Noise Impact Assessment

Bays Port Shore Power Project – White Bay Cruise Terminal

Port Authority of New South Wales

29 August 2024

311012-01011

Disclaimer

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PROJECT 311012-01011: Noise Impact Assessment

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Executive Summary

Worley Consulting (formerly Advisian) has been engaged by the Port Authority of New South Wales (Port Authority) to conduct a Noise Impact Assessment, to accompany the Review of Environmental Factors (REF) for the development of a landside electricity supply for cruise ships at White Bay Cruise Terminal (WBCT), as part of the Bays Port Shore Power Project at the Bays Port Precinct (the Precinct), New South Wales. The purpose of the Noise Impact Assessment is to determine the likely impacts to the local noise environment associated with the construction and operational phases of the proposal.

The Project is to be delivered in two (2) stages:

- Stage 1: White Bay Shore Power - White Bay Cruise Terminal (WBCT) connection consisting of the following Work Packages:
  - *Work Package 1: Power supply provision from the Rozelle Ausgrid substation to the Precinct to support all stages of the Project, including installation of high voltage connection kiosk (**to be undertaken by Ausgrid and Ausgrid's Accredited Service Providers (ASPs)**).*
  - Work Package 2: Shore power equipment supply and installation for WBCT berth (including design of internal electrical distribution network).
  - Work Package 3: Internal network civil works to support Stage 1 infrastructure.
- *Stage 2: Glebe Island Shore Power – Glebe Island 1, 2, 7 and 8 connections (to be undertaken in multiple phases and not part of this proposal; scope and phasing to be assessed and delivered at a later stage).*

The scope of works for the REF (the proposal) relates to Stage 1: WBCT Shore Power, Work Packages 2 and 3 only, as outlined above.

Stage 1: WBCT Shore Power, Work Package 1, is excluded from the REF (the proposal) as the scope relates to the new power supply and distribution of electricity to the Bays Port precinct and is governed by the *Electricity Supply Act 1995* (NSW) where Ausgrid is the Determining Authority. Planning approval for Work Package 1 scope and timeline will be conducted separately in accordance with Ausgrid's Environment Assessment Guidelines (NS174B) and Part 5 of the EP&A Act which generally applies to works for the purpose of an electricity transmission or distribution network.

To assess likely noise impacts, Worley Consulting prepared a noise model using the SoundPLAN v7.4 software package. The model was defined and configured in accordance with the *Draft Construction Noise Guideline* (NSW) for the construction scenario and the *Noise Policy for Industry* (NSW) for the operational scenario. The model included detailed terrain data extracted from Google Earth™ to account for the prominent cliff between the noise sources and nearby sensitive receptors and effective 12 metre difference in elevation. Sound pressure levels were predicted at four discrete locations representing identified noise catchment areas based on similar ambient noise levels and noise exposure to Glebe Island (adopted from previous assessments undertaken at the Precinct (AECOM, 2018 and SLR, 2013).

Results for the construction scenario demonstrated compliance with the relevant noise management levels (determined using the *Draft Construction Noise Guideline* (NSW EPA, 2020)) at all receptor locations.

Although the noise modelling predicts compliance with the relevant noise management levels, the following strategies are recommended to ensure best practice construction noise management:

- Noise emissions of the construction equipment will be considered when selecting the construction equipment fleet, prioritising low noise emissions where practicable. The machinery will be kept in good working order to reduce noise emissions as far as practicable.
- A Construction Noise Management Plan will be prepared which considers the above recommendation as well as community consultation prior to construction commencing, and provision for a Complaints Register and response strategies.

Results for the operational scenario, including inherent noise mitigation measures, showed sound pressure levels comfortably complied with the relevant project trigger noise levels (determined in accordance with the *Protection of the Environment Operations Act 1997* (NSW) (POEO Act)) at all sensitive receptor locations, including under the most conservative meteorological conditions. Therefore, the operational phase of the proposal is not expected to adversely affect the local noise environment.

It is suggested the orientation of the operational equipment is such that containers with switchgear are oriented closest to the nearest sensitive receptors, i.e., to the north of the site at the White Bay Cruise Terminal Onshore Power Supply, to potentially mitigate noise from the other containers. No further noise mitigation measures are required.

Acronyms and Abbreviations

Acronym/abbreviation	Definition
CMS	Cable Management System
dB	Decibel
dBA	A-weighted decibel
EPA	New South Wales' Environment Protection Authority
L_{Aeq}	The equivalent continuous (energy average) A-weighted sound pressure level over the sample period
m	Metres
Noise Policy	*Noise Policy for Industry* (NSW)
NSW	New South Wales
OPS	Onshore Power Supply
POEO Act	*Protection of the Environment Operations Act 1997* (NSW)
Port Authority	Port Authority of New South Wales
(the) Precinct	Bays Port Precinct
(the) Project	The Bays Port Shore Power Project – Stages 1 & 2
(the) proposal	The proposed works assessed being Stage 1 Work packages 2 & 3 at White Bay Cruise Terminal– the subject of this assessment
RBL	Rating background level
REF	Review of Environmental Factors
RMU	Ring Main Unit
SPL	Sound pressure level
SWL	Sound power level
WBCT	White Bay Cruise Terminal

1 Introduction

1.1 Background

Worley Consulting (formerly Advisian) has been commissioned by the Port Authority of New South Wales (Port Authority) to prepare a Noise Impact Assessment, to accompany the Review of Environmental Factors (REF) for the development of a landside electricity supply for cruise ships at White Bay Cruise Terminal (WBCT), as part of the Bays Port Shore Power Project (the Project) at the Bays Port Precinct (the Precinct), New South Wales (NSW).

The Bays Port Shore Power Project is to be delivered in two (2) stages:

- Stage 1: White Bay Shore Power – WBCT connection consisting of the following Work Packages:
  - *Work Package 1: Power supply provision from the Rozelle Ausgrid substation to the Precinct to support all stages of the Project, including installation of high voltage connection kiosk (**to be undertaken by Ausgrid and Ausgrid's Accredited Service Providers (ASPs)**).*
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The site is the area of works concerning the proposal and is the subject of the REF. The site, its context and setting are shown in Figure 1-1.

1.2 The proposal

The proposal involves the construction of internal electrical reticulation network within the Precinct and installation of landside electricity supply for cruise ships at WBCT. A breakdown of the scope of work for the construction of Stage 1: White Bay Cruise Terminal (WBCT) Shore Power, Work Packages 2 and 3, is outlined below and is illustrated in Figure 1-1.

a) Work Package 2

Installation of Shore Power equipment at WBCT.

- Installation of Onshore Power Supply (OPS) and switchgear units.
- Installation of a mobile cable management system (CMS) unit at WBCT.

- Installation of energy chain in a trench along WBCT berth for mobile CMS.
  (Note: Coordination with Work Package 3 contractor is required).
- Installation of switching station at WBCT.
- Installation of water-cooling system for WBCT OPS.
  (*Note: Coordination with Work Package 3 contractor is required for the water supply to the system*).
- Construction of façade or visual treatment such as perimeter or green walls at WBCT OPS building (to be determined during detailed design stage).

b) Work Package 3

Internal network civil works at White Bay, including demolition and construction.

- Demolition:
  - Demolition of decommissioned Administration Building, Canteen and toilet block, at White Bay berth 5.
- Construction:
  - Construction of concrete foundation for High voltage connection (HVC) kiosk, WBCT OPS and switchgear units, and WBCT switching station.
  - Construction of a shed for WBCT CMS unit. Location of CMS enclosure to be determined during the detailed design stage.
  - Installation of piping system for the water-cooling system at WBCT (in collaboration with Work Package 2 scope).
  - Installation of electrical trenches and conduits, at a depth of 1.1-1.3 m (approximate), and pits for power control and communication cables at the following locations:
    - HVC kiosk at Port Authority's' boundary (*Note: the HVC kiosk will be installed by Work Package 1 Contractor and not part of this proposal*).
    - White Bay berth 3 and 4, along the Port Access Road/services corridor.
    - WBCT, including along the berth for the energy chain installation.
  - Installation of power and control cables for the internal electrical reticulation network.

