# Hunter Power Project

## Noise Impact Assessment

Rev 0

6 April 2021

**Snowy Hydro Limited**

# Hunter Power Project

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## Document history and status

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# Executive Summary

**Background**

Snowy Hydro Limited (Snowy Hydro) ('the Proponent') proposes to develop a gas fired power station near Kurri Kurri, NSW ('the Proposal'). The Proponent is seeking approval from the NSW Minister for Planning and Public Spaces under the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act) for the Proposal.

The Proposal involves the construction and operation of an open cycle gas turbine power station. The power station would have a capacity of up to approximately 750 megawatts (MW), operating primarily on natural gas, with operation on diesel as required if there were a constraint or unavailability in the natural gas system and there was a need to supply electricity to the National Electricity Market (NEM).

The Proposal would operate as a "peak load" generation facility supplying electricity at short notice when there is a requirement in the National Electricity Market. The major supporting infrastructure that is part of the Proposal would be a 132 kV electrical switchyard located within the Proposal Site. The Proposal would connect into existing 132 kV electricity transmission infrastructure located adjacent to the Proposal Site. A new gas lateral pipeline and gas receiving station will also be required and this would be developed by a third party and be subject to a separate environmental assessment and planning approval. Other ancillary elements of the Proposal include:

- Storage tanks and other water management infrastructure
- Fire water storage and firefighting equipment such as hydrants and pumps
- Maintenance laydown areas
- Diesel fuel storage tank(s) and truck unloading facilities
- Stormwater basin
- Site access roads and car parking
- Office/administration, amenities, workshop/storage areas.

**Key features of the existing environment**

The Proposal Site is immediately surrounded by vacant industrial land to the south and east which will eventually be developed into separate industrial lots and form the nearest noise receivers to the Proposal. The immediate north and west of the Site is bushland and does not contain sensitive receivers. Approximately 1 km to the west of the Proposal Site is the suburb of Sawyers Gully, consisting of a number of rural residential and farmland land usage. Some 500 m to 1 km to the southeast of the Proposal Site is the suburb of Loxford, which is primarily rural residential in character while also containing a small number of light industrial, educational and commercial receivers. The nearest sensitive receiver is a residence in Loxford and is approximately 1.2 km from the Proposal Site. Approximately 3 km northeast of the Proposal Site is the southern extent of Gillieston Heights, containing mostly farmland and isolated rural residential receivers.

Background noise monitoring was performed within each of the noise catchment areas to determine the background noise conditions of each area, and in turn establish the noise criterion for the receivers in each area. Four noise catchment areas were established, representing Sawyers Gully, Eastern Loxford, Western Loxford and Gillieston Heights. Vibration receivers in the vicinity of the Proposal Site were identified, however all were far outside the typical range of vibration impact and therefore it was concluded that vibration from the Proposal is unlikely to be an issue.

**Technical Inputs**

Noise emissions have been predicted to occur during the construction and operation of the Proposal, as well as from Proposal traffic.

The construction noise levels have been determined by developing an equipment inventory for each general phase of construction works and applying an appropriate noise level for each piece of equipment from Jacobs' and other noise databases. The individual noise levels were then combined to form an overall sound power level for each stage of construction (detailed in Table 5.1). Likewise, any equipment that was predicted to be a source of vibration emissions was compared against vibration setback distances to determine the potential extent of vibration impacts resulting from the construction of the Proposal.

Operational noise impacts were determined based on sound power levels with noise attenuation measures in place, which were modelled to assess operational noise levels at receiving locations. Attenuation packages required by gas turbine suppliers in order to achieve operational noise levels that meet the regulatory criteria have also been identified. No vibration producing equipment is planned to be used during the operation of the Proposal.

**Assessment of impacts**

Noise impacts during the construction and operation phases were assessed using the SoundPLAN 8.0 acoustic modelling software. Noise levels at receivers were compared to criterion developed, using guidance from the Interim Construction Noise Guideline (ICNG) (DECCW, 2009) and Noise Policy for Industry (NPI) (NSW EPA, 2017). The contribution made to local traffic noise levels by the Proposal's construction and operational traffic were determined using the Roads and Maritime Services (RMS) Noise Estimator tool.

It was predicted that there would be no exceedances of construction noise criteria at any residential or non-residential receivers. There are no known vibration receivers within the vibration setback distances of the Proposal Site. The estimated traffic noise levels during both the construction and operation stages were above the TfNSW Road Noise Policy's (RNP) 60 dB(A) day and 55 dB(A) night traffic noise criteria, which is primarily as a result of the existing traffic on the road. Construction traffic was determined to increase the overall traffic noise by 0.2 dB(A), hence not exceeding the RNP's 2 dB(A) road noise traffic increase criterion.

Noise modelling of operational noise using the Proposal design with identified attenuation, demonstrated compliance with the *Noise Policy for Industry 2017* (NPI) project noise trigger levels at each of the nearest receivers within the four Noise Catchment Areas (NCAs), as well as at the industrial lots nearest to the Proposal Site. Low frequency emissions were also accounted for with a 2 dB correction to operational noise levels as per guidance from the NPI. No exceedances were predicted as a result of this correction.

As with construction traffic, the contribution of operational traffic to the overall traffic noise levels was minor, less than 0.1 dB(A) and well below the 2 dB(A) traffic noise increase criterion.

A number of potential cumulative noise impacts related to the Proposal have been identified and considered in this assessment due to ongoing or new projects. The construction and operation of the gas receival station, which will be located in the Proposal Site but assessed under a separate environmental assessment, has been assessed to have a negligible impact on overall Proposal noise levels. Additionally, works taking place as part of the ongoing Hydro Aluminium smelter demolition and remediation, as well as the upcoming ReGrowth Kurri Kurri project may have cumulative impacts with the construction of the Proposal. However, these impacts would be transient, and are unlikely to occur simultaneously.

In order to mitigate operational noise impacts, achieve the noise levels modelled in this assessment and comply with the relevant noise criterion, there will be a requirement for the equipment suppliers to provide attenuation for certain components of the power station, in order to match or exceed the attenuation used in this assessment. The attenuation measures to be adopted will be confirmed during detailed design and are expected to include:

- Slow fan speeds for cooling systems
- Improved sound enclosures
- Improved stack design
- Sound attenuation walls.

Following the commissioning of the Proposal, noise verification monitoring should be performed to confirm that operational noise levels are in line with those predicted in this assessment, assuring that the noise levels meet the noise criterion.

# 1. Introduction

## 1.1 Proposal background

Snowy Hydro Limited (Snowy Hydro) ('the Proponent') proposes to develop an open cycle gas fired power station near Kurri Kurri, NSW ('the Proposal'). The Proponent is seeking approval from the NSW Minister for Planning and Public Spaces under the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act) for the Proposal.

The Proposal involves the construction and operation of a power station and electrical switchyard, together with other associated supporting infrastructure. The power station would have a capacity of up to approximately 750 megawatts (MW) which would be generated via two heavy duty gas turbines. Although primarily a gas fired power station, the facility would also be capable of operating on diesel as required if there were a constraint or unavailability in the natural gas system and there was a need to supply electricity to the National Electricity Market.

## 1.2 Secretary's Environmental Assessment Requirements (SEARs)

An Environmental Impact Statement (EIS) for the Proposal has been prepared under Division 5.2 of the *Environmental Planning and Assessment Act 1979* (EP&A Act). This Noise Impact Assessment has been prepared to support the EIS. The purpose of this report is to address the relevant sections of the Secretary's Environmental Assessment Requirements (SEARs) issued on 5 February 2021 (SSI 12590060). The report preparation has also taken cognisance of any applicable agency comments. Table 1.1 outlines the SEARs relevant to this assessment.

Table 1.1: SEARs relevant to this assessment

| Secretary's requirement |
|---|
| Noise and vibration – including assessment of the likely construction noise impacts of the Proposal under the *Interim Construction Noise Guideline* (DECCW, 2009) |
| Noise and vibration – including an assessment of the likely operational noise impacts of the Proposal under the *NSW Noise Policy for Industry* (EPA, 2017) |
| Noise and vibration – including an assessment of the likely road noise impacts of the Proposal under the *NSW Road Noise Policy* (EPA, 2011) |
| Noise and vibration – including an assessment of the likely vibration amenity and structural impacts of the Proposal under *Assessing Vibration: A Technical Guideline* (DEC, 2006) and *German Standard DIN 4150-3 Structural Vibration – effects of vibration on structures* |

## 1.3 Proposal location

The Proposal Site is located approximately three kilometres (km) north of Kurri Kurri in New South Wales, in the small suburb or Loxford, and approximately 30 km north-west of Newcastle CBD (refer to Figure 1.1). The total area of the Proposal Site comprises of approximately 6.81 hectares (ha) allocated to the power station, with an additional 3.73 ha of buffer land to the south, approximately 1.3 ha allocated for the electrical switchyard to the north and some additional land for a stormwater basin and an Asset Protection Zone around some parts of the Proposal Site boundary.

The Proposal Site is entirely located within the site of the former Kurri Kurri aluminium smelter site, which is owned by Hydro Aluminium Kurri Kurri Pty Ltd (Hydro Aluminium). The Proposal Site is immediately surrounded by land zoned for industrial use to the east and south, while natural vegetation is located to the north and west and is zoned as Rural Landscape (RU2). Past the industrial land and vegetation, the predominate land use is rural residential and farmland.

The Hunter Expressway runs northeast-southwest directly through the rural land to the south of the Proposal Site, providing the main access route to the Proposal Site.

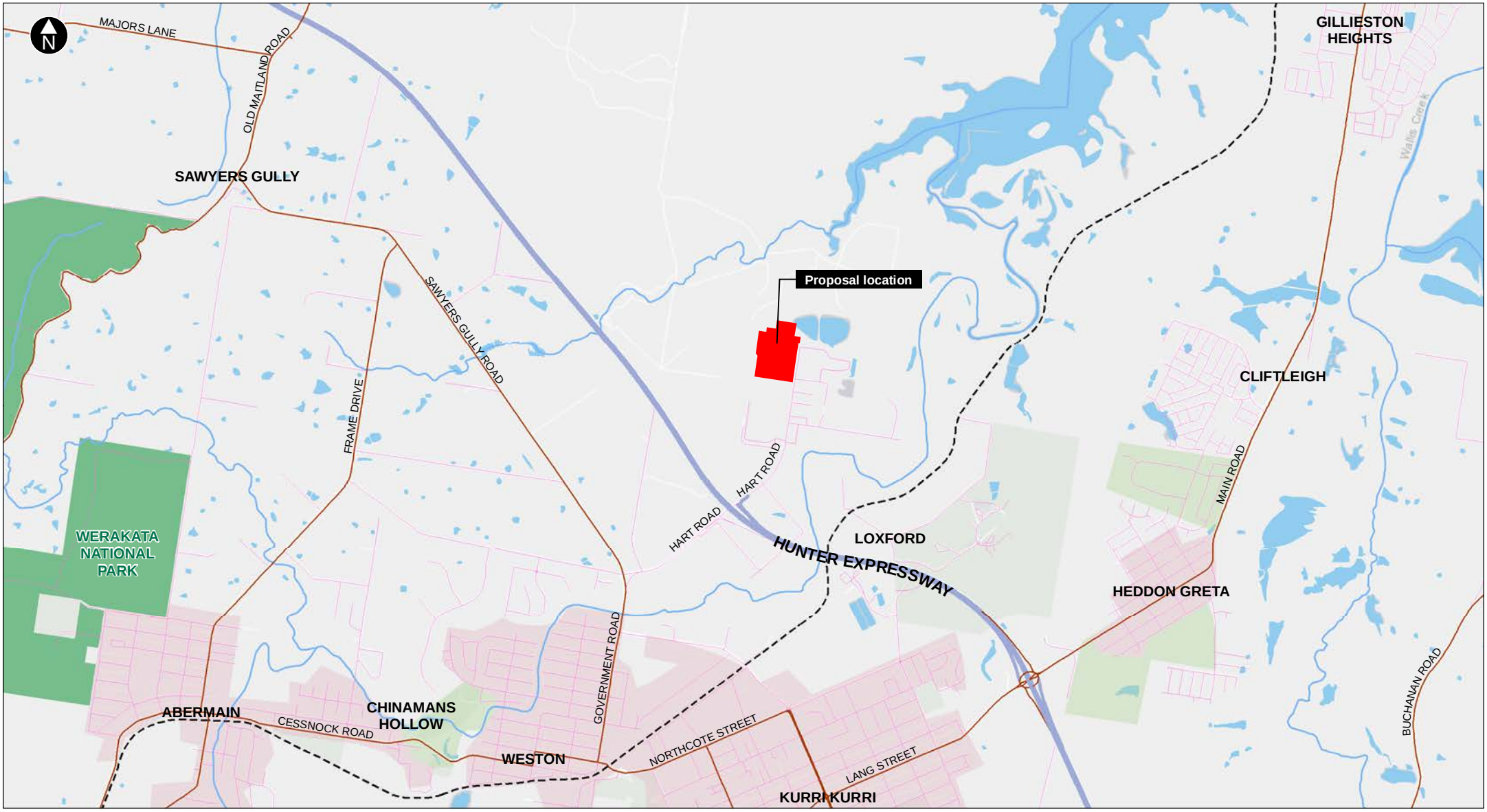



**Figure 1-1** Proposal location (regional)

## 1.4 Report structure

The report structure is as follows:

- Section 2: Proposal Description – describes the Proposal setting, details and potential noise and vibration-related risks.
- Section 3: Existing Environment – outlines key features of the existing environment including surrounding receivers and background noise levels.
- Section 4: Policy Setting and Criteria - establishes suitable assessment criteria.
- Section 5: Noise and Vibration Model Inputs – details the inputs used to calculate the noise and vibration impacts resultant from the Proposal.
- Section 6: Assessment of Impacts – estimates noise and vibration-related emissions during the construction and operation of the Proposal and predicts the potential for noise and vibration-related impacts at the identified surrounding receivers.
- Section 7: Mitigation and Management – evaluates the significance of these predictions and recommends mitigation and management measures.

# 2. Proposal description

## 2.1 Proposal overview

The Proposal involves the construction and operation of an open cycle gas fired power station comprising two heavy duty gas turbine generators. The power station would have a capacity of up to approximately 750 megawatts (MW).

The Proposal would operate as a "peak load" generation facility supplying electricity at short notice when there is a requirement in the National Electricity Market. The major supporting infrastructure that is part of the Proposal will be a 132 kV electrical switchyard located in the northern portion of the Proposal Site. The Proposal will connect into existing 132 kV electricity transmission infrastructure also located adjacent to the Proposal Site. A new gas lateral pipeline and gas receival station will also be required and this would be developed by a third party, subject to a separate environmental assessment and planning approval. Other ancillary elements of the Proposal include:

- Storage tanks and other water management infrastructure
- Fire water storage and firefighting equipment such as hydrants and pumps
- Maintenance laydown areas
- Diesel fuel storage tanks and truck unloading facilities
- Stormwater basin
- Site access roads and car parking
- Office/administration, amenities, workshop/storage areas.

The Proposal is seeking approval for a capacity factor of up to 10 per cent on natural gas and up to two per cent on diesel (providing a combined capacity factor of 12 per cent) in any given year. However, it is expected that likely operations would result in a capacity factor of two per cent in any given year.

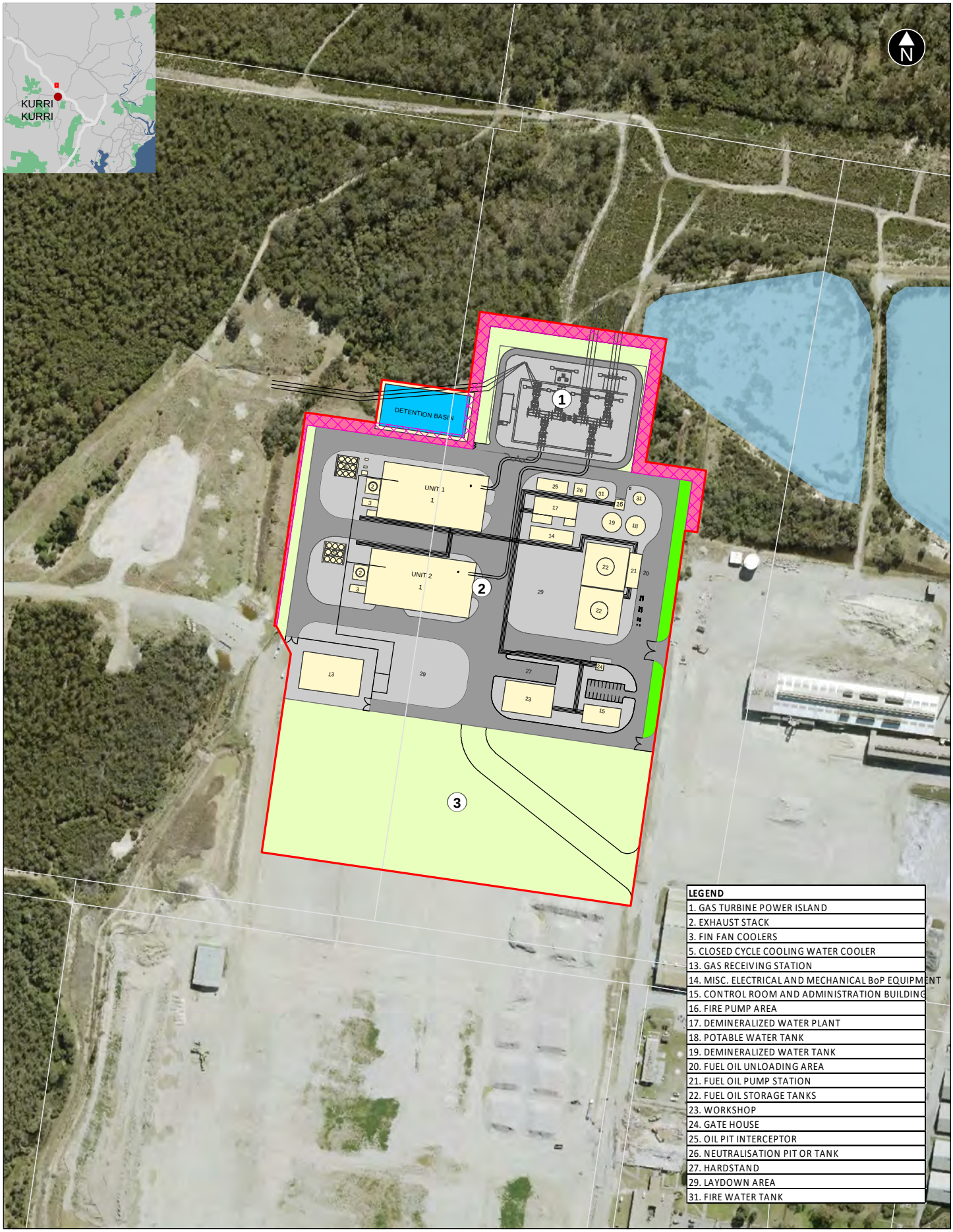
Construction activities are anticipated to commence early 2022 and the Proposal is intended to be fully operational by the end of 2023. The Proposal Site Layout is detailed in Figure 2.1.

## 2.2 Primary noise and vibration related risks

Noise and vibration-related impacts can arise when levels from industry or construction activities result in unacceptable levels at surrounding sensitive receivers. Noise has the potential to be generated during both the construction and operational phase of the Proposal, with vibration-generating plant and equipment also intended to be used during construction. The key construction and operational activities with the potential to generate noise and vibration during the Proposal include:

- Construction of the gas turbine units, switchyard and balance of plant
- Traffic related to the Proposal on roads around the Proposal Site
- Operation of the Proposal.

In addition to the above activities, noise impacts from additional traffic generated during the construction and operational phases of the Proposal have also been considered in this assessment.




Proposal Site
Asset protection zone
Detention basin
Sealed roadway
Crushed rock
Landscaping
Grass / Road base
Existing waterbodies
Existing cadastre
1 Proposed Switchyard Area
2 Proposed Plant Area
3 Proposed Buffer Area

0 100 200 m

1:4,000 at A4
GDA2020 MGA Zone 56

**Data sources:**
Jacobs
Metromap (Aerometrex) 2020
NSW Spatial Services

**Figure 2-1** Proposal Site Layout

# 3. Existing environment

## 3.1 Surrounding land use

The Proposal Site is located entirely within a former industrial area, on land formerly occupied by the Kurri Kurri aluminium smelter which closed permanently in 2014 and is still undergoing demolition and remediation works. The Proposal Site and surrounds are currently zoned RU2 Rural Landscape under the *Cessnock Local Environmental Plan 2011*. However, the Proposal Site and vicinity is currently the subject of a rezoning application.

The rezoning, subdivision and industrial development of the Hydro Aluminium Kurri Kurri Pty Ltd land is a major planning proposal by Regrowth Kurri Kurri to rezone approximately 329 ha of land at and around the former Kurri Kurri aluminium smelter from Rural Landscape (RU2) to residential and public recreation, business, heavy and general industrial, infrastructure and environmental conservation (B1, B5, IN1, IN3, R2, RE1 and SP2 (in part)), to reduce the minimum lot size from 40 ha to 450 $m^2$ (in part) and to identify the site as an urban release area. Under this plan, the Proposal Site would be designated Heavy Industrial. On 1 December 2020 the NSW Department of Planning, Industry and Environment issued a Gateway Determination enabling Cessnock City Council to place the Hydro Kurri Kurri Planning Proposal on public exhibition for a minimum of 28 days and submissions closed on 1 February 2021.

Land use surrounding the Proposal Site is described as follows:

- To the west is Sawyers Gully, a suburb predominately comprised of farmland and rural residential receivers
- To the southeast of the Proposal Site is Loxford
  - The western extent of Loxford, directly south of the Proposal Site comprises primarily of rural residential land with minor industry.
  - The eastern side of Loxford (to the southeast of the Proposal Site), comprises of rural residential receivers with the nearby Kurri Kurri TAFE
- Northeast of the Proposal Site the area of Gillieston North comprises isolated farmhouses and pasture
- Approximately two km south of the Proposal Site is an existing industrial area, and slightly further south is the township of Kurri Kurri which is predominately residential and commercial.

The surrounding land uses and noise sensitive receivers are detailed in Figure 3.1.

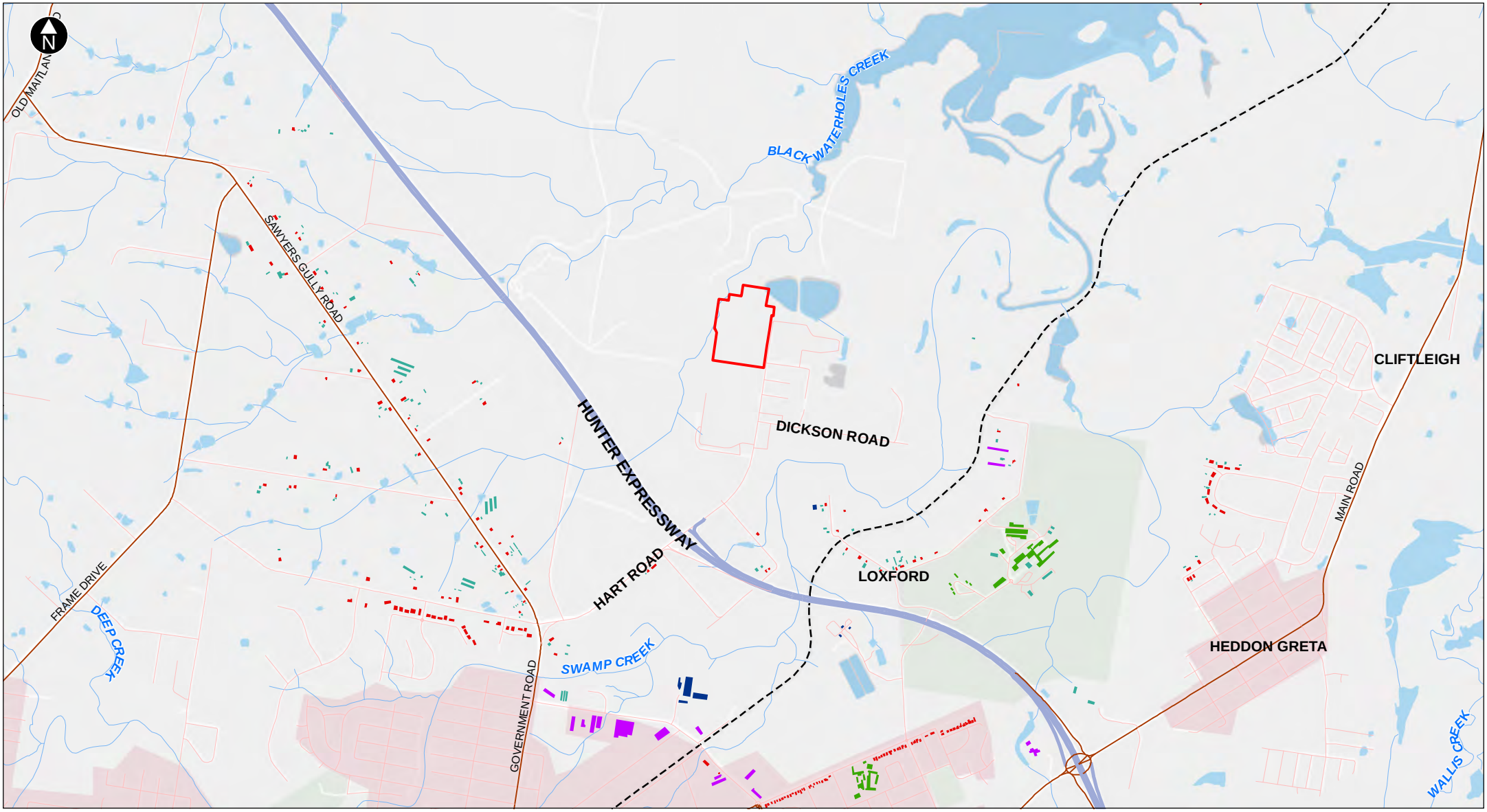



**Figure 3-1** Noise Sensitive Receivers

snowy hydro renewable energy Jacobs

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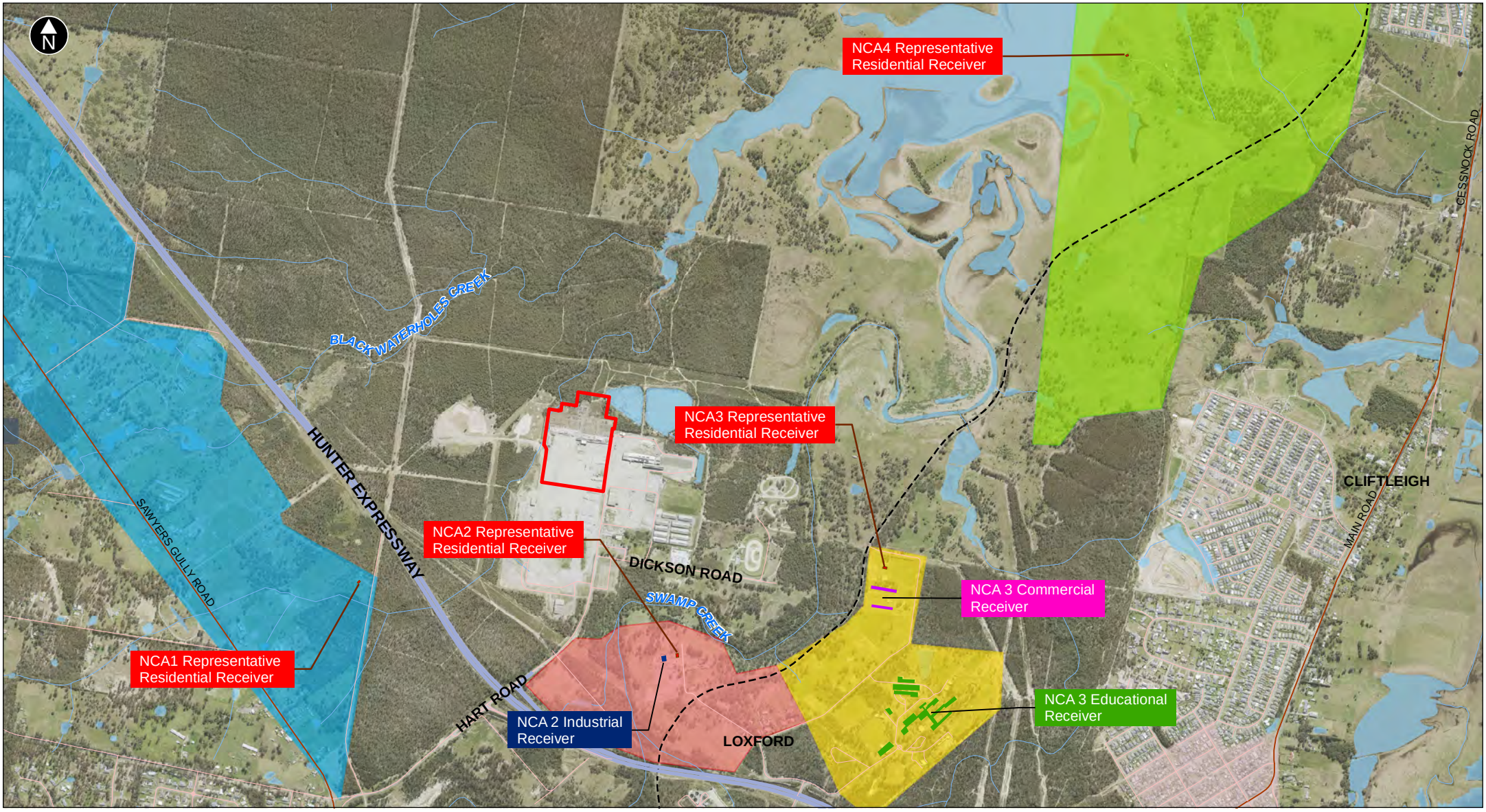
## 3.2 Noise catchment areas

Based upon the land use of the areas surrounding the Proposal Site, four Noise Catchment Areas (NCAs) have been established to assess potential noise impacts. In addition to the land use, other factors such as the predominate noise sources were also used to determine the NCAs. Table 3.1 below details each NCA, and the extent of the NCAs are displayed in Figure 3.2.

Table 3.1: Noise Catchment Area Summary

| Noise Catchment Area | Location | Approximate Distance of Nearest Sensitive Receiver from Centrepoint of Power Island | Predominate Land Uses | Predominate Background Noise Feature |
|---|---|---|---|---|
| NCA 1 | Sawyers Gully | 1,240 m | Rural Residential, Farmland | Hunter Expressway, Environmental Noise |
| NCA 2 | Western Loxford | 1,150 m | Rural Residential, Light Industry | Hunter Expressway, Environmental Noise, Industrial Noise |
| NCA 3 | Eastern Loxford | 1,610 m | Rural Residential, Educational | Environmental Noise, Local Road Noise |
| NCA 4 | Gillieston North | 3,210 m | Farmland | Environmental Noise |




Proposal site
Motorway
Main roads
Roads
Railway

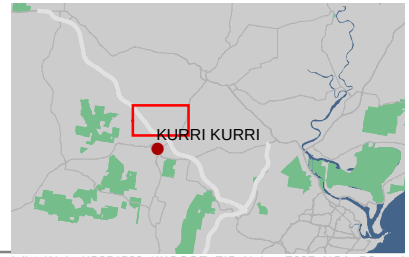
**Noise Catchment Areas**
NCA 1
NCA 2
NCA 3
NCA 4

**Receivers**
NCA 3 Commercial Receiver
NCA 3 Educational Receiver
NCA 2 Industrial Receiver
Representative Residential Receiver

0 0.5 1 km

1:25,000 at A4

GDA2020 MGA Zone 56




**Data sources:**
Jacobs
Metromap (Aerometrex) 2020
NSW Spatial Services

**Figure 3-2** Noise Catchment Areas

snowy hydro renewable energy Jacobs

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## 3.3 Background noise levels

Background noise monitoring was performed during a period between December 2020 and January 2021. A monitoring location was selected to represent each of the NCAs. A summary of the monitored background noise levels is provided in Table 3.2. Graphs of the monitored noise levels are detailed in Appendix C. It was noted that the evening period was louder than the day period at noise monitoring location 1 (NM1), mostly due to the contribution of cicadas and traffic noise. Additionally, rating background levels (RBLs; i.e. background noise levels) at NM3 were higher in the night period than in the evening period, mostly due to insects (e.g. crickets). In both cases, criterion derived from these noise levels were adjusted to prevent the more sensitive time period from having a less noise sensitive criterion.

Table 3.2: Background Noise Levels

| Monitor ID | NCA | Monitoring Location | Monitoring Duration | Measurement | Measured Noise Level – dB(A) | | |
|---|---|---|---|---|---|---|---|
| | | | | | Day (7:00 am to 6:00 pm) | Evening (6:00 pm to 10:00 pm) | Night (10:00 pm to 7:00 am) |
| NM1 | NCA 1 | 103 Bishops Bridge Rd, Sawyers Gully | 15 Jan – 23 Jan 2021* | $L_{Aeq}$ (equivalent noise level) | 56 | 58 | 53 |
| | | | | RBL (Background $L_{A90}$) | 47 | 48 | 44 |
| NM2 | NCA 2 | 10 Dawes Ave, Loxford | 30 Nov – 14 Dec 2020 | $L_{Aeq}$ (equivalent noise level) | 62 | 57 | 55 |
| | | | | RBL (Background $L_{A90}$) | 55 | 50 | 48 |
| NM3 | NCA 3 | 8 Bowditch Ave, Loxford | 30 Nov – 14 Dec 2020, 15 Jan – 23 Jan 2021* | $L_{Aeq}$ (equivalent noise level) | 58 | 55 | 52 |
| | | | | RBL (Background $L_{A90}$) | 52 | 44 | 46 |
| NM4 | NCA 4 | 464 Cessnock Rd, Gillieston Heights | 30 Nov – 14 Dec 2020 | $L_{Aeq}$ (equivalent noise level) | 56 | 51 | 51 |
| | | | | RBL (Background $L_{A90}$) | 48 | 48 | 45 |

* Monitoring was originally performed on the 30 Nov – 14 Dec, however the device was vandalised, requiring a second round of monitoring.

It is also noted that at NM3, the noise logger was operational for three days (Mon 30 Nov to Wed 2 Dec) before being vandalised, preventing the device from operating for the remaining monitoring period. A second round of monitoring took place wherein the noise logger suffered a technical malfunction, allowing it to only collect two days of data (Fri 15 Jan to Sat 16 Jan). Following the filtering of time periods of poor weather, approximately four and a half days of valid noise data remained in total. Although less than the seven days recommended in the "Noise Policy for Industry" (NPI) (NSW EPA, 2017), the noise data captured is still considered to have sufficient temporal coverage (Mon, Tue, Wed, Fri and Sat) which is the intent of the seven day requirement from the NPI in order to provide representative noise levels for the area.

