Appendix F

Noise and vibration impact assessment

Blast Furnace No. 6 Reline Project

Noise and Vibration Impact Assessment

BlueScope Steel (AIS) Pty Ltd

7 March 2022

→ The Power of Commitment

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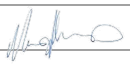
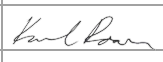
S4	1	A. Bagby	M. Velasco		K Rosen		07/03/2022

Executive summary

This report

This noise and vibration impact assessment (NVIA) report has been prepared on behalf of BlueScope Steel (AIS) Pty Ltd (BlueScope) to support the Environmental Impact Statement (EIS) for the No. 6 Blast Furnace (6BF) project (the project) and responds to the Secretary's Environmental Assessment Requirements (SEARs) for noise and vibration. This NVIA describes the existing noise environment, assesses the potential noise and vibration impacts associated with the construction and operational phases of the project, and assesses the potential increases in noise along the local transport network as a result of the proposal.

Existing environment

The study area identified for the purposes of this noise and vibration assessment is defined as a 3.5 kilometre radius from the central 6BF structure. Within this study area, 103 potential receivers have been selected, which are considered representative of the most-affected noise sensitive receivers to the project. Due to constraints surrounding the COVID-19 pandemic (as of June 2021), background noise monitoring was not undertaken for the specific purpose of this NVIA. Rating background noise levels (RBLs) have been established based on previous noise monitoring undertaken in the study area and have been used to establish the operational noise and construction noise criteria.

Noise impacts from the proposal during operation

An assessment of operational noise from the proposal (6BF and associated activities only, as opposed to a site-wide assessment) has been undertaken to predict noise levels at noise sensitive receivers. Operational noise criteria has been proposed for residential receivers based on a review of the existing Environment Protection License (EPL) 6092 for the Number 5 Blast Furnace (5BF), and guidance from the NSW EPA *Noise Policy for Industry* (NPfI) (NSW EPA, 2017). Operational noise criteria for non-residential receivers have been provided from NPfI.

A 3D noise model has been prepared to predict operational noise levels at noise sensitive receivers. Predictions show that compliance with the proposed operational noise criteria is achieved at all noise sensitive receivers based on the operation of equipment considered part of typical operations. A breakdown of the received noise levels at the most-affected residences indicate that noise emissions from operational noise sources at the Slag handling and Stockhouse areas comprise over half of the received acoustic energy from the modelled noise sources, with the blast furnace contributing to the rest.

The operational noise criteria used in this assessment is based on the NPfI discrete process criteria, which aims to ensure that noise emission from the proposal does not contribute to the existing total industrial noise level at the most affected receivers. As compliance is achieved, no cumulative noise impacts considering the existing industrial noise in the area are anticipated.

Sleep disturbance impacts have been assessed against the sleep disturbance screening criterion provided in the NPfI. Operational activities with the potential for short-duration $L_{A1(1min)}$ noise events have been identified, and predictions have been made to residential receivers. It is predicted that $L_{A1(1min)}$ noise levels will be below the screening criterion and as such, no sleep disturbance noise impacts are anticipated from the proposal.

Current noise emissions from Port Kembla Steelworks (PKSW) include the currently operating 5BF which will cease operations prior to ironmaking commencing at 6BF. A move of ironmaking operation from 5BF to 6BF will see little difference in the amount of noise generated from the PKSW.

Noise impacts from the proposal during construction

Construction noise levels have been predicted to the sensitive receivers within the study area with consideration to the acoustic requirements of the *Interim Construction Noise Guideline* (DECCW, 2011). Construction scenarios have been prepared to assess construction noise from laydown area operations, and the main construction activities within the 6BF site.

It is predicted that majority of the construction noise levels from laydown area operations and the main construction area activities will be below the Noise Management Levels (NMLs) for all sensitive receivers, for works both within and outside standard construction hours. Exceedances of the NMLs are predicted during high-intensity 6BF construction activities outside of standard construction hours. These exceedances are triggered by the use of high noise generating activities such as pile driving and rock-breaking, and will occur for a short duration at the commencement of construction activities. It is recommended that they only take place within the recommended standard construction hours.

An out of hours works procedure will be developed as part of the Construction Environmental Management Plan (CEMP) for the proposal, as authorisation for 24 hour construction is being sought as part of the request for planning approval. Subject to the final construction timetable, construction will be carried out between 7.00 am and 6.00 pm, Monday to Saturday. Where practical, noise generating activities with potential to impact any nearby receivers will be scheduled during standard hours.

For any high impact works required outside of standard hours, an application will be made to the EPA seeking approval in writing to undertake the works per EPL 6092. A description of the works, justification and management measures will be included as part of the application.

Vibration impacts from the proposal during construction

An assessment of construction vibration has been undertaken against criteria from *Assessing Vibration: A Technical Guideline* (DEC, 2006) for structural damage, and *BS6472: Guide to Evaluation of Human Exposure to Vibration in Buildings* (1 Hz to 80 Hz) (British Standards, 2008) for human comfort impacts. It is anticipated that short term human comfort impacts may be experienced for residences close to site preparation works in the No.1 Works laydown area during the use of an 18T vibratory roller however, this can be prevented through use of smaller equipment at this location. These impacts will be limited to the duration of work using this equipment, which is anticipated to only occur for a short duration at the commencement of construction activities. The potential impacts are considered to be a highly conservative approximation, since at this stage is not certain whether the roller is required, or for what duration. Due to the offset distances from the works and the nearest buildings, potential for any vibration related structural damage to occur as a result of the project is negligible.

Monitoring occurred for four blasts in January 2009 as part of previous blast furnace reline works. It concluded no discernible blast events (ground vibration or airblast overpressure) were identified at monitoring undertaken 1.1 kilometres to the southwest. Similarly, blasting required for the 6BF will take place approximately 1.1 kilometres away from the nearest residential receivers in Cringila and will use a similar methodology to the blasting at 5BF. Due to the similar distance from the source, no ground vibration or airblast overpressure impacts from blasting are anticipated at any of the nearby residential receivers.

Traffic noise impacts from the proposal during construction

Construction traffic noise levels on public roads are predicted to comply with the road traffic noise assessment criteria in accordance with the *NSW Road Noise Policy* (RNP) (DECCW, 2011) at the nearest residential receiver to the road. As such, no construction traffic noise impacts are anticipated. Construction traffic along internal private roads near sensitive receivers are also predicted to comply with construction NMLs for the site.

Mitigation and management measures have been recommended in response to the findings of the impact assessment.

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Abbreviations and acronyms

Term	Definition
AGL	Above ground level
AS	Australian Standards
AWS	Automatic weather station
BS	British Standards
BlueScope	BlueScope Steel (AIS) Pty Ltd
°C	Degrees Celsius
CEMP	Construction Environmental Management Plan
CNVG	Construction Noise and Vibration Guideline (TfNSW, 2016)
CSSI	Critical State Significant Infrastructure
dB	Decibel is the unit used for expressing the sound pressure level (SPL) or power level (SWL) in acoustics.
dBA	Decibel expressed with the frequency weighting filter used to measure 'A-weighted' sound pressure levels, which conforms approximately to the human ear response, as our hearing is less sensitive at low and high frequencies.
DCNG	Draft Construction Noise Guideline (EPA, 2021)
DEC	Department of Environment and Conservation NSW
DECC	Department of Environment and Climate Change NSW
DECCW	Department of Environment and Climate Change and Water NSW
DIN	German Institute for Standardisation (Deutsches Institut für Normung)
DP	Deposited Plan
DPIE	Department of Planning, Industry and Environment
EIS	Environmental Impact Statement
EPA	Environment Protection Authority NSW
GHD	Gutteridge Haskins & Davey
ICNG	Interim Construction Noise Guideline (DECC, 2009)
ISO	International Organization for Standardisation (Organisation internationale de normalisation)
km	Kilometre
$L_{A1(1min)}$	The noise level exceeded for 1 per cent of the time over a 1 minute period, used to denote maximum noise levels
m	Metre
m/s	Metres per second
NCA	Noise Catchment Area
NML	Noise Management Level
NPfI	Noise Policy for Industry (EPA, 2017)
NSW	New South Wales
RBL	Rating Background Noise Level
RNP	Road Noise Policy (DECCW, 2011)
SEARs	Secretary's Environmental Assessment Requirements

Term	Definition
SPL	Sound Pressure Level
SPLi	Internal Reverberant Sound Pressure Level
SSD	State Significant Development
SWL	Sound Power Level
TRT	Top gas recovery turbine
WGHR	Waste Gas Heat Recovery
5BF	Blast Furnace Number 5
6BF	Blast Furnace Number 6
µPa	Micropascals

Glossary of terms

Term	Definition
A weighting	The human ear responds more to frequencies between 500 Hz and 8 kHz and is less sensitive to very low-pitch or high-pitch noises. The frequency weightings used in sound level measurements are often related to the response of the human ear to ensure that the meter better responds to what you actually hear.
Noise-enhancing weather conditions	Weather effects that enhance noise (i.e. wind and temperature inversions) that occur at a site for a significant period of time (i.e. light winds, up to and including 3 m/s, occurring more than 30% of the time in any assessment period in any season and/or temperature inversions occurring more than 30% of the nights in winter).
Ambient noise	The all-encompassing noise associated within a given environment. It is the composite of sounds from many sources, both near and far. This is described using the Leq descriptor.
Background noise	The underlying level of noise present in the ambient noise, excluding the noise source under investigation, when extraneous noise is removed. This is described using the L90 descriptor.
Compliance	The process of checking that source noise levels meet with the noise limits in a statutory context.
Construction footprint	Defined as the area that will be directly affected by construction of the proposal. It includes: – The location of project infrastructure, 6BF, slag handling area and immediate surrounds – The area that will be directly disturbed by the movement of construction plant and machinery, and the location of the temporary, construction compounds and laydown areas that will be used during construction
Feasible and reasonable measures	Feasibility relates to engineering considerations and what is practical to build. Reasonableness relates to the application of judgement in arriving at a decision, considering the following factors: – Noise mitigation benefits (amount of noise reduction provided, number of people protected) – Cost of mitigation (cost of mitigation versus benefit provided) – Community views (aesthetic impacts and community wishes) – Noise levels for affected land uses (existing and future levels, and changes in noise levels)
Ground-borne vibration	Vibration transmitted from a source to a receptor via the ground.
Hertz	The measure of frequency of sound wave oscillations per second. 1 oscillation per second equals 1 hertz.
Maximum noise event	The loudest event or events within a given period of time. This is generally described using the L_{max} descriptor.
Meteorological conditions	Wind and temperature inversion conditions.
Most-affected location	Location(s) that experience (or will likely experience) the greatest noise impact from the construction works and operations under consideration. In determining these locations, existing background noise levels, noise source location(s), distance and any shielding between the construction works (or proposed works) and the residences and other sensitive land uses need to be considered.
Noise management level	The NML as defined by the ICNG. To be measured and assessed at the property boundary that is most exposed to construction noise, and at a height of 1.5 m above ground level. If the residential property boundary is more than 30 m from the residence, the location for measuring or predicting noise levels is at the most affected point within 30 m of the residence.
Noise sensitive land use	Land uses that are sensitive to noise, such as residential areas.

Term	Definition
Non-compliance	Development is in non-compliance with its noise consent/ licence conditions if the monitored noise levels exceed its statutory noise limit (exceptions may be given if the noise level exceeds by less than 2 dB).
Octave	A division of the frequency range into bands, the upper frequency limit.
One third-octave	Single octave bands divided into three parts.
Project noise trigger level	Target noise levels for a particular noise generating facility. They are based on the most stringent of the intrusive criteria or amenity criteria. Which of the two criteria is the most stringent is determined by measuring the level and nature of existing noise in the area surrounding the actual or propose noise generating facility.
Proponent	BlueScope Steel (AIS) Pty Ltd
Proposal site	The southern section of the No.2 Works, within the ironmaking facilities, which is located within Lot 1 DP 606434.
Rating Background Level	The RBL is defined by the Noise Policy for Industry (NPfI) as 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). This is the level used for assessment purposes.
Resonance	Resonance describes the phenomenon of increased amplitude that occurs when the frequency of a periodically applied force is equal or close to a natural frequency of the system on which it acts.
Study area	Land in the vicinity of, and including, the proposal site. The ‘study area’ is the wider area surrounding the proposal site.
Temperature inversion	An atmospheric condition in which temperature increases with height above the ground.
Z-Weighting (or Linear-weighted)	Zero-weighting or Linear-weighting indicates no weighting filter has been applied and refers to a flat frequency response for sound level meters.

1. Introduction

1.1 Background and overview

BlueScope Steel (AIS) Pty Ltd (BlueScope) is one of Australia's leading manufacturers and is a global leader in finished and semi-finished steel products. BlueScope's Port Kembla Steelworks (PKSW) operation in NSW includes two blast furnaces. No. 5 Blast Furnace (5BF) is currently operating, while No. 6 Blast Furnace (6BF) is currently in care and maintenance.

5BF is expected to continue to produce (molten) iron on a continuous basis until it reaches the end of its operational life at some stage between 2026 and 2030. BlueScope is proposing a move of iron production from 5BF to 6BF, after 5BF ceases operation.

6BF last produced iron in 2011, at which point it was taken out of service and placed into care and maintenance. To prepare 6BF to become operational again, major maintenance works are required (the project). The project aims to return 6BF to service through a reline process that will be carried out while 5BF continues to operate.

The project has been declared critical state significant infrastructure (CSSI) in accordance with section 5.13 of the *Environmental Planning and Assessment Act 1979* (EP&A Act) and Schedule 5 of the *State Environmental Planning Policy (State and Regional Development) 2011* (SRD SEPP). An environmental impact statement (EIS) has been prepared to support the application for approval.

This noise and vibration impact assessment report has been prepared by GHD Pty Ltd (GHD) as part of the EIS for the project. The EIS has been prepared to support the application for determination of the project and address the environmental assessment requirements of the Secretary's Environmental Assessment Requirements (SEARs) pertaining to noise and vibration.

1.2 Purpose of this report

The purpose of this report is to assess the potential noise and vibration impacts from constructing and operating the project. The report:

- Addresses the SEARs (DPIE, 2021) as listed in Table 2.1.
- Describes the existing environment with respect to noise and vibration.
- Assesses the potential impacts of constructing and operating the project on sensitive receivers.
- Recommends measures to mitigate and manage the impacts identified.

1.3 Structure of this report

The structure of the report is outlined below.

- **Section 1** – provides an introduction to the report
- **Section 2** – provides a description of the project during the operational and construction phases
- **Section 3** – describes the methodology used to assess potential impacts to sensitive receivers
- **Section 4** – describes the existing noise environment and the sensitive receivers in the study area
- **Section 5** – details the assessment criteria used to assess the potential noise and vibration impacts
- **Section 6** – summarises the outcomes of the assessment and a discussion of the potential impacts
- **Section 7** – provides the mitigation measures recommended to reduce the potential impacts
- **Section 8** – summarises the key outcomes of the noise and vibration impact assessment
- **Section 9** – lists the references used in this report

1.4 Limitations

This report has been prepared by GHD for BlueScope (AIS) Steel Pty Ltd and may only be used and relied on by BlueScope (AIS) Steel Pty Ltd for the purpose agreed between GHD and BlueScope (AIS) Steel Pty Ltd as set out in section 1.2 of this report. GHD otherwise disclaims responsibility to any person other than BlueScope (AIS) Steel Pty Ltd arising in connection with this report. GHD also excludes implied warranties and conditions, to the extent legally permissible.

The services undertaken by GHD in connection with preparing this report were limited to those specifically detailed in the report and are subject to the scope limitations set out in the report.

The opinions, conclusions and any recommendations in this report are based on conditions encountered and information reviewed at the date of preparation of the report. GHD has no responsibility or obligation to update this report to account for events or changes occurring subsequent to the date that the report was prepared.

The opinions, conclusions and any recommendations in this report are based on assumptions made by GHD described in this report. GHD disclaims liability arising from any of the assumptions being incorrect.

GHD has prepared this report on the basis of information provided by BlueScope (AIS) Steel Pty Ltd and others who provided information to GHD (including Government authorities), which GHD has not independently verified or checked beyond the agreed scope of work. GHD does not accept liability in connection with such unverified information, including errors and omissions in the report which were caused by errors or omissions in that information.

The opinions, conclusions and any recommendations in this report are based on information obtained from, and testing undertaken at or in connection with, specific sample points. Site conditions at other parts of the site may be different from the site conditions found at the specific sample points.

Investigations undertaken in respect of this report are constrained by the particular site conditions, such as the location of buildings, services and vegetation. As a result, not all relevant site features and conditions may have been identified in this report.

Site conditions may change after the date of this report. GHD does not accept responsibility arising from, or in connection with, any change to the site conditions. GHD is also not responsible for updating this report if the site conditions change.

2. Legislative and policy context

2.1 Secretary's Environmental Assessment Requirements

The SEARs relevant to noise and vibration, together with a reference to where they are addressed in this report are summarised in Table 2.1.

Table 2.1 Noise and vibration SEARs

Requirement	Where addressed in this report
Noise and vibration	
A quantitative assessment of potential construction, operational and transport noise and vibration impacts of the project prepared in accordance with the relevant Environment Protection Authority guidelines	Section 7.1 (Operation – EPL 6092 and NPfI) Section 7.2 and 7.3 (Construction – ICNG) Section 7.4 and 7.7 (Traffic noise – RNP)
Identification of sensitive receivers and consideration of cumulative noise from approved and/or proposed development on site and in the vicinity of the site	Section 5.2 (Sensitive receivers) Section 6.1.4 (Cumulative noise impacts)
Details and justification of proposed noise mitigation and monitoring measures	Section 8.2 (Construction mitigation) Section 8.3 (Operational) Section 8.4 (Draft Operational Noise Management Plan)

2.2 Guidelines and policies

The assessment was undertaken in accordance with the SEARs and with reference to the requirements of relevant legislation, policies and/or assessment guidelines, including:

– Interim Construction Noise Guideline (ICNG) (DECC, 2009)
  - Used for the assessment of construction noise and vibration impacts
– NSW Road Noise Policy (RNP) (DECCW, 2011)
  - Used for the assessment of traffic generation from the project; both in construction and operation phases
– Noise Policy for Industry (NPfI) (EPA, 2017)
  - Used for the assessment of operational noise impacts
– Assessing Vibration: A Technical Guideline (DEC, 2006)
  - Used for the assessment of construction vibration impacts
– *BS 7385-2:1993 Evaluation and measurement for vibration in buildings Part 2 – Guide to damage* (British Standards, 1993)
  - Used for the determination of suitable vibration intensity thresholds for structures
– *Technical Basis for Guidelines to Minimise Annoyance due to blasting overpressure and ground vibration* (ANZEC, 1990)
  - Used for the assessment of overpressure impacts resulting from blasting activities

3. Methodology

3.1 Key tasks

Project definition

– Review of operational noise sources from the project, and assignment of suitable source noise levels.
– Review of proposed construction staging and construction areas and indicative construction equipment lists.

Existing environment

– Identify the study area relevant to the noise and vibration assessment.
– Identify and classify sensitive receivers within the study area.
– Characterise the existing noise environment based on previous noise monitoring undertaken at representative locations in the study area.
– Determine the rating background levels (RBL) for residential receivers in the study area to establish the construction noise and operational noise criteria.

Operational noise assessment

– Identify the significant noise sources associated with the blast furnace during operation and indicative sound power levels based on measured or assumed noise data of similar equipment at 5BF supplemented with noise measurements undertaken by GHD.
– Determine worst-case operating scenarios during all periods of the day based on assumptions detailed in Appendix C.
– Predict noise levels at sensitive receivers using SoundPLAN Version 8.2 (SoundPLAN) noise modelling software with consideration to the local meteorological conditions.
– Where required, in-principle noise mitigation measures have been recommended to reduce noise to within acceptable and compliant levels. Operational noise criteria considers requirements both from the NSW EPA *Noise Policy for Industry* (NPfI) and the existing environment protection license EPL 6092 for 5BF. These noise mitigation measures are to be incorporated into the detailed design noise model.

Construction noise and vibration assessment

– The RBLs were used to establish the noise management levels (NMLs) in accordance with the ICNG.
– A list of likely construction activities and machinery was developed based on the constructability requirements for the project. The construction activities were used to develop construction scenarios for construction noise modelling. Representative sound power levels for the selected equipment were obtained from the *Construction Noise and Vibration Guideline (CNVG)* (TfNSW, 2016), AS2436:2010 *Guide to noise and vibration control on construction, demolition and maintenance sites* (Australian Standards, 2010).
– Noise modelling was undertaken for the identified construction scenarios and likely equipment that will be operating.
– Safe working distances for human comfort and cosmetic damage to buildings were sourced from the CNVG for various vibratory intensive equipment. Any sensitive receivers located within these safe working distances were identified.
– Where noise or vibration levels were predicted to exceed the construction noise management levels or vibration criteria, feasible and reasonable construction noise or vibration mitigation measures are recommended to reduce potential impacts.

Road traffic noise assessment during construction

A screening assessment has been undertaken for the construction traffic assessment. The screening assessment is based on the Road Noise Policy (DECCW, 2011) (RNP) which states "*any increase in the total noise level should be limited to 2 dB above that of the corresponding 'without construction' scenario*". Modelling has been undertaken using SoundPlan using the algorithm defined in the *Calculation of Road Traffic Noise* (Department of Transport, Welsh Office, 1988). Potential impacts have been identified using the following methodology:

– Identify the construction traffic routes and their road classifications.
– Determine the existing and future total traffic volumes along the route.
– Calculate the increase in road traffic noise traffic between the pre-construction and during-construction scenarios.
– Where the increase in traffic noise levels is above +2 dBA, assess the total noise levels against the RNP road traffic noise criteria to identify whether mitigation should be considered.

Road traffic noise assessment during operation

Traffic generation on public roads during operation is anticipated to be consistent with the existing conditions. As such, a quantitative assessment of potential road traffic noise increase on public roads as a result of the project is not considered necessary as the acoustic requirements of the NSW Road Noise Policy are anticipated to be met.

Blasting assessment

A high-level blasting assessment has been undertaken to identify potential airblast overpressure and ground vibration impacts from blasting at the blast furnace to nearby sensitive receivers and assessed against the ANZEC blasting guideline.

3.2 Study area

The study area has been defined as approximately 3.5 kilometres from the proposal site as noise impacts during construction or operation are not anticipated beyond this distance.

3.3 Noise monitoring

It was not possible to undertake noise monitoring to establish the background noise environment at the nearest residential receivers for the following reasons:

– There were concerns over the validity of long-term noise monitoring during a lockdown period due to NSW COVID-19 restrictions in an area where road traffic noise and commercial/industrial activity are the dominant noise sources in the study area (as of June 2021).
– Visits to residences necessary to request permission for noise monitoring to be carried out were not permitted under State Government restrictions put in place as a result of the COVID-19 Delta variant outbreak (as of June 2021).

In view of the above, background noise monitoring data has been utilised from a publicly available noise and vibration impact assessment in Port Kembla, the '*Port Kembla Gas Terminal – Noise and Vibration Impact Assessment*' (Australian Industrial Energy, 2018) to establish the RBL at residences within the study area.

Background noise monitoring conducted in 2018, using the NPfI long term method, was undertaken at two residential locations representative of the reasonably most affected locations to quantify the existing background and ambient noise levels in the surrounding environment. The measured background noise levels were used to establish the RBLs for each of the relevant periods of the day in accordance with Fact Sheet A and Fact Sheet B of the NPfI. The RBLs were used to establish the NMLs in accordance with the ICNG and the intrusiveness noise levels in accordance with the NPfI.

The relevant noise catchment areas (NCAs) where these RBLs have been used to establish the construction noise management levels are discussed in Section 5.2.

Table 3.1 Representative background and ambient noise levels in the study area

Monitoring I.D	Location	Rating Background Level (RBL), L90 - dBA			Ambient level, Leq - dBA		
		Day	Evening	Night	Day	Evening	Night
L1	117 Gladstone Avenue, Coniston	39	40 (39)	39	52	50	50
L2	16 Merrett Avenue, Cringilla	43	42	45 (42)	51	49	50

Notes:

1) Where the evening RBL is higher than the day RBL, the day RBL has been used to establish the criteria.

2) Where the night RBL is higher than the evening RBL, the evening RBL has been used to establish the criteria.

3.4 Operational noise assessment

3.4.1 Overview

Noise modelling of the 6BF has been based on near-field noise measurements of equipment undertaken as presented in *Environmental noise and vibration monitoring results for No. 5 Blast Furnace Reline Project* (BlueScope Steel / Hatch, 2009) to determine the sound power level of individual items of equipment or the internal sound pressure level of operations within buildings. Where noise levels were not provided for noise equipment/processes associated with the 5BF, sound power levels have been measured by GHD at the 5BF site or estimated based on a literature review of similar equipment. During the detailed design phase, source noise levels should be confirmed.

The location of noisy equipment/processes have been based on drawings and information provided by BlueScope and include the 3D dimensional co-ordinates of these items for inclusion in the noise model. Appendix B includes a general arrangement drawing showing the location of the noise sources in the model.

The duration and frequency/timing of each item (i.e. continuous, intermittent, emergency use only) has been taken into account in the noise model and time corrections have been applied where appropriate to represent a worst-case (15 minute) scenario of typical operations.

The following factors have been considered in the operational noise modelling:

– The sound power level (SWL) of external noise sources has been modelled as either a point source, area source (2D or 3D) or a line source. For line or area sources, the SWL can be represented either as a SWL (total area or line) or SWL" (per m^2) for an area of SWL" (per metre) for a line.
– Internal noise levels (SPLi) at the façade of buildings have been estimated based on measured data to predict break-out noise from noise generating buildings.

To predict the noise levels at sensitive receivers surrounding the site, the following factors have been taken into account in the operational noise modelling:

– External noise line sources (e.g. conveyors)
– External point sources (e.g. pumps, ventilation fans, valves, vibro-feeders, screens etc.)
– The envelope of each building (3-dimensional) to predict break-out noise levels from each building component including the noise reduction properties and surface area of each of the external building components
– Terrain topography
– Absorption from the ground coverage
– Atmospheric absorption
– Relevant shielding objects (e.g. buildings/noise barriers)
– The operating times/duration/frequency of the relevant noise sources
– The potential for noise enhancing meteorological conditions

3.4.2 Environmental noise modelling methodology

Acoustic modelling was undertaken using SoundPLAN noise modelling software to predict indicative environmental noise levels at the sensitive receivers surrounding the project site during the operation of the facility. SoundPLAN is a computer program for the calculation, assessment and prognosis of noise propagation. It calculates environmental noise propagation using industry standard models such as the ISO 9613-2 (ISO, 1996) prediction method.

General parameters used in the model are listed in Table 3.2.

Table 3.2 Noise modelling parameters

Variable	Parameter used
Calculation method	ISO 9613-2: 1996 *Acoustics — Attenuation of sound during propagation outdoors — Part 2: General method of calculation*
Topography	Sourced from ELVIS GIS Australia - 5 m elevation intervals
Receiver heights	1.5 m above building ground level
Ground absorption	0.5 for all areas (0 is non-porous ground and 1 is porous ground such as that found in a rural setting comprising of mainly grass and vegetation)
Temperature	10°C (conservative)
Humidity	90% (conservative)
Number of reflections	A maximum number of 2 reflections from surrounding structures
Building footprints and heights (outside the project site)	PSMA Geoscape data
Building footprints and heights (within the project site)	Based on drawings provided by BlueScope and a Navisworks model to estimate the height of buildings/structures
Source noise levels	Detailed assumptions for the source noise level inputs are presented in Appendix C for equipment shown in Table 4.2

3.4.3 Local meteorological conditions

Wind has the potential to increase noise levels at a receiver when it is light and stable and blows from the direction of the source of the noise. As the strength of the wind increases, the noise produced by the wind will mask noise from most industrial and transport sources.

Temperature inversions (i.e. where atmospheric temperature increases with altitude) typically occur during stable atmospheric conditions such as the night-time period in the winter months. Temperature inversion can also increase site noise levels at surrounding assessment locations.

Wind effects and temperature inversions need to be considered when predicting the long-term noise levels during the operation of the project.

3.4.3.1 Noise Policy for Industry requirements

The NPfI requires assessment of noise under standard and noise enhancing weather conditions. The NPfI defines these as follows:

– Standard meteorological conditions: defined by stability categories A through to D with wind speeds up to 0.5 m/s at 10 m above ground level (AGL) for day, evening and night periods.
– Noise-enhancing meteorological condition: defined by stability categories A through to D with light winds (up to 3 m/s at 10 m AGL) for the day and evening periods; and stability categories A through to D with light winds (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.