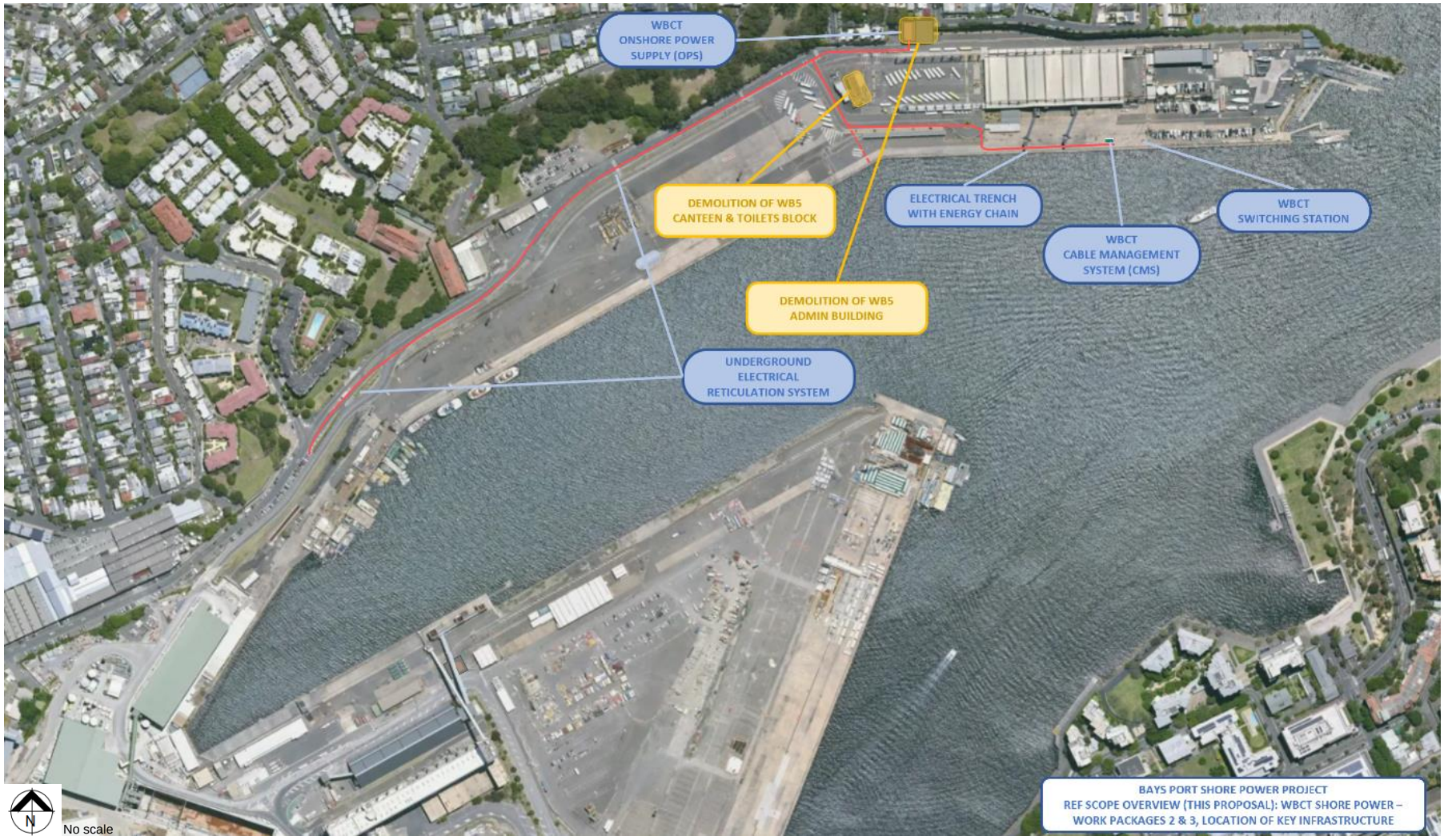

Figure 1-1: REF scope (Stage 1, Work Packages 2 and 3, only) (Source: Port Authority, 2024)

1.3 Purpose of this document

The purpose of this document is to determine the likely impacts to the local noise environment associated with the construction and operational phases of the proposal.

1.4 Scope of work

The scope of work in this document pertains specifically to Stage 1, Work Packages 2 and 3 and includes the following:

- Determine the relevant legal framework and standards pertaining to this assessment.
- Undertake a desktop assessment to characterise the existing noise environment at the Precinct, including existing noise levels and sensitive receptors.
- Determine noise emissions associated with the proposal.
- Develop a noise model to predict sound pressure levels (SPL) at receiving premises for one construction scenario and one operating scenario.
- Prepare a report (this document) outlining the method and results of the above line items. Include where required, mitigation measures to manage noise levels as far as practicable.

1.5 Assumptions

Assumptions made as part of this assessment include:

- The exact locations/layout/orientation and number of each piece of equipment for the operational and construction scenarios have been assumed to facilitate implementation of the noise model.

1.6 Limitations

Limitations of this assessment include the following:

- This assessment concerns Stage 1, Work Packages 2 and 3, only of the proposal. Stage 1, Work Package 1, is to be assessed, approved, and undertaken by Ausgrid and relevant parties, and involves the construction of a power supply connection from Rozelle substation to the Precinct. Stage 2 consists of Glebe Island Shore Power connection to be undertaken in multiple phases. Assessment of Stage 1, Work Package 1, and Stage 2 is outside the scope of this assessment and is excluded.
- Precision of predicted noise levels at sensitive receptors is constrained by the inherent limitations of the noise modelling software and digital elevation model used to conduct this assessment. Due to the complex nature of the terrain in the immediate vicinity of some of the noise sources and sensitive receptors, predicted noise levels are an estimate only and based on best available information.

2 Existing environment

The following section provides context around the existing land use and noise environment within the Precinct and surrounding areas.

2.1 Land use within the Precinct

The proposal site is located on the foreshore of Sydney Harbour at Bays Port (White Bay). The proposal site is part of a major port facility in Sydney Harbour and is currently a key facility in the NSW transport and logistics network. The port facility consists of five operational shipping berths at White Bay (2-6) and four berths at Glebe Island (1, 2, 7 and 8).

There is significant industry in the vicinity of the Precinct, and therefore associated industrial noise. Port operations within Glebe Island and the White Bay area occur 24 hours, 7 days a week, with noise generated from onsite plant and equipment as well as road traffic and ship movements (Sydney Ports Corporation, 2013a).

Port Authority operates the cruise terminal at White Bay 5 and manages White Bay 4 primarily for cruise overflow and ad-hoc vessel visits. White Bay 3 is used for a variety of ad hoc port and working harbour uses, White Bay 2 is occupied by licensees who operate independent businesses including commercial office, port services and non-trade vessels, and a dry boat storage and refuelling facility is at White Bay 6. Glebe Island 7 is used for unloading/loading bulk vessels for gypsum and sugar whilst Glebe Island 8 is for cement only. Glebe Island 1 and 2 are used for the unloading/loading of dry bulk goods as well as other occasional ad-hoc port related uses and laying-up of shipping vessels.

Other Port-based infrastructure includes the White Bay Cruise Terminal building (opened in 2013), silos and storage facilities, administration and amenities buildings, access roads, substations, hardstand, and parking areas. Part of the Port land is currently being leased out as ancillary sites and contractor parking for the WestConnex, Western Harbour Tunnel and Sydney Metro West construction projects.

2.2 Land use surrounding the Precinct

The north of the Precinct is bounded by residential areas of Balmain which are elevated and physically separated from the site by a cliff and retaining wall. These residences are located in Grafton, Vincent, Adolphus and Stephen Streets, Balmain (Wilkinson Murray Pty Limited, 2010). The residences to the north-west of White Bay comprise mainly multilevel residences with direct line of site to the Precinct (AECOM, 2018). Residences to the north of the Precinct comprise mainly single and double storey dwellings, with direct line of site to the Precinct (AECOM, 2018). South-east from the Precinct in Pyrmont lies multilevel residences, with direct line of site to the Precinct (AECOM, 2018). To the south of Glebe Island lies the residential premises of Glebe, comprising a mix of single and double storey houses, and multilevel residences with direct line of site to the Precinct (AECOM, 2018).See Figure 2-1 for proposal location and surrounding residential land uses.

2.3 Sensitive receptors

As mentioned above, the areas surrounding White Bay and Glebe Island include large portions of residential land. Representative residential receiver locations have been identified in previous assessments for the Precinct (AECOM, 2018 and SLR, 2013) and are adopted in this study for consistency. The noise sensitive locations are presented in Table 2-1 and shown in Figure 2-1 and represent identified noise catchment areas based on similar ambient noise levels and noise exposure to Glebe Island (AECOM, 2018).

