	Retail + Commercial Unit
C3.	Retail + Commercial Unit
C4.	Retail + Commercial Unit
C5.	Retail + Commercial Unit
T1.	Shared Amenities
T2.	Shared Amenities
T3.	Shared Amenities

	Commercial Unit	Retail + Commercial Unit	Retail + Commercial Unit
C1.			
C2.			

3. Shared Amenities

COMPLAINTS

10

CATION

4

measurement point

ON COUNCIL
16 MODIFICATION
NO: 10.2015.353.6
27/4/2017
[Signature]
Deputy Officer

BoTR Page 704

BoTR Page

NO: 10.2015.383.0
27/4/2017
Employment Officer

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3. Acoustic Assessment

3.1 The Decibel Scale

The human ear responds to sound pressure levels over a very wide range – the loudest sound pressure level to which the human ear responds is ten million times greater than the quietest. This large ratio is reduced to a more manageable size by the use of logarithms. To avoid scale which is too compressed a factor of ten is introduced, giving rise to the decibel. The following **Table 3.1** provides an indication of typical A-Weighted sound pressure levels measured in decibels with typical noise sources. The table provides a good reference when comparing decibel readings.

Table 3.1 Example noise sources and the corresponding A-weighted decibel levels

Sound Pressure Level (dBA)	Typical Source	Subjective Evaluation
140	Long range gun, gunner's ear	Extremely noisy to intolerable
130	Threshold of pain	
120	Jet take-off at 100m	
110	Night club dance floor	
100	Loud car horn at 3 metres	Very noisy
90	Heavy truck at 10m	
80	Curbside of busy street	Loud
70	Car interior	
60	Normal conversation at 1m	Moderate to quiet
50	Office noise	
40	Living room in quiet area	Quiet to very quiet
30	Inside bedroom at night	
20	Unoccupied recording studio	Almost silent

The sensitivity of people to noise level changes varies from person to person. However generally, a change of up to 3 dBA in the level of a sound is difficult for most people to detect, whilst a 3 dBA to 5 dBA change corresponds to a small but noticeable change in loudness. A 10 dBA change corresponds to an approximate doubling or halving in loudness.

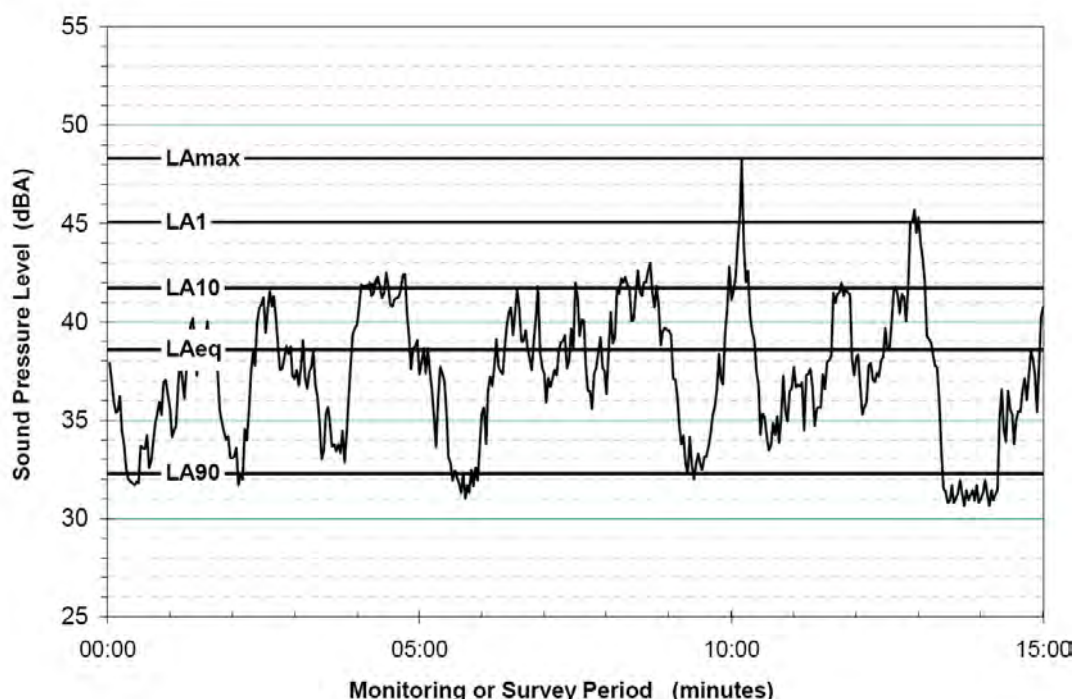
3.2 Acoustical Terms

This report makes reference to a number of different acoustical terms. Particularly the L_{Aeq} , L_{Amax} , L_{A10} and L_{A90} descriptors. Each descriptor is briefly explained below.

- The L_{Aeq} is essentially the average sound level. It is defined as the steady sound level that contains the same amount of acoustical energy as a given time; varying sound over a defined measurement period.
- The L_{Amax} noise level is the maximum A-weighted noise level.
- The L_{A10} is the A-weighted sound pressure level exceeded 10% of a given measurement period and is utilised normally to characterise typical maximum noise levels.
- The L_{A90} noise level is the A-weighted sound pressure level exceeded 90% of a given measurement period and is representative of the average minimum background sound level (in the absence of the source under consideration), or simply the “background” level.

A graphical display of typical noise indices and the relationship between each noise descriptor is provided below in Figure 3.1.

Figure 3.1 Graphical Display of Typical Noise Indices



3.3 Existing Noise Environment

The existing noise environment established in ENIA (February 2018) is described below:

The noise observed while on site without Barrio Café operating:

- ❖ During the day emanates from vehicles travelling along Bayshore Drive and operations from the neighbouring industrial precinct interspersed with bird calls;

- ❖ During the early evening (6pm to 8:30pm) vehicles travelling along Bayshore Drive;
- ❖ During the late evening period (8:30pm to 10:00pm) ocean, insects, cicadas. Secondary noise sources impacting on the subject site were bird calls; and
- ❖ During the night period (between 10pm and 7am) vehicle movement gradually desist and the dominate noise induces natural sounds including the ocean and insects.

The noise observed while on site with Barrio Café operating:

- ❖ During the day emanates from vehicles travelling along Bayshore Drive and operations from the neighbouring industrial precinct interspersed with bird calls and patrons at Barrio;
- ❖ During the early evening (6pm to 8:30pm) vehicles travelling along Bayshore Drive, interspersed with patrons from Barrio;
- ❖ During the late evening period (8:30pm to 10:00pm) patrons from Barrio, intermittent vehicles, ocean, insects, cicadas, Secondary noise sources impacting on the subject site were bird calls; and
- ❖ During the night period (between 10pm and 12am) patrons from Barrio, vehicle movement gradually desist and the dominate noise induces natural sounds including the ocean and insects.

A summary of the results obtained from analysis of data from the background day, evening and night time noise monitoring is provided below in **Table 3.2**.

Full copies of the raw data for the monitoring site can be found in **Appendix C**.

Table 3.2 Background Sound Pressure Levels

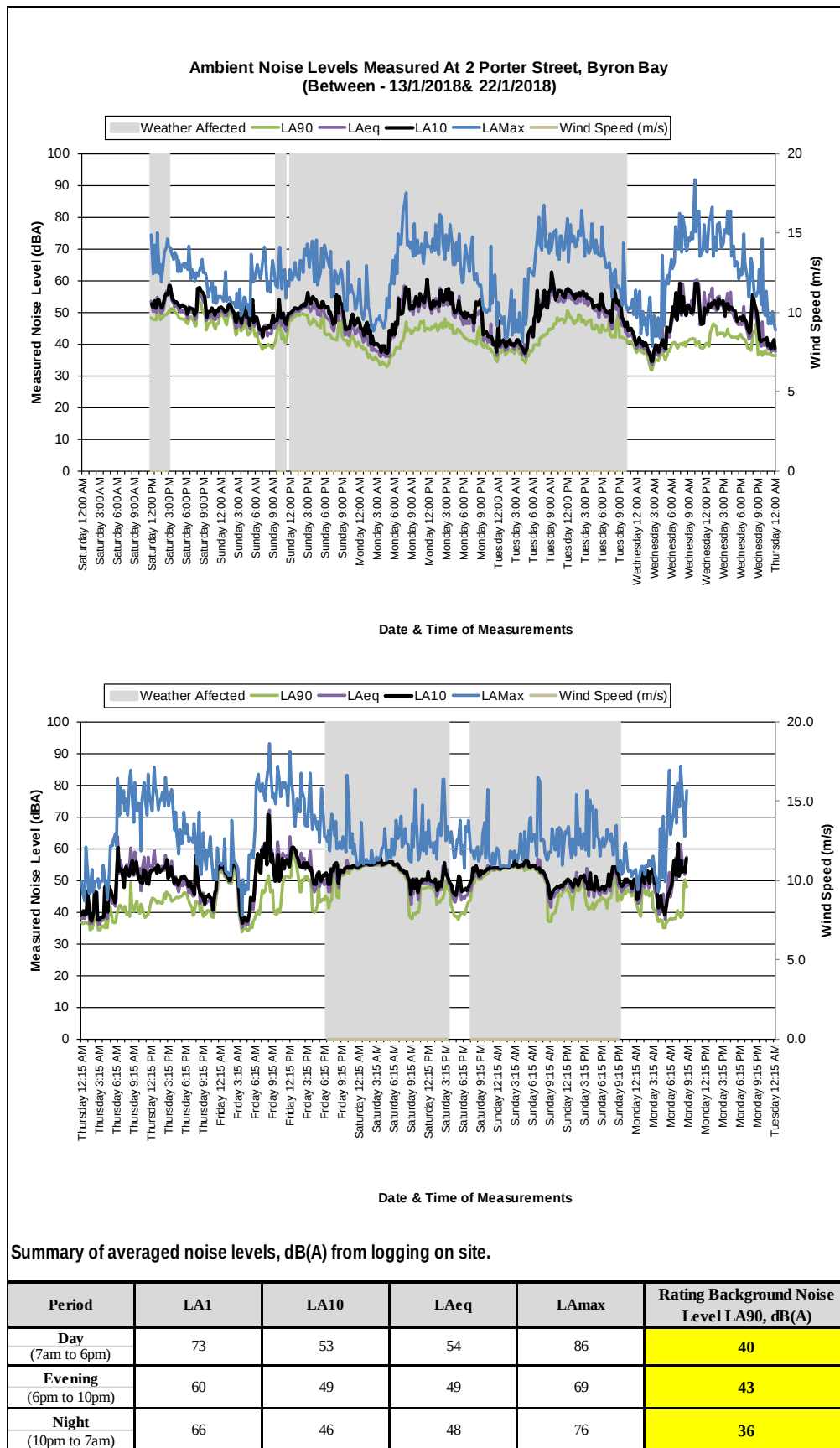
<i>Period</i>	<i>L_{Aeq(period)}*</i>	<i>RBL*</i>	<i>Amenity Criteria Suburban</i>	<i>RBL+5 dB</i>	<i>Project Specific Noise Criteria (PSNC) = lowest of column (4) and (5)</i>
<i>(1)</i>	<i>(2)</i>	<i>(3)</i>	<i>(4)</i>	<i>(5)</i>	
<i>Day</i>	54	40	55-60	45	45
<i>Evening</i>	49	43	45-50	48	45
<i>Night</i>	48	36	40-45	41	41

As can be seen from the above table, the project specific noise criteria for External Sensitive Receivers are determined by the intrusive noise criteria in the day period. The evening period PSNC cannot be more than the day period, therefore the evening period has been reduced to 45 dB whilst the night period is determined by the intrusiveness criteria. The Rating Background Levels reflect a location in close proximity to the Ocean.

