

APPENDIX R

NOISE IMPACT ASSESSMENT



VICTORIA PARK / BARRAMBIN MASTER PLAN

Local Government Infrastructure Designation

Noise Impact Assessment

Prepared for Brisbane City Council

Date
30 June 2023

Report
217401.0001.R02V07.LGID

DOCUMENT CONTROL

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Reference	Date	Description	Prepared	Checked
217401.0001.R02V01_draft	3/11/2022	Draft (LGID)	Beau Weyers	Samuel Wong
217401.0001.R02V02.LGID_Final	20/03/2023	Final (LGID)	Beau Weyers	Samuel Wong
217401.0001.R02V03.LGID_Final	19/04/2023	Final (LGID)	Beau Weyers	Samuel Wong
217401.0001.R02V03.LGID	04/05/2023	Final (LGID)	Beau Weyers	Samuel Wong
217401.0001.R02V04.LGID	19/05/2023	Final (LGID)	Beau Weyers	Samuel Wong
217401.0001.R02V05.LGID	05/06/2023	Final (LGID)	Beau Weyers	Samuel Wong
217401.0001.R02V06.LGID	30/06/2023	Final (LGID)	Beau Weyers	Samuel Wong

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EXECUTIVE SUMMARY

Trinity Consultants Australia was engaged by *Brisbane City Council* (BCC), as applicant, to prepare this Noise Impact Assessment to support a Local Government Infrastructure Designation (LGID) that is made over part of the Victoria Park / Barrambin Master Plan site, which will establish a framework for the ongoing development of the site.

The proposed development is to facilitate delivery of elements of the Victoria Park / Barrambin Master Plan, which will transform the 64-hectare parkland into a multi-function metropolitan park, with various spaces for passive and active recreation, along with opportunities to host an expanded range of diverse events and activations.

This document, the Noise Impact Assessment for the LGID, has been prepared to review the following aspects of the proposed operation against the relevant planning framework:

- Existing levels of noise within the site and surrounding areas via a comprehensive monitoring program.
- Modelling of existing traffic noise impacts onto the site.
- Consideration and modelling of noise from likely general use activities onto surrounding landusers, including;
 - Patrons
 - Car parking
 - Sporting activities
 - Mechanical plant

The proposal and associated activities have been assessed against the relevant legislation, including Brisbane City Council City Plan 2014, the Queensland Office of Liquor and Gaming Regulation, and the Queensland Environmental Protection Act 1994.

A comprehensive monitoring program has also been undertaken to identify the existing noise characteristics of the site and surrounds.

The intent of the assessment is to review proposed and potential noise generation activities as to the levels which could be experienced by surrounding sensitive landusers. Additional to off-site sensitive landusers, consideration to potential fauna on-site has been discussed.

Based on the review, ongoing typical use of the park associated with the Master Plan is unlikely to result in a significant change to existing off-site noise levels, provided timing restrictions are in place for relevant activities.

The modelling review considered the potential benefit of adding noise barriers to the design, however with minimal benefit, and identified in corroboration of proposed activities that while some areas of the parkland exceed the TMR guidelines, there are more than enough areas to qualify as compliant and below the thresholds.

Regarding special activities, including amplification, it is recommended that a Noise Management Plan, dictating the suitable activities and limitations (e.g. amplified volume, scale, frequency, location, and orientation) for various areas of the park are provided for the commencement of operations. This will assist with mitigating potential impacts on surrounding sensitive receivers.

The Noise Management Plan should also provide a method of receiving, tracking and responding to noise complaints (or other items for action) as necessary.

It can be considered that hirers proposing to utilise the parkland for unique/special activities not in-line with those presented in the Noise Management Plan, would complete an event specific Noise Management Plan to

demonstrate the ability to operate within the requirements of the site specific Noise Management Plan conditions and framework.

1. INTRODUCTION

1.1 Property Summary

The Victoria / Barrambin Master Plan comprises a number of land parcels. The primary land parcels forming part of the LGID include:

- 290 Gilchrist Avenue, Herston QLD 4006
- 271 Gilchrist Avenue, Herston QLD 4006
- 223 Herston Road, Herston QLD 4006
- 454 Gregory Terrace, Spring Hill 4000
- 74 Gregory Terrace, Spring Hill 4000
- 278 Gregory Terrace, Spring Hill 4000
- 400 Gregory Terrace, Spring Hill 4000
- 77A Victoria Park Road, Herston QLD 4000

1.2 Purpose of the Noise Impact Assessment

This Noise Impact Assessment is to support the making of a LGID for the Victoria Park / Barrambin site.

The proposed development has the potential to create noise impacts on nearby sensitive uses due to various aspects of the park use, including sports, entertainment, groups of people, mechanical plant, and vehicle movements (discussed more in **Section 2.3**). These potential impacts are required to be considered in the project design.

In addition to noise impacts off-site, the useability of the site is also considered regarding noise impacts onto the park from the adjoining Inner Northern Busway, Inner City Bypass and the railway.

This noise impact assessment has been undertaken to consider the following, which are used as a guide to inform an appropriate noise mitigation strategy for the development (discussed more in **Section 5**):

- Brisbane City Council
 - Brisbane City Plan 2014 (City Plan);
 - Noise impact assessment planning scheme policy
 - Outdoor sport and recreation code
 - Community facilities code
 - Noise Limits for Venues;
- Environmental Protection Act 1994 (EP Act)
 - Sections 440X, 440Y and 440ZC;
- Environmental Protection (Noise) Policy 2019
 - Acoustic Quality Objectives (AQOs); and
- Office of Liquor and Gaming Regulation (OLGR).

The following aspects of the noise impact assessment were developed in consultation with Council:

- Noise measurement methodology for ambient levels describing the site and surrounds;
- Applicable noise assessment criteria and noise sources of interest; and
- Proposed approach of noise modelling.

The purpose of this report is as follows:

- Outline the relevant project noise criteria.
- Present the results of noise monitoring.
- Model and assess the potential noise emissions from the proposed development.
- Review noise impacts onto the development from surrounding road network.
- Describe recommended noise management and mitigation requirements, if any.

To aid in the understanding of the terms in this report a glossary is included in **Appendix A**.

Trinity Consultants Australia have completed a review of the most applicable noise criteria for the intended uses at various locations within the park.

The aims of the assessment are as follows:

- Review the existing and typical levels of noise generated via activities and events in the various areas
- Define applicable criteria
- Define acceptable operational noise levels to achieve the established criteria

It is envisaged that, as the park has been utilised for the various desired activities historically with limited adverse comment from the surrounding sensitive areas (residences), the character of the area would allow for amplified music at a controlled volume and a controlled number of events, without causing undue noise impact on the surrounding residences and other tenancies (including additional sensitive landuse areas such as accommodation, schools and places of worship).

Review of ambient noise monitoring at the boundary areas have been undertaken for assessing potential noise impacts. Based on this review, it is desired to establish reasonable and consistent criteria to apply to the Victoria Park / Barrambin site.

1.3 Development Overview

Trinity Consultants Australia (T/A ASK Consulting Engineers) has been engaged by *Brisbane City Council* (BCC) as Applicant, to prepare this Noise Impact Assessment to support a Local Government Infrastructure Designation (LGID) that is made over part of the Victoria Park / Barrambin Master Plan site.

The LGID is made over part of the site to give statutory effect and facilitate the delivery of elements of the Victoria Park / Barrambin Master Plan (Master Plan) which is intended to transform the 64 -hectare parkland into a multi-function metropolitan park, with various spaces for passive and active recreation, along with opportunities to host an expanded range of diverse events and activations. The Master Plan sets out the roadmap for the park's redevelopment following community and stakeholder consultation and various technical studies, whereas the LGID will be the planning approval which allows elements of the master plan to be delivered on site.

The Plan of Designation illustrates the part of the site which is included in the Master Plan over which the LGID request applies (a shown in **Figure 2.1** below). For clarity, the part of the Master Plan area where statutory effect is sought through the LGID process will be referred interchangeably herein as the 'the site, premises and the Designation Area'.

Figure 1.1: Plan of Designation



The Illustrative Master Plan contained at **Appendix B** includes areas that extend beyond the proposed Designation Area, and existing elements within the Designation Area which are not intended to be subject to change as a consequence of the LGID. These areas do not form part of this LGID request.

Specific exclusions from the LGID include:

- The south-western part of the Master Plan area, which includes land at 15, 36, 40, 40A, 40B, 40C, 40D, 40E, 40F, 50, 70, 70A & 77 Gilchrist Avenue, Herston, 1A Ithaca Street, Kelvin Grove and 51A College Road, Spring Hill.
- Three small allotments at the southern side of the rail line, located at 140, 410 and 412 Gregory Terrace, Spring Hill.
- The western bridge connection from the south-western part of the Master Plan area to Brisbane Girls Grammar School;
- Old Club House at 309 Herston Road, Herston.

The existing uses and buildings associated with the Victoria Park Bistro, driving range (other than some changes to levels resulting from proposed earthworks), putt-putt, Function Centre and Centenary Pool located within the Designation Area are proposed to be retained.

The proposal seeks to designate the premises for various infrastructure purposes, in accordance with Schedule 5 of the Planning Regulation 2017 ('the Planning Regulation'). Specifically, the LGID seeks endorsement for the following infrastructure categories:

Infrastructure for transport

- 2 – transport infrastructure

Other infrastructure

- 3 – community and cultural facilities;
- 11 – facilities for parks and recreation;
- 17 – sporting facilities; and
- 20 – storage and works depots and similar facilities, including administrative facilities relating to the provision or maintenance of infrastructure stated in this part.

2. DEVELOPMENT OVERVIEW

2.1 Study Area

The proposed redevelopment includes a range of potential uses including sports, cultural, recreation and entertainment. **Figure 2.1** presents the proposed redevelopment area and existing aerial photo.

Figure 2.1: Site Aerial (Project Areas in Red)



2.2 Existing Site

Under the existing park operations agreement, no significant noise can be generated outside of 7am to 8pm Monday to Saturday and 8am to 8pm on Sundays, other than for approved events.

The northern portion of Victoria Park / Barrambin site is bounded by Inner City Bypass Road and Herston Road, and Inner Northern Busway (from south, counter clockwise) in Herston.

The southern portion of Victoria Park / Barrambin site is bounded by Inner City Bypass Road, rail line and Gregory Terrace in Spring Hill.

QUT Kelvin Grove Stadium as a potential crowd and amplified noise source is located north west of the northern portion of Victoria Park / Barrambin site. The University of Queensland – Herston Campus including various health, education and medical research buildings and Royal Brisbane and Women’s Hospital are located directly north of the venue, which also hosts surgical treatment facilities and beds.

The nearest noise sensitive receivers to the venue include residential and community buildings at the following locations:

- Herston suburb to the north, with the nearest residences along Herston Road. The University of Queensland – Herston Campus and Royal Brisbane and Women’s Hospital are also located in this area.
- Spring Hill suburb to east and south, various residential and community buildings including St Joseph’s College and Brisbane Grammar School along Gregory Terrace Road, opposite side of Inner City Bypass Road.
- Kelvin Grove suburb to the west, with the nearest residentials along Victoria Park Road. QUT Kelvin Grove campus is also located directly west of the venue.

A few public parks and recreational facilities are located in the area. **Figure 2.1** presents the site location.

The site is currently occupied by a number of uses, including:

- Function centre, driving range, bistro and putt putt;
 - Including 18-hole mini golf course, pro-shop, bistro, driving range and function centre
- Tennis courts, cricket nets and other sports fields
- Centenary Aquatic Centre and Health Club
- Queensland Energy Museum
- Maintenance facilities
- Parking

The site and surrounding areas are impacted upon by road traffic noise from a number of transport corridors, including:

- Inner City Bypass (ICB)
- Inner Northern Busway (INB)
- Railway adjacent ICB
- Bowen Bridge Road
- Herston Road
- Gregory Terrace.

2.3 Development Layout

The proposed development includes the following components (refer to **Figure 2.2**), noting that those highlighted in yellow fall outside the LGID boundary and are subject to resolution with Department of Main Roads and/or Queensland Rail:

- General
 - 4 – The Tree House and look out
 - 5 – Kelvin Grove Busway access
 - 14 – Parkway kiosk
 - 19 – Function centre, driving range, bistro and putt putt
 - 21 – Parkland arrival
 - 23 – Herston Busway access
 - 24 – Old Clubhouse
 - 28 – Dog park*
 - 33 – Community edible garden and connection to land bridge (south)
 - 36 – Gundoo Memorial Grove (rehabilitated) (south)
 - 44 – Dog park (south)
- Sports
 - 16 – Community sports precinct including a sports field, multi-purpose court, cricket nets, and tennis courts

-
- 19 – Function centre, driving range, bistro and putt putt
 - 31 – Community Tennis Courts (south)
 - 34 – Centenary Pool with upgraded carpark
 - Entertainment
 - 1 – Urban pump park
 - 4 – The Tree House, look out and café
 - 11 – Education Hub
 - 19 – Function centre, driving range, bistro and putt putt (*optional consideration of driving range for use as an event site*)
 - 16 – Community sports precinct including a sports field, multi-purpose court, cricket nets, and tennis courts
 - 32 – Spring Hill Common (south)
 - Play
 - 1 – Urban pump park
 - 3 – Adventure valley with mountain bike track and high ropes course
 - 10 – Nature water play gully
 - 13 – Adventure Playground
 - Car Parking
 - 1 – Urban pump park and small carpark (16 spaces)
 - 17 – Gilchrist Avenue drop-off zone and on-street parking (104 spaces)
 - 20 – Main car park
 - Victoria Park Entry parking (304 spaces)
 - Main entry (111 spaces)
 - Driving range/Pro shop (73)
 - 22 – Main parkland entry (with signalised intersection)
 - 34 – Centenary Pool with upgraded carpark (131 spaces)

The Master Plan

NORTH

- | | |
|---|---|
| 1 Urban pump park | 17 Gilchrist Avenue drop-off zone |
| 2 Park administration and operations | 18 Upper wetlands |
| 3 Adventure Valley with mountain bike track and high ropes course | 19 Function centre, driving range, bistro and putt putt |
| 4 The Tree House and lookout | 20 Main car park |
| 5 Kelvin Grove busway access | 21 Parkland arrival |
| 6 Green waste storage | 22 Main parkland entry (with signalised intersection) |
| 7 Parkway loop | 23 Herston busway access |
| 8 York's Hollow (revitalised) | 24 Old Clubhouse |
| 9 Elevated connection to land bridge | 25 Inner City Pedestrian and Cycle Bridge |
| 10 Nature water play gully | 26 Commuter bikeway/active transport connection |
| 11 Education Hub | 27 Lift to accessible elevated walkway* |
| 12 Lower wetlands and boardwalk | 28 Dog park* |
| 13 Adventure playground | 29 Upgraded pedestrian and cycle bridge* |
| 14 Parkway kiosk | 30 Commuter bikeway/active transport connection* |
| 15 Naturalised waterholes | |
| 16 Community sports precinct including a sports field, multi-purpose court, cricket nets, and tennis courts | |

SOUTH

- | | |
|--|--|
| 31 Community tennis courts | 34 Centenary Pool with upgraded car park |
| 32 Spring Hill Common | 35 Dog park |
| 33 Community edible garden and connection to land bridge | 36 Gundoo Memorial Grove (rehabilitated) |

* New features subject to resolution with Department of Transport and Main Roads and/or Queensland Rail

- LGID boundary
- Master Plan boundary



Figure 2.2: Master Plan Layout

3. PARK NOISE STUDY

3.1 Operational Noise Sources

3.1.1 General Use

There are a number of potential noise sources onsite within the LGID area, including:

- Sports facilities
- Carparking and driveways
- Groups of people talking, shouting, or children playing
- Mechanical plant (e.g. refrigeration, air-conditioning, exhaust fans)
- Maintenance compounds
- Dog off-leash area
- Event areas of various sizes (markets, outdoor cinema, entertainment)

It is expected that most of these noise sources will be adequately addressed due to the separation distance between the noise source and the nearest sensitive receiver.

It is acknowledged that many proposed activities are a continuation of existing and/or typical park usage. Furthermore, noise from activities occurring during normal daytime trading hours will often be masked by traffic noise at the boundaries of the site.

Figure 3.1: Modelled General Use Noise



3.2 Noise Sensitive Receptors

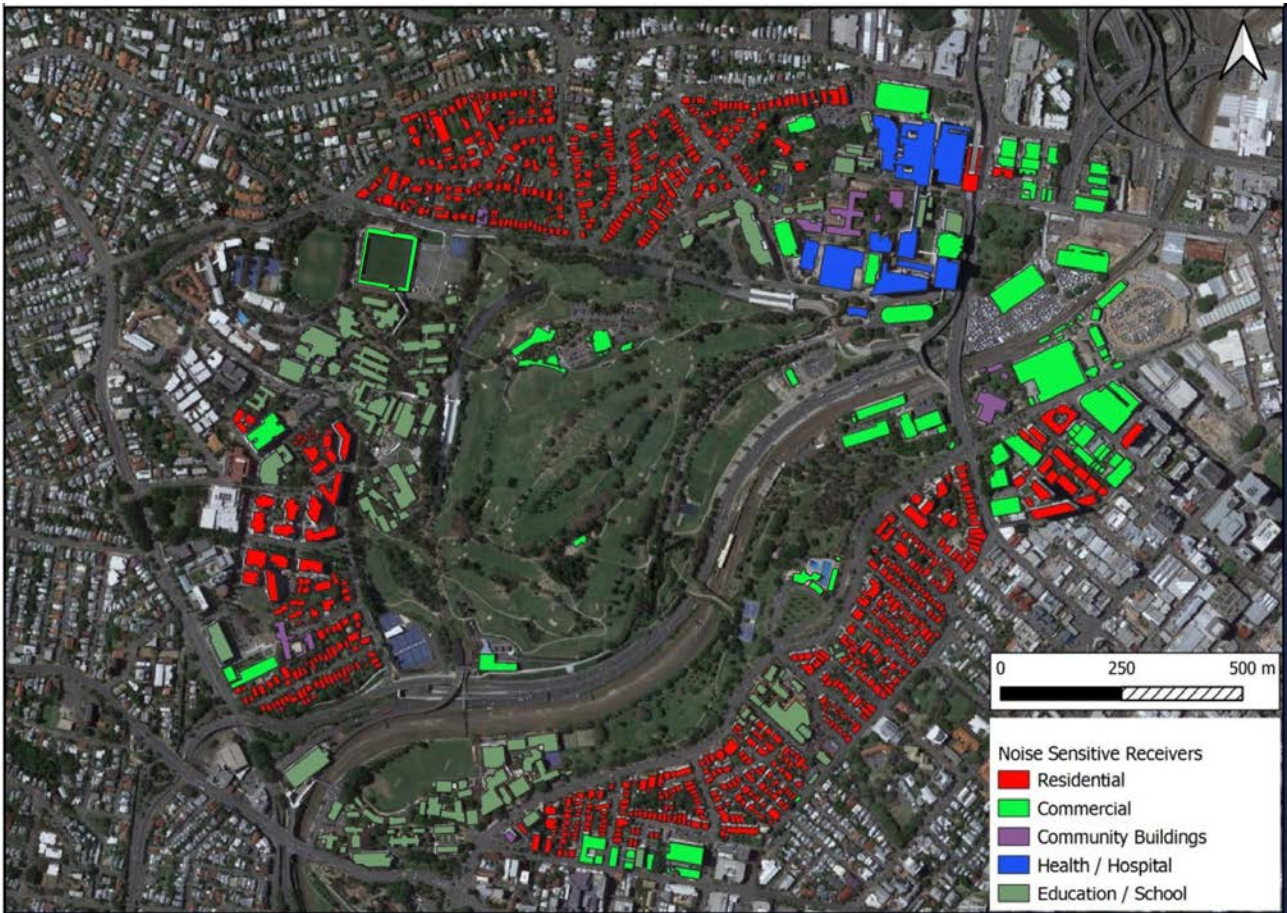
In order to review potential noise impacts from activities in the parkland on neighbouring residents, community and sensitive commercial buildings (temporary accommodation, child care centre, educational establishment, health care). The buildings considered in this assessment are shown in **Figure 3.3**, including their current use.