Table 2-1: Representative residential receiver locations (AECOM, 2018)

Number	Representative residential receiver locations	Coordinates (WGS84, UTM Zone 56S)		Approximate distance and direction from the proposal	Approximate elevation of receiver above sea level (m)
		Easting (m)	Northing (m)		
1	Balmain – Batty Street	331614	6251419	70 metres (m) north-west	17.4
2	Balmain (east) – Grafton Street	332338	6251883	20 m north-east	17.5
3	Pyrmont – Refinery Drive	332326	6250946	710 m south-east	9
4	Glebe – Leichhardt Street	332031	6250597	770 m south	4.3

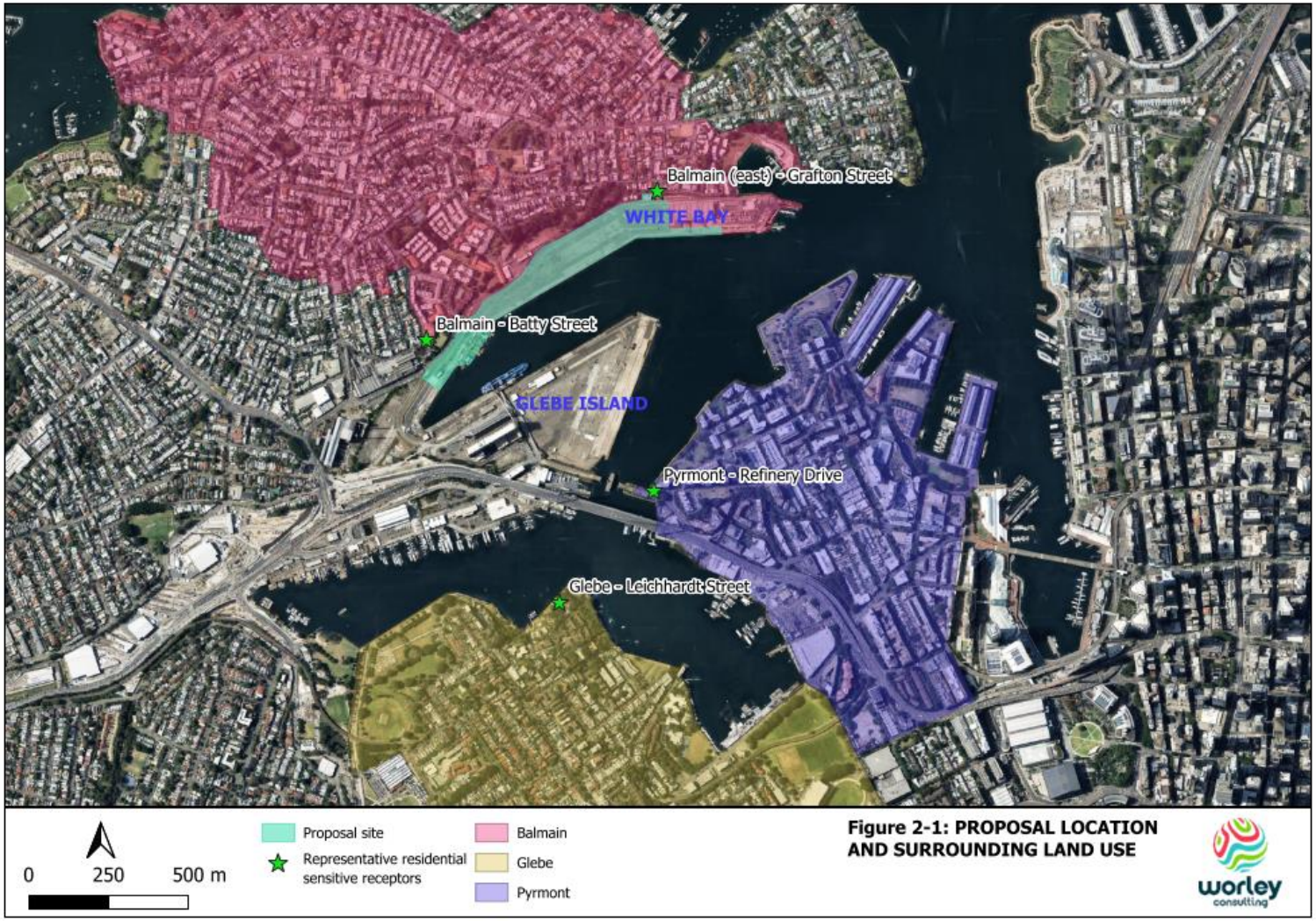

Figure 2-1: Proposal location and surrounding residential land use

2.4 Existing noise environment

Background noise levels have been adopted from the 2018 AECOM noise assessment for the Glebe Island Multi User Facility (AECOM, 2018), which were derived from the Sydney Ports Corporation 2013 Review of Environmental Factors (Sydney Ports Corporation, 2013a) and the White Bay Cruiser Terminal – Operational Environmental Management Plan (Sydney Ports Corporation, 2013b). The rating background levels[1] (RBL) were determined at the representative residential receiver locations (see Section 2.3) for day, evening and night-time periods and are considered valid for the current assessment as background noise levels within the proposal area have remained stable in recent years.

Table 2-2: Background noise levels at the representative sensitive receptors (AECOM, 2018)

Number	Representative residential receiver location	Time of day	RBL, L_{A90} (dBA)[1]
1	Balmain – Batty Street	Day[2]	51
		Evening[3]	49
		Night[4]	42
2	Balmain (east) – Grafton Street	Day	51
		Evening	49
		Night	44
3	Pyrmont – Refinery Drive	Day	50
		Evening	49
		Night	47
4	Glebe – Leichhardt Street	Day	46
		Evening	46
		Night	40

Note:
1. dBA is A-weighted decibels
2. Day is defined as 7:00 am to 6:00 pm
3. Evening is defined as 6:00 pm to 10:00 pm
4. Night is defined as 10:00 pm to 7:00 am

[1] The rating background level is the "overall single-figure background level representing each assessment period (day/evening/night) over the whole monitoring period (as opposed to over each 24-hour period used for the assessment background level)" *Noise policy for Industry* (NSW).

3 Legal framework and standards

3.1 Construction noise guidelines

The NSW Environmental Protection Authority provides guidelines on managing construction noise impacts. The *Draft Construction Noise Guideline* (NSW) helps to ensure "noise impacts associated with construction activities are identified, minimised and managed in a consistent and transparent manner." The document provides procedures for assessing the potential impact of construction noise. Although the framework and criteria provided in the document are not legislated, they are referenced to assess and manage construction activities appropriately. The focus of the document is to minimise the impact of construction rather than achieve compliance with particular noise criteria.

The *Draft Construction Noise Guideline* (NSW) provides noise management levels which should ideally not be exceeded. Should these management levels be exceeded at the noise sensitive premises, mitigation measures should be undertaken to manage noise levels. The noise management levels for construction are shown in Table 3-1.

Table 3-1: Noise management levels for construction (Draft Construction Noise Guideline (NSW))

Time of day	Management level, $L_{Aeq,\ 15\ min}$, dB(A)	How to apply
Recommended standard hours: 7:00 am to 6:00 pm on weekdays; and 8:00 am to 1:00 pm on Saturdays; no work on Sundays or public holidays	Noise affected RBL +10 dB	Where the predicted or measured $L_{Aeq,\ 15min}$ is greater than the noise affected management level, the proponent shall apply all feasible and reasonable work practices to meet this level. As a matter of good practice, noise should be reduced as far as reasonably practicable. The proponent should notify all potentially impacted residents.
	Highly noise affected 75 dB(A)	Where noise is above the highly noise affected management level, all feasible and reasonable mitigation shall be applied as well as engagement with the consent authority or regulator to identify other measures to manage noise impacts. Where appropriate, engagement with the community is encouraged to determine the preferred mitigation approach, such as: • Negotiated agreements and/or respite periods to restrict work activity. • Identification of times when the community is less sensitive to noise, including options for longer periods of construction in exchange for restrictions on construction times.
All other hours	Noise affected RBL +5 dB	Strong justification is required for works outside the recommended standard hours. The proponent shall apply all feasible and reasonable work practices to meet the noise affected management level. Where this cannot be met, residual impacts should be quantified, and potentially impacted residents notified. Supplementary mitigation measures (described in Table 5 of the *Draft Construction Noise Guideline* (NSW)) must also be considered, subject to the application.

Time of day	Management level, $L_{Aeq, 15\ min}$, dB(A)	How to apply
	Highly noise affected 65 dB(A)	The highly noise affected management level represents the point above which supplementary mitigation measures (described in Table 5 *Draft Construction Noise Guideline* (NSW)) must be considered. The proponent must justify the selection of feasible and reasonable mitigation, including the supplementary mitigation, with emphasis on consultation with the community and the consent authority or regulator, and community views on work scheduling and respite periods.