The ambient and background noise levels measured at monitoring location no 5 over the monitoring period are presented in **Figure 3.2**.

The noise criteria for various receivers located within Habitat are described in **Table 1.2**

Figure 3.2 Ambient and Background Noise Levels at Measurement Location No 5



3.4 Cumulative Impact of Habitat on Surrounding Residences

3.4.1 Noise Modelling

Noise levels from the expected activities from Habitat have been predicted to the closest sensitive dwellings using SoundPLAN v8.0 and the prediction methodology ISO 9613-2: 1996. All prediction models have limits to their accuracy of prediction. This is due to the inherent nature of the calculation algorithms that go into the design of the models, the assumptions made in the implementation of the model, and the availability of good source sound power data. Various researchers have suggested that an un-calibrated model has an accuracy of ± 5 dB while a calibrated model has an accuracy of ± 2 dB. Calibration means that the model has been established with reference to measured sound levels at a receiver, known source levels and tightly defined propagation variables (wind speed and direction, for example). Alternatively, a series of predictions with different programs but the same assumption variables can be used for verification purposes.

3.4.2 Noise Source Levels

Cumulative noise levels from Barrio Café, Stage 4 and Stage 5 of the development are represented by the noise sources described in the following **Table** and **Plates**. Internal noise from relevant buildings is represented by an internal SPL emanating through opened doors and windows (where openable), and through fixed glazing of a nominal 34R_w. Doors and windows are positioned as per the supplied development plans.

Table 3.3 Noise Source

Stage	Description	Sum dB(A)	Noise Source Timing		
			Day	Evening	Night
Barrio	Patrons - Voice Level, Normal	70 SWL	100%	100%	100%
Barrio	Mechanical Plant	74 SWL	100%	100%	100%
Barrio	Truck Movements	95 SWL	2vph 20kph	0vph	0vph
4	Patrons - Voice Level, Normal	70 SWL	100%	100%	50%
4	Truck Movements	95 SWL	4vph 20kph	4vph 20kph	0vph
4	Deliveries / Loading	80 SWL	25%	25%	0%
4	Café Patron Noise	70 SWL	100%	100%	0%
4	Café Internal Noise	75 SPL	100%	100%	0%
4	Café Live Music	90 SWL	100%	100%	0%
4	Rec Facility Internal Noise	80 SPL	100%	100%	0%
4 & 5	Vehicle Movement	85 SWL	95vph 20kph	92vph 20kph	46vph 20kph
4 & 5	Mechanical Plant	74 SWL	100%	100%	100%
5	Patrons (Except Pool)	70 SWL	100%	100%	50%
5	Patrons (Pool)	70 SWL	100%	100%	0%
5	Special Function Internal Noise	80 SPL	100%	100%	100%
5	Function / Breakout Internal Noise	80 SPL	100%	100%	100%
5	Restaurant Internal Noise	80 SPL	100%	100%	100%

Plate 3.1 **Location of point sources**

Plate 3.2 **Location of building noise sources Stage 4 and Stage 5, ground floor**



Plate 3.3 Location of building noise sources, level 1.

Plate 3.4 Location of Building Source noises, Level 2

Plate 3.7 Location of Noise Sources, Truck Movements

3.4.3 Sensitive Receptors

Three receptor points have been placed to represent the surrounding dwellings, which were chosen to match the Noise Impact Assessment for the development. The receptor points are placed on the property boundary closest to the noise source at a height of 1.5m above ground and predicted levels are free-field. Receptor locations are presented in **Plate 3.8**.

Additional receptor points are placed 1m from the façade of accommodation within the development. Note that accommodation within Stage 5 is not considered to be sensitive to noise from within Stage 5, therefore receptor points are placed on the most exposed outward facing façades only. Predicted noise levels for these receptors are façade-affected.

External receptor locations representing *suburban receivers* as well as internal receptor locations (within the Habitat Development) including *urban residential receivers* and *commercial interface receivers* are presented in **Plate 3.8**.

Plate 3.8 Location of sensitive receptors

3.4.4 Weather Conditions

Noise modeling has been made using the prediction methodology ISO9613-2: 1996 which, by default, presents noise levels at the receiver for meteorological conditions which are favorable for propagation from the sound source to the receiver.

The predicted noise levels are considered to represent the average propagation under meteorological conditions including wind and temperature inversion.

3.4.5 Model Verification

Since the model presents a future scenario of nominal noise sources that are variable in nature, calibration of the noise model is not meaningful, and the model is considered to be un-calibrated.

3.4.6 Calculation of Noise Levels

Noise levels from the development have been predicted to each receptor with all noise sources from Barrio Café, Stage 4 and Stage 5 operating simultaneously as per the timing in **Table 3.3**. Predicted noise levels include screening from topography, with topographic information sourced from Geoscience Australia. Predicted noise levels include screening from existing and proposed structures, as indicated in development

plans. Predicted noise levels and visual noise contours are presented in the following **Table** and **Plates**.

Table 3.5 Predicted noise levels. Levels are in dB(A) Leq.

Receiver	Floor	Façade	Predicted Noise Level			Applicable Criteria	Criteria			Assessment
			D	E	N		D	E	N	
R1	G	-	41	38	36	External	45	45	41	Pass
R2	G	-	42	37	36	External	45	45	41	Pass
R3	G	-	39	34	33	External	45	45	41	Pass
CT-A	G	NW	39	39	35	Commercial Interface	65	55	50	Pass
CT-B	G	NW	47	47	39	Commercial Interface	65	55	50	Pass
PL-A	G	SE	45	45	40	Urban Residential	60	50	45	Pass
PL-A	L1	SE	45	45	41	Urban Residential	60	50	45	Pass
PL-B	G	SE	48	48	43	Urban Residential	60	50	45	Pass
PL-B	L1	SE	48	48	43	Urban Residential	60	50	45	Pass
PL-C	G	S	40	40	36	Urban Residential	60	50	45	Pass
PL-C	L1	S	41	41	38	Urban Residential	60	50	45	Pass
PL-D	G	SE	47	47	44	Urban Residential	60	50	45	Pass
PL-D	L1	SE	47	47	45	Urban Residential	60	50	45	Pass
S5-C	G	SW	52	51	45	Commercial Interface	65	55	50	Pass
S5-C	L1	SW	51	51	45	Commercial Interface	65	55	50	Pass
S5-C	L2	SW	51	51	46	Commercial Interface	65	55	50	Pass
S5-D	G	SW	54	54	47	Commercial Interface	65	55	50	Pass
S5-D	L1	SW	54	54	47	Commercial Interface	65	55	50	Pass
S5-D	L2	SW	54	54	48	Commercial Interface	65	55	50	Pass
WL-A	G	NE	51	50	46	Commercial Interface	65	55	50	Pass
WL-B	G	NE	54	54	48	Commercial Interface	65	55	50	Pass
WL-C	G	NE	53	53	46	Commercial Interface	65	55	50	Pass
WL-D	G	NE	49	49	45	Commercial Interface	65	55	50	Pass

Plate 3.9 Noise contours at Ground Floor (1.5m), Day. Levels are in dB(A) Leq, including façade effects