Commercial, restaurants and retailers are not generally considered as sensitive receivers, however have been included as they are potentially impacted under non BCC Code criteria.

Recently constructed apartment buildings, hotels, and significant sensitive commercial uses (including hospitals and schools) are likely to be well insulated against noise due to the proximity to traffic noise.

Section 5.2 presents the zoning delineations in the City Plan for the surrounding area.

Figure 3.2: Victoria Park and Modelled Surrounding Noise Sensitive Receptors



3.3 Fauna Considerations

Further to commercial and public use, the Victoria Park area is home to various wildlife including but not limited to:

- Possums (with the Applicant providing various areas with possum boxes)
- Water bird areas
- Native and non-native bird areas

It is proposed to consider the impacts of any introduced highly noisy activities on the fauna (e.g. concerts). It is unlikely that any activity will exceed that of general lawn maintenance at the parkland. Potential noise impacts on fauna are discussed further in **Section 5.10**.

4. AMBIENT NOISE MEASUREMENTS

4.1 Overview

As part of the review of suitable operating noise levels, potential impacts on the surrounding land users, and review of existing ambient conditions, a variety of noise monitoring exercises have been undertaken or reviewed (historic data), including:

- Unattended ambient monitoring in order to identify and review the noise character of the area and define suitable operational noise criteria for various proposed areas:
 - 26 March – 4 April 2021 at 2 locations for a period of 7 days (1 week)
 - Positions A and B in **Figure 4.1**
 - 02 June – 09 June 2022 at 5 locations for a period of 7 days (1 week)
 - Positions L3 – L8 in **Figure 4.1**
- Attended measurements (15 minute) of existing noise environment within Victoria Park / Barrambin site at a variety of sample locations (**Figure 4.1** and **Figure 4.2**), including some at the LGID boundary:
 - Friday 26 March 2021 at the 2 ambient monitoring locations (confirming the monitoring data)
 - Tuesday 18 May 2021 at 9 locations along the ICB (reviewing road/rail noise impacts on the site)
 - Sunday 5 June 2022 at 3 ambient monitoring locations, during a Sunday daytime period (confirming the influences on the ambient monitoring data)
 - Sunday 5 June 2022 at 3 additional locations, during a Sunday daytime period (reviewing the road and rail noise impacts at the site)
- Attended measurements during the activities at the Green Heart Fair (2022) to gain an understanding of the level of noise associated with the activity, and review noise spill, and contributions from the ICB.

Full details of the monitoring exercises are detailed results are presented in **Appendix C** and **D**.

This section presents a summary of the results of the various monitoring exercises and establishment of reasonable and applicable noise criteria.

4.2 Noise Measurement Standard

The ambient noise surveys were undertaken in accordance with Australian Standard AS1055.1:2018 – Acoustics – Description and measurement of environmental noise – Part 1: General procedures and the Department of Environment and Science’s (DES) Noise Measurement Manual 2020.

This noise measurement method records total ambient noise levels at the site from all noise sources.

4.3 Noise Equipment

All monitoring equipment utilised are field-calibrated before and after the monitoring or logging sessions and reviewed against the performance requirements (+/- 0.5 dB drift). All instruments utilised (loggers, sound level meters, and field-calibrators) are Type 1 and hold current calibration certificates from a NATA certified calibration laboratory. Full details of the equipment utilised are presented in **Appendix C** and **D**.

4.4 Noise Monitoring Locations

The unattended noise monitoring locations are shown in **Figure 4.1**. Attended measurements were taken at locations A, B, L1, L3, L5 for validation of typical noise contributions.

Figure 4.1: Unattended Noise Logging Locations



The additional attended noise monitoring locations are shown in **Figure 4.2**, for review of typical noise contributions.

Figure 4.2: Attended Noise Logging Locations



The noise monitoring locations undertaken during the Green Heart Fair 2022 are discussed in **Appendix D**.

4.5 Weather and Extraneous Noise

Unattended monitoring data are reviewed against meteorological data collected by the Bureau of Meteorological station at the Brisbane Airport and Brisbane City. Where data is identified to exhibit elevated winds (above 5 m/s) or rain (>0.2mm) is considered that the weather may influence the noise monitoring data.

Therefore, the identified periods have been removed before calculating long term averages and deriving noise criteria. It is noted that the monitors established adjacent roads experience a significant amount of road traffic noise during the daytime and evening, which may occasionally influence the monitoring, however these are considered a normal character of the bounding area.

Data is additionally screened for extraneous spikes in data (e.g. lawn mowing in close proximity) as well as insect or bird noise. Monitoring completed in March was screened for insect noise, and monitoring in May and June was completed during generally cooler months, and no removal of insect noise was deemed necessary.

4.6 Ambient Noise Levels

Table 4.1 provides a summary of the noise monitoring results at the monitoring locations, with weather and local extraneous noise influences filtered out.

Table 4.1: Summar of Background Noise Monitoring dBA

Date	Period	L _{Aeq}	L _{Amax}	L _{A1}	L _{A10}	L _{A90}	RBL	Location Notes
Position A (North-west) – Herston Road, Near Residential Area (2021)								
Average	Day	60	73	67	63	50	46	Vegetated area 23m south of the northern boundary and 170m west of the eastern boundary.
	Evening	59	71	66	62	49	41	
	Night	53	67	63	56	39	33	
Position B (Central Gully) – Gilchrist Avenue, Existing Event Site (2021)								
Average	Day	58	70	63	60	56	55	Vegetated area 32m west of the eastern boundary and 290m north of the southern boundary. 130 m north and west of the ICB.
	Evening	56	66	61	58	53	50	
	Night	52	63	58	54	47	42	
Position L1 (North-west) – Herston Road, Near Residential Area (2022)								
Average	Day	59.4	71.0	65.3	62.0	51.4	49.2	30m from nearest traffic lane. Elevated from Herston Rd. 60m to Inner Northern Busway.
	Evening	57.5	68.9	64.1	60.6	47.4	44.0	
	Night	54.6	66.8	62.4	56.4	39.5	34.7	
Position L2 (North-east) – Herston Road, Near Hospital (2022)								
Average	Day	60.5	75.3	68.6	64.2	56.8	55.9	10m from Herston Rd (2m below), 10m from Inner Northern Busway (elevated above).
	Evening	60.4	74.7	67.7	62.8	53.5	51.8	
	Night	58.3	72.5	65.8	59.4	50.0	45.1	
Position L3 (Central) – Nearby the Function Areas of Golf Facility (2022)								
Average	Day	56.7	66.3	56.4	50.2	45.3	46.7	20m from function rooms (>5m below), 70m from driving range. 350m to ICB.
	Evening	50.5	66.3	54.7	50.2	46.3	44.8	
	Night	50.6	54.6	48.3	44.2	39.4	39.4	
Position L4 (South) – Adjacent St. Pauls Terrace and Residential Area (2022)								
Average	Day	62.2	73.7	66.7	62.8	58.6	57.6	15m from St. Pauls Tce (5m below). 125m to rail line, 200m to ICB.
	Evening	59.7	70.1	64.2	60.8	56.8	55.1	
	Night	56.1	67.3	62.0	56.7	50.4	44.3	

Date	Period	L _{Aeq}	L _{Amax}	L _{A1}	L _{A10}	L _{A90}	RBL	Location Notes
Position L5 (West) – Nearby QUT and Accommodation with line of sight to ICB (2022)								
Average	Day	54.0	68.2	60.4	55.3	49.8	48.5	60m to Victoria Park Rd. 290m to ICB. 145m to nearest Tennis Courts.
	Evening	50.5	63.3	56.8	51.9	46.1	44.4	
	Night	48.9	61.0	54.9	49.1	43.5	39.4	

4.7 Summary

Review of the full noise monitoring data sets in **Appendix C** and **D** identify:

- All locations exhibit diurnal patterns with reduced L_{A90} and L_{Aeq} between 11 pm and 6 am, generally assumed as a result of road traffic.
- There is generally a lull in average noise levels between 10 am and 3 pm due to a break in high traffic periods.
- At Position A (northwest, residential area), there were slightly higher noise levels during Thursday through Saturday evenings, including sustained L_{A10} and L_{Aeq} noise levels typically reducing after 8 pm. This is assumed to be associated with vehicles along Herston Road as the only existing noise source. It is noted that 2021 data may be affected by COVID19 lock-downs and underestimate typical traffic noise levels.
- At Position B (Central Gully, Gilchrist Avenue), there is a clear diurnal pattern from traffic noise on the ICB and Bowen Bridge Road with noise elevating to a relatively constant L_{A90} from 6am until 7pm when it slowly reduces. There are additional elevated periods for average noise (L_{A10} and L_{Aeq}) between 9am and midday (likely due to significant parking activities on Gilchrist Avenue), as well as at 6pm (insect noise). It is noted that 2021 data may be affected by COVID19 lock-downs and underestimate typical traffic noise levels.
- At Position L1 (northwest, Residential Area), there were slightly higher noise levels on Thursday through Saturday evenings, including sustained L_{A10} and L_{Aeq} noise levels extending up to 10 pm. This is assumed to be associated with vehicles along Herston Road as the only existing noise source. The higher levels (comparative to 2021) measured further from Herston Road are assumed to be due to increased traffic post COVID19.
- At Position L2 (northeast, bus stop and hospital), there were occasional periods influenced by ambulances or bus movements temporarily elevated L_{A1}, L_{Amax} and L_{Aeq} levels. Noise at the location is generally dominated by typical Herston Road activity, and possibly hum of ICB and Bowen Bridge Road traffic.
- At Position L3 (central, function centre), there were occasional periods influenced by functions, patrons or bird noise, generally lower than boundary areas, due to separation from busy roads. ICB likely defining the L_{A90}.
- At Position L4 (south, St. Pauls Terrace), there were generally sustained levels due to nearby traffic on St Pauls Terrace, and continuous traffic on the ICB. Some temporary elevated L_{A1}, L_{Amax} and L_{Aeq} levels likely due to specific vehicles on St Pauls Terrace.
- At Position L5 (west, QUT and residences), there were generally sustained levels due to elevated view of ICB, and occasionally elevated periods of vehicle use on Victoria Park Road. Some temporary elevated L_{A1}, L_{Amax} and L_{Aeq} levels were observed, likely due to specific vehicles on Victoria Park Road.
- Background noise levels are relatively similar on weekdays and weekends at all Locations.

Noise levels at the boundary of the parkland, adjacent the arterial roads (L2 and L4) are similar to an R4 Noise Area Category according to AS 1055.3-1997 Acoustics-Description and measurement of environmental noise:

- Daytime: L_{A90,T} = 55 dBA
- Evening: L_{A90,T} = 50 dBA
- Night: L_{A90,T} = 45 dBA

An R4 area is defined as an area with dense transportation or with some commerce or industry, which correlates well with the surrounding arterial road network. It is noted that L1 is adjacent to Herston Road, however setback approximately 25m and generally screened other than a view of approximately 120 degrees. The houses immediately fronting Herston Road may experience slightly higher levels of noise, however the review is catering to the 'worst-affected' sensitive areas in consideration of an R3 characterisation (as discussed below).

Noise levels setback from arterial roads (L1, L3 and L5) in the area are similar to an R3 Noise Area Category according to AS 1055.3-1997 Acoustics-Description and measurement of environmental noise:

- Daytime: $L_{A90,T} = 50$ dBA
- Evening: $L_{A90,T} = 45$ dBA
- Night: $L_{A90,T} = 40$ dBA

An R3 area is defined as an area with some commerce or industry, with slightly higher evening noise levels, which correlates well with current Victoria Park / Barrambin site surroundings.

It is clear that noise levels during the night time period (10 pm – 7 am) is significantly lower than other periods.

5. NOISE CRITERIA

5.1 Introduction

The following sections provide an overview of the applicable and adopted noise criteria used to consider the proposed development in the context of the LGID.

5.2 Brisbane City Plan 2014

5.2.1 Overview

The Brisbane City Council (BCC) City Plan 2014 (City Plan) includes noise criteria within the various codes in the document. The Noise impact assessment Planning Scheme Policy (PSP) in Schedule 6 of City Plan includes information on location of noise criteria within the City Plan, guidelines for preparation of a noise impact assessment report, noise impact control measure information (including maximum acoustic barrier heights), and methods for undertaking assessment.

According to BCC's online mapping (refer **Figure 5.1**), the subject site zoning is as follows:

- Majority of the project area is designated within SR3 Sport and Recreation 3 (Metropolitan) Zone.
- South-west corner of the project area is designated within SR2 Sport and Recreation 2 (District) Zone.
- Section of project area between ICB and Gregory Terrace is designated within SR3 Sport and Recreation 3 (Metropolitan) Zone, except the area including the railway line and eastern corner which is designated within SP4 Special Purpose (Utility Services) Zone.

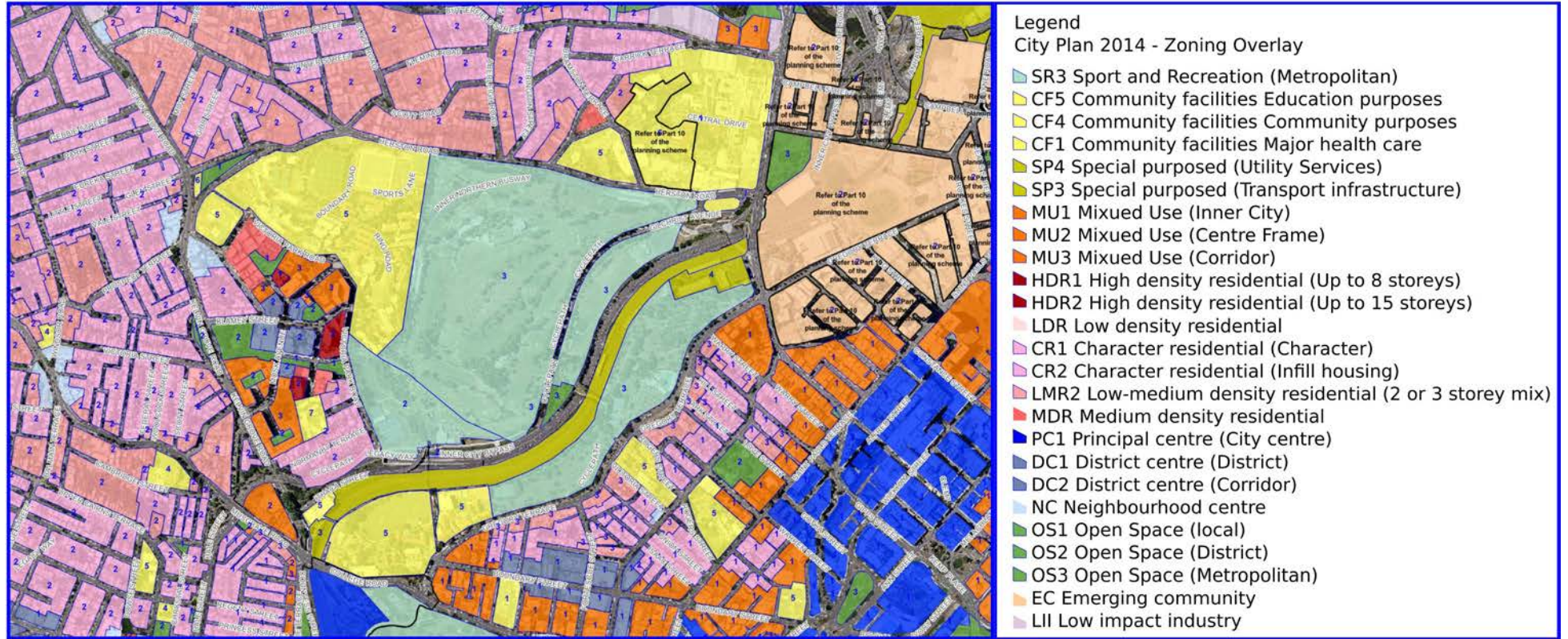
The areas outside the Victoria Park development site are a variety of zones, including residential zones.

The primary relevant codes for the proposed uses on the site (to be used as guidance) are as follows:

- Centre or Mixed Use code
- Outdoor sport and recreation code
- Community facilities code

The site is partially within a transport noise corridor for locally controlled roads, but as there are no proposed residential uses, the Transport Noise Corridor Code does not apply.

Figure 5.1: Brisbane City Plan 2014 – Zoning Overlay



5.2.2 Outdoor Sport and Recreation Code

The Outdoor Sport and Recreation Code is to be used as guidance for more formal outdoor sporting areas proposed on the site. The purpose of the code will be achieved through the following overall outcomes:

- Development locates a new use on a site which does not adversely affect the amenity of local residents, their neighbourhood or the capacity of the road system.
- Development is sited and designed to reduce adverse impacts on the surrounding area given the nature of the use and level of facility.
- Development ensures that the level of activities including ancillary development is consistent with the relevant zone precinct intent.
- Development ensures that the use of the sport and recreation facilities is maximised including through compatible mixed uses.

The relevant Performance Outcomes and Acceptable Outcomes are as follows in **Table 5.1**.

Table 5.1: Outdoor Sport and Recreation Code (Partial Copy of Code Table 9.3.15.3)

Performance Outcomes	Acceptable Outcomes
If in a District zone precinct, where a park management plan does not apply	
PO10 Development for any intensification of outdoor sport and recreation maintains the amenity of an adjoining residential area.	AO10 No acceptable outcome is prescribed.
PO11 Development ensures that the amenity of an adjoining residential zone is maintained and is consistent with reasonable community expectations for the use of a district park.	AO11 Development ensures that the hours of operation are restricted to 7am to 10pm.
PO13 Development ensures that the operation and servicing of a facility does not impose unreasonable adverse impacts on the surrounding residential area.	AO13 No acceptable outcome is prescribed.
PO14 Development ensures facility or activity preparation does not impose unreasonable adverse impacts on the surrounding residential area.	AO14 Development ensures that the hours of operation for facility or activity preparation are restricted to 6am to 7pm.
PO15 Development ensures that the facility does not impose unreasonable adverse amenity impacts on the surrounding residential area in terms of its location of buildings, vehicle access areas or operation.	AO15.1 Development ensures that the building setback from a boundary with a residential zone is a minimum of 15m or half the height of the building, whichever is the greater. AO15.2 Development involving vehicle movement or car parking areas which abut a boundary with a residential zone provide: <ol style="list-style-type: none"> 1. a 1.8m high, gap free, solid screen fence between car parks and vehicle movement areas and adjacent residential dwellings; 2. a minimum 2m wide vegetated buffer adjacent to the boundary.
If in a Metropolitan zone precinct, where a park management plan does not apply	
PO18	AO18

Performance Outcomes	Acceptable Outcomes
Development for any intensification of outdoor sport and recreation uses acknowledges the amenity of adjoining residential areas.	No acceptable outcome is prescribed.
PO19 Development ensures that the amenity of an adjoining residential zone is maintained and is consistent with reasonable community expectations for the use of a metropolitan park in the Metropolitan zone precinct.	AO19 Development ensures that the hours of operation are restricted to 7am to 10pm.
PO21 Development ensures that the operation and servicing of a facility does not impose unreasonable adverse impacts on the surrounding residential area.	AO21 No acceptable outcome is prescribed.
PO22 Development ensures facility or activity preparation does not impose unreasonable adverse impacts on the surrounding residential area.	AO22 Development ensures that the hours of operation for facility or activity preparation are restricted to 6am to 7pm.
PO23 Development ensures that the facility does not impose unreasonable adverse amenity impacts on the surrounding residential area in terms of its location of buildings, vehicle access areas or operation.	AO23.1 Development ensures that the building setback from a boundary with a residential zone is a minimum of 15m or half the height of the building, whichever is the greater. AO23.2 Development involving vehicle movement or car parking areas which abut a boundary with a residential zone provide: <ul style="list-style-type: none"> 3. a 1.8m high, gap free, solid screen fence between car parks and vehicle movement areas and adjacent residential dwellings; 4. a minimum 2m wide vegetated buffer adjacent to the boundary.