## 3.4 Meteorological conditions

Consistent with the NPI, 'standard' and 'noise-enhancing' case meteorological conditions were considered for the assessment. The specific meteorological conditions applied are detailed in Table 3.3.

Table 3.3: Meteorological Parameters used in the Assessment

| Atmospheric Condition | Definition | Air Temperature (degrees centigrade) | Humidity (%) | Wind Velocity (m/s) | Barometric Pressure (millibars) | Atmosphere Stability Class |
|---|---|---|---|---|---|---|
| Standard | Stability categories A-D with wind speed up to 0.5 m/s at 10 m AGL | 20 | 70 | 0 | 1013.3 | D |
| Noise Enhancing Day | Stability categories A-D with light wind (up to 3 m/s at 10 m AGL) | 20 | 70 | 3 | 1013.3 | D |
| Noise Enhancing Night | Stability categories A-D with light wind (up to 3 m/s at 10 m AGL) and/or stability category F with winds up to 2 m/s at 10 m AGL | 20 | 70 | 2 | 1013.3 | F |

## 3.5 Vibration sensitive receivers

Certain receivers and structures, such as medical centres, precision industry and heritage structures are typically more susceptible to vibration and are subject to more stringent criteria. The nearest medical centres to the Proposal Site, My Medical Services Kurri Kurri and Weston Medical Centre, are located 3.4 km south and 3.3 km southwest of the Proposal Site respectively. A single heritage structure has been identified in the vicinity of the Proposal, the South Maitland Railway System, located approximately 1.3 km from the Proposal Site. No precision industry was identified within a 4 km radius of the Proposal Site.

At these distances, no vibration impacts from the Proposal Site are predicted.

# 4. Policy setting and criteria

## 4.1 Construction noise

### 4.1.1 Noise management levels

The "Interim Construction Noise Guideline" (ICNG) (Department of Environment and Climate Change [DECC], 2009) provides guidance for assessing noise from construction activities in NSW. It establishes noise management levels (NMLs) for recommended standard construction hours and for outside of the recommended standard hours. Construction is considered to have the potential to cause a noise impact if the predicted noise exceeds the applicable noise management level. Table 4.1 lists ICNG guidance for establishing construction NMLs at residential receivers.

Table 4.1: ICNG guidance for establishing construction NMLs at residential receivers

| Time of day | Management level $L_{Aeq(15min)}$ | How to apply |
|---|---|---|
| Recommended standard hours (**SH**):<br>Monday to Friday 7:00 am to 6:00 pm<br>Saturday 8:00 am to 1:00 pm<br>No work on Sundays or public holidays | Noise affected:<br>Rating Background Level (**RBL**) + 10 dB(A) | The noise affected level represents the point above which there may be some community reaction to noise.<br>Where the predicted or measured $L_{Aeq(15\ min)}$ is greater than the noise affected level, the proponent should apply all feasible and reasonable work practices to meet the noise affected level.<br>The proponent should also inform all potentially impacted residents of the nature of works to be carried out, the expected noise levels and duration, as well as contact details. |
| | Highly noise affected:<br>75 dB(A) | The highly noise affected level represents the point above which there may be strong community reaction to noise.<br>Where noise is above this level, the relevant authority (consent, determining or regulatory) may require respite periods by restricting the hours that the very noisy activities can occur, taking into account: times identified by the community when they are less sensitive to noise (such as before and after school for works near schools, or mid-morning or mid-afternoon for works near residences if the community is prepared to accept a longer period of construction in exchange for restrictions on construction times. |
| Outside recommended standard hours (**OOH**) – All other times including public holidays | Noise affected:<br>RBL + 5 dB(A) | A strong justification would typically be required for works outside the recommended standard hours.<br>The proponent should apply all feasible and reasonable work practices to meet the noise affected level.<br>Where all feasible and reasonable practices have been applied and noise is more than 5 dB(A) above the noise affected level, the proponent should negotiate with the community.<br>For guidance on negotiating agreements see Section 7.2.2 of the ICNG. |

Considering the adopted RBLs presented in Table 3.2, the NMLs for the identified surrounding residential receivers are presented in Table 4.2.

Table 4.2: Construction noise management levels (residential receivers)

| NCA | NML $L_{eq\ 15\ min}$ dB(A) | | | |
|---|---|---|---|---|
| | **Day (during standard hours)**<br>**7:00 am – 6:00 pm Weekdays, 8:00 am – 1:00 pm Saturdays** | **Day (outside standard hours)**<br>**7:00 am – 6:00 pm Outside of Standard Hours** | **Evening**<br>**6:00pm-10:00pm** | **Night**<br>**10:00pm-7:00am** |
| NCA 1 | 57 | 52 | 52* | 49 |
| NCA 2 | 65 | 60 | 55 | 53 |
| NCA 3 | 62 | 57 | 49 | 49** |
| NCA 4 | 58 | 53 | 53 | 50 |

** Criteria reduced so Evening criteria is not higher than Day OoH criteria.*

*** Criteria reduced so Night criteria is not higher than Evening criteria.*

The ICNG also provides construction NMLs for non-residential land uses. These are presented in Table 4.3.

Table 4.3: ICNG NMLs for non-residential receivers

| Non-residential receiver type | Noise management level, $L_{Aeq(15min)}$ (applies when properties are being used) |
|---|---|
| Commercial | External Noise Level – 70 dB(A) |
| Industrial | External Noise Level – 75 dB(A) |
| Educational facilities | Internal Noise Level – 45 dB(A) |
| Hospital / Medical | Internal Noise Level – 45 dB(A) |
| Place of Worship | Internal Noise Level – 45 dB(A) |
| Passive Recreation | External Noise Level – 60 dB(A) |
| Active Recreation | External Noise Level – 65 dB(A) |

It should be noted that the NSW EPA is developing a new construction noise guideline, the *Construction Noise Guideline*, which is currently in-draft. When released, the *Construction Noise Guideline* will replace the ICNG.

### 4.1.2 Construction traffic noise impacts

Road traffic noise impacts due to the construction (and operation) of the Proposal were assessed against the following guidance from the application notes of the EPA's "NSW Road Noise Policy" (RNP) (2011):

> *'…for existing residences and other sensitive land uses affected by additional traffic on existing roads generated by land use developments, any increase in the total traffic noise level as a result of the development should be limited to 2 dB above that of the noise level without the development. This limit applies wherever the noise level without the development is within 2 dB of, or exceeds, the relevant day or night noise assessment criterion.'*

#### 4.1.3 Sleep disturbance

For premises where night construction (and operations) occur, the potential for noise levels to lead to sleep disturbance should be considered. Section 4.3 of the ICNG discusses the method for assessing and managing sleep disturbance. This guidance references further information in the *NSW Road Noise Policy* (RNP) (NSW EPA, 2013) that discusses criteria for the assessment of sleep disturbance.

Where noise levels from a construction (or industrial) source at a residential receptor at night exceeds the following, a maximum noise level event assessment should be undertaken:

- $L_{Aeq,15min}$ 40 dB(A) or the RBL + 5 dB(A), whichever is greater, and/or
- $L_{AFMax}$ 52 dB(A) or the RBL +15 dB(A), whichever is greater.

Based on this guidance, Table 4.4 presents sleep disturbance screening criterion for the noise catchment areas surrounding the Proposal.

Table 4.4: Sleep disturbance criterion

| Noise Catchment Area | Leq 15 min dB(A) | LAFMax dB(A) |
|---|---|---|
| NCA 1 | 49 | 54 |
| NCA 2 | 53 | 58 |
| NCA 3 | 51 | 56 |
| NCA 4 | 50 | 55 |

#### 4.1.4 'Annoying' noise characteristics

Equipment that has the potential to produce a tonal noise, an impulsive noise or any other type of noise defined by the ICNG as 'particularly annoying', the noise level for that particular equipment will receive a + 5 dB(A) penalty.

As per guidance from the NPI, the penalty for intermittent noise (e.g. the hammers, packers and compactors) would only be applied during night periods. The penalty for tonal noise (e.g. roadsaws and grinders) will apply for all periods.

### 4.2 Operational noise

#### 4.2.1 Overview

Operational noise criteria for the Proposal were determined in accordance with the NSW EPA's NPI which seeks to regulate noise impact from 'industrial activity' pertaining to noise from fixed industry and mechanical plant rather than from road, rail or construction sources. To achieve this, the NPI applies two separate noise criteria:

- Limiting the intrusiveness of the Proposal's noise against the prevailing background noise, and
- Achieving suitable acoustic amenity for the surrounding land uses from industry.

The more stringent of these is used to define the operational noise criteria for a Proposal.

### 4.2.2 Intrusiveness noise levels

A noise source will be deemed to be non-intrusive if the monitored $L_{Aeq\ (period)}$ noise level of the development does not exceed the RBL by more than 5 dB(A). Table 4.5 presents the noise intrusiveness criteria for the noise catchment areas, based on their RBLs (see Table 3.2). Intrusiveness noise levels are not used directly as regulatory criterion. They are used in combination with the amenity noise level to assess the potential impact of noise, assess reasonable and feasible mitigation options and subsequently determine achievable noise requirements.

Table 4.5: NPI intrusiveness noise levels

| Receiver Group | Time of Day | $L_{90}$ (RBL) dB(A) | Allowance | Noise intrusiveness criteria dB(A) |
|---|---|---|---|---|
| NCA 1 | Day (7:00 am to 6:00 pm) | 47 | +5 dB(A) | 52 |
| | Evening (6:00 pm to 10:00 pm) | 47* | | 52* |
| | Night (10:00 pm to 7:00 am) | 44 | | 49 |
| NCA 2 | Day (7:00 am to 6:00 pm) | 55 | | 60 |
| | Evening (6:00 pm to 10:00 pm) | 50 | | 55 |
| | Night (10:00 pm to 7:00 am) | 48 | | 53 |
| NCA 3 | Day (7:00 am to 6:00 pm) | 52 | | 57 |
| | Evening (6:00 pm to 10:00 pm) | 44 | | 49 |
| | Night (10:00 pm to 7:00 am) | 44* | | 49* |
| NCA 4 | Day (7:00 am to 6:00 pm) | 48 | | 53 |
| | Evening (6:00 pm to 10:00 pm) | 48 | | 53 |
| | Night (10:00 pm to 7:00 am) | 45 | | 50 |

** Level reduced to prevent noise level being higher than in the preceding period.*

### 4.2.3 Amenity noise levels

As per the NPI (2017), the recommended amenity noise levels represent the objective for total industrial noise at a receiver location, whereas the Proposal amenity noise level represents the objective for noise from a single industrial development at a receiver location. Proposal amenity noise levels ensure that industrial noise levels remain within the recommended amenity noise levels for an area.

Amenity noise levels are not used directly as regulatory criterion. They are used in combination with the Proposal intrusiveness noise level to assess the potential impact of noise, assess reasonable and feasible mitigation options, and subsequently determine achievable noise requirements.

Table 4.6 presents the recommended amenity noise levels as per the NPI, and the Proposal amenity noise level (recommended amenity noise level minus 5 dB, plus 3 dB to convert from a period level to a 15-minute noise level). Table 4.6 also presents the amenity noise levels for non-residential land usage. The recommended noise levels for the noise catchment areas was selected based upon the background noise levels. As the measured background levels were over 45 dB(A) during the day, 40 dB(A) during the evening and 35 dB(A) during the night, the 'Urban' classification was applied for the receivers.

Table 4.6: NPI amenity noise criteria, residential receivers

| Receiver type | Time of Day | Recommended $L_{Aeq}$ Noise Level dB(A) | Proposal amenity $L_{eq\ 15\text{-}minute}$ Noise Level dB(A) |
|---|---|---|---|
| Residential receivers (Urban) | Day (7 am to 6 pm) | 60 | 58 |
| | Evening (6 pm to 10 pm) | 50 | 48 |
| | Night (10 pm to 7 am) | 45 | 43 |
| Commercial | When in use | 65 | 63 |
| Industrial | When in use | 70 | 68 |
| Educational / Childcare | Noisiest 1-hour period when in use | 35 (internal), 45 (external) | 33 (internal), 43 (external) |
| Hospital / Medical | Noisiest 1-hour period | 35 (internal), 50 (external) | 33 (internal), 48 (external) |
| Place of Worship | When in use | 40 (internal), 50 (external) | 38 (internal), 48 (external) |
| Passive Recreation | When in use | 50 | 48 |
| Active Recreation | When in use | 55 | 53 |

### 4.2.4 Proposal operational noise criteria

The NPI recommends that the more stringent values between intrusiveness and amenity noise level criteria be applied for an operational noise assessment. Considering the intrusive and amenity criteria outlined in Section 4.2.2 and Section 4.2.3, Table 4.7 presents the operational noise criteria adopted for the various NCAs related to the Proposal and this assessment.

Table 4.7: Proposal operational noise criteria

| Receiver type | Time of day | Recommended $L_{Aeq}$ Noise Level dB(A) |
|---|---|---|
| NCA 1 | Day (7:00 am to 6:00 pm) | 52 |
| | Evening (6:00 pm to 10:00 pm) | 48 |
| | Night (10:00 pm to 7:00 am) | 43 |
| NCA 2 | Day (7:00 am to 6:00 pm) | 58 |
| | Evening (6:00 pm to 10:00 pm) | 48 |
| | Night (10:00 pm to 7:00 am) | 43 |
| NCA 3 | Day (7:00 am to 6:00 pm) | 57 |
| | Evening (6:00 pm to 10:00 pm) | 48 |
| | Night (10:00 pm to 7:00 am) | 43 |
| NCA 4 | Day (7:00 am to 6:00 pm) | 53 |
| | Evening (6:00 pm to 10:00 pm) | 48 |
| | Night (10:00 pm to 7:00 am) | 43 |

### 4.2.5 Sleep disturbance

The NPI (2017) also derives its guidance for the sleep disturbance screening criteria from the RNP (NSW EPA, 2011), and as such the criteria adopted for the construction phase (refer to Table 4.4) is also applicable for the operations phase.

### 4.2.6 'Annoying' noise characteristics

'Annoying' noise characteristics associated with the operation of industrial facilities are addressed in Fact Sheet C of the NPI. Where an 'annoying' noise characteristic is identified, a positive correction will be applied to the noise levels to account for it. For this assessment, the two most likely 'annoying' noise characteristics are tonality and low frequency noise.

Where a tonal noise is predicted to be generated from a noise source, a one-third octave analysis should be performed using the methodology detailed in *ISO 1996-2:2007 Annex D: Objective Method for Assessing the Audibility of Tones in Noise*. Where the level of one-third octave band exceeds the level of the adjacent bands on both sides by:

- 5 dB or more if the centre frequency of the band containing the tone is in the range 500–10,000 Hz;
- 8 dB or more if the centre frequency of the band containing the tone is in the range 160–400 Hz; or
- 15 dB or more if the centre frequency of the band containing the tone is in the range 25–125 Hz.

Then a correction of 5 dB should be applied to the noise source.

Low Frequency Noise is accounted for using a two-step assessment of the A-weighted and C-weighted noise levels. A correction for low frequency noise will be applied where:

1) The C-weighted noise contribution is 15 dB greater than the A-weighted noise source contribution at a noise receiver, **AND**
2) Any of the third octave noise levels presented in Table C2 of Fact Sheet C are exceeded at the noise receiver.

Where the exceedance of the third octave noise levels is less than or equal to 5 dB, a correction of 2 dB is applied during the evening and night periods, and where the exceedance of the third octave noise levels is greater than 5 dB, a correction of 5 dB is applied during the evening and night periods.

## 4.3 Vibration

### 4.3.1 Overview

Vibration arising from construction activities can result in impacts on human comfort or the damage of physical structures such as dwellings. These two outcomes have different criterion, with the effects of vibration on human comfort having a lower threshold.

### 4.3.2 Human comfort

With respect to human comfort, vibration arising from construction activities must comply with criteria presented in "Assessing Vibration: a technical guideline", (DECC, February 2006) and *British Standard 6472-1: 2008 Guide to evaluation of human exposure to vibration in buildings Part 1: Vibration sources other than blasting* [BS 6472-1: 2008]. DECC, 2006 identifies three different forms of vibration associated with construction activities:

- Continuous: uninterrupted vibration occurring over a defined period
- Impulsive: short-term (typically less than two seconds) bursts of vibration which occurs up to three times over an assessment period

- Intermittent: interrupted periods of continuous or repeated impulsive vibration, or continuous vibration that varies significantly in magnitude.

Continuous vibration may result from steady road traffic or steady use of construction equipment (e.g. generator). Impulsive vibration may arise during the loading or unloading of heavy equipment or materials or infrequent use of hammering equipment. Intermittent vibration may arise from the varied use of construction equipment (i.e. a dump truck moving around a site, idling while being loaded with materials, and then dumping the materials) or repeated high-noise activities such as hammering, piling or cutting.

Preferred and maximum values of human exposure for continuous and impulsive vibrations are listed in Table 4.8 (DECC, 2006), for relevant receivers to this Proposal. As per DECC, daytime is between 7:00 am and 10:00 pm, and night is between 10:00 pm and 7:00 am.

Table 4.8: Preferred and maximum weighted Root Mean Square (RMS) values for continuous and impulsive vibration acceleration ($m/s^2$) 1-80 Hz

| Location | Assessment period[1] | Preferred values | | Maximum values | |
|---|---|---|---|---|---|
| | | z-axis[2] | x and y axis[2] | z-axis | x and y axis |
| **Continuous vibration** | | | | | |
| Residences | Day | 0.010 | 0.0071 | 0.020 | 0.014 |
| | Night | 0.007 | 0.005 | 0.014 | 0.010 |
| **Impulsive vibration** | | | | | |
| Residences | Day | 0.30 | 0.21 | 0.60 | 0.42 |
| | Night | 0.10 | 0.071 | 0.20 | 0.14 |

[1] Daytime is 7:00 am to 10:00 pm. Night-time is 10:00 pm to 7:00 am

[2] z-axis refers to vertical vibration, while the x and y axes refer to horizontal vibration.

Intermittent vibration is assessed differently using vibration dose values (VDV). Preferred and maximum VDVs for different types of receivers have been reproduced in Table 4.9 for relative receivers in this assessment.

Table 4.9: Preferred and maximum VDVs for intermittent vibration ($m/s^{-1.75}$), (DECC, 2006)

| Location | Day time (7:00 am to 10:00 pm) | | Night-time (10:00 pm to 7:00 am) | |
|---|---|---|---|---|
| | Preferred VDV | Maximum VDV | Preferred VDV | Maximum VDV |
| Residences | 0.20 | 0.40 | 0.13 | 0.26 |

### 4.3.3 Buildings and structures

Section J4.4.3 of *Australian Standard AS2187.2 – 2006 Explosives – Storage and use Part 2: Use of explosives* provides frequency-dependent guide levels for cosmetic damage to structures arising from vibration. These levels are adopted from *British Standard BS7385: 1990 Evaluation and measurement for vibration in buildings Part 2: Guide to damage levels from groundborne vibration* [BS7385-2:1993] and are presented in Table 4.10.

Table 4.10: Transient vibration guideline values for cosmetic damage

| Type of building | Peak particle velocity (ppv) mm/s | | |
|---|---|---|---|
| | 4 to 15 Hz | 15 to 40 Hz | 40 Hz and above |
| Reinforced or framed structures industrial and heavy commercial buildings | 50 | | |
| Un-reinforced or light-framed structures residential or light commercial type buildings | 15 to 20 | 20 to 50 | 50 |

Guidance for more sensitive structures is presented in the German standard, *DIN 4150-3 Vibrations in buildings – Part 3: Effects on structures* (DIN 4150-3: 2016). Vibration velocities not exceeding 3 mm/s at 1 to 10 Hz are recommended in this standard.

### 4.3.4 Construction noise and vibration guideline

Section 7 of the CNVG provides guidance for safe working distances to achieve human comfort (*Assessing Vibration: a technical guideline*, (DECC, 2006) and cosmetic building damage (BS7385-2:1993) criteria for a range of different plant and equipment. These safe working distances are relevant for some plant and equipment that may be used during construction of the Proposal, and so this guidance (presented below in Table 4.11) was considered.

Table 4.11: Recommended safe setback distances

| Plant | Rating / description | Safe working distance (metres) | |
|---|---|---|---|
| | | Cosmetic damage (Ref: BS7385-2: 1993) | Human response (Ref: DECC, 2006) |
| Vibratory Roller | <50 kN (typically 1-2 tonne)<br><100 kN (typically 2-4 tonne)<br><200 kN (typically 4-6 tonne)<br><300 kN (typically 7-13 tonne)<br>>300 kN (typically 13-18 tonne)<br>>300 kN (> 18 tonne) | 5 m<br>6 m<br>12 m<br>15 m<br>20 m<br>25 m | 15 m to 20 m<br>20 m<br>40 m<br>100 m<br>100 m<br>100 m |
| Small hydraulic hammer | 300 kg – 5 to 12 tonne excavator | 2 m | 7 m |
| Medium hydraulic hammer | 900 kg – 12 to 18 tonne excavator | 7 m | 23 m |
| Large hydraulic hammer | 1600 kg – 18 to 34 tonne excavator | 22 m | 73 m |
| Vibratory pile driver | Sheet piles | 2 m to 20 m | 20 m |
| Pile boring | ≤800 mm | 2 m (nominal) | 4 m |
| Jackhammer | Handheld | 1 m (nominal) | 2 m |

# 5. Technical inputs

## 5.1 Construction noise emissions

### 5.1.1 Construction staging and plant

Sound power levels were estimated for certain main phases of construction for the Proposal. Sound power levels for each construction phase were determined by developing an inventory of noise producing equipment and the estimated numbers of equipment based on the works taking place, and estimating the sound power levels of each piece of equipment using sound power levels presented in national and international standards and guidelines, as well as from a Jacobs measurement database.

The indicative construction phases for the Proposal works are presented in Table 5.1.

Table 5.1: Construction Phase Sound Power Levels

| Phase | Works | Location | Equipment | Number of Equipment | Individual Equipment SWL | Phase SWL |
|---|---|---|---|---|---|---|
| 1 | Site earthworks | Whole Site | Excavator 5-20t | 1 | 99 | 117 |
| | | | Dozer | 1 | 116 | |
| | | | Grader | 1 | 108 | |
| | | | Delivery Truck | 1 | 100 | |
| | | | Generator | 1 | 101 | |
| | | | Roller | 1 | 104 | |
| | | | Water Cart | 1 | 95 | |
| | | | Cars | 1 | 95 | |
| 2 | Pile foundations | Power Islands | Franna | 1 | 99 | 117 |
| | | | Piling Rig (Driven)* | 1 | 116 | |
| | | | Hand Tools | 1 | 94 | |
| | | | Concrete Truck | 1 | 109 | |
| | | | Delivery Truck | 1 | 100 | |
| | | | Generator | 1 | 101 | |
| | | | Cars | 1 | 95 | |
| 3 | Underground services | From power islands to gas receiving station, demineralised water plant, fuel oil storage tanks, stormwater basin and control building | Excavator 5-20t | 1 | 99 | 119 |
| | | | Concrete Saw** | 1 | 118 | |
| | | | Roller | 1 | 104 | |
| | | | Vacuum Truck | 1 | 109 | |
| | | | Hand Tools | 1 | 94 | |
| | | | Delivery Truck | 1 | 100 | |
| | | | Generator | 1 | 101 | |
| | | | Cars | 1 | 95 | |

| Phase | Works | Location | Equipment | Number of Equipment | Individual Equipment SWL | Phase SWL |
|---|---|---|---|---|---|---|
| 4 | Balance of plant (BoP) | Closed Cycle heat exchangers, Demineralised Water Tanks, Potable Water Tanks, Fuel Oil Storage Tanks, Buildings | Franna | 1 | 99 | 111 |
| | | | Excavator 5-20t | 1 | 99 | |
| | | | Hand Tools | 1 | 94 | |
| | | | Concrete Truck | 1 | 109 | |
| | | | Delivery Truck | 1 | 100 | |
| | | | Generator | 1 | 101 | |
| | | | Cars | 1 | 95 | |
| 5 | Switchyard – Electrical | Switchyard | Power Hand Tools | 1 | 96 | 106 |
| | | | Welder | 1 | 97 | |
| | | | Generator | 1 | 101 | |
| | | | Franna | 1 | 99 | |
| | | | Delivery Truck | 1 | 100 | |
| | | | Cars | 1 | 95 | |
| 6 | Primary installation of gas turbine and generator | Power Islands | Power Hand Tools | 1 | 96 | 106 |
| | | | Welder | 1 | 97 | |
| | | | Generator | 1 | 101 | |
| | | | Franna | 1 | 99 | |
| | | | Delivery Truck | 1 | 100 | |
| | | | Cars | 1 | 95 | |
| 7 | HV electrical installation | GT Transformers | Power Hand Tools | 1 | 96 | 108 |
| | | | Excavator 5-20t | 1 | 99 | |
| | | | Generator | 1 | 101 | |
| | | | Roller | 1 | 104 | |
| | | | Delivery Truck | 1 | 100 | |
| | | | Cars | 1 | 95 | |
| 8 | Site Surfacing | Whole Site | Paving Machine | 1 | 104 | 119 |
| | | | Concrete Truck | 1 | 109 | |
| | | | Roller | 1 | 104 | |
| | | | Excavator 5-20t | 1 | 99 | |
| | | | Generator | 1 | 101 | |
| | | | Grader | 1 | 108 | |
| | | | Concrete Saw** | 1 | 118 | |
| | | | Delivery Truck | 1 | 100 | |
| | | | Cars | 1 | 95 | |

* - Receives a 5 dB(A) penalty for intermittent noise when works take place during night periods. As the works take place in standard hours, no penalty was applied.

** - Receives a 5 dB(A) penalty for tonal noise. The time correction applied to the saw and grinder (typically 5 minutes out of a 15-minute period) and the penalty have both been taken into account when calculating the equipment noise level.

### 5.1.2 Vibration-generating plant and equipment

From the plant and equipment expected to be used during the construction phase of the Proposal, the following pieces of equipment were identified as vibration-generating:

- Vibratory roller
- Piling rig.

These pieces of equipment were considered as the potential sources of vibration during the construction of the Proposal and were considered in the vibration impact assessment.

### 5.1.3 Construction timing

For this assessment, it has been assumed that construction works will take place during standard construction hours, with the potential for some out of hours day works (i.e. Saturdays 1:00 pm – 6:00 pm) occurring.

### 5.1.4 Construction traffic

The Proposal would result in additional traffic movements to the Proposal Site, which would result in additional vehicle-related noise emissions being generated.

During construction, the predicted peak additional traffic flows were estimated as follows (Note: one vehicle entering then leaving the site is counted as two vehicle movements, one in and one out):

- Up to 400 additional light vehicle movements per day, with morning and afternoon peaks (200 inbound trips during the morning peak hour and 200 outbound trips during the afternoon peak hour)
- Approximately 120 additional heavy vehicle movements (60 inbound trips and 60 outbound trips)
- Approximately two additional oversize overmass heavy vehicle movements during the night (one inbound trip and one outbound trip).

## 5.2 Operational noise emissions

### 5.2.1 Operational plant and equipment

The operational noise was largely divided into two sources, emanating from the power islands (i.e. the gas turbines, generator, stack along with the other supporting equipment), and the balance of plant (i.e. diesel unloading station, water pumps and the demineralization plant). Table 5.2 details the estimated noise levels of the main power island components based on a representative 'typical' offering from the major equipment suppliers, in addition to noise reductions that would be achieved by attenuation to be included in the Proposal. The table also displays the attenuated component levels, which were used in the noise modelling and impact assessment.

The attenuation was modelled as being applied equally across the dB(A), dB(C) and unweighted dB, and the levels of attenuation required have been developed to sit well below what is considered feasibly possible to be provided from a supplier. Table 5.3 displays the indicative noise levels from the balance of plant.

It is noted that while the switchyard to the north of the power station is part of the Proposal Site, the switchyard noise levels have been considered to be negligible as the associated generator step-up transformers would be located within the power island footprints. As such, the noise levels from the power islands would mask any noise generated from the electrical switchyard itself.

The power island noise levels for the Proposal have been derived from noise data provided to Jacobs by potential equipment suppliers. Due to this, the noise spectra for these pieces of equipment as well as the balance of plant equipment have not been shown for confidentiality reasons.

Table 5.2: Power Island Sound Power Levels

| Noise Source | Unattenuated SWL | | | Attenuation Applied (dB) | Attenuated SWL | | |
|---|---|---|---|---|---|---|---|
| | dB | dB(A) | dB(C) | | dB | dB(A) | dB(C) |
| Exhaust Stack/Opening | 135 | 109 | 132 | 12 | 123 | 97 | 120 |
| Exhaust Diffuser | 125 | 112 | 122 | 14 | 111 | 98 | 108 |
| Gas Turbine Housing | 122 | 104 | 123 | 6 | 116 | 98 | 117 |
| Gas Turbine Air Inlet | 117 | 107 | 116 | 12 | 105 | 95 | 104 |
| Gas Turbine Generator Enclosure | 121 | 102 | 119 | 5 | 116 | 97 | 114 |
| Generator Step-up Transformers* | 116 | 104 | 115 | 5 | 111 | 99 | 110 |
| Generator Fin Fan Cooler | 116 | 100 | 112 | 3 | 113 | 97 | 109 |
| Hydraulic Skid | 99 | 96 | 99 | Nil | 99 | 96 | 99 |
| Liquid Fuel Module | 100 | 96 | 99 | Nil | 100 | 96 | 99 |
| Fuel Gas Systems | 99 | 96 | 98 | Nil | 99 | 96 | 98 |

* Transformers were indicated as a candidate for the tonality noise level correction as per Fact Sheet C of the NPI. However, suppliers have indicated that the transformers will be attenuated for tonal noise, hence the attenuated transformers were predicted to not pose a tonal noise risk and the tonality correction was not applied.

Table 5.3: Balance of Plant Sound Power Levels

| Noise Source | Overall SWL | | |
|---|---|---|---|
| | dB | dB(A) | dB(C) |
| Water Tank Pumps | 95 | 93 | 95 |
| Liquid Fuel (diesel) Pump Station | 88 | 85 | 88 |
| Demineralization Plant | 88 | 85 | 88 |

### 5.2.2 Operational traffic

The operation of the Proposal would require traffic movements to deliver personnel, fuel and equipment to the Proposal Site. As with during construction, this would result in additional vehicle-related noise emissions generated from the Proposal Site.

During operation, two events would result in higher traffic flows than normal conditions. These are:

- Diesel Fuel Replacement Events (infrequent event which could occur up to approximately seven days a year depending on the amount of diesel fuel that needs to be replaced):
  - Up to 12 heavy vehicle movements per day (6 inbound trips and 6 outbound trips)
- Gas Turbine Major Overhaul Events (occurring for approximately six days a week for a six-week period, once every 10 years):
  - Up to 80 light vehicle movements per day (40 inbound trips and 40 outbound trips)
  - Up to 10 heavy vehicle movements per day (5 inbound trips and 5 outbound trips).

## 5.3 Model setup

Noise from the operation of the Proposal was modelled using the SoundPLAN 8.0 acoustic modelling software. Within the noise modelling software, the CONCAWE noise propagation calculation was applied for dB(A) noise calculations. The CONCAWE calculation was selected due to its reliability in assessing industrial noise impacts. CONCAWE considers noise propagation and attenuation by:

- Geometrical spreading
- Atmospheric absorption
- Ground effects
- Meteorological conditions conducive of the propagation of noise
- Barriers
- Topography and distance between the source and receptor.

A number of inputs were used to create the model. These are detailed in Table 5.4.

Table 5.4: Noise Model Input Details

| Model Input | Details |
|---|---|
| Topography | Terrain data were derived from NSW Land Property Information (LPI) 10 m resolution bare earth Digital Elevation Model (DEM). The DEM was produced from a standard LiDAR survey conducted by LPI. |
| Buildings | Footprints for receptor and other buildings in the area surrounding works was determined from aerial photography. Heights and floor numbers were ascertained from Google Street view, or otherwise, assuming a building height of 3 m per floor plus 2 m for the roof. |
| Ground Absorption | Heavily Forested Area: 1.00<br>Rural Area/Grassland: 0.75<br>Urban Area: 0.50<br>Water: 0.00 |
| Noise Sources | Construction and Operational SWLs were set as outlined in Section 5.1.1 and Section 5.2.1, respectively. |
| Meteorology | Meteorological conditions were set out as outlined in Section 3.4 |

## 5.4 Noise measurement locations

In order to understand the noise impact at each noise catchment area surrounding the Proposal, several receivers were selected as locations where modelled construction and operation noise levels were measured at. These include the residential receivers nearest to the Proposal in each NCA, as well as any identified non-residential land use in the NCAs. These receivers are listed in Table 5.5, and are displayed in Figure 5.1.

Table 5.5: Measurement Locations for Noise Modelling

| Receiver | Noise Catchment Area | Land Use | Address | Approximate Distance of Nearest Sensitive Receiver from Centrepoint of Power Island |
|---|---|---|---|---|
| NCA 1 Representative Residential Receiver | NCA 1 | Residential | 103 Bishops Bridge Rd, Sawyers Gully | 1,240 m |
| NCA 2 Representative Residential Receiver | NCA 2 | Residential | 8 Dawes Avenue, Loxford | 1,150 m |
| NCA 3 Representative Residential Receiver | NCA 3 | Residential | 20 Bowditch Avenue, Loxford | 1,610 m |
| NCA 4 Representative Residential Receiver | NCA 4 | Residential | 464 Cessnock Rd, Gillieston Heights | 3,210 m |
| NCA 2 Industrial Receiver | NCA 2 | Industrial | 6 Dawes Avenue, Loxford | 1,130 m |
| NCA 3 Educational Receiver | NCA 3 | Educational | TAFE Kurri Kurri, McLeod Road, Loxford | 1,995 m |
| NCA 3 Commercial Receiver | NCA 3 | Commercial | 18 Bowditch Avenue, Loxford | 1,595 m |

Additionally, noise levels were also measured across the Proposal boundary where a proposed industrial lot is predicted to be adjacent. The highest levels measured along the boundary were considered when assessing noise impacts.