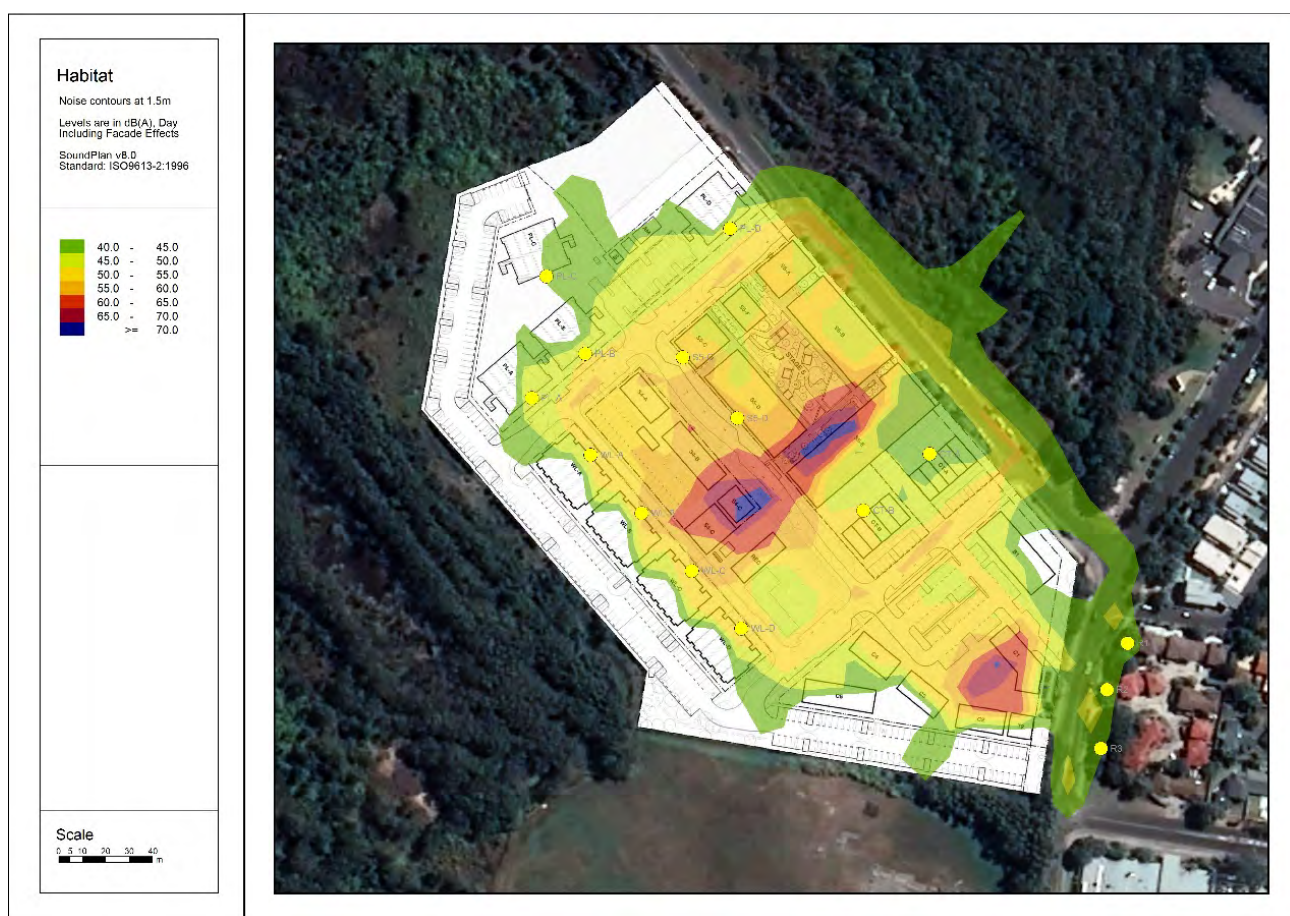


Plate 3.10 Noise contours at Ground Floor (1.5m), Evening. Levels are in dB(A) Leq, including façade effects

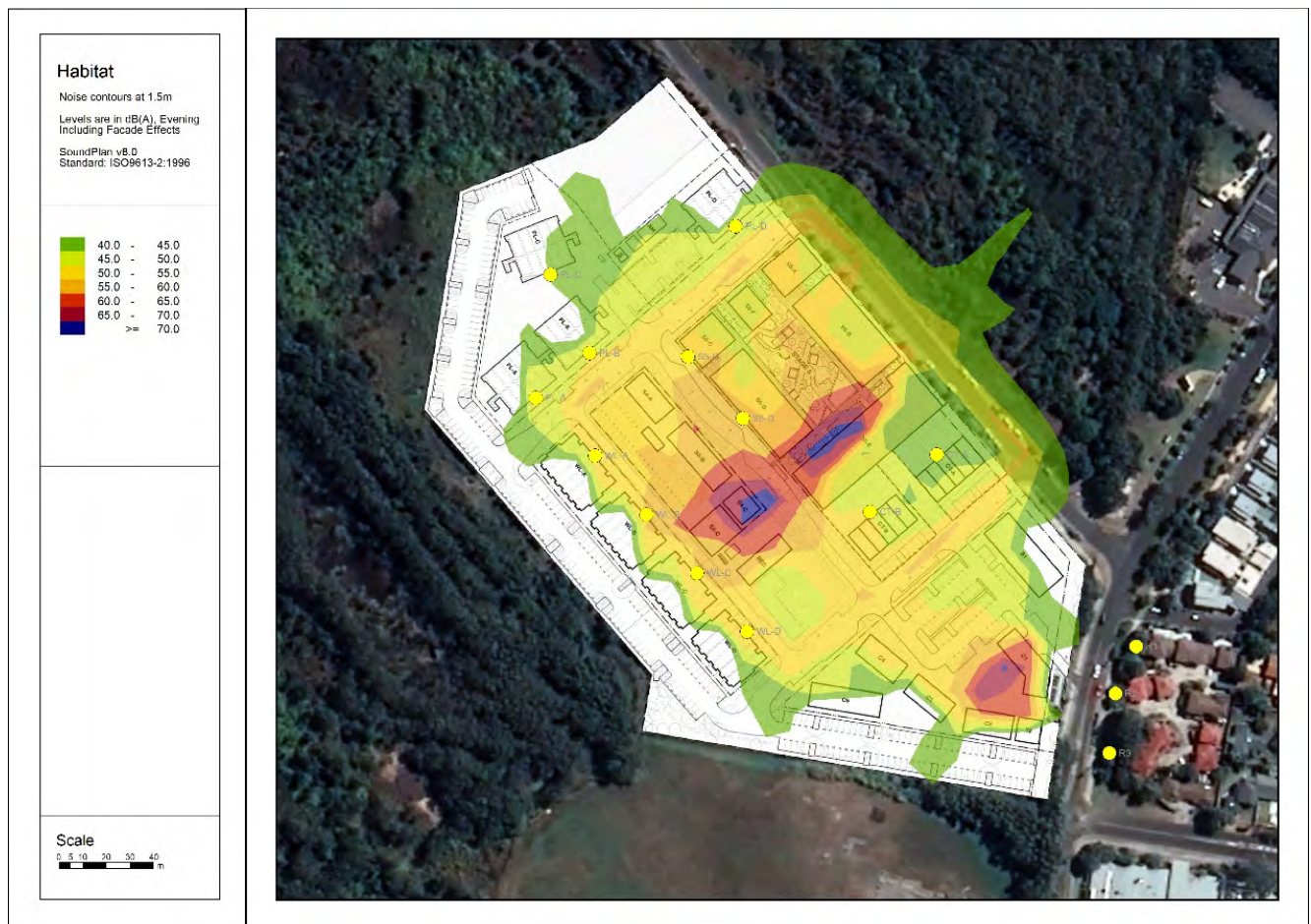


Plate 3.11 Noise contours at Ground Floor (1.5m), Night. Levels are in dB(A) Leq, including façade effects

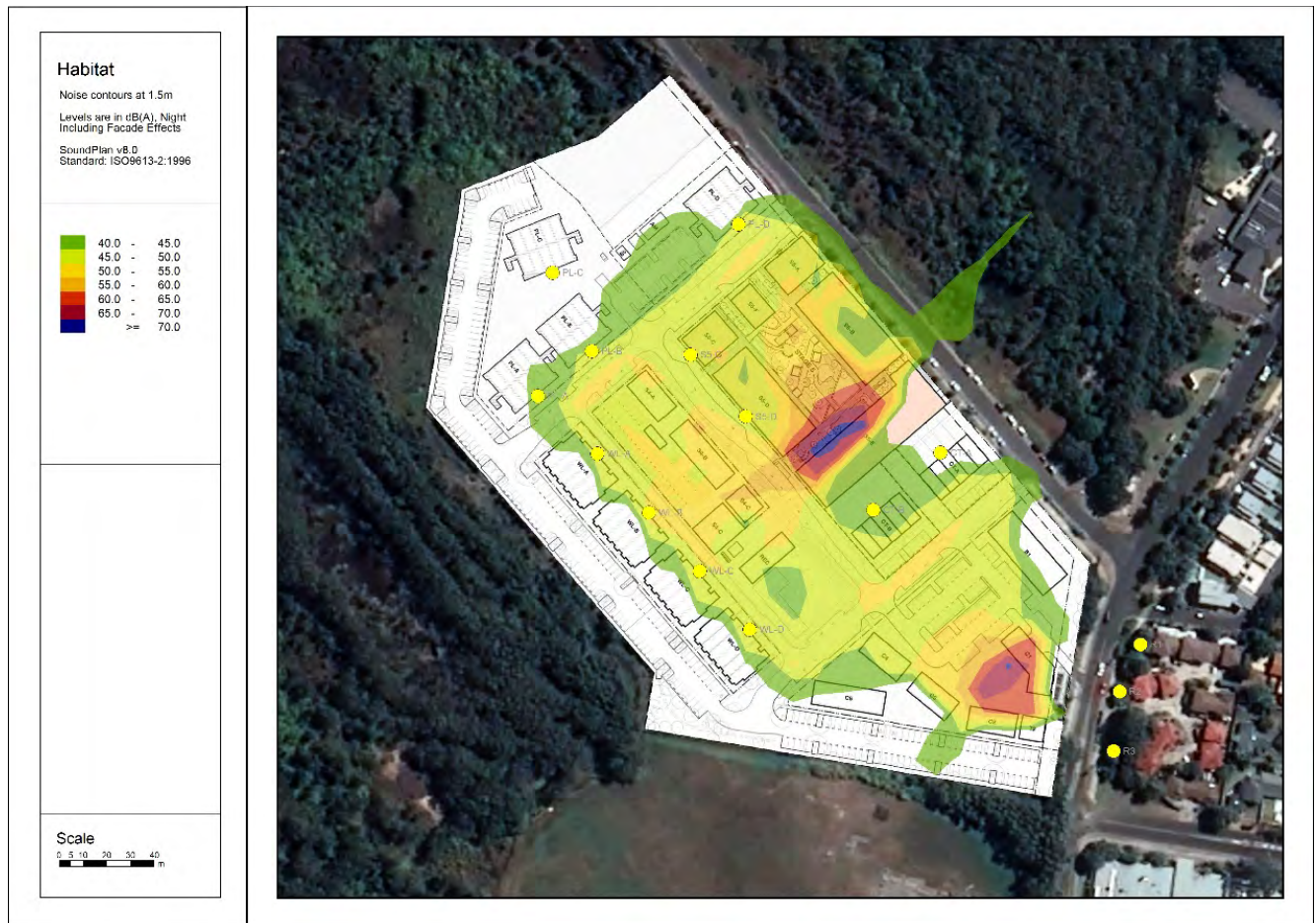


Plate 3.12 Noise contours at Level 1 (4.6m), Day. Levels are in dB(A) Leq, including façade effects