It can be seen from **Table 5.1** that whilst there are no specific noise limits, there is a requirement to achieve amenity and avoid unreasonable impact at nearby uses (e.g. residences) and limit uses to between 7am and 10pm.

In review of applicable Performance Outcome PO11, it is considered that it is possible to meet the requirements of the Performance Outcomes while operating outside the hours of 7am to 10pm (i.e. achieve amenity and reasonable impact at adjoining sensitive uses during these hours). Further, limiting the use to within the hours of 7am to 10pm does not imply that adjoining sensitive uses (e.g. residences) have acceptable amenity and reasonable impact.

5.2.3 Community Facilities Code

Minor aspects of the development are considered against the criteria in the Community Facilities Code in City Plan. The Community Facilities Code contains performance outcomes and acceptable outcomes for noise impacts relating to community developments. The relevant performance outcomes and acceptable outcomes from the Code are presented in **Table 5.2**.

Table 5.2: Community Facilities Code (Partial Copy of Code Table 9.3.5.3.A)

Performance Outcomes	Acceptable Outcomes
PO2 Development ensures that noise generated does not exceed the noise (planning) criteria in Table 9.3.5.3.B	AO2.1 Development: <ul style="list-style-type: none"> ■ does not involve amplified music entertainment;

Performance Outcomes	Acceptable Outcomes
<p>and night-time noise criteria in Table 9.3.5.3.C at a sensitive zone or sensitive use.</p> <p>Note—A noise impact assessment report prepared in accordance with the Noise impact assessment planning scheme policy can assist in demonstrating achievement of this performance outcome.</p> <p>Note—Where the development involves an activity regulated by the Entertainment Venues and Events Local Law, the operating noise levels and requirements may be specified on a permit or approval issued under that law.</p>	<ul style="list-style-type: none"> ■ is conducted wholly within an enclosed building and does not involve external activity, dining or entertainment areas; ■ provides a 2m high acoustic fence along any boundary with land in a residential zone; ■ ensures mechanical plant or equipment is acoustically screened from adjoining sensitive uses. <p>Note—Mechanical plant includes generators, motors, compressors and pumps such as air-conditioning, refrigeration or coldroom motors.</p> <p>AO2.2 Development does not generate noise that is clearly audible and creates a disturbance within a dwelling or its associated balcony or patio.</p>

Table 5.3: Relevant Noise Criteria for Sensitive Uses (Partial Copy of Code Table 9.3.5.3.B)

Criteria Location	Intrusive Noise Criteria Day, evening and night $L_{Aeq,adi,T}$ are not greater than the RBL plus the value in this column for the relevant criteria location, where T equals: day – 11hr evening – 4hr night – 9hr	Acoustic Amenity Criteria Day, evening and night $L_{Aeq,adi,T}$ are not greater than the values in the columns below for the relevant criteria location, where T equals: day – 11hr evening – 4hr night – 9hr		
		Day	Evening	Night
Character residential zone boundary	3 dBA	50 dBA	45 dBA	40 dBA
Low and Low-medium residential zone boundary	3 dBA	55 dBA	45 dBA	40 dBA
Medium density residential zone boundary	3 dBA	55 dBA	50 dBA	45 dBA
High density residential zone boundary	3 dBA	55 dBA	50 dBA	50 dBA

Table 5.4: Relevant Night-time Noise Criteria for Sensitive Uses (Partial Copy of Table 9.3.5.3.C)

Criteria location	Where the existing $L_{Aeq,9hr}$ night at the criteria location is:	Average of the highest 15 single L_{Amax} events over a given night (10pm–7am) period is not greater than the following values at the relevant criteria location	The absolute highest single L_{Amax} event over a given night (10pm–7am) period is not greater than the following values at the relevant criteria location
At the zone boundary of a:	<45 dBA	50 dBA	55 dBA
Low density residential zone	45 to 60 dBA	$L_{Aeq,9hr \text{ night}} + 5 \text{ dBA}$	$L_{Aeq,9hr \text{ night}} + 10 \text{ dBA}$
Low-medium density residential zone	>60 dBA	65 dBA	70 dBA
Medium density residential zone			
High density residential zone			
Character residential zone			
Tourist accommodation zone			

Criteria location	Where the existing $L_{Aeq,9hr}$ night at the criteria location is:	Average of the highest 15 single L_{Amax} events over a given night (10pm–7am) period is not greater than the following values at the relevant criteria location	The absolute highest single L_{Amax} event over a given night (10pm–7am) period is not greater than the following values at the relevant criteria location
Emerging community zone			
External to a sensitive use located in a:	Not applicable	65 dBA	70 dBA
Principal centre zone			
Major centre zone			
District centre zone			
Neighbourhood centre zone			
Specialised centre zone			
Mixed use zone			
Rural zone			
Rural residential zone			
Township zone			

5.3 Office of Liquor and Gaming Regulation (OLGR)

The Queensland Office of Liquor and Gaming Regulation (OLGR) requires licensed premises to comply with specific noise criteria within the Liquor Regulation 2002 (the regulation) and Liquor Act 1992 (the Act).

The Act is understood to allow OLGR to limit ‘unreasonable noise’ through abatement notices and compliance orders. OLGR may “require the person to stop all specified noise coming from the premises until the person demonstrates to the commissioner that the noise can be permanently limited to reasonable noise”, and it “may require the person to give the commissioner an acoustic report that complies with the commissioner’s guideline (if any) about acoustic reports.”.

In the Act, unreasonable noise is defined as

- a. *exceeds the limits (if any) prescribed by regulation; or*
- b. *contravenes a compliance order that applies to the premises; or*
- c. *contravenes a condition that applies to the licence or permit for the premises.*

The definition of unreasonable noise in the Regulation is as follows:

- a. *between 6am and 10pm – the adjusted maximum sound pressure level L_{A10} , plus adjustments for tonal and impulse components, exceeding the background level L_{A90} by more than 10 dBA.*
- b. *between 10pm and 6am – the sound pressure level L_{OCT10} , in a full octave band with centre frequencies from 63Hz to 2000Hz, exceeding the background level L_{OCT90} by more than 8 dB in any octave band.*

It is noted that for noise between 6am and 10pm, a +5 dBA tonality adjustment may be applied for music, which then results in an effective noise limit of ‘background level L_{90} + 5 dBA’ instead of ‘background level L_{90} + 10 dBA’.

5.4 Environmental Protection Act

5.4.1 Overview

In Queensland, the environment is protected under the Environmental Protection Act 1994. Section 3 of the EP Act states that the object of the Act is to protect Queensland's environment while allowing for development that improves the total quality of life, both now and in the future, in a way that maintains the ecological processes on which life depends (ecologically sustainable development).

This Act refers to the Environmental Protection Policies as being subordinate legislation to the Act.

The Act describes a number of offences relating to noise standards, including building work, regulated devices (e.g. power tools), pumps, air-conditioning equipment, refrigeration equipment, indoor venues, outdoor events, amplifier devices other than at indoor venue or open-air event, power boat sports in a waterway, operating power boat engine at premises, blasting, and outdoor shooting ranges. The relevant standards are included below.

5.4.2 Open-Air Events (440X)

1. An occupier of premises must not use, or permit the use of, the premises for an open-air event on any day—
 2. before 7a.m, if the use causes audible noise; or
 3. from 7a.m. to 10p.m, if the use causes noise of more than 70dBA; or
 4. from 10p.m. to midnight, if the use causes noise of more than the lesser of the following—
 5. 50dBA;
 6. 10dBA above the background level.
7. However, subsection (1) does not apply to licensed premises.
8. Also, subsection (1)(b) does not apply if—
 9. the premises is, or is part of, an educational institution; and
 10. the use of the premises for an open-air event is organised by or for the educational institution for non-commercial purposes of the institution.

(Note¹: The appropriate measurement parameter for this criterion, as defined in the Environmental Protection Act and subordinate legislation, is the $L_{Aeq,T}$ index)

The EP Act 440X criteria are generally applied where the venue holds open air concerts on an infrequent basis.

There are a number of other sites across Brisbane that host major events up to 12 times per year. Further review will occur as the site is developed and operational to determine how many major events are deemed suitable on an infrequent basis considering its location.

5.4.3 Amplifier Devices other than at Indoor Venue or Open-Air Event (440Y)

This section applies to a person who operates an amplifier device other than at an indoor venue or open-air event.

11. The person must not operate the device in a way that makes audible noise—
 12. on a business day, before 7a.m. or after 10p.m; or

¹ The Queensland Noise Measurement Manual (2020) which provides guidance for undertaking compliance monitoring under the EP Act, defines noise limits using the L_{Aeq} parameter and adopts a measurement time of at least 15-minutes except where the noise continues for less than 15 minutes, in which case the duration of the source noise is adopted (Environmental Protection Regulation 2019, S58(a)).

-
13. on any other day, before 8a.m. or after 6p.m.
 14. At a time when the person may operate the device under subsection (2), the person must not operate the device in a way that makes noise of more than 10dBA above the background level.
 15. However, subsection (3) does not apply if the person is operating the device at an educational institution.
 16. In this section—
amplifier device means any of the following—
 17. a loudhailer;
 18. a megaphone;
 19. a public address system, other than for a railway;
 20. a remote telephone bell;
 21. a telephone repeater bell.

5.5 Environmental Protection (Noise) Policy

In respect of the acoustic environment, the object of the Act is achieved by the Environmental Protection (Noise) Policy 2019 (EPP (Noise)). This policy identifies environmental values to be enhanced or protected, states acoustic quality objectives, and provides a framework for making decisions about the acoustic environment.

The EPP (Noise) contains a range of acoustic quality objectives for a range of receptors. The objectives are in the form of noise levels, and are defined for various periods of the day, and use a number of acoustic parameters. The objectives are not target levels but rather maximum levels.

Schedule 1 of the EPP(Noise) includes the following acoustic quality objectives to be met at residential dwellings:

- Outdoors
 - Daytime and Evening: 50 dBA $L_{Aeq,adj,1hr}$, 55 dBA $L_{A10,adj,1hr}$ and 65 dBA $L_{A1,adj,1hr}$
- Indoors
 - Daytime and Evening: 35 dBA $L_{Aeq,adj,1hr}$, 40 dBA $L_{A10,adj,1hr}$ and 45 dBA $L_{A1,adj,1hr}$
 - Night: 30 dBA $L_{Aeq,adj,1hr}$, 35 dBA $L_{A10,adj,1hr}$ and 40 dBA $L_{A1,adj,1hr}$

In the DEHP EcoAccess Guideline “Planning For Noise Control” documentation it is proposed that the noise reduction provided by a typical residential building façade is 7 dBA assuming open windows. That is, with an external noise source, a 7 dBA reduction in noise levels from outside a house to inside a house is expected when windows are fully open. Thus the indoor noise objectives noted above could be converted to the following external objectives (with windows open):

- Daytime and Evening: 42 dBA $L_{Aeq,adj,1hr}$, 47 dBA $L_{A10,adj,1hr}$ and 52 dBA $L_{A1,adj,1hr}$
- Night: 37 dBA $L_{Aeq,adj,1hr}$, 42 dBA $L_{A10,adj,1hr}$ and 47 dBA $L_{A1,adj,1hr}$

Schedule 1 of the EPP(Noise) includes the following acoustic quality objectives to be met at sensitive non-residential premises:

- Educational and library (indoors): 35 dBA $L_{Aeq,adj,1hr}$
- Childcare (indoors): 30 dBA $L_{Aeq,adj,1hr}$
- School or playground (outdoors): 55 dBA $L_{Aeq,adj,1hr}$
- Hospital, surgery or other medical institution

-
- visiting hours (indoors): 35 dBA $L_{Aeq,adj,1hr}$
 - non-visiting hours (indoors): 30 dBA $L_{Aeq,adj,1hr}$
 - Note: According to Queensland Health websites the RBWH visiting hours in most wards are 10am to 8pm.

A façade noise reduction of at least 20 dBA can be assumed for air-conditioned buildings with windows and doors closed. More detailed review of the buildings would be recommended before proposing an increased façade noise reduction. Therefore the following external objectives are proposed:

- Educational and library: 55 dBA $L_{Aeq,adj,1hr}$
- Childcare: 50 dBA $L_{Aeq,adj,1hr}$
- Hospital, surgery or other medical institution
 - visiting hours: 55 dBA $L_{Aeq,adj,1hr}$
 - non-visiting hours: 50 dBA $L_{Aeq,adj,1hr}$
 - Note: According to Queensland Health websites the RBWH visiting hours in most wards are 10am to 8pm.

A sensitive receptor is defined as “an area or place where noise is measured”.

Given the outdoor objectives within the EPP(Noise) are higher than the calculated external objective (with windows open), then the use of the outdoor objectives may require residents (or other sensitive uses) to close their windows and doors to achieve an acceptable indoor amenity.

The EPP(Noise) states that the objectives are intended to be progressively achieved over the long term. However, as this project involves the introduction of new noise sources it would seem reasonable that the acoustic quality objectives are achieved upon commencement of operation of the project, and this may be the intent of the policy. Therefore, consideration to achieving these acoustic quality objectives will be included in the design noise limits for the project.

It is noted that the acoustic quality objectives do not take into consideration the existing noise environment and therefore it is considered that they do not necessarily protect or enhance the acoustic amenity of the area surrounding the site as required by the EPP(Noise). Therefore, it is considered that the objectives should not be used as the sole noise limits for a development, and reference should also be made to noise limits which are determined with consideration for the existing noise environment, i.e. those within Council policy and the EP Act.

The EPP(Noise) identifies that background creep is to be prevented or minimised. The relevant requirements under the City Plan are considered satisfactory to address this issue.

5.6 Low Frequency (Bass) Music

Further to the dBA criteria, it is recommended to ensure dBC – dBA is not greater than 20 dB for a major event (and sometimes no greater than 10 dB for more frequent activities). The adoption of a C-weighted criteria in addition to an A-weighted noise limit provides for screening of ‘bass’ heavy music, which may not have a significant A-weighted content. These low frequency aspects of music are often a source of complaints especially where larger sound systems are involved.

These dBC offsets are considered in the adopted criteria for screening purposes, and only for the major concert noise level considerations. It is not typical to review bass content when considering low volume activities.

5.7 Brisbane City Council

5.7.1 Event Noise Management Plan

Brisbane City Council (BCC) provides guidance as part of event preparation and safety for events and festivals, including preparation of an event noise management plan. Within the advice provided, it is recommended that the plan contains strategies for:

- Compliance with the Environmental Protection (Noise) Policy 2019
- Satisfying the relevant Australian Standards and Codes
- Maintaining noise levels within the following parameters given in **Table 5.5**.

Table 5.5: Brisbane City Council – Noise Limits for Venues

Location	Permissible Level	Maximum Level
Rear of Venue	85 dBA $L_{eq}(15min)$	100 dBA L_{A10}
Nearest residence or other sensitive place	55 dBA $L_{eq}(15min)$	70 dBA L_{A10}
30 metres from the stage (mixer position) or noise source	95 dBA $L_{eq}(15min)$	100 dBA $L_{A10(5min)}$ and 105 dBA $L_{A10(5min)}$ at 63 Hz

- The plan must encompass:
 - Location and height of the stage
 - Location and height of the speakers
 - Direction of speakers
 - Specific sound barriers used and their location
 - Atmospheric conditions used in calculations
 - Proposed measures for low frequency sound control (i.e. Bass)
 - Topography of the land
 - Details of the sound system
 - Measurement procedures
 - Hours of operations
 - All calculations.

If it is proposed to have live bands or use amplified devices at an event, then a Noise Management Plan may need to be provided from a qualified acoustic engineer to Council before an Entertainment Event permit application can be assessed. Should a qualified acoustic engineer be engaged to develop the Noise Management Plan, Association of Australian Acoustical Consultants provides a list of member grade Acoustical Consultants.

The plan should include:

- A site plan including the location of the event, neighbouring land-use details, location
- And orientation of stages and public address or audio systems
- All potential sources of noise nuisance
- Steps that will be taken to minimise the risk of nuisance
- A plan for notifying potential noise-affected premises and closest sensitive receptors
- Details of acoustic monitoring during the event
- How complaints received before, during and after the event will be addressed.

This acoustic assessment and associated Noise Management Plan is intended to provide a generic review of potential uses and operational management for the Victoria Park facility. The potential adoption of the limits defined by the BCC guidance will be considered.

It is noted that the criteria in **Table 5.5** for 105 dBA L_{A10} 5min at 63Hz is assumed to be a typographical error, and intended to be L_{Z10} for consistency with acoustic principles.

For permanent venues, the requirements of the City Plan apply, in addition to the State liquor licensing requirements if the venue is to be licensed.

5.8 Summary

Based on the preceding sections of the report it is considered that there are several noise criteria that could be considered for the development, and their application depends on the type of noise source (e.g. mechanical plant, sports, one-off outdoor music event) and the regularity of the event (e.g. occurs daily, once per week, once per month etc). The criteria relevant for development is summarised in **Table 5.6**.

Table 5.6: Criteria for Use of Noise Emissions Criteria

Criteria		Typical Use of Criteria (Subject to Evaluation of Actual Noise Limits)
#	Description	
1	BCC Community facilities zone code	Compliance with these 'background plus' type criteria is proposed to allow unlimited use within the compliant time periods.
2	EPP (Noise) Acoustic Quality Objectives – indoor	Compliance with these criteria, or the external (+ 7dBA) version of the criteria, is expected to allow restricted regular use.
3	EPP (Noise) Acoustic Quality Objectives – outdoor	Compliance with these criteria may allow restricted regular use.
4	EPA – Open Air Event	Compliance with these criteria is expected to be allowed but with significant restrictions.
5	BCC – Noise Limits for Venues	Guidance from BCC for routine use of venues for amplified entertainment activities. An approved site specific Noise Management Plan would supersede this.
6	Office of Liquor and Gaming	Licensed premises will require site specific noise limits based on ambient conditions in the surrounding area.

The OLGR (licensed venues) criteria and EPA 'Amplifier Devices' criteria will be applied as required.

The project noise criteria are summarised in **Table 5.6** and will result in a number of noise limits which can be applied based on the noise source and proposed frequency of use. From **Table 5.6**, Criteria #1 are required to be calculated based on the noise monitoring results using the approach in **Table 5.4** and **Table 5.5**. The noise limits for residences near Herston Road are calculated using the background noise levels at Location A, as shown in **Table 5.7**.

Table 5.7: Noise Limits for Residences – General

Period	Rating Background Noise Level RBL L_{90} dBA	Intrusive Noise Limits $L_{eq,adj,T}$ dBA	Amenity Noise Limits $L_{eq,adj,T}$ dBA	Overall Noise Limits
L1 – Herson Road				
Day (7am to 6pm)	49	52	50-55	49 dBA $L_{eq,adj,T}$
Evening (6pm to 10pm)	44	47	45-50	44 dBA $L_{eq,adj,T}$
Night (10pm to 7am)	35	38	40-50	38 dBA $L_{eq,adj,T}$
				65 dBA L_{max}

Period	Rating Background Noise Level RBL L ₉₀ dBA	Intrusive Noise Limits L _{eq,adj,T} dBA	Amenity Noise Limits L _{eq,adj,T} dBA	Overall Noise Limits
				60 dBA L _{max,15event}
L2 – UQ / Hospital				
Day (7am to 6pm)	56	59	55	59 dBA L _{eq,adj,T}
Evening (6pm to 10pm)	52	55	50	55 dBA L _{eq,adj,T}
Night (10pm to 7am)	45	48	50	48 dBA L _{eq,adj,T} 68 dBA L _{max} 63 dBA L _{max,15event}
L4 – Gregory Tce				
Day (7am to 6pm)	58	61	55	61 dBA L _{eq,adj,T}
Evening (6pm to 10pm)	55	58	50	58 dBA L _{eq,adj,T}
Night (10pm to 7am)	44	47	50	47 dBA L _{eq,adj,T} 66 dBA L _{max} 61 dBA L _{max,15event}
L5 – Victoria Park Rd				
Day (7am to 6pm)	48	51	50-55	51 dBA L _{eq,adj,T}
Evening (6pm to 10pm)	44	47	45-50	47 dBA L _{eq,adj,T}
Night (10pm to 7am)	39	42	40-50	42 dBA L _{eq,adj,T} 59 dBA L _{max} 54 dBA L _{max,15event}

The criteria in **Table 5.6** can be developed as the following noise limits in **Table 5.8**.