The NPfI specifies the following two options to consider meteorological effects:

1. Adopt the noise-enhancing meteorological conditions for all assessment periods for noise impact assessment purposes without an assessment of how often these conditions occur – a conservative approach that considers source-to-receiver wind vectors for all receivers and F class temperature inversions with wind speeds up to 2 m/s at night.
2. Determine the significance of noise-enhancing conditions. This involves assessing the significance of temperature inversions (F and G class stability categories) for the night-time period and the significance of light winds up to and including 3 m/s for all assessment periods during stability categories other than E, F or G. Significance is based on a threshold of occurrence of 30% determined in accordance with the provisions in this policy. Where noise-enhancing meteorological conditions occur for less than 30% of the time, standard meteorological conditions may be adopted for the assessment.

3.4.3.2 Wind effects

The NPfI recommends consideration of wind effects if they are “significant”. The NPfI defines “significant” as the presence of source-to-receiver wind speed (measured at 10 m above ground level) of 3 m/s or less, occurring for 30% of the time in any assessment period and season.

This is further clarified by defining source-to-receiver wind direction as being the directional component of wind. The NPfI states that where wind is identified to be a significant feature of the area then assessment of noise impacts should consider the highest wind speed below 3 m/s, which is considered to prevail for at least 30% of the time.

A review of the vector components of hourly wind data from 2016 to 2020 was undertaken for data from the Bureau of Meteorology’s Port Kembla Harbour automatic weather station (AWS) (ID: 068253). The observations are approximately 2 km from the site and are considered representative for the site and surrounds.

Figure 3.1 shows the wind roses (2016 to 2020) for each NPfI assessment period and for each season. Table 3.3 provides a summary of the prevailing wind conditions that are relevant to the assessment. The analysis indicates that noise-enhancing wind conditions are identified to be a significant feature of the area in the following wind directions: South-Southwest, Southwest, West-southwest, West and West-northwest. These wind directions all blow from the site to the sea and not in the direction of any sensitive receiver locations. As such, noise-enhancing conditions due to wind effects have not been considered in this assessment.

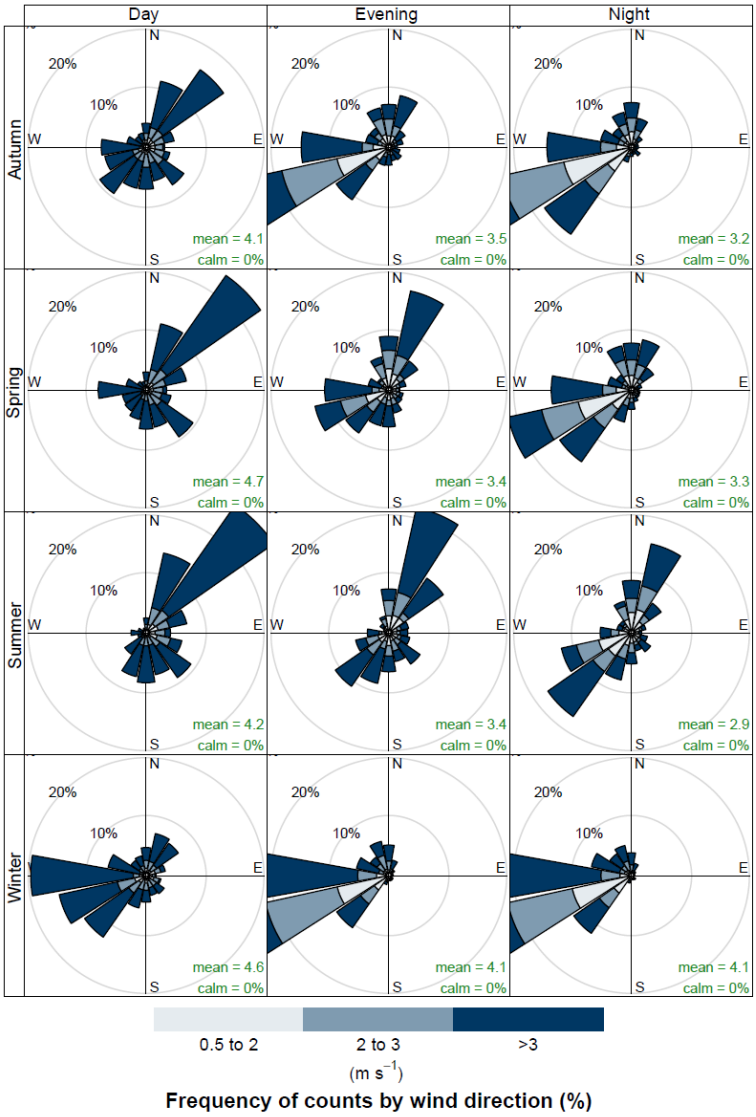


Figure 3.1 5 year wind rose (seasonal and relevant assessment periods) – 068253 AWS

Table 3.3 Significant wind effects analysis – Port Kembla Harbour AWS

Wind direction[1]	Summer			Autumn			Winter			Spring		
	Day	Evening	Night	Day	Evening	Night	Day	Evening	Night	Day	Evening	Night
N	10%	19%	23%	10%	17%	14%	9%	9%	6%	9%	21%	18%
NNE	13%	20%	23%	12%	15%	12%	10%	7%	4%	12%	21%	17%
NE	16%	19%	19%	14%	11%	9%	10%	4%	2%	14%	18%	12%
ENE	19%	16%	15%	14%	7%	4%	9%	2%	1%	15%	13%	8%
E	17%	11%	9%	15%	4%	2%	9%	1%	0%	15%	9%	5%
ESE	15%	10%	7%	14%	3%	1%	9%	1%	0%	13%	8%	4%
SE	13%	12%	9%	14%	3%	2%	9%	1%	0%	11%	9%	5%
SSE	12%	13%	12%	14%	4%	3%	10%	1%	1%	10%	10%	7%
S	9%	15%	19%	13%	8%	12%	11%	7%	7%	9%	13%	14%
SSW	7%	17%	26%	12%	26%	34%	14%	28%	29%	6%	19%	28%
SW	5%	15%	28%	10%	30%	39%	14%	33%	34%	4%	20%	32%
WSW	3%	12%	26%	7%	30%	40%	13%	34%	35%	3%	18%	32%
W	1%	10%	23%	6%	32%	41%	12%	36%	36%	2%	18%	31%
WNW	1%	8%	20%	5%	32%	35%	10%	33%	32%	1%	18%	28%
NW	2%	10%	16%	5%	18%	18%	7%	14%	12%	2%	16%	17%
NNW	5%	15%	21%	7%	17%	15%	8%	10%	8%	5%	19%	17%

Notes:

1) The percentages shown are the frequency of counts by wind direction for light winds up to 3 m/s and include the arithmetic sum of the direction being reported and the four closest directions. Where 30% occurrence is exceeded, the cell is shaded blue

3.4.3.3 Temperature inversions

Temperature inversions typically occur during the night-time period in the winter months and have the potential to increase noise levels from the operations at the blast furnace to the surrounding sensitive land uses. Per the NPfI, temperature inversions are to be assessed when they are found to occur for 30% of the time (about two nights per week) or greater during the winter months. As the project is proposed to operate 24 hours a day, the effect of temperature inversions on noise levels at night should be considered.

Noise enhancement due to temperature inversions occurs when the atmosphere is relatively stable which corresponds with Pasquill-Gifford stability category F and G. The Bureau of Meteorology (BoM) Port Kembla Harbour AWS data did not contain cloud cover measurements. As such, cloud data has been sourced from the nearest available BoM AWS, being Bellambi AWS (ID: 068228) approximately 11 kilometres to the north of the site, which is considered representative of the site for the purposes of determining the occurrence of temperature inversions.

An analysis of the Bellambi AWS meteorological data (three winter months from 2016 to 2020) has been undertaken using the Turner method which considers the following observations parameters:

– Hourly wind speed and direction at 10 metres
– Hourly cloud cover measurements
– Hourly cloud ceiling-height measurements
– Daily records of time of sunrise and sunset

The percentage occurrence of the stability categories are presented in Table 3.4.

Table 3.4 Percentage occurrence of Pasquill stability categories

Pasquill–Gifford stability category	Percentage occurrence (winter nights)	F and G combined (night period)	Are temperature inversions a feature of the area?
A	0	38%	Yes
B	0		
C	0		
D	33		
E	28		
F	28		
G	11		

The results indicate that ‘F’ and ‘G’ class temperature inversions are a feature of the area as they occur for more than 30% of the time during the winter and therefore are relevant to the assessment.

The ISO 9613-2 algorithm considers a moderate source-to-receiver wind or a temperature inversion in the algorithm. As such, the environmental noise propagation prediction method is considered appropriate and representative of the worst-case meteorological conditions for the site. Option 1 as described in Section 3.4.3.1 in accordance with the NPfI has hence been selected.

3.4.3.4 Atmospheric conditions

Temperature and humidity affects how sound is absorbed by the atmosphere. With a fixed temperature at 10ºC, a decrease in relative humidity from 90% to 30% can decrease the sound level for a listener standing 800 m from the noise source by 3 dB (at 1000 Hz). Fixing the relative humidity at 90%, and increasing the temperature from 10 ºC to 25 ºC can decrease the sound level 800 m from the noise source by 3 dB (at 1000 Hz).

Adopting an average temperature of 10°C and average humidity of 90% is generally representative of the worst-case atmospheric conditions for environmental noise propagation and is considered conservative for the purposes of this assessment.

3.4.4 Source noise levels

6BF is not currently in operation and as such, source noise levels have been estimated based on the noise monitoring report at 5BF for similar equipment titled *"Environmental noise and vibration monitoring results for No. 5 Blast Furnace Reline Project* (Hatch, 2009)".

A site visit was also conducted by GHD in September 2021 to confirm source noise levels of certain items of equipment, and to conduct noise measurements of equipment where noise data was not available.

Source noise heights and building heights have been based on drawings provided by BlueScope. Detailed assumptions for each noise source are presented in Appendix C, along with noise data and screenshots of the 3D SoundPLAN noise model.

All source sound power levels are presented in Appendix C. Column *Noise level source* stipulates where each equipment sound power level is sourced from, corresponding as follows:

– "GHD measurements 2021" – noise measurements undertaken by GHD during a site visit to BlueScope facility, conducted in September 2021.
– "SWL_Hatch (Table 6.2)" – Table 6.2 from *Environmental noise and vibration monitoring results for No.5 Blast Furnace Reline Project* (Hatch, 4 December 2009). Sound levels calculated from measurements by Hatch.
– "SWL_BlueScope (Table 6.3)" – Table 6.3 from *Environmental noise and vibration monitoring results for No.5 Blast Furnace Reline Project* (Hatch, 4 December 2009). Sound power levels using measured data from BlueScope measurements.

3.5 Construction noise assessment

3.5.1 Construction noise prediction method

Acoustic modelling was undertaken using SoundPLAN noise modelling software to predict the effects of construction noise generated by the proposed works. General parameters used in the model are listed in Table 3.5.

Table 3.5 Noise modelling parameters

Variable	Parameter used
Calculation method	ISO 9613-2:1996 *Acoustics — Attenuation of sound during propagation outdoors — Part 2: General method of calculation* (recommended in the DCNG for construction noise)
Meteorology	Well-developed moderate ground based temperature inversion, such as commonly occurs on clear, calm nights or 'downwind' conditions which are favourable to sound propagation
Topography	Sourced from ELVIS GIS Australia - 5 m elevation intervals
Receiver heights	1.5 metres above building ground level
Ground absorption	0.5 for all areas (0 is non-porous ground and 1 is porous ground such as that found in a rural setting comprising of mainly grass and vegetation)

The exact details of the construction methodology, plant or equipment for the project, such as the intensity of works, sound power levels or operating duration are not yet known therefore this assessment is based on a variety of conservative assumptions. This information will be refined during detailed design and construction planning. The magnitude of the noise levels associated with construction activities will be dependent upon a number of factors:

– The intensity and location of construction activities
– The type of equipment used
– Existing local noise sources
– Intervening terrain
– The prevailing weather conditions

3.5.2 Construction scenarios

The sound power noise levels for all construction equipment have been sourced from the following documents:

– AS2436 – Guide to Noise Control on Construction, Maintenance and Demolition Site (Australian Standards, 2010)

– Construction Noise and Vibration Guideline (RMS, 2016).

To represent the worst-case construction activities, the construction noise modelling scenarios set out in Table 3.6 for laydown areas and Table 3.7 for 6BF construction activities have been prepared for construction noise modelling. The modelling scenarios are intended to be a high-level representation of overall construction noise emission from the project, and are based on identified high noise-generating equipment as provided in Table 4.6.

For works in the *No 2 Works* areas (No2W), some rock breaking will be required during the site preparation phase of construction activities. A geotechnical survey of the proposed areas will be conducted at the commencement of construction activities. These scenarios are denoted in Table 3.6 as “Rock breaking”.

Table 3.6 Indicative construction scenarios – laydown areas

Construction scenario	Anticipated construction equipment			Activity sound power level (SWL), dBA
	20T Forklift	Excavator	Rock breaker	
Equipment SWL, dBA	105	105	120	-
No1W 1	✓	✓		105
No1W 4	✓	✓		105
No1W 5	✓	✓		105
No2B 1	✓	✓		105
No2W 1	✓	✓		105
No2W 1 – Rock breaking			✓	120
No2W 2	✓	✓		105
No2W 2 – Rock breaking			✓	120
No2W 3	✓	✓		105
No2W 3 – Rock breaking			✓	120
No2W 4	✓	✓		105
No2W 4 – Rock breaking			✓	120
No2W 5	✓	✓		105
No2W 5 – Rock breaking			✓	120
No2W 6	✓	✓		105
No2W 6 – Rock breaking			✓	120
RA 4	✓	✓		105
RA 5	✓	✓		105
SpringHill Electrical	✓	✓		105

Table 3.7 Indicative construction scenarios – 6BF construction activities

Construction scenario	Anticipated construction equipment						Activity sound power level (SWL), dBA
	Large excavator	Franna crane	Front end loaders	Vibratory roller	Rock breaker	Pile driver	
Equipment SWL, dBA	115	98	112	109	120	130	
General construction activities	✓	✓	✓	✓			116
High intensity construction activities					✓	✓	130

3.6 Road traffic noise assessment

3.6.1 Methodology overview

Noise modelling has been undertaken to predict road traffic noise levels at residences along the transport routes for the following scenarios:

– The existing road traffic conditions (pre-construction)
– Road traffic conditions during construction (existing traffic + traffic generation during construction and operation phases)

Road traffic noise levels during construction and operation are assessed against the RNP road traffic noise criteria (see Section 6.4) to identify any potential noise impacts at residences and whether any receivers qualify for consideration of noise mitigation.

3.6.2 Prediction method

Noise modelling was undertaken using RMS' construction noise estimator tool using the parameters presented in Table 3.8.

Table 3.8 Noise modelling parameters

Variable	Parameter used
Calculation method	RMS Construction noise estimator tool using the Department of Transport, Welsh Office Calculation of Road Traffic Noise (CoRTN) (UK) prediction method adjusted for NSW conditions
Shielding	No topography or shielding from buildings included (conservative)
Traffic speeds	Sign posted speeds
Façade correction	+2.5 dBA
Receiver heights	1.5 metres above building ground level
CoRTN conversion	-3 dBA for conversion between $L_{A10(1hr)}$ and $L_{Aeq(1hr)}$ noise levels
Ground absorption	0.5 for all areas within the site

4. Project description

This section provides a description of the project with a focus on elements that relate to the assessment of potential noise and vibration impacts.

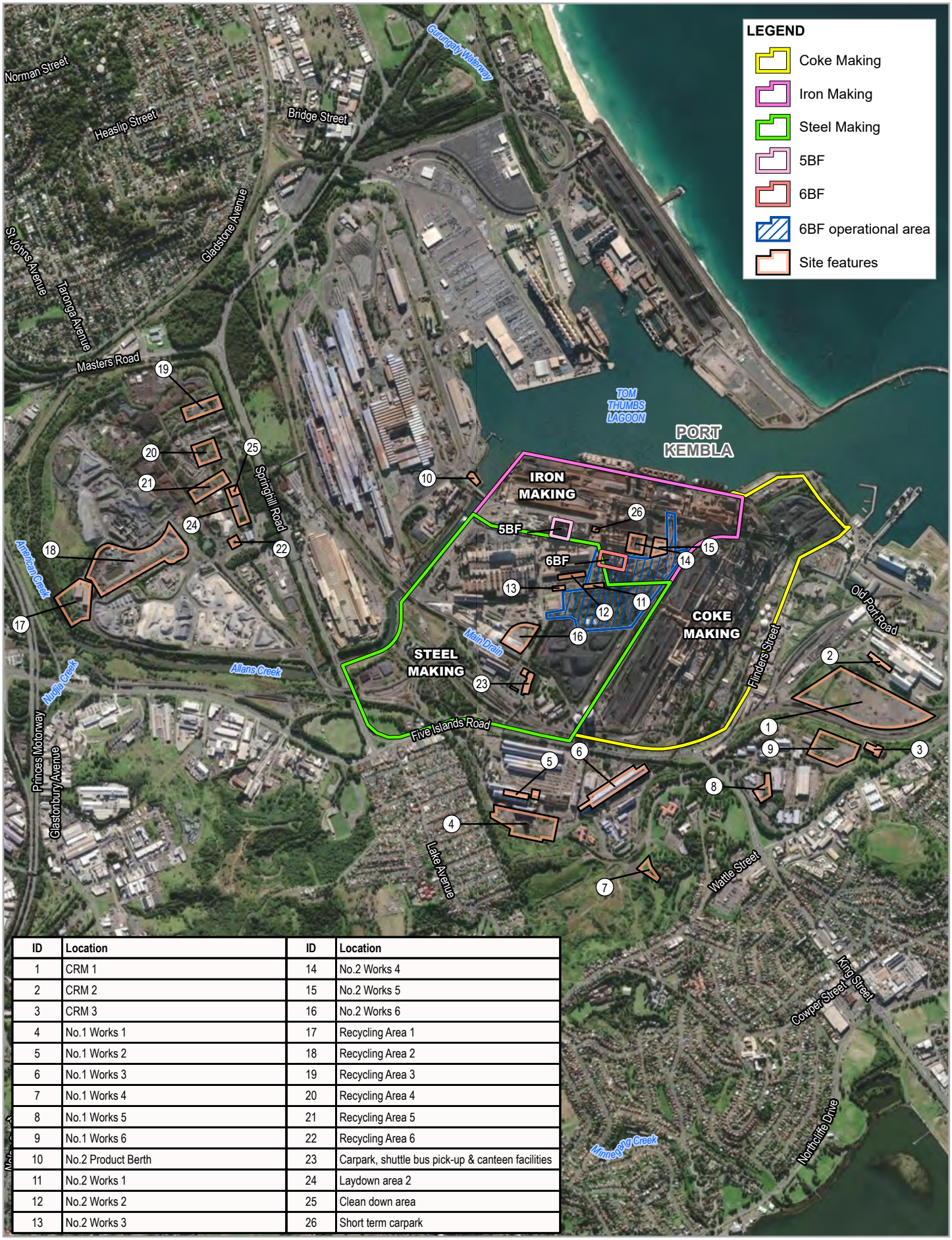
4.1 Project summary

Table 4.1 provides a summary of the key elements of the project. Key features of the project are shown on Figure 4.1.

Table 4.1 Project summary

Project element	Summary
6BF operational area and construction footprint location	Lot 1 DP 606434
Construction	Major construction work will be required within the blast furnace and surrounding facilities and will involve removing the remaining burden materials, refractory bricks and blocks, and staves within the interior of the blast furnace for replacement. Any required repairs or replacement of ancillary equipment or structures will also be carried out.
Access	The majority of the construction traffic will access the site via the major roads that service the Port Kembla industrial area, including the Princes Motorway and Princes Highway, Shellharbour Road, Springhill Road, Five Islands Road and Masters Road. No changes to existing access arrangements are proposed.
Ancillary construction facilities	Various locations within the PKSW site within Lot 1 DP 606434, Lot 1 DP 606432, Lot 1 DP 595307 and Lot 1 DP 606430.
Ironmaking components and systems	– Raw materials handling – Sinter plant – Blast furnace – Charging system – Blast furnace vessel – Cooling system – Casthouse – Hot blast system – Off gas system – Slag handling
Operations	Operation of 6BF will be generally the same as existing operations utilised at 5BF (24-hour operation), including: – Processing and transport of raw materials (iron ore, coal, coke, fluxes). – Production of sinter (agglomeration of iron ore, coke and limestone dust) for use within the blast furnace. – Production of approximately 2.7 Mtpa of iron from 6BF. – Processing of approximately 0.88 Mtpa of blast furnace slag for reuse as construction products.
Construction work hours	Where practical, and subject to the final construction program, construction will be carried out during the following construction hours: – Monday to Friday: 7.00 am to 6.00 pm – Saturday: 7.00 am to 6.00 pm – Sundays and public holidays: no work A number of construction activities will be scheduled to be undertaken as night works. Final construction phase will require 24 hour construction (estimated to be a period of 5 months). 24 hour construction may also be required for an extended period if 6BF is required online earlier than 2026.

Project element	Summary
Construction duration	Approximately 3 years
Operational duration	Approximately 20 years



ID	Location	ID	Location
1	CRM 1	14	No.2 Works 4
2	CRM 2	15	No.2 Works 5
3	CRM 3	16	No.2 Works 6
4	No.1 Works 1	17	Recycling Area 1
5	No.1 Works 2	18	Recycling Area 2
6	No.1 Works 3	19	Recycling Area 3
7	No.1 Works 4	20	Recycling Area 4
8	No.1 Works 5	21	Recycling Area 5
9	No.1 Works 6	22	Recycling Area 6
10	No.2 Product Berth	23	Carpark, shuttle bus pick-up & canteen facilities
11	No.2 Works 1	24	Laydown area 2
12	No.2 Works 2	25	Clean down area
13	No.2 Works 3	26	Short term carpark

Paper Size ISO A4

0 0.2 0.4 0.6 0.8 1

Kilometres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

N

GHD

BlueScope Steel Ltd
No.6 Blast Furnace Reline and Operations
Noise and Vibration Impact Assessment

Project No. **12541101**
Revision No. **0**
Date **28/10/2021**

Key project features

FIGURE 4-1

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Print date: 28 Oct 2021 - 10:49

Data source: LPI: DTDB/DCDB, 2017. World Imagery: Maxar.
Created by: tmorton

4.2 Operation of the project

The main noise generating systems associated with the operation of 6BF are:

– 6BF, including:
  - Hot blast system and hot blast stoves
  - Blast furnace proper and furnace top (including bleeder valves)
  - Casthouses
  - Gas cleaning system, including dust handling and effluent treatment
  - Cooling system
  - Top gas recovery turbine (TRT)
  - Casthouse and Stockhouse Bag houses
– Slag handling area, including:
  - Slag granulator
  - Slag handling yard and pits
– Charging system, including:
  - Stockhouse
  - Conveyors

4.3 Noise generating equipment/processes

4.3.1 Typical operations

The major external noise generating equipment associated within each operational component of the project are listed in Table 4.2 along with the operating assumptions used for noise modelling purposes. The operation of the blast furnace is 24 hours a day, 7 days a week, however not all equipment will operate at maximum capacity for an entire 15 minute period. As such, the assumed operating conditions is considered representative of a worst-case scenario for a 15-minute assessment period.

The locations of noise generating equipment are shown in a drawing provided by BlueScope which is included in Appendix B.

Table 4.2 Significant noise sources to be considered

System / Area	Noise sources	No. of items	Operating assumptions
Number 6 Blast Furnace			
Hot Blast	Combustion Air Fans	2	Operating continuously; noise data sourced from 5BF measurements
	Stove Purge Fans	3	Not contributing to overall noise emission from the site
	COG Booster Fans	2	Intermittent operations; noise data obtained from GHD 2021 measurements
	Stove pressurisation valve	3	Intermittent operations; noise data obtained from GHD 2021 measurements
	Stove depressurisation valve	3	Intermittent operations; noise data obtained from GHD 2021 measurements
	Snort Control Valve Silencer	1	Considered as emergency and shutdown operations only
Furnace Top	Material Bin Pressure Relief Silencers	1	Intermittent operations; noise data obtained from GHD 2021 measurements

System / Area	Noise sources	No. of items	Operating assumptions
	Material Bin Pressure Relief Valve Silencer[1]	1	Intermittent operations; noise data obtained from GHD 2021 measurements
	Gear Box Planetary Drive	1	Not contributing to overall noise emission from the site
	Gear Box Tilt Drive	1	Not contributing to overall noise emission from the site
	Stock Rod Drives	1	Operating continuously; noise data sourced from 5BF measurements
	Furnace Top Bleeders	1	Considered as emergency operations only
Gas Cleaning	Scrubber Feed Pumps	3	Operating continuously; noise data obtained from Hatch 5BF measurements
	Scrubber Recirculation Pumps	3	Operating continuously; noise data obtained from Hatch 5BF measurements
	Aeration Blowers	1	Not contributing to overall noise emission from the site
	Cooling Tower Fans	2	Not contributing to overall noise emission from the site
	RS Elements	1	Not contributing to overall noise emission from the site
	Dust Handling System	1	Not contributing to overall noise emission from the site
Cooling system	RWS Cooling Pump	5	Not contributing to overall noise emission from the site
	PW Gearbox Cooling Pump	2	Not contributing to overall noise emission from the site
	SBC Pumps	4	Operating continuously; noise data obtained from Hatch 5BF measurements
TRT	TRT	1	Not contributing to overall noise emission from the site
	TRT Alternator	1	Not contributing to overall noise emission from the site
Bag Houses	Stockhouse Baghouse Fan	1	Operating continuously; noise data obtained from Hatch 5BF measurements
	Casthouse Baghouse Fans	2	Operating continuously; noise data obtained from Hatch 5BF measurements
	Baghouse Blowers	3	Operating continuously; noise data obtained from GHD 2021 measurements
Slag Handling Area			
Slag Granulator	Slag Granulation Cooling Tower Fans	2	Operating continuously; noise data obtained from Hatch 5BF measurements
	Granulation Pump	2	Intermittent operations; noise data obtained from Hatch 5BF measurements
	Condensation Pump	2	Intermittent operations; noise data obtained from Hatch 5BF measurements
	Cooling Circuit Pump	2	Intermittent operations; noise data obtained from Hatch 5BF measurements
Slag handling yard and pits	Spray pumps	2	Operating continuously; noise data obtained from Hatch 5BF measurements
	Truck wash	1	Not contributing to overall noise emission from the site
	Knocking block / slag pot carrier	1	Operating continuously; noise data obtained from GHD noise database
Charging system			
Stockhouse	Conveyor Drives	27	Operating continuously; noise data obtained from Hatch 5BF measurements

System / Area	Noise sources	No. of items	Operating assumptions
	Small vibro-feeders and screens	31	Intermittent operations; noise data obtained from GHD 2021 measurements, adjusted for size
	Medium vibro-feeders and screens	11	Intermittent operations; noise data obtained from GHD 2021 measurements, adjusted for size
	Large vibro-feeders and screens	4	Intermittent operations; noise data obtained from GHD 2021 measurements
Conveyors	Conveyors	17	Operating continuously; noise data obtained from GHD noise database. These are generally enclosed and do no result in significant noise emissions.
Note 1: Noise emission takes into consideration noise reduction performance of silencer. Noise emission is modelled at silencer outlet location.			

4.3.2 Noise generating buildings

The noise generating buildings associated with the 6BF are shown in Table 4.3. Noise generating equipment and operations within these buildings generate average internal noise levels up to $L_{Aeq(15min)}$ 85 dBA at ground level. These buildings are enclosed and the façade will provide a sound transmission reduction of approximately 20 dBA. As such, it is assumed that these buildings do not contribute to the overall noise emission from the blast furnace site and have not been included in the noise model, with the exception of the cast house hydraulic room (included due to its large size).

Table 4.3 Noise generating buildings associated with 6BF

Building	Operating assumptions	Building construction / openings
Furnace Top Hydraulic Room	Not contributing to overall noise emission from the site.	Steel metal sheet / windows
Gas Cleaning Hydraulic Room		Steel metal sheet / windows
TRT Hydraulic Room		Steel metal sheet / windows
Conveyor Drive Houses		Steel metal sheet / windows
Cast House Hydraulic Room	Included in noise model based on measured noise levels.	Steel metal sheet / windows

4.3.3 Emergency and shutdown operations

During emergencies (i.e. not anticipated during typical operation), the noise sources listed in Table 4.4 may operate. As the pressure release safety valve has the potential to occur during any time of the day, a sleep disturbance screening assessment has been undertaken in Section 7.1.2.

Table 4.4 Noise sources during emergencies

Emergency equipment	Frequency of operation (events per year)	Typical duration of event (s)	Included in L_{Aeq} assessment?	Included in $L_{A1(1min)}$ assessment?[1]
Furnace Top Bleeder Valve	Average 2 times per year	10 seconds	No	No
Snort Control Valve Silencer	2.8 times per year Approximately every 18 weeks	10 seconds	No	Yes

4.4 Construction of the project

4.4.1 Overview

The reline and transition to operation of 6BF will be completed in approximately three years which, assuming a construction start during 2023, will see completion of construction in 2026. The actual construction start and completion dates will depend on the operational performance of the 5BF facility, and the timing of when furnace condition requires that it be decommissioned.