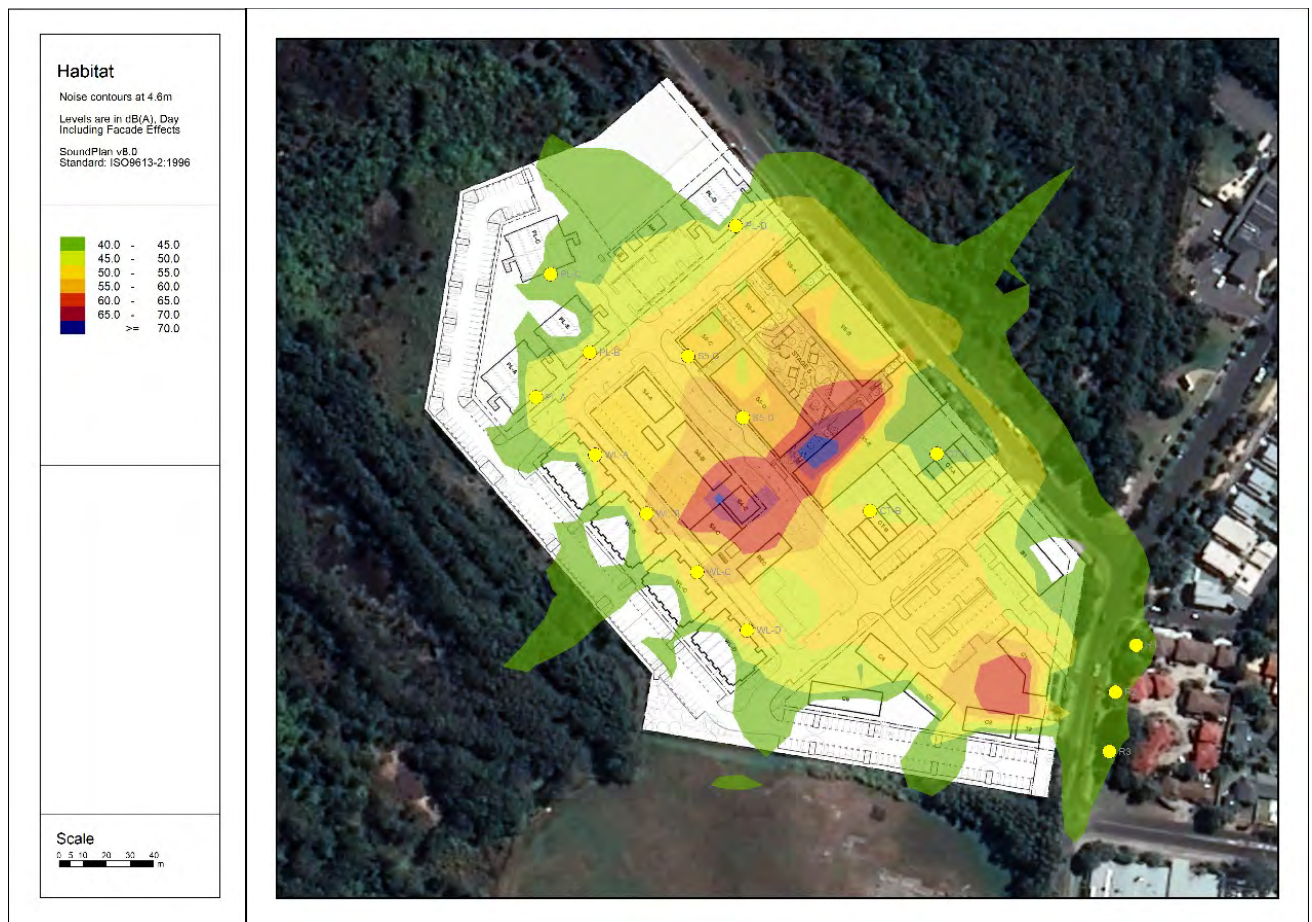


Plate 3.13 Noise contours at Level 1 (4.6m), Evening. Levels are in dB(A) Leq, including façade effects.

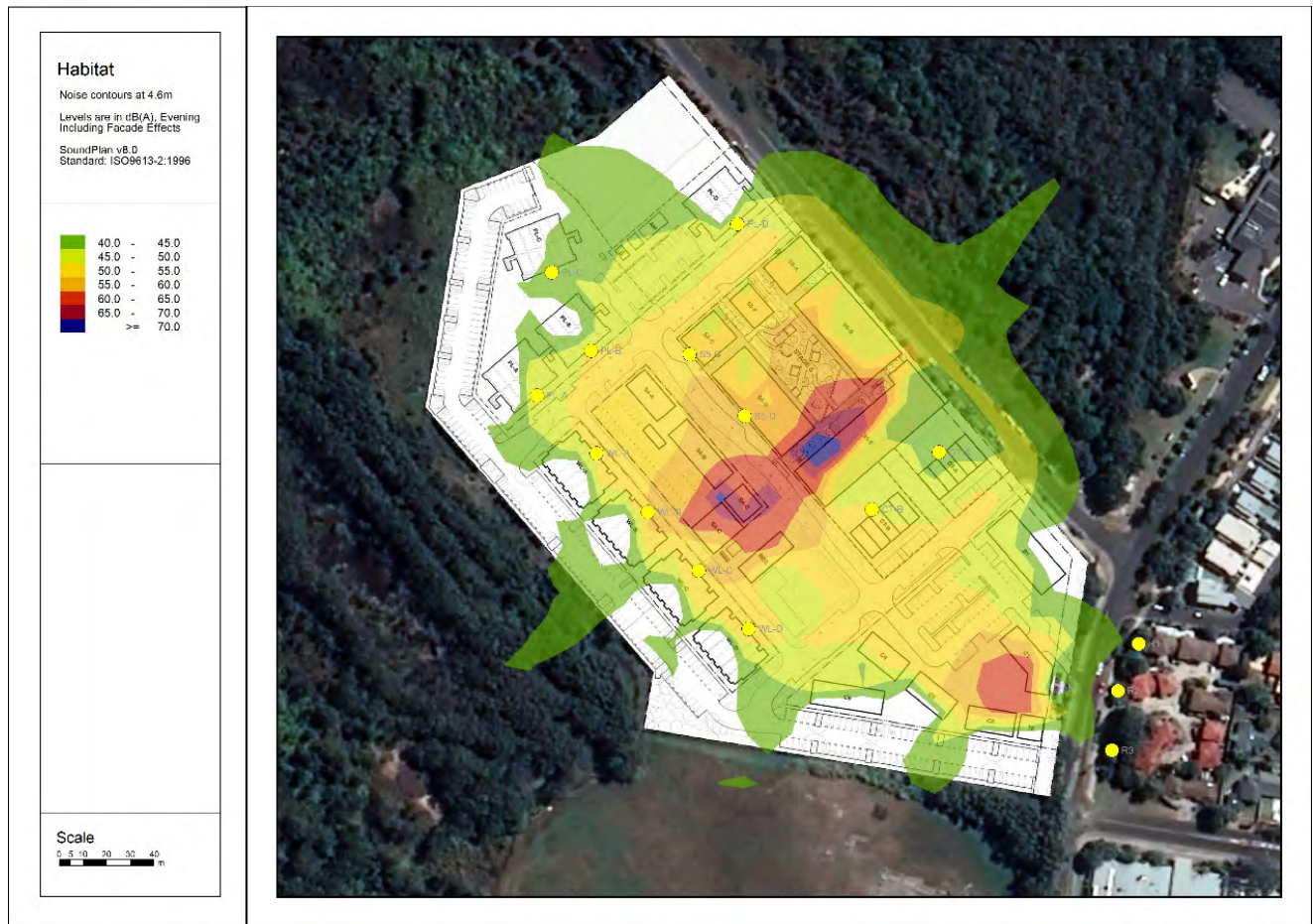


Plate 3.14 Noise contours at Level 1 (4.6m), Night. Levels are in dB(A) Leq, including façade effects.

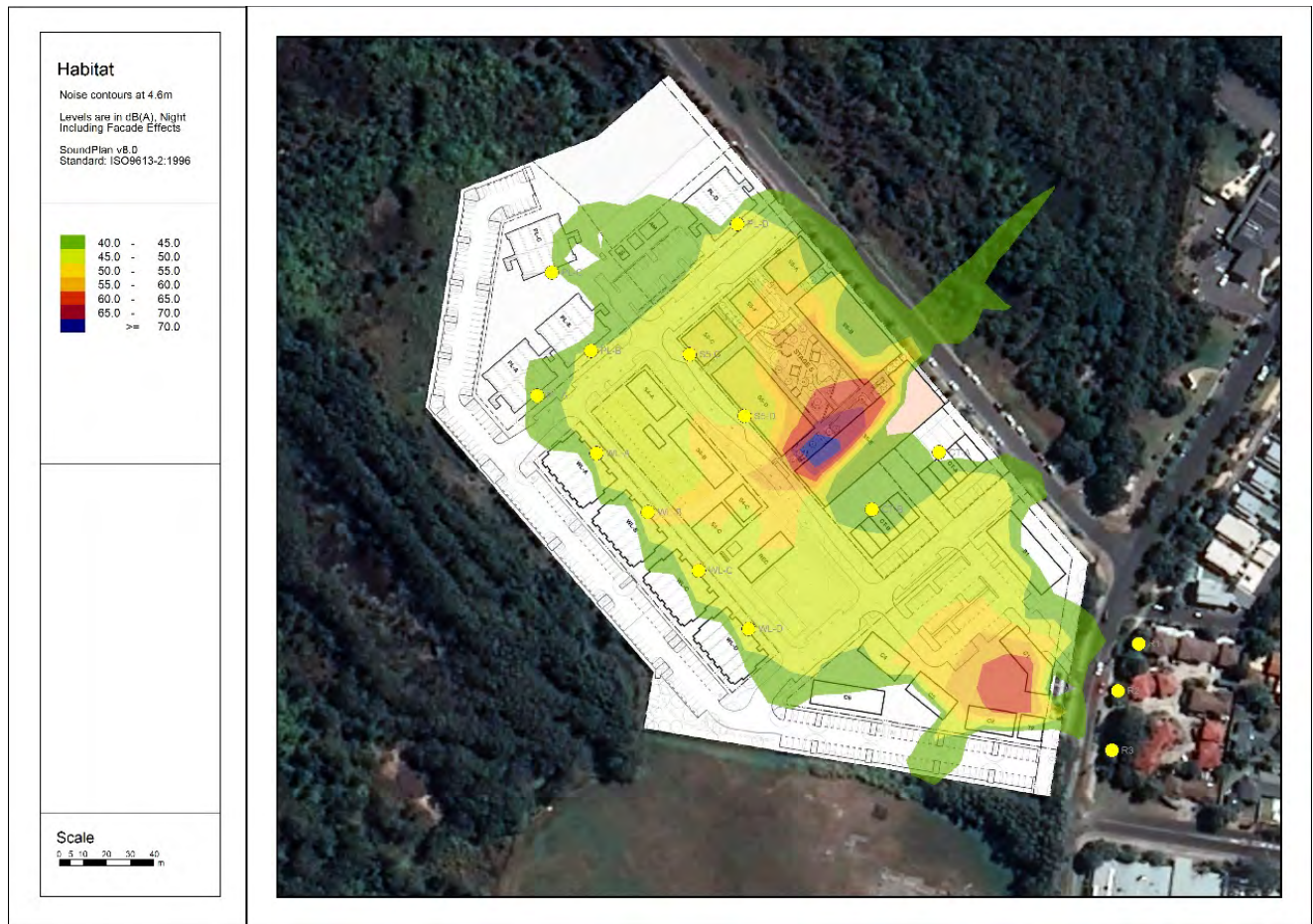


Plate 3.15 Noise contours at Level 2 (7.4m), Day. Levels are in dB(A) Leq, including façade effects.