Table 5.8: Noise Limits

#	Criteria Description	Noise Limits dBA			Proposed Use of Criteria and (Notes)
		Day	Evening	Night	
1	Council Community Facilities Code	See Table 3.7			These 'background plus' type criteria are to be used for continuous or regular daily activities, e.g. mechanical plant.
2	EPP (Noise) Acoustic Quality Objectives – indoor	Residential: 42 dBA L _{Aeq,adj,1hr} 47 dBA L _{A10,adj,1hr} 52 dBA L _{A1,adj,1hr}		Residential: 37 dBA L _{Aeq,adj,1hr} 42 dBA L _{A10,adj,1hr} 47 dBA L _{A1,adj,1hr}	These criteria are not proposed to be used, as they are lower than, or similar to Criteria #1
3	EPP (Noise) Acoustic Quality Objectives – outdoor	50 dBA L _{Aeq,adj,1hr} 55 dBA L _{A10,adj,1hr} 65 dBA L _{A1,adj,1hr} Education/school: 55 dBA L _{Aeq,adj,1hr} Childcare: 50 dBA L _{Aeq,adj,1hr} Hospital*: (10am-8pm) 55 dBA L _{Aeq,adj,1hr} (other) 50 dBA L _{Aeq,adj,1hr}		Hospital: 50 dBA L _{Aeq,adj,1hr}	These criteria are similar to Criteria #1 in the daytime but offer increased noise emissions in the evening. These criteria may be used for evening activities that do not occur on a daily basis. (Note: Hospital visiting hours are taken as 10am to 8pm, though this may vary)

Criteria		Noise Limits dBA			Proposed Use of Criteria and (Notes)
#	Description	Day	Evening	Night	
4	EPA – Open Air Event	70 dBA $L_{Aeq,adj,1hr}$		43 dBA $L_{Aeq,adj,1hr}$ (33 + 10)	These criteria would only be adopted for infrequent events (e.g. several times per year).
5	BCC – Noise Limits for Venues	55 dBA $L_{eq(15min)}$	70 dBA L_{A10}	n/a	Nearest residence or other sensitive place
6	OLGR	$L_{A90} + 10$ dBA L_{A10}		$L_{OCT,90} + 8$ dBA (63 – 2kHz 1/1 Octaves) $L_{OCT,10}$	Applicable and specific to individual licensed premises.

5.9 Ecological Impacts (Fauna)

5.9.1 Guidance for Ecological Receptors

There is limited research data pertaining to the ecological impacts from music events, however observational response (changes in behaviour) is the best indication that fauna are disrupted by the activity.

It is noted the site a variety of fauna including but not limited to:

- Possums, and possum boxes
- Water bird areas
- Native and non-native bird areas

Each fauna species are likely to have different levels of sensitivity to different noise sources and/or large crowds of people. Many species are likely to acclimate to the introduction of continuous or routine noise, or low levels of noise. However various species can be startled and go into distress as a result of sharp changes in volumes or the introduction of significant levels of very-low or very-high frequency noise.

Within the site, it may be seasonally necessary to identify certain areas as having ecological significance. This should be completed by an ecologist, with the guidance of the goals and values of the Brisbane City Council.

This should be considered during periodic review of any Noise Management Plan associated with the use of the facility.

There are known approvals for nature reserve areas in Australia which were approved provided a limit of 65 dB(A) established via approvals prepared in accordance with the Environment Protection and Biodiversity Conservation Act (EPBC Act 1999), however this is not a suitable reference for the Victoria Park / Barrambin site, which is surrounded by busy roadways which often have levels in excess of this level.

It is also noted that for certain facilities in Australia it is opted to avoid sudden loud noises (which likely include things like Pyrotechnics and certain music performances or cinematic movies) are not permitted within 500-metres of the Grey-Headed Flying Fox camp.

It is noted that fireworks occurring at the function centre have not been specifically identified as a concern for the fauna in the park, and are of an extreme noise level, albeit for brief periods.

5.9.2 Noise Management for Ecological Receptors

No specific numerical noise goals are applicable to the existing fauna within the park.

Any changes to animal behaviour as a result of the event noise activities should be observed and recorded, to ensure the elevated noise (or associated activity) at irregular times, specifically any very high, and very low-frequency content is not adversely disrupting their normal behaviour.

If at any time the operational staff find that a source of noise is unduly impacting the fauna, the requirement to reduce the scale of activity, or relocate may be required, as well as documentation to guide future planning.

Suggested mitigation to provide minimal impact to known existing wildlife areas adjacent to any new concert areas, include:

- Background noise – white noise or similar (e.g. waterfalls) operational for the duration
- Reduced Volumes – in specific areas, potentially seasonally relevant (e.g. flying fox breeding season)
- Acclimatisation – through gradual increase of event volumes, and ‘slow ramp’ of noise levels
- Shielding – e.g. shipping containers along the boundary of the noisy activities or the fauna areas

5.10 Traffic Noise – Intrusion to Site

There are no sensitive uses (e.g. residences, child care, educational, hospital) proposed within Victoria Park. However, concern has been raised regarding the road traffic noise impact onto the site, specifically from the ICB, and the effect on the park users. It is noted that road traffic noise from the ICB already impacts the site, and no substantial increase in ICB road traffic noise is being considered.

The Department of Transport and Main Roads (DTMR) Code of Practice (Noise) includes the following noise criteria for new roads, busways or railways, which are to be achieved in parks:

- Roads: 63 dBA $L_{10(12\text{hour})}$, where the 12 hours is 6am to 6pm.
- Busways or light rail: 57 dBA $L_{\text{eq},1\text{hr}(\text{day})}$ and 66 dBA $L_{\text{max}(\text{day})}$.
- Additional Considerations:
 - *For areas greater than 2000 square metres, the criterion level is to be achieved for a minimum 2000 square metres. For areas less than 2000 square metres, the criterion level shall be achieved in the whole area. The noise measurement / calculation / prediction height for outdoor areas shall be 1.5 m above ground level in the free field.*
 - *All available relevant information about the provision and future use of the outdoor educational or passive recreational areas should be considered. All cases shall be determined on a case-by-case basis.*
 - *For example, in large areas of open spaces, only a small percentage may be affected by the impact of transport noise. There is often scope to locate activities away from the influence of transport noise without the requirement of noise barriers. This may be of benefit from a security perspective and also break the visual monotony for the road user of long sections of continuous noise barriers within the road corridor. The Department recognises that, in some situations, it will be desirable to provide some protection for these areas. This should be resolved by consultation with local government and community groups.*

The DTMR criteria are not enforceable for this project, as the ICB and other bounding roads are all Council controlled roads, but the criteria are provided as a guide to reasonable traffic noise levels in parkland.

The Queensland Environmental Protection (Noise) Policy includes the following acoustic quality objective for ‘park or garden that is open to the public (whether or not on payment of an amount) for use other than for sport or organised entertainment’: ‘the level of noise that preserves the amenity of the existing park or garden’. Given the traffic noise sources are not changing, aside from expected gradual increases due to increasing traffic volumes, there would not appear to be any relevant acoustic quality objective for this Park.

The New South Wales Roads and Maritime Noise Criteria Guideline (April 2015) includes the following noise criteria for open spaces (parks) affected by proposed road projects and traffic generating developments:

- Open space (active): $L_{\text{Aeq}(15\text{hour})}$ 60 dBA, where the 15 hours is 7am to 10pm.

-
- Open space (passive use): $L_{Aeq(15hour)}$ 55 dBA, where the 15 hours is 7am to 10pm.
 - Additional Considerations:
 - *Active recreation is characterised by sporting activities and activities which generate their own noise or focus for participants, making them less sensitive to external noise intrusion.*
 - *Passive recreation is characterised by contemplative activities that generate little noise and where benefits are compromised by external noise intrusion, e.g. playing chess, reading.*
 - *In determining whether areas are used for active or passive recreation, the type of activity that occurs in that area and its sensitivity to noise intrusion should be established. For areas where there may be a mix of passive and active recreation, e.g. school playgrounds, the more stringent criteria apply. Open space may also be used as a buffer zone for more sensitive land uses.*

Overall, whilst there is considered not to be any enforceable criteria for the traffic noise impact onto the Park, the Queensland and New South Wales criteria will be considered in this report.

6. EXTERNAL NOISE IMPACTS ONTO PARK

6.1 General Operation and Activities (External Impact)

In order to consider the quality of the Victoria Park / Barrambin site for the intended use and various spaces, it has been considered to review the noise intrusion onto the site, from the surrounding activities.

Where noise levels are elevated above human comfort levels, consideration of relocation of certain uses, and/or mitigation (e.g. noise barriers or intervening structures, dense foliage, or boundary buffers) can be reviewed.

Based on various site inspections carried out in 2021, 2022, and 2023 the following noise generating activities with the potential to encroach on the park and it's patrons have been identified.

- Bus stops (and patrons)
- Driving range (including low level music)
- Schools (University of Queensland, QUT, Kelvin Grove State High School)
- Hospital
- Businesses

Generally, the main sources of noise in the existing area likely to impact on the proposed uses within the Master Plan are those of transport infrastructure bounding the site, detailed in **Section 6.2**.

6.2 Traffic Noise (Impact Onto Park – Reverse Amenity)

6.2.1 Traffic Noise – Monitoring Data Review

Road traffic noise criteria for parks have considered Queensland and New South Wales road transport noise criteria. The criteria are not considered regulatory requirements for the project but will be considered advisory with respect to traffic noise impacts. The criteria are summarised as follows:

- Parks: 63 dBA $L_{10(12\text{hour})}$, where the 12 hours is 6am to 6pm.
- Active parks: $L_{Aeq(15\text{hour})}$ 60 dBA, where the 15 hours is 7am to 10pm.
- Passive use parks: $L_{Aeq(15\text{hour})}$ 55 dBA, where the 15 hours is 7am to 10pm.

The attended noise measurements (**Appendix C**) have been used in conjunction with the noise logging at Location B (near ICB), to determine the following road traffic noise levels at the attended noise measurement locations as shown in **Table 6.1**. The apricot cells indicate marginal exceedance of park and active park criteria, Light blue cells indicate exceedance of passive use park criterion.

Table 6.1: Comparison of Road Traffic Noise Levels near ICB with Advisory Park Noise Criteria

Location (Refer Figures 5.1 and 7.1)	Park Usage		Calculated Noise Levels at Ground Level, dBA	
	Existing	Proposed Future	$L_{10(12\text{hour})}$	$L_{eq(15\text{hour})}$
Criteria			63	55 and 60
A – Herston Road	-	-	61	57
B – near ICB	Golf	Parkway connection, wetlands and elevated walkway	60	56
1 – sports fields	Rugby fields	Lake and sports field	64	60

Location (Refer Figures 5.1 and 7.1)	Park Usage		Calculated Noise Levels at Ground Level, dBA	
	Existing	Proposed Future	L ₁₀ (12hour)	L _{eq} (15hour)
2 – Gilchrist Avenue	Edge of rugby fields	Kiosk and edge of lake and sports field	63	59
3 – Cricket nets	Cricket	Wetlands and elevated walkway	62	59
4 – Lake	Lake	Lake	58	54
5 – Land bridge	Seating adjacent path	Seating adjacent path	62	59
6 – Spring Hill south	General, path	General, path	64	61
7 – Spring Hill	General, path	Community court precinct	59	56
8 – Spring Hill	General spaces amongst trees	Maintenance compound	56	53
9 – Spring Hill north	General spaces amongst trees	Maintenance compound	56	53

From the above tabulated results, the following comments are made:

- Traffic noise levels achieve the Queensland DTMR criterion of 63 dBA L₁₀(12hour), except for a minimal 1 dB exceedance at Location 1 (sports fields) and Location 6 (Spring Hill south).
- Traffic noise levels achieve the NSW criterion of 60 dBA L_{eq}(15hour) for active parks, except for a minimal 1 dB exceedance at Location 6 (Spring Hill south).
- Traffic noise levels achieve the NSW criterion of 55 dBA L_{eq}(15hour) for passive parks at Location 4 (Lake), and Locations 8 and 9 (Spring Hill), but exceed the criteria, but exceed at other locations. Where locations are in proposed active parks (Location 1, 2 and 7) or on the land bridge (Location 5) the exceedances may be disregarded. Therefore, the exceedances potentially remain at Locations B, 3 (Wetlands and elevated walkway) and 6 (general path area), depending on the interpretation of the use.
- Traffic noise levels would generally reduce further back from the ICB and increase in closer proximity to Herston Road and Gregory Terrace.

6.2.2 Noise Barriers

As part of the review of impacts, some basic traffic noise calculations have been performed to estimate the relative effectiveness of a noise barrier built adjacent the ICB. Based on the following results, the proposal for a noise barrier has been excluded from the design as it provides minimum benefit unless constructed to significant height.

Calculations have been based on receivers located at (i) 50 metres and (ii) 100 metres from the edge of the trafficable lanes of the ICB, and with relative heights (i) level with ICB, (ii) 3m below ICB (similar to existing sports fields), and (iii) 10m above ICB. The barrier effectiveness for all six scenarios is relatively similar and the range of results is shown below in **Table 6.2**.

Table 6.2: ICB Traffic Noise Barrier Effectiveness (Relative to Existing 1.2m kerb)

Barrier Height	Noise Reduction (Relative to Existing 1.2m kerb) dBA	Change In Subjective Loudness*	Significance of Change*
Existing 1.2m kerb	0 (reference)	-	-
2m (e.g. 1.2m + 0.8m atop)	1 to 2	Nil	Insignificant

Barrier Height	Noise Reduction (Relative to Existing 1.2m kerb) dBA	Change In Subjective Loudness*	Significance of Change*
3m	4	Noticeable	Marginal
4m	6	-	-
5m	7 to 9	-	-
6m	9 to 11	About double/half	Significant

* Note: Information taken from Table 2.4 of Volume 1, Chapter 2 of the DTMR Code of Practice Volume 1 – Road Traffic Noise, November 2013. There is no information for noise level changes of 6 to 9 dBA.

The above calculations assume the barrier is sufficiently long to interrupt the complete angle of view of the road from the receiver position. Detailed computational modelling may identify localised benefits, however the proposal for a noise barrier has been excluded from the current design.

6.2.3 Modelling Traffic Noise Intrusions

Further to the monitoring of on-site activities, it is of interest as to the intrusive levels throughout the remainder of the parkland. A screening model of the levels of noise experienced within Victoria Park as a result of the major road network source (ICB) have been calculated. It is noted that Herston Road, Bowen Bridge Road, and Gregory Terrace will have additional localised impacts, however reliable data for these roads was not readily available.

Utilising the Calculation of Road Traffic Noise (CoRTN) 1988 methodologies, and utilising the most recently available Average Annual Daily Traffic (AADT) counts:

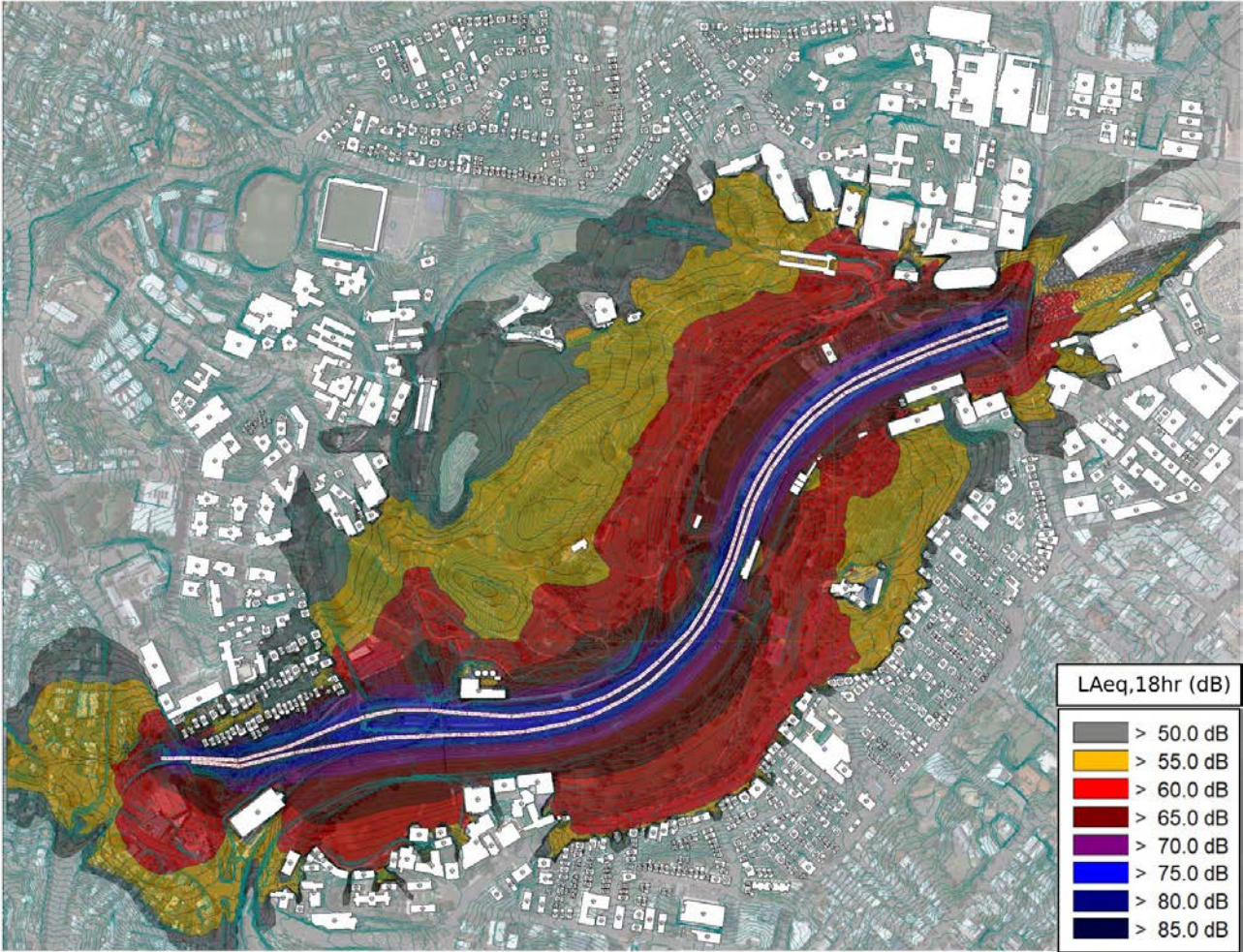
- Inner City Bypass (ICB)
 - o 2015 Eastbound daily 52,291 vehicles,
 - o 2015 Westbound daily 48,636 vehicles,
 - o 5% heavy vehicles,
 - o 60km/hr,

The Cadna/A computational model noise contour plot of the typical daily $L_{Aeq,18hour}$ levels through Victoria Park during a typical 18-hour day is shown in **Figure 6.1**.

Predictions are made at 1.8m above ground level, approximating patron ear level, using a 10m x 10m grid spacing. The noise contours are in 1 dB increments. No barriers are included in this model.

In use of any given area, it is generally desired to be 10 dB or more above the ambient noise levels for any activity intended to have clear communication or entertainment (amplification, sports whistles).