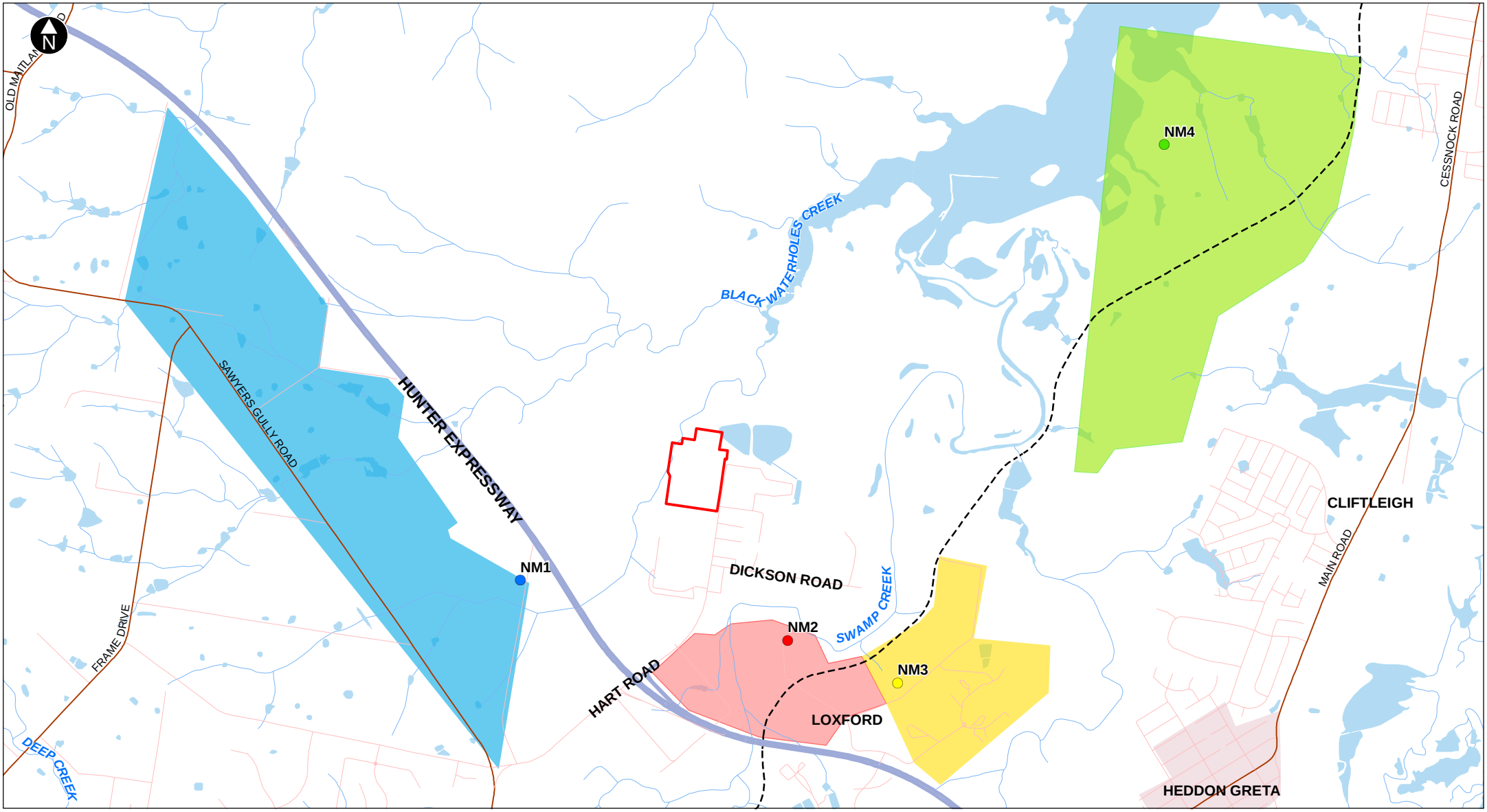


**Figure 5-1** Monitoring locations

snowy hydro renewable energy Jacobs

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# 6. Assessment of impacts

## 6.1 Construction noise

Estimated noise levels at the nearest receivers were predicted from the anticipated noise levels generated during each construction phase of the Proposal. Table 6.1 presents the predicted noise impact at each representative residential receiver during each construction phase, while Table 6.2 presents the predicted noise impact at each non-residential receiver during each construction phase.

The assessment assumed all plant and equipment for each activity was operated concurrently while positioned at the location closest to each individual receiver. This was considered to be a conservative approach and while this may provide for the determination of conservative noise levels, actual construction noise levels should be lower than predicted in this assessment.

As Table 6.1 shows, noise levels were not predicted to exceed the standard hours or out of hours day NMLs of any residential receivers in each NCA during any construction phase.

As listed in Table 6.2, noise levels were not predicted to exceed NMLs at any non-residential receivers in each of the NCAs.

The construction phases which were predicted to result in the highest noise levels at the nearest sensitive receiver are the initial site earthworks and surfacing works (i.e. Phases 1 and 8). These works would result in noise levels of 51 dB(A) and 49 dB(A) at the nearest residential receiver, respectively.

Noise contour maps for each of the assessed construction stages are displayed in Appendix A.

Table 6.1: Noise Impacts from Construction Works at Residential Receivers

| Construction Phase | NCA 1 | | | NCA 2 | | | NCA 3 | | | NCA 4 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Highest Predicted Noise Level at NCA 1 Representative Residential Receiver (dB(A)) | Compliant with Noise Criteria? | | Highest Predicted Noise Level at NCA 2 Representative Residential Receiver (dB(A)) | Compliant with Noise Criteria? | | Highest Predicted Noise Level at NCA 3 Representative Residential Receiver (dB(A)) | Compliant with Noise Criteria? | | Highest Predicted Noise Level at NCA 4 Representative Residential Receiver (dB(A)) | Compliant with Noise Criteria? | |
| | | Standard Hours – 57 dB(A) | Out of Hours, Day – 52 dB(A) | | Standard Hours – 65 dB(A) | Out of Hours, Day – 60 dB(A) | | Standard Hours – 62 dB(A) | Out of Hours, Day – 57 dB(A) | | Standard Hours – 58 dB(A) | Out of Hours, Day – 53 dB(A) |
| 1 | 47 | Yes | Yes | 51 | Yes | Yes | 45 | Yes | Yes | 32 | Yes | Yes |
| 2 | 42 | Yes | Yes | 45 | Yes | Yes | 40 | Yes | Yes | <30 | Yes | Yes |
| 3 | 45 | Yes | Yes | 48 | Yes | Yes | 43 | Yes | Yes | 31 | Yes | Yes |
| 4 | 36 | Yes | Yes | 40 | Yes | Yes | 35 | Yes | Yes | <30 | Yes | Yes |
| 5 | 30 | Yes | Yes | 34 | Yes | Yes | 30 | Yes | Yes | <30 | Yes | Yes |
| 6 | 31 | Yes | Yes | 35 | Yes | Yes | <30 | Yes | Yes | <30 | Yes | Yes |
| 7 | 33 | Yes | Yes | 36 | Yes | Yes | 31 | Yes | Yes | <30 | Yes | Yes |
| 8 | 45 | Yes | Yes | 49 | Yes | Yes | 43 | Yes | Yes | 30 | Yes | Yes |

Table 6.2: Noise Impacts from Construction Works at Non-Residential Receivers

| Phase | NCA 2[1] | | NCA 3* | | | |
|---|---|---|---|---|---|---|
| | Highest Predicted Noise Level at NCA 2 Industrial Receiver (dB(A)) | Compliant with Noise Criteria? Industrial – 75 dB(A) | Highest Predicted Noise Level at NCA 3 Commercial Receiver (dB(A)) | Compliant with Noise Criteria? Commercial – 70 dB(A) | Highest Predicted Noise Level at NCA 3 Educational Receiver (dB(A)) | Compliant with Noise Criteria? Educational – 55 dB(A) |
| 1 | 51 | Yes | 45 | Yes | 42 | Yes |
| 2 | 45 | Yes | 40 | Yes | 38 | Yes |
| 3 | 48 | Yes | 43 | Yes | 40 | Yes |
| 4 | 40 | Yes | 35 | Yes | 32 | Yes |
| 5 | 34 | Yes | 30 | Yes | 27 | Yes |
| 6 | 34 | Yes | 29 | Yes | 26 | Yes |
| 7 | 36 | Yes | 31 | Yes | 29 | Yes |
| 8 | 49 | Yes | 43 | Yes | 40 | Yes |

* There were no non-residential receivers identified in NCA 1 and NCA 4

## 6.2 Noise resulting from construction traffic

Existing traffic volumes on the Hunter Expressway were obtained from the nearest Transport for NSW (TfNSW) permanent count stations (ID HEX1 & HEX2) located 3.5 km north of the Expressway exit to the Proposal Site. Table 6.3 presents the average daily traffic count from the traffic ID stations in 2020.

Table 6.3: Average daily vehicle movements TfNSW permanent count stations HEX1 & HEX2

| Vehicle type | Day | | Night | |
|---|---|---|---|---|
| | Northbound | Southbound | Northbound | Southbound |
| Light | 7052 | 8370 | 2003 | 862 |
| Heavy | 1378 | 1791 | 535 | 280 |

During construction of the Proposal, the estimated peak vehicle movements per day at the peak of construction is expected to be 400 light vehicle movements, along with 120 heavy vehicle movements during standard hours daily, along with two oversize overmass movements during the night (one inbound trip and one outbound trip).

Considering the estimate of construction vehicle movements per day, using the Construction Noise Estimator, it was determined that noise from the existing road traffic plus the additional construction noise traffic would be 63 dB(A) during the day and 61.2 dB(A) during the night, which is above the 60 dB(A) $L_{Aeq,15hr}$ noise criteria and 55 dB(A) $L_{Aeq,9hr}$ noise criteria at the nearest sensitive receiver (75 m away from the road alignment). However, the additional construction noise traffic associated with the Proposal would only contribute 0.2 dB(A) to the overall traffic noise level during the day and would contribute less than 0.1 dB(A) to the traffic noise level during the night. Therefore, the 2 dB(A) traffic noise increase criterion would not be exceeded, and it was concluded that the noise generated from the additional traffic during construction of the Proposal would not present a noise impact issue.

## 6.3 Sleep disturbance – construction

Construction is not predicted to take place during the night, and as such construction activities associated with the Proposal would not result in sleep disturbance impacts.

## 6.4 Operational noise

The noise impacts resulting from the operation of the Proposal on residential receivers are detailed in Table 6.4, while impacts on non-residential receivers are detailed in Table 6.5.

The 'standard' and 'noise-enhancing' meteorological conditions were adopted for the assessment (refer to Section 3.4), and the Proposal has been assumed to potentially operate at any time of day or night.

It has been predicted by the noise model that operational noise levels would be compliant at all receivers at all times. The receiver with the highest noise impact was the nearest sensitive receiver in NCA 2. Under standard conditions noise levels were predicted to be 39 dB(A), while noise levels under noise-enhancing conditions were predicted to be 43 dB(A). Generally, noise-enhancing conditions increase noise levels at receivers by approximately 5 dB(A).

It has been noted that the operational noise emissions were closest to the noise criterion during the night period. However, this is also the least likely time for operations to occur, resulting in the noise impact being minimised to a smaller occurrence and duration compared to the day and evening period.

Noise contours displaying the spatial distribution of noise from the Proposal are displayed in Figure 6.1 and Figure 6.2, as well as Appendix B.

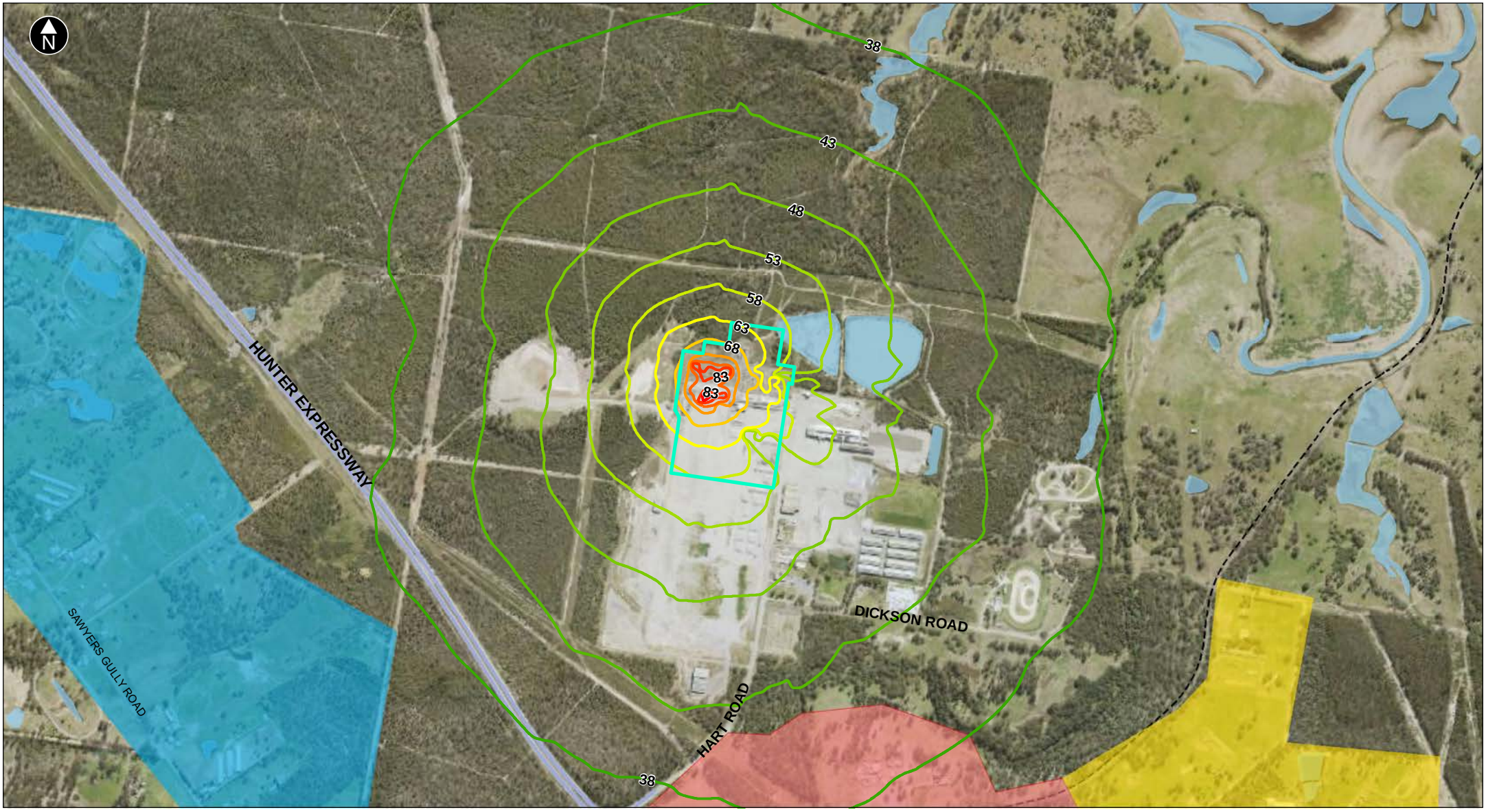
Table 6.4: Operational Noise Impact at the nearest Residential Receivers

| Noise Level at Nearest Residential Receiver in Noise Catchment Area | Highest Predicted Noise Level at Residential Receiver | | Noise Criteria | Compliant with Noise Criteria? | |
|---|---|---|---|---|---|
| | Standard Conditions | Noise-Enhancing Conditions | | Standard Conditions | Noise-Enhancing Conditions |
| NCA 1 Representative Residential Receiver | 36 dB(A) [1] | 41 dB(A) * | Day – 52 dB(A) | Yes | Yes |
| | | | Evening – 48 dB(A) | Yes | Yes |
| | | | Night – 43 dB(A) | Yes | Yes |
| | | | Sleep Disturbance – 54 dB(A) | Yes | Yes |
| NCA 2 Representative Residential Receiver | 39 dB(A)[1] | 43 dB(A) * | Day – 58 dB(A) | Yes | Yes |
| | | | Evening – 48 dB(A) | Yes | Yes |
| | | | Night – 43 dB(A) | Yes | Yes |
| | | | Sleep Disturbance – 58 dB(A) | Yes | Yes |
| NCA 3 Representative Residential Receiver | 34 dB(A) | 39 dB(A) | Day – 57 dB(A) | Yes | Yes |
| | | | Evening – 48 dB(A) | Yes | Yes |
| | | | Night – 43 dB(A) | Yes | Yes |
| | | | Sleep Disturbance – 56 dB(A) | Yes | Yes |
| NCA 4 Representative Residential Receiver | <30 dB(A) | <30 dB(A) | Day – 53 dB(A) | Yes | Yes |
| | | | Evening – 48 dB(A) | Yes | Yes |
| | | | Night – 43 dB(A) | Yes | Yes |
| | | | Sleep Disturbance – 55 dB(A) | Yes | Yes |

* A 2dB positive adjustment for low frequency noise applies to the predicted noise levels as required under the NSW NPI (2017). Refer to Section 6.5 for the low frequency noise assessment detailing how the adjustment was derived.

Table 6.5: Operational Noise Impact at the nearest existing Non-Residential Receivers

| Non-Residential Receiver | Highest Predicted Noise Level at Non-Residential Receiver | | Noise Criteria | Exceedance of Noise Criteria? | |
|---|---|---|---|---|---|
| | Standard Conditions | Noise-Enhancing Conditions | | Standard Conditions | Noise-Enhancing Conditions |
| NCA 2 Industrial Receiver | 39 dB(A) | 44 dB(A) | Industrial Criteria – 68 dB(A) | Yes | Yes |
| NCA 3 Commercial Receiver | 34 dB(A) | 39 dB(A) | Commercial Criteria – 63 dB(A) | Yes | Yes |
| NCA 3 Educational Receiver | 32 dB(A) | 37 dB(A) | Educational Criteria – 43 dB(A) | Yes | Yes |




Proposal site
Motorway
Railway
Waterbodies

**Noice catchment areas**
NCA 1
NCA 2
NCA 3

**Noise Level dB(A)**
38
43
48
53
58
63
68
73
78
83
88

0 0.5 1 km

***Representative frequency range:***
***16 Hz to 8000 Hz***
Modelling parameters:
- Calculation at 1.5m above ground
- 20°C temperature and 70% humidity
- Neutral weather conditions (Pasquill Grade D with wind speed of 0 m/s)
- Softground G = 1.0
- Calculation method: Concawe

1:15,000 at A4
GDA2020 MGA Zone 56

**Data sources:**
Jacobs
Metromap (Aerometrex) 2020
NSW Spatial Services

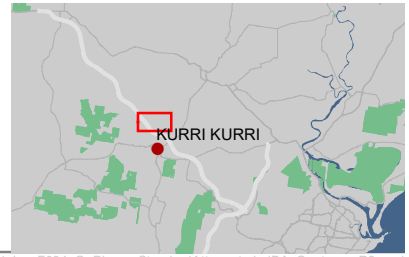



**Figure 6-1** Power Station dB(A) Levels under Standard Meteorological Conditions

snowy hydro renewable energy
Jacobs

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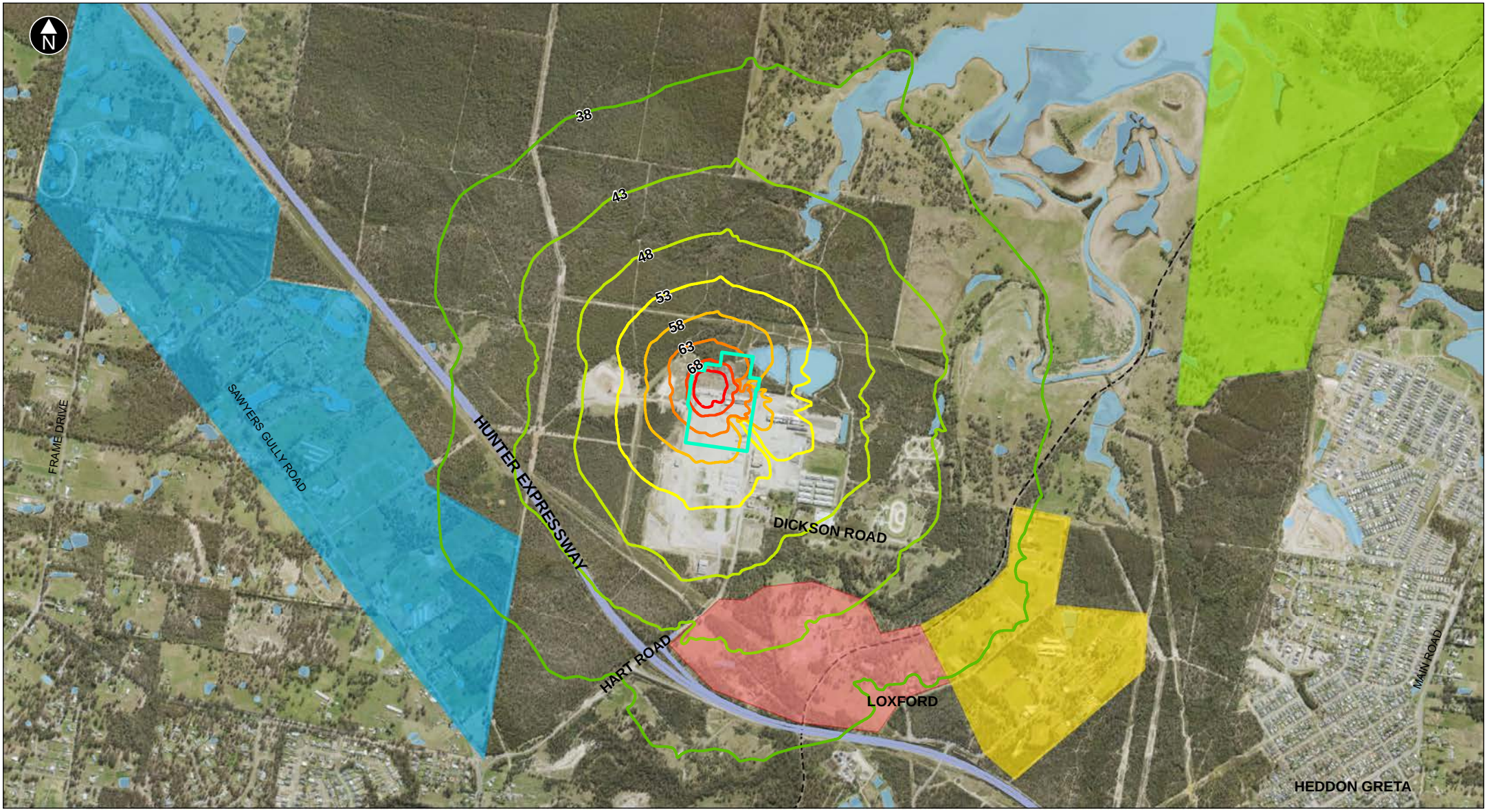


**Figure 6-2** Power Station dB(A) Levels under Adverse Meteorological Conditions



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When the planned industrial lots adjacent to the Proposal Site are occupied, the occupiers of those lots would experience noise from the Proposal. However, the levels would remain below the operational noise criteria for industrial receivers. The operational noise impact at the Proposal Site boundary is detailed in Table 6.6.

Table 6.6: Operational Noise Impacts at the Proposal Boundary

| Non-Residential Receiver | Highest Predicted Noise Level at Non-Residential Receiver | | Noise Criteria | Exceedance of Noise Criteria? | |
|---|---|---|---|---|---|
| | Standard Conditions | Noise-Enhancing Conditions | | Standard Conditions | Noise-Enhancing Conditions |
| Site Boundary | 61 dB(A) | 64 dB(A) | Industrial Criteria – 68 dB(A) | Yes | Yes |

## 6.5 Low frequency noise assessment

As per the Fact Sheet C of the NPI, and as described in the NPI, in order to account for potential low frequency noise impacts, a correction is applied to noise levels based on a two-step criterion. The first step is to analyse the difference between the C-weighted and A-weighted noise levels predicted at the assessed receivers. If the difference between the C-weighted and A-weighted noise levels is greater than 15 dB, the second step of the assessment will take place. This is to determine if a positive adjustment (i.e. a penalty) of two dB or five dB should be applied to the predicted A-weighted noise levels during the evening and night periods. C-weighted noise levels under noise-enhancing conditions were predicted in SoundPlan and were compared to the A-weighted levels under noise-enhancing conditions, to develop the worst-case scenario to assess the noise levels against. The comparison of the difference in C and A weighted noise levels, and whether each exceeds the NPI criterion is detailed below in Table 6.7.

Table 6.7: Predicted Operational Noise Levels (C and A weighted)

| Noise Sensitive Receiver | Difference between C and A weighted predicted noise levels $L_{eq,15min}$ dB | |
|---|---|---|
| | Worst-Case Conditions | Requires assessment at the octave band level to determine the level of adjustment due to LFN? |
| NCA 1 Nearest Residential Receiver | 57 – 39 > 15 | Yes |
| NCA 2 Nearest Residential Receiver | 59 – 41 > 15 | Yes |
| NCA 3 Nearest Residential Receiver | 54 – 37 >15 | Yes |
| NCA 4 Nearest Residential Receiver | 44 – 28 >15 | Yes |
| NCA 3 Educational Receiver | 51 – 35 >15 | Yes |

As displayed, the difference between C and A weighted noise levels exceeds the 15 dB criteria at each receiver. As such, the low frequency third octave noise contribution at each receiver was compared to the criterion presented in Table C2 of the NPI. The comparisons of the low frequency contribution of the Proposal to the criterion are detailed in Table 6.8.

Table 6.8: Predicted Low Frequency Contribution

| Noise Sensitive Receiver | 25 Hz | 31.5 Hz | 40 Hz | 50 Hz | 63 Hz | 80 Hz | 100 Hz | 125 Hz | 160 Hz |
|---|---|---|---|---|---|---|---|---|---|
| NPI Table C2 Threshold Levels | 69 | 61 | 54 | 50 | 50 | 48 | 48 | 46 | 44 |
| NCA 1 Nearest Residential Receiver | 56 | 51 | 46 | 53 | 49 | 45 | 45 | 41 | 39 |
| NCA 2 Nearest Residential Receiver | 57 | 52 | 47 | 55 | 51 | 47 | 48 | 45 | 42 |
| NCA 3 Nearest Residential Receiver | 53 | 48 | 43 | 50 | 46 | 42 | 43 | 40 | 37 |
| NCA 4 Nearest Residential Receiver | 43 | 38 | 33 | 41 | 37 | 33 | 34 | 31 | 28 |
| NCA 3 Educational Receiver | 50 | 45 | 40 | 48 | 44 | 40 | 41 | 38 | 35 |

As displayed, the contribution of the Proposal in the 50Hz (at two of the residential receivers) and 63Hz (at one of the residential receivers) one third octave bands exceeds the Noise Policy criteria for those octave bands by 1 – 5 dB. Due to this, a 2 dB correction has been applied to the noise levels of the Proposal to account for low frequency noise at the respective receivers.

As per the most sensitive noise criterion detailed in Table 6.4, with the correction applied, the night noise level at the nearest residential receiver in NCA 2 will reach but not exceed the night criterion for that receiver. No receiver noise criteria are expected to be exceeded as a result of this correction.

## 6.6 Noise Resulting from Operational Traffic

During operation of the Proposal, two events, the diesel fuel replacement and the Gas Turbine Major Overhaul, would result in higher daily traffic numbers than during normal operation. The traffic movements for each event have been detailed in Section 5.2.2. Existing traffic values are detailed in Table 6.3.

During both events, the existing road traffic plus the additional operational traffic noise would be 62.7 dB(A) during the day, above the 60 dB(A) $L_{Aeq,15hr}$ day noise criteria at the nearest sensitive receiver (75 m away). However, the additional operational traffic noise associated with both events would contribute less than 0.1 dB(A) to the overall daytime traffic noise levels. As such, the two dB(A) traffic noise increase criterion would not be exceeded, and it was concluded that the noise generated from the additional traffic during the operation of the Proposal would not lead to any noise impact.

## 6.7 Vibration

As identified in Section 5.1.2, a vibratory roller and piling rig, which are considered to be a vibration-generating plant, would be used during construction. With the use of a piling rig and vibratory roller, cosmetic damage impacts may occur up to 25 m away from the works, while human response impacts may occur up to 100 m away from the works. As no vibration receivers are located within these distances, no vibration impacts have been predicted. Additionally, as the nearest medical facility is over three km away from the Proposal site, no impacts to medical facilities due to construction vibration have been predicted.

No equipment used during the operation of the Proposal has been predicted to produce vibration impacts.

## 6.8 Cumulative impacts

### 6.8.1 Interfaces with adjacent industrial receivers

The current schedule for the construction of the Proposal means that the Proposal will be constructed prior to the occupation of any of the adjacent industrial lots. Hence, impacts at these lots have not been considered during the assessment. However, if the construction of the Proposal is delayed, these lots may be occupied, and hence impacts may occur. As such, the potential noise impacts at the boundary of the Proposal Site has been assessed in the following subsections.

#### 6.8.1.1 Construction noise

During a number of construction phases, the highest predicted noise along the Proposal Site boundary is reached, but does not exceed the noise criterion for industrial receivers. Additionally, a number of construction phases nearly reach the noise criteria. Phases one and three reach the noise criteria, while phases four and eight are within 1-2 dB(A) of the noise criteria. The noise levels in comparison to the criteria during each construction phase are detailed in Table 6.9.

Table 6.9: Construction Noise Impacts at the Proposal Boundary

| Phase | Industrial Lot | |
|---|---|---|
| | Highest Predicted Noise Level at the Boundary (dB(A)) | Compliant with Noise Criteria? |
| | | Industrial – 75 dB(A) |
| 1 | 75 | Yes |
| 2 | 66 | Yes |
| 3 | 75 | Yes |
| 4 | 74 | Yes |
| 5 | 70 | Yes |
| 6 | 54 | Yes |
| 7 | 57 | Yes |
| 8 | 73 | Yes |

#### 6.8.1.2 Construction vibration

As mentioned in Section 6.7, with the use of a piling rig and vibratory roller, cosmetic damage impacts may occur up to 25 m away from the works, while human response impacts may occur up to 100 m away from the works. If any adjacent industrial lots were occupied prior to or during construction of the Proposal, some impacts may occur. It is advised that if the adjacent lots are occupied, suggested mitigation measures to reduce vibration impact provided in Section 7.1.2 should be implemented

### 6.8.2 Gas receival station

The gas receival station is subject to a separate third-party proposal and approval process. However, as construction of the gas receival station is estimated to commence towards the end of the construction phase of the Proposal, based on the current schedule for the Proposal. Therefore, construction of the gas receival station could potentially coincide with both the construction and operation stages of the Proposal.

Based on the current construction scheduling, the gas receival station will most likely be constructed towards the end of the construction of the Proposal and prior to the operation of the Proposal's turbines on gas. Due to this, it is unlikely that timing of the noisiest activities of the gas receival station construction would coincide with the timing of the noisiest construction and operational phases of the Proposal, hence significant cumulative noise impacts are not expected during the construction of the gas receival station.

During its operation, the Proposal and the gas receival station would be in operation simultaneously, leading to a cumulative impact. Modelling has been performed to determine the contribution that the gas receival station would make to overall operational noise levels. The SWLs of the gas receival station are detailed in Table 6.10.

Table 6.10: Gas Receival Station Sound Power Levels

| Noise Source | Sound Power Level, SWL (dB) Octave Band Centre Frequency (Hz) | | | | | | | | | | Overall SWL | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 16 | 31.5 | 63 | 125 | 250 | 500 | 1000 | 2000 | 4000 | 8000 | dB | dB(A) | dB(C) |
| Gas Receival Station | 106 | 106 | 103 | 92 | 85 | 75 | 74 | 72 | 74 | 76 | 110 | 84 | 106 |

The modelling found that the gas receival station would contribute less than 0.1 dB to the noise levels at the boundary of the Proposal Site and hence would not impose a cumulative noise impact.

### 6.8.3 Demolition and remediation of the Hydro Aluminium smelter

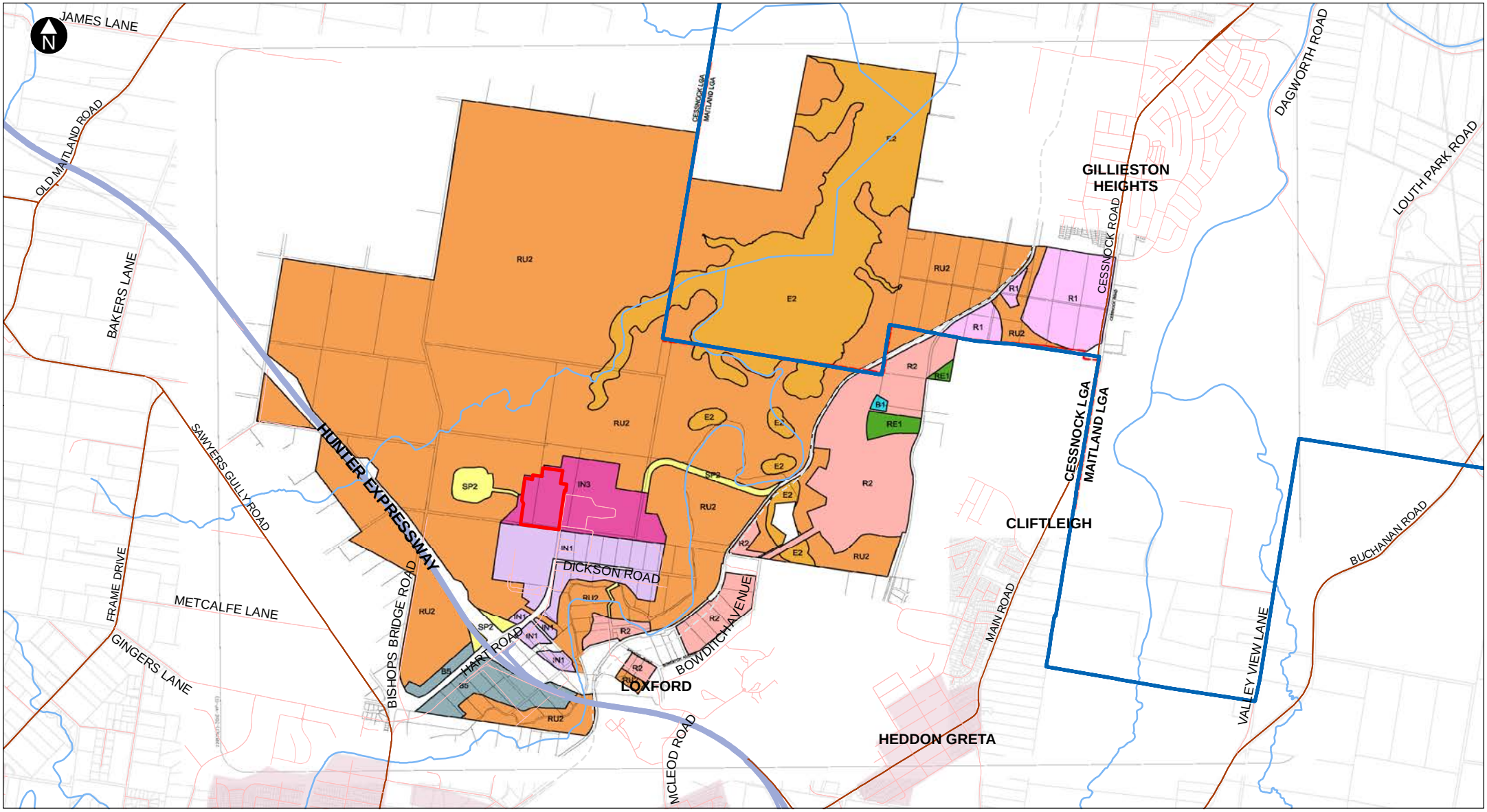
The Proposal Site forms part of the decommissioned Hydro Aluminium Kurri Kurri Pty Ltd aluminium smelter site, which ceased operation in late 2012 and was permanently closed in 2014. Demolition of the former aluminium smelter and remediation of the land is an approved State Significant Development and was the subject of an Environmental Impact Statement that was publicly exhibited in 2016. The extensive works are ongoing but would be completed within the Proposal Site prior to construction of the Proposal. Remediation of the former Kurri Kurri aluminium smelter land outside of (adjacent) the Proposal Site is estimated to be ongoing to late 2023 and therefore concurrent with the construction of the Proposal. However, this is expected to be primarily traffic movements within the industrial estate that the Proposal site forms a part, during day time hours only, and consequently cumulative impacts from this interaction are expected to be minimal.