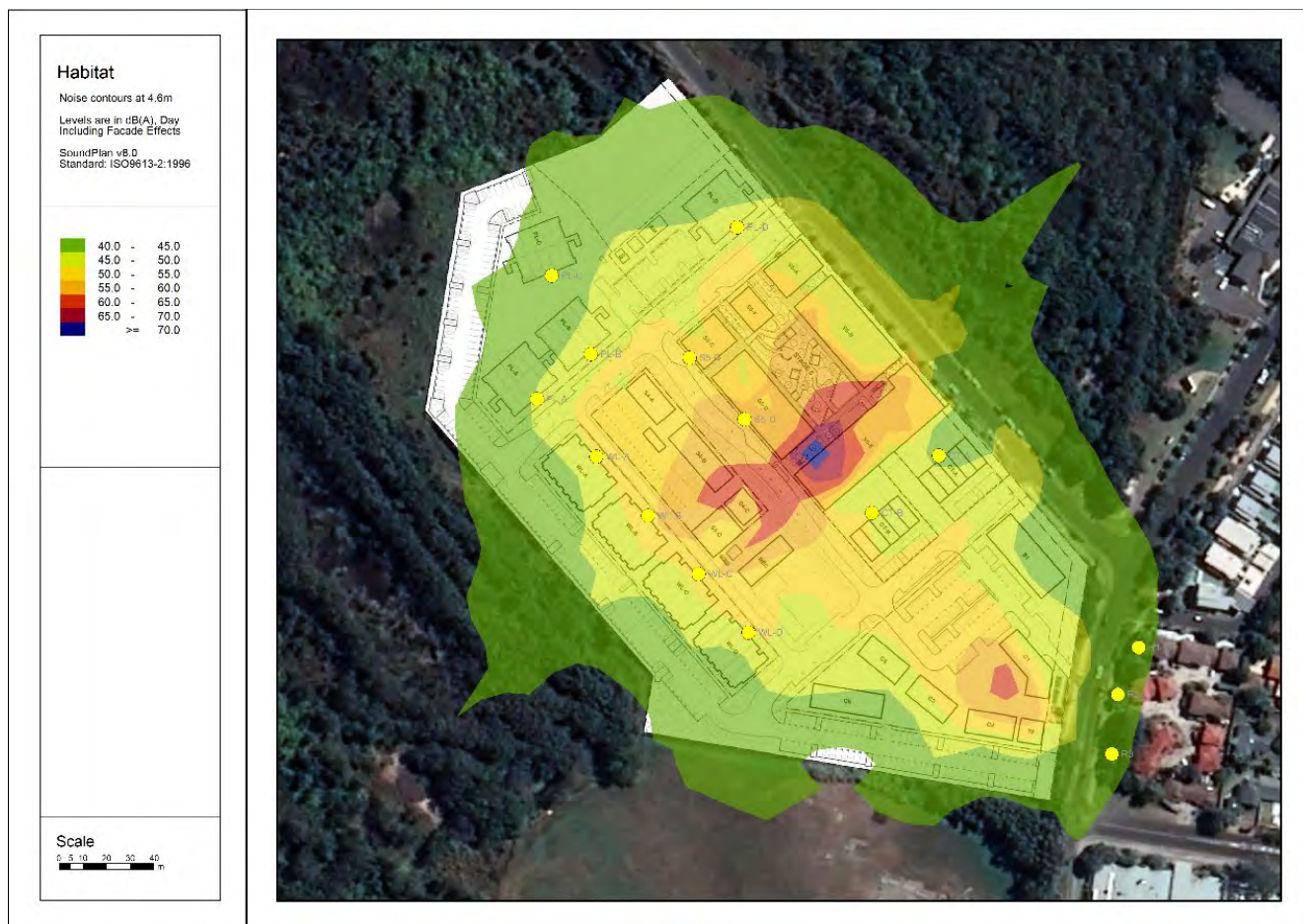


Plate 3.16 Noise contours at Level 2 (7.4m), Evening. Levels are in dB(A) Leq, including façade effects.

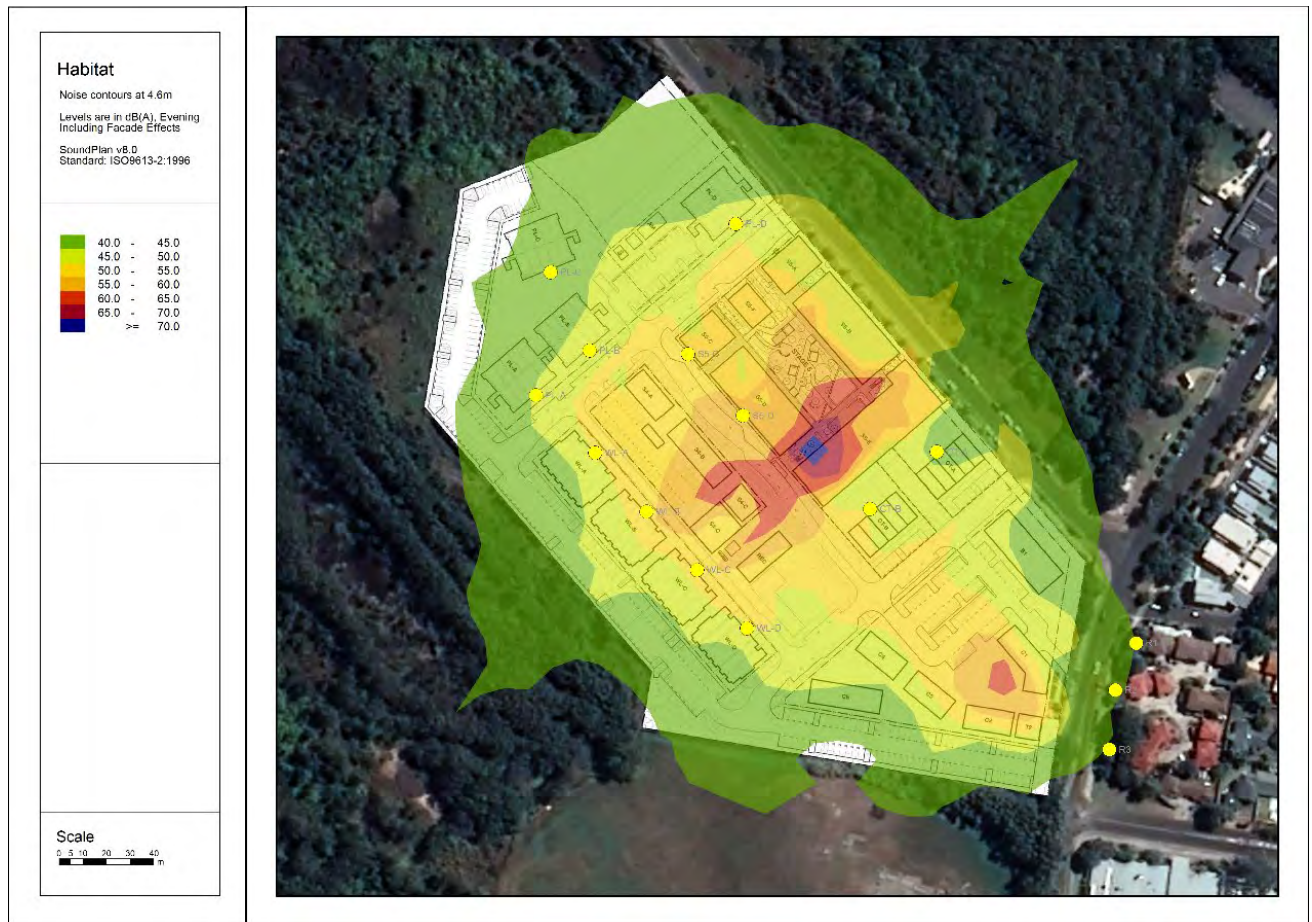
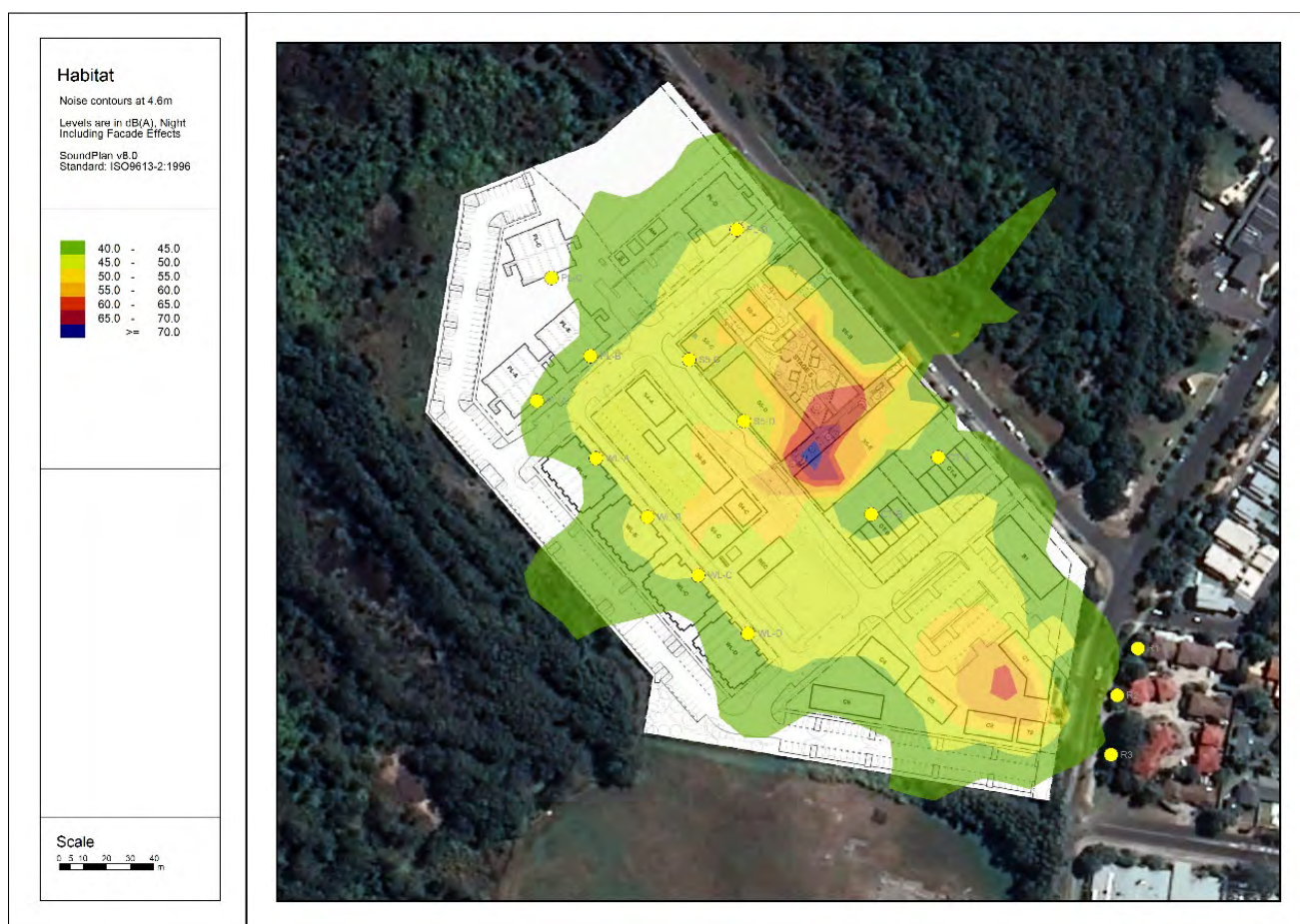