Figure 6.1: Noise Contour Plot – Road Traffic Noise



7. ASSESSMENT OF NOISE EMISSIONS

Various activities are proposed to occur across the Victoria Park / Barrambin Master Plan development site, with the potential to generate audible noise offsite, including:

- Vehicles and car parking
- Patrons and crowds (including at the pump track, and sports areas)
- Miscellaneous (dog park, water park, waste collection, maintenance facilities)
- Mechanical plant
- General facility amplification (e.g. restaurants / kiosks)
- Amplified events (markets, concerts, other entertainment)

The above items have been considered in the following sections.

7.1 General Activity

7.1.1 Overview

Typical day to day activities have been modelled and results have been compared to two criteria types:

- all activity average noise levels ($L_{Aeq,15min}$) across a 15-minute period, and
- instantaneous maximum noise levels ($L_{Amax,15event}$)

It is noted that modelling of car parking and general activity has been modelled based on highly conservative assumptions, and actual levels are likely to be much lower. It is noted that the reviewed criteria are the lowest of those identified in **Table 5.8**, and do not account for often higher levels of ambient noise from traffic (ie. Based on the quietest 1-hour period across a week of monitoring).

Further to the conservative nature of the assessment, the review additionally considers the extent of proposed future activity and typical locations patrons, or other activities are expected to occur, and makes no account of the existing noise of similar type (e.g. where main entry carpark is increasing from 353 to 488 spaces, no account of existing levels of noise are reviewed, only the resulting total).

It should be noted that the modelling of the dog park has not been completed at this time.

7.1.2 Modelling Assumptions

The modelling inputs and assumptions are detailed in **Table 7.1** below, and modelling includes the locations and sources identified in **Figure 7.1**.

Table 7.1: General Activity Modelling Inputs and Scenarios

Modelling Element	
Methodology	Cadna/A (ver 2023) Modelling package utilising; Industrial Noise Impact: ISO 9613.2_1996 "Acoustics Attenuation of Sound During Propagation Outdoors"
Weather Conditions	All predictions have been undertaken in accordance with ISO Standard 9613 2 (1996) Acoustics Attenuation of sound during propagation outdoors. ISO 9613 2 predictions are relevant for light to moderate downwind conditions (1 to 5 m/s) or a well-developed moderate ground-based temperature inversion (e.g. clear, calm night).
Receiver Location and Height	Receiver locations are shown in Figure 3.3 . Predictions are made for each façade and floor assuming a ground floor height of 1.5 m and 3 m above for each subsequent level.
Source Sound Power Level	Car Park vehicle movements and patrons

Modelling Element	
	<ul style="list-style-type: none"> • An L_{Aeq} sound power spectra with an overall level of 88 dB(A) was utilised in the computer model as a line source at 0.5m above ground traversing the entire car park areas shown in Figure 5.1 to model car door movement noise. • The modelled line source represents 1 vehicle for every spot traversing the entire carpark in a 15-minute period at 10 km/h speed (highly conservative). • Modelling of the Urban pump track has considered 2 vehicles for every spot, due to the low supply (accounting for people entering and leaving without finding a spot). <p>Car Park door closures and patrons</p> <ul style="list-style-type: none"> • An L_{Amax} sound power spectra with an overall level of 94 dB(A) was utilised in the computer model as a point source at 1.5m above ground traversing the entire car park areas shown in Figure 5.1 to model car door movement noise. • The modelled line source represents 1 vehicle for every spot traversing the entire carpark in a 15-minute period at 10 km/h speed (highly conservative). <p>Meeting/activity/sport areas bounding the park</p> <ul style="list-style-type: none"> • Modelling of groups of up to 25 patrons generating typical group 'rabble' noise at the edge of main activity area or sport fields have considered an overall sound power level of 94 dB(A) modelled as an area source at 1.5m above ground. This level has also been assumed for the urban pump track. • It is noted that the pathway from the tree house and lookout to the main carpark has been modelled based on 100 patrons in a 15-minute period travelling at 5 km/hour (each with a sound power level of 80 dB(A)). <p>Court sport areas</p> <ul style="list-style-type: none"> • Each tennis or basketball court have been modelled with an overall average sound power level of 80 dB(A) at 1.5 m above ground, however additionally with a maximum review of whistle noise up to 100 dB(A). <p>Mechanical Plant</p> <ul style="list-style-type: none"> • To provide a conservative review of potential activities, a typical air conditioning condenser unit has been assumed at the building adjacent the Urban pump track, with a continually operating sound power level of 86 dB(A) during daytime and evening periods.
Scenarios	<p>Average Noise – (See Figure 5.1)</p> <ul style="list-style-type: none"> • Car park vehicle movements • Patron Noise (group rabble/shouting) • Sport activities (including rabble/shouting/whistles) • Mechanical plant (a/c condenser at Urban pump track building) <p>Maximum Noise – (See Figure 5.1)</p> <ul style="list-style-type: none"> • Car park door closing • Patron Noise (maximum shout) • Sport activities (maximum shout/whistle)

Figure 7.1: Modelled General Use Noise



7.1.3 Modelling Results

Modelled results for the average and maximum noise levels for activities in each area, and cumulatively are presented in **Table 7.2** and **Table 7.3** below. It should be noted that the totals presented are conservatively summing the most affected receiver in each scenario, rather than a total of an individual receiver.

There are no applicable criteria for commercial users for maximum noise, so a screening level of 70 dBA has been adopted for human comfort levels (assuming a desire for internal office levels of 45 dBA, and construction suitable for facing a main road).

Predicted exceedances of the applicable/adopted criteria are presented in red.

Table 7.2: General Activity Noise Modelling - Average Results

Group	Location Type	Highest Predicted Level (dB(A))								TOTAL	Criteria	
		A	B	C	D	E	H	K	L			
N	Residential	45	31	27	42	20	18	19	22	47	44	Evening
N	Community	33	20	16	42	18	15	15	14	42	44	Evening
N	Commercial	23	14	20	17	-5	-1	3	17	26	65	Commercial
NE	Residential	22	23	26	8	12	19	20	31	33	55	Evening
NE	Community	25	27	29	10	13	18	14	34	36	55	Evening
NE	Commercial	29	33	38	11	16	21	24	45	46	65	Commercial
E	Residential	25	27	32	10	15	28	39	44	46	58	Evening
E	School	20	21	25	8	14	25	35	24	36	61	Evening
SE	School	21	21	28	8	16	35	41	22	42	61	Day
S	Residential	19	19	24	7	15	44	33	19	44	58	Evening
S	School	17	15	22	6	13	34	24	15	35	61	Day
S	Community	12	11	15	-4	6	22	19	13	25	58	Evening
S	Commercial	18	16	22	7	14	35	26	16	36	65	Commercial
SW	School	19	17	24	9	17	51	26	17	51	51	Day
W	Residential	22	17	23	10	25	27	20	15	31	47	Evening
W	School	17	15	19	14	15	20	16	14	26	47	Evening
W	Community	18	15	18	4	17	24	19	14	27	47	Evening
W	Commercial	20	15	18	13	16	22	18	14	27	65	Commercial
QUT	School	33	21	26	38	34	25	21	18	41	51	Day
UQ	Residential	19	7	11	15	2	13	14	5	22	55	Evening
UQ	School	47	37	35	24	19	20	21	25	48	59	Day
UQ	Hospital	34	40	36	18	16	20	22	30	42	55	Evening
UQ	Community	27	33	32	17	16	18	20	25	37	55	Evening
UQ	Commercial	30	34	33	17	15	19	21	28	38	65	Commercial
GolfClub	Commercial	46	31	33	31	36	22	23	23	47	65	Commercial

Table 7.3: General Activity Noise Modelling - Maximum Results

Group	Location Type	Highest Predicted Level (dB(A))								TOTAL	Criteria	
		A	B	C	D	E	H	K	L			
N	Residential	50	38	33	50	35	24	22	25	53	60	Night
N	Community	37	27	22	49	33	21	20	19	50	60	Night
N	Commercial	26	23	30	26	17	5	8	23	33	70	Commercial
NE	Residential	27	31	32	17	25	25	25	33	38	60	Night
NE	Community	29	35	35	19	26	25	24	36	41	60	Night
NE	Commercial	33	40	43	20	29	27	28	47	49	70	Commercial
E	Residential	30	35	37	20	29	34	44	47	49	60	Night
E	School	27	28	29	18	28	30	39	28	41	60	Night
SE	School	27	29	33	18	29	39	44	27	46	60	Night
S	Residential	26	25	30	17	29	49	35	24	49	60	Night
S	School	23	22	26	15	28	39	27	20	40	60	Night
S	Community	19	17	20	6	23	25	24	18	30	60	Night
S	Commercial	24	23	27	16	28	40	29	21	41	70	Commercial
SW	School	25	24	29	19	32	55	29	21	55	60	Night
W	Residential	28	24	26	23	38	35	23	19	41	60	Night
W	School	23	22	23	25	29	26	20	18	34	60	Night
W	Community	25	22	22	9	32	32	22	18	36	60	Night
W	Commercial	26	23	23	16	29	25	21	18	33	70	Commercial
QUT	School	36	29	31	44	49	32	24	21	50	60	Night
UQ	Residential	23	15	16	24	18	19	19	12	29	60	Night
UQ	School	54	45	41	31	32	26	24	28	55	60	Night
UQ	Hospital	38	48	43	25	29	26	25	32	50	60	Night
UQ	Community	33	42	38	24	28	24	23	28	44	60	Night
UQ	Commercial	34	42	39	24	28	25	24	30	45	70	Commercial
GolfClub	Commercial	51	40	38	38	51	27	26	26	55	70	Commercial

It is noted that use of the park for casual/friendly sport is modelled with a sound power level of L_{eq} 95 dBA, however a competitive organised local football (soccer) game has been measured as being up to 105 dBA and

should only be organised to occur on the existing designated fields (location C). Review of the modelling results indicate all activities in this area were predicted >10 dBA below the applicable criteria, and as such are suitable for this location.

Review of the modelling output identifies compliance across all areas and activities modelled with the exception of the nearest residence to the main carparking area. An exceedance of 1 dBA is predicted for the nearest residential building on Herston Road. Analysis of this specific location and the conservative nature of the modelling deems this acceptable based on the following:

- Compliance by 4 dB(A) when considering the daytime criteria (when busy car park activity is likely).
- Monitoring and modelling of transport noise along Herston Road are far louder at this receiver location.
- Conservatism in the modelling has considered that all vehicles entering the main car park will drive past the nearest point to this receiver.

Based on the notes above, and total compliance predicted across the site for the conservative assumptions, it is concluded that noise from typical park operations considered are unlikely to result in impacts to off-site sensitive areas, provided they occur within typical daytime and evening hours.

7.2 General Facility Amplification

For fixed use activities, the OLGR (licensed venues) criteria and EPA 'Amplifier Devices' criteria will be applied as required. These will establish an operationally compliant volume at the commencement of activities.

For temporary and event use (e.g. concerts) refer to **Section 7.5**.

7.3 Miscellaneous

Other unique activities, with the potential to generate noise, likely to be associated with the park operations include:

- Park Maintenance
 - Waste storage and collection
 - Portable plant (lawn mowing, leaf blowers, etc)
 - Maintenance facilities
- Fixed mechanical plant
 - Air conditioning / chillers
 - Water movements (pumping/filtering/sprinklers)
- Dog Park

Activities associated with park maintenance, should be completed within the requirements of BCC (regarding hours of operations, and acceptable scale of equipment). Consideration of surrounding residential areas and schools should also factor into the siting of facilities and when activities occur at locations around the parkland.

Fixed mechanical plant items should be sited and designed in accordance with the Noise Limits in Table 3.8. It is noted that the modelling in Section 5.1 included a typical air conditioning condenser unit at the building proposed at the pump track, however no additional mechanical plant have been included in the review. Given the separation distances to the off-site sensitive areas, it is not anticipated that impacts are likely to these areas, unless for significant mechanical plant items (e.g. significant pumps, or generators).

Dog parks should be signed for use only during daytime/evening periods, to avoid potential impacts to sensitive off-site areas (this may be reviewed upon final location).

7.4 Mechanical Plant Noise Assessment

Noise limits proposed for mechanical plant are generally adopted as the lowest of the applicable Council Community Facilities Code (Criteria #1 of **Table 5.8**) based on the location and operating times.

Though the Council has acceptable outcomes for mechanical plant noise emission requiring acoustic screening, this can be difficult to achieve where multi-storey residences overlook the mechanical plant. Therefore, it is generally recommended that plant be designed to achieve the nominated noise limits, and this often can be assisted with via acoustic screening measures.

The project is expected to include air-conditioning plant, refrigeration plant and other exhaust fans. Localised there may also be pumps and other water related plant. At this stage the mechanical design is not complete and therefore it is proposed that plant is designed and selected to achieve the above recommended noise limits. Consideration should also be given to the construction of acoustic screening to plant, or screening via placement (far side of buildings from residential areas).

Background noise levels can vary around a site and therefore when detailed information on mechanical plant is known, consideration of the background noise measurement data representative of the receiver area and noise limits (**Section 5**) can be advised by the project acoustic consultant.

7.5 Amplified Activities

Prior to use for major amplification activities, a noise management plan should be prepared and distributed to operators during any proposed amplified activities/events, and as part of defining the scale and schedule of events for the venue. Unique high level activities may require to prepare an event specific noise management plan, to demonstrate the ability to achieve the necessary noise goals.

8. RECOMMENDATIONS AND CONCLUSION

A noise assessment has been conducted to support a Local Government Infrastructure Designation (LGID) , that is made over part of the Victoria Park / Barrambin Master site. The results and recommendations of the assessment are as follows:

- It is considered that there are several noise criteria that could be considered for the development, and their application depends on the type of noise source (e.g. mechanical plant, sports, one-off outdoor music event) and the regularity of the event (e.g. occurs daily, once per week, once per month etc). The criteria are summarised in **Table 5.7**.
- A review of noise from typical use of the site has been completed.
 - The modelling and review demonstrate the following typically proposed activities can occur throughout the parkland while meeting the applicable criteria:
 - Vehicle access and car parking
 - Patrons and crowds (including pump track and sports areas)
 - Certain activities should only occur within typical council provisions and time-frames (daytime and evening periods), and where possible be considerate of off-site sensitive receivers in how and when they are utilised:
 - Miscellaneous (dog parks, waste collection, maintenance)
 - Mechanical plant
 - It is noted that all uses have restrictions on timing (generally 7am – 10pm Monday to Saturday, and 8am – 10pm Sunday and public holidays), which are generally applicable to the above items.
 - Routine amplification (restaurants, kiosks) should be operated in accordance with the Office of Liquor and Gaming regulations limits.
- It is recommended that a Noise Management Plan, dictating the suitable activities and limitations (e.g. amplified volume, scale, frequency, orientation) for various areas of the park are provided before the commencement of amplified activities.
- A review of road traffic noise impacts onto the site is included in **Sections 6** and **7.5.7**. The review considered the potential benefit of noise barriers with minimal benefit identified. Further to this, it was identified in corroboration of proposed activities that while some areas of the parkland exceed the TMR guidelines, there is more than enough remaining area of parkland below the thresholds, to qualify as compliant.

Based on the review, ongoing typical use of the Park associated with activities within the LGID area of the Master Plan site is unlikely to result in a significant change to existing off-site noise levels, provided timing restrictions and/or controls are in place for noise generating activities.

Regarding special activities, including amplification, it is recommended that a Noise Management Plan, dictating the suitable activities and limitations (e.g. amplified volume, scale, frequency, location, and orientation) for various areas of the park are provided for the commencement of operations. The Noise Management Plan should also provide a method of receiving, tracking and responding to noise complaints (or other items for action) as necessary.

It can be considered that hirers proposing to utilise the parkland for unique/special activities would complete an event specific Noise Management Plan to demonstrate the ability to operate within the requirements of the site specific Noise Management Plan conditions and framework.

APPENDIX A GLOSSARY

Parameter or Term	Description
dB	The decibel (dB) is the unit measure of sound. Most noises occur in a range of 20 dB (quiet rural area at night) to 120 dB (nightclub dance floor or concert).
dBA or dB(A)	Noise levels are most commonly expressed in terms of the 'A' weighted decibel scale, dBA. This scale closely approximates the response of the human ear, thus providing a measure of the subjective loudness of noise and enabling the intensity of noises with different frequency characteristics (e.g. pitch and tone) to be compared.
dBC or dB(C)	A measure of the overall noise level of sound across the audible spectrum with a frequency weighting (i.e. 'C' weighting) that places an increased focus on the low frequencies (bass).
Day	The period between 7am and 6pm.
Evening	The period between 6pm and 10pm.
Night	The period between 10pm and 7am.
Façade Noise Level	Refers to a sound pressure level determined at a point close to an acoustically reflective surface (in addition to the ground). Typically a distance of 1 metre is used.
Free-field	The description of a noise receiver or source location which is away from any significantly reflective objects (e.g. buildings, walls).
L ₁	The noise level exceeded for 1% of the measurement period.
L ₁₀	The noise level exceeded for 10% of the measurement period. It is sometimes referred to as the average maximum noise level.
L ₉₀	The noise level exceeded for 90% of the measurement period. This is commonly referred to as the background noise level.
ABL	Acoustic background level – the 90th percentile of 15 minute L _{A90} measurements for the period (Day/Evening/Night) of interest on a given day.
RBL	The median of the measured ABL's for the relevant period (Day/Evening/Night) for all relevant periods of in the overall measurement data set
L _{eq} Equivalent Continuous Sound Level	The equivalent continuous sound level, which is the constant sound level over a given time period, which is equivalent in total sound energy to the time-varying sound level, measured over the same time period.
L _{eq,5-minute}	As for L _{eq} except the measurement intervals are defined as 5-minute duration representative of a typical musical song duration.
L _{eq,1hour}	As for L _{eq} except the measurement intervals are defined as 1 hour duration.
L _{eq} (24 hour)	The average L _{eq} noise level over the 24-hour period from midnight to midnight.
L ₁₀ (18 hour)	The arithmetic average of the one-hour L ₁₀ values between 6am and midnight. This parameter is used in the assessment of road traffic noise.
L _{max}	Maximum A-weighted sound pressure level typically in the fast time weighting.
Hertz (Hz)	A measure of the frequency of sound. It measures the number of pressure peaks per second passing a point when a pure tone is present.
Acoustically screened	Brisbane City Council 2014 City Plan definition: The source of noise is completely screened from view of habitable rooms (including balconies, patios, decks and verandas) of an adjoining sensitive use by solid, gap free material and construction e.g. acoustic fence, building, or enclosure.
Acoustic fence	Brisbane City Council 2014 City Plan definition: Solid, gap free fence with minimum panel surface density of 12.5kg/m ² .