### 6.8.4 ReGrowth Kurri Kurri Rezoning, subdivision and industrial development

The rezoning, subdivision and industrial development of the Hydro Aluminium Kurri Kurri Pty Ltd aluminium smelter land is a major planning proposal by Regrowth Kurri Kurri to rezone approximately 329 ha of land at and around the former aluminium smelter from Rural Landscape (RU2) to residential and public recreation, business, heavy and general industrial, infrastructure and environmental conservation (B1, B5, IN1, IN3, R2, RE1 and SP2 (in part)), to reduce the minimum lot size from 40 ha to 450 $m^2$ (in part) and to identify the site as an urban release area.

The rezoning proposal is subject to further approval and physical works would be subject to lodgement and approval of separate development applications. Development applications for development of the land following rezoning and subdivision are not expected until 2023, by which time the Proposal is anticipated to be well under construction or even in operation. There are no current development applications, nor any further detail around the type of future development that might occur adjacent to the Proposal Site. Therefore, potential cumulative impacts from the ReGrowth Kurri Kurri rezoning, subdivision and industrial development have not been assessed. It is assumed however, in terms of the applicable land use zoning of the Proposal Site and the likely adjacent future land use context, that the rezoning proposal will be approved.

The rezoning would result in sections of NCA 2 and NCA 3 changing from RU2 – 'Rural Landscape' to R2 – 'Low Density Residential'. As this assessment already considers the residential receivers within these locations, the results of this assessment should not fundamentally change as a result of the rezoning.




Proposal Site
Urban areas
Cadastre
Motorway
Main roads
Roads
Railway
Local Government Area

| | |
|---|---|
| B1 | NEIGHBOURHOOD CENTRE (1.19ha) |
| B5 | BUSINESS DEVELOPMENT (33.20ha) |
| E2 | ENVIRONMENTAL CONSERVATION (268.51ha) |
| IN1 | GENERAL INDUSTRIAL (65.73ha) |
| IN3 | HEAVY INDUSTRIAL (53.48ha) |
| R1 | GENERAL RESIDENTIAL (56.57ha) |
| R2 | LOW DENSITY RESIDENTIAL (137.22ha) |
| RE1 | PUBLIC RECREATION (8.54ha) |
| RU2 | RURAL LANDSCAPE (1246.75ha) |
| SP2 | SPECIAL PURPOSE INFRASTUCTURE (12.77ha) |

0 1 2 km

1:40,000 at A4

GDA2020 MGA56

Source: McCloy Group, December 2020
Note: Subject to Planning Approval and subject to change.
This image has been georeferenced to this location.
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**Figure 6-3** Hydro Kurri Kurri rezoning concept master plan

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# 7. Mitigation measures

## 7.1 Construction

### 7.1.1 Noise

No residential or non-residential exceedances have been predicted at any of the NCAs surrounding the Proposal, nor have any exceedances of the industrial receiver criteria been predicted. As such, no mitigation measures for noise impacts have been deemed necessary. However, a number of mitigation measures have been suggested in Table 7.1 to assure that construction noise levels remain below relevant criterion.

Table 7.1: Standard noise mitigation measures during construction

| Reference | Mitigation measure | Timing |
|---|---|---|
| NVIA1 | Wherever possible and safe, limit works to standard hours of construction. | During construction |
| NVIA2 | Select low-noise plant and equipment. Ensure equipment mufflers operate in a proper and efficient manner. | Prior to and during construction |
| NVIA3 | Where possible, use quieter and less vibration emitting construction methods. | During construction |
| NVIA4 | Only have necessary equipment on-site and turn off when not in use. | During construction |
| NVIA5 | Where possible, concentrate noisy activities at one location and move to another as quickly as possible. | During construction |
| NVIA6 | Vehicle movements, including deliveries outside standard hours, should be minimised and avoided where possible. | During construction |
| NVIA7 | All plant and equipment is to be well maintained and where possible, fitted with silencing devices. | Prior to and during construction |
| NVIA8 | Use only the necessary size and powered equipment for tasks. | During construction |
| NVIA9 | Implement training to induct staff on noise sensitivities | Prior to and during construction |
| NVIA10 | Where possible, consider the application of less intrusive alternatives to reverse beepers such as ‘squawker’ or ‘broadband’ alarms. | During construction |
| NVIA11 | Consider the installation of temporary construction noise barriers or earth mounds for concentrated, noise-intensive activities. | During construction |
| NVIA12 | Where practicable, install enclosures around noisy mobile and stationary equipment as necessary. | During construction |
| NVIA13 | Where possible, avoid simultaneous operation of two or more noisy plant close to receivers.<br>The offset distance between noisy plant and sensitive receivers should be maximised. | During construction |

| Reference | Mitigation measure | Timing |
|---|---|---|
| | Plan traffic flow, parking and loading/unloading areas to minimise reversing movements. | Prior to and during construction |
| NVIA14 | Complete routine monitoring to evaluate construction noise levels and evaluate whether the mitigation measures in place are adequate or require revision. | During construction |

Other additional mitigation measures to address potential cumulative impacts are provided below:

- Discuss works schedules and timings with the proponents of other works to gain an understanding of when noisy work surrounding the Proposal will take place. Should respective project schedules and work priorities change, proponents should commit to regular meetings to ensure all proponents are aware of the changes.
- Where possible, scheduling works to occur at different times of the day to prevent multiple noisy activities from taking place at the same time
- Where possible, scheduling works to take place at different locations on site to prevent noisy activities from taking place in close proximity to one another which will limit the amplification of the noise.

### 7.1.2 Vibration

No vibration impacts have been predicted as a result of the construction of the Proposal. However, in the event that the scenario described in Section 6.8.1 takes place, some vibration impacts have been predicted.

*Assessing Vibration: a technical guideline*, (DECC, 2006) provides general guidance for limiting vibration impacts during construction. These have again been reviewed and the relevant recommendations have been summarised below. If the scenario in Section 6.8.1 occurs, or if vibration is a concern during the construction of the project, these measures should be implemented.

Table 7.2: Vibration management measures from DECC, 2006

| Control measure | Details |
|---|---|
| Controlling vibration levels from the source | ▪ Choosing alternative, lower-impact equipment or methods wherever possible<br>▪ Scheduling the use of vibration-causing equipment at the least sensitive times of the day (wherever possible)<br>▪ Locating high vibration sources as far away from sensitive receiver areas as possible<br>▪ Sequencing operations so that vibration-causing activities do not occur simultaneously.<br>▪ Keeping equipment well maintained<br>▪ Do not conduct vibration intensive works within the recommended safe setback distances. |
| Consultation | Informing nearby receivers about the nature of construction stages and the vibration-generating activities. |

## 7.2 Operation

As displayed in Section 6.4, compliance with the operational noise criterion can be achieved through the advised level of attenuation detailed in Table 5.2. This level of attenuation can be achieved through the use of bespoke attenuation packages, which are provided by the suppliers of the gas turbine equipment and are specifically incorporated into the design of the equipment (i.e. a bespoke design will be done specifically to meet the requirements for the Proposal Site). Attenuation options may include:

- Slow fan speeds for cooling systems
- Improved sound enclosures
- Improved stack design
- Sound attenuation walls.

Following the commissioning of the Proposal, noise verification monitoring should be performed to confirm that operational noise levels are in line with those predicted in this assessment, assuring that the noise levels meet the noise criterion.

# 8. Conclusion

The noise and vibration impact assessment has been undertaken to assess the noise and vibration risks associated with the Proposal and to address the SEARs relevant to noise and vibration.

## 8.1 Construction

During the Proposal's construction, noise levels were predicted to be compliant at all noise receivers during both standard hours and the out of hours daytime periods. Construction traffic was predicted to increase daytime traffic noise levels by 0.2 dB(A), which is well below the 2 dB(A) traffic noise increase criterion. No vibration receivers have been identified within the predicted extent of vibration impact.

As no impacts have been predicted during the construction of the Proposal, no mitigation of construction noise or vibration impact is required. However, if the Proponent seeks to control noise and vibration impact during the construction stage, mitigation measures from the Interim *Construction Noise Guideline and Assessing Vibration: a technical guideline* have been suggested.

## 8.2 Operation

Noise modelling of the Proposal determined that operational noise impact would not exceed the relevant noise criterion for any nearby residential receivers at any time period. This included a 2 dB increase to noise levels to account for low frequency noise.

Similarly, noise levels at non-residential receivers, including the industrial receiver in NCA 2 and the educational and commercial receivers in NCA 3, as well as the industrial lots surrounding the proposal were not predicted to exceed their respective criterion.

Traffic from the operation of the Proposal was found to increase overall daytime traffic noise levels by less than 0.1 dB(A), well below the two dB(A) traffic noise increase criterion.

No vibration intensive activities have been predicted to occur during the operation of the Proposal.

# 9. References

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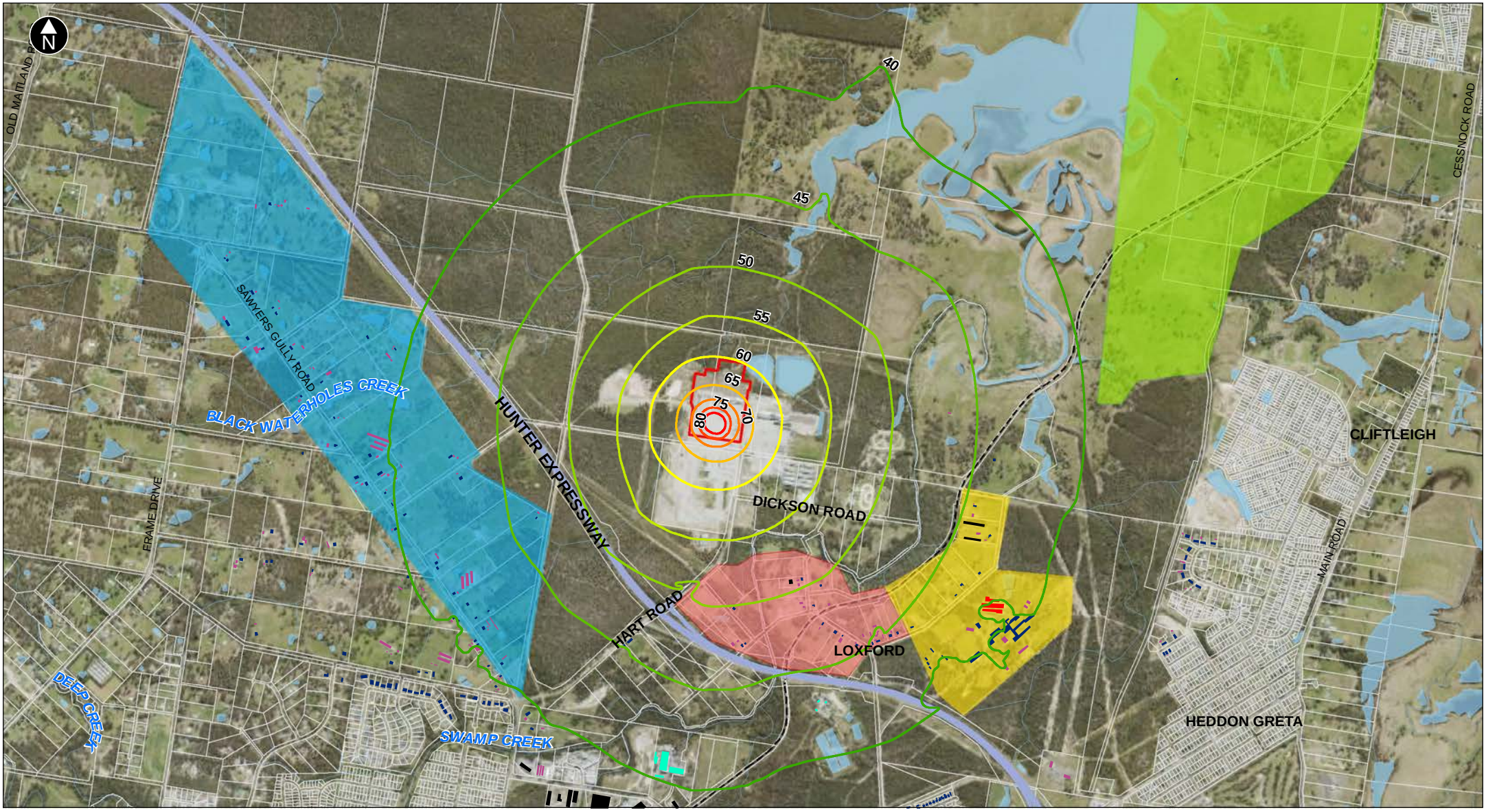
# Appendix A. Construction noise contour maps




Proposal site
Motorway
Railway
Waterbodies

**Surrounding Receivers**
Commercial
Educational
Industrial
Residential
Unoccupied / Unused

**Noice catchment areas**
NCA 1
NCA 2
NCA 3
NCA 4

**Noise Contours LAeq,15min dB(A)**
40
45
50
55
60
65
70
75
80

0 1 2 km

***Representative frequency range: 16 Hz to 8000 Hz***

Modelling parameters:
- Calculation at 1.5m above ground
- 20°C temperature and 70% humidity
- Neutral weather conditions (Pasquill Grade D with wind speed of 3 m /s)
- Softground G = 1.0
- Calculation method: Concawe

1:30,000 at A4
GDA2020 MGA Zone 56

**Data sources:**
Jacobs
Metromap (Aerometrex) 2020
NSW Spatial Services

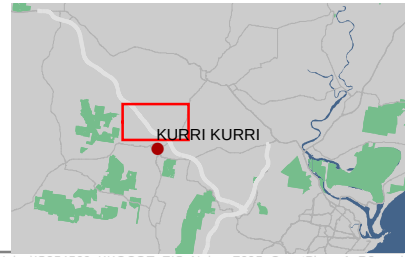



**Figure A-1** Construction Phase 1

snowy hydro renewable energy
Jacobs

Date: 5/03/2021 Path: J:\IE\Projects\04_Eastern\IS354500\22_Spatial\GIS\Directory\Templates\Figures\KurriKurriEIS\Specialists\Noise\IS354500_KKOCGT_EIS_Noise_F005_ConstPhase1_R2.mxd
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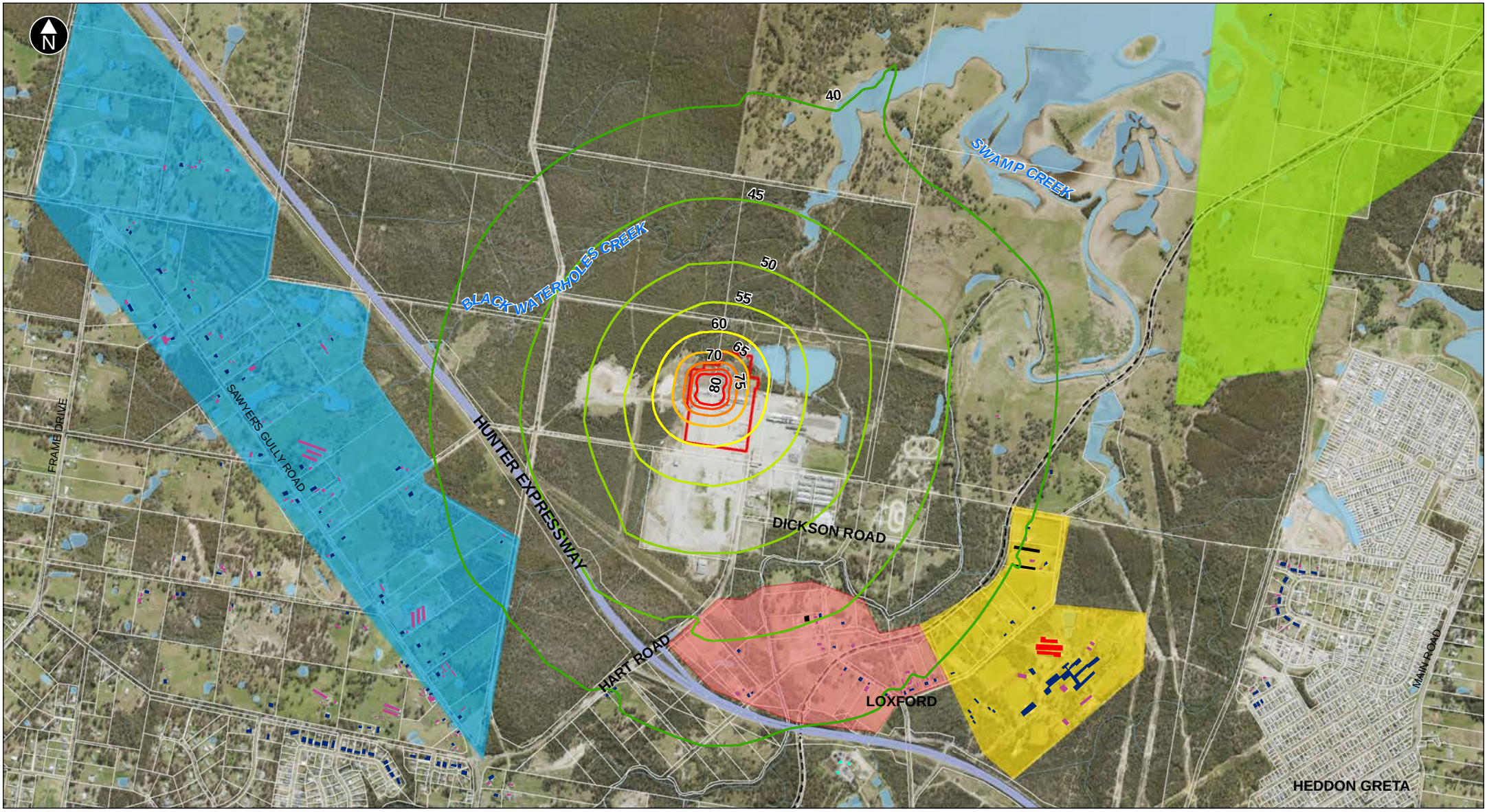


Proposal site
Motorway
Railway
Waterbodies

**Surrounding Receivers**
Commercial
Educational
Industrial
Residential
Unoccupied / Unused

**Noice catchment areas**
NCA 1
NCA 2
NCA 3
NCA 4

**Noise Contours LAeq,15min dB(A)**
40
45
50
55
60
65
70
75
80

0 0.5 1 km

***Representative frequency range: 16 Hz to 8000 Hz***

Modelling parameters:
- Calculation at 1.5m above ground
- 20°C temperature and 70% humidity
- Neutral weather conditions (Pasquill Grade D with wind speed of 3 m /s)
- Softground G = 1.0
- Calculation method: Concawe

1:25,000 at A4
GDA2020 MGA Zone 56

**Data sources:**
Jacobs
Metromap (Aerometrex) 2020
NSW Spatial Services

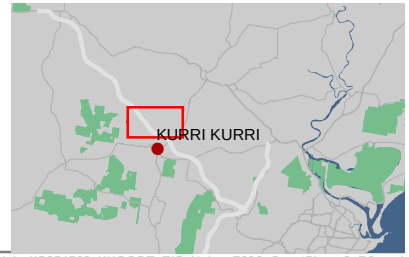


**Figure A-2** Construction Phase 2

snowy hydro renewable energy
Jacobs

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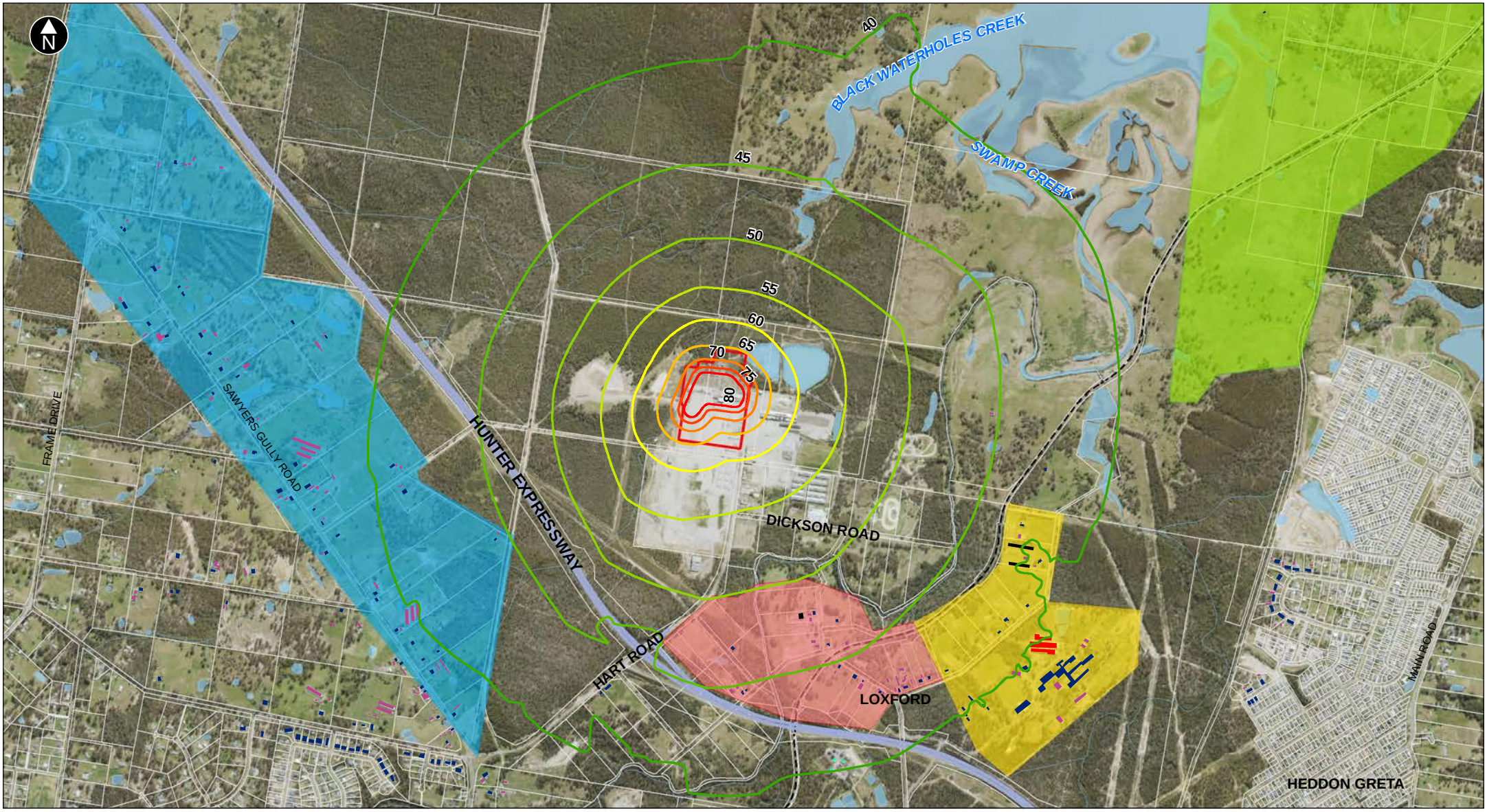


**Figure A-3** Construction Phase 3

snowy hydro renewable energy Jacobs

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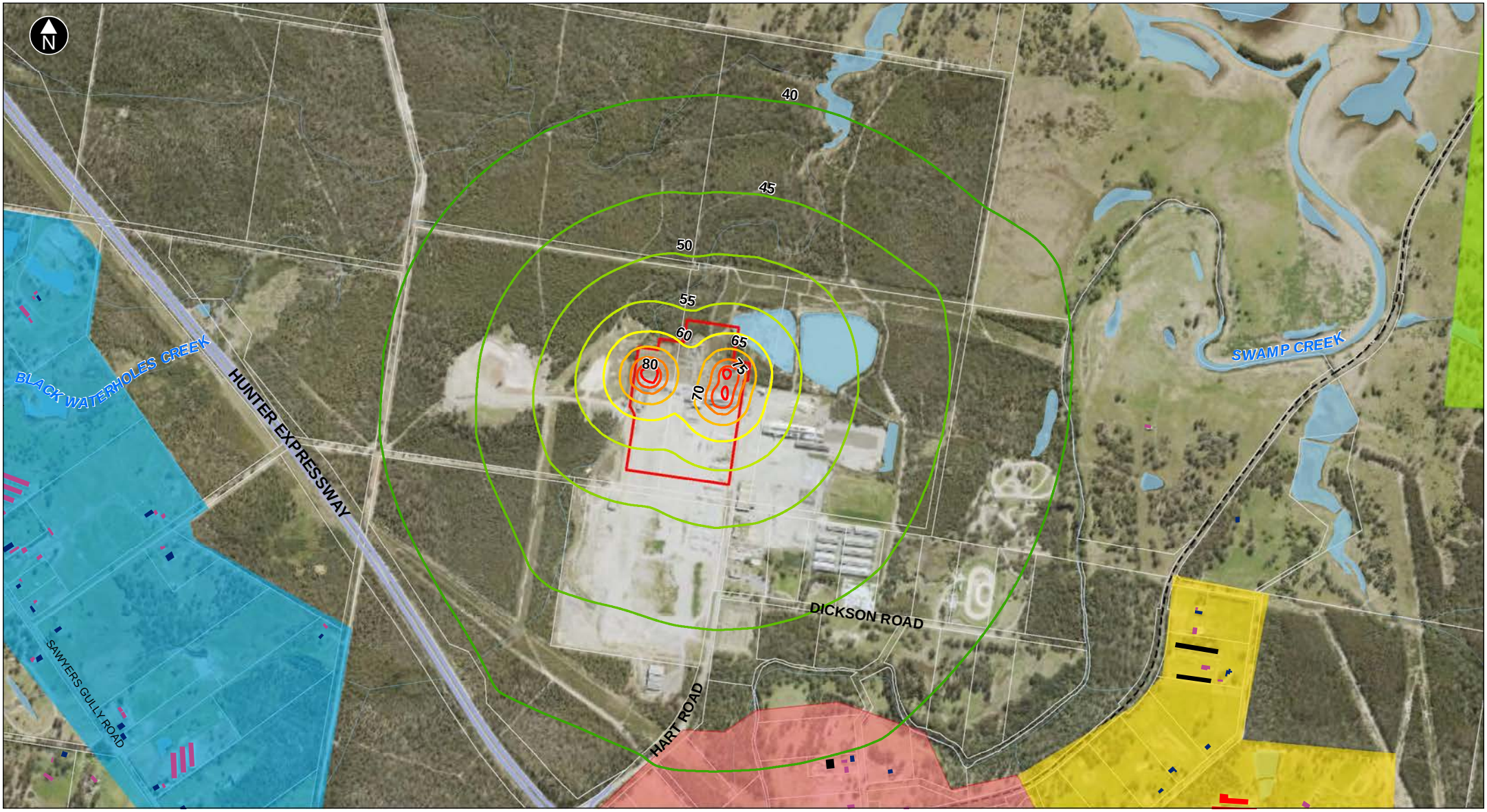


**Figure A-4** Construction Phase 4

snowy hydro renewable energy Jacobs

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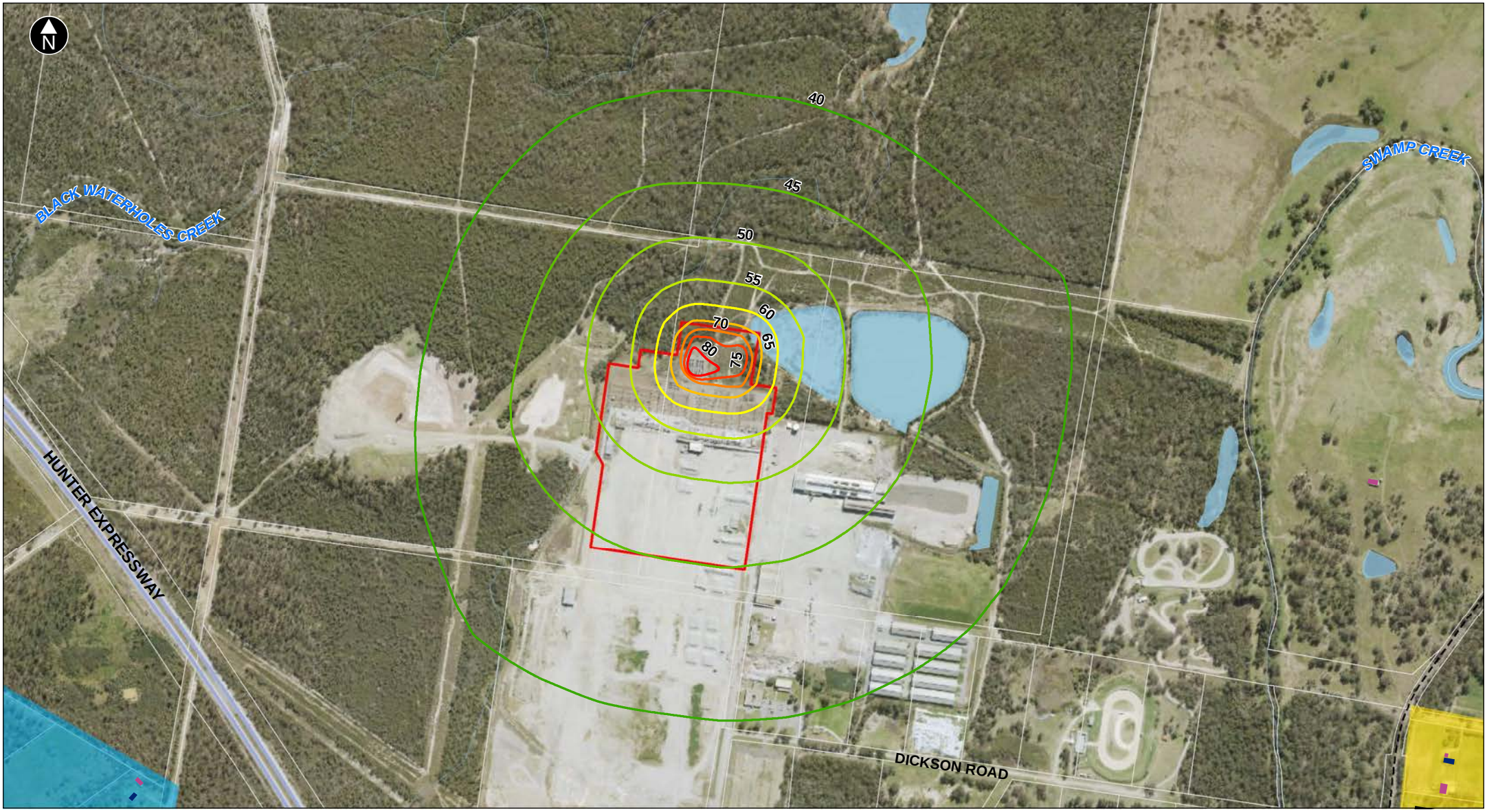


Proposal site
Motorway
Railway
Waterbodies

**Surrounding Receivers**
Commercial
Residential
Unoccupied / Unused

**Noice catchment areas**
NCA 1
NCA 3

**Noise Contours LAeq,15min dB(A)**
40
45
50
55
60
65
70
75
80

0 250 500 m

***Representative frequency range: 16 Hz to 8000 Hz***

Modelling parameters:
- Calculation at 1.5m above ground
- 20°C temperature and 70% humidity
- Neutral weather conditions (Pasquill Grade D with wind speed of 3 m /s)
- Softground G = 1.0
- Calculation method: Concawe