Construction will commence once all necessary approvals are obtained. Detailed construction planning, including timing, staging and work sequencing, will be confirmed once construction contractors have been engaged.

The construction information described in this chapter is preliminary and is based on the current stage of the design. It provides an indicative construction method that retains flexibility for the successful contractors to refine and optimise aspects of the approach. The construction methodology will be refined as the design progresses, and once the construction contractors are engaged. A final construction methodology and program will be jointly developed by the project team and construction contractors based on the conditions of approval and the mitigation and management measures provided in this document.

4.4.2 Construction access

Deliveries of construction plant and materials will be via sub-arterial or arterial roads to access the BlueScope site where vehicles will utilise internal access roads to access the 6BF. PKSW has established rail connections and shipping berths however no construction deliveries are currently expected from rail or ships. Deliveries will be unloaded to designated areas within the construction laydown areas or taken direct to their set location. The majority of construction staff vehicle movements will take place at the beginning and end of each day. Heavy vehicle movements will occur throughout the day.

4.4.3 Construction storage/laydown areas

The project will require approximately 31,000 m^2 of indoor storage and 57,000 m^2 of outdoor storage. The delivery of materials and equipment to the work sites will be staged as required with minimal storage available in the area immediately adjacent to 6BF. Indicative laydown areas are shown on Figure 4.2.

Construction support facilities, car parks and laydown areas identified are on areas of the site which have been historically used for similar activities including during previous reline events. A summary of proposed laydown areas is provided in Table 4.5.

Table 4.5 Ancillary facilities

ID	Location	Activity	Size (m^2)	Indoor/Outdoor	Comments
No1W 1	No.1 Works 1	Storage	28,500	Outdoor	Currently used as coke storage (rarely used)
No1W 2	No.1 Works 2	Storage	5,000	Indoor	No change to the use of the space as it is used today – not considered as part of noise assessment
No1W 3	No.1 Works 3	Storage	36,500	20,000 indoor 16,500 outdoor	No change to the use of the space as it is used today – not considered as part of noise assessment
No1W 4	No.1 Works 4	Storage	6,400	Outdoor	-
No1W 5	No.1 Works 5	Storage	4,000	500m^2 indoor 3,500m^2 outdoor	-

ID	Location	Activity	Size (m^2)	Indoor/Outdoor	Comments
No1W 6	No.1 Works 6	Storage	17,000	Outdoor	No change to the use of the space as it is used today – not considered as part of noise assessment
1	CRM 1	Storage	80,000	Outdoor	-
2	CRM2	Storage	3,000	Indoor	Operations indoor – not considered as part of noise assessment as operations assumed to not contribute
3	CRM3	Storage	2,800	Indoor	Operations indoor – not considered as part of noise assessment as operations assumed to not contribute
No2W 1	No.2 Works 1	Construction	1,000	Outdoor	-
No2W 2	No.2 Works 2	Construction	3,000	Outdoor	-
No2W 3	No.2 Works 3	Construction	1,500	Outdoor	-
No2W 4	No.2 Works 4	Storage	3,000	Outdoor	-
No2W 5	No.2 Works 5	Storage	7,000	Outdoor	-
No2W 6	No.2 Works 6	Storage	7,000	Outdoor	-
No2B 1	No.2 Products Berth	Storage	2,500	Outdoor	-
Ra 1	Recycling Area 1	Storage / cleaning	14,000	3,000 indoor 11,000 outdoor	No change to the use of the space as it is used today – not considered as part of noise assessment
Ra 2	Recycling Area 2	Processing	88,000	Outdoor	No change to the use of the space as it is used today – not considered as part of noise assessment
Ra 3	Recycling Area 3	Processing	25,000	Outdoor	No change to the use of the space as it is used today – not considered as part of noise assessment
Ra 4	Recycling Area 4	Storage / Processing	11,000	Outdoor	-
Ra 5	Recycling Area 5	Storage / Processing	20,000	Outdoor	-
Ra 6	Recycling Area 6	Storage	4,500	Outdoor	No change to the use of the space as it is used today – not considered as part of noise assessment
SPE	Springhill Electrical	Storage	3,000	Indoor	Operations indoor – not considered as part of noise assessment as operations assumed to not contribute

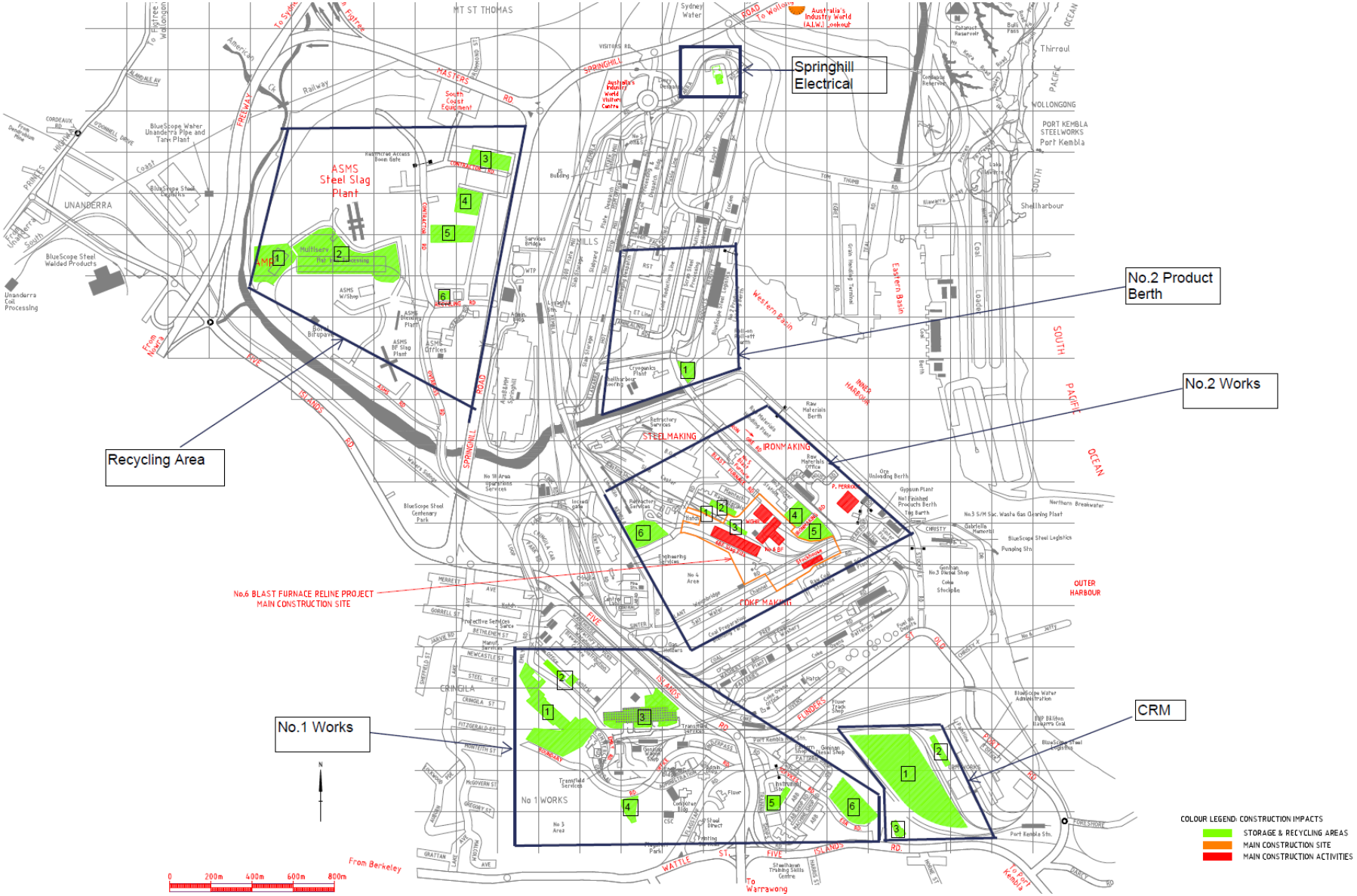


Figure 4.2 Indicative laydown areas locations

4.4.4 Reline construction activities

Major construction work will be required within the blast furnace and surrounding facilities and will involve removing the remaining burden materials, refractory bricks and blocks, and staves within the interior of the blast furnace for replacement. Any required repairs or replacement of ancillary equipment or structures will also be carried out. The location of the reline construction activities are provided in Figure 4.2 as red highlighted areas.

Construction activities will indicatively involve the following tasks:

– Removal of the remaining burden materials.
– Removal of the iron skull.
– Removal of worn carbon block refractories in the hearth.
– Removal of worn refractories in the remainder of the vessel.
– Demolition of other equipment including:
  - Cooling staves which protect the blast furnace shell.
  - Hot blast main refractory lining where required, including the expansion joints.
  - Clarifier tank and associated equipment where required.
– Repairs to the blast furnace shell where required.
– Installation of a new clarifier tank and associated equipment.
– Installation of the new hearth, sidewall refractories and staves.
– Repair/replacement of tuyeres, tapholes and instrumentation.
– Repair, maintenance and/or upgrade of ancillary equipment including:
  - Furnace cooling systems.
  - Hot blast system including the stoves, with the addition of a Stove Waste Gas Heat Recovery (WGHR) system.
  - Gas system, with addition of a Top Gas Recovery Turbine (TRT).
  - Furnace top, including the charging equipment, bleeder valves and outrigger crane.
  - Casthouse floors and associated equipment.
  - Stockhouse (raw materials feed system).
  - Automation and power systems.
  - Services.
– Construction of a new primary ferrous feed system in the Raw Materials Handling area.
– Civil works for the new slag handling area.
– Installation of a new slag granulation system.
– Commissioning and ramp up of 6BF operations.

4.4.5 Reline indicative equipment list

A list of indicative equipment required for the reline construction activities is presented in Table 4.6 and categorised into general construction equipment and high-impact construction equipment for modelling purposes.

Table 4.6 Indicative equipment list at Blast Furnace and surrounding facilities

Indicative construction equipment			
General construction equipment			
Excavators ranging from 5t to 40t	Bobcats (skid steer loaders)	Water blasters	Rail tamper
Cranes of various capacity ranging from 15t to 800t	Plate compactors	Grit blasters	Various brick saws and mixers

Indicative construction equipment			
Dump trucks	Explosives equipment (drilling rig)	Semi trailers	Material hoists and winches
Front end loaders	Air compressors	Abbey hoists	Refractory gunning machine
Telescopic boom excavator	Diesel welders	Forklifts	Temporary stove burners, fuel pipe and fans.
Liquids tankers	Welding Machines	Sykes pumps	Alimak passenger and goods lifts
Tear-Out machine	Temporary conveyors	Nitrogen welding and cutting gases	Scaffolding
Boom and scissor lifts	Vacuum loading (suck) trucks	Concrete mixers	Concrete pumps
Fuel trucks	Flat Bed Trucks	Vibratory roller	-
High-intensity construction equipment			
Piling Rigs	Rock-breaker	Concrete saw	-

4.4.6 Blasting

Explosive blasting may be required within the 6BF steel furnace shell structure to break up the iron skull. Should blasting be required, a summary of the proposed blasting works is as follows (subject to change):

– Approximately 500 tonnes of residual iron skull to be removed
– Approximately 200 holes to be drilled
– Approximately 150 kg of explosives to be deployed
– Approximately 10 blasts over 10 days in mid to late 2024

4.4.7 Construction hours

Authorisation for 24 hour construction is being sought as part of the request for planning approval.

Where practical, and subject to the final construction timetable, construction will be carried out during the following construction hours:

– Monday to Friday: 7.00 am to 6.00 pm
– Saturday: 7.00 am to 6.00 pm
– Sundays and public holidays: no work

However, there will be a number of construction activities that need to be undertaken outside of standard hours for safety purposes to minimise interaction between the project and the remainder of the PKSW operations. Where practical, noise generating activities with potential to impact any nearby receivers will be scheduled during standard hours.

4.4.8 Blasting hours

The recommended standard hours for blasting as prescribed in the ICNG are:

– Monday to Friday: 7:00 am to 6:00 pm
– Saturdays: 9:00 am to 1:00 pm
– No work on Sundays or public holidays

The proposed hours for blasting activities required for the skull excavation inside the 6BF are:

– Monday to Sunday: 6:00 am to 8:00 pm

The justification for blasting works outside of the recommended standard hours is as follows:

1. An overriding necessity to maintain the highest levels in personnel safety and risk mitigation. The blasts will be conducted when there is a minimum of personnel on site, that is, the most appropriate scheduling is at shift change times when the site is much less populated.
2. The level of explosive used will be optimised to minimise potential collateral damage to the critical existing equipment inside of the Blast Furnace which must be retained for future use, as well as reducing community impact.
3. The blasts will be contained within the 6BF steel furnace shell structure, which will contribute significantly to the attenuation of noise impacts at these more sensitive times of day.
4. Ground vibration levels and airblast overpressure levels are anticipated to be well below the criteria at the most-affected residences (see Section 7.3 and 7.5).

The proposed approach to blasting is consistent with industry standards and also with previous reline activities undertaken at the PKSW.

4.4.9 Timing

The overall construction program is anticipated to be around 3 years. An indicative construction timeline showing durations of key activities is provided below in Table 4.7.

Table 4.7 Indicative works schedule

Project stage	Activities	Approximate duration
1	– Progress with refurbishment activities that do not require long-lead items. – Early works commences for enabling activities. Includes cranes, lifts, casthouse roof replacement, drainage, construction facilities.	24 to 30 months
2	– Construction activities including demolition, civils, stockhouse, slag handling, hot blast system, gas system, cooling system, wreck out of furnace, furnace top. – Control system and automation upgrade.	24 months
3	– Initiated with twelve months advance notice of end of 5BF operations. – Construction activities including relining of furnace. – Pre-commissioning and commissioning of 6BF.	12 months
4	– Managed transition of operations from 5BF to 6BF with ramp-down of 5BF followed by ramp-up production of 6BF. – 5BF decommissioned and made safe on ceasing operation.	1 month

4.4.10 Construction traffic

The construction of the project is expected to generate:

– Approximately 300 light vehicles per day, comprising of contractors and construction personnel vehicles, which will result in 600 light vehicle movements per day (300 arrivals and 300 departures). These vehicles are expected to arrive between 5:00 am to 6:00 am and depart between 4:00 pm to 6:00 pm.
  - It is estimated that around ninety to ninety-five percent of the expected light vehicle movements will be directed to park in the central car park via Cringila Car Park Access Road. Some contractors and visitors may also use this access to the car park, where they will then be transported via mini bus through the gate at Loop Road.
  - The remaining five percent of light vehicle movements is assumed to enter and exit via the North Gate.
– Up to 50 buses per day resulting in 100 bus movements per day via Cringila Car Park Road. These buses will be used to transport workers within PKSW premises e.g. from central car park to construction site and vice versa.
– Between 50 and 100 trucks per day (depending upon the phase of construction works), resulting in between 100 and 200 truck movements per day.

– Based on conservative estimates, the expected peak traffic generation for the construction activities is summarised in Table 4.8.

Table 4.8 Traffic generation – two-way traffic

	Daily traffic generation (vehicles)	Peak Hour traffic generation (vehicles)
Light vehicles	600	300
Heavy vehicles	300	30
Total	900	330

Three typical construction traffic access routes have been considered for the purpose of this assessment. These include the following routes and are shown in Figure 4.3.

– **Route 1:** access to laydown area via Cringila Car Park Road. Vehicles to depart at Emily Road/Five Islands Road intersection.
– **Route 2:** access to laydown area via Flagstaff Road and Five Islands Road intersection.
– **Route 3:** access to laydown area and construction site via Flinders Street, Stockpile Road and Old Port Road.

A summary of these routes is provided in Figure 4.3.

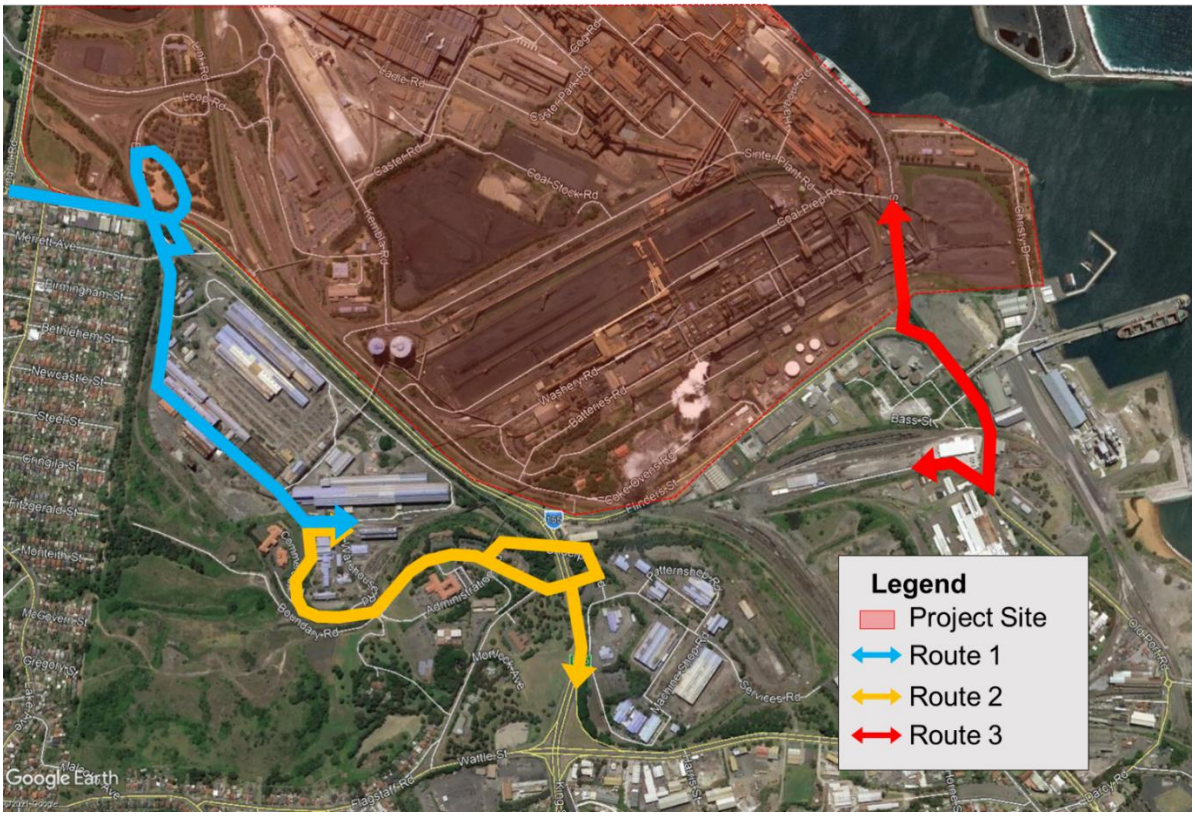


Figure 4.3 Construction Traffic Routes

Source: Google maps (2021), modified by GHD

Table 4.9 Construction access routes to each construction site

Route ID	From	To	Route	Assumptions
1A	Wollongong	PKSW project site	Princes Motorway (SB)	– Trips on Princes Motorway assumed to be split 50/50 – 70% of HV trips generated – 70% of 95% of LV trips generated
			Five Islands Road (EB)	
			Cringila Car Park Road (NB)	
			Loop Road (SB)	
			Emily Road (SB)	
1B	PKSW project site	Wollongong	Emily Road (NB)	– Trips on Princes Motorway assumed to be split 50/50 – 70% of HV trips generated – 70% of 95% of LV trips generated
			Emily Road (NB)	
			Five Islands Road (WB)	
			Princes Motorway (NB)	
2A	Port Kembla	PKSW project site	Five Islands Road (NB)	– 30% of HV trips generated – 30% of 95% of LV trips generated
			Flagstaff Road (WB)	
			General Office Road (WB)	
			Emily Road (NB)	
2B	PKSW project site	Port Kembla	Emily Road (SB)	– 30% of HV trips generated – 30% of 95% of LV trips generated
			General Office Road (EB)	
			Underpass Road (EB)	– Flagstaff Road (EB)
			Five Islands Road (SB)	– Five Islands Road (NB)
3	PKSW project site	Other PKSW locations	Old Port Road	– Along Old Port Road
4	PKSW project site	Other PKSW locations	Internal PKSW roads only	– Internal only

5. Existing environment

5.1 Project site location

The project is located in Port Kembla in the Wollongong LGA and Illawarra region of NSW. Sydney is approximately 80 km to the north of Port Kembla, while the Wollongong Central Business District (CBD) is approximately 2.5 km to the north and Lake Illawarra is approximately 3 km to the south. Port Kembla is the main industrial centre of the Illawarra region.

The PKSW site is zoned IN3 – Heavy Industrial under *State Environmental Planning Policy (Three Ports) 2013* (Three Ports SEPP). The PKSW site is a multiuse industrial area which includes storage, manufacturing, port berths, private internal roads and offices. Access to PKSW is provided by Springhill Road, Five Islands Road, Flinders Street, and Christy Drive and then private internal roads in PKSW.

The closest urban developments to PKSW are the suburbs of Cringila, Berkeley, Lake Heights, Warrawong and Port Kembla to the south, Unanderra, Cobblers Hill, Mount St Thomas, Coniston and Figtree to the north and west.

5.2 Noise sensitive land uses

Noise sensitive land uses are defined based on the type of occupancy and the activities performed in the land use. Noise sensitive land uses include:

– Residential dwellings.
– Classrooms at schools and other educational institutes.
– Hospital wards and operating theatres.
– Places of worship.
– Passive and active recreational areas such as parks, sporting fields, golf courses. Note that these recreational areas are only considered sensitive when they are in use or occupied.
– Community centres.
– Hotels, motels, caretaker's quarters, holiday accommodation and permanent resident caravan parks.

Offices, retail outlets and other business such as theatres and childcare centres could be considered noise sensitive. However, typically industrial and commercial premises are not considered particularly noise sensitive and have a relatively high noise criteria.

The study area has been defined as approximately 3.5 kilometres from the 6BF structure as noise impacts are not anticipated beyond this distance under normal operating conditions. Within this distance, 103 potential receivers have been selected to represent all sensitive receivers within the study area. The sensitive receivers and planning zones are shown in Figure 5.1.

Residential areas have been categorised into four discrete noise catchment areas (NCAs), being:

– NCA01 – The most-affected residences in Wollongong
– NCA02 – The most-affected residences in Coniston/Mount Saint Thomas
– NCA03 – The most-affected residences in Cringila
– NCA04 – The most-affected residences in Warrawong and Port Kembla

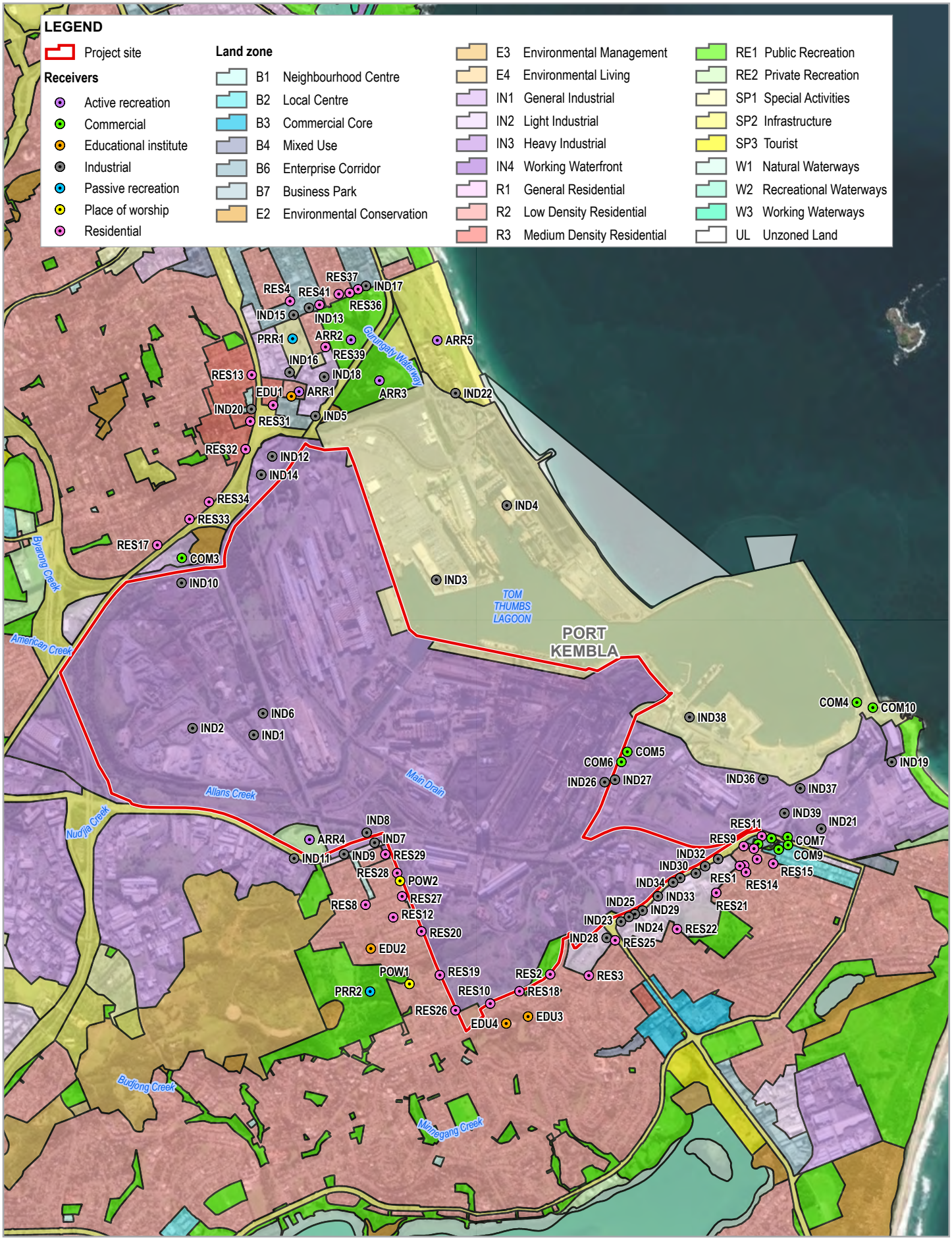
For the purposes of this noise assessment, key residential receivers have been selected for each NCA. If compliance is achieved at these residential receivers, then compliance will be ensured for all other residential receivers for each NCA. These key residential receivers are provided below in Table 5.1. Non-residential noise sensitive receivers considered in this noise assessment are provided in Table 5.2.

Table 5.1 Key residential sensitive receivers

ID	MGA20 Z56 coordinates		Type	NCA	Distance from 6BF structure (m^2)	Direction	Description
	x	y					
RES39	306246	6187289	Residential	NCA01	2,950	N	Most-affected residences in Wollongong
RES33	304813	6186719	Residential	NCA02	2,650	NNW	Most-affected residences in Coniston
RES29	304828	6183990	Residential	NCA03	1,250	ESE	Most-affected residences in Cringila
RES01	306945	6182674	Residential	NCA04	1,900	SSE	Most-affected residences in Port Kembla
RES23	305641	6182840	Residential	NCA04	1,550	SSE	Most-affected residences in Warrawong

Table 5.2 Non-residential sensitive receivers

ID	MGA20 Z56 coordinates		MGA20 Z56 coordinates	Distance from 6BF structure (m^2)	Direction	Description
	x	x				
ARR1	305928	6187111	Active recreation	2,750	N	Coniston Primary School playground
ARR2	306427	6187243	Active recreation	2,900	N	JJ Kelly Park
ARR3	306457	6186895	Active recreation	2,600	N	Australia's Industry World Lookout
ARR4	304418	6184347	Active recreation	1,600	W	BlueScope Centenary Park
ARR5	306950	6186936	Active recreation	2,750	NNE	Wollongong Golf Club
EDU01	305865	6187109	Educational institute	2,750	N	Coniston Primary School
EDU02	304408	6183468	Educational institute	1,850	ESE	Cringila Public School
EDU03	305126	6182501	Educational institute	2,050	SSE	Warrawong High School
EDU04	304969	6182536	Educational institute	2,100	SSE	Warrawong Public School
POW01	304519	6183117	Place of worship	1,950	SE	Imam Rida As Mosque Cringila
POW02	304823	6183777	Place of worship	1,350	ESE	Bilal Mosque
PRR01	306075	6187455	Passive recreation	3,100	N	Wollongong Cemetery
PRR02	304253	6183209	Passive recreation	2,100	ESE	Park in Cringila



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Kilometres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

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GHD

BlueScope Steel Ltd
No.6 Blast Furnace Reline and Operations
Noise and Vibration Impact Assessment

Project site locations, sensitive receivers, planning zones and noise monitoring locations

Project No. **12541101**
Revision No. **0**
Date **28/10/2021**

FIGURE 5-1

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Print date: 28 Oct 2021 - 10:49

Data source: LPI: DTDB/DCDB, 2017. DPE: Land zones, 2019. World Imagery: Maxar.
Created by: tmorton

5.3 Rating Background Levels (RBL)

As discussed in Section 3.3, RBLs have been established based on previous noise monitoring undertaken in the study area and are considered representative of the noise environment for the most-affected residences within each NCA. These RBLs have been used to establish the construction noise management levels in this assessment. The most-affected residences (all NCAs) can be characterised as urban residential as the acoustic environment:

– Is dominated by 'urban hum' or industrial source noises
– Has through-traffic with characteristically heavy and continuous traffic lows during peak periods
– Is near commercial and industrial districts

Table 5.3 Representative background and ambient noise levels in the study area

Monitoring I.D	Noise Catchment Area (NCA)	Rating Background Level (RBL), L90 - dBA			Ambient level, Leq – dBA		
		Day	Evening	Night	Day	Evening	Night
L1	NCA01 and NCA02	39	39	39	52	50	50
L2	NCA03 and NCA04	43	42	42	51	49	50

6. Assessment criteria

6.1 Operational noise criteria

6.1.1 Existing operational noise limits – EPL 6092

The operations associated with the 6BF form one area within the larger PKSW site. EPL 6092 contains operational noise limits for individual activities within the Port Kembla Steelworks site, including the 5BF. The operational noise limits for the 5BF are presented below in Table 6.1 along with additional notes.