As per the *Draft Construction Noise Guideline* (NSW), residents directly adjoining the Precinct (number 2: Balmain (east) – Grafton Street) are classified as "highly noise affected"; the remaining residents (represented by numbers 1, 3 and 4) are classified as "noise affected".

It should be noted that construction is planned to occur at the following times:

- Monday to Friday: 7:00 am – 6:00 pm.
- Saturday: 8:00 am – 1:00 pm.
- Sunday and Public Holidays: No works.

The proposed construction hours comply with the recommended standard hours on all days of the week.

3.1.1 Adopted construction noise levels

The construction noise management level for noise affected areas requires background noise levels to be determined by short- or long-term noise monitoring. Noise monitoring was not undertaken for the proposal; however, background noise levels were taken from the AECOM noise assessment (AECOM, 2018) and are considered relevant for this assessment. The RBLs determined in the AECOM noise assessment are used in this study and are shown in Table 2-2. The resulting construction noise management levels are shown in Table 3-2.

Table 3-2: Location specific noise management levels for proposal construction

Number	Representative residential receiver location	Time of day	Category	Management level, $L_{Aeq, 15\ min}$, dB(A)	
				Recommended standard hours	All other hours
1	Balmain – Batty Street	Day - 7.00 am to 6.00 pm on weekdays; and 8.00 am to 1.00 pm on Saturdays; no work on Sundays or public holidays	Noise affected	61	56
2	Balmain (east) – Grafton Street		Highly noise affected	75	65
3	Pyrmont – Refinery Drive		Noise affected	60	55
4	Glebe – Leichhardt Street		Noise affected	56	51

3.2 Operational noise guidelines

The following legal framework and standards are applicable to the proposal in the context of this noise impact assessment:

- *Protection of the Environment Operations Act 1997* (NSW) (POEO Act)
- *Noise Policy for Industry* (NSW) (Noise Policy)

The POEO Act is NSW's overarching piece of environmental legislation. The objectives of POEO Act include:

> "…to protect, restore and enhance the quality of the environment in NSW", and
>
> "…to reduce risks to human health and prevent the degradation of the environment by the use of mechanisms that promote… pollution prevention" (POEO Act (NSW)).

The purpose of the Noise Policy is to "ensure noise impacts associated with particular industrial developments are evaluated and managed in a consistent and transparent manner. It provides noise levels for assessing the potential impact of noise from industry and includes a framework for considering feasible and reasonable noise mitigation measures" (*Noise Policy for Industry* (NSW)). The Noise Policy does not pertain to construction activities.

Under the Noise Policy, project trigger noise levels are determined relevant to the development of interest, which applies to existing noise-sensitive receptors. Where a project trigger noise level is predicted to be exceeded, management measures need to be considered to reduce the predicted noise level. It should be noted project trigger noise levels are not mandatory, but provide a benchmark that, should they be exceeded, indicate a potential impact on the community.

The project trigger noise level is the more stringent of the project intrusiveness noise level and project amenity noise level, both of which are discussed below.

3.2.1 Project intrusiveness noise levels[2]

The intrusiveness noise level aims to protect against significant changes in noise levels. It is considered acceptable if the noise level from the source of interest does not exceed background noise levels by more than five decibels (dB). The intrusiveness noise level is determined as follows:

$$L_{Aeq,\ 15\ min} = \textit{Rating background noise level} + 5\ dB$$

Where:

$L_{Aeq,\ 15\ min}$	is the equivalent continuous (energy average) A-weighted sound pressure level of the source over 15 minutes
Rating background noise level (RBL)	is the background noise level to be used for assessment purposes, as determined by noise monitoring

[2] Note the *project trigger noise level*, *project intrusiveness noise level* and *project amenity noise level* are terms specifically defined by the POEO Act (NSW). The use of the word "project" in this context is not referring to the Bays Port Shore Power Project – Stages 1 & 2. Rather, project trigger/intrusiveness/amenity noise levels determined in this assessment pertain to the proposal only (Stage 1, Work Packages 2 and 3) and excludes Stage 1, Work Package 1, and Stage 2.

The project intrusiveness level requires background noise levels to be determined by short- or long-term noise monitoring. Noise monitoring was not undertaken for the proposal; however, background noise levels were taken from the AECOM noise assessment (2018) and are considered relevant for this assessment. The RBLs taken from the AECOM noise assessment and used in this study are shown in Table 2-2. The resulting project intrusiveness levels (RBL+5 dB) are shown in Table 3-3.

Table 3-3: Project intrusiveness noise levels at the representative sensitive receptors

Number	Representative residential receiver location	Time of day L_{Aeq}, dB(A)		
		Day[1]	Evening[2]	Night[3]
1	Balmain – Batty Street	56	54	47
2	Balmain (east) – Grafton Street	56	54	49
3	Pyrmont – Refinery Drive	55	54	52
4	Glebe – Leichhardt Street	51	51	45

The time of day is defined as follows:

1. 7 am to 6 pm Monday to Saturday or 8 am to 6 pm on Sundays and public holidays
2. 6 pm to 10 pm
3. All remaining periods

3.2.2 Project amenity noise levels

To limit continual increase of background noise from progressive additional activities, the noise level from the source of interest should remain below the amenity noise level, as specified in the Noise Policy, depending on the type of receiving environment. The amenity noise level is given as:

> *Project amenity noise level for industrial developments = Recommended amenity noise level* – 5 dBA*
> *defined in Table 2.2 of Noise Policy (*Noise Policy for Industry* (NSW)).

According to the classifications in the Noise Policy, residents directly adjoining the Precinct would be classified as "Industrial Interface". This is "an area that is in close proximity to existing industrial premises and that extends out to a point where the existing industrial noise from the source has fallen by 5 dB, or an area defined in a planning instrument. Beyond this region the amenity noise level for the applicable category applies" (*Noise Policy for Industry* (NSW)). For these sensitive receptors (considered to be number 2: Balmain (east) – Grafton Street), 5 dB is added to the recommended noise amenity area. The residences beyond the "Industrial Interface" classification are classified as Residential – Urban.

The amenity noise levels relevant to this assessment are shown in Table 3-4.

Table 3-4: Project amenity noise levels relevant to this study (Noise Policy for Industry (NSW))

Receiver type	Noise amenity area	Time of day[2] L_{Aeq}, dB(A)		
		Day	Evening	Night
Industrial Interface (applicable only to residential noise amenity areas)	All	60[1]	50[1]	45[1]
Residential	Urban	55	45	40

Note:
1. The Industrial Interface amenity noise level is the Residential – Urban amenity noise level plus 5 dB
2. Time of day as defined in Table 3-3

3.2.3 Project trigger noise levels

The resulting project trigger noise levels (that is the lesser of the project intrusiveness noise levels and the project amenity noise levels) adopted for this assessment are shown in Table 3-5.

Table 3-5: Project trigger noise levels at the representative sensitive receptors

Number	Representative residential receiver location	Time of day[1] L_{Aeq}, dB(A)		
		Day	Evening	Night
1	Balmain – Batty Street	55	45	40
2	Balmain (east) – Grafton Street	56	50	45
3	Pyrmont – Refinery Drive	55	45	40
4	Glebe – Leichhardt Street	51	45	40

Note:
1. Time of day as defined in Table 3-3

4 Noise modelling method

4.1 Noise modelling scenarios

Noise modelling was undertaken for both construction and operational phases of the proposal. The scenarios modelled are shown in Table 4-1.

Table 4-1: Modelled scenarios

Model ID	Model name	Model description
1	Construction activities	Construction phase of the proposal
2	Operational activities	Operational phase of the proposal as designed, including inherent noise mitigation measures (water-cooling system for WBCT OPS and building enclosure)

4.2 Noise emissions

The following subsections outline the methods undertaken to determine sound power levels (SWL) to be used as input into the noise model, associated with construction and operation of the proposal.

4.2.1 Construction noise emissions

Construction is estimated to take approximately nine months (non-consecutive) and commence in quarter three of 2024. Standard working hours are proposed for the construction phase as follows:

- Monday to Friday: 7:00 am – 6:00 pm.
- Saturday: 8:00 am – 1:00 pm.
- Sunday and Public Holidays: No works.