1:10,000 at A4
GDA2020 MGA Zone 56

**Data sources:**
Jacobs
Metromap (Aerometrex) 2020
NSW Spatial Services

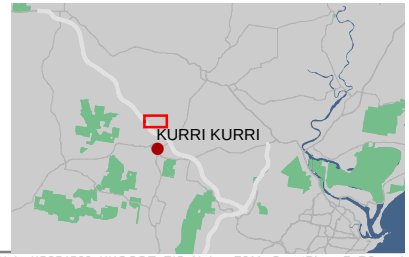


**Figure A-5** Construction Phase 5

snowy hydro renewable energy
Jacobs

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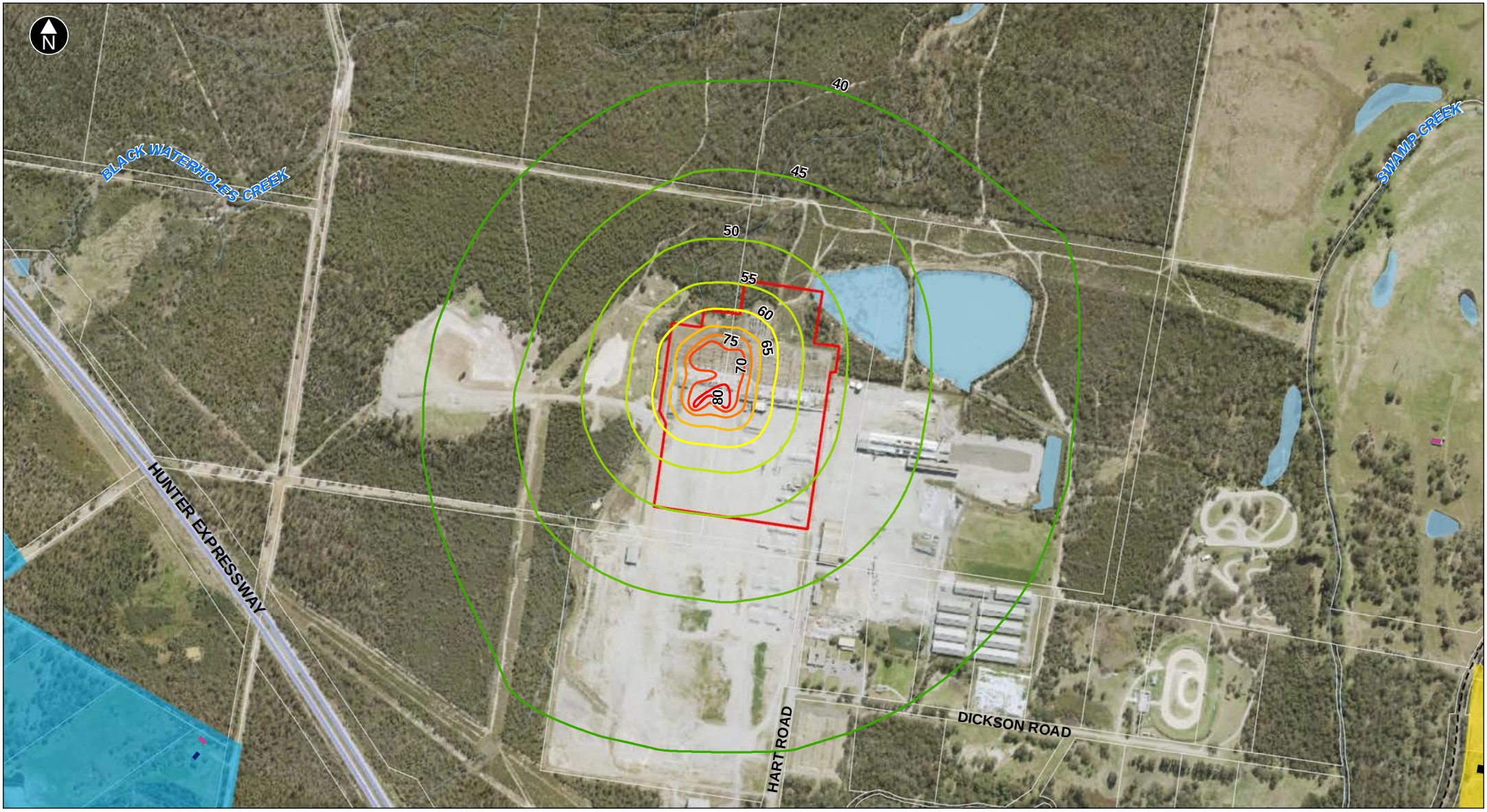


**Figure A-6** Construction Phase 6

snowy hydro renewable energy Jacobs

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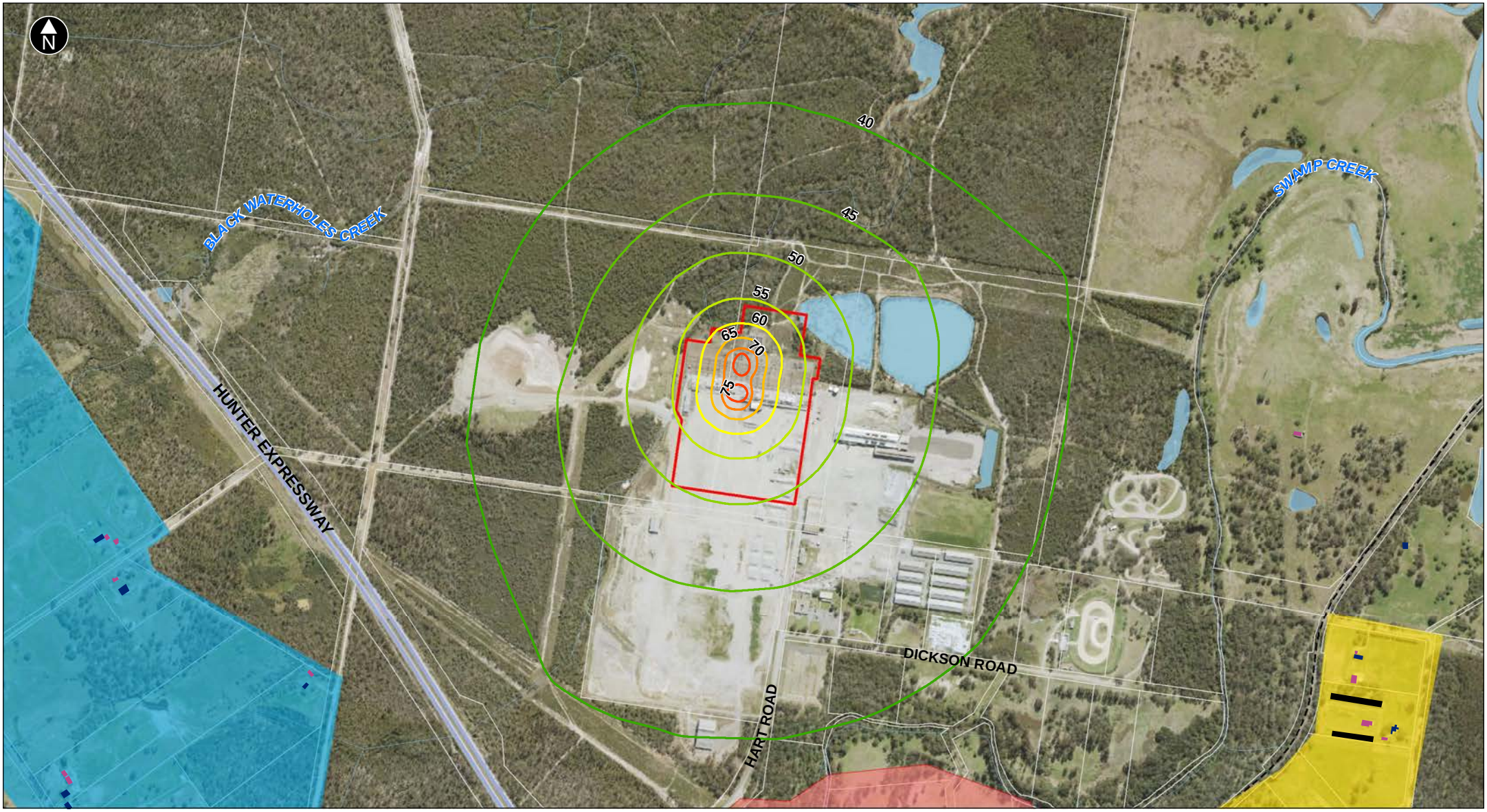


Proposal site
Motorway
Railway
Waterbodies

**Surrounding Receivers**
Commercial
Residential
Unoccupied / Unused

**Noice catchment areas**
NCA 1
NCA 2
NCA 3

**Noise Contours LAeq,15min dB(A)**
40
45
50
55
60
65
70
75

0 250 500 m

***Representative frequency range: 16 Hz to 8000 Hz***

Modelling parameters:
- Calculation at 1.5m above ground
- 20°C temperature and 70% humidity
- Neutral weather conditions (Pasquill Grade D with wind speed of 3 m /s)
- Softground G = 1.0
- Calculation method: Concawe

1:12,500 at A4
GDA2020 MGA Zone 56

**Data sources:**
Jacobs
Metromap (Aerometrex) 2020
NSW Spatial Services

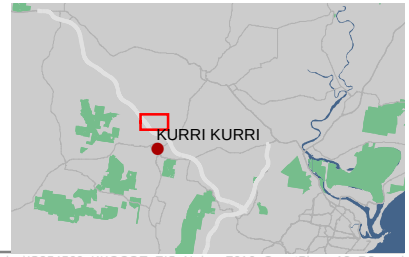


**Figure A-7** Construction Phase 7

snowy hydro renewable energy
Jacobs

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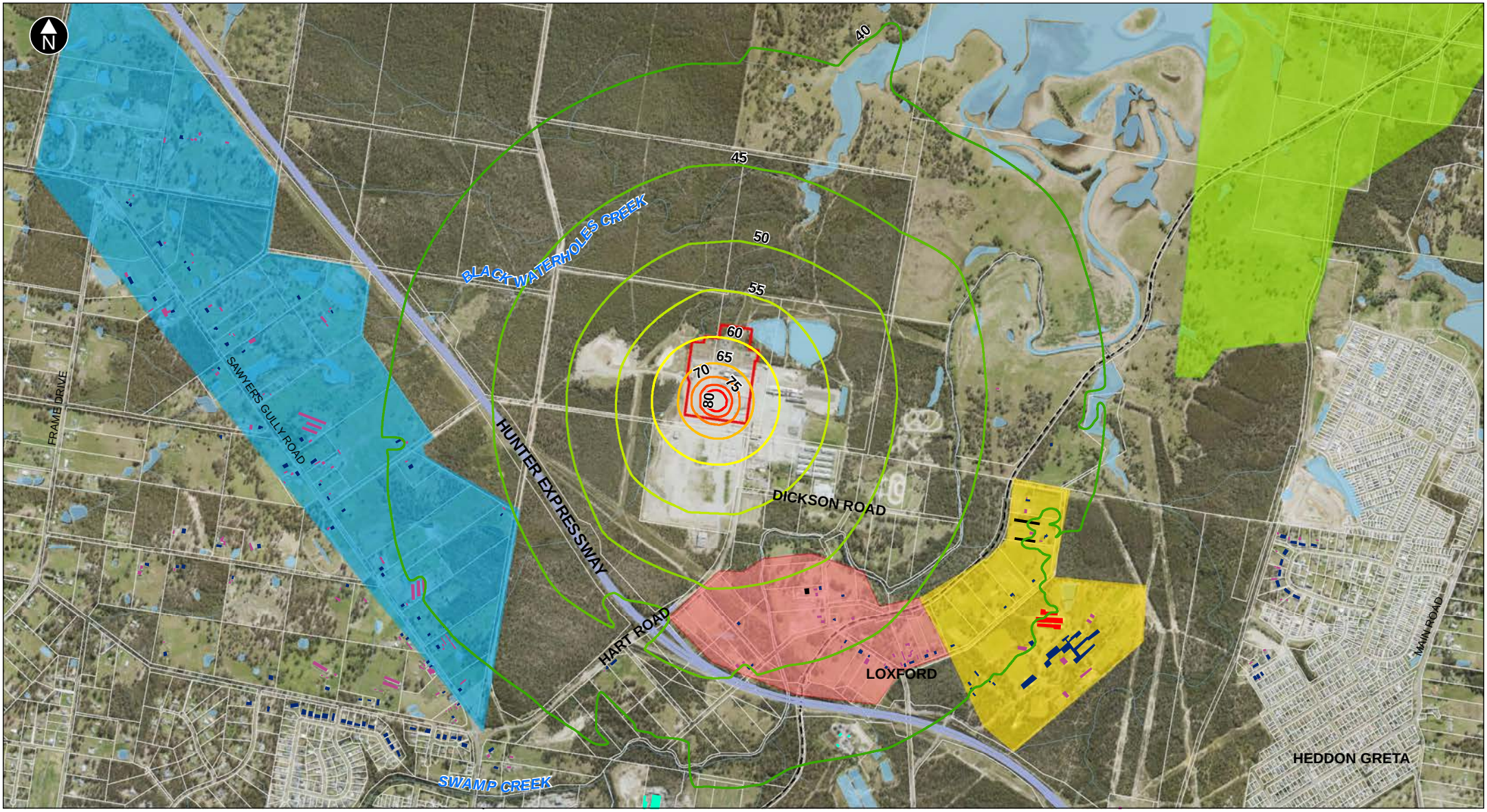


Proposal site
Motorway
Railway
Waterbodies

**Surrounding Receivers**
Commercial
Educational
Industrial
Residential
Unoccupied / Unused

**Noice catchment areas**
NCA 1
NCA 2
NCA 3
NCA 4

**Noise Contours LAeq,15min dB(A)**
40
45
50
55
60
65
70
75
80

0 0.5 1 km

***Representative frequency range: 16 Hz to 8000 Hz***

Modelling parameters:
- Calculation at 1.5m above ground
- 20°C temperature and 70% humidity
- Neutral weather conditions (Pasquill Grade D with wind speed of 3 m /s)
- Softground G = 1.0
- Calculation method: Concawe

1:25,000 at A4
GDA2020 MGA Zone 56

**Data sources:**
Jacobs
Metromap (Aerometrex) 2020
NSW Spatial Services

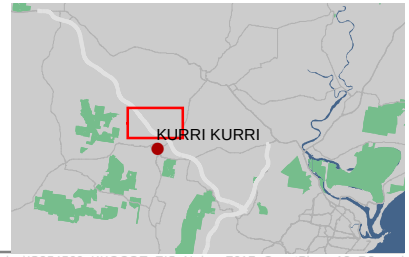


**Figure A-8** Construction Phase 8

snowy hydro renewable energy Jacobs

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Created by : AA | QA by : KI

# Appendix B. Operational noise contour maps

## B.1 Standard meteorological conditions

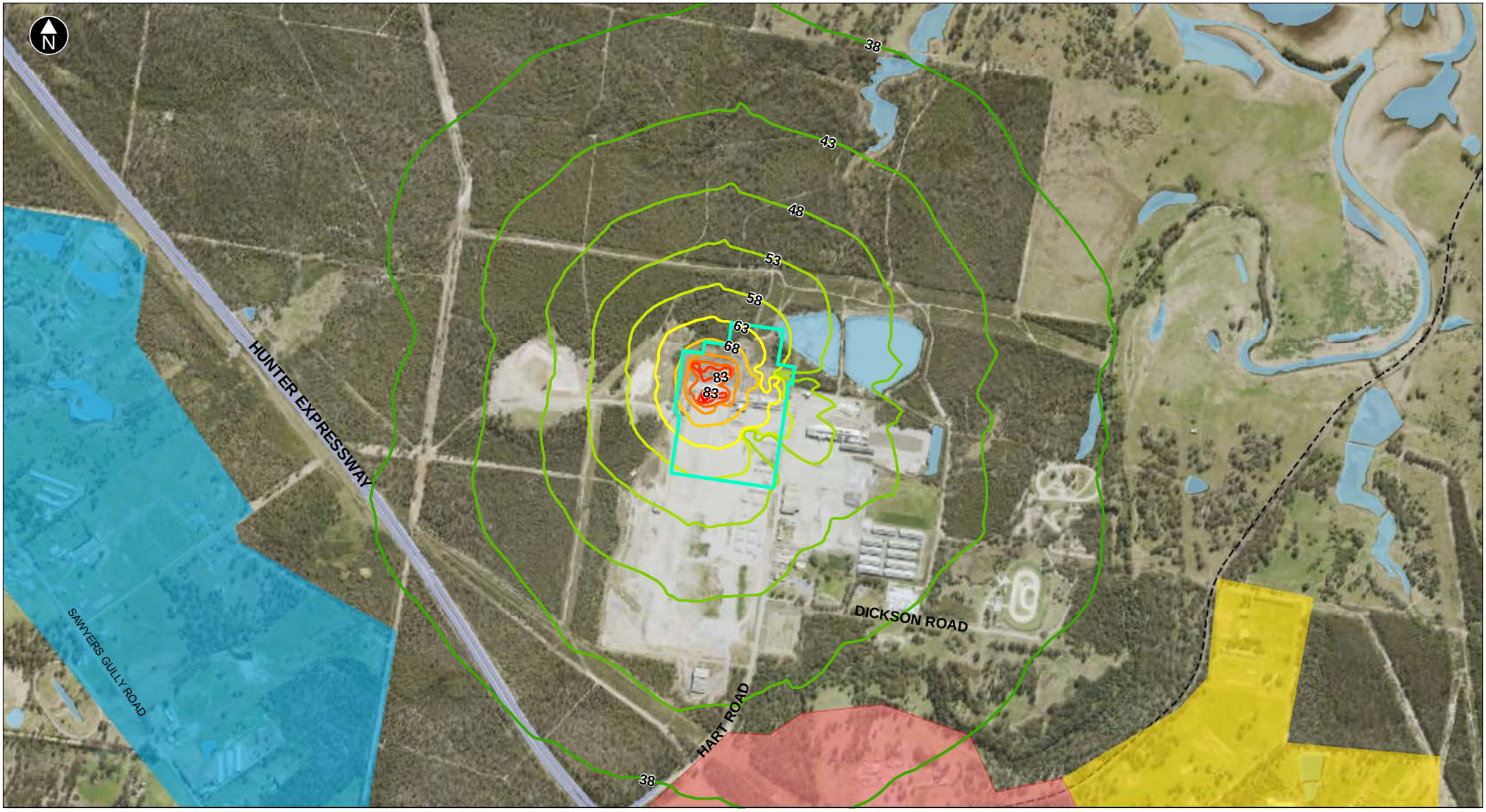


**Figure B-1** Attenuated F-Class OCGT Power Station – Standard Meteorological Conditions – dB(A)

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Created by : AA | QA by : KI


Proposal site
Motorway
Waterbodies
Exceedance of 68 dB(A) Industrial Limit
Exceedance of 63 dB(A) Commercial Limit
OCGT project setup

① Proposed Switchyard Area
② Proposed Plant Area
③ Proposed Buffer Area

0 250 500 m

***Representative frequency range: 16 Hz to 8000 Hz***

Modelling parameters:
- Calculation at 1.5m above ground
- 20°C temperature and 70% humidity
- Neutral weather conditions (Pasquill Grade D with wind speed of 0 m/s)
- Softground G = 1.0
- Calculation method: Concawe

1:7,500 at A4
GDA2020 MGA Zone 56

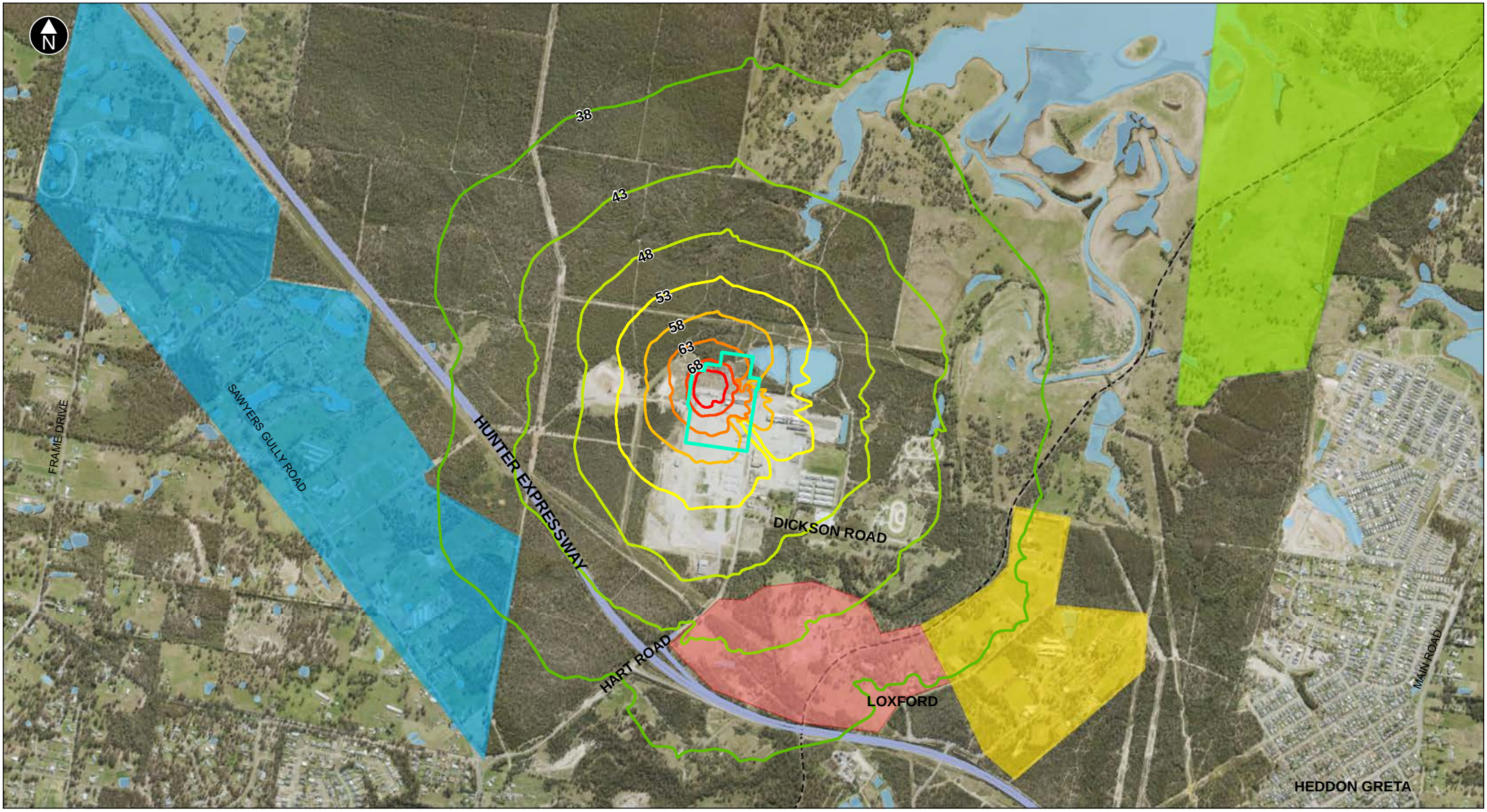
**Data sources:**
Jacobs
Metromap (Aerometrex) 2020
NSW Spatial Services


**Figure B-2** Attenuated F-Class OCGT Power Station – Standard Meteorological Conditions – dB(A)

snowy hydro renewable energy Jacobs

Date: 5/03/2021 Path: J:\IE\Projects\04_Eastern\IS354500\22_Spatial\GIS\Directory\Templates\Figures\KurriKurriEIS\Specialists\Noise\IS354500_KKOCGT_EIS_Noise_F030_OpPhase_StandardAttenuated_dBA_R2.mxd
Created by : AA | QA by : KI

## B.2 Noise-Enhancing Meteorological Conditions




Proposal site
Motorway
Railway
Waterbodies

**Noice catchment areas**
NCA 1
NCA 2
NCA 3
NCA 4

**Noise Level dB(A)**
38
43
48
53
58
63
68
73

0 1 2 km

***Representative frequency range: 16 Hz to 8000 Hz***
Modelling parameters:
- Calculation at 1.5m above ground
- 20°C temperature and 70% humidity
- Neutral weather conditions (Pasquill Grade D with wind speed of 3 m /s)
- Softground G = 1.0
- Calculation method: Concawe

1:25,000 at A4
GDA2020 MGA Zone 56

**Data sources:**
Jacobs
Metromap (Aerometrex) 2020
NSW Spatial Services

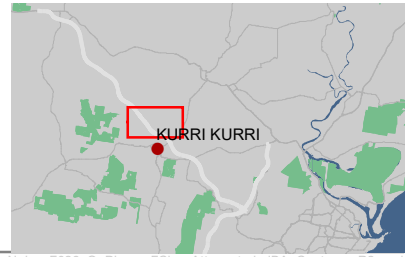



**Figure B-3** Attenuated F-Class OCGT Power Station – Adverse Meteorological Conditions – dB(A)

snowy hydro renewable energy Jacobs

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Created by : AA | QA by : KI


Proposal site
Motorway
Waterbodies
Exceedance of 68 dB(A) Industrial Limit
Exceedance of 63 dB(A) Commercial Limit
OCGT project setup

1 Proposed Switchyard Area
2 Proposed Plant Area
3 Proposed Buffer Area

0 250 500 m

***Representative frequency range: 16 Hz to 8000 Hz***

Modelling parameters:
- Calculation at 1.5m above ground
- 20°C temperature and 70% humidity
- Neutral weather conditions (Pasquill Grade D with wind speed of 3 m /s)
- Softground G = 1.0
- Calculation method: Concawe

1:7,500 at A4
GDA2020 MGA Zone 56

**Data sources:**
Jacobs
Metromap (Aerometrex) 2020
NSW Spatial Services

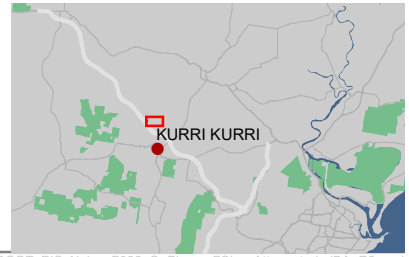


**Figure B-4** Attenuated F-Class OCGT Power Station – Adverse Meteorological Conditions – dB(A)

snowy hydro renewable energy Jacobs

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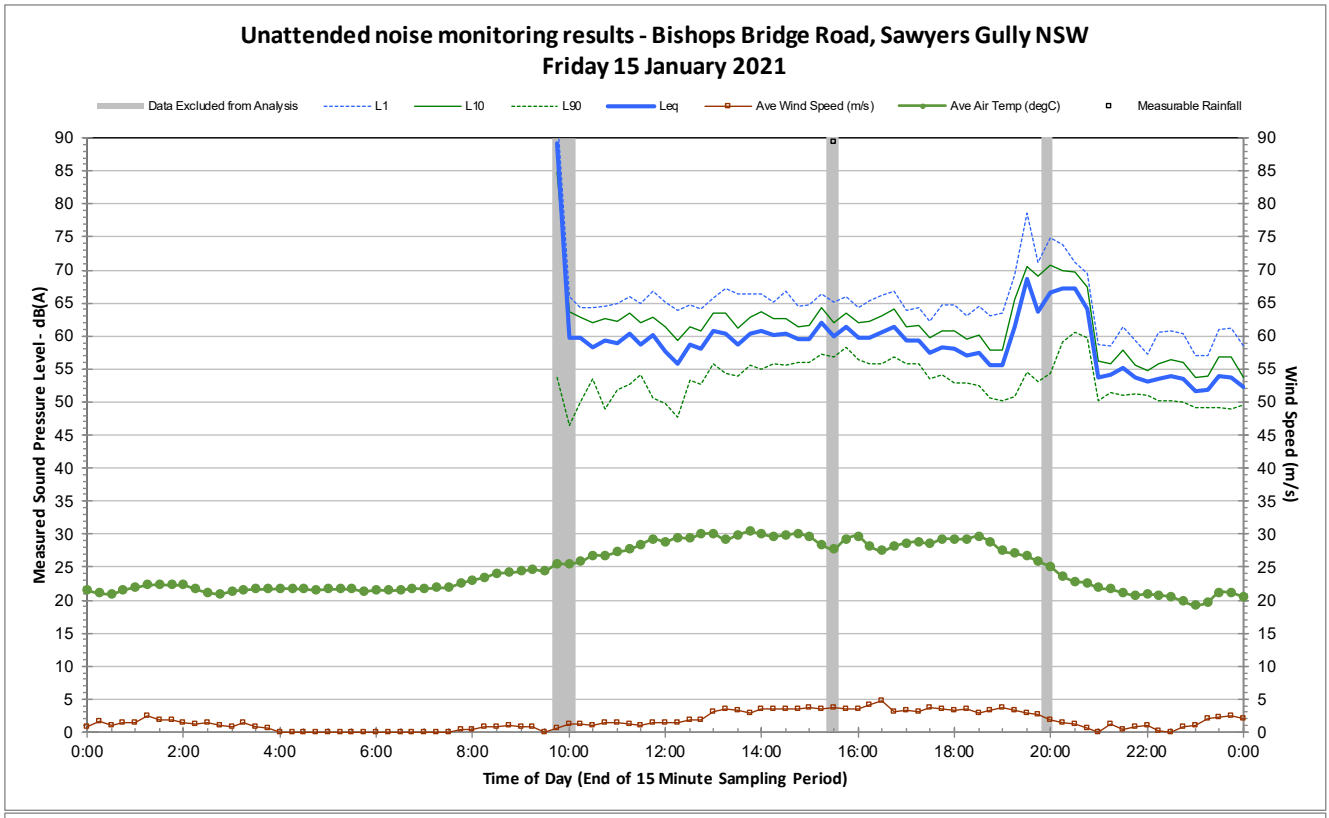
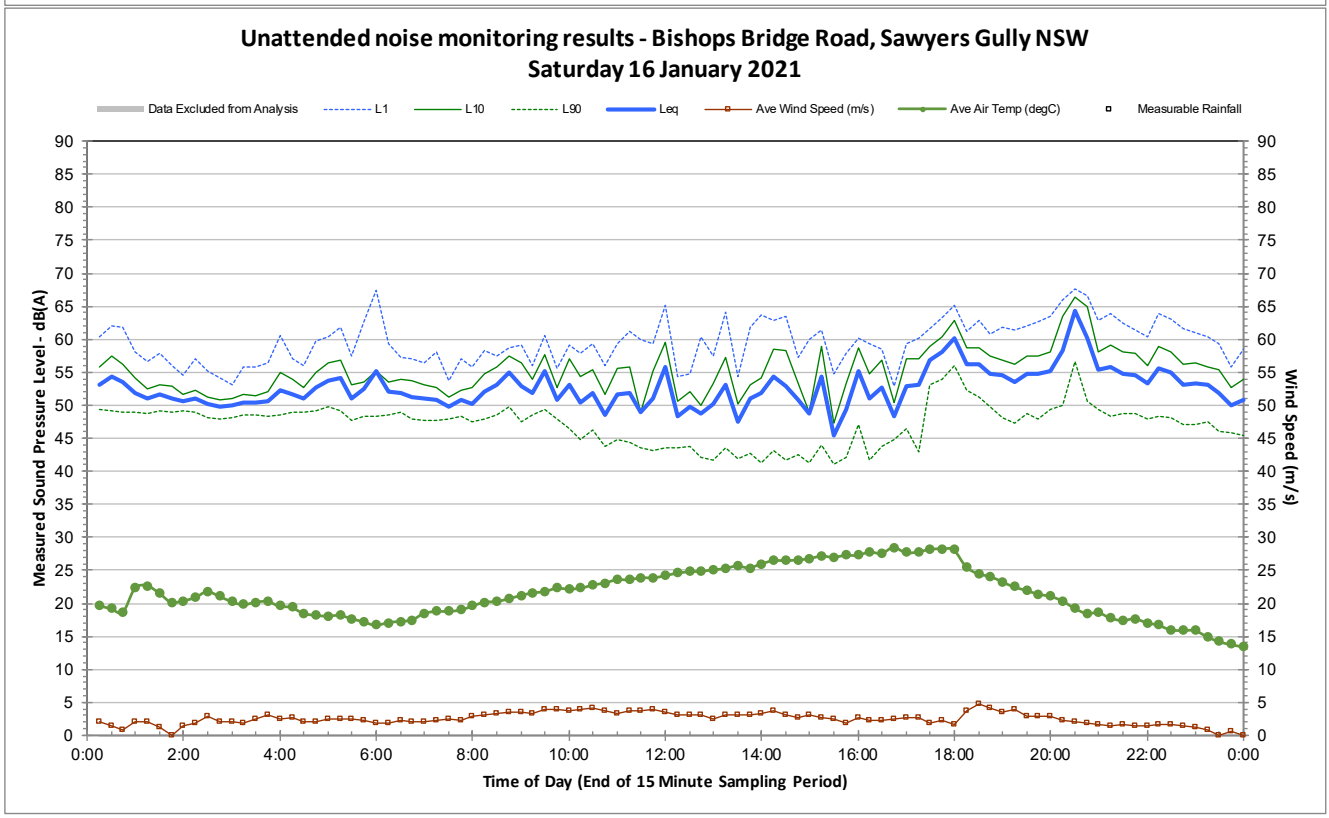
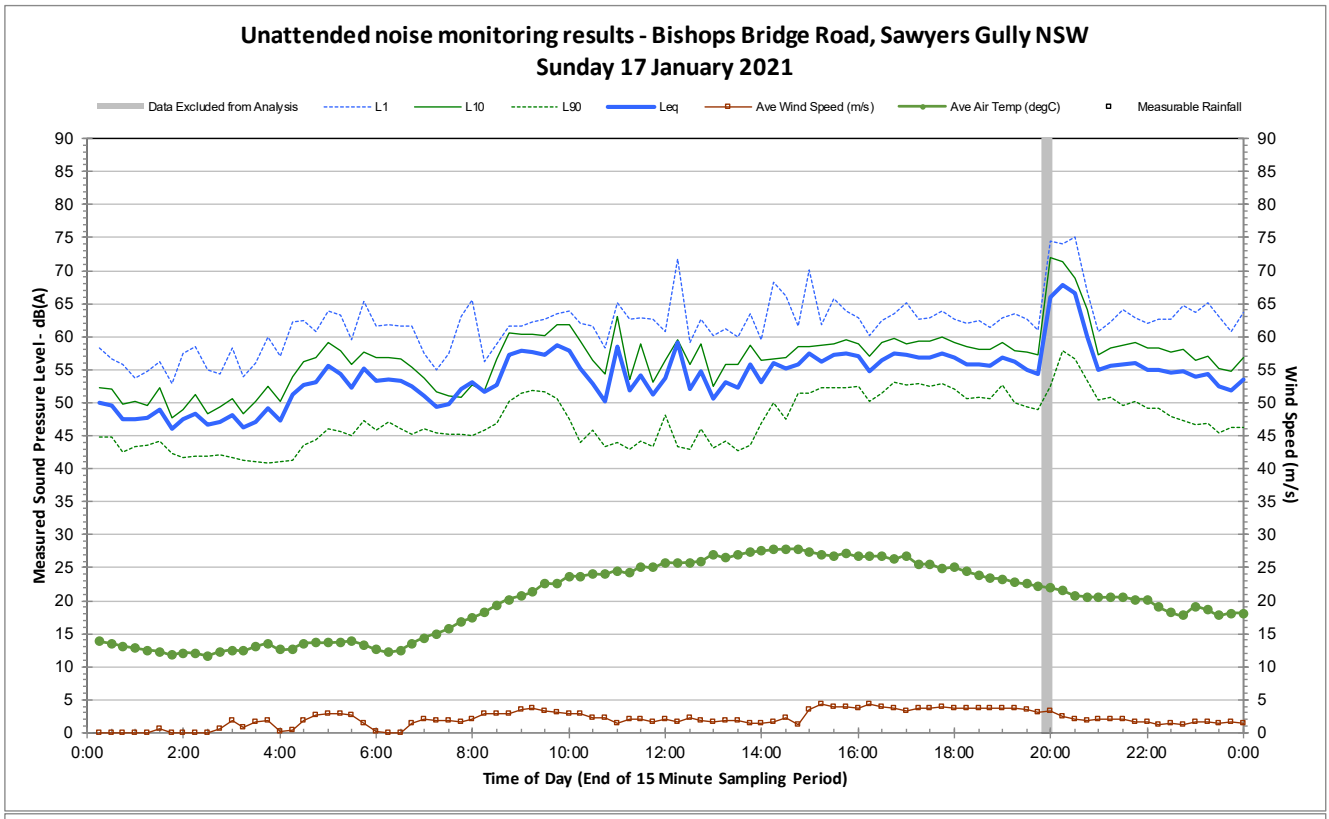
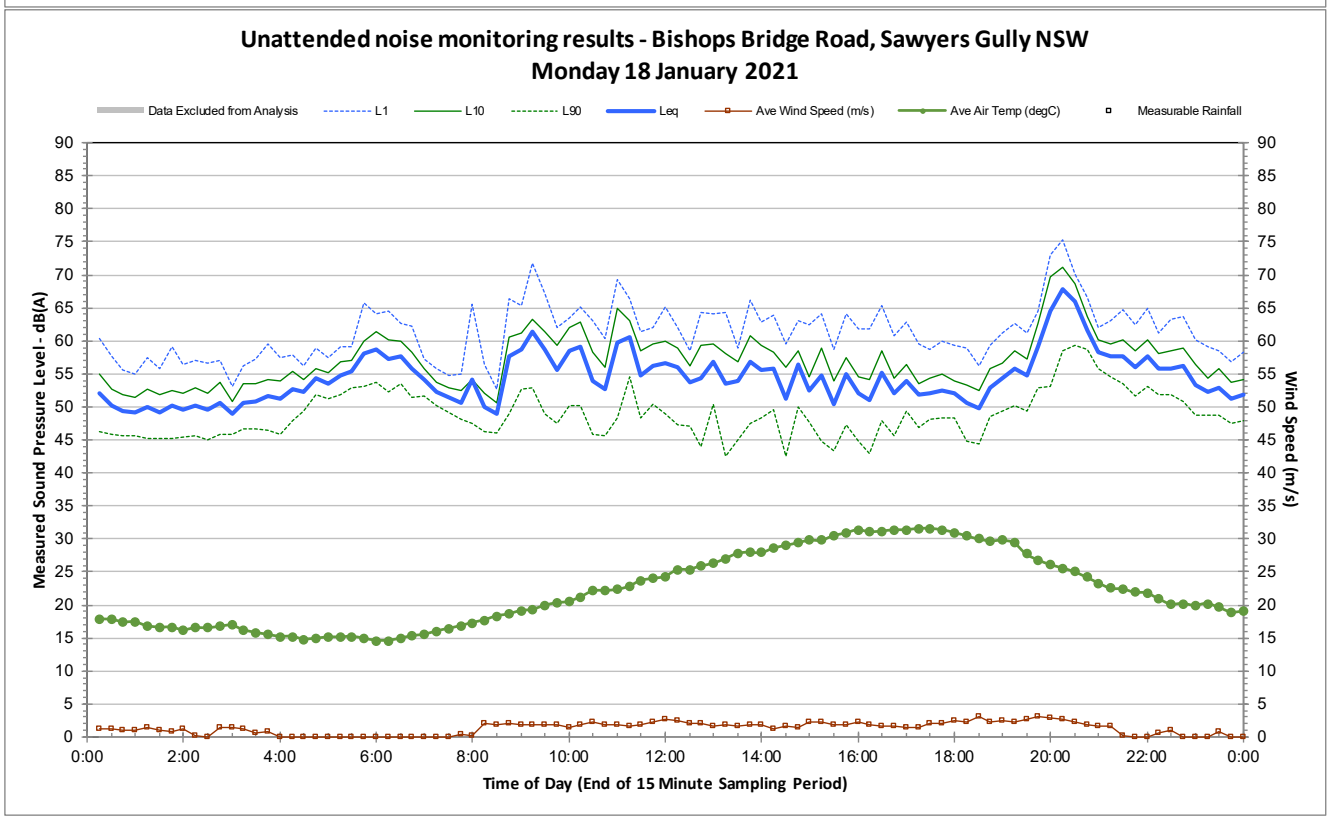
# Appendix C. Background noise levels