> *"L6.6 For the purpose of the noise measurements referred to in condition L6.5, 5dB(A) must be added to the measured level if the noise is substantially tonal and impulsive in character.*
>
> *Noise monitoring must use the "FAST" response on the sound level meter.*
>
> *Note: Noise impacts that may be enhanced by temperature inversions shall be addressed by:*
>
> *a) documenting noise complaints received to identify any higher level of impacts or patterns of temperature inversions; and*
>
> *b) where levels of noise complaints indicate a higher level of impact then actions to quantify and ameliorate any enhanced impacts under temperature inversions conditions should be developed and implemented"*

In lieu of site-wide noise monitoring and noise modelling of the entire PKSW site, it is proposed that noise emission from the 6BF is assessed against the existing operational noise limit for the 5BF, being $L_{Aeq(15min)}$ 35 dBA at the most-potentially affected residence. It should be noted that there are currently no operational noise limits for the slag handling area or the stockhouse associated with 5BF as previous environmental noise assessments for 5BF did not include noise emissions from these areas.

There is no $L_{A1(1min)}$ operational noise limit for the 5BF to assess maximum noise events during the night period such as noise from pressure release valves or the noise from activities within the stockhouse. A such, sleep disturbance impacts have been assessed against a $L_{A1(1min)}$ noise level of 55 dBA and is consistent with the $L_{A1(1min)}$ operational noise limits for scrap cutting and the steam assets upgrade project (assessed at the most potentially affected residences).

Table 6.1 Assessment criteria – 6BF

Activity	Noise Limit $L_{Aeq(15min)}$, dBA	Noise Limit $L_{A1(1min)}$, dBA	Compliance Location
Number 5 Blast Furnace	35	55	Most potentially affected residence

6.1.2 NSW EPA Noise Policy for Industry (NPfI)

The following guidance is provided in the NPfI pertaining to certain criteria which may apply to existing industrial operations with a proposed discrete modification to their operations:

> *"Where a development proposal involves a discrete process and premises-wide mitigation, has or is to be considered outside of the development proposal, a project noise trigger level for noise from new/modified components (not the whole site) of the operation may be set at 10 dB(A) or more below existing site noise levels or requirements. This approach means that the increase in noise from the whole site is minimised and provides scope for existing components to achieve noise reductions over time."*

Previous industrial compliance noise monitoring for the BlueScope site was conducted by SLR as part of *BlueScope Steel – Port Kembla N&V Compliance Monitoring August 2018* (SLR, December 2018). Monitoring locations have been selected which are considered representative of the NCAs used in this noise assessment. This noise monitoring data is also generally supported by the ambient noise descriptors as provided in GHD's background noise monitoring data in Table 3.1 (refer to night period measurements). As such, this compliance noise monitoring data is considered suitable to establish criteria for a NPfI discrete process assessment. This assessment criteria for a discrete process is provided below in Table 6.2.

Table 6.2 Existing industrial noise level, and NPfI discrete assessment noise criteria

Representative monitoring location (SLR)	NCA representation	Measured industrial noise level (night period), dBA	NPfI discrete process criteria (night period) $L_{Aeq(15min)}$, dBA
M2 (BlueScope Air Monitoring Station – Flagstaff Road, Lake Heights)	NCA04 – Warrawong	48 (General site noise)	38
M5 (Site-office – Merret Avenue, Cringila)	NCA03 – Cringila	51 (General site noise)	41
M6 (Cnr Hill Street and Ocean Street, Mt St Thomas)	NCA02 – Mt St Thomas	41 (General low frequency rumble)	31
	NCA01 – Wollongong		

Due to the complexity and scale of the PKSW site, premises-wide mitigation is not proposed. The following matters must be considered in the context of future noise emissions relevant to the project:

– 5BF will not be operational during the operation of 6BF and as such, noise emissions from the existing 5BF will be cease.

– The stockhouse and slag handling areas associated with 5BF were not originally included in the previous environmental noise assessments for 5BF. As such, the existing EPL does not contain operational noise limits for the operations associated with the 5BF slag handling and stockhouse areas. This noise assessment considers noise emission from the 6BF including the slag handling areas and the stockhouse areas and recommends opportunities to reduce noise levels from these activities. If required, mitigation strategies are recommended in Section 8.3 to reduce operational noise levels to compliant levels.

– Compliance for noise emission from 5BF could not be determined at the most-affected residences as the contribution could not be determined at a far-field location (Cringila and Warrawong). This is due to the fact that the EPL operational noise limit for 5BF is 35 dBA and the existing industrial noise levels from the overall PKSW site is approximately 51 dBA at the most-affected Cringila receivers and 48 dBA at the most-affected Lake Heights/Warrawong Receivers. As such, it is proposed that an intermediate compliance location (between the source and the most-affected residences) be used to verify noise levels once 6BF is operational to identify any potential noise issues. Details of this is provided in Section 8.3.

6.1.3 Operational noise criteria

With consideration to the operational noise criteria provided above in Sections 6.1.1 and 1.1.1, the following approach is proposed for the assessment of operational noise from 6BF:

– The operational noise emission from industrial processes directly associated with the 6BF will be assessed towards the NPfI discrete process criteria to ensure existing industrial noise levels do not increase as a result of the project when assessed at the most-affected residences.
– The operational noise emission from the 6BF components (not including the slag handling or stockhouse), will be assessed towards the existing EPL 6092 noise limit, as the limit was intended for the specific 5BF process.

The operational noise criteria for this assessment is provided below in Table 6.3. Assessment against the NPfI discrete process criteria should ensure that noise contribution from the 6BF (including slag handling and stockhouse) does not contribute to the overall noise emission levels from the overall PKSW site at the most-affected residences.

Table 6.3 Operational noise criteria

Assessment	Receiver type	Operational noise criteria, $L_{Aeq(15min)}$ dBA	Operational components considered in assessment	
			Operational component	Modelled source groups
NPfI discrete assessment	Residential – NCA01	31	6BF Slag Handling Area Stockhouse	Hot Blast Slag Granulator Conveyor belts Bag Houses Furnace Top Gas Cleaning Cooling Stockhouse Slag handling yard and pits
	Residential – NCA02			
	Residential – NCA03	41		
	Residential – NCA04	38		
EPL 6092 noise limit	Residential (All)	35	6BF	Hot Blast Slag Granulator Bag Houses Furnace Top Gas Cleaning Cooling

6.1.4 Cumulative noise criteria for residential receivers

Cumulative noise impacts affecting receivers from all industrial noise sources are assessed according to the amenity criteria of the NPfI. The combined impact of all industrial noise sources at a receiver point should be considered, where industrial facilities are either operating or have been approved for development. The cumulative noise criteria that apply for the residential receivers within the project area shown in Table 6.4.

Table 6.4 Amenity noise level for urban residential receivers

Receiver type	Time of day	Recommended amenity noise level L_{Aeq}, dBA
Urban residential receivers	Day	60
	Evening	50
	Night	45

Based on the previous noise monitoring data and compliance noise monitoring, the recommended amenity noise level for urban residential receivers is currently being exceeded during the night period at the most-affected residential receivers in Cringila and Warrawong; refer to Table 6.2. Adoption of the assessment criteria in Section 6.1.3 should ensure noise emissions from the PKSW site do not increase as a result of the project and would negate any potential any cumulative noise impacts from existing and planning industrial noise sources.

6.1.5 Operational noise criteria for non-residential receivers

Operational noise criteria for non-residential receivers have been established based on the project amenity noise levels provided in Section 2.4 of the NPfI. These noise limits are based on the recommended amenity noise level minus 5 dB. The operational noise criteria for non-residential receivers are provided below in Table 6.5.

Table 6.5 Non-residential receiver project amenity noise criteria

Receiver type	Time of day	Recommended amenity noise level L_{Aeq}, dBA	Project amenity noise criteria $L_{Aeq(15min)}$[2], dBA
Educational institute	When in use	45[1]	43
Place of worship	When in use	50	48
Active recreation	When in use	55	53
Passive recreation	When in use	50	48

Note 1: The recommended amenity noise level is provided as an internal noise level. A + 10 dB correction has been applied to convert to an external noise level, based on a 10 dB reduction for a partially open window

Note 2: A + 3 dB correction has been applied to convert the L_{Aeq} noise descriptor to a $L_{Aeq(15min)}$ noise descriptor, as per guidance from the NPfI

6.2 Construction noise

The EPA has released the Draft Construction Noise Guideline (DCNG) in 2020 for public consultation purposes only and once public consultation is complete, the feedback will be used to provide a final guideline to replace the ICNG. The ICNG will remain applicable for projects as it is referred to in the SEARs.

However, the DCNG still provides useful guidance and includes the following changes:

– Emphasis on the need to engage with the community, to ensure that the community's views are considered when planning how to manage construction noise impacts.
– Improved guidance for managing noise from construction activities taking place outside the recommended standard hours of work.
– Alignment of the level of assessment required with risk of noise impact.
– A simplified assessment path for routine activities undertaken by public authorities on public infrastructure through industry management procedures.
– Increased emphasis on the need for proponents to justify the selection of noise mitigation measures to improve transparency.

The intent of these changes has been considered in this assessment however construction noise associated with the project has been assessed against the requirements of the ICNG.

6.2.1 ICNG/EPL construction hours

The ICNG provides guidance for assessment and management of construction noise. The guideline recommends standard hours for construction activities as follows:

– Monday to Friday: 7:00 am to 6:00 pm
– Saturday: 8:00am to 1:00 pm
– No work on Sundays or Public Holidays

Figure 6.1 shows the ICNG recommended standard construction hours (consistent with the EPL construction hours) and the out-of-hours work periods for the day, evening and night.

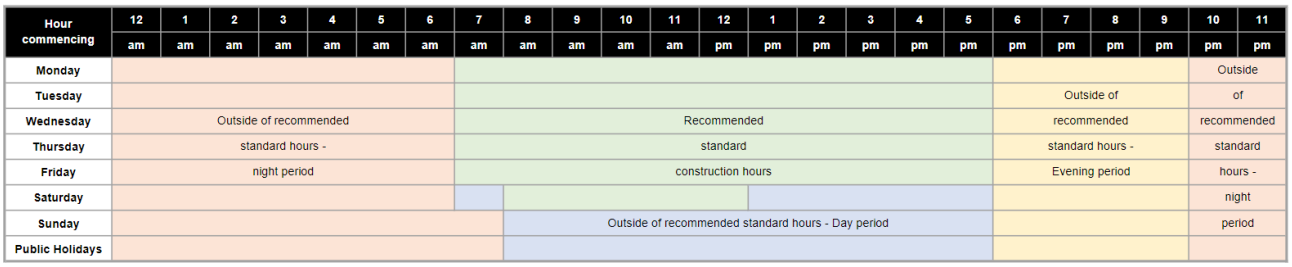

Figure 6.1 Recommended standard and outside of recommended standard construction hours

Per condition L6.3 of EPL 6092, the hours of construction may be varied by written consent of the EPA.

Authorisation for 24 hour construction is being sought as part of the request for planning approval.

Where practical, and subject to the final construction timetable, construction will be carried out during the following construction hours:

– Monday to Friday: 7.00 am to 6.00 pm
– Saturday: 7.00 am to 6.00 pm
– Sundays and public holidays: no work

6.2.2 Outside of recommended standard hours work

There will be a number of construction activities scheduled to be undertaken as night works to manage interaction with the remainder of the PKSW operations and the higher day shift workforce.

Where practical noise generating activities with potential to impact any nearby receivers will be scheduled during standard hours.

Final installation of components inside the blast furnace and other residual construction activities will require 24 hour construction (estimated to be a period of 5 months). Further, 24 hour construction may be required for an extended period to speed up the completion of construction if 6BF is required online earlier than 2026.

For any high impact activities required outside of the construction hours (7.00 am to 6.00 pm, Monday – Saturday), an application will be made to the EPA seeking approval in writing to undertake the works per EPL 6092. A description of the works, justification and management measures will be included as part of the application.

Operation of 6BF will be 24 hours per day seven day a week in line with 5BF current operations. There will be no concurrent ironmaking operation of both 5BF and 6BF.

6.2.3 Noise management levels

The construction noise management levels represent a noise level that, if exceeded, will require management measures including:

– Reasonable and feasible work practices
– Contact with the residences to inform them of the nature or works to be carried out, the expected noise levels, and durations and contact details

The management measures are aimed at reducing noise impacts at the residential receivers. However, it may not be reasonable and feasible to reduce noise levels to below the noise affected management level at all times. The noise affected construction noise management levels are not intended as a noise limit but rather a level at which noise management is required and as such should not be considered as a noise limit in the environmental protection licence or approval conditions.

Table 2 in the ICNG provides recommended NML for residences, which are detailed in Table 6.6.

Table 6.6 Residential construction noise management levels, dBA (ICNG, 2009)

Time of day	Noise management level, $L_{Aeq(15\ min)}$	Application notes
Recommended standard hours	Noise affected: RBL + 10 dBA	The noise affected level represents the point above which there may be some community reaction to noise. 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. 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: 75 dBA	The highly noise affected level represents the point above which there may be strong community reaction to noise. 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, 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	Noise affected: RBL + 5 dBA	A strong justification will typically be required for works outside the recommended standard hours. The proponent should apply all feasible and reasonable work practices to meet the noise affected level. Where all feasible and reasonable measures have been applied and noise is more than 5 dBA above the noise affected level, the proponent should negotiate with the community.

6.2.4 Sleep disturbance

Whilst some out of hours works may be required, generally these will be afternoon, evening or weekend works and not during times where sleep disturbance may be caused. No significant construction works are proposed during the night period (10:00 pm to 7:00 am Monday to Saturday and 10:00 pm on Saturday to 8:00 am on Sunday). If activities are required to be undertaken during these times it will be limited to activities which are not audible at the nearest sensitive receiver, or discreet events which need to be undertaken outside standard hours for safety reasons. It should also be noted that operational activities at PKSW occur 24 hours a day so this is typical of the local noise environment.

As such, no sleep disturbance impacts are anticipated during the construction phase of the project.

6.2.5 Project specific construction noise management levels

The noise management levels at sensitive receivers in the study area are summarised in Table 6.7 and have been based on Table 6.6. As the measured RBLs are lower than the minimum background levels specified in the NPfI, the minimum background noise levels have been used.

Table 6.7 Project specific construction noise management levels

Sensitive receiver type	Construction Noise Management Levels, $L_{Aeq(15min)}$					Sleep disturbance (Night)
	Standard construction hours		Outside standard construction hours			
	Noise affected	Highly noise affected	Day	Evening	Night	
Residential NCA01 (Wollongong) and NCA02 (Coniston/Mt. St. Thomas)	49	75	44	44	44	54 $L_{A1(1min)}$

Sensitive receiver type	Construction Noise Management Levels, $L_{Aeq(15min)}$					Sleep disturbance (Night)
	Standard construction hours		Outside standard construction hours			
	Noise affected	Highly noise affected	Day	Evening	Night	
Residential NCA03 (Cringila) and NCA04 (Warrawong / Port Kembla)	53	75	48	47	47	57 $L_{A1(1min)}$
Educational institutions	55 (external)					-
Places of worship	55 (external)					-
Active recreation areas	65					-
Passive recreation areas	60					-

6.3 Construction vibration

6.3.1 Human comfort

Vibration is assessed based on the criteria in *Assessing Vibration: A Technical Guideline* (DEC, 2006). *BS6472: Guide to Evaluation of Human Exposure to Vibration in Buildings* (1 Hz to 80 Hz) (British Standards, 2008) is recognised as the preferred standard for assessing the 'human comfort criteria'. Intermittent vibration, such as construction work, is assessed using the vibration dose value.

Whilst the assessment of response to vibration in BS 6472-1:2008 is based on vibration dose value and weighted acceleration, for construction related vibration it is considered more appropriate to provide guidance in terms of a peak particle velocity (PPV), since this parameter is likely to be more routinely measured based on the more usual concern over potential building damage. Table 6.9 provides guidance on the effect of vibration levels for human comfort in peak particle velocity as reference against the vibration guide values shown in Table 6.8.

Table 6.8 Acceptable PPV Values for Human Comfort (BS 6472-2008)

Receiver	Period	Continuous and impulsive vibration guide goals	
		Preferred value	Maximum value
Residential	Day	0.28 (8.6)	0.56 (17.0)
Offices, schools, educational institutes and places of worship	When in use	0.56 (18.0)	1.1 (36.0)
Workshops	When in use	1.1 (18.0)	2.2 (36.0)

Notes:

1) Impulsive goals are shown in brackets – These are most relevant to activities that create up to 3 distinct vibration events in an assessment period, e.g. occasional dropping of heavy equipment, occasional loading and unloading.

Humans are capable of detecting vibration at levels which are well below those causing risk of damage to a building. The degrees of perception for humans are suggested by the vibration level categories given in *BS5228.2 – 2009, Code of Practice Part 2 Vibration for noise and vibration on construction and open sites – Part 2: Vibration* (British Standards, 2009), as shown below in Table 6.9.

Table 6.9 Guidance on effect of vibration levels for human comfort (BS 5228.2 – 2009)

Vibration level	Effect
0.14 mm/s	Vibration might be just perceptible in the most sensitive situations for most vibration frequencies associated with construction.
0.3 mm/s	Vibration might be just perceptible in residential environments.
1.0 mm/s	It is likely that vibration at this level in residential environments will cause complaints, but can be tolerated if prior warning and explanation has been given to residents.
10 mm/s	Vibration is likely to be intolerable for any more than a very brief exposure.

6.3.2 Structural damage to standard structures

The minimum working distances for structural (cosmetic) damage used for this assessment have been based on *BS 7385-2:1993 Evaluation and measurement for vibration in buildings Part 2 – Guide to damage* (British Standards, 1993) levels from ground borne vibration which enables the likelihood of building damage from ground vibration to be assessed. The use of BS7385 is the preferred standard in NSW to assess potential vibration impacts to standard structures and is consistent with the Transport for NSW noise and vibration guidelines.

The vibration levels in this standard are adopted as building damage criteria and are presented in Table 6.10.

Table 6.10 Transient vibration guide values - minimal risk of cosmetic damage

Type of building	Peak component particle velocity in frequency range of predominant pulse[1]	
	4 Hz to 15 Hz	15 Hz and above
Reinforced or framed structures industrial and heavy commercial building	50 mm/s at 4 Hz and above	
Unreinforced or light framed structures residential or light commercial type buildings [2]	15 mm/s at 4 Hz increasing to 20 mm/s at 15 Hz	20 mm/s at 15 Hz increasing to 50 mm/s at 40 Hz and above

Notes:

1) Values referred to are at the base of the building.

2) At frequencies below 4 Hz, a maximum displacement of 0.6 mm (zero to peak) should not be exceeded.

6.3.3 Structural damage to heritage structures

The German Standard DIN 4150-3: 1999 Structural Vibration – Part 3: Effects of vibration on structures provides guideline values for the maximum absolute value of the velocity ‘at the foundation of various types of building. Experience has shown that if these values are complied with, damage that reduces the serviceability of the building will not occur. If damage nevertheless occurs, it is to be assumed that other causes are responsible.’ These values are provided in Table 6.11.

Measured values exceeding those listed in Table 6.11 do not necessarily lead to damage; should they be significantly exceeded however, further investigations are necessary. No heritage structures have been identified within 250 metres of the construction footprint and as such, no vibration impacts to heritage impacts are anticipated.

Table 6.11 Guideline values for short term vibration on structures

Line	Type of building	Guideline values for velocity, (mm/s)		
		1 Hz to 10 Hz	10 Hz to 50 Hz	50 Hz to 100 Hz
3	Structures that, because of their particular sensitivity to vibration, cannot be classified under lines 1 and 2 and are of great intrinsic value (e.g. listed buildings under preservation order)	3	3 to 8	8 to 10

Notes:

1) Values referred to are at the base of the building.

2) At frequencies below 4 Hz, a maximum displacement of 0.6 mm (zero to peak) should not be exceeded.

6.4 Traffic noise (construction and operation)

The RNP provides traffic noise target levels for residential receivers in the vicinity of existing roads and are applied to road upgrades. For this assessment these levels are also applied to construction works to identify potential construction traffic impacts and the potential for reasonable and feasible mitigation measures. The RNP road types are based on the functional roles shown in Table 6.12.

The additional traffic during construction and operation is anticipated to have a negligible effect on the existing traffic volumes (and traffic noise) on the local road network. As such, no further assessment of potential road traffic noise increases on the local road network is deemed necessary.

Table 6.12 Road Categories from RNP

Road category	Functional role	Public roads used by project
Freeways or motorways/arterial roads	Support major regional and inter-regional traffic movement. Freeways and motorways usual feature strict access controls via grade separated interchanges.	– Princes Motorway
Sub-arterial road or collector road	Provide connection between arterial roads and local roads. May support arterial roads during peak period. May have been designed as local streets but can serve major traffic generating developments or support non-local traffic.	– Springhill Road – Masters Road – Five Islands Road
Local roads	Provide vehicular access to abutting property and surrounding streets. Provide a network of the movement of pedestrians and cyclists, and enable social interaction in a neighbourhood. Should connect, where practicable, only to sub-arterial roads.	– Flagstaff Road

The application notes for the RNP state that "*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*."

If the road traffic noise increase from the construction work is within 2 dBA of current levels then the objectives of the RNP are met and no specific mitigation measures are required. Mitigation should be applied when road traffic noise levels increase by 2 dB *and* the controlling noise criterion in Table 6.13 are exceeded at the façade of the residence.

Table 6.13 Road traffic noise criteria, dBA

Development type	Applicability to assessment	Day 7:00 am to 10:00 pm	Night 10:00 pm to 7:00 am
Existing residence affected by additional traffic on arterial / sub-arterial / collector roads generated by land use developments	– Springhill Road – Five Islands Road	60 $L_{eq(15hr)}$	55 $L_{eq(9hr)}$
Existing residence affected by additional traffic on local roads generated by land use developments	– Flagstaff Road	55 $L_{eq(1hr)}$	50 $L_{eq(1hr)}$

6.5 Blasting noise and vibration

The following documents were used to establish the blasting criteria for this assessment:

– Technical Basis for guidelines to minimise annoyance due to blasting overpressure and ground vibration (ANZECC, 1990)
– Australian Standard AS2187.2 (2006) Explosives – Storage and use Part 2: Use of explosives

6.5.1 Airblast overpressure

The recommended human comfort level for airblast overpressure is 115 dB(L) peak. This level may be exceeded on up to five per cent of the total number of blasts over a period of 12 months, however should not exceed 120 dB(L) peak.

6.5.2 Ground vibration

The recommended human comfort level for vibration should not exceed a peak particle velocity of 5 mm/s. This level may be exceeded on up to five per cent of the total number of blasts over a period of 12 months, however should not exceed 10 mm/s.

6.5.3 Structural damage

AS2187.2 (2006) recommends the following in relation to structural damage:

– A limit of 133 dBL airblast overpressure on structures as research showed no damage (even cosmetic) occurs at airblast levels below this level.
– BS7385.2 values can be adopted for the prevention of minor or cosmetic damage occurring in structures from ground vibration which are 15 mm/s at 4 Hz PPV for standard residential buildings.

The human comfort level is significantly below the structural damage criteria which will be used to manage impacts, therefore structural damage is considered highly unlikely at surrounding sensitive receivers.

Table 6.14 Summary of blasting criteria

Type	Impact	Screening criteria	Source
Ground vibration	Human comfort	5 mm/s	ANZECC (1990)
	Structural damage to residences	15 mm/s	AS2187.2 (2006)
Airblast overpressure	Human comfort	115 dBL_{peak}	ANZECC (1990)
	Structural damage to residences	133 dBL_{peak}	AS2187.2 (2006)

7. Impact assessment

7.1 Operational noise

7.1.1 Predicted noise levels

The predicted $L_{Aeq(15min)}$ noise levels at each key sensitive receiver are presented in Table 7.1 and only include the noise sources identified in Table 4.2 (i.e. 6BF, Slag Handling and Charging System) against the NPfI discrete process criteria for residential receivers, and amenity criteria for non-residential receivers.

The noise modelling indicates compliance is predicted at all sensitive receiver locations with RES29 in Cringila predicted to receive the highest noise levels. Table 7.2 shows the contribution of the modelled noise sources at RES29 in Cringila, considered to be the most affected residence. L_{Aeq} noise contours at 1.5 metres above ground are presented in Figure 7.2. Full operational noise results to noise sensitive receivers are provided in Appendix D.

Figure 7.1 is a pie chart displaying the noise level contributions from each of the noise source groups associated with the operation of 6BF when assessed at RES29. The noise levels from each component are converted from a decibel (dBA, reference pressure of 20 µPa) to a pressure intensity (µPa) to show the percentage contribution in a non-logarithmic manner. It is illustrated noise levels from the main 6BF components at RES29 contribute to approximately half of the noise emissions, whilst the slag handling area and the stockhouse area contribute to a quarter of the noise emissions each.