Parameter or Term	Description
Sensitive Uses	<p>Brisbane City Council 2014 City Plan definition:</p> <p>A use that is child care centre, community care centre, community residence, dual occupancy, dwelling house, dwelling unit, educational establishment, health care services, hospital, multiple dwelling, relocatable home park, residential care facility, retirement facility, rooming accommodation, short term accommodation or tourist park.</p>
Suitably Qualified Person or Accredited Acoustical Consultant	<p>'Suitably Qualified Person' as defined under section 564 of the Environmental Protection Act, or an acoustical consultant who is a member of one or more of the following organisations: The Association of Australian Acoustical Consultants; the Australian Acoustical Society; or the Institution of Engineers Australia.</p>
Crowd	<p>Number of patrons in a fixed area simultaneously.</p>
Event	<p>An outdoor event whose primary purpose is entertainment involving continuous amplified musical performance taking place within the approved hours of operation.</p>
Event Noise	<p>Noise from amplified entertainment noise</p>
Sound Check	<p>Sound check for a concert that is carried on outdoors where sound amplification equipment is used as part of the sound check.</p>

APPENDIX B DRAWINGS

The Master Plan

NORTH

- 1 Urban pump park
- 2 Park administration and operations
- 3 Adventure Valley with mountain bike track and high ropes course
- 4 The Tree House and lookout
- 5 Kelvin Grove busway access
- 6 Green waste storage
- 7 Parkway loop
- 8 York's Hollow (revitalised)
- 9 Elevated connection to land bridge
- 10 Nature water play gully
- 11 Education Hub
- 12 Lower wetlands and boardwalk
- 13 Adventure playground
- 14 Parkway kiosk
- 15 Naturalised waterholes
- 16 Community sports precinct including a sports field, multi-purpose court, cricket nets, and tennis courts
- 17 Gilchrist Avenue drop-off zone
- 18 Upper wetlands
- 19 Function centre, driving range, bistro and putt putt
- 20 Main car park
- 21 Parkland arrival
- 22 Main parkland entry (with signalised intersection)
- 23 Herston busway access
- 24 Old Clubhouse
- 25 Inner City Pedestrian and Cycle Bridge
- 26 Commuter bikeway/active transport connection
- 27 Lift to accessible elevated walkway*
- 28 Dog park*
- 29 Upgraded pedestrian and cycle bridge*
- 30 Commuter bikeway/active transport connection*

SOUTH

- 31 Community tennis courts
- 32 Spring Hill Common
- 33 Community edible garden and connection to land bridge
- 34 Centenary Pool with upgraded car park
- 35 Dog park
- 36 Gundoo Memorial Grove (rehabilitated)

* New features subject to resolution with Department of Transport and Main Roads and/or Queensland Rail

--- LGID boundary
 --- Master Plan boundary



The Master Plan

APPENDIX C 2021 NOISE MONITORING PROGRAM

C1 Noise Measurements

C1.1 Overview

Acoustic measurements consisted of attended noise measurements and noise logging. Noise logging over periods of 7 to 10 days was conducted at Locations A and B, as shown in **Figure C1**, and described as follows:

- Location A: Located in a vegetated area approximately 23 m south of the northern boundary and 170m west of the eastern boundary.
- Location B: Located in a vegetated area approximately 32 m west of the eastern boundary and 290m north of the southern boundary. The location is approximately 130 m west of the ICB road.

Attended noise measurements were conducted at Locations A and B, as well as Locations 1 to 9 shown in **Figure C2**. Measurements were conducted at Locations 1 to 9 to understand the traffic noise impact on areas near to the ICB.

The noise monitoring was undertaken in general accordance with Australian Standard AS1055 Acoustics – Description and measurement of environmental noise and the DES Noise Measurement Manual.

Figure C1: Noise Measurement Locations A and B (Project Areas in Red)

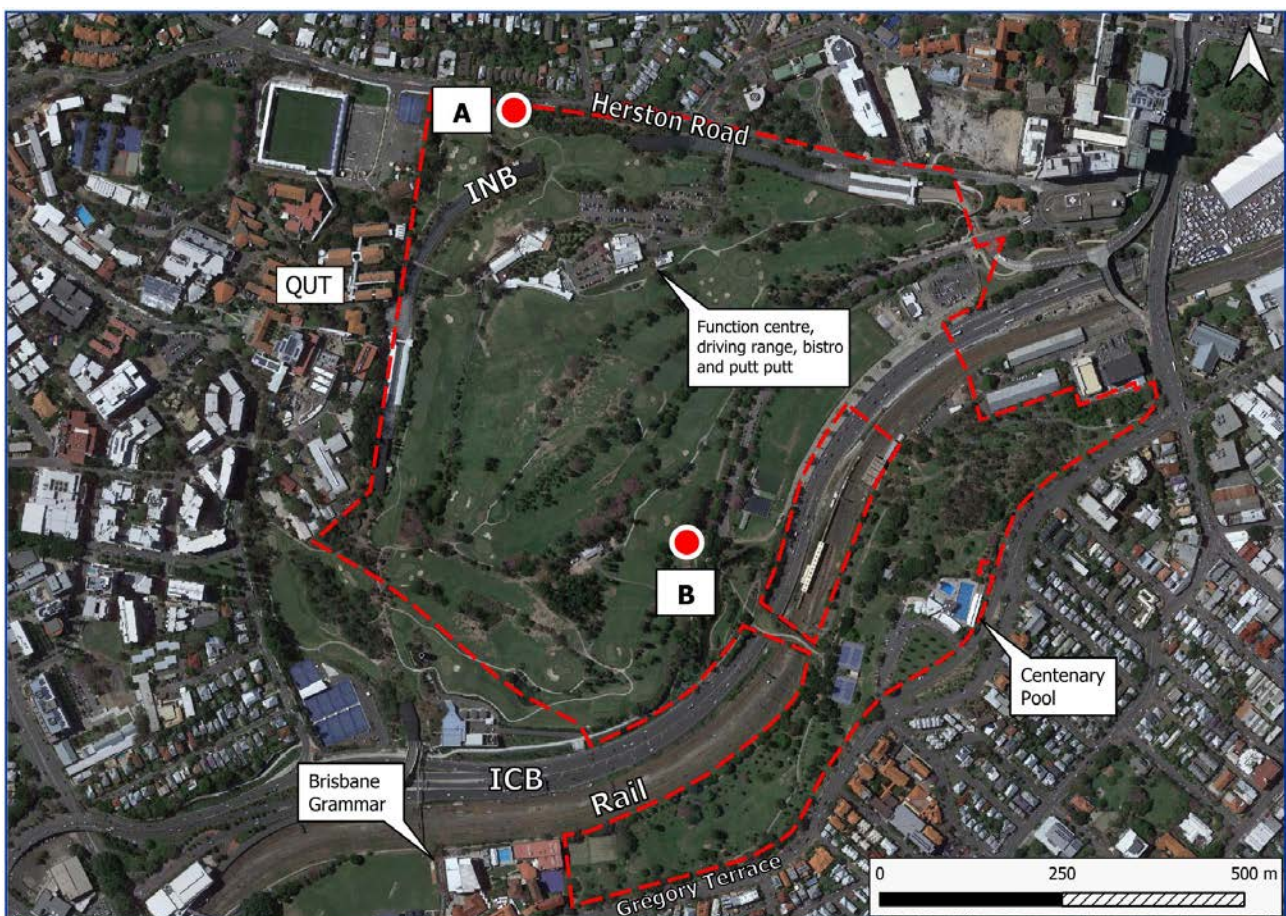
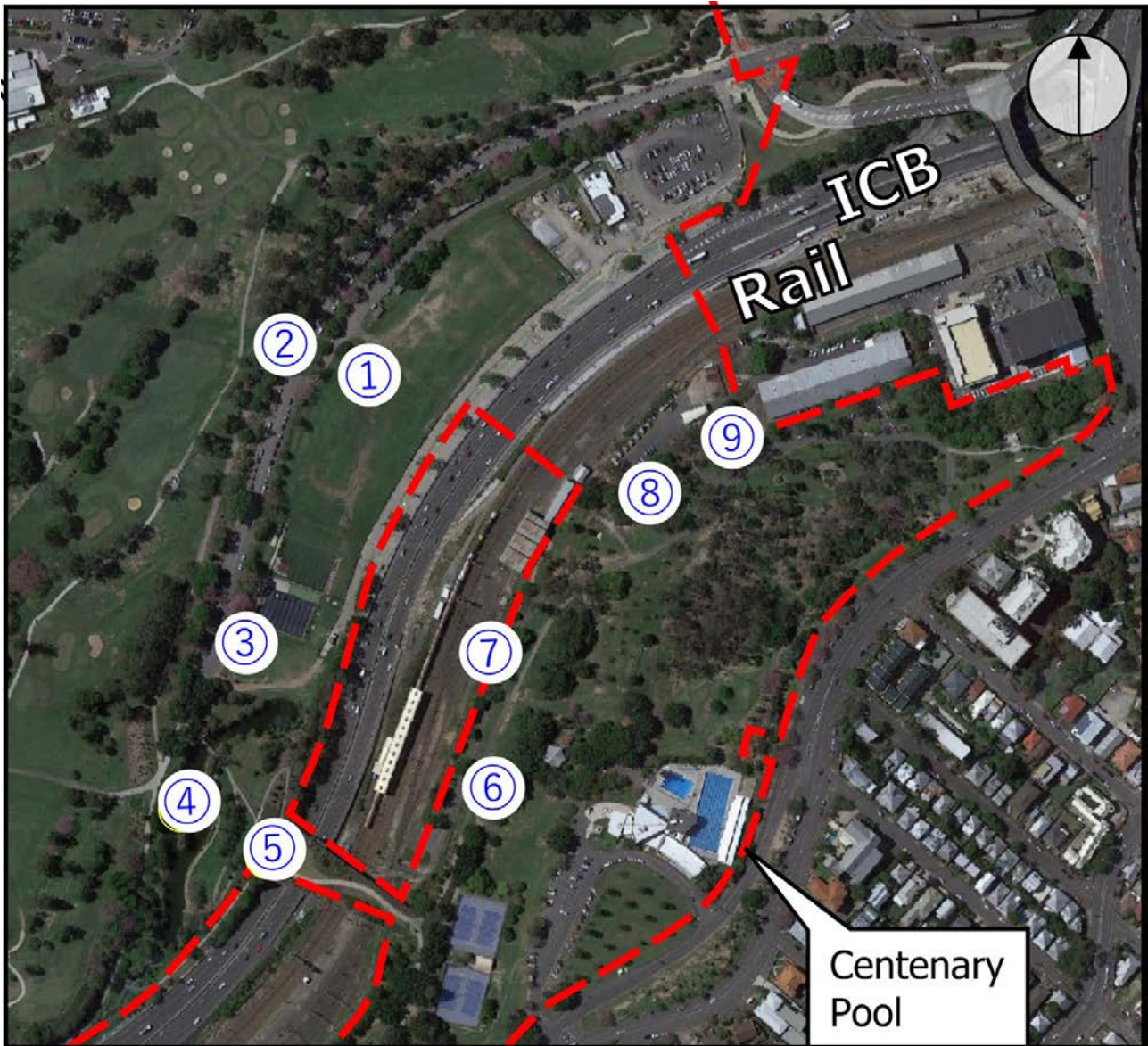


Figure C2: Noise Measurement Locations 1 to 9 (Project Areas in Red)



C1.2 Attended Noise Measurements

Attended noise measurements were undertaken at Locations A, B and 1 to 9. The measurements were undertaken using field and laboratory calibrated Larson Davis LD831 sound level meters. The microphone heights were approximately 1.3 metres above natural ground level and located in the free field at all locations.

Weather during the periods of monitoring was:

- Friday 26/03/2021: Fine, 5/8 cloud cover, with a slight breeze from the south-east at approximately 0 to 3 m/s.
- Tuesday 18/05/2021: Fine, 1/8 cloud cover, with either calm conditions or a slight breeze from the north.

The measured noise levels at Locations A and B are detailed in **Table C1**.

Table C1: Attended Noise Measurement Results

Location (refer Figure 5.1)	Date, Time and Duration	Results and Notes
A	02:02 pm Friday 26/03/2021 15 minutes	Statistical noise levels: L ₁₀ 62 dBA, L _{eq} 59 dBA, L ₉₀ 52 dBA Passing traffic (Herston Road): 56 to 71 dBA Insects (Clearly Audible) Golf Buggy: 59 to 61 dBA Background (average due to traffic): 53 to 57 dBA Motorbike: 73 to 76 dBA
B	02:42 pm Friday 26/03/2021 15 minutes	Statistical noise levels: L ₁₀ 61 dBA, L _{eq} 60 dBA, L ₉₀ 58 dBA Traffic from ICB: 58 to 61 dBA Insect noise (Somewhat Audible)

Note: * The reported noise levels, excluding the statistical noise levels, are the instantaneous levels read from the sound level meter, and generally represent the range in noise levels or maximum noise levels for a particular noise source.

From **Table C1** it can be seen that the sites are both impacted by road traffic noise to a similar degree based on the L₁₀ and L_{eq} values, however the background noise level (L₉₀) is substantially quieter at Location A. Whilst the traffic noise levels are similar, the characteristics are quite different. At Location A, the site is quite close to the road, however the traffic is intermittent. At Location B, the site is well back from the ICB, while the traffic is continuous and of a much higher volume than on Herston Road near Location A.

The measured noise levels at all locations are summarised in **Table C2**.

Table C2: Attended Noise Measurement Levels

Location (refer Figure 5.2)	Day and Date	Time	Duration (minutes)	Noise Levels, dBA		
				L ₁₀	L _{eq}	L ₉₀
A – Herston Road	Friday 26/03/2021	2:02 PM	15	62	59	52
B – near ICB	Friday 26/03/2021	2:42 PM	15	61	60	58
1 – sports fields	Tuesday 18/05/2021	2:56 PM	10	65	63	62
2 – Gilchrist Avenue	Tuesday 18/05/2021	3:07 PM	10	64	62	60
3 – Cricket nets	Tuesday 18/05/2021	2:41 PM	10	64	62	60
4 – Lake	Tuesday 18/05/2021	3:26 PM	10	58	57	56
5 – Land bridge	Tuesday 18/05/2021	3:40 PM	10	62	61	59
6 – Spring Hill south	Tuesday 18/05/2021	4:33 PM	10	64	63	61
7 – Spring Hill	Tuesday 18/05/2021	3:58 PM	10	57	59	56
8 – Spring Hill	Tuesday 18/05/2021	4:11 PM	10	55	56	54
9 – Spring Hill north	Tuesday 18/05/2021	4:24 PM	1.5*	55	56	54

* Note: This measurement was shortened due to nearby truck affecting the noise levels.

From **Table C2** and measurement locations on **Figure C2**, it can be seen that traffic noise levels are noisier at the existing sports fields (Locations 1, 2 and 3) and southern portion of the Spring Hill side (Location 6), quieter near the existing lake (Location 4) and northern portion of the Spring Hill side (Locations 7, 8 and 9).

C1.3 Noise Logging

Noise logging was undertaken at Locations A and B. Logging was undertaken between Friday 26/03/2021 and Monday 05/04/2021 using field and laboratory calibrated Larson Davis LD831 environmental noise loggers. Noise logging was undertaken in the free field at both locations A and B.

Data from the Bureau of Meteorology (Brisbane, Station #: 040913) indicates that weather during the monitoring period was generally fine and warm, but with light rainfall on Friday 02/04/2021 (2.8mm), Sunday 4th (8.4mm) and Monday 05/04/2021 (9.4mm). Overall, the noise monitoring data is considered acceptable for use in this report, with recognition that monitoring on Sunday 4th and Monday 5th April is likely to be highly affected by rain noise.

The measured noise levels are shown graphically in **Section C1.5**.

From the noise logging the statistical results have been summarised in **Table C3**.

Table C3: Statistical Noise Levels at Location A and Location B

Parameter	Noise Levels dBA [Maximum-Top 10%-(Average)-Bottom 10%-Minimum]		
	Day	Evening	Night
Location A – Near Herston Road			
L _{max}	100, 79, (73), 68, 66	94, 78, (71), 66, 63	83, 72, (67), 63, 59
L ₁	80, 69, (67), 65, 63	79, 69, (66), 63, 61	72, 66, (63), 60, 52
L ₁₀	70, 65, (63), 61, 59	78, 66, (62), 59, 57	67, 62, (56), 46, 36
L _{eq}	69, 62, (60), 57, 55	76, 63, (59), 55, 51	64, 59, (53), 47, 40
L ₉₀	62, 53, (50), 46, 40	74, 60, (49), 40, 36	61, 49, (39), 33, 31
L ₉₀ less insects	61, 53, (49), 46, 39	73, 59, (48), 39, 36	57, 48, (38), 32, 30
Location B – Near ICB			
L _{max}	94, 77, (70), 64, 59	80, 71, (66), 61, 58	81, 71, (63), 57, 53
L ₁	75, 66, (63), 60, 57	71, 65, (61), 57, 56	73, 62, (58), 53, 50
L ₁₀	69, 62, (60), 57, 56	69, 61, (58), 55, 54	62, 59, (54), 50, 47
L _{eq}	65, 60, (58), 56, 54	68, 60, (56), 53, 52	60, 58, (52), 47, 44
L ₉₀	60, 58, (56), 54, 51	66, 57, (54), 50, 48	59, 54, (48), 42, 40
L ₉₀ less insects	59, 58, (56), 54, 51	66, 57, (53), 49, 47	58, 54, (47), 42, 39
Location A minus Location B (Average Values Only)			
L _{max}	(3)	(5)	(4)
L ₁	(4)	(5)	(5)
L ₁₀	(3)	(4)	(2)
L _{eq}	(2)	(3)	(1)
L ₉₀	(-6)	(-5)	(-9)
L ₉₀ less insects	(-7)	(-5)	(-9)

From **Table C3** it is observed that short-term (L_{max}, L₁, L₁₀) and average (L_{eq}) noise levels are higher at Location A near Herston Road, but background noise levels (L₉₀, L₉₀ less insects) are higher at Location B near ICB due to the continuous high traffic volumes on the ICB.

The daily statistical noise levels are summarised in **Table C4**.

Table C4: Daily Statistical Noise Levels at Location A and Location B

Day and Date	Daily Statistical Noise Levels dBA						
	Leq (24 hour)	L ₁₀ (18 hour)	L ₁₀ (12 hour)	Maximum Leq(1 hour)		L ₉₀ (8 hour)	L ₉₀ (18 hour)
				Day	Night		
Location A – Near Herston Road							
Saturday 27/03/21	60	64	64	67	59	41	52
Sunday 28/03/21	59	62	63	61	60	36	47
Monday 29/03/21	59	62	63	64	59	38	49
Tuesday 30/03/21	57	61	62	63	59	34	46
Wednesday 31/03/21	58	61	62	65	59	36	47
Thursday 1/04/21	58	62	63	62	56	36	49
Friday 2/04/21	57	62	62	62	56	36	47
Saturday 3/04/21	58	62	63	63	57	37	47
Sunday 4/04/21	59	63	63	66	55	37	47
Monday 5/04/21	63	63	63	75	63	52	50
Average	59	62	63	65	58	38	48
Average (7 days)	59	62	63	65	58	38	48
Location B – Near ICB							
Saturday 27/03/21	58	59	59	65	57	49	56
Sunday 28/03/21	55	57	57	58	59	46	53
Monday 29/03/21	57	59	60	61	59	46	55
Tuesday 30/03/21	57	59	61	62	59	46	54
Wednesday 31/03/21	57	59	61	61	60	47	54
Thursday 1/04/21	58	59	61	61	55	47	55
Friday 2/04/21	56	58	59	61	54	45	54
Average	57	59	60	61	58	47	54
Average (7 days)	57	59	60	61	58	47	54
Location A minus Location B (Average Values Only)							
Average	2	3	3	4	0	-9	-6

Note: * The 7-day average is calculated as the average of five times the average weekday plus 2 times the average weekend day.

From **Table C4**, the observations are the same as expressed regarding the results in **Table C3**, i.e. traffic noise levels are higher at Location A near Herston Road, but background noise levels (L₉₀ parameters) are higher at Location B near the ICB due to the continuous high traffic volumes on the ICB.

The average Leq,9hour(night) result, excluding rainy days, was 54 dBA at Location A near Herston Road and 53 dBA at Location B near the ICB.

The background noise level was affected by insect noise. As the insect noise is likely a seasonal influence, the noise level data has been filtered to remove the insect noise. The resulting background noise levels, calculated using the lowest 10th percentile method, are shown in **Table C5**.