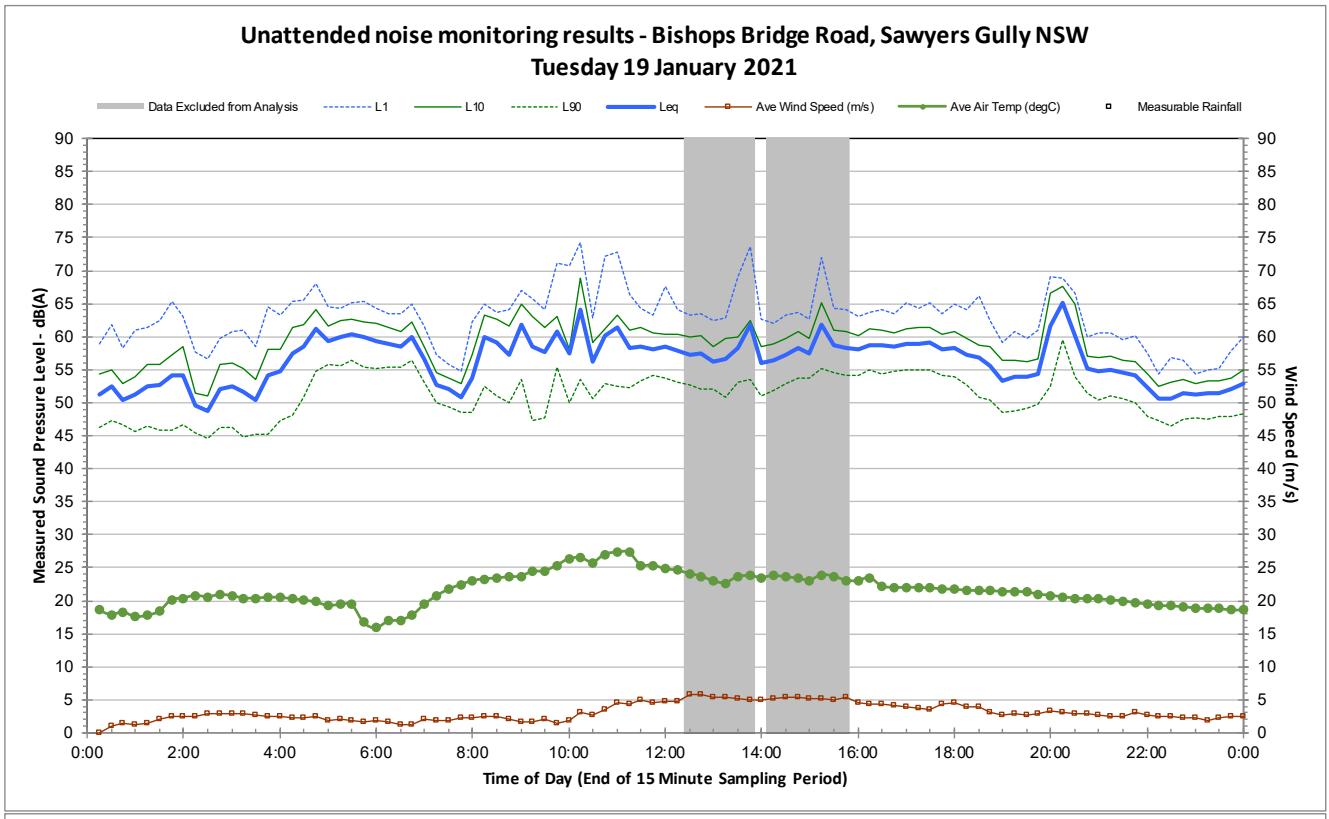
## C.1 Bishops Bridge Road, Sawyers Gully

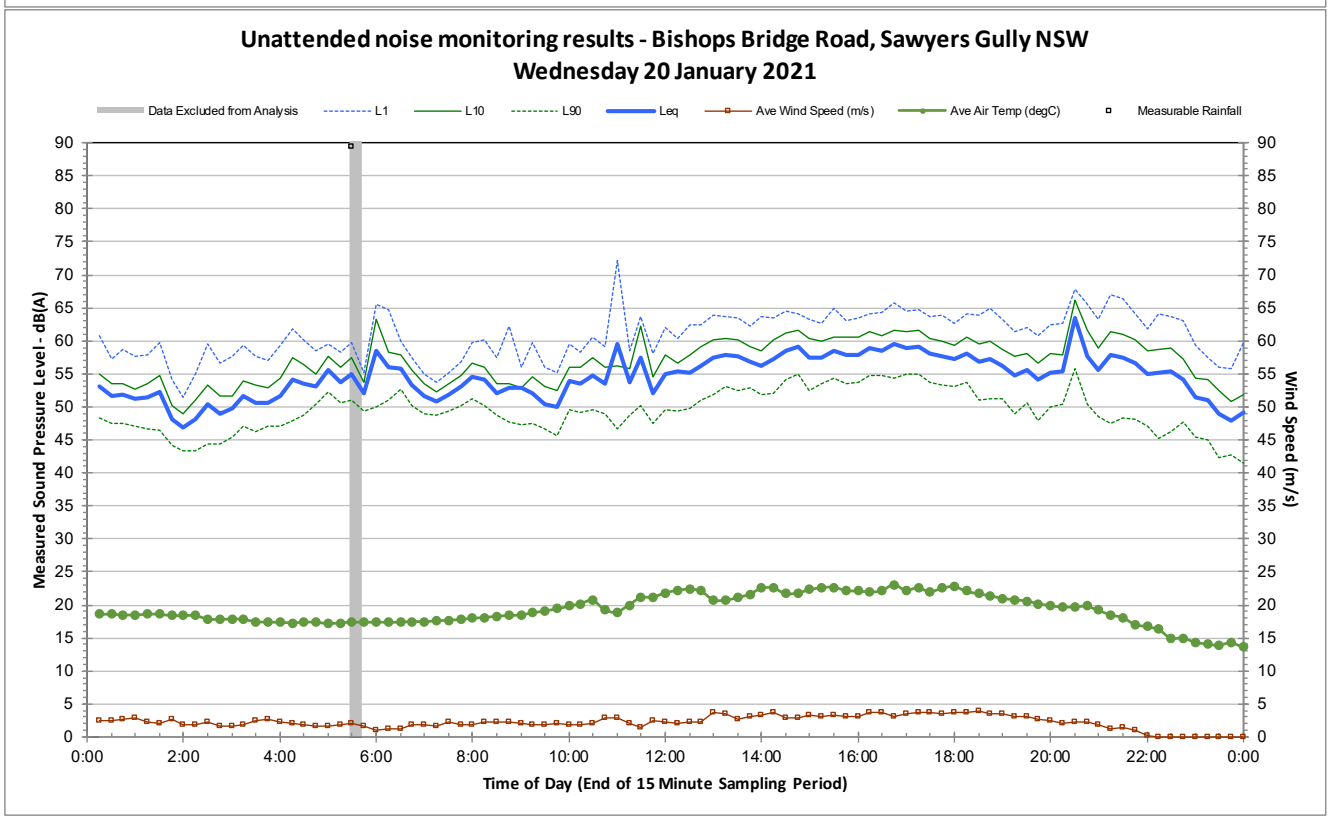


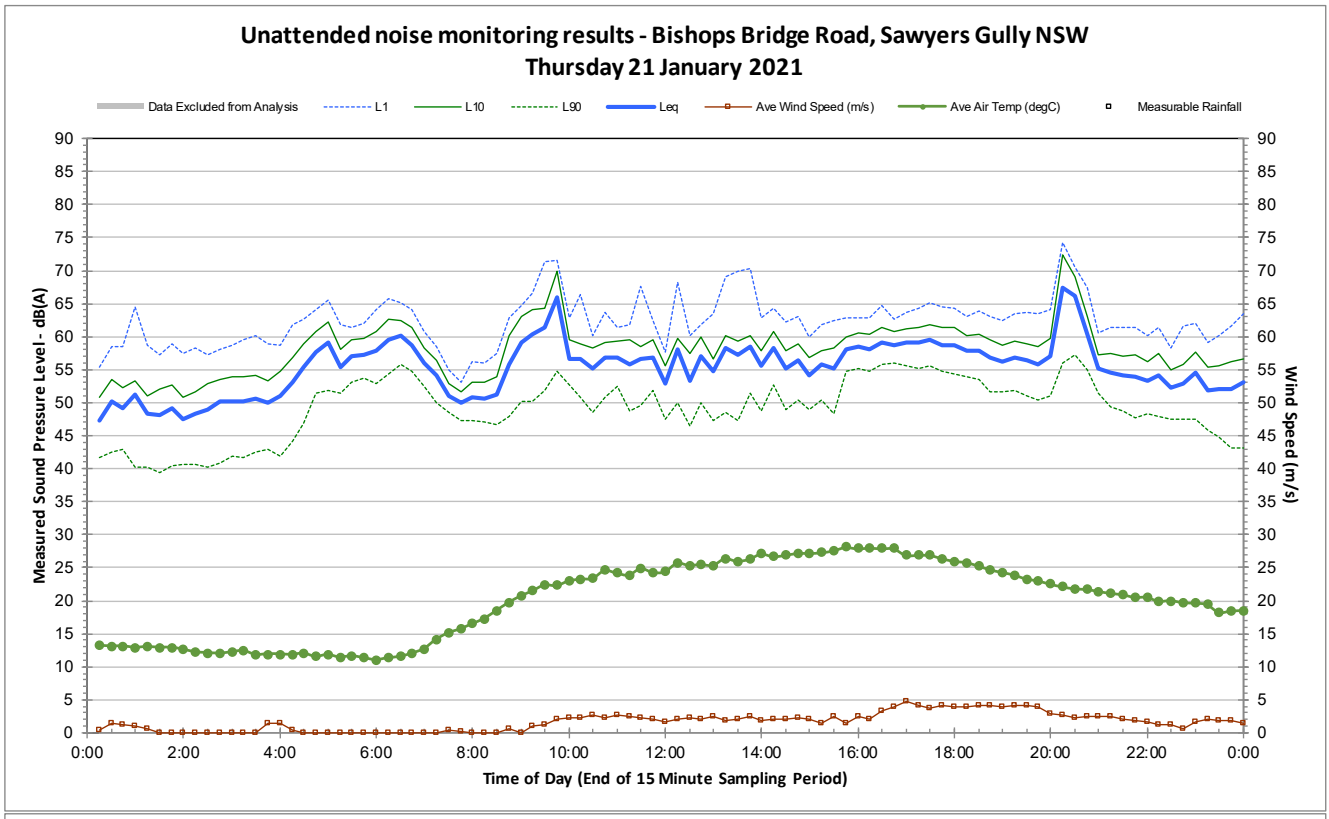



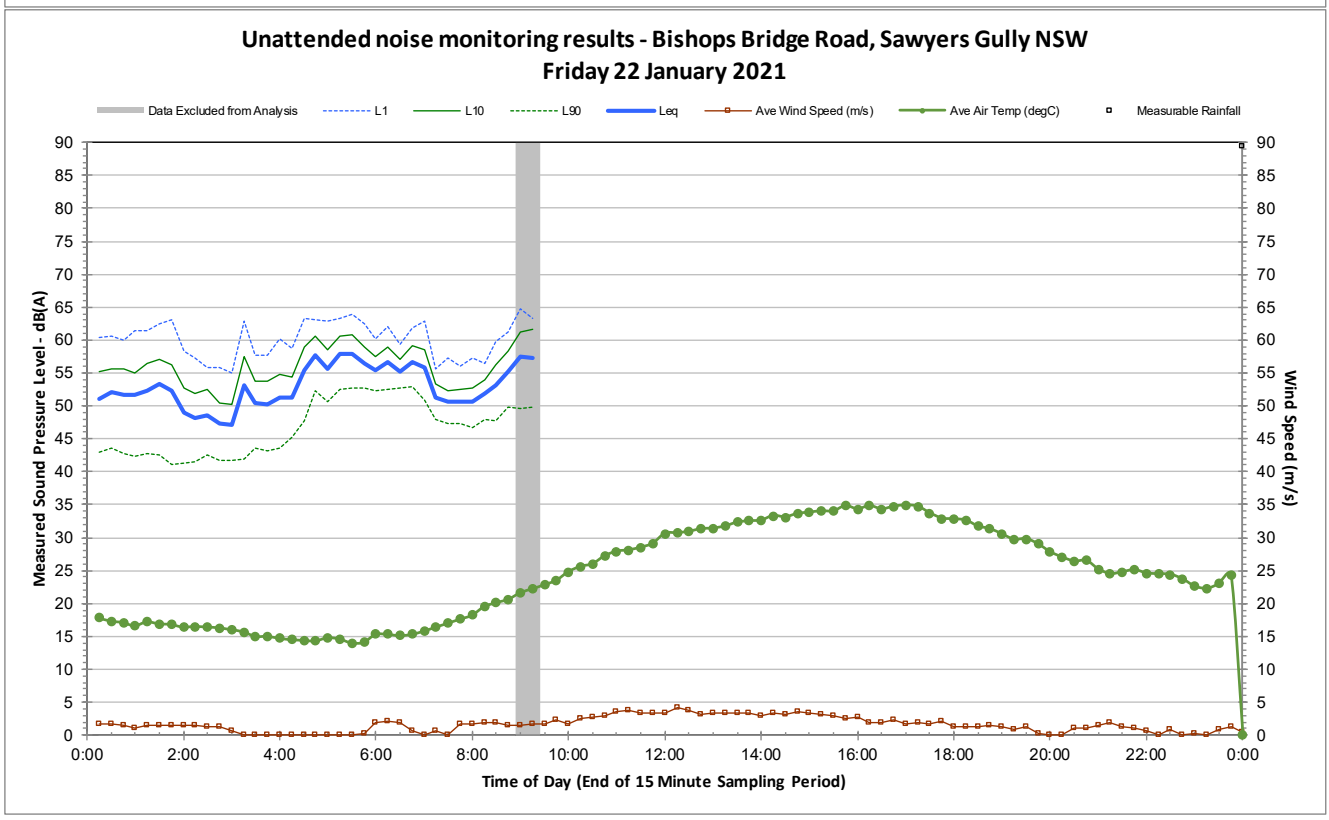

Unattended noise monitoring results - Bishops Bridge Road, Sawyers Gully NSW
Sunday 17 January 2021
Data Excluded from Analysis
L1
L10
L90
Leq
Ave Wind Speed (m/s)
Ave Air Temp (degC)
Measurable Rainfall
Measured Sound Pressure Level - dB(A)
Wind Speed (m/s)
Time of Day (End of 15 Minute Sampling Period)


Unattended noise monitoring results - Bishops Bridge Road, Sawyers Gully NSW
Monday 18 January 2021
Data Excluded from Analysis
L1
L10
L90
Leq
Ave Wind Speed (m/s)
Ave Air Temp (degC)
Measurable Rainfall
Measured Sound Pressure Level - dB(A)
Wind Speed (m/s)
Time of Day (End of 15 Minute Sampling Period)

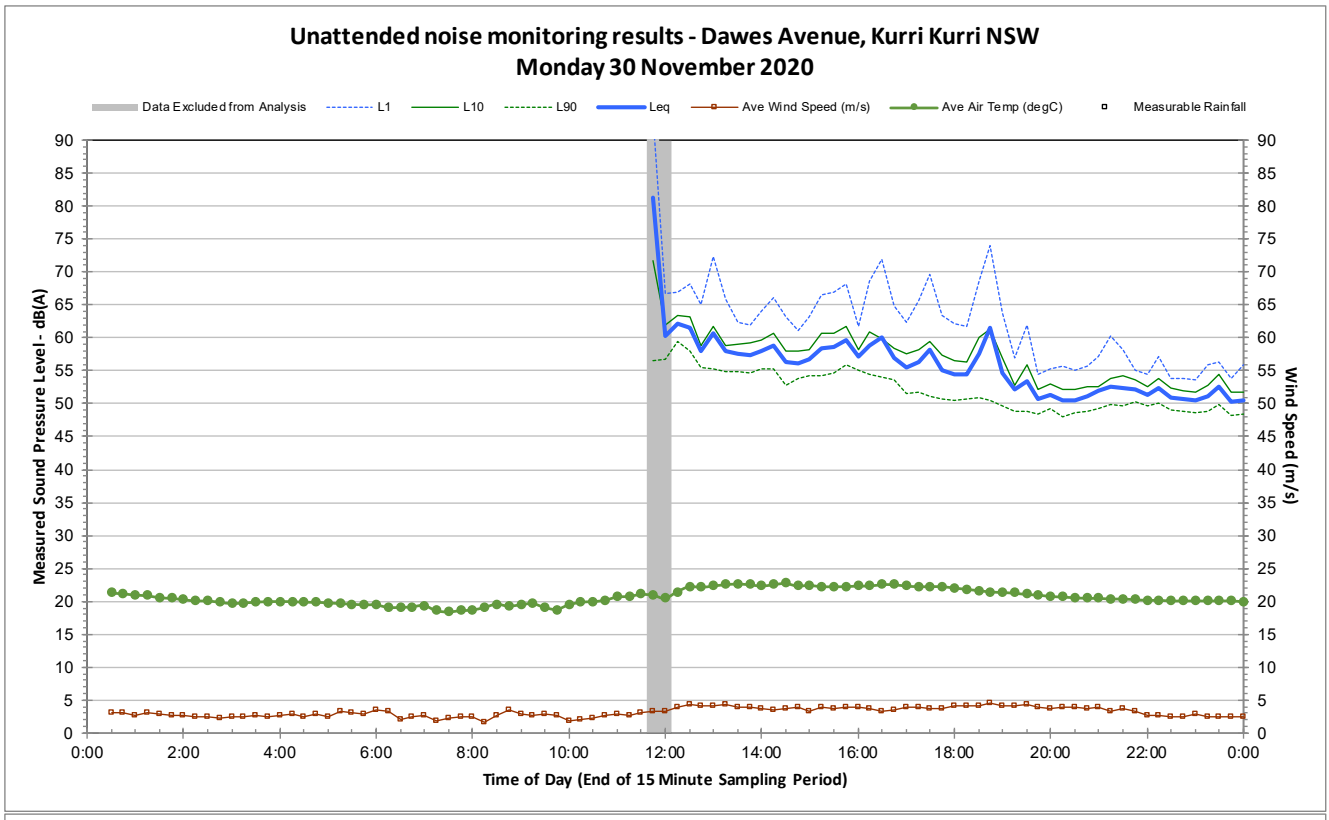

Unattended noise monitoring results - Bishops Bridge Road, Sawyers Gully NSW
Tuesday 19 January 2021
Data Excluded from Analysis
L1
L10
L90
Leq
Ave Wind Speed (m/s)
Ave Air Temp (degC)
Measurable Rainfall
Measured Sound Pressure Level - dB(A)
Wind Speed (m/s)
Time of Day (End of 15 Minute Sampling Period)

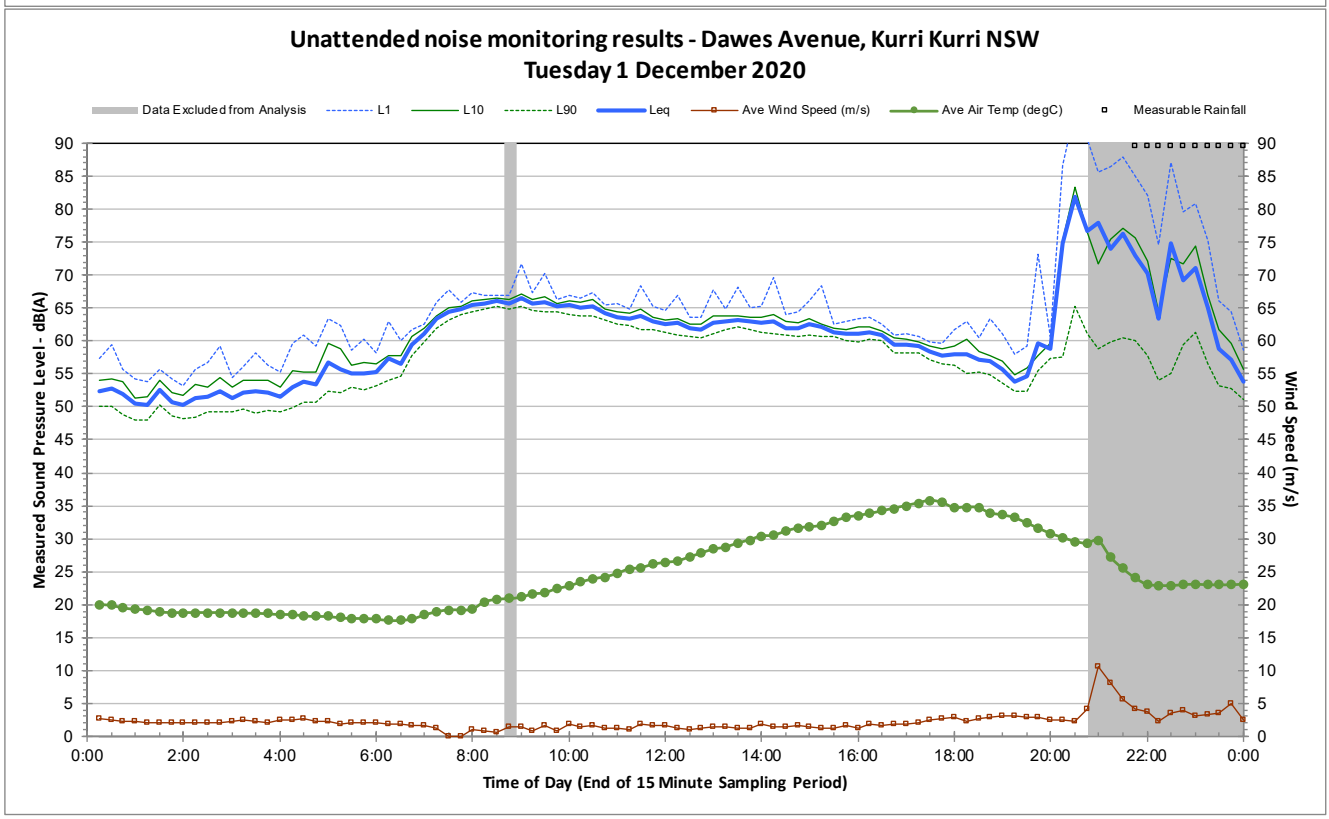

Unattended noise monitoring results - Bishops Bridge Road, Sawyers Gully NSW
Wednesday 20 January 2021
Data Excluded from Analysis
L1
L10
L90
Leq
Ave Wind Speed (m/s)
Ave Air Temp (degC)
Measurable Rainfall
Measured Sound Pressure Level - dB(A)
Wind Speed (m/s)
Time of Day (End of 15 Minute Sampling Period)

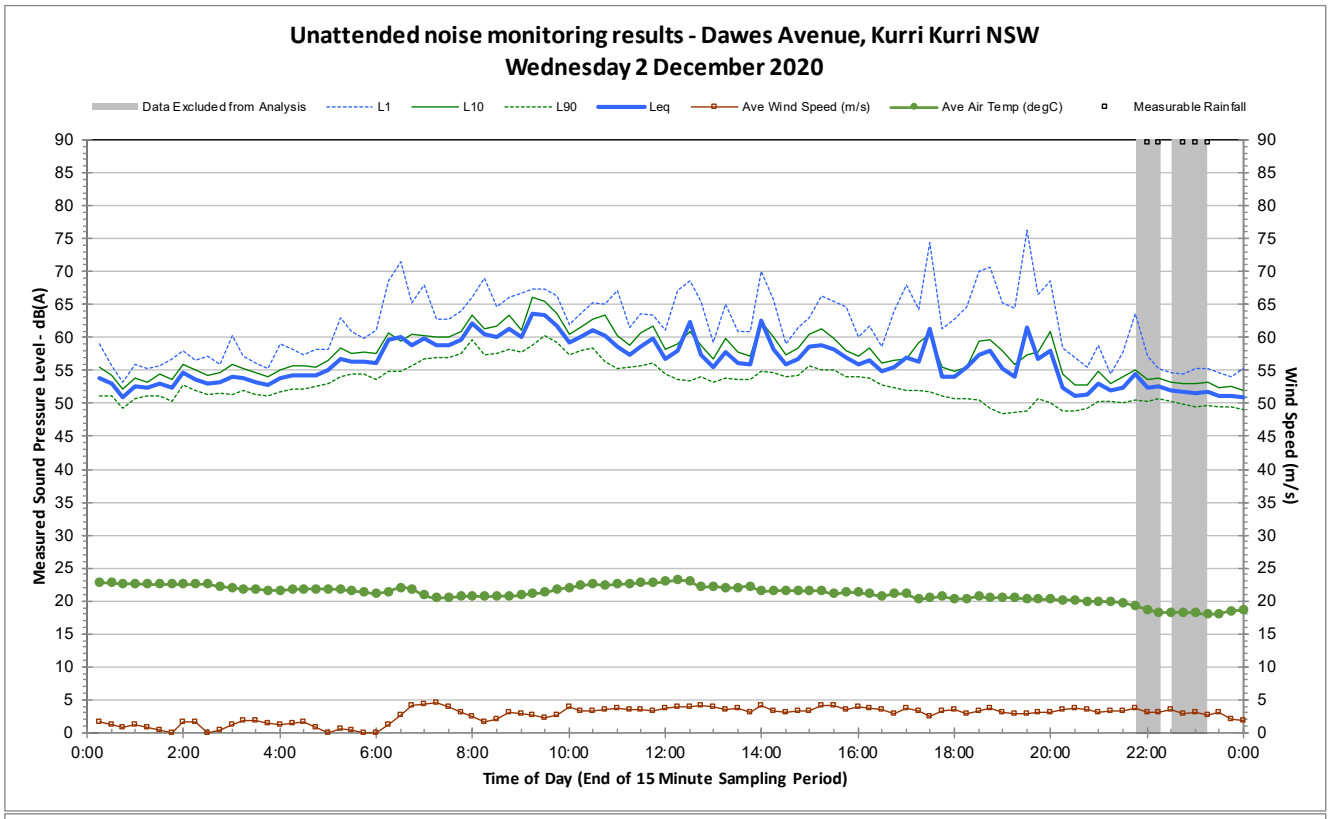

Unattended noise monitoring results - Bishops Bridge Road, Sawyers Gully NSW
Thursday 21 January 2021
Data Excluded from Analysis
L1
L10
L90
Leq
Ave Wind Speed (m/s)
Ave Air Temp (degC)
Measurable Rainfall
Measured Sound Pressure Level - dB(A)
Wind Speed (m/s)
Time of Day (End of 15 Minute Sampling Period)

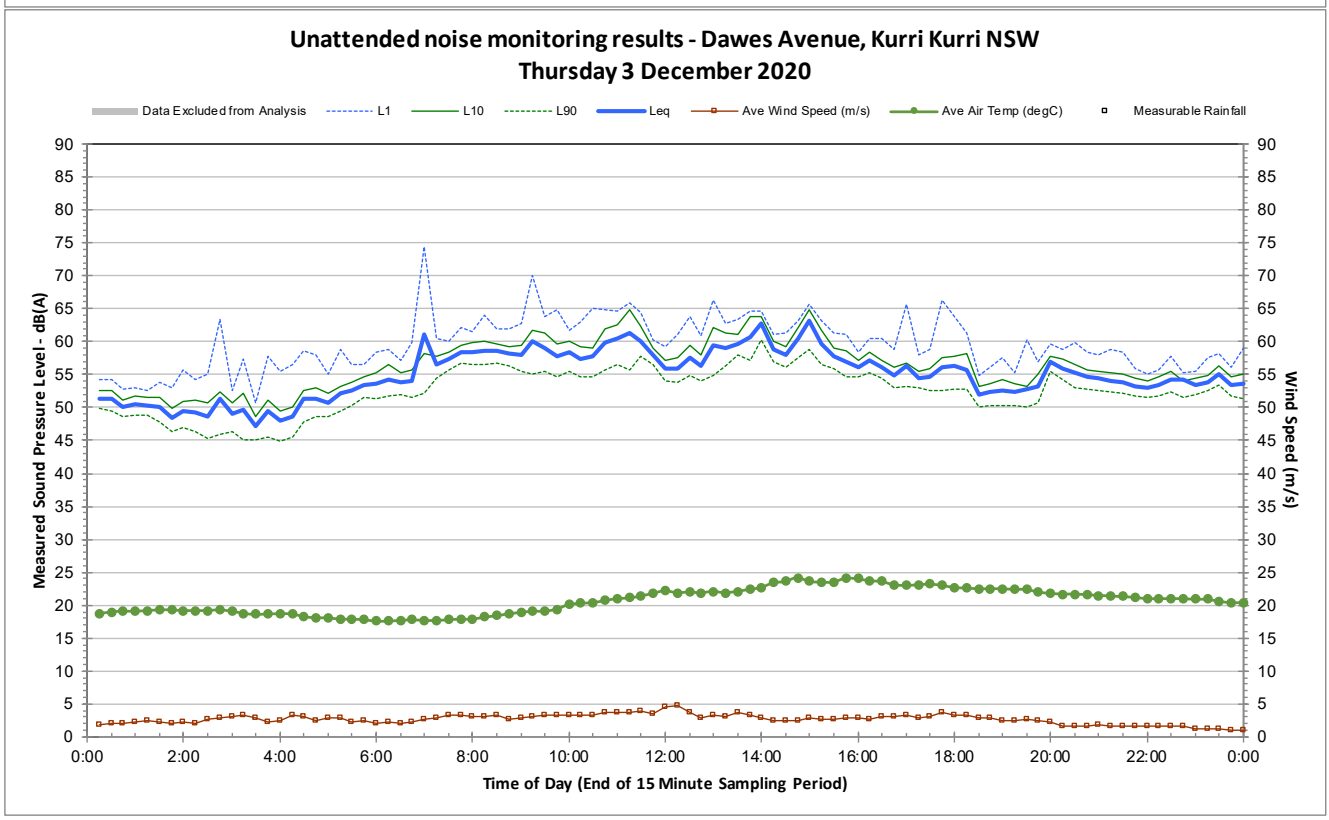

Unattended noise monitoring results - Bishops Bridge Road, Sawyers Gully NSW
Friday 22 January 2021
Data Excluded from Analysis
L1
L10
L90
Leq
Ave Wind Speed (m/s)
Ave Air Temp (degC)
Measurable Rainfall
Measured Sound Pressure Level - dB(A)
Wind Speed (m/s)
Time of Day (End of 15 Minute Sampling Period)