Table 7.1 Predicted $L_{Aeq(15min)}$ noise levels at sensitive receivers, dBA

RID	Receiver Type	$L_{Aeq(15min)}$ noise level, dBA		Complies?
		Criteria	Predicted noise level	
ARR1	Active recreation	53	22	Yes
ARR2	Active recreation	53	20	Yes
ARR3	Active recreation	53	25	Yes
ARR4	Active recreation	53	32	Yes
ARR5	Active recreation	53	23	Yes
EDU1	Educational institute	43	18	Yes
EDU2	Educational institute	43	36	Yes
EDU3	Educational institute	43	28	Yes
EDU4	Educational institute	43	27	Yes
POW1	Place of worship	48	27	Yes
POW2	Place of worship	48	33	Yes
PRR1	Passive recreation	48	20	Yes
PRR2	Passive recreation	48	28	Yes
RES1	Residential - NCA04	38[1]	33	Yes
RES23	Residential - NCA04	38[1]	35	Yes
RES29	Residential - NCA03	41[1]	39	Yes
RES33	Residential - NCA02	31[1]	28	Yes
RES39	Residential - NCA01	31[1]	23	Yes
Note 1: In accordance with the NPfI discrete process assessment criteria provided in Table 6.3				

Table 7.2 Predicted $L_{Aeq(15min)}$ contribution of noise sources at most-affected residences (RES29 in Cringila) dBA

Source group	Operational component	EPL 6092 criteria	Contributed noise level $L_{Aeq(15min)}$, dBA	
Hot Blast	6BF	35 (based on 5BF)	27	31 (Total from 6BF)
Conveyor belts			24	
Bag Houses			23	
Furnace Top			22	
Gas Cleaning			21	
Cooling			18	
Stockhouse	Charging system	N/A	36	
Slag Handling	Slag handling	N/A	35	
Slag Granulator			25	
Total			39	

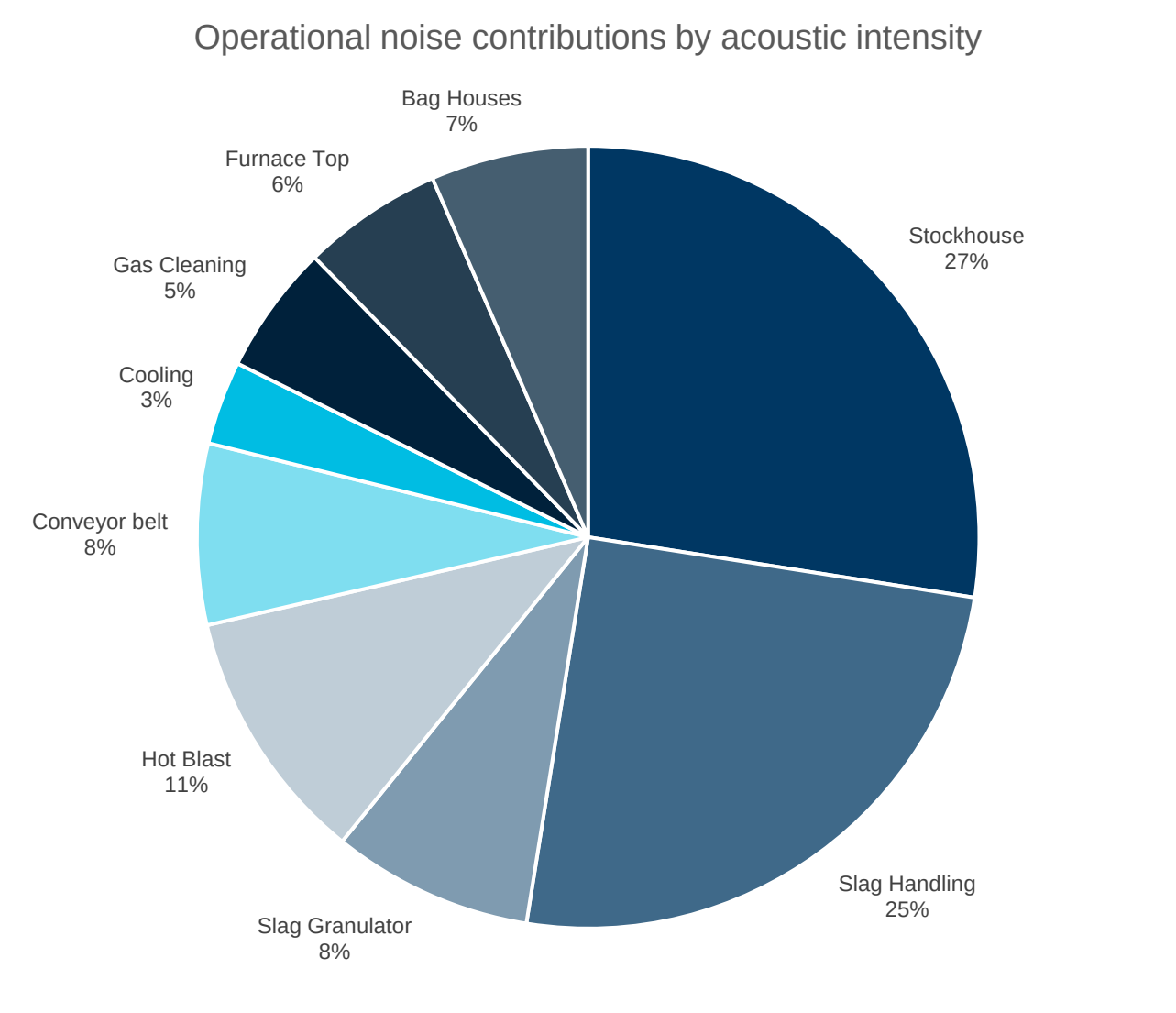

Figure 7.1 Operational noise contributions by acoustic intensity (RES29 in Cringila), percentage of overall noise emission based on µPa

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0 0.2 0.4 0.6 0.8

Kilometres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

N

BlueScope Steel Ltd
No.6 Blast Furnace Reline and Operations
Noise and Vibration Impact Assessment

Operational noise emission
L_{Aeq} noise contours

Project No. **12541101**
Revision No. **0**
Date **28/10/2021**

FIGURE 7-2

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Print date: 28 Oct 2021 - 10:49

Data source: LPI: DTDB/DCDB, 2017. DPE: Land zones, 2019. World Imagery: Maxar.
Created by: tmorton

7.1.2 Sleep disturbance impacts

The potential for sleep disturbance is considered from short-duration, high level noise events. In this case, significant maximum noise levels events have been modelled from the following set of operational equipment. The modelled $L_{A1(1min)}$ noise levels considered in the assessment are as provided in Appendix C:

– Furnace top:
  - Bin pressure relief silencer
  - Bin pressure relief valve
– Hot blast:
  - Furnace top bleeder– not considered as part of normal operations, as noise emissions only occur during emergency operation
  - Snort control valve silencer
  - Stove pressurisation/depressurisation valves
– Stockhouse:
  - Vibrofeeders
  - Screens
– Slag handling:
  - Knocking block

Regarding the furnace top bleeder and snort control valve silencer, sound levels of these events were measured during cold commissioning of 5BF during its reline in 2009. Both were audible at residential receiver locations with the following observations:

– Noise from the Snort control valve silencer was barely audible
– Noise from the Furnace top bleeder valves were easily audible and measured

These sources however occur infrequently, with the furnace top bleeder only operating in a noise-producing state in emergency situations and on initial commissioning; it is not part of normal operations and therefore it is not considered as part of the sleep disturbance assessment. The Snort valve operates at shutdown and start-up (approximately every 18 weeks) and in emergency situations. Whilst it is not considered part of typical operations, it has been included in the sleep disturbance assessment, as discussed above in Table 4.4. The predicted $L_{A1(1min)}$ noise levels are presented in Table 7.3.

Table 7.3 Predicted $L_{A1(1min)}$ noise levels at sensitive receivers during the night, dBA

RID	Receiver Type	$L_{A1(1min)}$ EPL sleep disturbance criterion	Highest $L_{A1(1min)}$ noise level, dBA						
			Furnace top		Hot blast		Stockhouse		Slag handling
			Bin Pressure Relief Silencer	Bin Pressure Relief Valve	Snort Control Valve Silencer	Stove Depressurisation Valve	Screen	Vibrofeeder	Knocking Block
RES01	Residential - NCA04	55	30	27	42	10	31	30	36
RES23	Residential - NCA04	55	35	35	30	14	32	34	40
RES29	Residential - NCA03	55	38	38	40	18	36	35	45
RES33	Residential - NCA02	55	27	27	39	8	25	23	31
RES36	Residential - NCA01	55	22	23	37	3	23	22	14

$L_{A1(1min)}$ noise predictions indicate that the sleep disturbance screening criterion is not exceeded at the key residential receivers from worst case maximum noise events. It is noted that the furnace top bleeder is not considered in this $L_{A1(1min)}$ sleep disturbance assessment, as it will only occur as an emergency operation, or during commission testing. In the rare event of its occurrence, $L_{A1(1min)}$ noise levels at residential receivers are expected to be significantly above the $L_{A1(1min)}$ noise criterion, however it is not considered representative of typical maximum noise events as part of normal operation.

As part of the commissioning stage of this project, testing of the furnace top bleeder will need to be undertaken. $L_{A1(1min)}$ noise levels from its testing are predicted to reach up to 85 dBA at the nearest residential receivers. This noise event is expected to last up to approximately 10 seconds, and will be highly intrusive to residential receivers. Appropriate mitigation measures to manage this noise event are provided in Section 8.3.1.

7.1.3 Cumulative noise impacts

As stated in Section 2.1 of the NPfI, "*The project amenity noise level seeks to protect against cumulative noise impacts from industry and maintain amenity for particular land uses*." The operational noise criteria used in this assessment is more stringent than the NPfI project amenity noise level. It is based on the NPfI discrete process criteria, which aims to ensure the noise emission from the proposal does not contribute to the existing total industrial noise level at the most affected receivers. Compliance with the assessment criteria should ensure there are no cumulative noise impacts as a result of the proposal.

A list of the major projects in the vicinity of the proposal is presenting in Section 9.10.1 of the EIS for reference.

7.2 Construction noise

7.2.1 Predicted noise levels

Construction noise levels have been predicted at the sensitive receivers within the study area with consideration to the acoustic requirements of the ICNG. The predicted maximum noise level along with the NML from laydown area operations for each receiver is provided in Table 7.4 for residential receivers, and Table 7.5 for non-residential receivers. The predicted maximum noise level along with the NML from 6BF construction activities is provided in Table 7.6. The noise modelling assumes that the loudest equipment in the scenario is operating at maximum capacity simultaneously at the closest distance between the construction work area and the receiver. Construction noise contours are provided in Figure 7.3 for laydown area operations, and Figure 7.4 and Figure 7.5 for 6BF construction activities.

Exceedances of the NML during standard construction hours are printed in red. Exceedances of the NML during outside standard construction hours are printed in blue.

Table 7.4 Construction noise levels for laydown areas – Residential receivers

Laydown area and construction activity	Noise Management Levels Standard hours: 53 OOHW Day: 48 OOHW Evening: 47 OOHW Night: 47			Noise Management Levels Standard hours: 49 OOHW Day: 44 OOHW Evening: 44 OOHW Night: 44	
	RES01 (NCA04)	RES23 (NCA04)	RES29 (NCA03)	RES33 (NCA02)	RES39 (NCA01)
No1W 1 – excavator / forklift	5	38	20	16	8
No1W 4 – excavator / forklift	3	40	9	10	4
No1W 5 – excavator / forklift	11	34	17	10	6
No2B 1– excavator / forklift	13	17	25	22	16
No2W 1 – excavator / forklift	15	23	25	14	0
No2W 1 – Rock breaking	30	38	40	29	15
No2W 2 – excavator / forklift	18	24	29	6	0
No2W 2 – Rock breaking	33	39	44	21	10
No2W 3 – excavator / forklift	19	23	27	17	10
No2W 3 – Rock breaking	33	39	42	32	25
No2W 4 – excavator / forklift	19	22	22	14	11
No2W 4 – Rock breaking	34	37	37	29	26
No2W 5 – excavator / forklift	19	20	21	15	12
No2W 5 – Rock breaking	34	35	36	30	27
No2W 6 – excavator / forklift	18	26	34	16	7
No2W 6 – Rock breaking	33	41	49	31	22
RA 4 – excavator / forklift	7	11	21	31	15
RA 5 – excavator / forklift	8	13	22	30	14
SpringHill Electrical – excavator / forklift	0	1	6	15	19

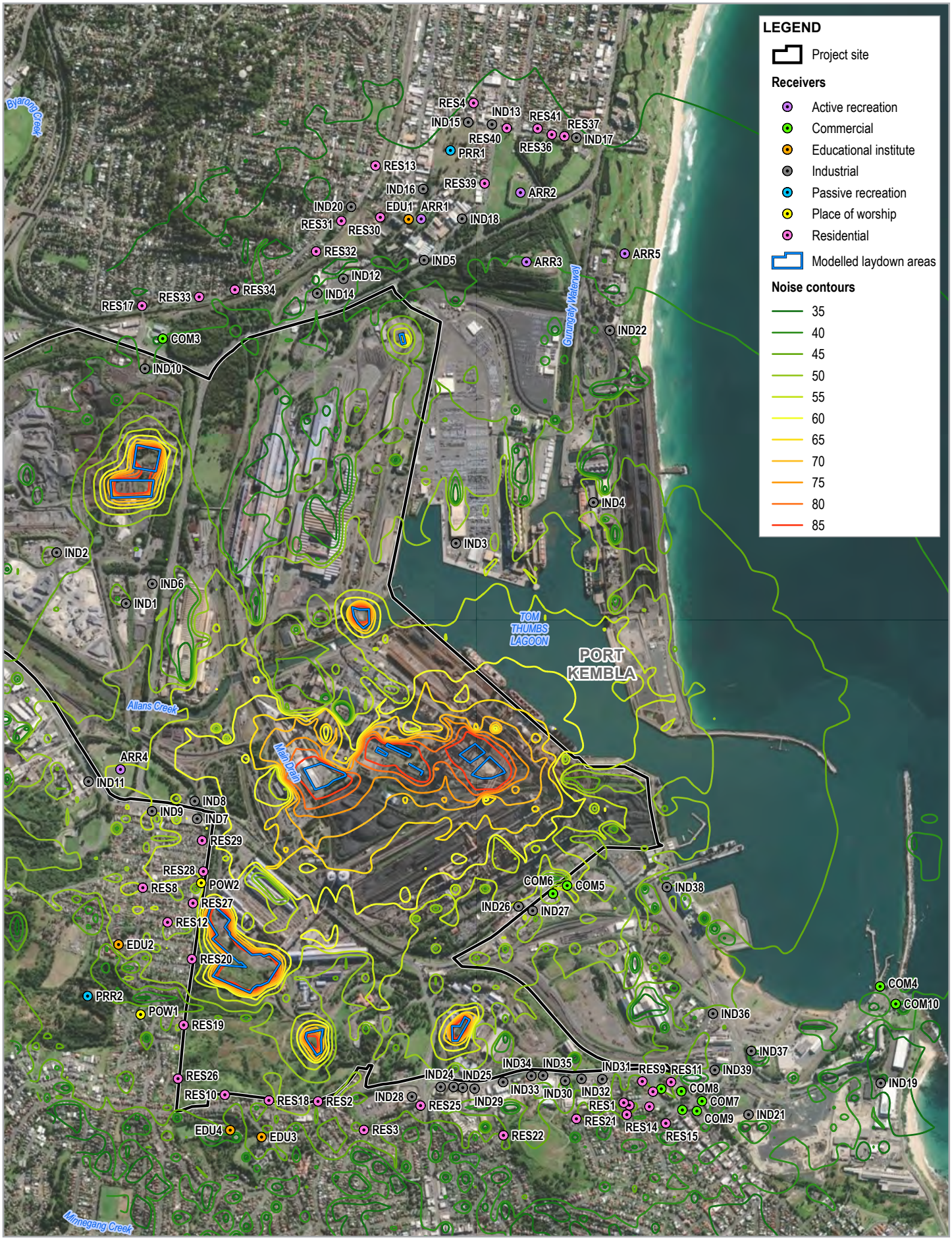
Table 7.5 Construction noise levels for laydown areas – Non-residential receivers

Laydown area and construction activity	NML (Active Recreation) 65 dBA					NML (Educational) 55 dBA				NML (Place of worship) 55 dBA		NML (Passive Recreation) 60 dBA	
	ARR1	ARR2	ARR3	ARR4	ARR5	EDU1	EDU2	EDU3	EDU4	POW1	POW2	PRR1	PRR2
No1W 1 – excavator / forklift	9	8	10	28	9	9	41	30	28	38	47	7	32
No1W 4 – excavator / forklift	6	5	7	20	6	7	31	23	21	29	27	5	29
No1W 5 – excavator / forklift	7	6	8	17	8	2	23	24	21	20	22	6	19
No2B 1– excavator / forklift	18	16	18	23	16	9	21	10	9	12	12	15	13
No2W 1 – excavator / forklift	1	2	12	20	7	0	22	11	17	17	19	2	13
No2W 1 – Rock breaking	16	17	27	35	22	11	37	26	32	32	34	17	28
No2W 2 – excavator / forklift	0	0	5	23	2	0	25	18	18	20	23	0	18
No2W 2 – Rock breaking	11	10	20	38	17	10	40	33	33	35	38	11	33
No2W 3 – excavator / forklift	10	10	14	22	12	0	25	7	4	9	22	10	12
No2W 3 – Rock breaking	25	25	28	38	26	13	40	21	19	22	37	25	25
No2W 4 – excavator / forklift	8	11	14	17	12	0	20	17	16	15	6	4	7
No2W 4 – Rock breaking	23	26	29	32	27	13	35	32	31	30	21	20	22
No2W 5 – excavator / forklift	14	13	15	17	14	13	21	16	15	8	20	11	14
No2W 5 – Rock breaking	29	28	30	32	29	28	36	31	30	23	35	26	29
No2W 6 – excavator / forklift	9	9	11	31	10	0	29	21	21	22	30	9	22
No2W 6 – Rock breaking	24	24	26	46	25	13	44	36	36	37	45	24	37
RA 4 – excavator / forklift	11	15	17	21	13	20	16	11	10	13	16	16	13
RA 5 – excavator / forklift	10	15	16	26	13	21	18	12	10	14	18	15	14
SpringHill Electrical – excavator / forklift	25	18	21	4	15	7	2	0	0	0	1	17	0

Table 7.6 Construction noise levels from 6BF construction activities (main construction site)

Receiver ID	Noise Management Level, $L_{Aeq(15min)}$ dBA	Prediction construction noise level, $L_{Aeq(15min)}$ dBA	
		General construction activities[1]	High impact construction works[2]
ARR1	65 (Active recreation)	26	35
ARR2		25	34
ARR3		28	37
ARR4		35	44
ARR5		26	35
EDU1	55 (Educational institute)	24	33
EDU2		38	47
EDU3		32	41
EDU4		30	39
POW1	55 (Place of worship)	32	41
POW2		38	47
PRR1	60 (Passive recreation)	24	33
PRR2		30	39
RES1 (NCA04)	NMLs for Residences in Cringila, Warrawong and Port Kembla: Standard hours: 53 OOHW Day: 48 OOHW Evening: 47 OOHW Night: 47	34	43
RES23 (NCA04)		37	46
RES29 (NCA03)		42	51
RES33 (NCA02)	NMLs for Residences in Wollongong, Coniston and Mt. St Thomas: Standard hours: 49 OOHW Day: 44 OOHW Evening: 44 OOHW Night: 44	29	38
RES39 (NCA01)		26	35

Note 1: Based on a selection of the highest noise generating equipment from this scenario's equipment list, being large excavator, franna crane, front end loaders and vibratory roller
Note 2: Based on a selection of the highest noise generating equipment from this scenario's equipment list, being a rock breaker and pile driver



Paper Size ISO A4

0 0.2 0.4 0.6 0.8

Kilometres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

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BlueScope Steel Ltd
No.6 Blast Furnace Reline and Operations
Noise and Vibration Impact Assessment

Construction noise contours laydown area operations

Project No. **12541101**
Revision No. **0**
Date **28/10/2021**

FIGURE 7-3

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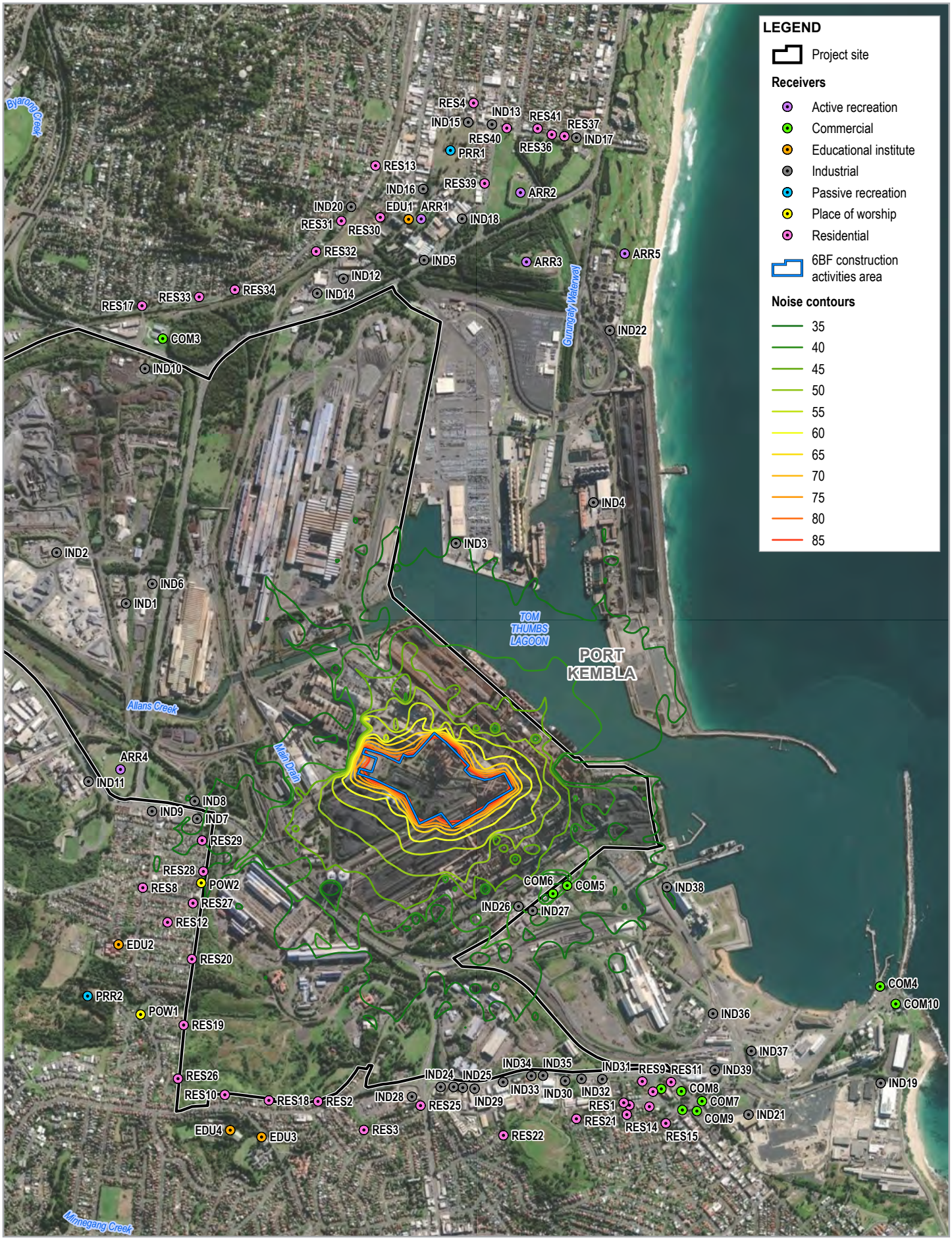
Print date: 28 Oct 2021 - 10:49

Data source: LPI: DTDB/DCDB, 2017. DPE: Land zones, 2019. World Imagery: Maxar.
Created by: tmorton



Paper Size ISO A4

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Kilometres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

N

BlueScope Steel Ltd
No.6 Blast Furnace Reline and Operations
Noise and Vibration Impact Assessment

Construction noise contours 6BF construction activities, general construction activities

Project No. **12541101**
Revision No. **0**
Date **28/10/2021**

FIGURE 7-4

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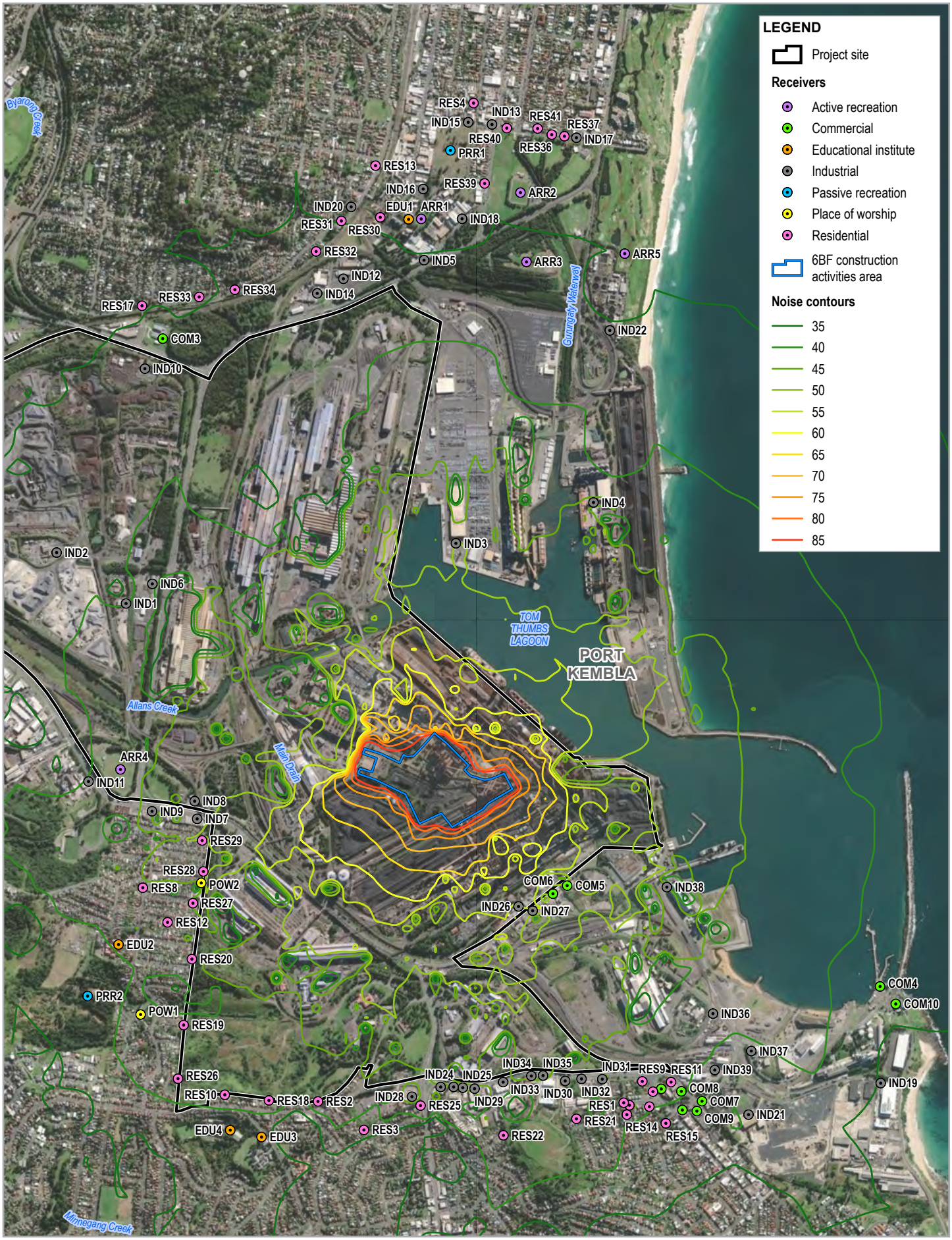
Print date: 28 Oct 2021 - 10:49

Data source: LPI: DTDB/DCDB, 2017. DPE: Land zones, 2019. World Imagery: Maxar.
Created by: tmorton



Paper Size ISO A4

0 0.2 0.4 0.6 0.8

Kilometres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

N

BlueScope Steel Ltd
No.6 Blast Furnace Reline and Operations
Noise and Vibration Impact Assessment

Construction noise contours 6BF construction activities, high intensity construction activities

Project No. **12541101**
Revision No. **0**
Date **28/10/2021**

FIGURE 7-5

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Print date: 28 Oct 2021 - 10:49

Data source: LPI: DTDB/DCDB, 2017. DPE: Land zones, 2019. World Imagery: Maxar.
Created by: tmorton

7.2.2 Construction noise impacts during standard construction hours

Laydown area operations

It is predicted that construction noise levels from all laydown area operations are below the NML during standard construction hours. As such, long term construction noise impacts from these activities are not anticipated.

6BF construction activities – general construction activities

It is predicted that construction noise levels from 6BF construction activities involving general construction are below the NML for all residential receivers. It is anticipated that these construction activities will make up the majority of construction noise for the life of the construction project.

6BF construction activities – high intensity construction activities

It is predicted that construction noise levels from 6BF construction activities involving high intensity activities are below the NML for almost all residential receivers during standard construction hours.

7.2.3 Construction noise impacts outside standard construction hours

Laydown area operations

It is predicted that rock breaking activities may lead to exceedances of the NML at one residential receiver outside of standard construction hours. For all other receivers, it is predicted that noise generation is below the NML for out of hours works.

It is anticipated that these activities may be required at the project commencement phase for site and laydown area establishment. It is not confirmed these activities will be required however they have been assessed to confirm worst case impacts. It is therefore recommended that these activities be scheduled to only occur during standard construction hours to ensure that construction noise levels do not exceed the NML at the nearest residential receivers during out of hours construction works.

6BF construction activities – general construction activities

It is predicted that construction noise levels from 6BF construction activities involving general construction are below the NML for all residential receivers outside standard construction hours.

6BF construction activities – high intensity construction activities

It is predicted that construction noise levels from 6BF construction activities involving high intensity activities are above the NML at residential receiver RES29 outside standard construction hours. These exceedances will occur during the following activities:

– Rock breaking
– Impact piling

It is recommended that these activities be scheduled to only occur during standard construction hours to ensure that construction noise levels do not exceed the NML at the nearest residential receivers during out of hours construction works.

7.2.4 Construction noise impacts for non-residential receivers

It is predicted that all noise generation from laydown areas and construction activities is below the NML at the nearest noise sensitive non-residential receivers.

7.2.5 Cumulative noise impacts

Section 9.10.1 of the EIS provides a list of proposed major projects in the vicinity of the proposal site. There is the potential for construction of these projects to occur concurrently which may lead to cumulative construction noise impacts. Based on predicted construction noise levels, potential cumulative construction noise impacts would only be anticipated during high intensity 6BF construction activities, however this is only considered minor. Noise emission from all other construction activities is predicted to be significantly below the NMLs at the nearest residential receivers, which makes up the majority of construction activities for the proposal.

When the Construction Noise and Vibration Management Plan for the proposal is prepared, it can be determined whether construction activities are to occur concurrently alongside noise emission from proposed major projects in the vicinity.