Plate 3.17 Noise contours at Level 2 (7.4m), Night. Levels are in dB(A) Leq, including façade effects.



It is concluded that –

- A noise model has been constructed to predict the propagation of expected noise sources at Habitat from Barrio Café, Stage 4 and Stage 5. The model includes shielding effects from topography, existing and proposed structures. Topography information included in the model was sourced from Geoscience Australia.
 - Noise levels are predicted for all sources operating simultaneously at times specified in **Table 3.5**. Noise sources within buildings (e.g. café noise, sound stage, etc) are presented with internal noise emanating through opened doors and fixed glazing of a nominal 34Rw.
 - Noise levels from the specified sources are predicted to be within criteria at all receptors during all time periods.
 - It is noted that noise from the Special Function and Breakout area is likely to cause exceedances of criteria at the Pocket Living dwellings if the internal noise level is above 80 dBA SPL. It is recommended that doors remain closed during entertainment above 80 dBA SPL.
- *The Special Function room is Air conditioned

4 Conclusion

Following our review of the background noise levels and previous attended noise measurements coupled with fresh additional noise modelling it is our view that the noise levels from the specified sources are predicted to be within criteria at all receptors during all time periods from proposed Habitat Stage 5. It is noted that noise from the Sound Stage* and Function Breakout area is likely to cause exceedances of criteria at the Pocket Living dwellings if the internal noise level is above 80 dBA SPL. It is recommended that doors remain closed during activities above 80 dBA SPL.

In accordance with best practice it is recommended a specific Noise Management Plan be prepared for both the Restaurant and Special Function Centre to ensure adequate measures, roles and responsibilities are in place to achieve the project specific noise criteria. Each Noise Management Plan should detail the methods that will be implemented for the whole project to minimise operational noise. Information should include:

- a) identification of nearby residences and other sensitive land uses;
- b) assessment of expected noise impacts;
- c) detailed examination of feasible and reasonable work practices that will be implemented to minimise noise impacts;
- d) clear and defined acceptable rules of behaviour for patrons;
- e) adherence to responsible service of alcohol regulations;
- f) strategies to promptly deal with and address noise complaints;
- g) details of performance evaluating procedures (for example, noise monitoring or checking work practices and equipment);
- h) procedures for notifying nearby residents of forthcoming works that are likely to produce noise impacts; and
- i) reference to relevant consent conditions.

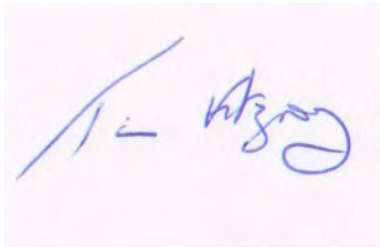
It is concluded that –

- A noise model has been constructed to predict the propagation of expected noise sources at Habitat from Barrio Café, Stage 4 and Stage 5. The model includes shielding effects from topography, existing and proposed structures. Topography information included in the model was sourced from Geoscience Australia.
- Noise levels are predicted for all sources operating simultaneously at times specified in **Table 3.5**. Noise sources within buildings (e.g. café noise, sound stage, etc) are presented with internal noise emanating through opened doors and fixed glazing of a nominal 34Rw.
- Noise levels from the specified sources are predicted to be within criteria at all receptors during all time periods.
- It is noted that noise from the Special Function* and Breakout area is likely to cause exceedances of criteria at the Pocket Living dwellings if the internal

noise level is above 80 dBA SPL. It is recommended that doors remain closed during entertainment above 80 dBA SPL.

*The Special Function Area is Air conditioned

This report has been prepared by Tim Fitzroy of *Tim Fitzroy & Associates*. Noise modelling was undertaken by Matt Dever, Noise Measurement Services, *Brisbane*.



Tim Fitzroy
Environmental Health Scientist
Environmental Auditor

References

- NSW EPA 2000 Industrial Noise Policy, Environment Protection Authority, Sydney
- NSW DECC, 2009 Noise Guide for Local Government, Department of Environment, Climate Change & Water, Sydney
- A/NZ Standards, 1987 Internal noise limits from Australian/New Zealand Standard AS/NZS 2107:1987.
- World Health Organisation 1999 Guidelines for Community Noise (Editor B Berglund et al Geneva Switzerland 1999)

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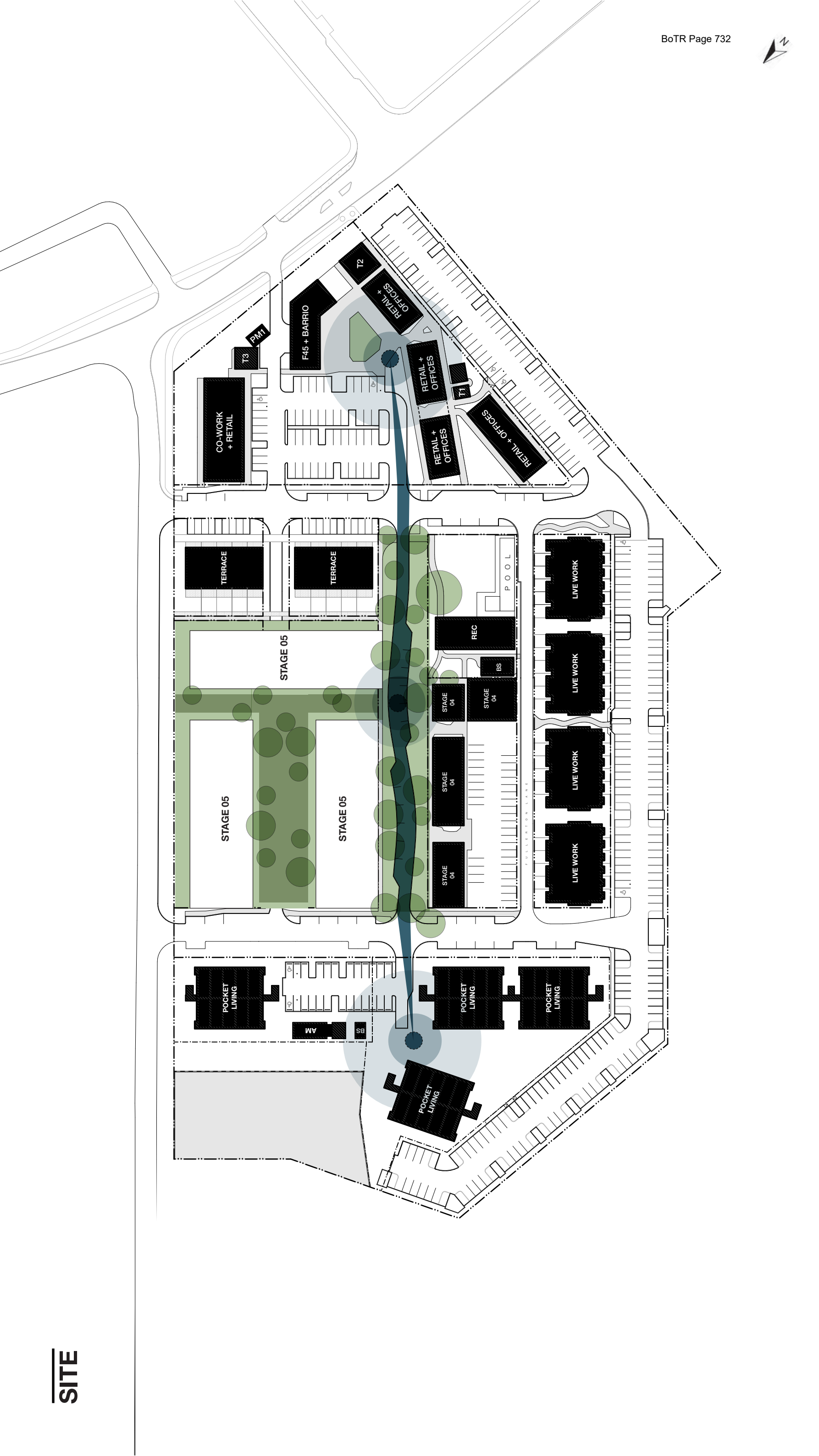
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A Development Plans