An indicative list of construction plant and equipment provided by Port Authority was used to determine construction noise sources. The list of plant and equipment likely to contribute to noise emissions is as follows:

- Dump truck
- Excavator
- Grader
- High reach excavator
- Skid steer loader.

On average, up to 10 workers and six to eight vehicle (combination of light and heavy vehicles) movements per day, per site, would be required during the peak construction period.

Sound pressure levels (SPLs) for the relevant construction equipment were obtained from publicly available technical specifications (CAT, 2021) and other noise information (The Centre for Construction Research and Training, 2024). Sound power levels (SWL) in dB(A), which are required as input to a noise model, were calculated from the documented SPLs using the following equation.

$$SWL = SPL + 10 \times log_{10}\left(\frac{S}{S_0}\right)$$

Equation 1

Where:

SWL	is sound power level in dB(A)
SPL	is sound pressure level in dB(A)
S	is the surface area of a virtual hemisphere at measurement distance around the noise source in m^2
S_0	is 1 m^2

Due to the dynamic nature of construction activities, it cannot be determined when each piece of construction equipment will be operating. Although it is unlikely to occur, as a worst case scenario, it was assumed all construction equipment are co-located and would operate simultaneously. Therefore, the construction SWLs were included as combined noise sources. The equivalent SWL for all construction noise emissions was calculated using Equation 2. Noise sources and associated SWLs used as input into the construction noise model are listed in Table 4-2 and shown in Figure 4-1.

$$SWL_{total} = 10 \times log_{10} \sum_{i=1}^{n} 10^{\left(\frac{SWL_i}{10}\right)}$$

Equation 2

Where:

SWL_{total}	is the total sound power level in dB(A)
SWL_i	is the sound power level for each source from i = 1 to n in dB(A)

Table 4-2: Construction noise emissions included in the model

Construction noise source	SWL (dBA)
Dump truck	106
Excavator	106
Grader	106
High reach excavator	106
Skid steer loader	104
Combined source	**113**

Given the size of the proposal site, and proximity to sensitive receptors, the location of construction equipment may have an appreciable effect on noise levels received at a receptor, however, their exact location at any time cannot be known. As such, the construction noise sources were modelled using a combined volume source located at the construction area at WBCT, as well as line sources representing the laying of cable and travel of the equipment around the Precinct. This ensures all construction equipment could be operating at the nearest point to each receiver location. This is considered a conservative approach and represents the overall noise emissions associated with construction of the proposal over the construction period as a worst-case scenario as opposed to noise emissions at any singular moment in time.

Figure 4-1: Construction noise sources included in the model

4.2.2 Operational noise emissions

Operational noise sources were adopted from a noise analysis report undertaken by the proposed supplier, PowerCon (PowerCon, 2024). SWLs and some SPLs were provided for each piece of equipment, which include the inherent noise mitigation measures designed as part of the proposal (water cooling system). It was assumed the SWLs and SPLs pertain to the equipment in an open area; therefore, the SWLs and SPLs were adjusted to account for the presence of containers in which most of the equipment will be housed. The following methods were used to determine SWLs emanating from the containers at WBCT.

Where SPLs where not provided in the noise analysis report (PowerCon, 2024), these were calculated from the SWLs using Equation 3.

$$SPL = SWL - (20 \times log_{10}(d) + 11)$$

Equation 3

Where:

- SPL is sound pressure level in dB
- SWL is sound power level in dB
- d is the distance at which the SPL is measured (m), assumed to be 1 metre

As the noise sources will be housed in a series of containers, the noise from each source was combined to represent one cumulative noise source from each container. The resulting individual SPLs from Equation 3 were summed using Equation 2 (see Section 4.2.1).

Transmission loss (reduction in noise level) from the container walls and roof were then subtracted from the total SWLs for each container. Transmission loss was taken from Bies and Hanson (2009) for a 16 gauge galvanised steel sheet.

The resulting SPLs where then adjusted to correspond to a distance of one metre external to the container using Equation 4 below.

$$SPL_{L1} = SPL_{L0} - 10 \times log_{10}\left(\frac{d + t + 1}{d + t}\right)$$

Equation 4

Where:

- SPL_{L1} is the sound pressure level at 1 m distance from the container (dB)
- SPL_{L0} is the original sound pressure level (dB)
- d is the distance (m) from the noise source to the nearest wall of the container (assuming the container is a Sabine chamber, in which the SPL is uniform inside). I.e., half the width of the container, equating to 1.22 m
- t is the thickness of the container wall in metres (assumed to be 0.001905 m, equating to 0.075 inches)

Finally, the SPLs at one metre distance were calculated back to SWLs using Equation 1 (see Section 4.2.1), representing the noise emanating from each external face of each container. The resulting SWLs were input into the noise model.

Additionally, three point sources were included in the model, which will not be housed in the containers. The SWLs for these sources were taken directly from the noise analysis report (PowerCon, 2024).

The operational noise sources and associated SWLs included in the model are listed in Table 4-3 and shown in Figure 4-2.

It should be noted finer details regarding the locations of the containers were not provided. Therefore, the orientation and exact coordinates of the operational equipment were assumed. It was assumed the containers with switchgear (GS1 and GS2 at WBCT) are to be oriented closest to the nearest sensitive receptors, i.e., to the north of the proposal site to potentially mitigate noise from the other containers.

Table 4-3: Operational noise sources included in the model

Container	Noise source	Quantity	SWL (dB)[1] for each applicable frequency band (Hz)				Noise model source type
			Front	Back	Side	Top	
White Bay Cruise Terminal							
WBCT-T1.1	Step down trafo	2	66.8 dB – 125 Hz 35.8 dB – 2000 Hz	66.8 dB – 125 Hz 35.8 dB – 2000 Hz	69.4 dB – 125 Hz 38.4 dB – 2000 Hz	N/A	Industrial building
	Step up trafo	2					Industrial building
	Trafo-fans	4					Industrial building
WBCT-T1.2	Step down trafo	2	66.8 dB – 125 Hz 35.8 dB – 2000 Hz	66.8 dB – 125 Hz 35.8 dB – 2000 Hz	N/A	N/A	Industrial building
	Step up trafo	2					Industrial building
	Trafo-fans	4					Industrial building
WBCT-T2.1	Step down trafo, 2	2	67.8 dB – 125 Hz 36.8 dB – 2000 Hz	67.8 dB – 125 Hz 36.8 dB – 2000 Hz	70.4 dB – 125 Hz 39.4 dB – 2000 Hz	70.0 dB – 125 Hz 39.0 dB – 2000 Hz	Industrial building
	Step up trafo, 2	2					Industrial building
	Trafo-fans, 2	4					Industrial building
WBCT-T2.2	Step down trafo, 2	2	67.8 dB – 125 Hz 36.8 dB – 2000 Hz	67.8 dB – 125 Hz 36.8 dB – 2000 Hz	N/A	70.0 dB – 125 Hz 39.0 dB – 2000 Hz	Industrial building
	Step up trafo, 2	2					Industrial building
	Trafo-fans, 2	4					Industrial building
WBCT-LV1	AUX trafo	1	43.8 dB – 125 Hz	43.8 dB – 125 Hz	N/A	N/A	Industrial building
WBCT-C1	Converter fans	2	24.8 dB – 2800 Hz	24.8 dB – 2800 Hz	N/A	N/A	Industrial building
WBCT-C2	Converter fans, 2	2	25.8 dB – 2800 Hz	25.8 dB – 2800 Hz	N/A	27.9 dB – 2800 Hz	Industrial building
WBCT-SC1	Water cooling	1	41.8 dB – 500 Hz	41.8 dB – 500 Hz	44.4 dB – 500 Hz	N/A	Industrial building
Outside GS1	A/C SWG cont.	1	50 dB – 500 Hz				Point source

Note:
1. Note the SWLs were input into the noise model as dB. The noise model converts these to dB(A) for a consistent assessment.

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Figure 4-2: Operational noise sources included in the model

4.3 Noise modelling software and configuration

Noise modelling was undertaken with the SoundPLAN v7.4 software package. The model was defined and configured in accordance with the *Draft Construction Noise Guideline* (NSW) for the construction scenario and the *Noise Policy for Industry* (NSW) for the operational scenario. Specific details used are shown in Table 4-4.