7.3 Construction vibration

7.3.1 Vibration safe working distances

The method for the construction vibration assessment included:

- Identifying safe working distances to comply with the human comfort and the cosmetic damage criteria. These buffer distances have been adopted from *Construction Noise and Vibration Strategy*.
- Safe working distances for vibration intensive equipment are shown in Table 7.7. The vibratory equipment associated with the project include vibratory rollers and excavators.
- Buildings within the safe working distances have been identified for consideration of management measures.
- The safe working distance for heritage structures has been estimated as twice the distance as the safe working distance for standard structures.

Safe working distances for vibratory intensive equipment are shown in Table 7.7.

Table 7.7 Vibration safe working distances

Equipment	Human comfort (OH&E Vibration guideline)	Cosmetic damage to standard structures	Cosmetic damage to heritage structures
Piling rig – Bored <800 mm	N/A	2 m (nominal)	4 m
Piling rig–Hammer (12 t down force)	50 m	15 m	30 m
Piling rig – Vibratory (sheet piles)	20 m	2 m to 20 m	40 m
Vibratory roller (>18 tonnes)	100 m	25 m	50 m
Vibratory roller (13-18 tonnes)	100 m	20 m	40 m
Vibratory roller (7-13 tonnes)	100 m	15 m	30 m
Vibratory roller (4-6 tonnes)	40 m	12 m	24 m
Vibratory roller (2-4 tonnes)	20 m	6 m	12 m
Vibratory roller (1-2 tonnes)	15 m	5 m	10 m
Small hydraulic hammer 300 kg (5-12t excavator)	7 m	2 m	4 m
Medium hydraulic hammer 900 kg (12-18t excavator)	23 m	7 m	14 m
Large hydraulic hammer 1600 kg (18-34t excavator)	73 m	22 m	44 m
Jackhammer (handheld)	Avoid contact with structure	1 m (nominal)	2 m

7.3.2 Human comfort

It is anticipated that as part of the site preparation phase for works associated with laydown area No.1 Works area 1, a vibratory roller may be used for earthworks. For a conservative assessment, an 18T vibratory roller is considered. The closest distance between the proposed laydown area and the nearest residence is approximately 85 metres, and falls within the buffer distance of 100 metres for an 18T vibratory roller. Whilst this may indicate construction vibration impacts for human comfort, it will only be limited to the duration of this phase of work. Further, this is based on a highly conservative approximation of the potential works; at this stage is not certain whether use of the roller is required, or for what duration. As such, long term residual human comfort vibration impacts are not anticipated.

7.3.3 Structural damage

Rolling activities have the potential to exceed the structural damage vibration criteria should these works occur within 20 metres of residences or 40 metres of heritage structures. No residences or heritage structures have been identified within 40 metres of any construction works and as such, no adverse structural damage vibration impacts are anticipated as a result of the project.

7.4 Construction traffic noise along public roads

7.4.1 Construction traffic generation on public and local private roads

During construction, the project is expected to generate up to 600 light vehicle (300 arrivals and 300 departures) and 300 heavy vehicle (150 arrivals and 150 departures) movements per day and will likely utilise the roads listed in Table 7.8. Public roads adjacent to residences have been assessed against the Road Noise Policy and local private roads adjacent to residences have been assessed against the ICNG NMLs. Roads away from residences have not been included in the assessment as noise impacts are not anticipated.

Table 7.8 Public and local private roads to be used during construction

Public roads adjacent to residences	Public roads not near any residences	Local private roads within PKSW site not near any residences	Local private roads within PKSW site adjacent to residences
– Springhill Road – Five Islands Road	– Flagstaff Road (small section between intersections of Five Islands Road and General Office Road)	– Cringila Car Park Road – Loop Road – BlueScope Access Road	– Emily Road (assessed in Section 7.5)

7.4.2 Noise impacts along public roads

Based on the anticipated construction traffic numbers and timing as outlined in the projects Traffic Impact Assessment (GHD, 2021), the traffic generation for the assessed roads are provided below in Table 7.9.

Table 7.9 Construction traffic generation

Road name	Assessment type	Time frame	Light vehicles	Heavy vehicles
Springhill Road	Arterial / sub-arterial – collector roads	Daily	4	44
Five Islands Road		Daily	200	110

Traffic volumes on Springhill Road and Five Islands Road will have to increase by more than 58% to result in an increase of 2 dBA. Mid-block traffic counts for Springhill Road, Five Islands Road and Flinders Street were provided by Transport for NSW (Australian Industrial Energy, 2018) in 2015 as presented in Table 7.10. The traffic generation as a result of the construction works on public roads is considered to be negligible when compared to the existing traffic volumes and as such, the acoustic requirements of the Road Noise Policy (RNP) are anticipated to be met.

Table 7.10 Existing traffic volumes on haulage routes

Road	Section	24 hour volume (bi-directional), 2015
Five Islands Rd	Between Springhill Rd and Flinders St	40,564
Five Islands Rd-	Between Princes Hwy and Glastonbury Ave	21,686
Five Islands Rd	Between Glastonbury Ave and Springhill Rd	23,890
Five Islands Rd	Between King St and Darcy Rd	8,572
Spring Hill Road-	North of Keira St	17,384
Spring Hill Road-	Between Masters Road and Keira St	42,389
Spring Hill Road-	Between Five Islands Road and Masters Rd	50,185

7.5 Construction traffic noise within project site

One of the anticipated construction traffic routes involves use of Emily Road, which at certain points is situated approximately 70 metres from residential receivers. These residential receivers are represented by key receiver RES29. Based on the anticipated construction traffic generation (GHD, 2021), approximately 200 light vehicles and 11 heavy vehicles may use this access road between 5:00 am and 6:00 am, and have the potential to lead to construction related noise impacts. Noise modelling has been conducted along Emily Road to assess noise impacts from construction traffic towards residential receivers; because it falls within the project site boundary and not along a public road, it is assessed against the ICNG NMLs rather than the RNP criteria.

The assumptions and results of the assessment are provided below in Table 7.11. It is predicted that noise from construction traffic along Emily Road is below the NML for residential receivers within NCA02. As such, construction noise impacts from traffic along Emily Road is not anticipated.

Table 7.11 Emily Road construction traffic assessment

Assessed Road	Road speed	Road surface	Construction traffic		Receiver ID	Predicted noise level $L_{Aeq(15min)}$, dBA	NML – night, $L_{Aeq(15min)}$, dBA
			Light vehicles	Heavy vehicles			
Emily Road	40 km/hr	DGA	200	11	RES29 – NCA02	48	48

7.6 Blasting impacts

Monitoring the slag pit skull blasting for airblast overpressure noise and ground vibration occurred at two locations in January 2009 at the base of the 5BF and at the Merrett Avenue office car-park, the nearest BlueScope residential boundary approximately 1.1 kilometres to the southwest. Monitoring occurred for four blasts in January 2009 and no discernible blast events (ground vibration or airblast overpressure) were identified at the Merrett Avenue office car park (representative of the most-affected residences in Cringila). Blasting required for the 6BF will take place approximately 1.1 kilometres away from the nearest residential receivers in Cringila and will use a similar methodology to the blasting at 5BF. Due to the similar distance from the source, no ground vibration or airblast overpressure impacts from blasting are anticipated at any of the nearby residential receivers.

Blast levels measured in the blast furnace basement area during the slag pit skull blasting (near the source) were up to about 3.5 mm/s ground vibration and airblast overpressures of about 130 to 134 dBL. It is difficult to estimate the airblast overpressure levels at the most-affected residences due to the acoustic shielding provided shell of the blast furnace, however it is anticipated airblast overpressure levels will be well below the criteria of 115 dBL given no blast events could be measured at the Merrett Avenue office carpark during the 5BF blasting activities. Similarly, given ground vibration levels were measured to be 3.5 mm/s near the source of the blasting, ground vibration levels are predicted to be well below 5 mm/s when assessed at the nearest residences over 1 km away.

7.7 Operational traffic impacts

The existing traffic along the haulage route would need to increase by approximately 58 % in order for noise levels to increase by 2 dBA. No operational road traffic noise impacts are expected as existing traffic volumes are not anticipated to increase by over 58 % on any public roads as traffic generation is anticipated to be consistent with the existing conditions during operation.

8. Mitigation measures

8.1 Justification for proposed mitigation measures

Mitigation measures for both construction and operational phases of the proposal are primarily focused around mitigation at the source. This is considered the most feasible and reasonable to implement, as any noise reduction at the source would benefit the greatest number of sensitive receivers. Due to the size of the proposal site, mitigation in transmission between the source and the receiver is not considered as feasible (Note should be made that local shielding/barriers close to noise sources is considered reasonable and feasible). Mitigation at the receiver is not required as noise mitigation at the source is considered appropriate to minimise any potential noise impacts during construction or operation.

8.2 Construction mitigation measures

8.2.1 Reasonable and feasible mitigation measures

The ICNG identifies that, due to the nature of construction, it is inevitable that impacts arise where construction occurs near sensitive receivers. During construction there will be noise impacts on some receivers during certain times and during certain construction activities.

Where noise is above the construction noise management levels, all feasible and reasonable work practices to minimise noise will be implemented, and all potentially affected receivers will be informed.

Table 8.1 Reasonable and feasible mitigation measures during the construction phase

Control type	Mitigation measure
At source mitigation measures	
Construction hours and scheduling	Where feasible and reasonable, construction will be carried out during the standard daytime working hours. Work generating high noise and/or vibration levels will be scheduled during less sensitive time periods.
Equipment selection	Quieter and less vibration emitting construction methods will be used where feasible and reasonable.
Plant noise levels	The noise levels of plant and equipment will have an operating sound power lower or similar to the levels presented in Table 3.6 and Table 3.7.
Selection of low-noise attachments for rock breaking equipment	Where rock breaking and impact piling works are required within No2. Works areas 1,2,3 and 6, mitigations measures should be considered, such as: – Low noise attachments for rock breakers – Resilient pad (dolly) between pile and hammerhead for impact piling
Location of plant	As much distance as possible will be placed between the plant or equipment and residences and other sensitive land uses, where possible.
Direction of equipment	Equipment with directional noise characteristics will be oriented away from noise sensitive receivers.
Plan worksites and activities to minimise noise and vibration.	Where additional activities or plant may only result in a marginal noise increase and speed up works, the duration of impact will be limited by concentrating noisy activities at one location and moving to another as quickly as possible.
Reduced equipment power	Only the necessary size and power of equipment will be used.
Minimise disturbance arising from delivery of goods to construction sites.	– Loading and unloading of materials/deliveries will occur as far as practically possible from sensitive receivers.
Engine compression brakes	The use of engine compression brakes will be limited in proximity to residences.
Maintain equipment	Equipment will not be operated until it is maintained or repaired, where maintenance or repair would address the annoying character of noise identified.

Control type	Mitigation measure
Reduce size of vibratory roller or compactor	Limit the size of the vibratory compactor to 18 tonnes to maintain the safe work buffer distances.
Construction traffic within project site	Construction traffic travelling along Emily Road to remain below the speed limit of 40 km/hr.
Scheduling of high-intensity construction activities	The following works should only be undertaken within recommended standard construction hours – Impact piling – Rock breaking
In transmission path mitigation measures	
Utilise acoustic shielding between the source and receiver from buildings / barriers	– Temporary site buildings and materials stockpiles will be used as noise barriers. – Natural landform as noise barrier – fixed equipment will be place in cuttings, or behind earth berms.

8.2.2 Construction noise and vibration management plan (CNVMP)

A construction noise and vibration management plan (CNVMP) will be developed once a detailed construction methodology has been prepared. The construction noise and vibration management plan will include a review of the construction noise predictions during the environmental impact assessment phase based. The plan will be based on the construction method and include a detailed examination of feasible and reasonable work practices and noise mitigation measures to manage sensitive receivers that are predicted to be 'noise affected'. The construction noise and vibration management plan will also include:

- Details of the construction methodology
- Feasible and reasonable mitigation measures to be implemented
- Updated noise predictions at sensitive receivers
- A noise monitoring procedure and program for the duration of works
- A community consultation plan to liaise with the noise affected receivers, including:
  - Notification to residences a minimum of seven calendar days prior to the start of works and should include information such as total building time, what works are expected to be noisy, their duration, what is being done to minimise noise and when respite periods will occur.
  - A procedure for complaints, including maintaining a compliant register on site.

8.2.3 Construction noise monitoring

A noise monitoring procedure and program will be carried out for the duration of construction works in accordance with the construction noise and vibration management plan and any approval or licence conditions. Monitoring reports will be prepared in accordance with the requirements of the noise monitoring procedures.

Details around specific noise monitoring requirements, locations and procedures would be determined once detailed information around construction activities and scheduling is available. Monitoring would look to assess noise from both 'typical' and 'high intensity' construction activities.

8.2.4 Construction management measures

Management measures to reduce potential noise impacts at sensitive receivers will be incorporated into the CNVMP and will include the following as a minimum:

- All employees, contractors and subcontractors are to receive an environmental induction. The site induction must at least include:
  - All project specific and relevant standard noise and vibration mitigation measures.
  - Relevant licence and approval conditions.
  - Permissible hours of work.

- Any limitations on high noise generating activities.
- Location of nearest sensitive receivers.
- Construction employee parking areas.
- Designated loading/unloading areas and procedures.
- Site opening/closing times (including deliveries).
- Environmental incident procedures.

– All rock-breaking and pile driving activities should be confined between the hours: daytime hours of 7:00 am to 6:00 pm from Monday to Friday and 8:00 am to 1:00 pm on Saturday, with the exception of the following activities:
  - The delivery of oversized plant or structures.
  - Emergency work to avoid the loss of life or damage to property, or to prevent environmental harm.
– Works required to be undertaken outside of standard construction hours (ICNG) should be justified in the project CEMP and assessed against the noise requirements of the ICNG.

8.3 Mitigation measures for operation

All conclusions from the operational noise assessment are based on a combination of similar noise sources from 5BF, alongside additional noise measurements where required conducted by GHD in 2021. To check that noise model predictions are representative of 6BF operational noise emission at sensitive receivers, noise validation measurements should be undertaken at an intermediate location in the path between source equipment and Cringila receivers. The location should be selected so that a signal to noise ratio of minimum 10 dB is achieved, with:

– Signal being noise levels from the 6BF operations (6BF, Stockhouse, Slag handling)
– Noise being extraneous noise source not associated with 6BF operations

A proposed noise validation location is provided below in Table 8.2, along with the predicted noise level. This is also graphically provided in Figure 8.1.

Table 8.2 Noise validation location and predicted noise level

Noise validation location coordinates (MGA Z56)		Validation location predicted noise level $L_{Aeq(15min)}$, dBA
x	y	
305837	6184054	56

Figure 8.1 Proposed noise validation measurement location – coordinates MGA94 Z56

If the results of the noise validation measurements indicated that operational noise levels are above the noise predictions, then mitigation measures for the Stockhouse and Slag handling areas can be considered for noise reduction. These may include:

– Nearfield shielding adjacent to operating noise sources to block line of site to receivers, such as barriers or enclosures.
– Incorporation of measures to reduce knocking or impact noise for vibrofeeders and screens.
– Selection of low noise vehicles alternatives for industrial pot carriers within the Slag handling area.
– Additional noise measurements of operating equipment, and comparison against assumed noise sources provided in Appendix C. The operational noise model may be refined where appropriate.

8.3.1 Furnace top bleeder testing

It is anticipated that $L_{A1(1min)}$ noise levels from the furnace top bleeder testing will reach up to 85 dBA at the nearest residential receivers. As such, notification will be provided to surrounding residences of this testing prior to its commencement. The notification will include details around its anticipated start time and date, duration of noise event, description of the noise, and anticipated noise levels.

8.4 Operational Noise Management Plan (NMP)

An operational noise management plan should be developed to minimise the risk of adverse noise impacts during the operation. It should be refined throughout the design process and have consideration to:

– The relevant licence conditions
– Conditions of approval

– The *Noise Policy for Industry*
– *Australian Standards 1055 Acoustics – Description and measurement of environmental noise*
– *Approved methods for the measurement and analysis of environmental noise in NSW* – currently in draft form
– Conclusions of validation noise monitoring prior to operations commencing

The operational noise management plan should include:

– Operational noise management measures to be implemented
– Updated operational noise predictions at sensitive receivers
– A noise monitoring program
– A complaints handling protocol

Table 8.3 provides draft inclusions for incorporation into the operational noise management plan to minimise the risk of adverse noise impacts at sensitive receivers during the operation.

Table 8.3 Draft operational noise management plan inclusions

Control type	Measure
Operational noise management measures for operators/workers	
Operational noise management measures for operators/workers	– All equipment will be properly maintained in accordance with the manufacturer's specifications. – All equipment will be operated in the appropriate manner. – The use of engine/compression brakes on-site will be minimised. – Dropping and scraping of materials on the ground will be minimised, where practical. – Building openings such as doors or shutters will remain closed when not in use. – All buildings and enclosures will be maintained to preserve their acoustic performance. – All significant items of noisy plant will be designed and tested to meet the required internal or external noise levels to satisfy environmental noise goals. – Where noisy maintenance is required, it will be scheduled to occur during periods when receivers are less sensitive, such as during the daytime.
Noise monitoring program	
Noise complaint records	In the event of a noise complaint received from the community, the complaint will be promptly investigated and resolved.
Noise monitoring qualifications	All attended noise monitoring will be carried out by a suitably qualified noise specialist. Records of routine equipment calibration and testing will be maintained by the qualified noise specialist undertaking the monitoring.
Frequency of noise monitoring	Noise monitoring will be carried out during the first year of operation, to confirm compliance and verify noise emissions. On completion of this year, the frequency of noise monitoring will be reviewed.

9. Evaluation and conclusion

This noise and vibration impact assessment report has been prepared on behalf of BlueScope for the project to support the EIS and responds to the SEARs for noise and vibration. It describes the existing ambient and background noise and vibration and assesses the potential noise impacts associated with the construction and operational phases of the proposal and the increases in noise along the local transport network (during construction and operation) with respect to the following guidelines:

– Operational phase - Noise Policy for Industry (NPfI) (EPA, 2017)).
– Construction phase - Interim Construction Noise Guideline (ICNG) (DECC, 2009). The Draft Construction Noise Guideline (DCNG) (EPA, 2021) has also been considered for general guidance only.
– Road transport network - Road Noise Policy (DECCW, 2011).
– Vibration – Assessing Vibration: A Technical Guideline (DEC, 2006) and BS 7385-2:1993 Evaluation and measurement for vibration in buildings Part 2 – Guide to damage (British Standards, 1993).
– Blasting - Technical Basis for Guidelines to Minimise Annoyance due to blasting overpressure and ground vibration (ANZEC, 1990).

Recommended mitigation and management measures were identified in response to the impact assessment findings.

9.1 Impacts from the proposal during operation

An assessment of operational noise from the proposal has been undertaken to predict noise levels at noise sensitive receivers. Operational noise criteria has been proposed for residential receivers based on a review of the existing Environment Protection License (EPL) 6092 for the 5BF, and guidance from the NSW EPA *Noise Policy for Industry* (NPfI) (NSW EPA, 2017). Operational noise criteria for non-residential receivers has been provided from NPfI.

An operational noise model has been prepared to predict operational noise levels at noise sensitive receivers. Predictions show that compliance with the proposed operational noise criteria is achieved at all noise sensitive receivers, based on the operation of equipment considered part of typical operations. An acoustic intensity breakdown of received noise levels indicate that noise emission from the Slag handling and Stockhouse operational source group areas comprise over half of the received acoustic energy from the site.

The operational noise criteria used in the assessment is based on the NPfI discrete process criteria, which aims to ensure that noise emission from the proposal does not contribute to the existing total industrial noise level at the most affected receivers. As compliance is achieved, no cumulative noise impacts are anticipated considering the existing industrial noise in the area are anticipated.

To ensure that noise predictions are representative of operational noise levels from the proposals, noise validation measurements should be undertaken prior to operations commencing. Based on the results of this, the noise model and assumptions may be refined, and operational mitigation measures can be incorporated where appropriate. This may include:

– Nearfield source shielding, such as barriers and enclosures.
– Impact noise mitigation devices.

Sleep disturbance impacts have been assessed against the sleep disturbance screening criterion provided in the NPfI. Operational activities with the potential for short-duration $L_{A1(1min)}$ noise events have been identified, and predictions have been made to residential receivers. It is predicted that $L_{A1(1min)}$ noise levels are below the screening criterion, and as such no sleep disturbance noise impacts are anticipated from the proposal.

9.2 Impacts from the proposal during construction

Construction noise levels have been predicted to the sensitive receivers within the study area with consideration to the acoustic requirements of the *Interim Construction Noise Guideline* (DECCW, 2011). Construction scenarios have been prepared to assess construction noise from laydown area operations, and 6BF construction activities.

It is predicted that construction noise levels from almost all laydown area operations and construction area activities are below the NMLs for all sensitive receivers, for works both within and outside standard construction hours. Exceedances of the NMLs are predicted during high intensity 6BF construction activities outside of standard construction hours. These exceedances are triggered from the use of high noise generating equipment such as impact piles and rock breakers, and will occur for a short duration at the commencement of construction activities. It is planned that they only take place within standard construction hours. At source mitigation treatments may also be considered such as:

– Low noise attachments for rock breakers.
– Resilient pad (dolly) between pile and hammerhead for impact piling.

There is the potential for construction of these projects to occur concurrently which may lead to cumulative construction noise impacts. Based on predicted construction noise levels, potential cumulative construction noise impacts would only be anticipated during high intensity 6BF construction activities, however this is only considered minor. Noise emission from all other construction activities is predicted to be significantly below the NMLs at the nearest residential receivers, which makes up the majority of construction activities for the proposal.

An assessment of construction vibration has been undertaken against criteria from *Assessing Vibration: A Technical Guideline* (DEC, 2006) for structural damage, and *BS6472: Guide to Evaluation of Human Exposure to Vibration in Buildings* (1 Hz to 80 Hz) (British Standards, 2008) for human comfort impacts. It is anticipated that short term human comfort impacts may be experienced for residences close to site preparation works in the No.1 Works laydown area during the use of an 18T vibratory roller. These impacts will be limited to the duration of the these works, which are anticipated to only occur for a short duration at the commencement of construction activities. It is based on a highly conservative approximation of the potential works, since at this stage it is not certain whether the roller is required, or for what duration.

Monitoring occurred for four blasts in January 2009 as part of previous reline works. It concluded no discernible blast events (ground vibration or airblast overpressure) were identified at monitoring undertaken 1.1 kilometres to the southwest. Similarly blasting required for the 6BF will take place approximately 1.1 kilometres away from the nearest residential receivers in Cringila and will use a similar methodology to the blasting at 5BF. Due to the similar distance from the source, no ground vibration or airblast overpressure impacts from blasting are anticipated at any of the nearby residential receivers.

Construction traffic noise levels on public roads are predicted to comply with the road traffic noise assessment criteria at the nearest residential receiver to the road and no construction traffic impacts are expected. Construction traffic along internal private roads near sensitive receivers is also predicted to comply with construction NMLs for the site.

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Appendices

Appendix A

Acoustic concepts and terminology

Acoustic concepts and terminology

Definition of 'noise'

Sound may be defined as any pressure variation that the human ear can detect. The terms "sound" and "noise" are more or less interchangeable however, "noise" is generally often referred to as unwanted sound.

Factors that contribute the environmental noise

Noise from an activity such as construction noise or noise during the operation of a facility at a given receiver location can be affected by a number of different factors, including:

- How loud the source activity is and the type of source:
  - Point (for e.g. a pump or motor)
  - Line (for e.g. a road or railway line)
  - Area (for e.g. the external façades of an industrial building)
- The distance from the source to receiver
- The type of ground between the sound and receiver locations (e.g. hard surfaces or porous ground)
- The ground topography between the source and the receiver. For e.g. is it flat or hilly? Blocking the line of sight will generally reduce the noise level for the receiver
- Obstacles that may block the line of sight between the source and the receiver. For e.g. buildings or noise walls
- Atmospheric absorption (dependent on humidity and temperature)
- Meteorological conditions that may increase or reduce environmental sound propagation (for e.g. wind direction or temperature inversions)

Noise measurements

Noise is generally measured using a specially designed 'sound level meter' (SLM) and must meet internationally recognized performance standards. To avoid expressing sound or noise in terms of Pa, which could involve some unmanageable numbers, the logarithmic decibel or dB scale is used. The scale uses the hearing threshold of 20 µPa or 20 x 10^{-6} Pa as the reference level and is defined as 0 dB.

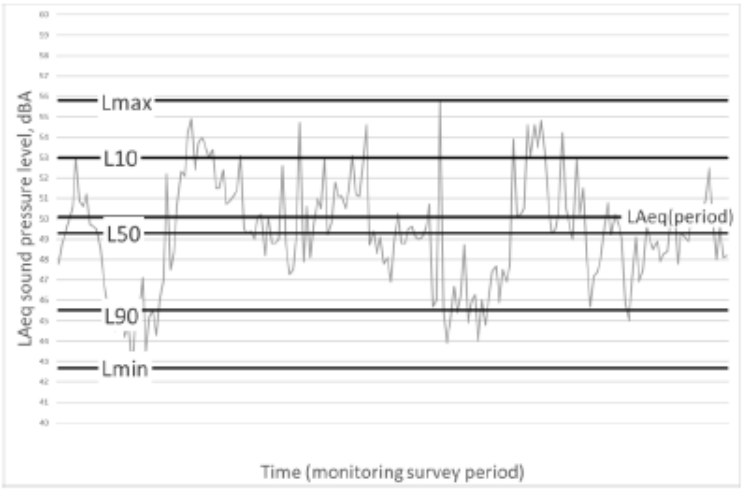
Typical noise levels

The table below presents typical noise sources for each various sound pressure levels and a corresponding subjective noise level description.

Subjective level	Sound pressure level (dBA)	Typical sources
Silent	0	Threshold of hearing
Almost silent	20	Recording studio
Quiet	30	Bedroom
	40	Private office
Moderate	50	General office
	60	Department store
Loud	70	Loud television
	80	Kerb side of busy street
Very loud	90	Construction site
	100	Loud car horn (3 m away)
Extremely loud	110	Grinding on steel
	120	Heavy rock concert
Intolerable	130	Threshold for pain

Typical noise descriptors

Noise is represented by the descriptor L_{AN}, representing a statistical sound measurement recorded on the 'A' weighted scale. A typical noise monitoring chart is shown in the graph below along with the noise descriptors.



Where:

- L_{Amax}: The maximum sound level recorded during the measurement period.
- L_{Amin}: The minimum sound level recorded during the measurement period.
- $L_{A10(period)}$: The A-weighted sound pressure level that is exceeded for 10% of the measurement period.
- $L_{Aeq(period)}$: Equivalent sound pressure leve, the steady sound level that, over a specified period of time, would produce the same energy equivalence as the fluctuating sound level actually occurring.
- $L_{A90(period)}$: The A-weighted sound pressure level that is exceeded for 90% of the time over which a given sound is measured. This is considered to represent the background noise e.g. $L_{A90(15min)}$.

Changes in noise levels

The table below presents a qualitative description of average human responses to changes in noise levels.

Difference	Human response
Difference of 2 dBA	Generally imperceptible by the human ear
Difference of 5 dBA	Considered significant
Difference of 10 dBA	Perceived as a doubling (or halving) of the noise source
Addition of two identical noise levels	Increase levels by 3 dBA
Addition of second noise level of similar character	If the secondary noise level is a minimum 8 dBA below the primary noise level, the noise level will not significantly increase
Doubling of distance between source and receiver	Results in a 3 dBA decrease for a line source and 6 dBA for a point source
A doubling of traffic volume	Results in a 3 dBA increase in noise

Audibility of noise

The table below presents quantitative guidance and qualitative descriptions regarding the audibility of noise.

Audibility	Description
Inaudible	Noise source cannot be heard. The noise level is generally less than the background noise level, potentially by more than 10 dBA or greater
Barely audible	Characteristics of the noise is difficult to define or masked by extraneous noise. The noise level is generally 5-7 dBA below the background noise or ambient noise level, depending on the nature of the noise e.g. constant or intermittent
Just audible	Characteristics of the noise can be defined but extraneous noise sources are also contributing to the received noise. The noise level is typically below the background and ambient noise level.
Audible	Characteristics of the noise can be easily defined. The noise level may be at the level of the background noise and above.
Dominant	The noise source is significantly 'louder' than all other noise sources. The noise level will likely be significantly greater than the background noise level.

Types of noise sources

The table below offers a qualitative description of various noise types and provides the noise descriptor that is typically used to measure the type of noise.