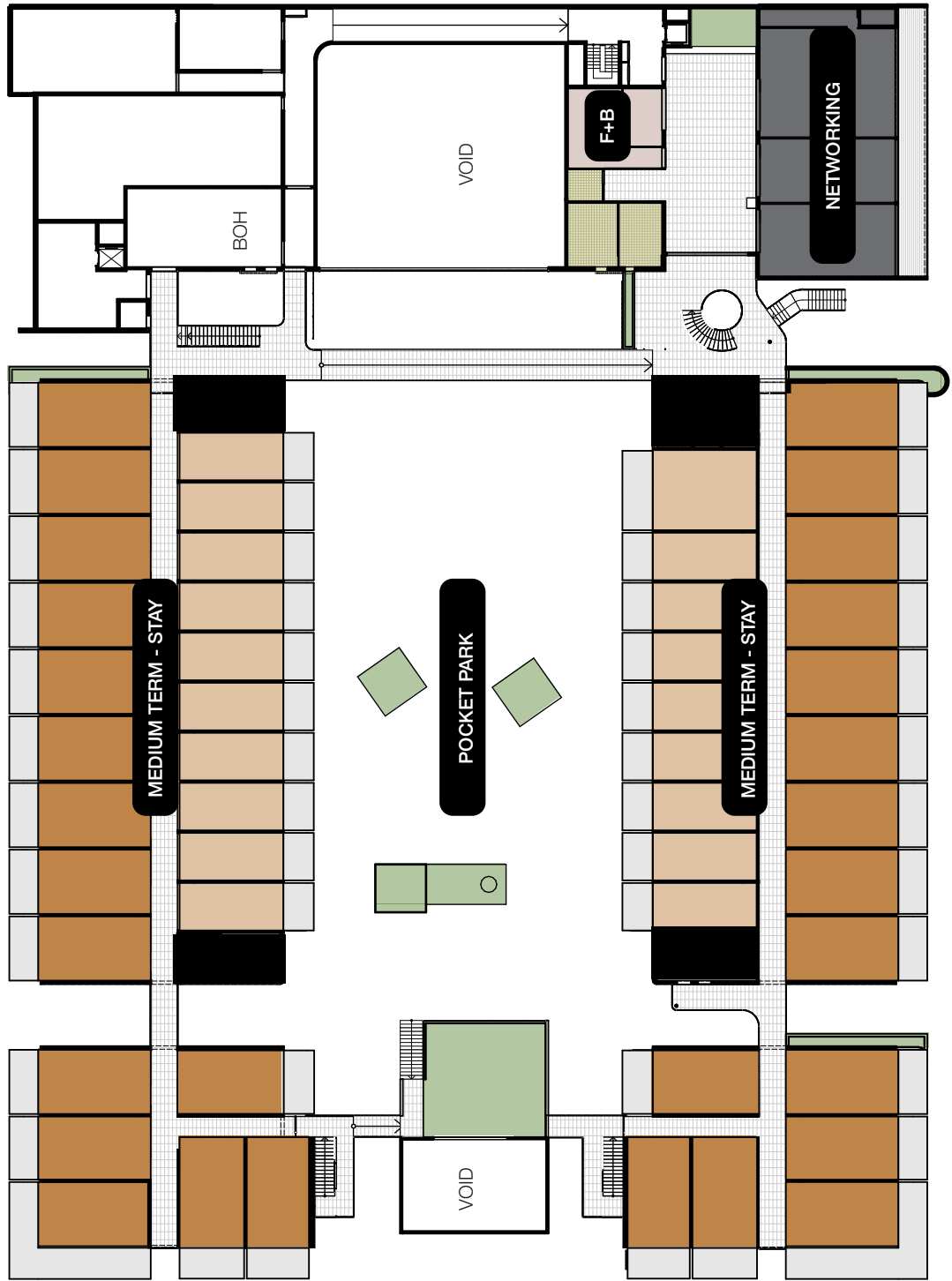
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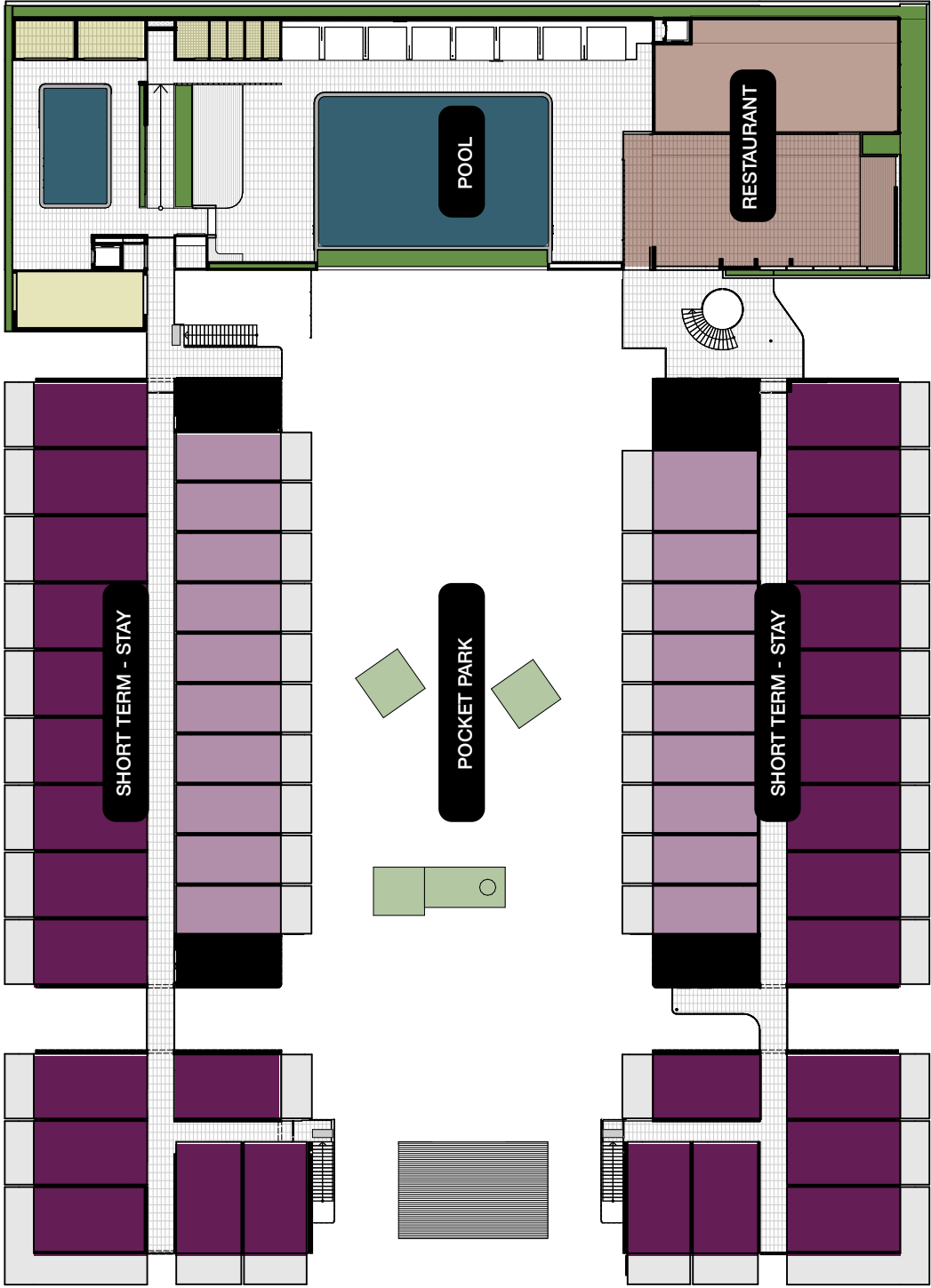
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LEVEL 01