Table 4-4: Model settings

Model element		Configuration description	
		Construction scenario	Operational scenario
Modelling software		SoundPLAN v7.4	
Calculation algorithm		CONCAWE	
Topographical data		Digital Elevation Model (DEM) (Google Earth™, 2023)[1]	
Noise sources		Noise emissions modelled as combined volume and line sources with SWL shown in Section 4.2.1	Noise emissions modelled as point sources or an industrial building with SWLs shown in Section 4.2.2
Ground absorption coefficients	**Water**	0.0 (highly reflective)	
	Hardstand	0.0 (highly reflective)	
	All other areas	0.6 (average absorption)	
Air absorption		ISO 3891 standard	
Gridded calculation area	**Easting Range**	331115 m – 333290 m (2.2 km)	
	Northing Range	6250360 m – 6252010 m (1.7 km)	
	Resolution	1 m over the Balmain area (Grafton Street) 5 m over the extent of the calculation area	
	Elevation	2.0 m above ground level	
Output information		A-weighted SPL contour plots for L_{Aeq} • Day[2] conditions (stability classes[3] A through D)	A-weighted SPL contour plots for L_{Aeq}: • Day conditions (stability classes A through D) • Evening conditions (stability classes A through D) • Night conditions (stability classes A through D)

Note:
1. Note several spot height and terrain contours were manually edited to include the prominent geographical features within close range of the WBCT OPS. Further details are described below.
2. No construction is scheduled outside of day time hours
3. Pasquill Stability Class is used to describe atmospheric stability. Stability class is designated a letter from A-F. A = very unstable, B = unstable, C = slightly unstable and D = neutral. E (slightly stable) and F (moderately stable) are not required for this assessment as per the *Noise Policy for Industry* (NSW).

The *Noise Policy for Industry* (NSW) provides specific meteorological conditions to be considered as part of noise modelling. An assessment of the significance of noise-enhancing conditions determines

the requirement to use standard meteorological conditions or noise-enhancing meteorological conditions. This assessment was undertaken by SLR as part of an investigation for the proposed Hanson concrete batching plant (SLR, 2017), based on weather station data less than 2 km from the Bays Port Precinct. This assessment was adopted as part of the 2018 AECOM noise assessment for the Glebe Island Multi User Facility (AECOM, 2018) and is also considered relevant to this assessment.

Results of the assessment (SLR, 2017) showed no significant noise-enhancing conditions based on the requirements for assessment shown in Appendix D of *Noise Policy for Industry* (NSW). Therefore, standard meteorological conditions were used in the operational noise model as part of this assessment, provided in Table 4-5.

Table 4-5: Meteorological Conditions Used in the Noise Model

Parameter	Day time conditions (7.00 am to 6.00 pm)[1]	Evening conditions (6:00 pm to 10:00 pm)	Night time conditions (all other times)	Source of Configuration Setting
Industry noise	CONCAWE			*Noise Policy for Industry* (NSW) and *Observatory Hill Weather Station Data Assessment* conducted by SLR as presented in the 2018 AECOM noise assessment for the Glebe Island Multi User Facility (AECOM, 2018)
Wind Speed	0.5 m/s			
Wind Direction	Defined to be directly from source to receptor for all receptors (i.e., 'worst case')			
Pasquill Stability Class (CONCAWE)	A–D			
Air Pressure	1013.3 millibar			
Air Temperature	20°C	19°C	19°C	
Relative Humidity	59%	66%	74%	

Note:
1. Day time conditions only were considered for the construction scenario as no construction is scheduled outside of day time hours

The topographical model used for this assessment was calculated from terrain data extracted from Google Earth™ (2023). Spot heights were extracted and utilised to determine a digital terrain model within SoundPLAN v7.4 to calculate a ground surface. Notably, the extracted Google Earth™ data was not available at a fine enough resolution to capture some of the detailed features of the terrain within proximity to some of the noise sources, which is essential for a noise model (namely the prominent cliff between the noise sources at the WBCT OPS and nearby sensitive receptors). Therefore, several spot height and terrain contours were manually edited to include the geographical features within close range of the WBCT OPS, adequately simulating the effective 12 metre difference in elevation between noise source ground level and nearby receptor ground level.

Major structures and buildings were included in the model to identify any obstructions to noise propagation. The structures were manually defined from aerial imagery in Google Earth™ (2023) and include residential, commercial, and industrial buildings.

Additionally, as stated in Table 4-4, absorption coefficients for the surrounding ground surfaces were included in the model to simulate the effects of the surrounding land use.

5 Noise modelling results

This section presents the results of noise modelling for the construction and operational scenarios. Results are provided as SPLs predicted at each discrete sensitive receptor, as well as contour figures showing the overall propagation of noise over the proposal area and relevant surrounding areas.

5.1 Construction noise modelling results

Predicted SPLs at the representative residential receiver locations are shown in Table 5-1 across stability classes A, B, C and D.

For Scenario 1, predicted SPLs comply with the relevant noise management levels at all representative residential receivers for all times of day and meteorological conditions.

Predicted noise contours for the construction scenario under stability class D (considered to be the worst-case conditions) are shown in Appendix A.

Table 5-1: Predicted SPLs at the representative residential receiver locations for the construction modelling scenario

Sensitive receptor	Time of day	Management levels, dB(A)	Stability class			
			A	B	C	D
Balmain – Batty Street	Recommended standard hours	61	56	56	58	58
Balmain (east) – Grafton Street	Recommended standard hours	75	64	64	64	64
Pyrmont – Refinery Drive	Recommended standard hours	60	53	52	56	56
Glebe – Leichhardt Street	Recommended standard hours	56	48	48	52	52

5.1.1 Construction noise modelling discussion

Results for the construction scenario (1) showed compliance with the relevant project trigger noise levels.

Due to the dynamic nature of construction, the exact timing and use of equipment cannot be predicted. Therefore, as a conservative estimate, all relevant construction equipment were included in the noise model to operate simultaneously and were co-located. In reality, it is likely only a subset of the construction equipment would be operating at any one time and/or spread out over a larger area, resulting in lower noise levels received at the sensitive receptors.

Although the noise modelling predicts compliance with the relevant noise management levels, to ensure best practice construction noise management, it is recommended that noise emissions of the construction equipment be considered when selecting the construction equipment fleet, prioritising low noise emissions where practicable. The machinery shall also be kept in good working order to reduce noise emissions as far as practicable.

Additionally, it is recommended a Construction Noise Management Plan is prepared which considers the above recommendations as well as community consultation prior to construction commencing, and provision for a Complaints Register and response strategies.

5.2 Operational noise modelling results

Predicted SPLs at the representative residential receiver locations are shown in Table 5-2 for day, evening and night-time conditions across stability classes A, B, C and D.

From Table 5-2 it can be seen that predicted SPLs comfortably comply with the relevant project trigger noise levels at all sensitive receptor locations across all meteorological conditions and all times of the day/night. Balmain – Batty Street, Pyrmont – Refinery Drive, and Glebe – Leichhardt Street are at such distances that noise associated with the proposal is predicted to be inaudible at these locations.

Predicted noise contours for the operational scenario at night and under stability class D (considered to be the worst-case conditions) are shown in Appendix B.

Table 5-2: Predicted SPLs at the representative residential receiver locations for the operational modelling scenario

Sensitive receptor		**Balmain – Batty Street**			**Balmain (east) – Grafton Street**			**Pyrmont – Refinery Drive**			**Glebe – Leichhardt Street**		
Time of day		**Day**	**Evening**	**Night**	**Day**	**Evening**	**Night**	**Day**	**Evening**	**Night**	**Day**	**Evening**	**Night**
Proposal trigger noise levels, dB(A)		**55**	**45**	**40**	**56**	**50**	**45**	**55**	**45**	**40**	**51**	**45**	**40**
Stability class:	A	NA[1]	NA	NA	19[2]	19	19	NA	NA	NA	NA	NA	NA
	B	NA	NA	NA	19	19	19	NA	NA	NA	NA	NA	NA
	C	NA	NA	NA	19	19	19	NA	NA	NA	NA	NA	NA
	D	NA	NA	NA	19	19	19	NA	NA	NA	NA	NA	NA

Note:
1. NA means inaudible.
2. 5 dB have been added to the predicted noise levels to account for the potential tonal nature of the operational noise as required in of *Noise Policy for Industry* (NSW) (Appendix C).

5.2.1 Operational noise modelling discussion

With the inherent noise mitigation measures accounted for in the model (water cooling system and building enclosure), all predicted SPLs for the operational scenario (2) comply comfortably with the relevant project trigger noise levels at the sensitive receptor locations, including under the most conservative conditions (night time and D class stability). Therefore, the operational phase of the proposal is not expected to adversely affect the local noise environment.