Duration of the noise	Description
Continuous noise	Continuous noise is produced by equipment or activities that operates without interruption in the same mode, for e.g. blowers, pumps and processing equipment. Measuring for just a few minutes with hand-held equipment is sufficient to determine the noise level. If tones or low frequencies are heard, the frequency spectrum can be measured for documentation and further analysis. Continuous noise sources are generally captured by the L_{90} noise descriptor.
Intermittent noise	Intermittent noise is a noise level that increases and decreases rapidly. This might be caused by a train passing by, factory equipment that operates in cycles, or aircraft flying above. Intermittent noise is measured in a similar way to continuous noise, with a sound level meter. The duration of each occurrence and the time between each event is important to note. To gain a more reliable estimate of the noise level, multiple occurrences of the noise source is measured to gain a reliable estimate. Intermittent noise sources are generally captured by the L_{eq} noise descriptor.
Impulsive noise	The noise from impacts or explosions, for e.g. from a pile driver, punch press or gunshot, is called impulsive noise. It is brief and abrupt, and its startling effect causes greater annoyance than would be expected from a simple measurement of sound pressure level. To quantify the impulsiveness of noise, the difference between a quickly responding and a slowly responding parameter can be used. Impulsive noise sources are generally captured by the L_{max} or L_{peak} noise descriptor.
Frequency content	Description
Low frequency	Noise containing major components in the low-frequency range (10 hertz [Hz] to 160 Hz) of the frequency spectrum
Tonal noise	Tonal noise contains one or more prominent tones (i.e. distinct frequency components), and is normally regarded as more offensive than 'broad band' noise
Defining characteristic	Description
Extraneous noise	Noise resulting from activities that are not typical of the area. Atypical activities may include construction, and traffic generated by holiday periods and by special events such as concerts or sporting events. Normal daily traffic is not considered to be extraneous.
Subject noise	The noise in question removed from any extraneous noise in the area
Offensive noise	The definition of offensive noise in the POEO Act is noise: (a) that, by reason of its level, nature, character or quality, or the time at which it is made, or any other circumstances: (i) is harmful to (or is likely to be harmful to) a person who is outside the premises from which it is emitted, or (ii) interferes unreasonably with (or is likely to interfere unreasonably with) the comfort or repose of a person who is outside the premises from which it is emitted, or (b) that is of a level, nature, character or quality prescribed by the regulations or that is made at a time, or in other circumstances, prescribed by the regulations.

Frequency analysis

Frequency analysis is the process used to examine the tones (or frequency components) which make up the overall noise or vibration signal. This analysis was traditionally carried out using analogue electronic filters, but is now normally carried out using Fast Fourier Transform (FFT) analysers. The units for frequency are Hertz (Hz), which represent the number of cycles per second. Frequency analysis can be in:

- Octave bands (where the centre frequency and width of each band is double the previous band)
- 1/3 octave bands (3 bands in each octave band)
- Narrow band (where the spectrum is divided into 400 or more bands of equal width)

Vibration

Definition of 'vibration'

Vibration may be defined as cyclic or transient motion. This motion can be measured in terms of its displacement, velocity or acceleration. Most assessments of human response to vibration or the risk of damage to buildings use measurements of vibration velocity.

Vibration descriptors

These may be expressed in terms of 'peak' velocity or 'rms' velocity. The former is the maximum instantaneous velocity, without any averaging, and is sometimes referred to as 'peak particle velocity', or PPV. The latter incorporates 'root mean squared' averaging over some defined time period. Vibration measurements may be carried out in a single axis or alternatively as triaxial measurements. Where triaxial measurements are used, the axes are commonly designated vertical, longitudinal (aligned toward the source) and transverse. The common units for velocity are millimetres per second (mm/s). As with noise, decibel units can also be used, in which case the reference level should always be stated. A vibration level V, expressed in mm/s can be converted to decibels by the formula 20 log (V/Vo), where Vo is the reference level (10^{-9} m/s). Care is required in this regard, as other reference levels may be used by some organisations.

Types of vibration

Vibration in buildings can be caused by many different external sources, including industrial, construction and transportation activities. The vibration may be continuous (with magnitudes varying or remaining constant with time), impulsive (such as in shocks) or intermittent (with the magnitude of each event being either constant or varying with time). A description of each vibration type including examples are presented in the table below.

Vibration type	Description	Examples
Continuous vibration	Vibration continues uninterrupted for a defined period (usually throughout daytime and/or night-time). This type of vibration is assessed on the basis of weighted rms acceleration values	Machinery, steady road traffic, continuous construction activity (such as tunnel boring machinery)
Impulsive vibration	A vibration source (continuous or intermittent) which has a rapid build up to a peak followed by a damped decay that may or may not involve several cycles of vibration (depending on frequency and damping). This type of vibration is assessed on the basis of weighted rms acceleration values	Infrequent: Activities that create up to 3 distinct vibration events in an assessment period, e.g. occasional dropping of heavy equipment, occasional loading and unloading.
Intermittent vibration	Interrupted periods of continuous (for e.g. a drill) or repeated periods of impulsive vibration (for e.g. a pile driver), or continuous vibration that varies significantly in magnitude. This type of vibration is assessed on the basis of vibration dose values	Trains, nearby intermittent construction activity, passing heavy vehicles, forging machines, impact pile driving, jack hammers. Where the number of vibration events in an assessment period is three or fewer this would be assessed against impulsive vibration criteria

How humans perceive vibration

People are able to 'feel' vibration at levels lower than those required to cause even superficial damage to the most susceptible classes of building (even though they may not be disturbed by the motion). An individual's perception of motion or response to vibration depends very strongly on previous experience and expectations, and on other connotations associated with the perceived source of the vibration. For example, the vibration that a person responds to as 'normal' in a car, bus or train is considerably higher than what is perceived as 'normal' in a shop, office or dwelling.

Typical vibration levels

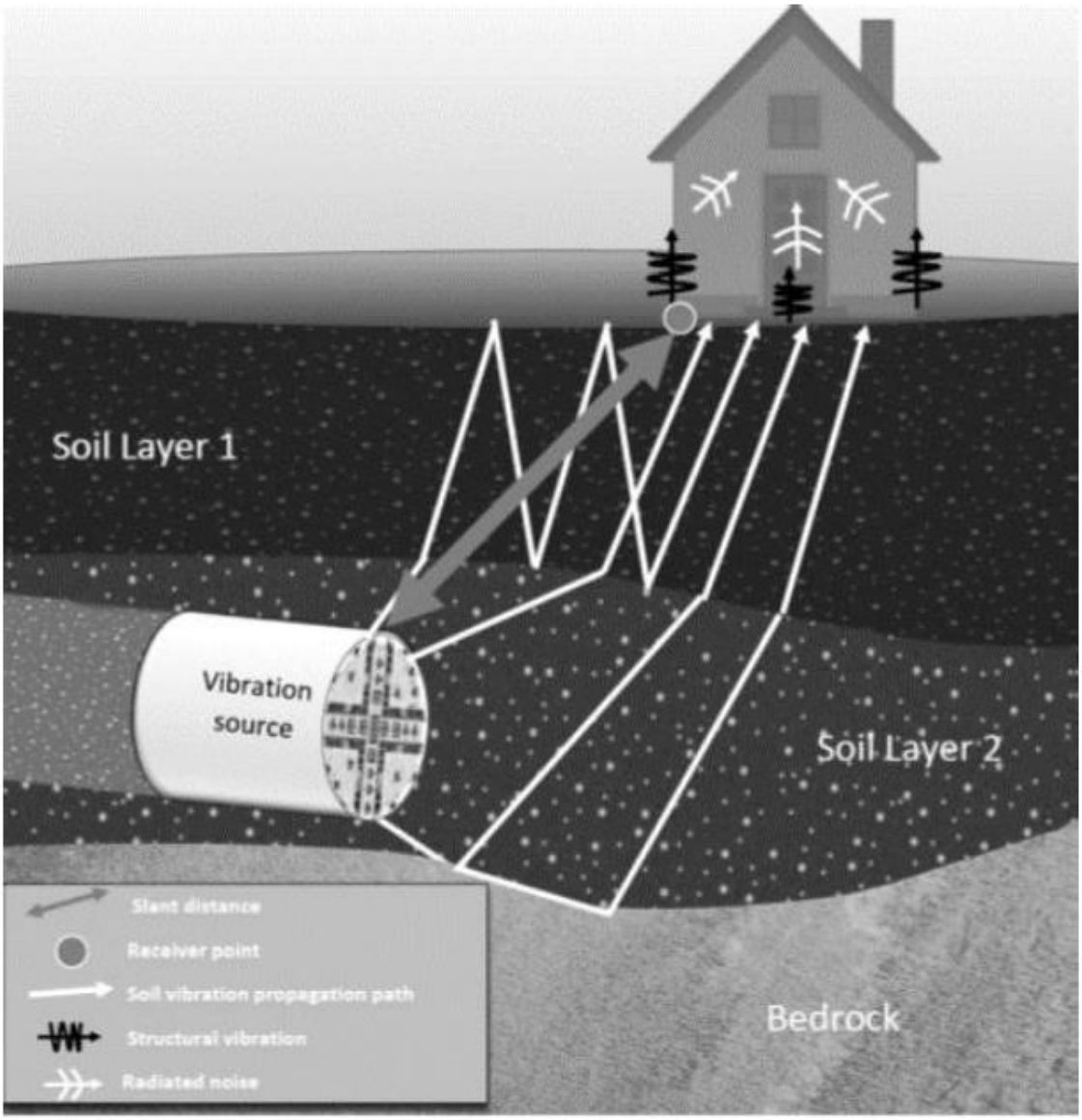
Typical ground vibration from civil construction activities occurs in the frequency range of approximately 8 Hz to 100 Hz. Within this frequency range, building contents such as blinds and pictures would commence visible movement at 0.5 mm/s. At vibration levels higher than 0.9 mm/s, rattling of windows, crockery or loose objects would be audible and annoying.

Velocity level (mm/s)	Typical source	Response
0.01	Typical background vibration level	Scanning electron microscopes to 50000 x amplification
0.03		500x amplification bench microscopes
0.1	Average passenger train vibration	Approximate threshold for human perception of vibration
0.3	Average freight train vibration Max passenger train vibration	Approx. residential annoyance for train passbys
1	Large rock breaker	Vibration level that will generally result in complaints
3	Blasting/ Impact pile driving	Threshold for minor cosmetic damage

Ground-borne noise and vibration

Noise that propagates through a structure as vibration and is radiated by vibrating wall, ceiling and floor surfaces is termed “ground-borne noise”, “regenerated noise”, or sometimes “structure borne noise”. Ground-borne noise originates as vibration and propagates between the source and receiver through the ground and/or building structural elements, rather than through the air. Typical sources of ground-borne noise include tunnelling construction works or underground railway operations.

The figure below presents the various paths by which vibration and ground-borne noise may be transmitted between a source and receiver for construction activities that occur below the ground level (for e.g. a tunnel boring machine).



Acronyms and abbreviations

Term	Definition
AWS	Automatic Weather Station
BOM	Bureau of Meteorology
dB	Decibel is the unit used for expressing the sound pressure level (SPL) or power level (SWL) in acoustics.
dBA	Decibel expressed with the frequency weighting filter used to measure 'A-weighted' sound pressure levels, which conforms approximately to the human ear response, as our hearing is less sensitive at low and high frequencies.
dBZ or dBL	The unit used to measure 'Z-weighted' sound pressure levels with no weighting applied, linear.
CEMP	Construction Environmental Management Plan
DECC	Department of Environment and Climate Change
DECCW	Department of Environment, Climate Change and Water
EPA	Environmental Protection Authority
ICNG	*Interim Construction Noise Guideline* (DECC, 2009).
NPfI	*Noise Policy for Industry* (EPA, 2017).
$L_{Aeq(period)}$	Equivalent sound pressure level: the steady sound level that, over a specified period of time, would produce the same energy equivalence as the fluctuating sound level actually occurring.
$L_{A10(period)}$	The noise level exceeded for 10 per cent of the time and is approximately the average of the maximum noise levels.
$L_{A90(period)}$	The sound pressure level that is exceeded for 90% of the measurement period.
L_{Amax}	The absolute maximum noise level in a noise sample
NSW	New South Wales
OOHW	Out-of-hours Works
PPV	Peak particle velocity is the maximum vector sum of three orthogonal time-synchronized velocity components regardless of whether these component maxima occurred simultaneously.
RBL	Rating Background Level . The overall single-figure background level representing each assessment period (day/evening/night) over the whole monitoring period.
rms	Root Mean Square Amplitude (rms) is the square root of the average of the squared values of the waveform. In the case of the sine wave, the RMS value is 0.707 times the peak value, but this is only true in the case of the sine wave.
RNP	*Road Noise Policy* (DECCW, 2011).
SEARs	Secretary's Environmental Assessment Requirements
SPL	Sound Pressure Level
SWL	Sound Power Level
SWRO	Seawater Reverse Osmosis
Rw	Weighted Sound Reduction Index which provides a single-number quantity which characterises the airborne sound insulation of a material or building element over a range of frequencies
TBM	Tunnel Boring Machine
VDV	Vibration dose value - As defined in BS6472 – 2008, VDV is given by the fourth root of the integral of the fourth power of the frequency weighted acceleration.
WFP	Water Filtration Plant

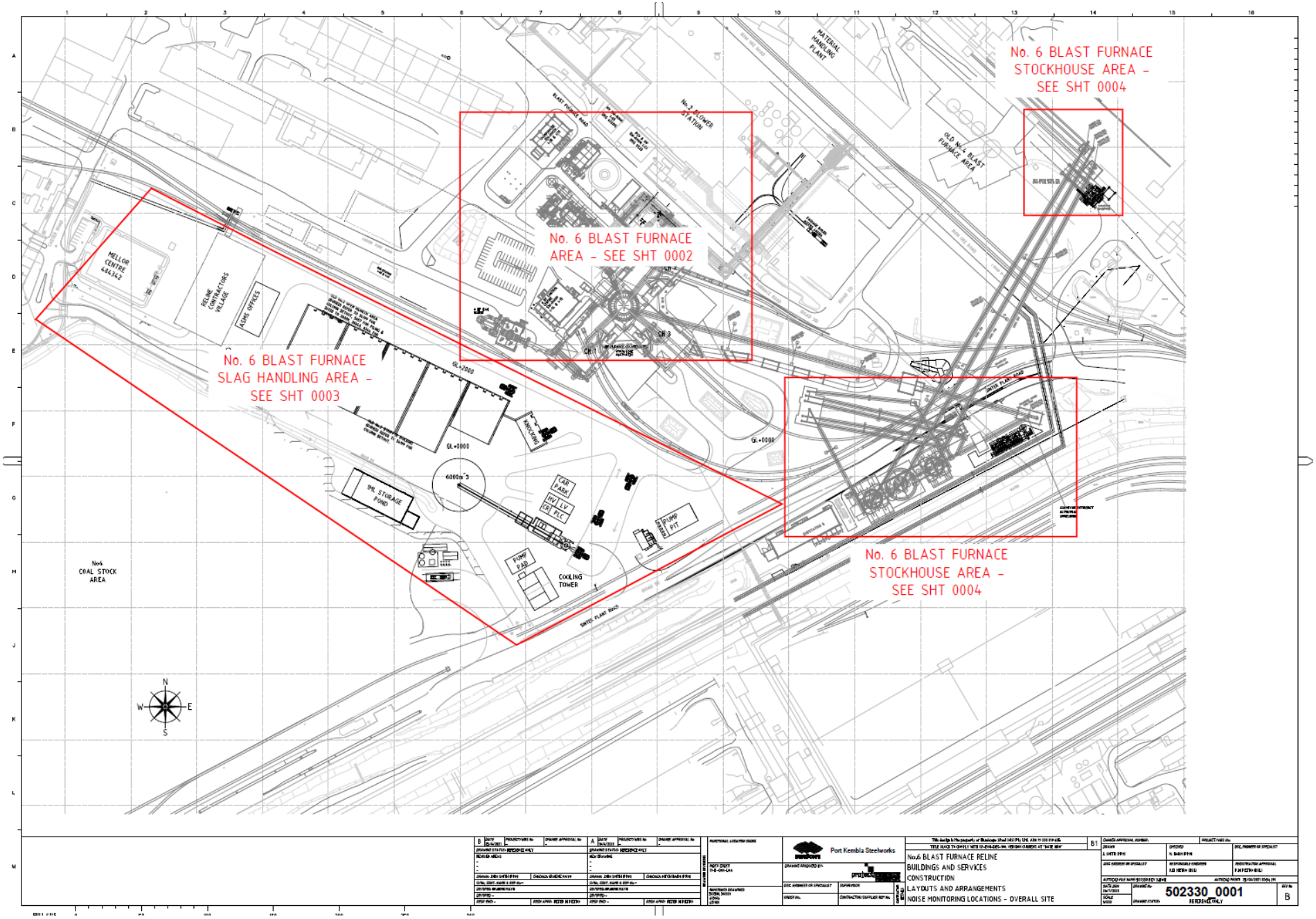
Common Terms

Term	Definition
A weighting	The human ear responds more to frequencies between 500 Hz and 8 kHz and is less sensitive to very low-pitch or high-pitch noises. The frequency weightings used in sound level measurements are often related to the response of the human ear to ensure that the meter better responds to what you actually hear
Adverse weather	Weather effects that enhance noise (that is, wind and temperature inversions) that occur at a site for a significant period of time (that is, wind occurring more than 30% of the time in any assessment period in any season and/or temperature inversions occurring more than 30% of the nights in winter).
Ambient noise	The all-encompassing noise associated within a given environment. It is the composite of sounds from many sources, both near and far. This is described using the Leq descriptor
Background noise	The underlying level of noise present in the ambient noise, excluding the noise source under investigation, when extraneous noise is removed. This is described using the L90 descriptor
Compliance	The process of checking that source noise levels meet with the noise limits in a statutory context.
Determining authority	Defined by Section 110 of the *Environmental Planning and Assessment Act 1979* as 'a Minister or public authority and, in relation to any activity, means the Minister or public authority by or on whose behalf the activity is or is to be carried out or any Minister or public authority whose approval is required in order to enable the activity to be carried out.'
Extraneous noise	Noise resulting from activities that are not typical of the area. Atypical activities may include construction, and traffic generated by holiday periods and by special events such as concerts or sporting events. Normal daily traffic is not considered to be extraneous
EIS	Environmental Impact Assessment
Feasible and reasonable measures	Feasibility relates to engineering considerations and what is practical to build. reasonableness relates to the application of judgement in arriving at a decision, taking into account the following factors: - Noise mitigation benefits (amount of noise reduction provided, number of people protected); Cost of mitigation (cost of mitigation versus benefit provided); Community views (aesthetic impacts and community wishes); Noise levels for affected land uses (existing and future levels, and changes in noise levels)
Ground-borne noise	Noise heard within a building that is generated by vibration transmitted through the ground into the structure from construction works, sometimes referred to as 'regenerated noise' or 'structure-borne noise'. Ground-borne noise can be more noticeable than airborne noise for underground works such as tunnelling. The ground-borne noise levels are only applicable when ground-borne noise levels are higher than airborne noise levels.
Ground-borne vibration	Vibration transmitted from a source to a receptor via the ground
Hertz	The measure of frequency of sound wave oscillations per second. 1 oscillation per second equals 1 hertz.
Masking	The phenomenon of one sound interfering with the perception of another sound. For example, the interference of traffic noise with use of a public telephone on a busy street.
Maximum noise event	The loudest event or events within a given period of time. This is generally described using the L_{max} descriptor
Meteorological conditions	Wind and temperature inversion conditions
Most-affected location	Location(s) that experience (or will likely experience) the greatest noise impact from the construction works under consideration. In determining these locations, existing background noise levels, noise source location(s), distance and any shielding between the construction works (or proposed works) and the residences and other sensitive land uses need to be considered.

Term	Definition
Noise management level	The Noise Management Level (NML) as defined as the EPA's ICNG. To be measured and assessed at the property boundary that is most exposed to construction noise, and at a height of 1.5 m above ground level. If the residential property boundary is more than 30 m from the residence, the location for measuring or predicting noise levels is at the most affected point within 30 m of the residence.
Noise sensitive receiver	An area or place potentially affected by noise which includes: a residential dwelling an educational institution, library, childcare centre or kindergarten a hospital, surgery or other medical institution an active (e.g. sports field, golf course) or passive (e.g. national park) recreational area commercial or industrial premises a place of worship.
Non-compliance	Development is deemed to be in non-compliance with its noise consent/ licence conditions if the monitored noise levels exceed its statutory noise limit (exceptions may be given if the noise level exceeds by less than 2 dB)
Octave	A division of the frequency range into bands, the upper frequency limit
Project noise trigger level	Target noise levels for a particular noise generating facility. They are based on the most stringent of the intrusive criteria or amenity criteria. Which of the two criteria is the most stringent is determined by measuring the level and nature of existing noise in the area surrounding the actual or propose noise generating facility.
Proposal	The construction and operation of the SWRO site, the modifications to the Illawarra WFP site and associated infrastructure including the power route, the delivery pipeline, the se and the intake and outlet tunnels.
proposal site	The immediate location of the proposal, which is the area that has the potential to be directly disturbed by construction and operation.
Resonance	Resonance describes the phenomenon of increased amplitude that occurs when the frequency of a periodically applied force is equal or close to a natural frequency of the system on which it acts.
Study area	Land in the vicinity of, and including, the proposal site. The 'study area' is the wider area surrounding the proposal site.
Temperature inversion	An atmospheric condition in which temperature increases with height above the ground.
Third-octave	Single octave bands divided into three parts.

Appendix B

Operational noise sources general arrangement

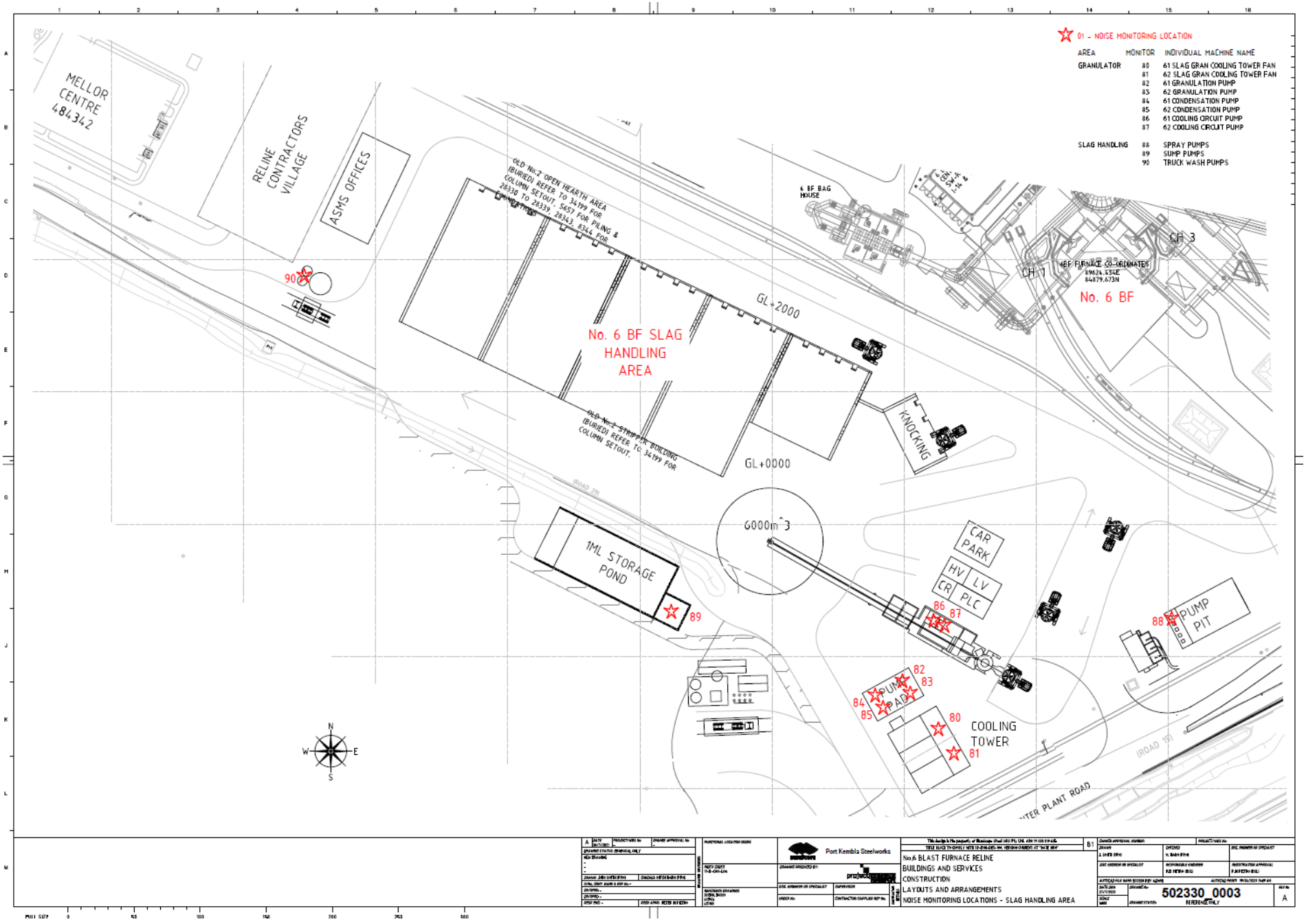


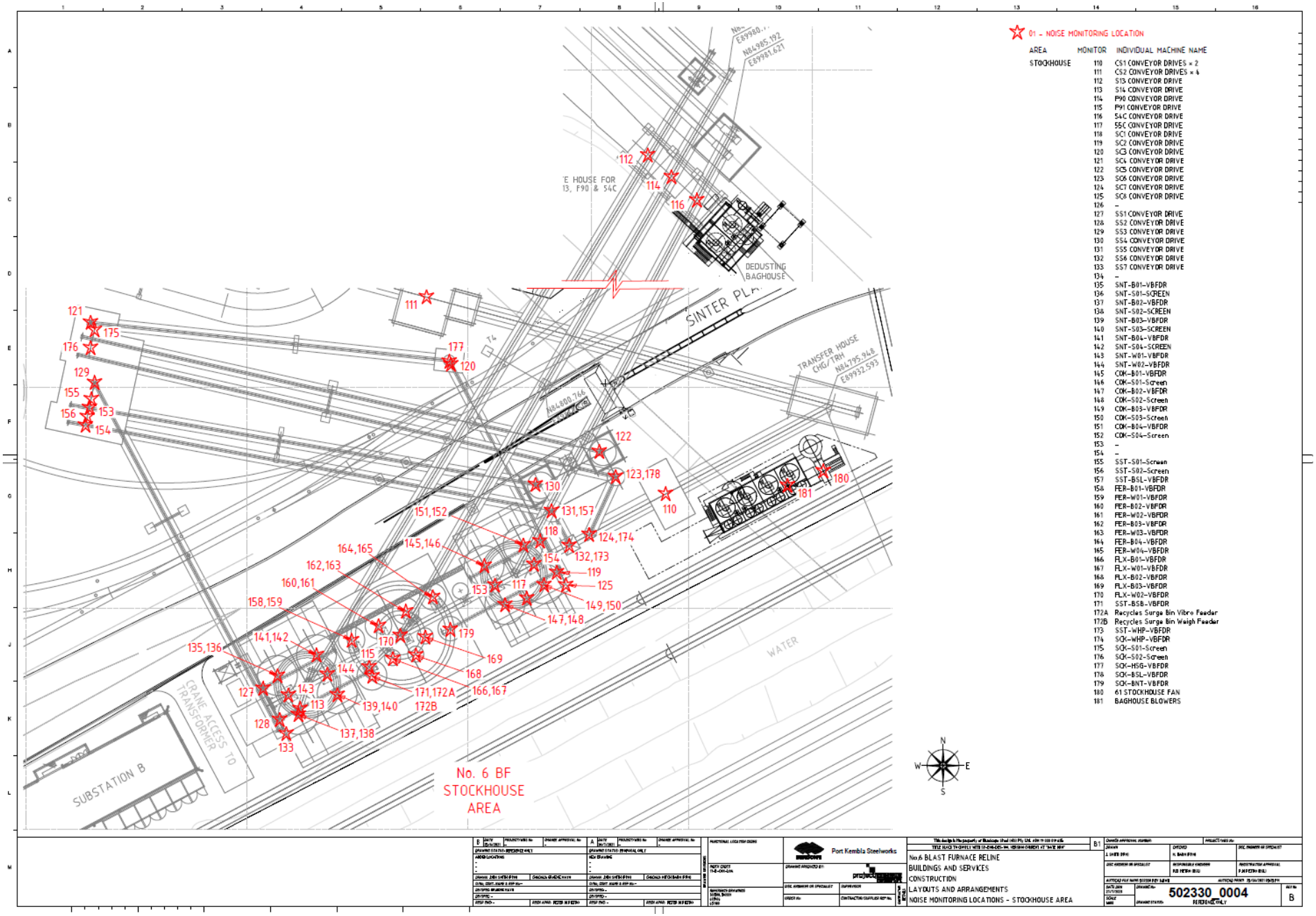
Port Kembla Steelworks

No.6 BLAST FURNACE RELINE
BUILDINGS AND SERVICES
CONSTRUCTION
LAYOUTS AND ARRANGEMENTS
NOISE MONITORING LOCATIONS - OVERALL SITE