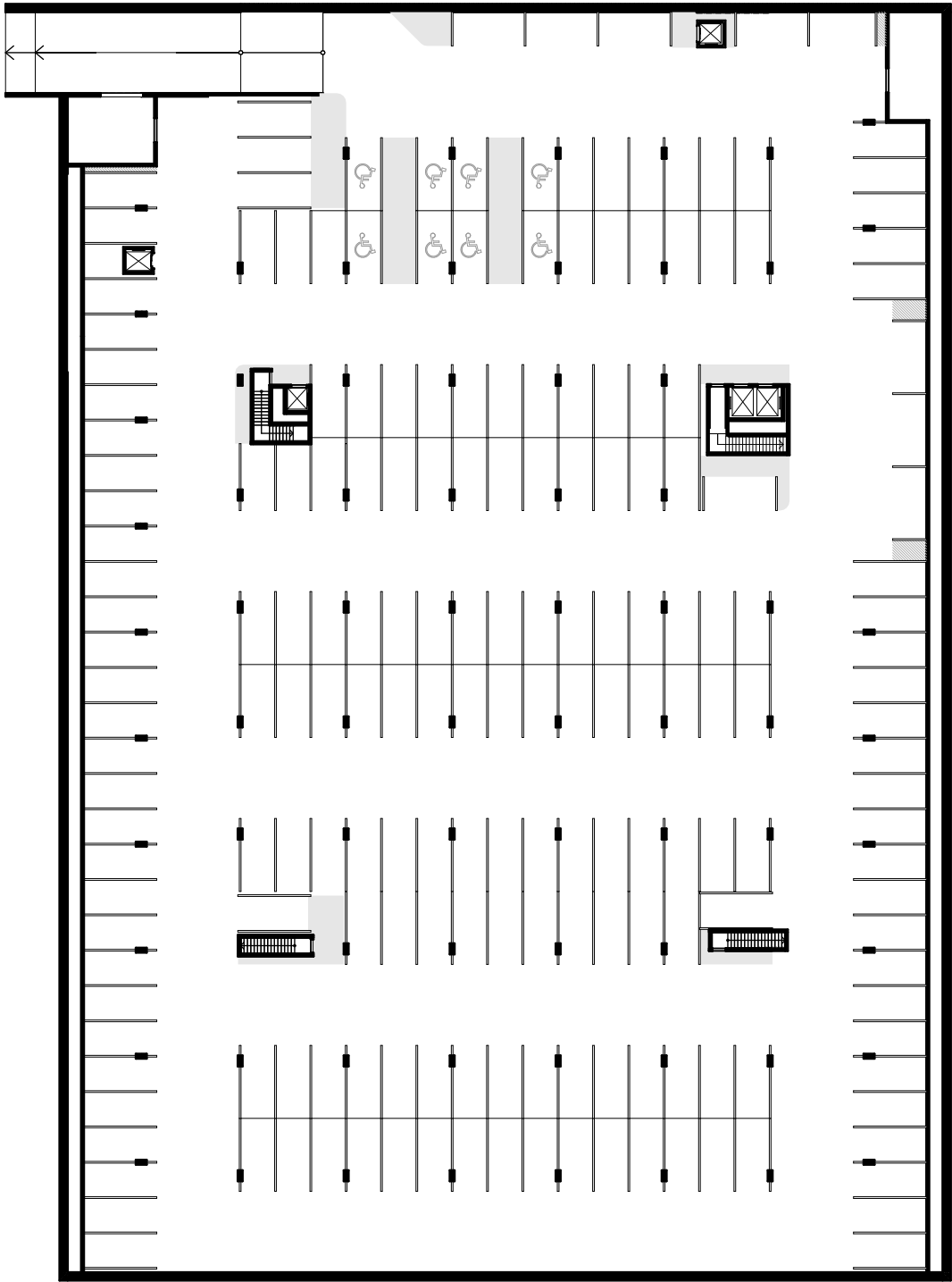


LEVEL 02





BASEMENT



B Noise Data

Only Mech Plant with Mech Ex on High Speed and condensor	
Name	L10 dBA
Middle Ground	38.1
Middle Upper	42.1
MU1	41.7
North Ground	47.5
North Upper	47.5
South Ground	42
South Upper	35.1
South Upper	38.5

Only Fans On High	
Name	L10 dBA
Middle Ground	36.3
Middle Upper	39.6
MU1	38.7
North Ground	35.2
North Upper	35.2
South Ground	33.2
South Upper	36.2

Only Condensers	
Name	L10 dBA
Middle Ground	33.4
Middle Upper	38.3
MU1	39.7
North Ground	37.7
North Upper	37.7
South Ground	30.4
South Upper	34.6

note run
run
run
25 2m open window
31 resl
26 resl bar stuff
110
130 (use linn)
110
76.4
41.8
61.5

Night time background by 1m run 17, surf noise in distance.

63Hz dBA	125Hz dBA	250Hz dBA	500Hz dBA	1kHz dBA	2kHz dBA	4kHz dBA	8kHz dBA
31	44	46	43	41	35	31	27
							25
							18

criteria for council

7am to 12pm at boundary

49

51

48

46

43

41

35

31

27

25

12am to 7am at boundary
44
46
46
43
41
35
31
27
25
inadmissible in a room can be taken as background noise minus 10 inside. We don't know inside background but estimate 25, allow 10db thru open window and = est 35 outside for mech plant at night. Condensers should have boure to drop a few db

windows open, all mech plant high, patrons inside and out and calibrated

Name	L10/dBA	63Hz dBA	125Hz dBA	250Hz dBA	500Hz dBA	1kHz dBA	2kHz dBA	4kHz dBA	8kHz dBA
2m from windows	75.6	42.6	55.8	61	70	72.2	68.6	60.2	47.5
Middle Ground	56.1	31.3	39	42	51.3	52.7	48	37.7	21.6
Middle Upper	61	32.9	41	44.9	53.9	58	54.9	45.8	31.1
MU1	61	32.9	41	44.9	53.9	58	54.9	45.8	31.1
North Ground	52.1	30.1	36.4	37.9	46	49.3	44	35.4	19.9
North Upper	56.3	33.2	38	40.9	48.9	53.4	50	40.8	25.9
South Ground	53.4	25.8	36.1	37.8	47.2	50.5	46	36	19.3
South Upper	57.9	29.7	37.9	41.3	50.3	55	51.8	42.4	26.4

windows open, all mech plant high, patrons inside only

Name	L10/dBA	63Hz dBA	125Hz dBA	250Hz dBA	500Hz dBA	1kHz dBA	2kHz dBA	4kHz dBA	8kHz dBA
2m from windows	75.6	42.5	55.7	60.9	69.9	72.1	68.5	60.1	47.5
Middle Ground	55.7	31.2	38.7	41.7	50.9	52	47.6	37.4	21.3
Middle Upper	60.7	33.4	40.9	44.6	53.6	57.6	54.5	46.5	30.9
MU1	60.7	33.4	40.9	44.6	53.6	57.6	54.5	46.5	30.9
North Ground	51.8	30	36.3	37	45.6	48.7	44.2	34.8	19.5
North Upper	55.9	33.6	38.1	40.8	48.5	53	49.6	40.5	25.8
South Ground	52.9	25.6	35.6	37.4	46.7	50	45.5	36.6	18.9
South Upper	57.4	29.5	37.3	40.9	49.8	54.5	51.2	41.9	26

windows closed all mech plant high, patrons inside only

Name	L10/dBA	63Hz dBA	125Hz dBA	250Hz dBA	500Hz dBA	1kHz dBA	2kHz dBA	4kHz dBA	8kHz dBA
2m from windows	56.8	34.4	42.1	44.7	51.6	53	48.7	39.6	25.6
Middle Ground	43	30.6	34.7	34.9	35.3	38.1	33.8	27.4	15.9
Middle Upper	46.4	35.2	37.5	38.8	39.3	41.2	36.5	31	22.5
MU1	46.4	35.2	37.5	38.8	39.3	41.2	36.5	31	22.5
North Ground	48.8	29.8	33.9	34.2	36	39.8	35.5	28.8	16.6
North Upper	47.2	34	35.8	37.6	39	43.3	39.8	32	21
South Ground	44.8	23.8	31.5	31.9	38.2	41.6	37.2	28.3	13.6
South Upper	50.7	30.1	34.1	36.6	43.5	47.7	44	34.5	19.3

windows closed all mech plant high, patrons outside and 3m barrier 7m long

Name	L10/dBA	63Hz dBA	125Hz dBA	250Hz dBA	500Hz dBA	1kHz dBA	2kHz dBA	4kHz dBA	8kHz dBA
2m from windows	55.2	34.4	41.8	44.3	50.8	50.8	45.7	36.4	23.2
Middle Ground	42.4	30.6	34.7	34.9	35.3	36.6	32.6	27.1	15.8
Middle Upper	46.1	32.8	35.2	36.9	37.3	41.3	37.5	31.9	22.3
MU1	46.1	32.8	35.2	36.9	37.3	41.3	37.5	31.9	22.3
North Ground	41.6	29.8	33.9	34.1	34.5	36.6	31.6	27.5	16.3
North Upper	44.3	34	35.8	37.4	38.6	38.4	34.2	29.4	20.7
South Ground	38.9	23.6	30.3	30.3	32.5	33.8	29.8	24.3	12
South Upper	48.2	30.5	33.8	35.9	41.6	45	40.6	30.9	17

windows closed all mech plant high, patrons outside and 3m barrier 7m long and absorptive ceiling

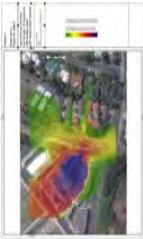
Name	L10/dBA	63Hz dBA	125Hz dBA	250Hz dBA	500Hz dBA	1kHz dBA	2kHz dBA	4kHz dBA	8kHz dBA
2m from windows	55.2	34.4	41.8	44.3	50.8	50.8	45.7	36.4	23.2
Middle Ground	42.3	30.6	34.6	34.3	35.3	32.5	26.6	21.5	15.5
Middle Upper	46.2	32.8	35.1	36.1	36.2	41.2	36.9	31.2	22.2
MU1	46.2	32.8	35.1	36.1	36.2	41.2	36.9	31.2	22.2
North Ground	41.4	29.8	33.8	33.5	34.4	35.5	31.5	26.6	15.6
North Upper	44.1	34	35.7	36.7	36.5	38.3	34	28.7	20.4
South Ground	38.9	23.6	30.3	30.3	32.5	33.8	29.8	24.3	12
South Upper	48.2	30.5	33.8	35.9	41.6	45	40.6	30.9	17

windows closed all mech plant high, patrons outside and full barrier and absorptive ceiling and 1.2m glass balcony

Name	L10/dBA	63Hz dBA	125Hz dBA	250Hz dBA	500Hz dBA	1kHz dBA	2kHz dBA	4kHz dBA	8kHz dBA
2m from windows	55.2	34.4	41.8	44.3	50.8	50.8	45.7	36.4	23.2
Middle Ground	42.3	30.6	34.6	34.3	35.3	32.5	26.6	21.5	15.5
Middle Upper	46.2	32.8	35.1	36.1	36.2	41.2	36.9	31.2	22.2
MU1	46.2	32.8	35.1	36.1	36.2	41.2	36.9	31.2	22.2
North Ground	41.3	29.8	33.8	33.5	34	35.3	31.4	26.6	15.6
North Upper	44	34	35.7	36.7	36.2	38.2	33.9	28.7	20.4
South Ground	38.9	23.6	30.3	30.3	32.5	33.8	29.8	24.3	12
South Upper	48.2	30.5	33.8	35.9	41.6	45	40.6	30.9	17

windows closed all mech plant patrons outside and full barrier to roof and absorptive ceiling

Name	L10/dBA	63Hz dBA	125Hz dBA	250Hz dBA	500Hz dBA	1kHz dBA	2kHz dBA	4kHz dBA	8kHz dBA
2m from windows	55.2	34.4	41.8	44.3	50.8	50.8	45.7	36.4	23.2
Middle Ground	42.3	30.6	34.6	34.3	35.3	32.5	26.6	21.5	15.5
Middle Upper	46.2	32.8	35.1	36.1	36.2	41.2	36.9	31.2	22.2
MU1	46.2	32.8	35.1	36.1	36.2	41.2	36.9	31.2	22.2
North Ground	41.3	29.8	33.8	33.5	34	35.3	31.4	26.6	15.6
North Upper	44	34	35.7	36.7	36.2	38.2	33.9	28.7	20.4
South Ground	38.9	23.6	30.3	30.3	32.5	33.8	29.8	24.3	12
South Upper	48.2	30.5	33.8	35.9	41.6	45	40.6	30.9	17



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