Table C5: Background Noise Levels (Measured and with Insect Noise Removed) at Locations A and B

Period	Measured Rating Background Noise Level (RBL) L ₉₀ dBA			Filtered (Less Insect Noise) Rating Background Noise Level (RBL) L ₉₀ dBA		
	Weekdays	Weekend	Overall	Weekdays	Weekend	Overall
Location A – Near Herston Road						
Day (7am to 6pm)	47	47	47	47	46	46
Evening (6pm to 10pm)	40	43	41	38	42	41
Night (10pm to 7am)	33	33	33	33	33	33
Location B – Near ICB						
Day (7am to 6pm)	55	53	55	55	53	55
Evening (6pm to 10pm)	50	52	51	49	52	50
Night (10pm to 7am)	42	43	42	42	42	42
Location A minus Location B						
Day (7am to 6pm)	-8	-6	-8	-8	-7	-9
Evening (6pm to 10pm)	-10	-9	-10	-11	-10	-9
Night (10pm to 7am)	-9	-10	-9	-9	-9	-9

From **Table C5** it can be seen that background noise levels are 6 to 11 dBA quieter (average 9 dBA) at Location A, near Herston Road, than at Location B, near the ICB. It is also noted that background noise levels are similar in the day and night periods on weekdays and weekends at both locations, but the weekday evenings are several decibels quieter than weekends.

C1.4 Summary

From the results above the following comments are made:

- Road traffic is the dominant noise on the site, particularly at the measurement locations. Other parts of the site, particularly those further from the ICB and Herston Road, could be affected by other local noise sources, e.g. sports noise near sports facilities, mechanical plant noise near commercial buildings, and bus noise near the INB.
- Traffic noise levels are several decibels higher at Location A near Herston Road than Location B near the ICB, as Location A is much closer to the road than Location B. Were the loggers at the same setback distance, the traffic noise levels would be higher beside the ICB, predominantly due to its significantly higher traffic volume.
- Background noise levels are substantially higher (average of 9 dBA) at Location B near ICB, compared to Location A near Herston Road, due to the continuous high traffic volumes on the ICB.
- Background noise levels are similar on weekdays and weekends at both Locations A and B.

C1.5 2021 Graphical Monitoring Plots

Figure C3: Graph of Noise Logging Results at Location A

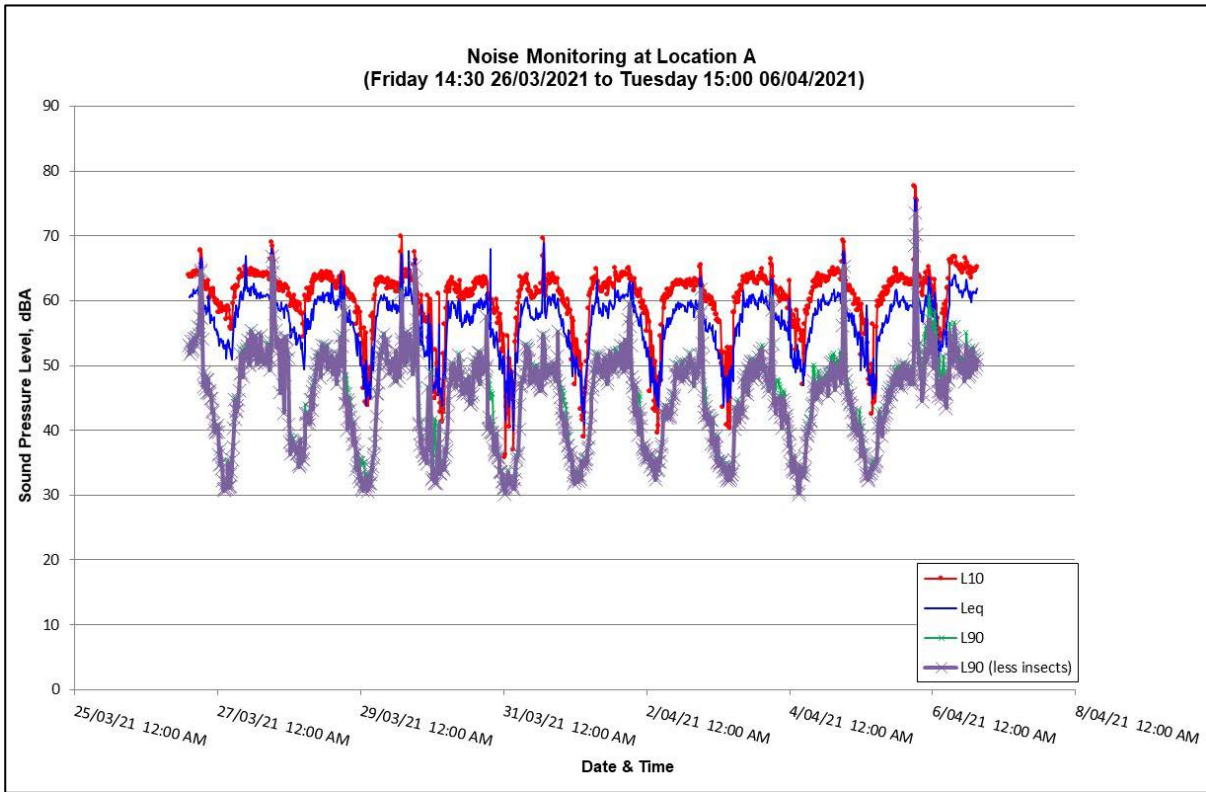


Figure C4: Graph of Daily Noise Logging Results at Location A

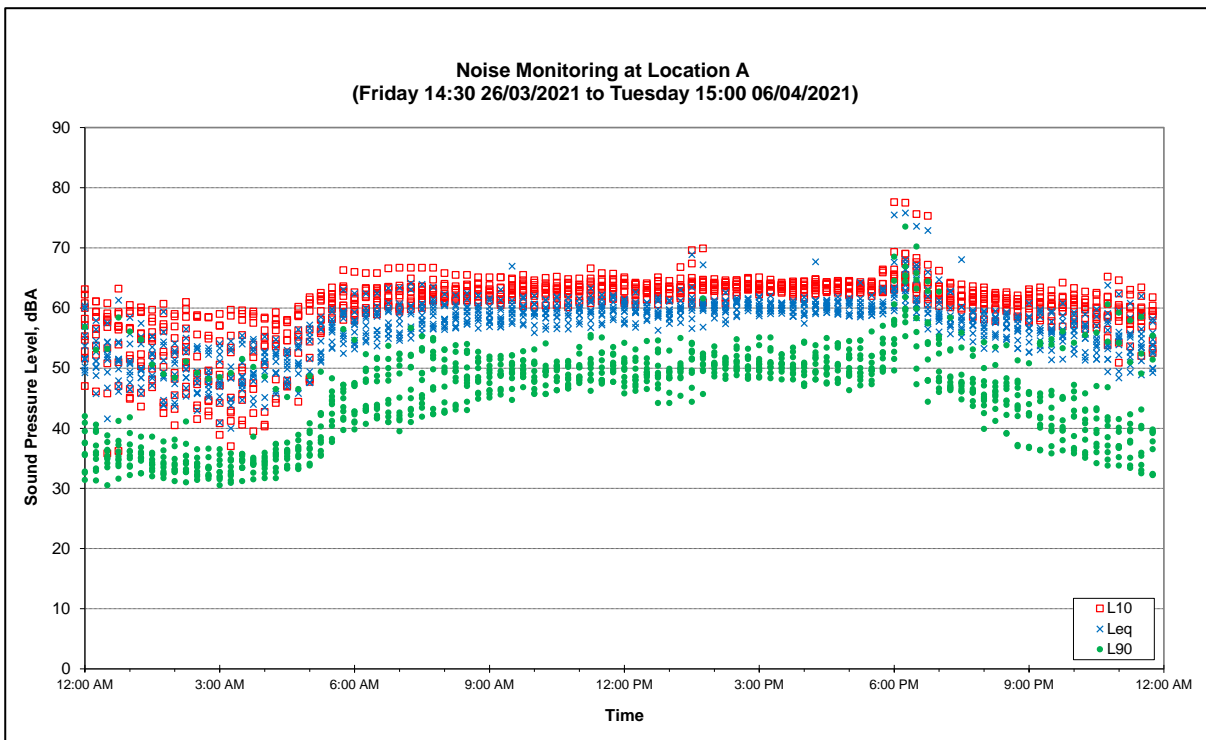


Figure C5: Graph of Noise Logging Results at Location B

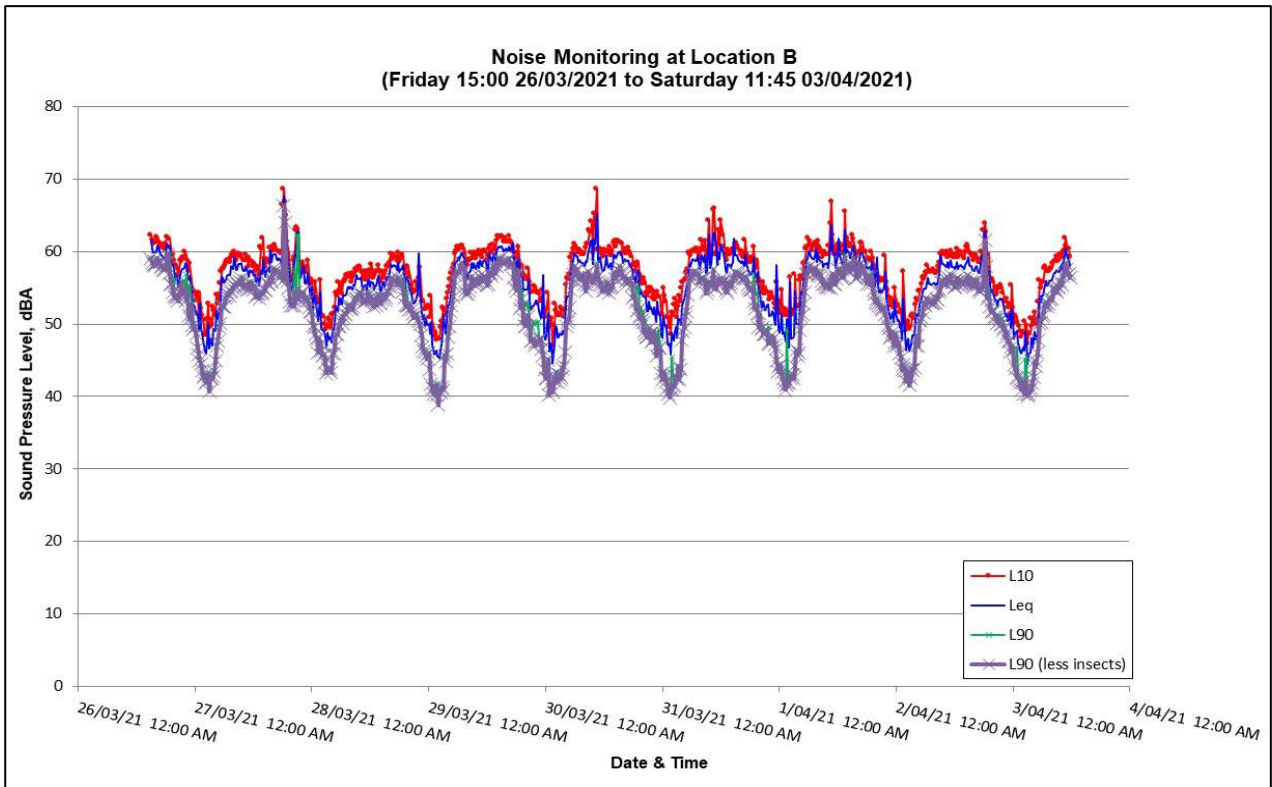
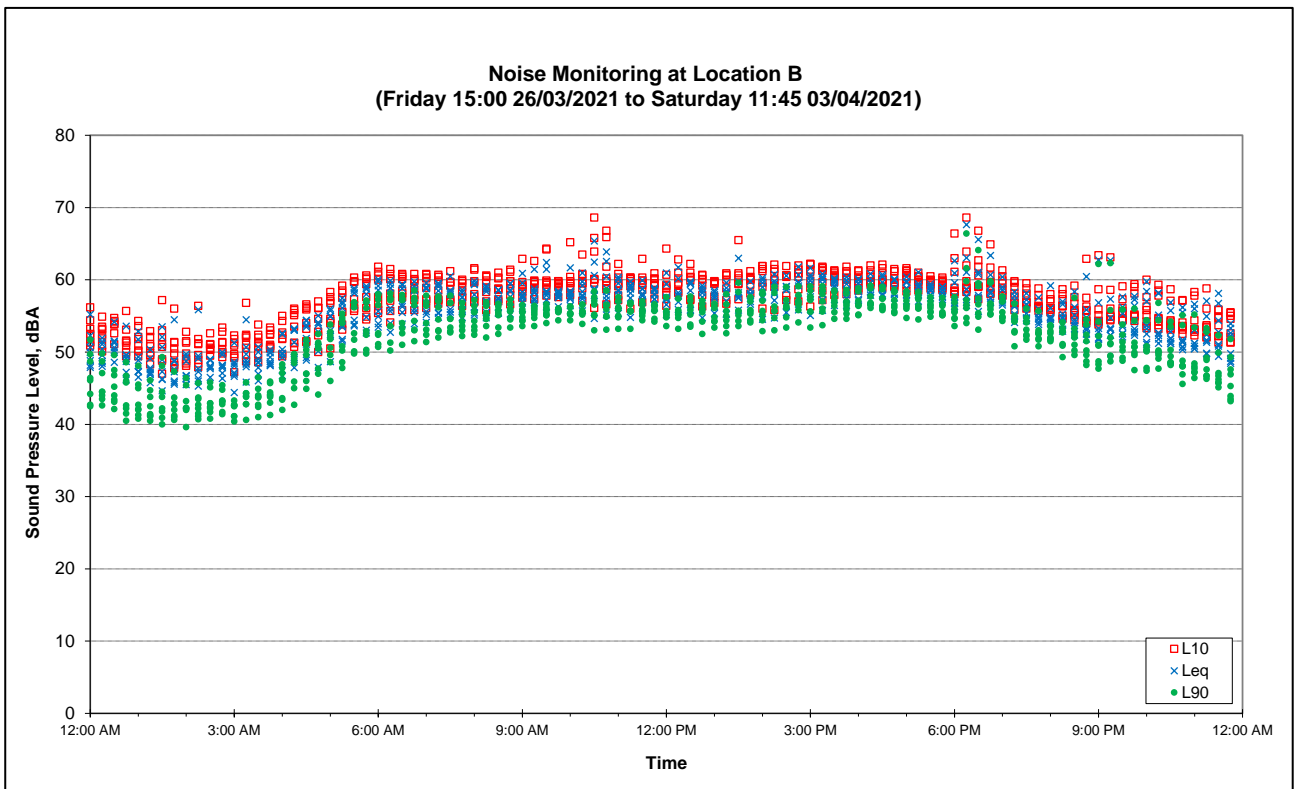


Figure C6: Graph of Daily Noise Logging Results at Location B



APPENDIX D 2022 NOISE MONITORING PROGRAM

D1 Background Noise Monitoring

D1.1 Overview

As part of the review of suitable operating noise levels, potential impacts on the surrounding landusers, and review of existing ambient conditions, a variety of noise monitoring exercises have been undertaken or reviewed (historic data), including:

- Attended measurements of existing noise environment within Victoria Park:
 - 15 min attended noise measurement at a sample of locations during a Sunday daytime period (refer to **Section D2.2**).
- Unattended ambient monitoring at 5 locations for a period of 7 days (1 week) in order to identify and review the noise character of the area and define suitable operational noise criteria for various proposed areas.
- Attended measurements during the activities at the Green Heart Fair (2022) to gain an understanding of the level of noise associated with the activity, and review noise spill, and contributions from the ICB.

This section presents a summary of the results of the various monitoring exercises and establishment of reasonable and applicable noise criteria.

D2.1 Ambient Noise Monitoring

D2.1.1 Details of Ambient Noise Monitoring

Background noise monitoring was undertaken at five locations bounding Victoria Park for a period of 7 days (1 week) between 02 June and 09 June 2022. The following section outlines the noise monitoring methodology and results. Monitoring locations are shown in **Figure D1**.

The loggers were installed to represent and review the ambient conditions in the area surrounding Victoria Park.

The ambient monitoring data collected was reviewed to identify:

- The noise character of the area, to aid in defining criteria for various land users;
- The existing noise levels of the area to review the required volumes for effective amplification during activities (desired operating volumes).

This section presents a summary of the results of the monitoring and a comparison with reasonable and applicable noise criteria.

D2.1.2 Monitoring Location and Methodology

Unattended background noise monitoring was undertaken for a period of 7 days (including a weekend) at five locations representative of the receivers directly adjacent to or within Victoria Park.

Figure D1 presents the unattended noise monitoring locations (L) and photos of the installations.

Figure D1: Noise Monitoring Locations



Additionally attended measurements were taken to verify the contributing noise sources.

Noise measurements were undertaken in accordance with the requirements of AS 1055-2018 'Acoustics – Description and measurement of environmental noise'. ARL Ngara and B&K Sound Level Meters were used for the unattended background measurements. The serial numbers and calibration information for the instruments are presented in **Table D1**. For the background monitoring, an averaging time of 15-minutes was adopted with measurements made over 7 days. The microphones were situated at a height of 1.5 metres above ground/floor level and fitted with a windshield throughout the measurements.

Table D1: Noise Instrument Calibration Information

Location	Instrument / Serial No.	Monitoring Dates	NATA Calibration Current to:	Field Calibration	
				Pre-	Post-
L1 – North-west	NGara2 / 87809C	02/06/22 – 09/06/22	10/12/22	94.2	93.7
L2 – North-east	B&K3 / 3010656	02/06/22 – 09/06/22	12/07/23	91.6*	91.6*
L3 – Central	NGara1 / 878065	02/06/22 – 09/06/22	12/05/24	93.9	94.2
L4 – South	B&K2 / 3011143	02/06/22 – 06/06/22**	19/07/23	94.0	94.0
L5 – West (QUT)	NGara5 / 87808A	02/06/22 – 09/06/22	07/05/23	94.0	93.9
A6,7,8 (Attended 1)	Nor140-1 / 1405055	-	02/06/23	94.0	94.0
L1,3,5 (Attended 2)	Nor140-2 / 1405206	-	15/12/22	94.0	94.0
Calibrator	C1 / 77518	-	28/09/22	-	-
Calibrator	C2 / 20031	-	18/04/23	-	-

* L2 instrument was adjusted -2.4 dB while in the field. Once re-adjusted instrument calibrated exactly to 94.0 dB. As such the results have been adjusted +2.4 dB and suitable for use.

** L4 instrument had a battery failure, however collected data across the weekend (period of greatest interest) suitable for review.

The monitoring data was additionally reviewed against meteorological data collected by the Bureau of Meteorological station at the Brisbane Airport and Brisbane City. The collected data indicates that there were no measured periods of elevated winds (above 5 m/s) and a few periods of rain (>0.2mm) as follows:

- Friday 3 June 2022 – 6.6mm Rain between 10:00pm and 2:00am
- Monday 6 June 2022 – 2.2mm Rain between 3:30am and 4:30am

Periods where rain, wind or extraneous localised sources which may influence the noise monitoring data, have been removed before calculating long term averages and deriving noise criteria. It is noted that the monitors established adjacent roads experience a significant amount of road traffic noise during the daytime and evening, which may occasionally influence the monitoring, however these are considered a normal character of the bounding area.

As the monitoring was completed during the winter months, no removal of insect noise was deemed necessary.

Section D3 presents graphical plots of the monitoring data and associated weather conditions. **Section D2.3** presents the summary of the monitoring data utilised in establishing criteria.

D2.1.3 Ambient Noise Monitoring Result

Table D2 and **D3** provide a summary of the noise monitoring results at the monitoring locations, with weather and local extraneous noise influences filtered out.