It is suggested the orientation of the operational equipment is such that containers with switchgear (GS1 and GS2 at WBCT) are oriented closest to the nearest sensitive receptors, i.e., to the north of the site to potentially mitigate noise from the other containers. No further noise mitigation measures are required.

6 Conclusion

Worley Consulting was commissioned to conduct a Noise Impact Assessment, to accompany the REF for the Bays Port Shore Power Project at the Bays Port Precinct in NSW. The scope of works related to the REF and this Noise Impact Assessment pertain to Stage 1, Work Packages 2 and 3 only (proposal). The purpose of the Noise Impact Assessment was to determine the likely impacts to the local noise environment associated with the construction and operational phases of the proposal.

Noise modelling was undertaken in accordance with the *Draft Construction Noise Guideline* (NSW) for the construction scenario and the *Noise Policy for Industry* (NSW) for the operational scenario. SPLs were predicted at four discrete locations representing identified noise catchment areas.

Results for the construction scenario demonstrated compliance with the relevant noise management levels at all sensitive receptor locations.

Although noise modelling predicts compliance with the relevant noise management levels, the following strategies are recommended to ensure best practice construction noise management:

- Noise emissions of the construction equipment will be considered when selecting the construction equipment fleet, prioritising low noise emissions were practicable. The machinery will be kept in good working order to reduce noise emissions as far as practicable.
- A Construction Noise Management Plan will be prepared which considers the above recommendation as well as community consultation prior to construction commencing, and provision for a Complaints Register and response strategies.

Results for the operational scenario showed SPLs complied with the relevant project trigger noise levels at all times of the day/night and under all meteorological conditions assessed. Therefore, the operational phase of the proposal is not expected to adversely affect the local noise environment.

It is suggested the orientation of the operational equipment is such that containers with switchgear (GS1 and GS2 at WBCT) are oriented closest to the nearest sensitive receptors, i.e., to the north of the site to potentially mitigate noise from the other containers. No further noise mitigation measures are required.

7 References

AECOM 2018. *Glebe Island Multi-User Facility Construction and Operation Noise and Vibration Impact Assessment.* Report prepared for Port Authority of New South Wales. Sydney, New South Wales. January 2018.

Bies, A., and Hanson, H 2009. *Engineering Noise Control Theory and Practice, Fourth Edition.* Published by Spon Press, Abingdon, England. 2009.

CAT 2021. *272D3 XE Skit Steer Loader.* Technical Specifications. 2021.

The Centre for Construction Research and Training 2024. *Solution Summary: Quieter Motor Graders*. Available from: https://www.cpwrconstructionsolutions.org/heavy_equipment/solution/832/quieter-motor-graders.html.

Google Earth 2023. Bays Port, New South Wales. Accessed November 2023.

PowerCon 2024. *Noise Analysis – PC_15 Preliminary Noise Analysis Description for WBCT &GI8. 22 April 2024.*

SLR 2013. *Glebe Island Wharves 1 & 2 Proposed Multi User Facility.* Report Number 610.04309-R51. Revision 0. May 2013.

SLR 2017. Observatory Hill Weather Station Data September 2015 to August 2017 (Appendix K of Report Number 610.13361.00200). 2017.

Sydney Ports Corporation 2013a. *Multi User Facility Glebe Island Berth 1 and 2 Review of Environmental Factors.* June 2013.

Sydney Ports Corporation 2013b. *White Bay Cruise Terminal Operational Environmental Management Plan Cruise Operations.* March 2013.

Wilkinson Murray Pty Limited 2010. *White Bay Passenger Terminal Noise Assessment.* Report prepared for Sydney Ports Corporation. September 2010.

Appendix A
Predicted day time noise contours under stability class D for scenario 1 (construction activities)

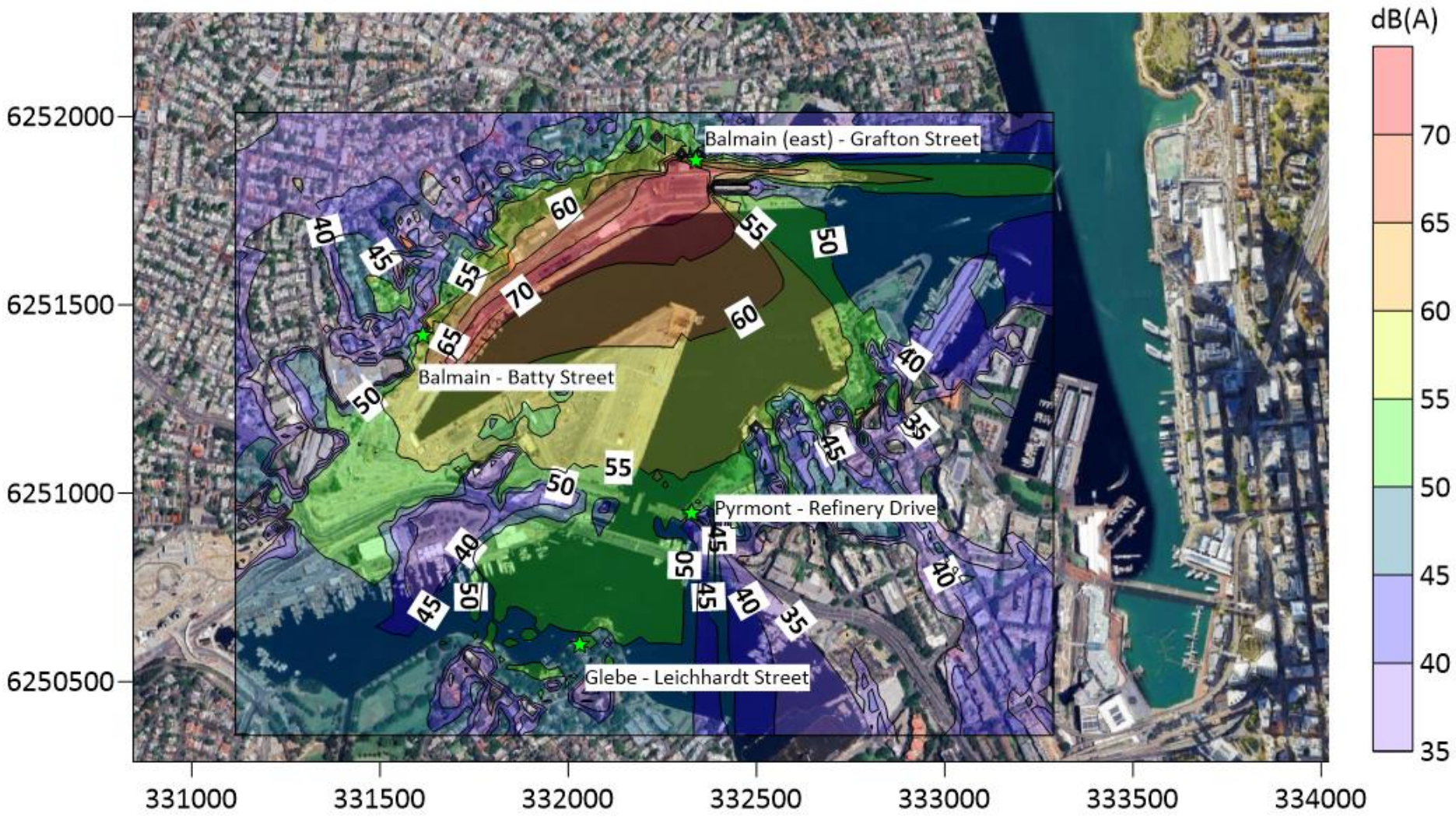

Figure A-1: Predicted day time noise contours (dB(A)) under stability class D for construction activities – full proposal site

From Figure A1 it is evident the construction noise beyond the Precinct is generally limited to a maximum of 65 dB(A). At Balmain (east) - Grafton Street, Pyrmont – Refinery Drive, Glebe – Leichhardt Street, and Balmain – Batty Street the predicted SPLs are below the relevant criteria of 75 dB(A), 60 dB(A), 56 dB(A), and 61 dB(A) respectively.