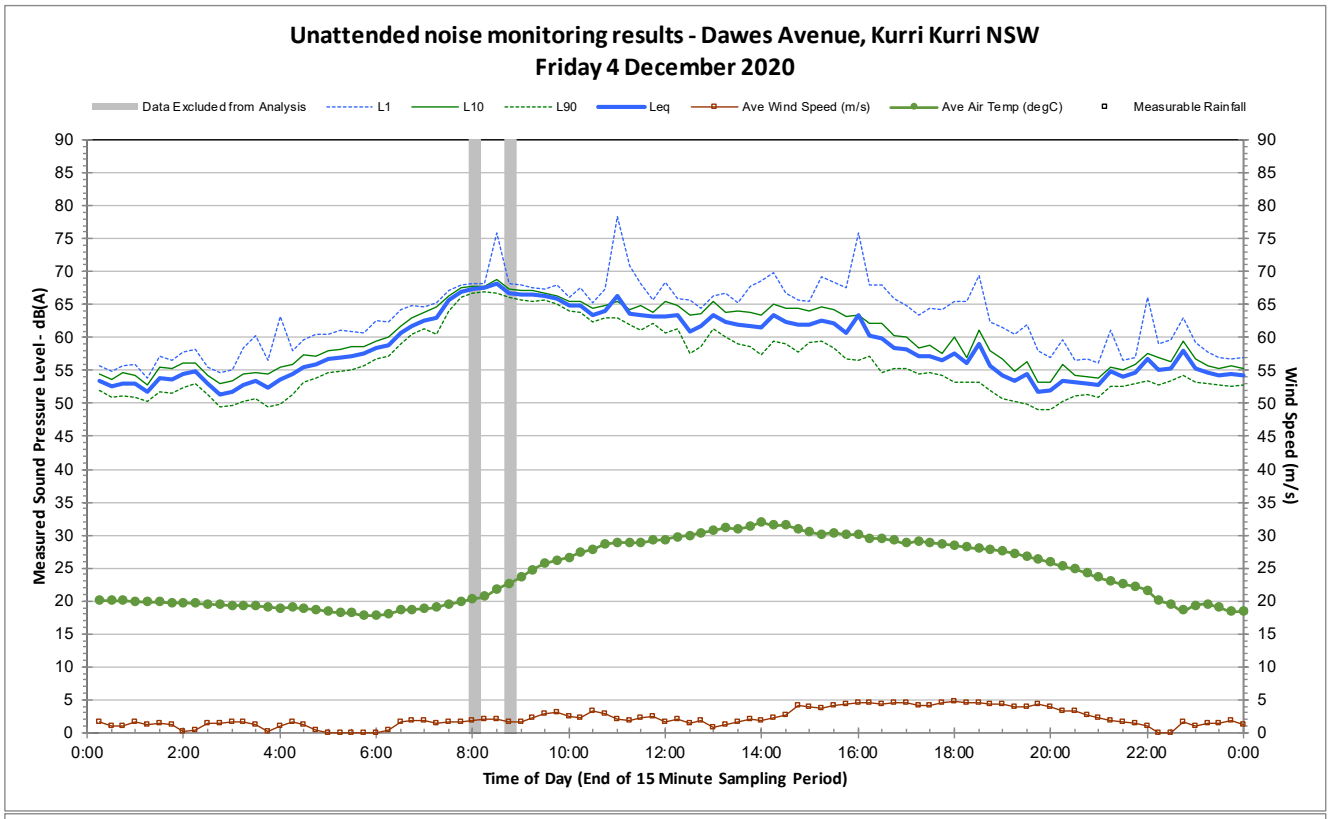
## C.2 Dawes Avenue, Loxford

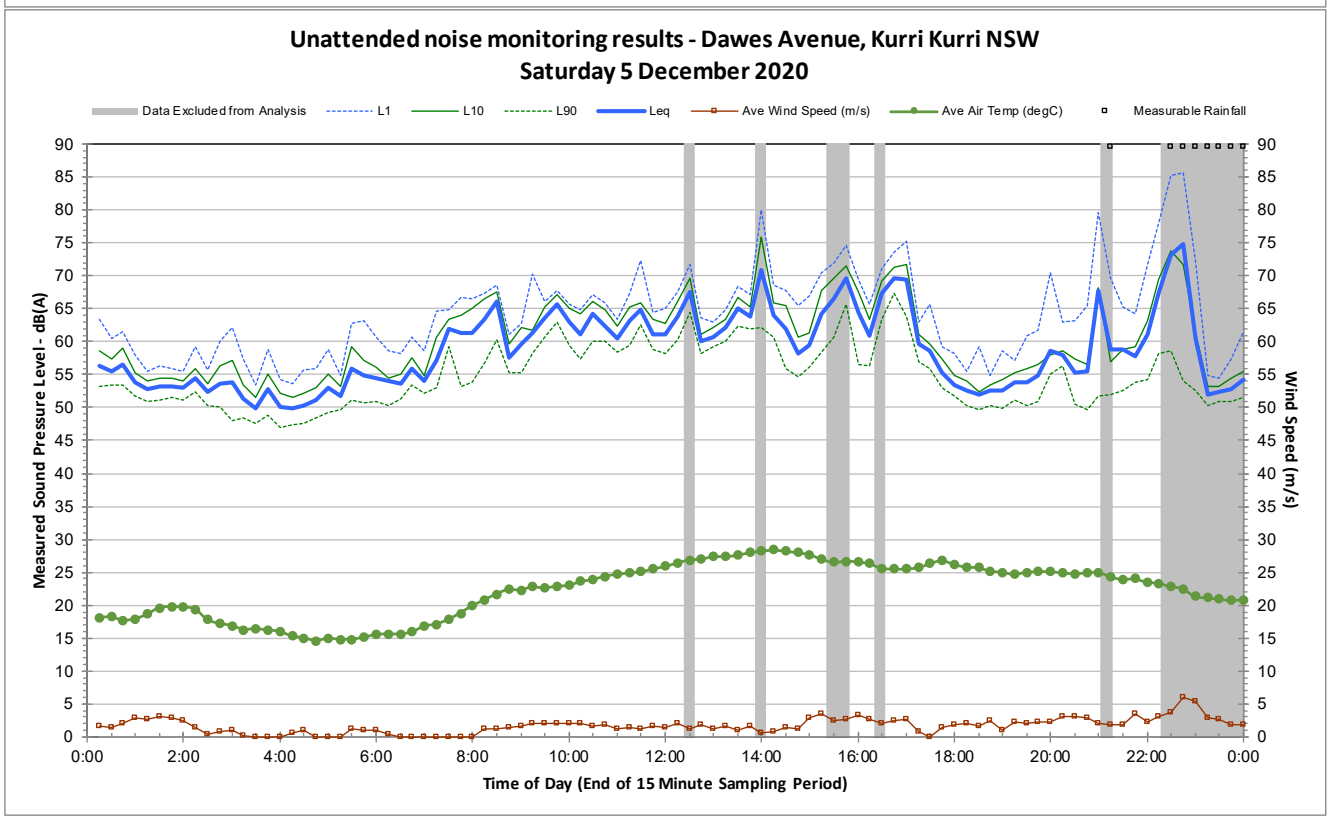


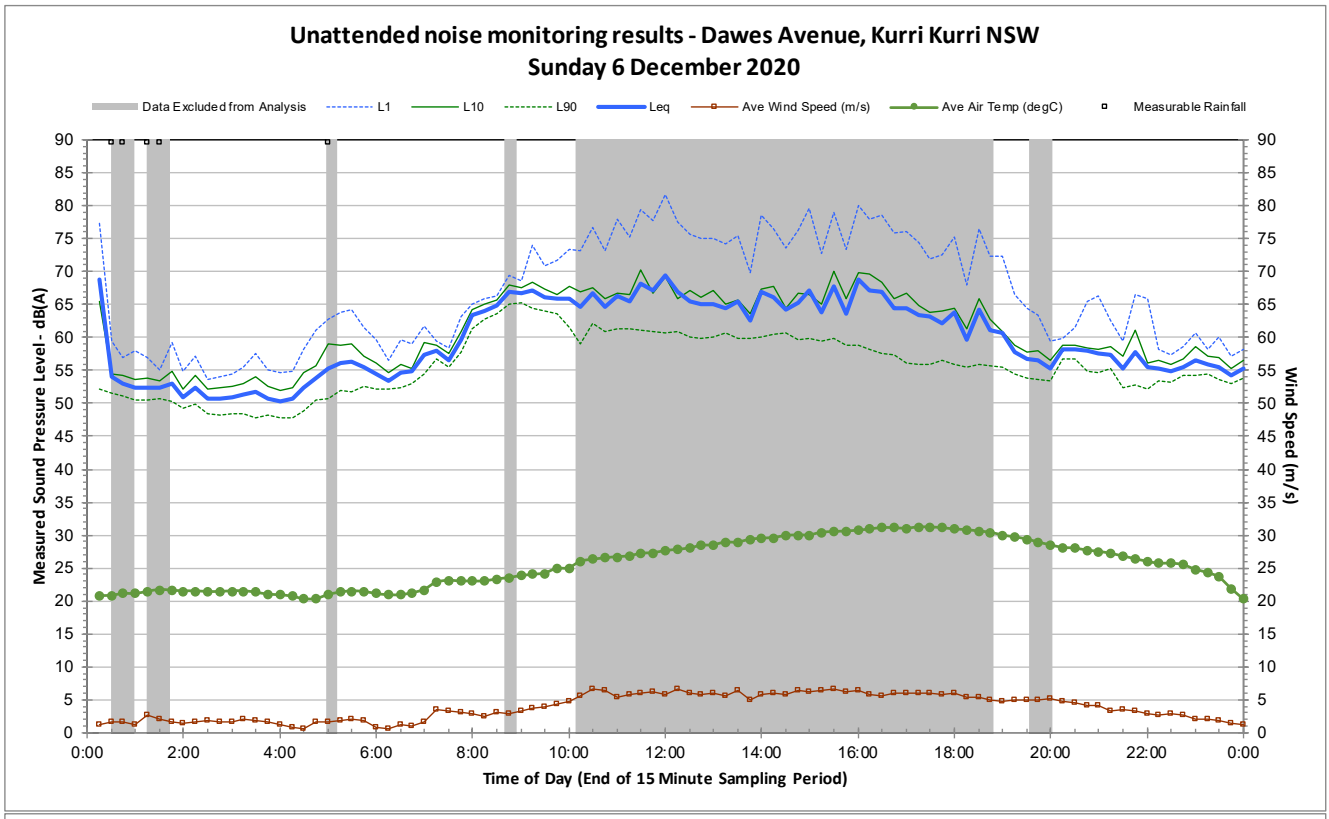



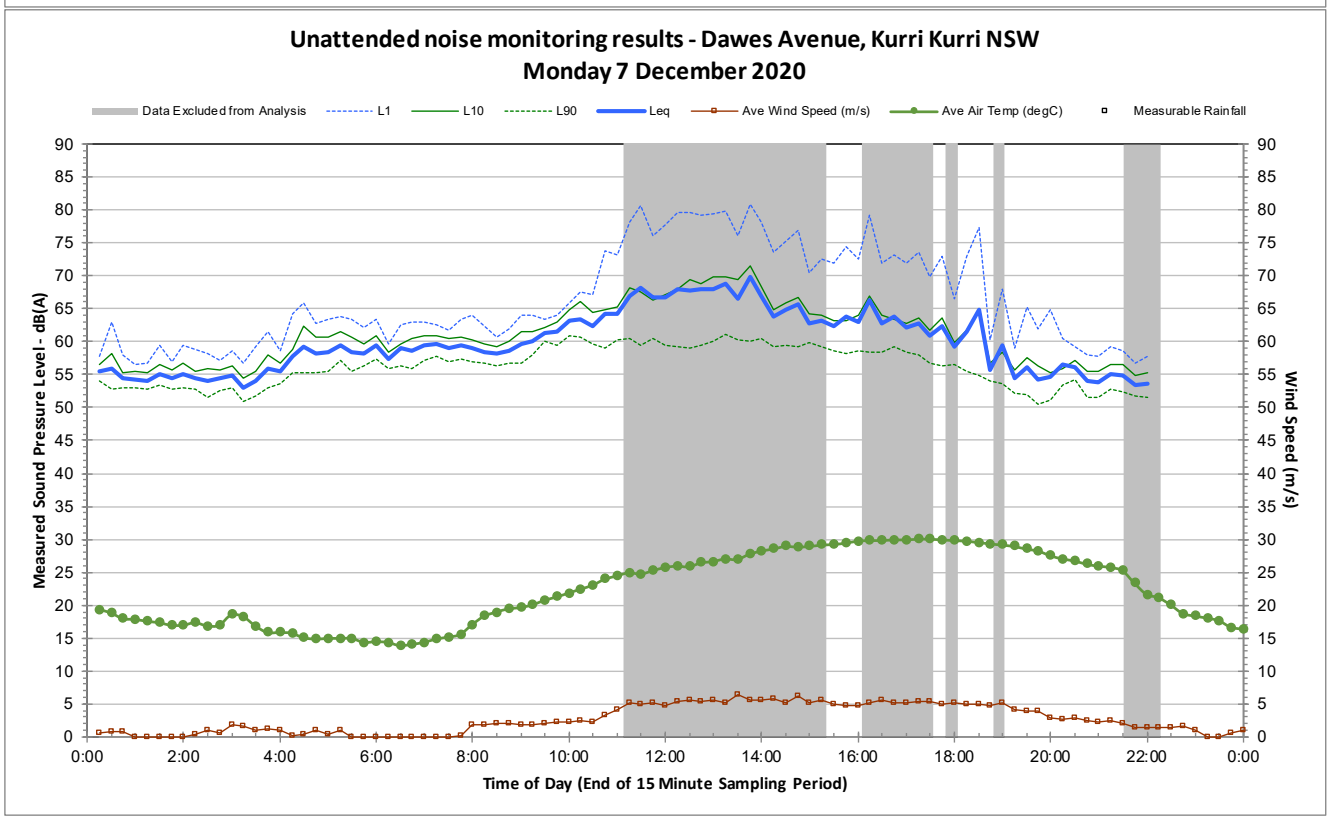

Unattended noise monitoring results - Dawes Avenue, Kurri Kurri NSW
Wednesday 2 December 2020
Data Excluded from Analysis
L1
L10
L90
Leq
Ave Wind Speed (m/s)
Ave Air Temp (degC)
Measurable Rainfall
Measured Sound Pressure Level - dB(A)
Wind Speed (m/s)
Time of Day (End of 15 Minute Sampling Period)


Unattended noise monitoring results - Dawes Avenue, Kurri Kurri NSW
Thursday 3 December 2020
Data Excluded from Analysis
L1
L10
L90
Leq
Ave Wind Speed (m/s)
Ave Air Temp (degC)
Measurable Rainfall
Measured Sound Pressure Level - dB(A)
Wind Speed (m/s)
Time of Day (End of 15 Minute Sampling Period)

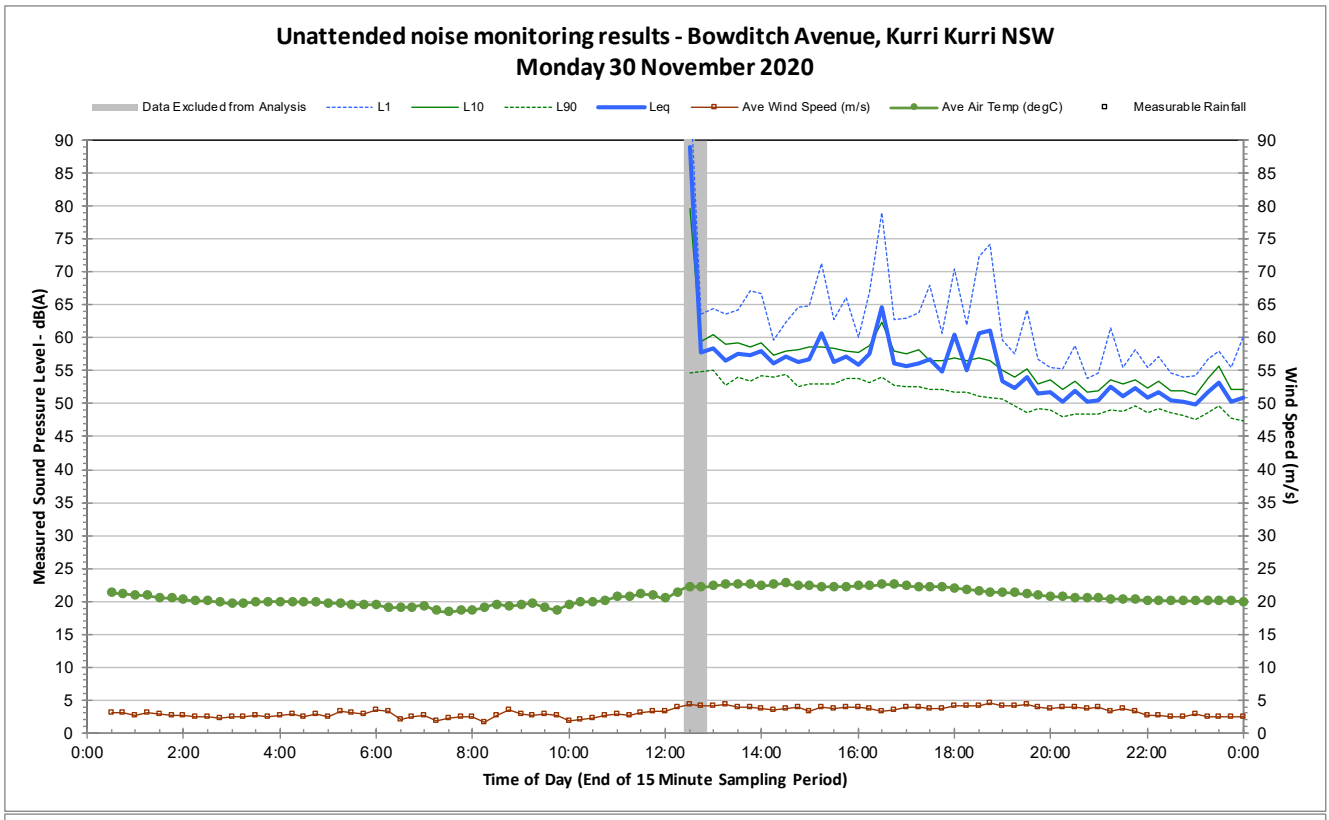

Unattended noise monitoring results - Dawes Avenue, Kurri Kurri NSW
Friday 4 December 2020
Data Excluded from Analysis
L1
L10
L90
Leq
Ave Wind Speed (m/s)
Ave Air Temp (degC)
Measurable Rainfall
Measured Sound Pressure Level - dB(A)
Wind Speed (m/s)
Time of Day (End of 15 Minute Sampling Period)

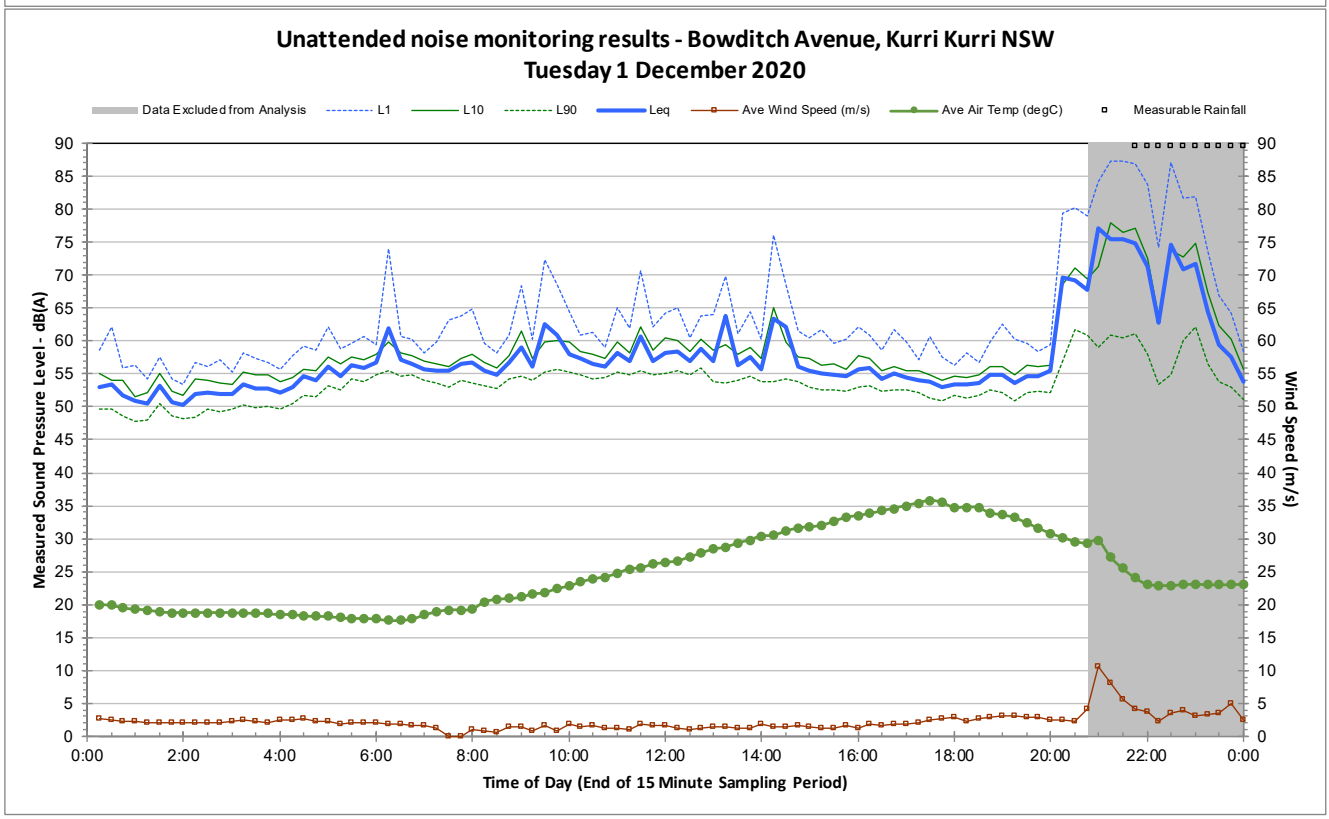

Unattended noise monitoring results - Dawes Avenue, Kurri Kurri NSW
Saturday 5 December 2020
Data Excluded from Analysis
L1
L10
L90
Leq
Ave Wind Speed (m/s)
Ave Air Temp (degC)
Measurable Rainfall
Measured Sound Pressure Level - dB(A)
Wind Speed (m/s)
Time of Day (End of 15 Minute Sampling Period)

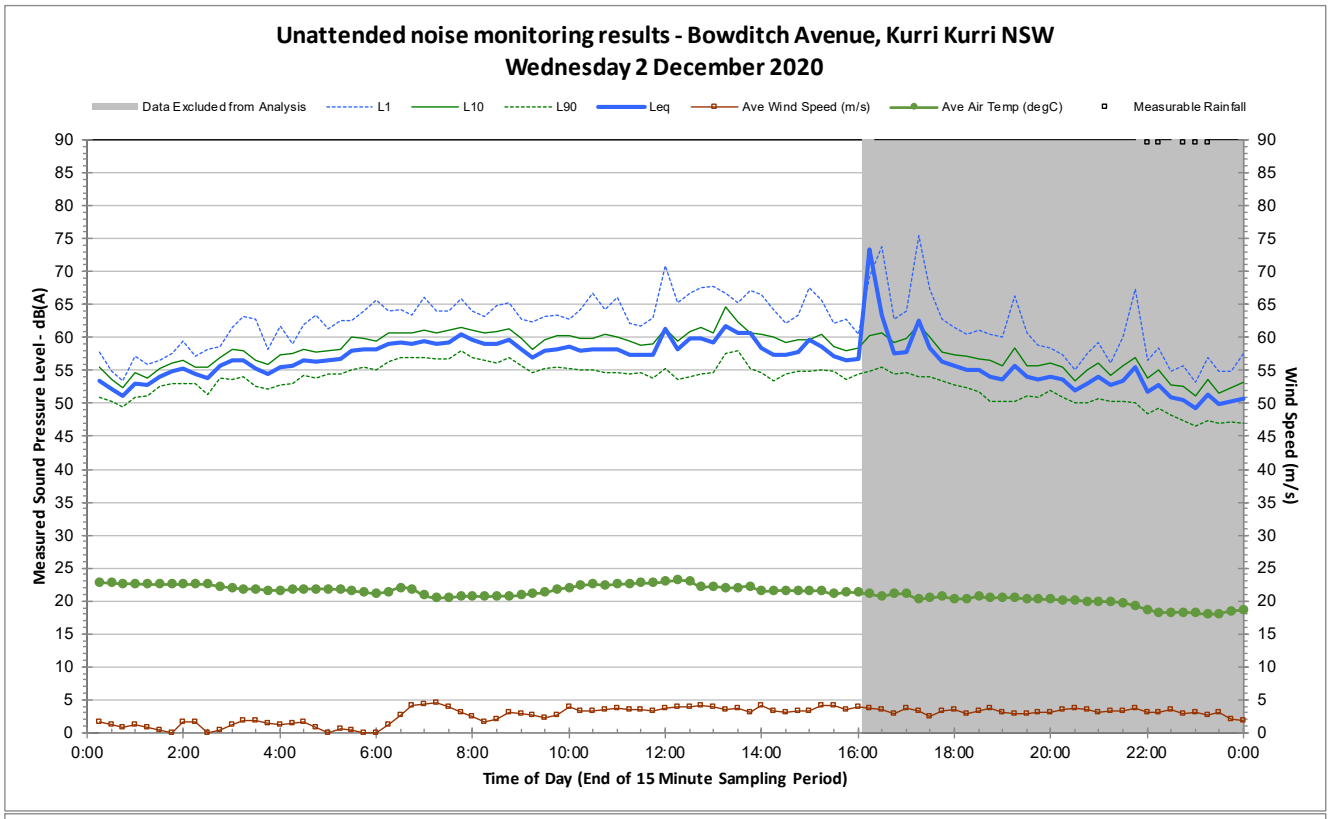

Unattended noise monitoring results - Dawes Avenue, Kurri Kurri NSW
Sunday 6 December 2020
Data Excluded from Analysis
L1
L10
L90
Leq
Ave Wind Speed (m/s)
Ave Air Temp (degC)
Measurable Rainfall
Measured Sound Pressure Level - dB(A)
Wind Speed (m/s)
Time of Day (End of 15 Minute Sampling Period)

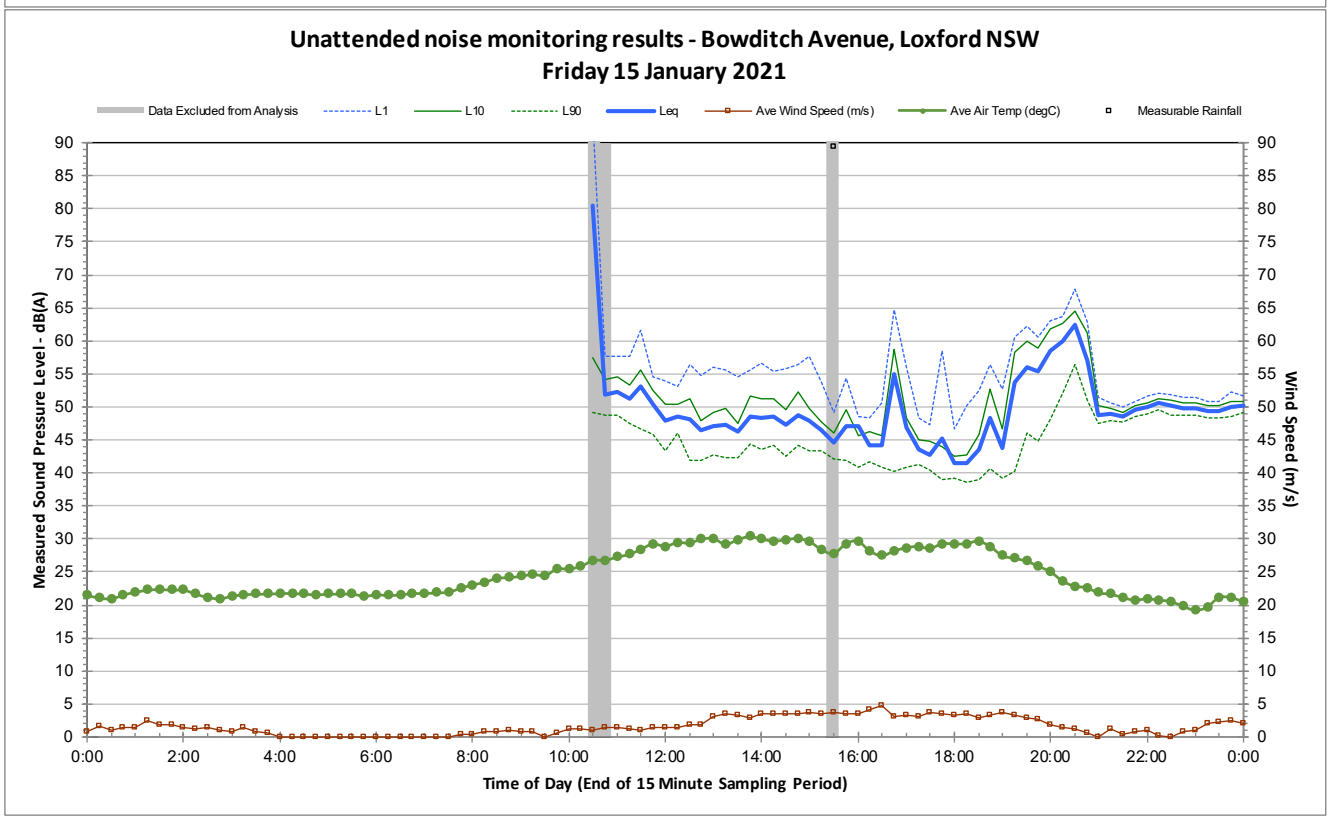

Unattended noise monitoring results - Dawes Avenue, Kurri Kurri NSW
Monday 7 December 2020
Data Excluded from Analysis
L1
L10
L90
Leq
Ave Wind Speed (m/s)
Ave Air Temp (degC)
Measurable Rainfall
Measured Sound Pressure Level - dB(A)
Wind Speed (m/s)
Time of Day (End of 15 Minute Sampling Period)