Review of the 15-minute interval plots in identify:

- All locations exhibit diurnal patterns with reduced L_{A90} and L_{Aeq} between 11 pm and 6 am, generally assumed as a result of road traffic.
- There is generally a lull in average noise levels between 10 am and 3 pm due to a break in high traffic periods.
- Position 1 (northwest, residential area), there were slightly higher noise levels during Thursday through Saturday evenings, including sustained L_{A10} and L_{Aeq} noise levels extending up to 10 pm. This is assumed to be associated with vehicles along Herston Road as the only existing noise source.
- Position 2 (northeast, bus stop and hospital), occasional periods influenced by ambulances or bus movements temporarily elevated L_{A1} , L_{Amax} and L_{Aeq} levels. Noise at the location is generally dominated by typical Herston Road activity, and possibly hum of ICB and Bowen Bridge Road traffic.
- Position 3 (central, function centre rooms), occasional periods influenced by functions, patrons or bird noise, generally lower than boundary areas, due to separation from busy roads. ICB likely defining the L_{A90} .
- Position 4 (south, St. Pauls Terrace), generally sustained levels due to nearby traffic on St Pauls Terrace, and continuous traffic on the ICB. Some temporary elevated L_{A1} , L_{Amax} and L_{Aeq} levels likely due to specific vehicles on St Pauls Terrace.
- Position 5 (west, QUT and residences), generally sustained levels due to elevated view of ICB, and occasionally elevated periods of vehicle use on Victoria Park Road. Some temporary elevated L_{A1} , L_{Amax} and L_{Aeq} levels likely due to specific vehicles on Victoria Park Road.

Noise levels at the boundary of the parkland, adjacent the arterial roads (L2 and L4) are similar to an R4 Noise Area Category according to AS 1055.3-1997 Acoustics-Description and measurement of environmental noise:

- Daytime: $L_{A90,T} = 55$ dBA
- Evening: $L_{A90,T} = 50$ dBA
- Night: $L_{A90,T} = 45$ dBA

An R4 area is defined as an area with dense transportation or with some commerce or industry, which correlates well with the surrounding arterial road network. It is noted that L1 is adjacent to Herston Road,

however setback approximately 25m and generally screened other than a view of approximately 120degrees. The houses immediately fronting Herston Road may experience slightly higher levels of noise, however the review is catering to the 'worst-affected' sensitive areas in consideration of an R3 characterisation (as discussed below).

Noise levels setback from arterial roads (L1, L3 and L5) in the area are similar to an R3 Noise Area Category according to AS 1055.3-1997 Acoustics-Description and measurement of environmental noise:

- Daytime: $L_{A90,T} = 50$ dBA
- Evening: $L_{A90,T} = 45$ dBA
- Night: $L_{A90,T} = 40$ dBA

An R3 area is defined as an area with some commerce or industry, with slightly higher evening noise levels, which correlates well with current Musgrave Park surroundings.

It is clear that noise levels during the night time period (10 pm – 7 am) is significantly lower than other periods.

Table D2: Summary Noise Monitoring dBA

Date	Period	L_{Aeq}	L_{Amax}	L_{A1}	L_{A10}	L_{A90}	RBL	Location Notes
Position L1 (North-west) – Herston Road, Near Residential Area								
Average	Day	59.4	71.0	65.3	62.0	51.4	49.2	30m from nearest traffic lane. Elevated from Herston Rd. 60m to Inner Northern Busway.
	Evening	57.5	68.9	64.1	60.6	47.4	44.0	
	Night	54.6	66.8	62.4	56.4	39.5	34.7	
Position L2 (North-east) – Herston Road, Near Hospital								
Average	Day	60.5	75.3	68.6	64.2	56.8	55.9	10m from Herston Rd (2m below), 10m from Inner Northern Busway (elevated above).
	Evening	60.4	74.7	67.7	62.8	53.5	51.8	
	Night	58.3	72.5	65.8	59.4	50.0	45.1	
Position L3 (Central) – Nearby the Function Areas of Golf Facility								
Average	Day	56.7	66.3	56.4	50.2	45.3	46.7	20m from function rooms (>5m below), 70m from driving range. 350m to ICB.
	Evening	50.5	66.3	54.7	50.2	46.3	44.8	
	Night	50.6	54.6	48.3	44.2	39.4	39.4	
Position L4 (South) – Adjacent St. Pauls Terrace and Residential Area								
Average	Day	62.2	73.7	66.7	62.8	58.6	57.6	15m from St. Pauls Tce (5m below). 125m to rail line, 200m to ICB.
	Evening	59.7	70.1	64.2	60.8	56.8	55.1	
	Night	56.1	67.3	62.0	56.7	50.4	44.3	
Position L5 (West) – Nearby QUT and Accommodation with line of sight to ICB								
Average	Day	54.0	68.2	60.4	55.3	49.8	48.5	60m to Victoria Park Rd. 290m to ICB. 145m to nearest Tennis Courts.
	Evening	50.5	63.3	56.8	51.9	46.1	44.4	
	Night	48.9	61.0	54.9	49.1	43.5	39.4	

D2.1.4 Attended Ambient Monitoring

In addition to the long term unattended monitoring, short duration attended monitoring and observation at each of the monitoring positions identified in **Figure C2** were undertaken during the morning of Sunday 5 June 2022, to identify activities and noise contributions during a typical Sunday daytime period (likely the most sensitive time of proposed operations).

During the monitoring it was observed that the weather conditions were generally clear and sunny with minimal cloud cover and only light winds (1-3 m/s) not significantly influencing or impacting the collected data.

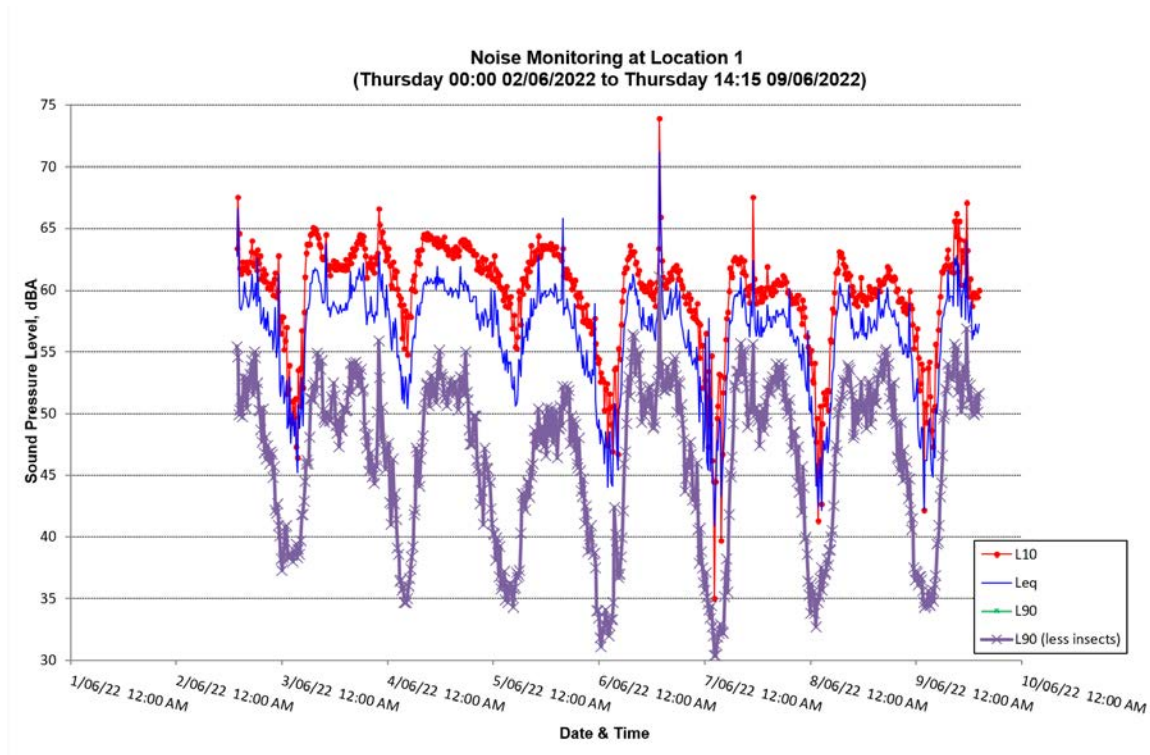
Table D3: Attended Noise Monitoring Data and Observations (5 June 2022)

Location	Time	LAeq	LAmx	LA1	LA10	LA90	Notes
L5	10:30	52.2	70.0	59.0	54.4	48.4	Birds. Vehicles generally constant from ICB, occasional local defining averages and ambient.
L3	11:11	53.6	67.3	63.1	56.4	48.3	Music and cheering from ceremony at Golf Function centre defining LA10, birds and low levels of music defining LA90. Some short periods of aircraft/helicopter noise in distance. ICB is perceptible but lower than other local noise (would define LA90 if music ceased).
L1	11:50	60.4	70.3	66.9	64.5	47.2	Traffic on Herston Rd dominant throughout, with bird noise constant from surrounding trees to a much lower level.
A6	10:30	55.3	73.5	60.7	56.3	53.4	Wind in trees to very low level (<LA90), traffic continuous defining LA90. Bicycles on path adjacent monitoring position spiking levels to 60-73.5dBA. Music approximately 100m away up to 54 dBA. Train up to 58 dBA moving very slowly. Motorcycle, trucks, ambulance, aircraft occasionally spiking levels closer to 60 dBA
A7	11:11	58.7	65.7	62.9	60.1	56.9	ICB defining average levels. Tennis/Cricket approximately 120m away with instantaneous noise levels up to 60 dBA. Aircraft, motorcycle, truck reversing beepers nearby with slightly higher levels. Bird noise comparable to traffic levels.
A8	11:35	54.1	68.4	58.8	55.7	52.0	ICB approximately 52dBA defining the LA90. Birds, bus station, heavy vehicles and motorbikes generate temporary high levels. Maximum from nearby bicycle pathway.

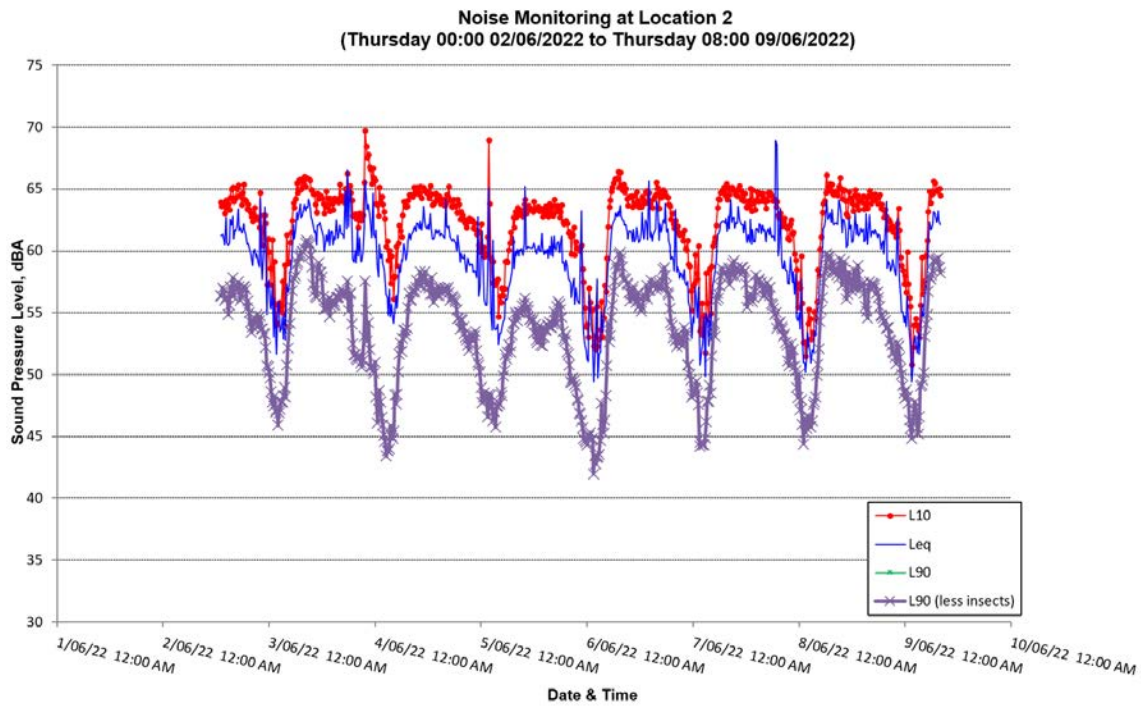
The attended data generally corroborates with the unattended logging data to highlight that the arterial roads and ICB are dominating the ambient levels throughout the monitoring areas in and around Victoria Park.

D3.1 2022 Graphical Monitoring Plots

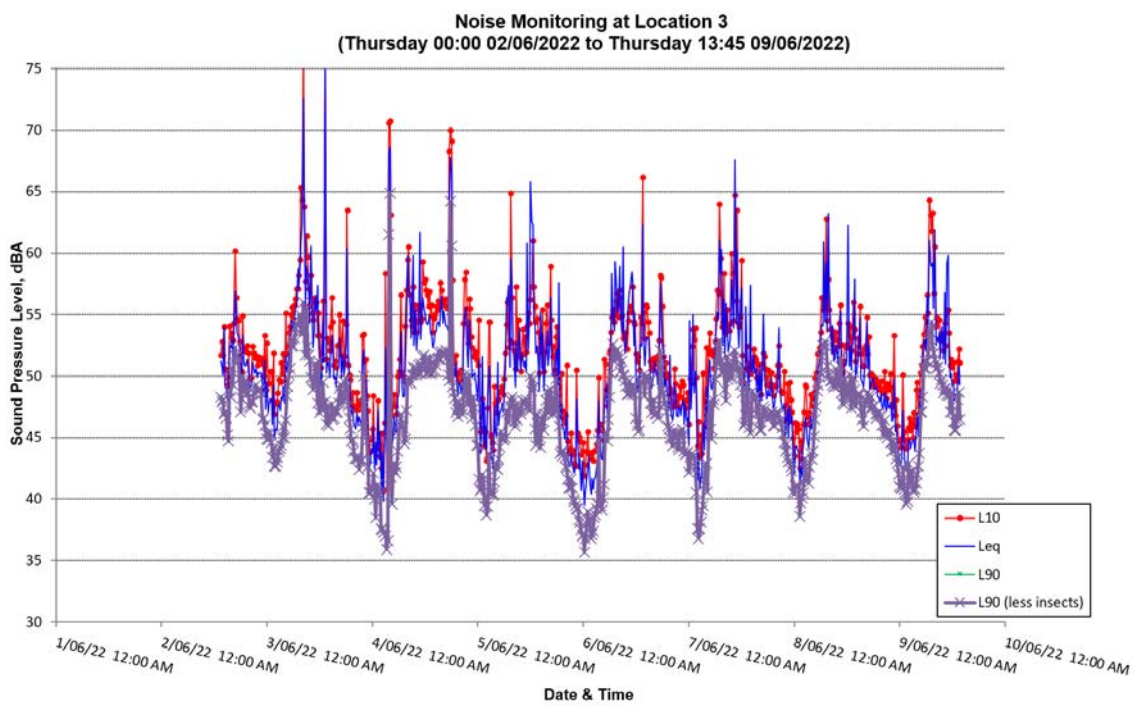
Location 1 – North-west, Herston Road



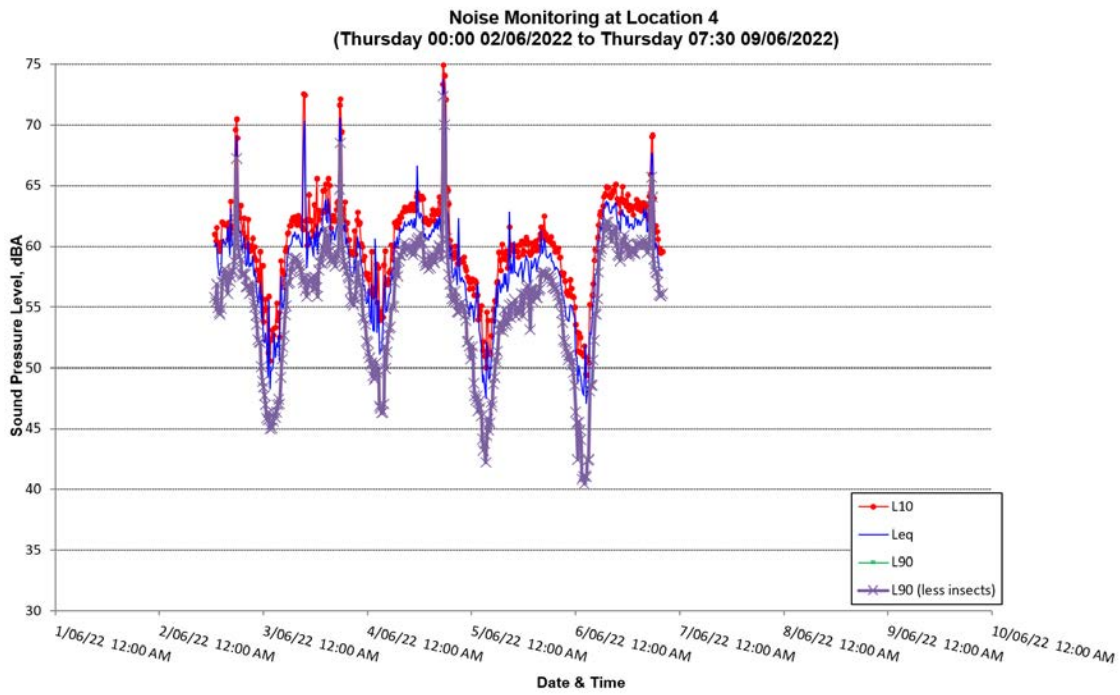
Location 2 – North-east, Herston Road - Hospital



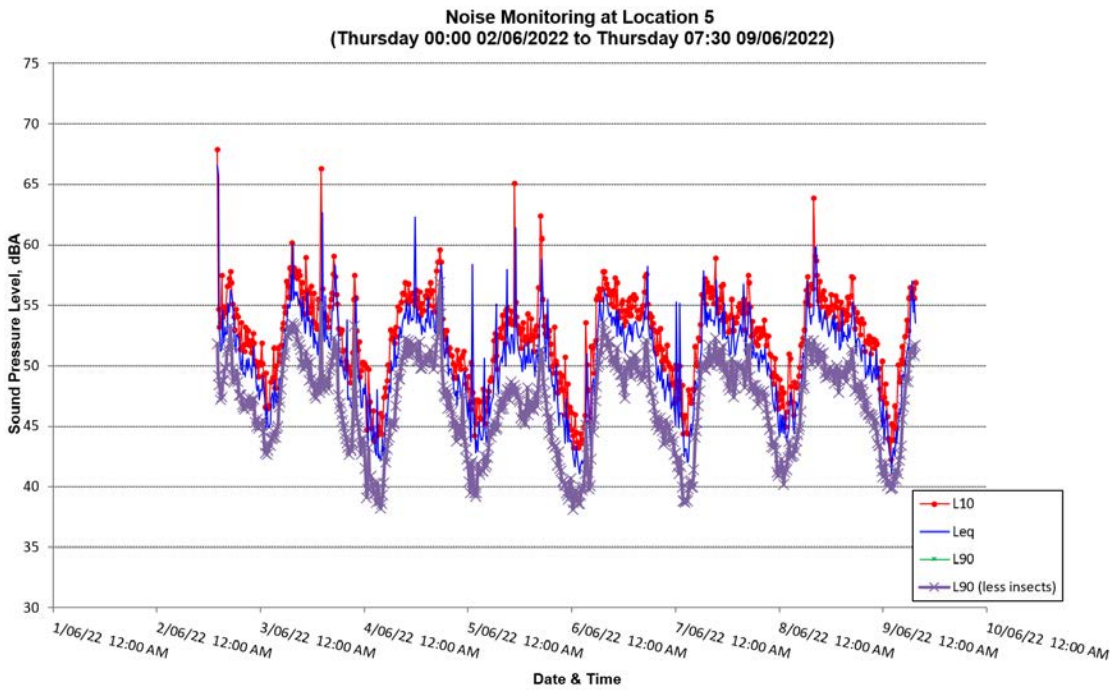
Location 3 – North-east, Herston Road - Hospital



Location 4 – North-east, Herston Road - Hospital



Location 5 – North-east, Herston Road - Hospital





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