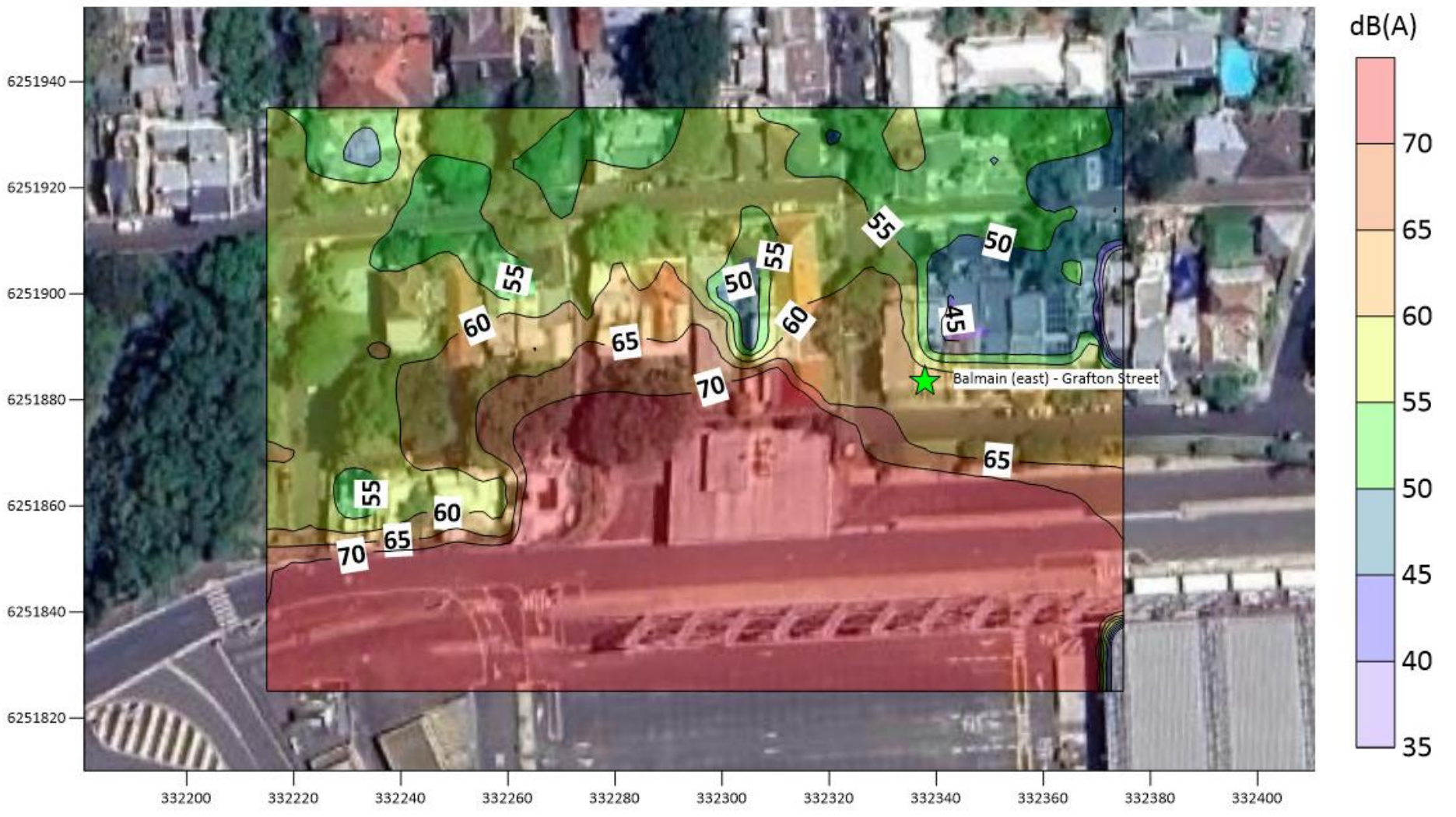

Figure A-2: Predicted day time noise contours (dB(A)) under stability class D for construction activities – Grafton Street close up

Figure A-2 shows the same data as Figure A-1 at finer detail over Balmain (east) - Grafton Street. The predicted SPLs at this location are well below the relevant criterion of 75 dB(A) beyond the Precinct. The impact of the presence of the prominent cliff is noticeable at the 70 dB(A) contour line.

Appendix B
Predicted night time noise contours under stability class D for scenario 2 (operational activities)

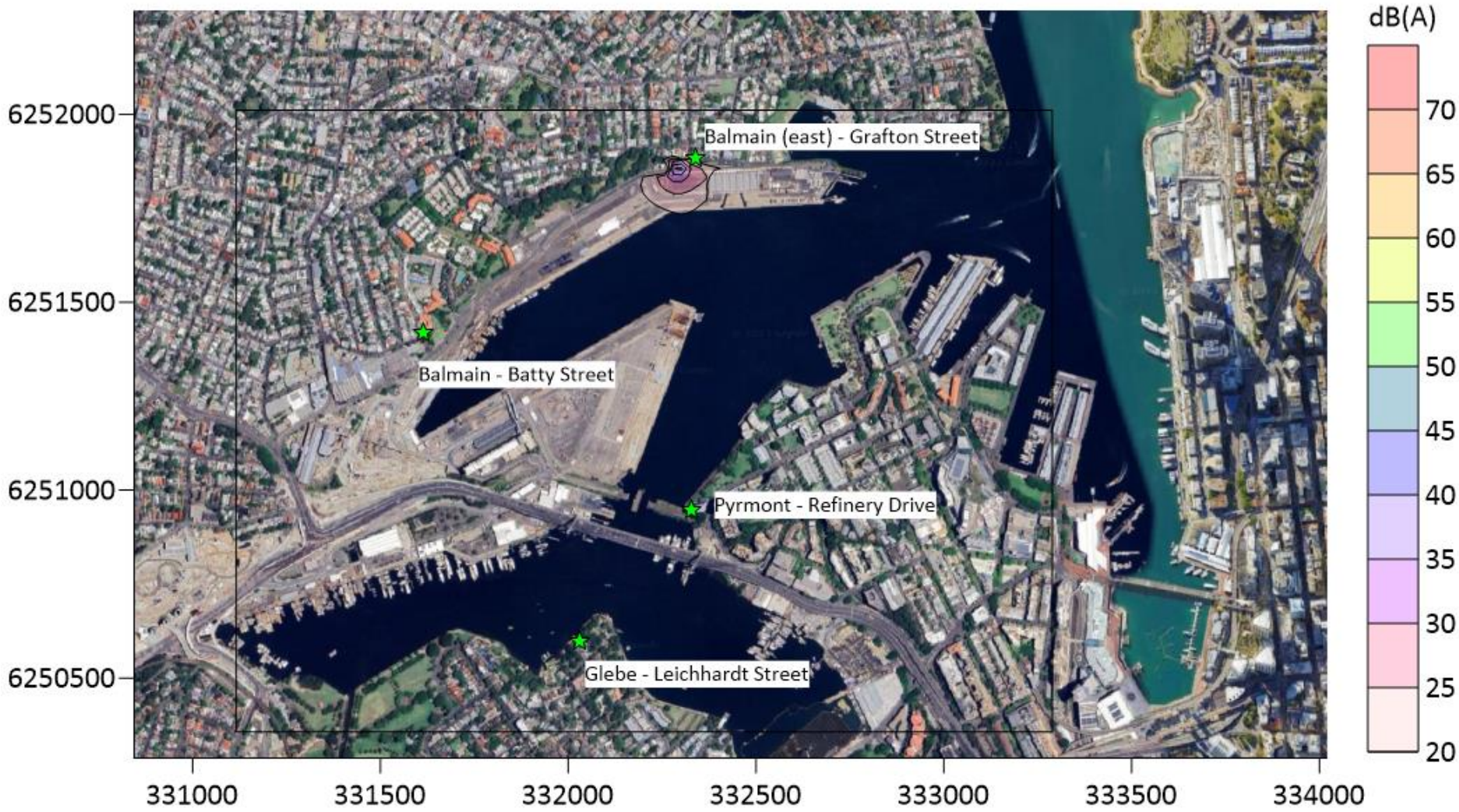

Figure B-1: Predicted night time noise contours (dB(A)) under stability class D for operational activities as designed – full proposal site (including 5 dB penalty for potential tonal characteristics)

From Figure B1 it is evident the operational noise beyond the Precinct is generally limited to a maximum of 20 dB(A). At all sensitive receptor locations, noise associated with the proposal is inaudible and therefore below the relevant criteria, including the most stringent criterion of 40 dB(A).

Figure B-2: Predicted night time noise contours (dB(A)) under stability class D for operational activities as designed – Grafton Street close up (including 5 dB penalty for potential tonal characteristics)

Figure B-2 shows the same data as Figure B-1 at finer detail over Balmain (east) - Grafton Street. The predicted SPLs at this location are well below the most stringent criterion of 40 dB(A) beyond the Precinct. The impact of the presence of the prominent cliff is noticeable at the 25 dB(A) contour line.