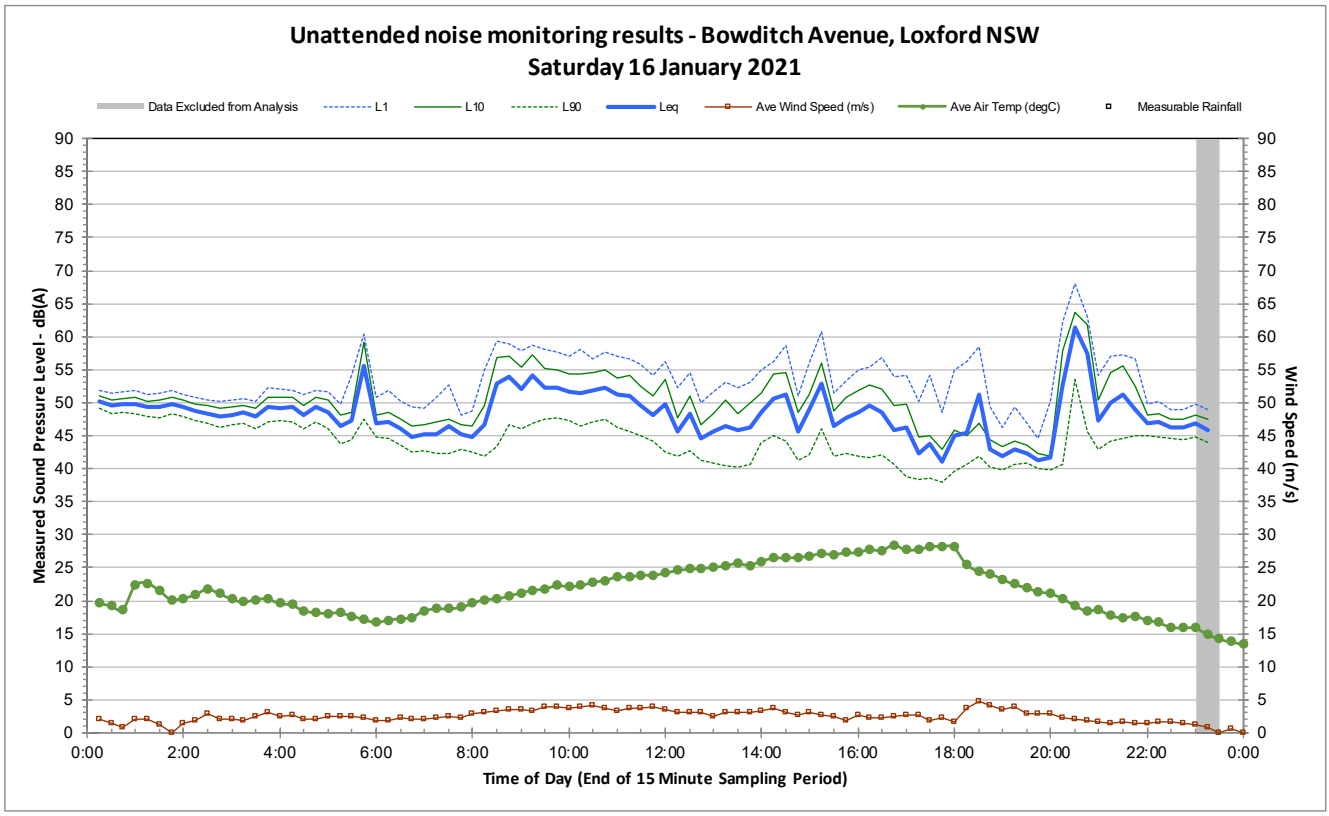
## C.3 Bowditch Avenue, Loxford



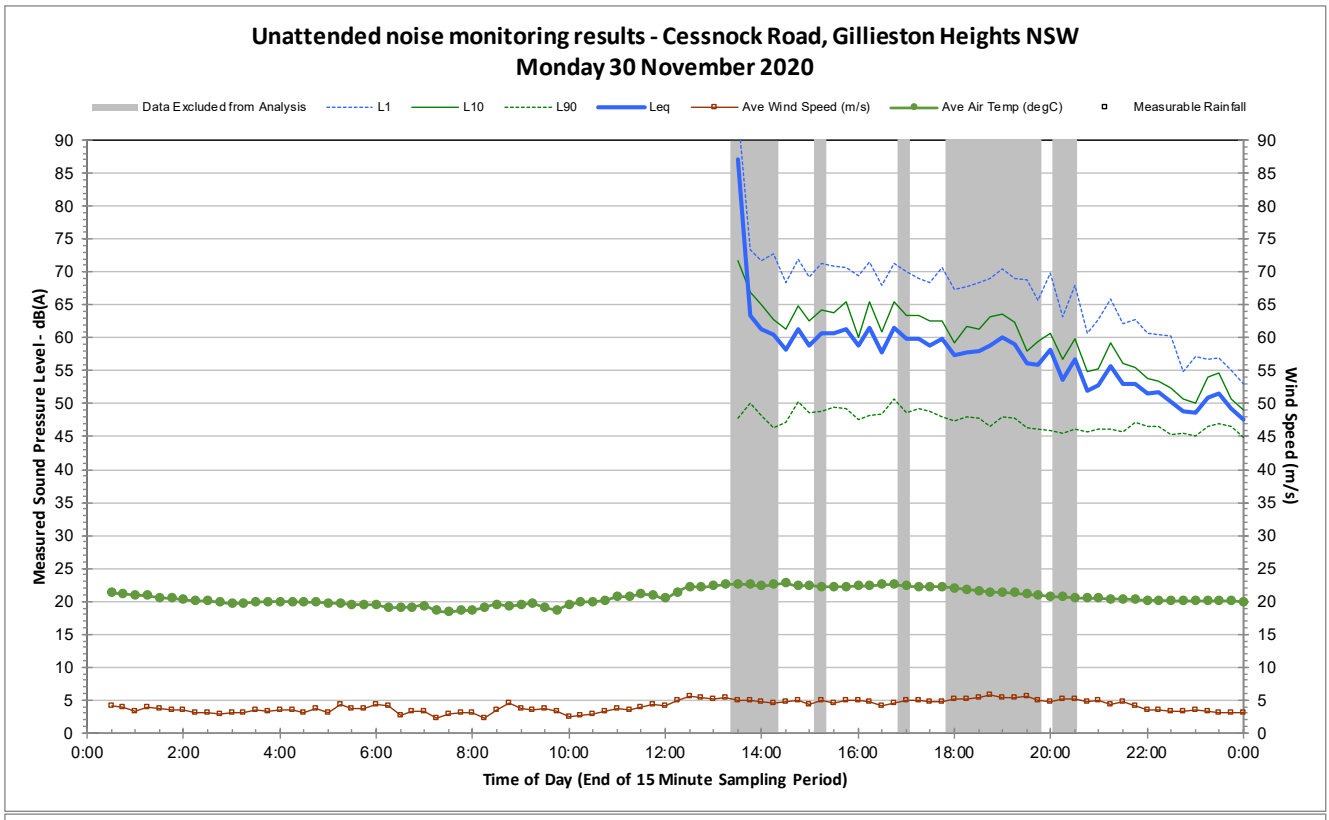



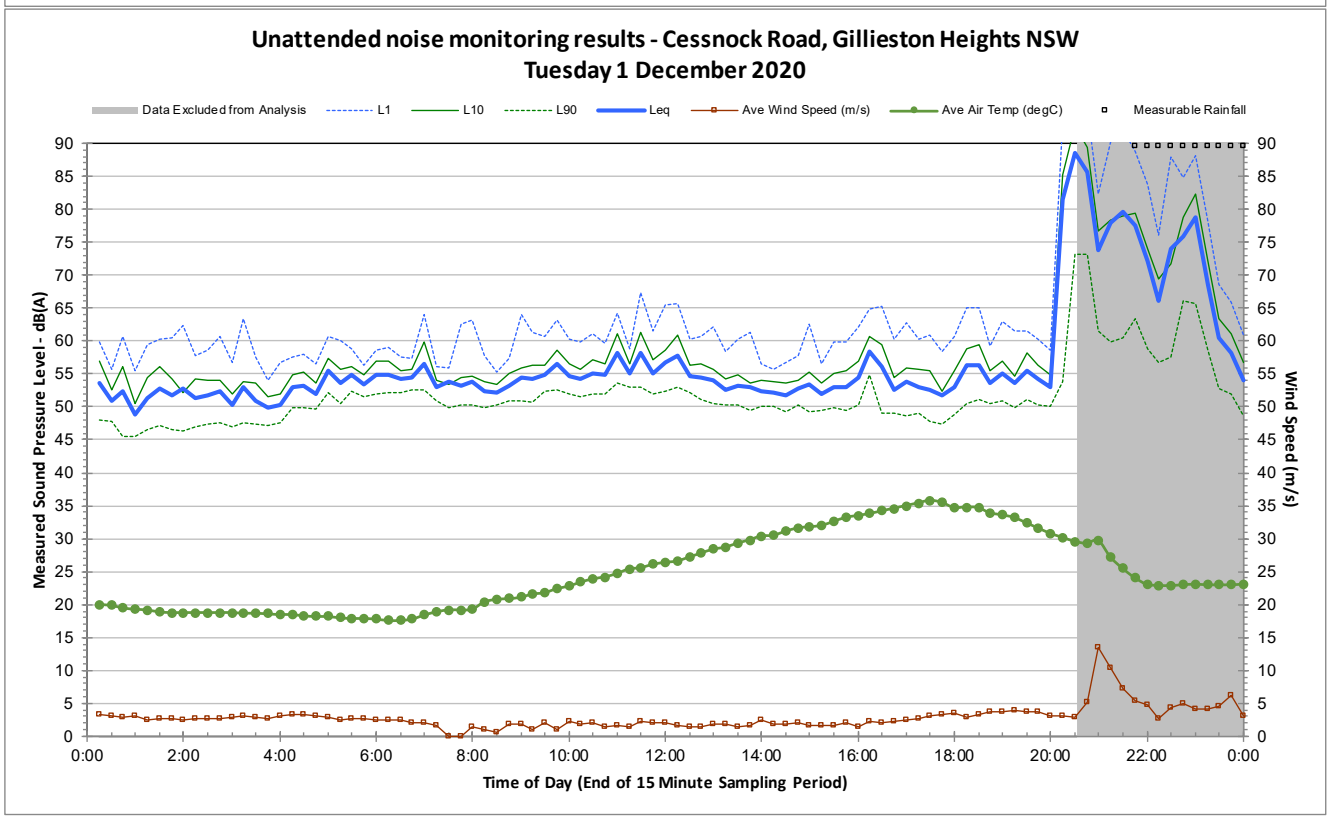

Unattended noise monitoring results - Bowditch Avenue, Kurri Kurri NSW
Wednesday 2 December 2020
Data Excluded from Analysis
L1
L10
L90
Leq
Ave Wind Speed (m/s)
Ave Air Temp (degC)
Measurable Rainfall
Measured Sound Pressure Level - dB(A)
Wind Speed (m/s)
Time of Day (End of 15 Minute Sampling Period)

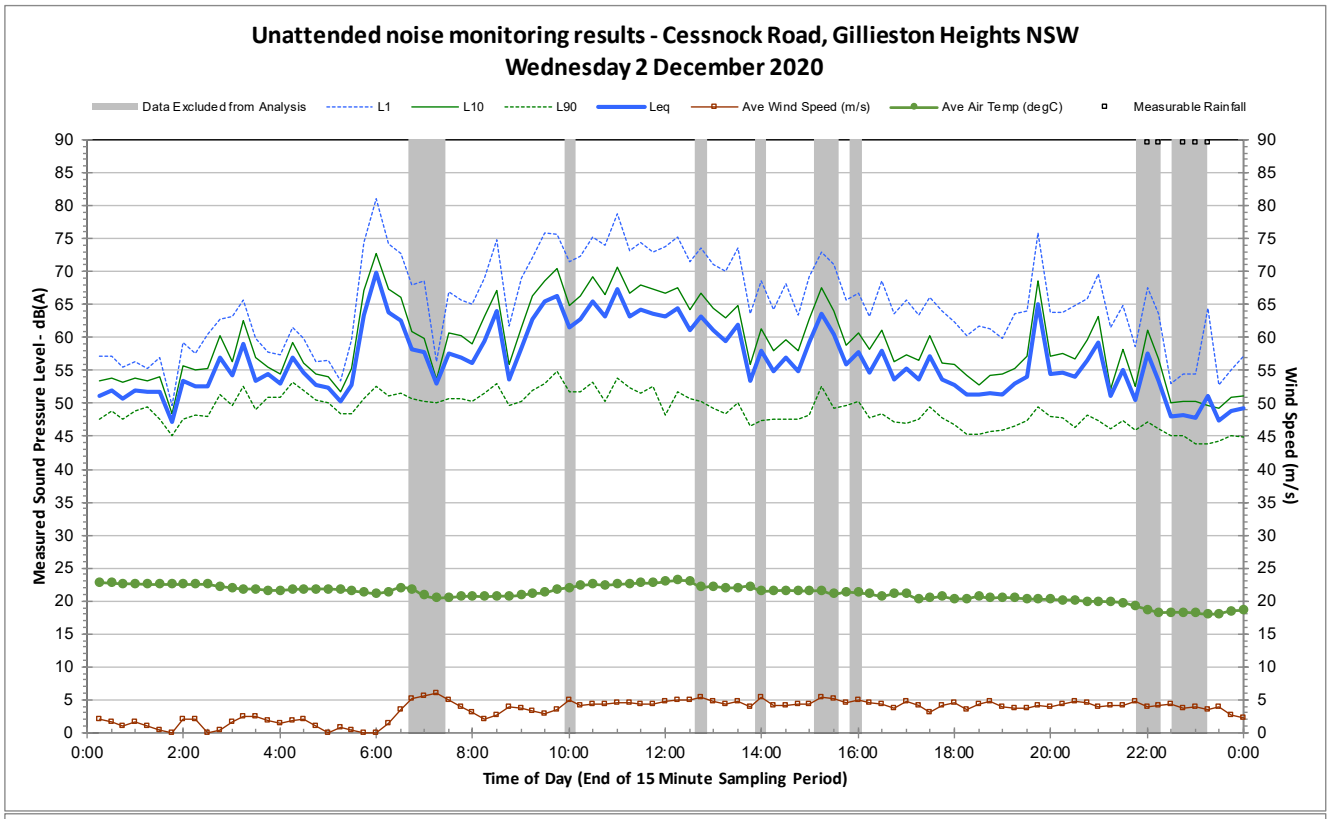

Unattended noise monitoring results - Bowditch Avenue, Loxford NSW
Friday 15 January 2021
Data Excluded from Analysis
L1
L10
L90
Leq
Ave Wind Speed (m/s)
Ave Air Temp (degC)
Measurable Rainfall
Measured Sound Pressure Level - dB(A)
Wind Speed (m/s)
Time of Day (End of 15 Minute Sampling Period)

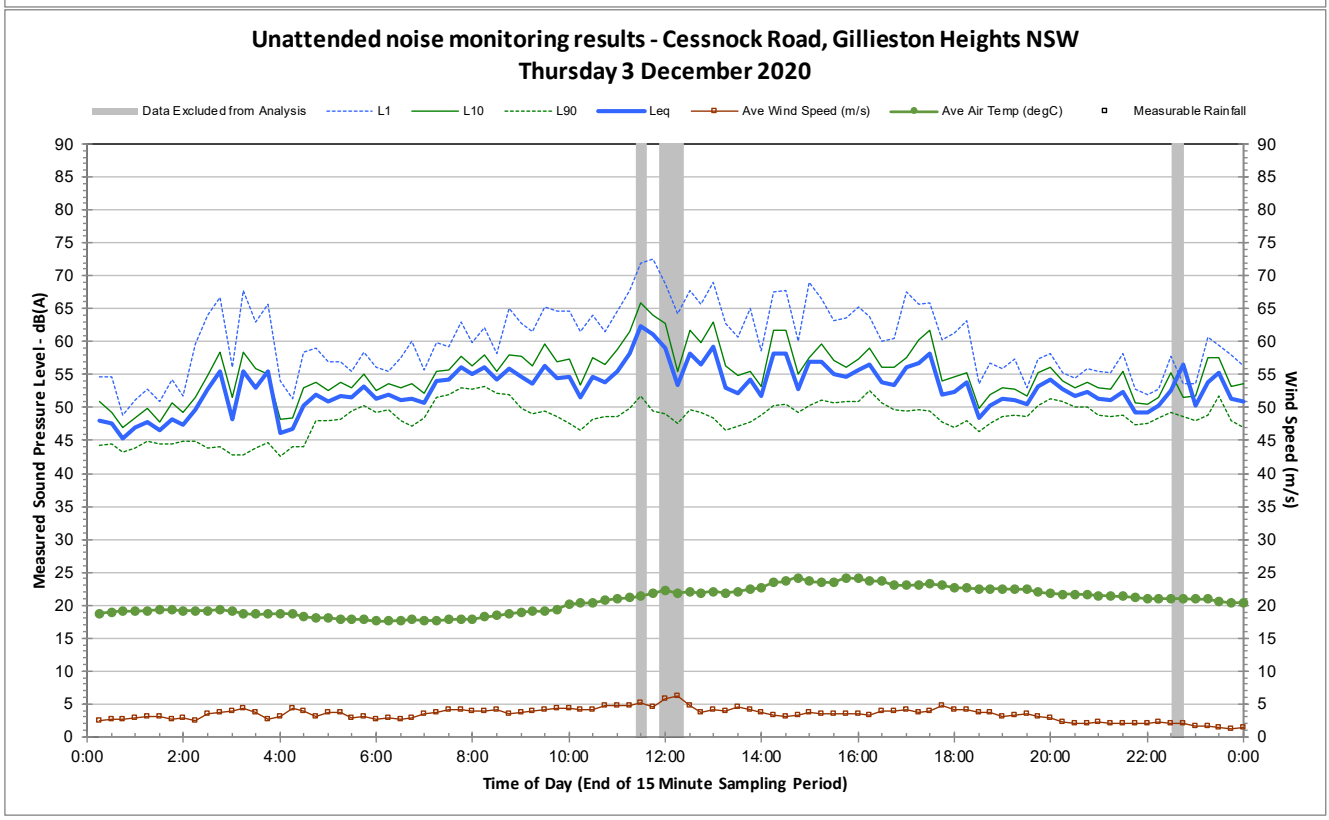

Unattended noise monitoring results - Bowditch Avenue, Loxford NSW
Saturday 16 January 2021
Data Excluded from Analysis
L1
L10
L90
Leq
Ave Wind Speed (m/s)
Ave Air Temp (degC)
Measurable Rainfall
Measured Sound Pressure Level - dB(A)
Wind Speed (m/s)
Time of Day (End of 15 Minute Sampling Period)
0:00
2:00
4:00
6:00
8:00
10:00
12:00
14:00
16:00
18:00
20:00
22:00
0:00

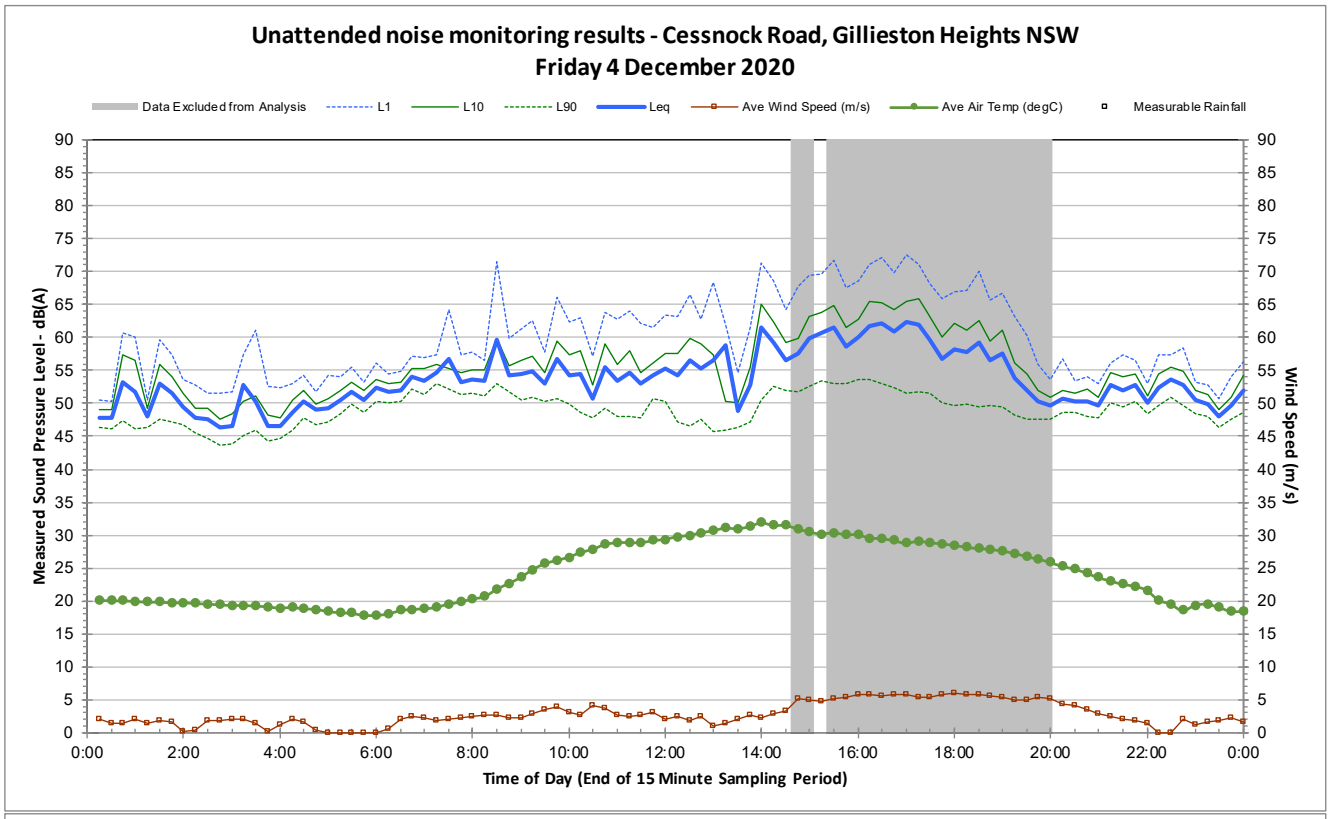
## C.4 Cessnock Road, Gillieston Heights

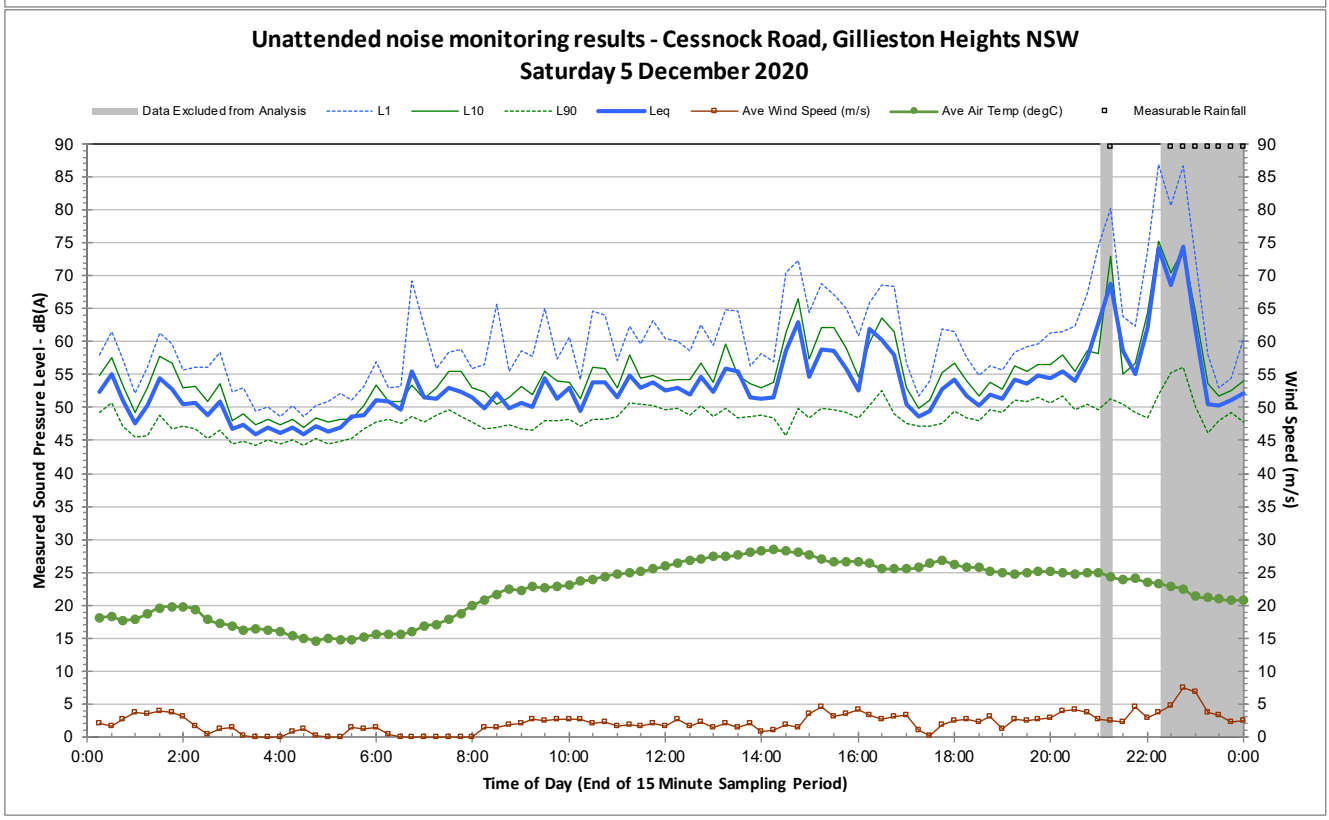


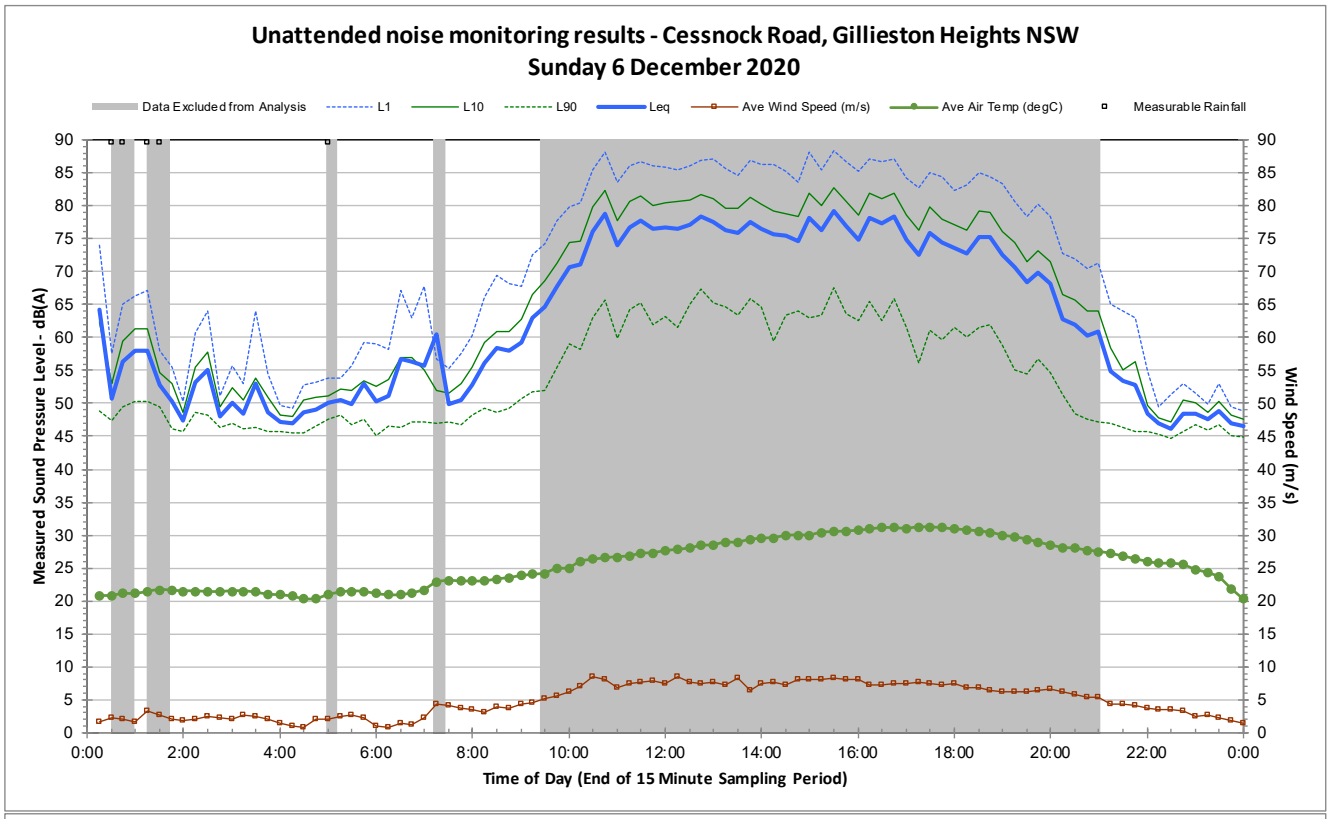



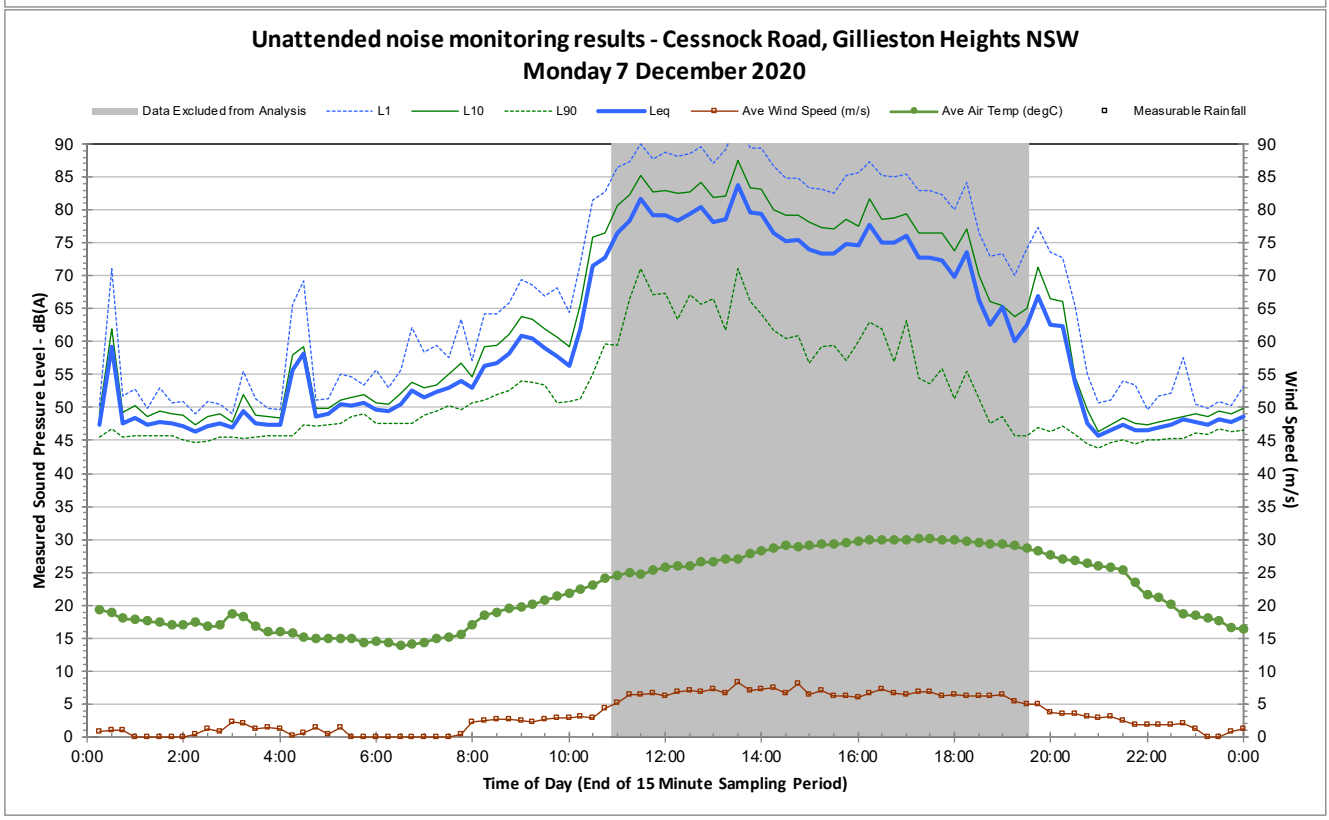

Unattended noise monitoring results - Cessnock Road, Gillieston Heights NSW
Wednesday 2 December 2020
Data Excluded from Analysis
L1
L10
L90
Leq
Ave Wind Speed (m/s)
Ave Air Temp (degC)
Measurable Rainfall
Measured Sound Pressure Level - dB(A)
Wind Speed (m/s)
Time of Day (End of 15 Minute Sampling Period)

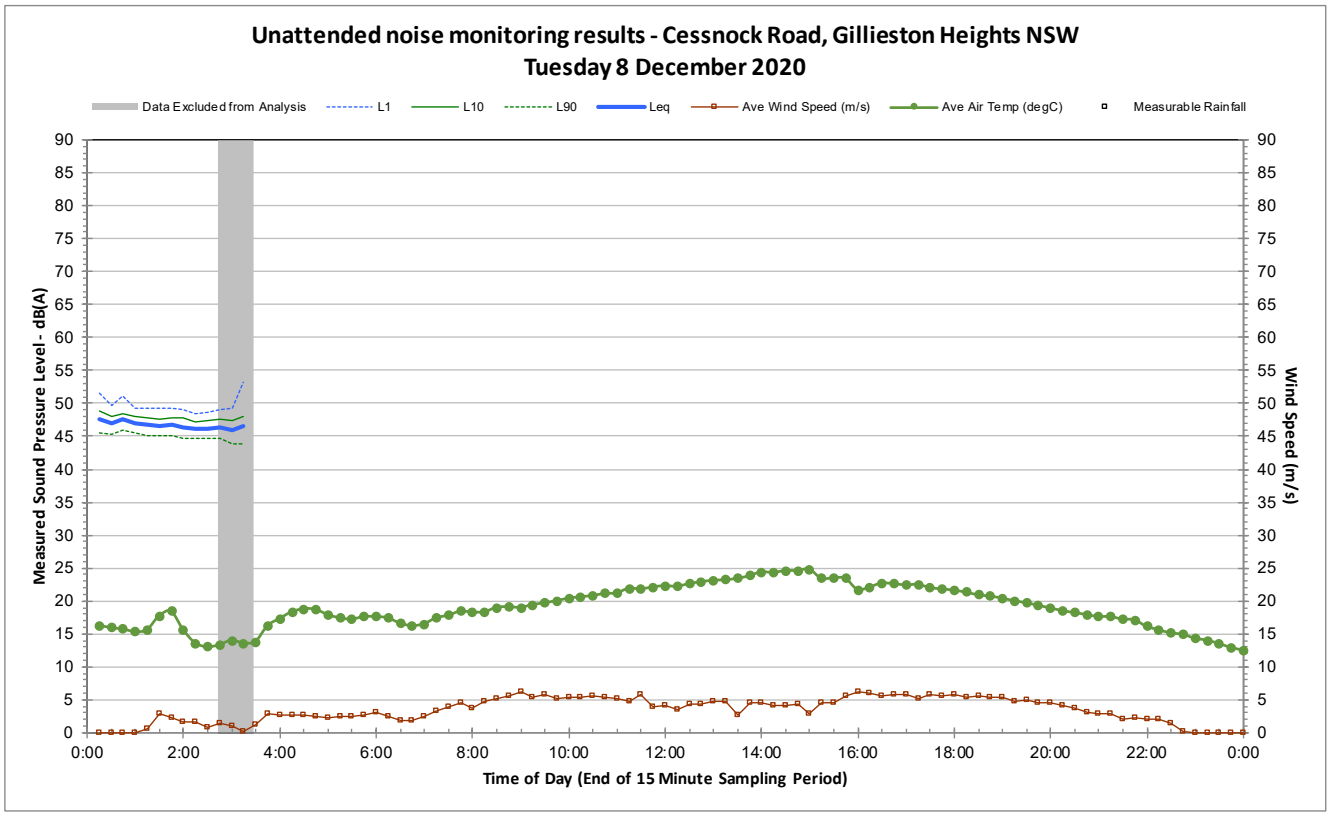

Unattended noise monitoring results - Cessnock Road, Gillieston Heights NSW
Thursday 3 December 2020
Data Excluded from Analysis
L1
L10
L90
Leq
Ave Wind Speed (m/s)
Ave Air Temp (degC)
Measurable Rainfall
Measured Sound Pressure Level - dB(A)
Wind Speed (m/s)
Time of Day (End of 15 Minute Sampling Period)


Unattended noise monitoring results - Cessnock Road, Gillieston Heights NSW
Friday 4 December 2020
Data Excluded from Analysis
L1
L10
L90
Leq
Ave Wind Speed (m/s)
Ave Air Temp (degC)
Measurable Rainfall
Measured Sound Pressure Level - dB(A)
Wind Speed (m/s)
Time of Day (End of 15 Minute Sampling Period)


Unattended noise monitoring results - Cessnock Road, Gillieston Heights NSW
Saturday 5 December 2020
Data Excluded from Analysis
L1
L10
L90
Leq
Ave Wind Speed (m/s)
Ave Air Temp (degC)
Measurable Rainfall
Measured Sound Pressure Level - dB(A)
Wind Speed (m/s)
Time of Day (End of 15 Minute Sampling Period)


Unattended noise monitoring results - Cessnock Road, Gillieston Heights NSW
Sunday 6 December 2020
Data Excluded from Analysis
L1
L10
L90
Leq
Ave Wind Speed (m/s)
Ave Air Temp (degC)
Measurable Rainfall
Measured Sound Pressure Level - dB(A)
Wind Speed (m/s)
Time of Day (End of 15 Minute Sampling Period)


Unattended noise monitoring results - Cessnock Road, Gillieston Heights NSW
Monday 7 December 2020
Data Excluded from Analysis
L1
L10
L90
Leq
Ave Wind Speed (m/s)
Ave Air Temp (degC)
Measurable Rainfall
Measured Sound Pressure Level - dB(A)
Wind Speed (m/s)
Time of Day (End of 15 Minute Sampling Period)


Unattended noise monitoring results - Cessnock Road, Gillieston Heights NSW
Tuesday 8 December 2020
Data Excluded from Analysis
L1
L10
L90
Leq
Ave Wind Speed (m/s)
Ave Air Temp (degC)
Measurable Rainfall
Measured Sound Pressure Level - dB(A)
Wind Speed (m/s)
Time of Day (End of 15 Minute Sampling Period)
0:00
2:00
4:00
6:00
8:00
10:00
12:00
14:00
16:00
18:00
20:00
22:00
0:00