502330_0001

B


01 – NOISE MONITORING LOCATION
AREA
MONITOR
INDIVIDUAL MACHINE NAME
GRANULATOR
80 61 SLAG GRAN COOLING TOWER FAN
81 62 SLAG GRAN COOLING TOWER FAN
82 61 GRANULATION PUMP
83 62 GRANULATION PUMP
84 61 CONDENSATION PUMP
85 62 CONDENSATION PUMP
86 61 COOLING CIRCUIT PUMP
87 62 COOLING CIRCUIT PUMP
SLAG HANDLING
88 SPRAY PUMPS
89 SUMP PUMPS
90 TRUCK WASH PUMPS
MELLOR CENTRE 484342
RELINE CONTRACTORS VILLAGE
ASMS OFFICES
OLD No.2 OPEN HEARTH AREA (BURIED) REFER TO 34199 FOR COLUMN SETOUT, 5657 FOR PILING & 28338 TO 28339, 28343, 8344 FOR
OLD No.2 STRIPPER BUILDING (BURIED) REFER TO 34199 FOR COLUMN SETOUT.
6 BF BAG HOUSE
GL+2000
No. 6 BF SLAG HANDLING AREA
GL+0000
KNOCKING
CH 1
CH 3
6BF FURNACE CO-ORDINATES
89624.334E
84879.673N
No. 6 BF
6000m^3
1ML STORAGE POND
CAR PARK
HV
LV
CR
PLC
PUMP PIT
PUMP PAD
COOLING TOWER
(ROAD 15)
N
S
E
W
Port Kembla Steelworks
No.6 BLAST FURNACE RELINE
BUILDINGS AND SERVICES
CONSTRUCTION
LAYOUTS AND ARRANGEMENTS
NOISE MONITORING LOCATIONS - SLAG HANDLING AREA
502330_0003
REFERENCE ONLY
A


01 – NOISE MONITORING LOCATION
AREA MONITOR INDIVIDUAL MACHINE NAME
STOCKHOUSE 110 CS1 CONVEYOR DRIVES × 2
111 CS2 CONVEYOR DRIVES × 4
112 S13 CONVEYOR DRIVE
113 S14 CONVEYOR DRIVE
114 F90 CONVEYOR DRIVE
115 F91 CONVEYOR DRIVE
116 54C CONVEYOR DRIVE
117 55C CONVEYOR DRIVE
118 SC1 CONVEYOR DRIVE
119 SC2 CONVEYOR DRIVE
120 SC3 CONVEYOR DRIVE
121 SC4 CONVEYOR DRIVE
122 SC5 CONVEYOR DRIVE
123 SC6 CONVEYOR DRIVE
124 SC7 CONVEYOR DRIVE
125 SC8 CONVEYOR DRIVE
126 –
127 SS1 CONVEYOR DRIVE
128 SS2 CONVEYOR DRIVE
129 SS3 CONVEYOR DRIVE
130 SS4 CONVEYOR DRIVE
131 SS5 CONVEYOR DRIVE
132 SS6 CONVEYOR DRIVE
133 SS7 CONVEYOR DRIVE
134 –
135 SNT-B01-VBFDR
136 SNT-S01-SCREEN
137 SNT-B02-VBFDR
138 SNT-S02-SCREEN
139 SNT-B03-VBFDR
140 SNT-S03-SCREEN
141 SNT-B04-VBFDR
142 SNT-S04-SCREEN
143 SNT-W01-VBFDR
144 SNT-W02-VBFDR
145 CDK-B01-VBFDR
146 CDK-S01-Screen
147 CDK-B02-VBFDR
148 CDK-S02-Screen
149 CDK-B03-VBFDR
150 CDK-S03-Screen
151 CDK-B04-VBFDR
152 CDK-S04-Screen
153 –
154 –
155 SST-S01-Screen
156 SST-S02-Screen
157 SST-BSL-VBFDR
158 FER-B01-VBFDR
159 FER-W01-VBFDR
160 FER-B02-VBFDR
161 FER-W02-VBFDR
162 FER-B03-VBFDR
163 FER-W03-VBFDR
164 FER-B04-VBFDR
165 FER-W04-VBFDR
166 FLX-B01-VBFDR
167 FLX-W01-VBFDR
168 FLX-B02-VBFDR
169 FLX-B03-VBFDR
170 FLX-W02-VBFDR
171 SST-BSB-VBFDR
172A Recycles Surge Bin Vibro Feeder
172B Recycles Surge Bin Weigh Feeder
173 SST-WHP-VBFDR
174 SCK-WHP-VBFDR
175 SCK-S01-Screen
176 SCK-S02-Screen
177 SCK-HSG-VBFDR
178 SCK-BSL-VBFDR
179 SCK-BNT-VBFDR
180 61 STOCKHOUSE FAN
181 BAGHOUSE BLOWERS
No. 6 BF STOCKHOUSE AREA
SUBSTATION B
CRANE ACCESS TO TRANSFORMER
DEDUSTING BAGHOUSE
TRANSFER HOUSE CHG/TRH
SINTER PLA
WATER
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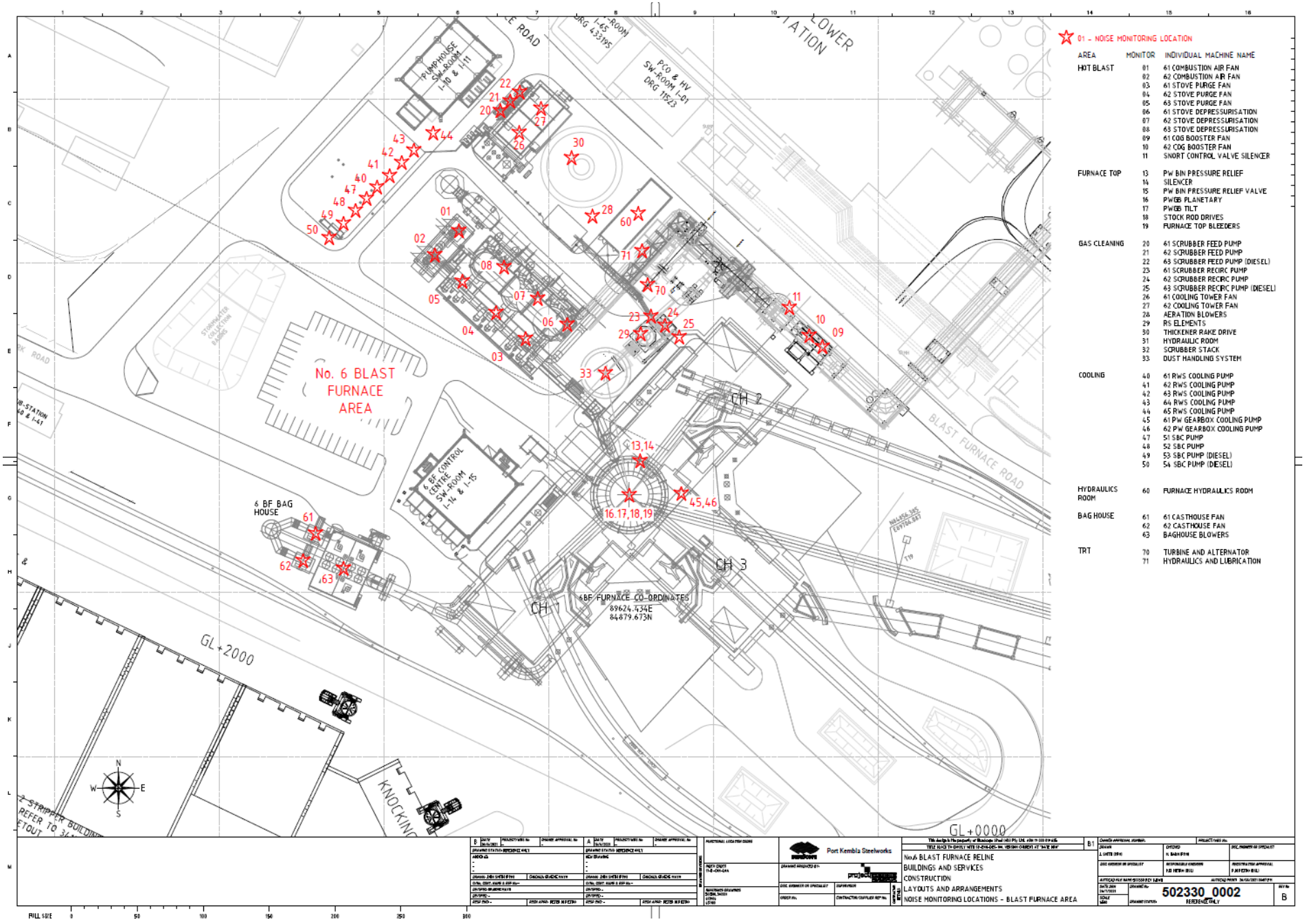
No.6 BLAST FURNACE RELINE
BUILDINGS AND SERVICES
CONSTRUCTION
LAYOUTS AND ARRANGEMENTS
NOISE MONITORING LOCATIONS - STOCKHOUSE AREA
502330 0004
B

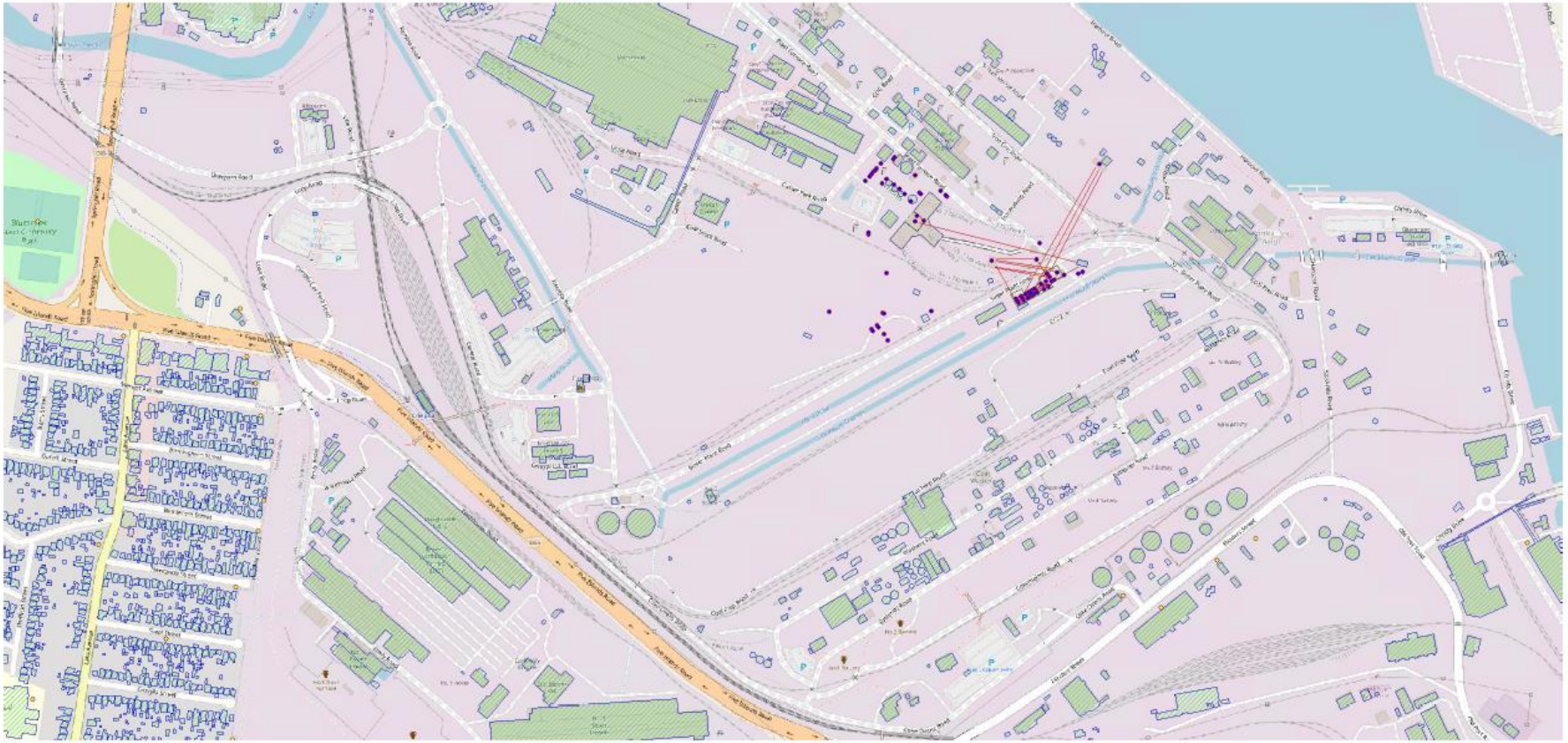

01 – NOISE MONITORING LOCATION
AREA MONITOR INDIVIDUAL MACHINE NAME
HOT BLAST 01 61 COMBUSTION AIR FAN
02 62 COMBUSTION AIR FAN
03 61 STOVE PURGE FAN
04 62 STOVE PURGE FAN
05 63 STOVE PURGE FAN
06 61 STOVE DEPRESSURISATION
07 62 STOVE DEPRESSURISATION
08 63 STOVE DEPRESSURISATION
09 61 COG BOOSTER FAN
10 62 COG BOOSTER FAN
11 SNORT CONTROL VALVE SILENCER
FURNACE TOP 13 PW BIN PRESSURE RELIEF
14 SILENCER
15 PW BIN PRESSURE RELIEF VALVE
16 PWGB PLANETARY
17 PWGB TILT
18 STOCK ROD DRIVES
19 FURNACE TOP BLEEDERS
GAS CLEANING 20 61 SCRUBBER FEED PUMP
21 62 SCRUBBER FEED PUMP
22 63 SCRUBBER FEED PUMP (DIESEL)
23 61 SCRUBBER RECIRC PUMP
24 62 SCRUBBER RECIRC PUMP
25 63 SCRUBBER RECIRC PUMP (DIESEL)
26 61 COOLING TOWER FAN
27 62 COOLING TOWER FAN
28 AERATION BLOWERS
29 RS ELEMENTS
30 THICKENER RAKE DRIVE
31 HYDRAULIC ROOM
32 SCRUBBER STACK
33 DUST HANDLING SYSTEM
COOLING 40 61 RWS COOLING PUMP
41 62 RWS COOLING PUMP
42 63 RWS COOLING PUMP
43 64 RWS COOLING PUMP
44 65 RWS COOLING PUMP
45 61 PW GEARBOX COOLING PUMP
46 62 PW GEARBOX COOLING PUMP
47 51 SBC PUMP
48 52 SBC PUMP
49 53 SBC PUMP (DIESEL)
50 54 SBC PUMP (DIESEL)
HYDRAULICS ROOM 60 FURNACE HYDRAULICS ROOM
BAG HOUSE 61 61 CASTHOUSE FAN
62 62 CASTHOUSE FAN
63 BAGHOUSE BLOWERS
TRT 70 TURBINE AND ALTERNATOR
71 HYDRAULICS AND LUBRICATION
No. 6 BLAST FURNACE AREA
6 BF BAG HOUSE
6 BF CONTROL CENTRE SW-ROOM I-14 & I-15
PUMPHOUSE SW-ROOM I-10 & I-11
P/CO & HV SW-ROOM I-01 DRG 115.23
I-65 SW-ROOM DRG 433WS
BLAST FURNACE ROAD
6BF FURNACE CO-ORDINATES
89624.434E
84879.673N
CH 1
CH 2
CH 3
GL+2000
GL+0000
KNOCKING
Port Kembla Steelworks
No.6 BLAST FURNACE RELINE
BUILDINGS AND SERVICES
CONSTRUCTION
LAYOUTS AND ARRANGEMENTS
NOISE MONITORING LOCATIONS – BLAST FURNACE AREA
502330_0002
B

Appendix C

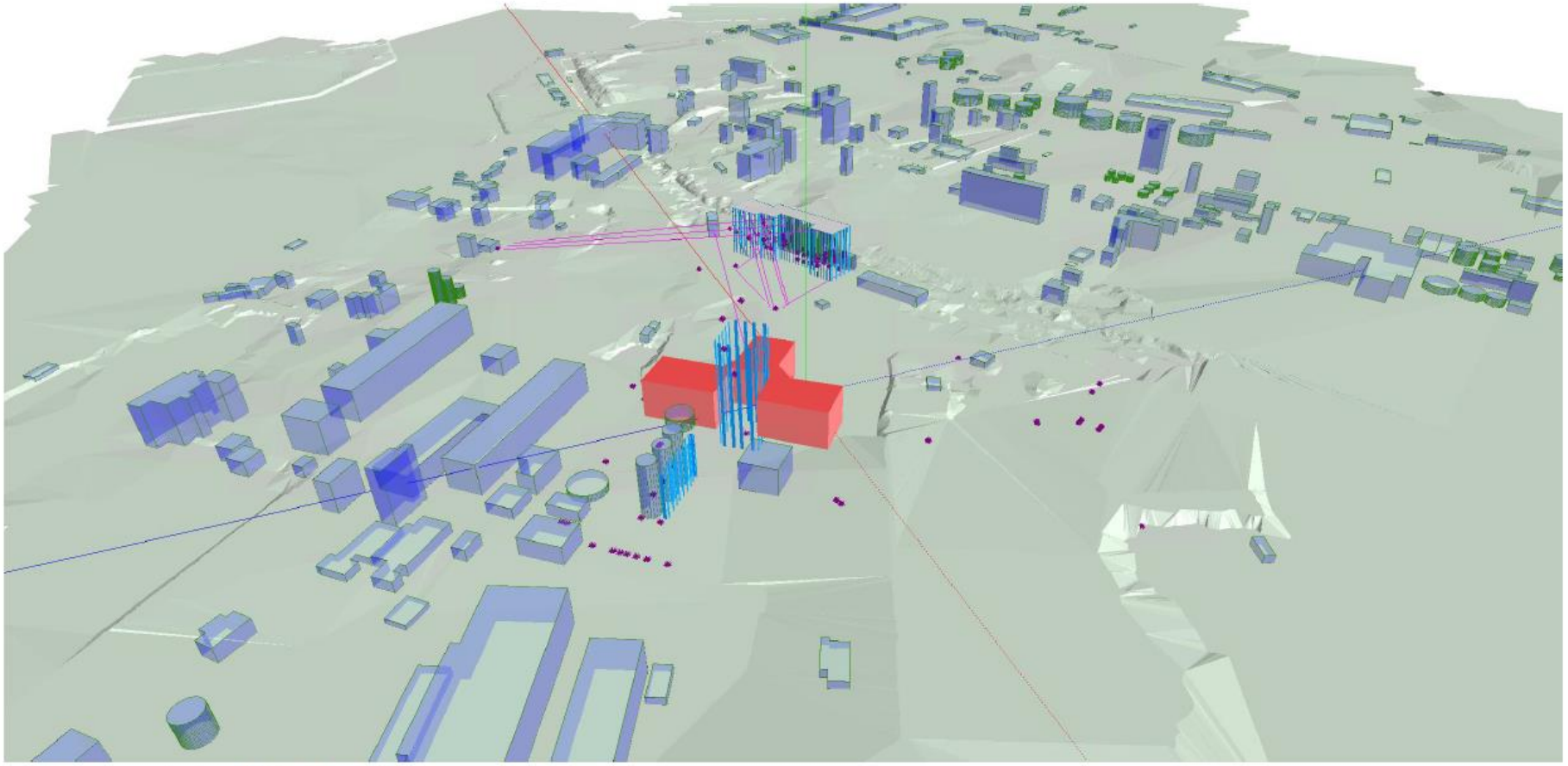
Noise source levels and modelling assumptions

Area	Equipment name	6BF location ID	MGA Location - Easting	MGA Location - Northing	Heigh above ground, metres	LAeq1min noise level, dBA	Operating time per 15 minute period, minutes	Time correction, dB	LAeq15min noise level, dBA	LAmax noise level considered in assessment, dBA	Noise level source
Hot Blast	61 Combustion Air Fan	1	305980.6011	6184425.678	2.5	102	15	-	102	-	GHD measurements 2021
Hot Blast	62 Combustion Air Fan	2	305973.1456	6184417.253	2.5	102	15	-	102	-	GHD measurements 2021
Hot Blast	61 Stove Purge Fan	3	306000.2159	6184392.687	1	-	-	-	-	-	Not contributing to noise emission
Hot Blast	62 Stove Purge Fan	4	305990.4802	6184401.304	1	-	-	-	-	-	Not contributing to noise emission
Hot Blast	63 Stove Purge Fan	5	305980.7445	6184409.92	1	-	-	-	-	-	Not contributing to noise emission
Hot Blast	61 Stove Depressurisation Valve	6	306014.7968	6184398.148	3.6	106	5	-4.8	101	106	GHD measurements 2021
Hot Blast	62 Stove Depressurisation Valve	7	306005.0611	6184406.763	3.6	106	5	-4.8	101	106	GHD measurements 2021
Hot Blast	63 Stove Depressurisation Valve	8	305995.3243	6184415.379	3.6	106	5	-4.8	101	106	GHD measurements 2021
Hot Blast	61 COG Booster Fan	9	306092.3597	6184393.941	5	101	8	-3.0	98	-	SWL_Bluescope (Table 6.3)
Hot Blast	62 COG Booster Fan	10	306089.9245	6184396.096	5	101	8	-3.0	98	-	SWL_Bluescope (Table 6.3)
Hot Blast	Snort Control Valve Silencer	11	306080.8658	6184404.113	22	140	0	-16.5	123	140	Calculated from Hatch monitoring report farfield measurements
Furnace Top	PW Bin Pressure Relief Silencer	14	306037.3023	6184357.872	79.5	114	0	-22.6	91	124	GHD measurements 2021
Furnace Top	PW Bin Pressure Relief Valve	13	306037.3023	6184357.872	60.4	114	0	-22.6	91	124	GHD measurements 2021
Furnace Top	PWGB Planetary	16	306034.2682	6184347.261	47.1	-	-	-	-	-	Not contributing to noise emission
Furnace Top	PWGB Tilt	17	306034.2682	6184347.261	46.6	-	-	-	-	-	Not contributing to noise emission
Furnace Top	Stock Rod Drives	18	306034.2682	6184347.261	0	104	15	-	104	-	SWL_Bluescope (Table 6.3)
Furnace Top	Furnace top bleeders	19	306034.2682	6184347.261	90	171	0	-16.5	154	171	Calculated from Hatch monitoring report farfield measurements
Gas Cleaning	61 Scrubber Feed Pump	20	305993.2958	6184462.804	0.8	94	15	-	94	-	SWL_Hatch (Table 6.2)
Gas Cleaning	62 Scrubber Feed Pump	21	305995.6156	6184465.426	0.8	94	15	-	94	-	SWL_Hatch (Table 6.2)
Gas Cleaning	63 Scrubber Feed Pump (Diesel)	22	305998.3133	6184468.46	0.8	99	0	-	99	-	SWL_Hatch (Table 6.2)
Gas Cleaning	61 Scrubber Recirc Pump	23	306042.4544	6184400.146	0.75	90	15	-	90	-	SWL_Bluescope (Table 6.3)
Gas Cleaning	62 Scrubber Recirc Pump	24	306044.1747	6184398.332	0.75	91	15	-	91	-	SWL_Bluescope (Table 6.3)
Gas Cleaning	63 Scrubber Recirc Pump (Diesel)	25	306045.8265	6184396.591	0.75	98	0	-	98	-	SWL_Hatch (Table 6.2)
Gas Cleaning	61 Cooling Tower Fan	26	305998.7729	6184456.895	11.5	-	-	-	-	-	Not contributing to noise emission
Gas Cleaning	62 Cooling Tower Fan	27	306005.2373	6184464.201	11.5	-	-	-	-	-	Not contributing to noise emission
Gas Cleaning	Aeration blowers	28	306020.9013	6184431.707	1	92	15	-	92	-	GHD measurements 2021
Gas Cleaning	RS Elements	29	306035.8439	6184396.289	8	-	-	-	-	-	Not contributing to noise emission
Gas Cleaning	Thickener Rake Drive	30	306014.8567	6184449.169	9	104	15	-	104	-	SWL_Bluescope (Table 6.3)
Gas Cleaning	Dust Handling System	33	306026.28	6184384.112	7.6	89	15	-	89	-	SWL_Hatch (Table 6.2)
Cooling	61 RWS Cooling Pump	40	305957.4963	6184439.136	1	-	-	-	-	-	Not contributing to noise emission
Cooling	62 RWS Cooling Pump	41	305960.0158	6184442.13	1	-	-	-	-	-	Not contributing to noise emission
Cooling	63 RWS Cooling Pump	42	305962.7983	6184445.127	1	-	-	-	-	-	Not contributing to noise emission
Cooling	64 RWS Cooling Pump	43	305965.4498	6184448.122	1	-	-	-	-	-	Not contributing to noise emission
Cooling	65 RWS Cooling Pump	44	305970.7517	6184454.115	1	-	-	-	-	-	Not contributing to noise emission
Cooling	61 PW Gearbox Cooling Pump	45	306049.7954	6184348.21	34.1	-	-	-	-	-	Not contributing to noise emission
Cooling	62 PW Gearbox Cooling Pump	46	306049.7954	6184348.21	34.1	-	-	-	-	-	Not contributing to noise emission
Cooling	51 SBC Pump	47	305953.8507	6184435.017	1	89	15	-	89	-	SWL_Hatch (Table 6.2)
Cooling	52 SBC Pump	48	305949.8745	6184430.523	1	89	15	-	89	-	SWL_Hatch (Table 6.2)
Cooling	53 SBC Pump (Diesel)	49	305946.8923	6184427.153	1	89	0	-	89	-	SWL_Hatch (Table 6.2)
Cooling	54 SBC Pump (Diesel)	50	305942.2527	6184421.911	1	95	15	-	95	-	SWL_Hatch (Table 6.2)
Stockhouse	CS1 Conveyor Drives * 2	110	306306.576	6184248.759	1.5	104	15	-	104	-	SWL_Bluescope (Table 6.3)
Stockhouse	CS2 Conveyor Drives * 4	111	306251.8519	6184292.295	1	104	15	-	104	-	SWL_Bluescope (Table 6.3)
Stockhouse	S13 Conveyor Drive	112	306371.0849	6184454.887	4.1	104	11	-1.5	102	-	SWL_Bluescope (Table 6.3)
Stockhouse	S14 Conveyor Drive	113	306224.7538	6184198.265	37.5	104	11	-1.5	102	-	SWL_Bluescope (Table 6.3)
Stockhouse	F90 Conveyor Drive	114	306376.0762	6184450.483	4.1	104	15	-	104	-	SWL_Bluescope (Table 6.3)
Stockhouse	F91 Conveyor Drive	115	306240.317	6184208.377	30.5	104	15	-	104	-	SWL_Bluescope (Table 6.3)
Stockhouse	54C Conveyor Drive	116	306381.9531	6184445.297	10	100	9	-2.2	98	-	SWL_Bluescope (Table 6.3)
Stockhouse	55C Conveyor Drive	117	306275.6935	6184224.597	40	100	9	-2.2	98	-	SWL_Bluescope (Table 6.3)
Stockhouse	SC1 Conveyor Drive	118	306278.6747	6184237.788	9	95	8	-3.0	92	-	SWL_Bluescope (Table 6.3)
Stockhouse	SC2 Conveyor Drive	119	306282.5668	6184230.799	9	95	8	-3.0	92	-	SWL_Bluescope (Table 6.3)
Stockhouse	SC3 Conveyor Drive	120	306257.5883	6184277.214	10.5	98	8	-3.0	95	-	SWL_Bluescope (Table 6.3)
Stockhouse	SC4 Conveyor Drive	121	306175.7246	6184285.046	10.5	94	15	-	94	-	SWL_Bluescope (Table 6.3)
Stockhouse	SC5 Conveyor Drive	122	306291.606	6184257.68	19.5	88	15	-	88	-	SWL_Bluescope (Table 6.3)
Stockhouse	SC6 Conveyor Drive	123	306294.6623	6184252.674	23.5	100	15	-	100	-	SWL_Bluescope (Table 6.3)
Stockhouse	SC7 Conveyor Drive	124	306290.0674	6184240.248	9	100	15	-	100	-	SWL_Bluescope (Table 6.3)
Stockhouse	SC8 Conveyor Drive	125	306221.8956	6184192.978	5.2	95	0	-	95	-	SWL_Bluescope (Table 6.3)
Stockhouse	SS1 Conveyor Drive	127	306216.6202	6184203.204	9	98	11	-1.5	96	-	SWL_Bluescope (Table 6.3)
Stockhouse	SS2 Conveyor Drive	128	306220.5148	6184196.216	9	94	11	-1.5	92	-	SWL_Bluescope (Table 6.3)
Stockhouse	SS3 Conveyor Drive	129	306176.8934	6184271.407	19.5	88	11	-1.5	86	-	SWL_Bluescope (Table 6.3)
Stockhouse	SS4 Conveyor Drive	130	306277.2878	6184250.407	19.5	104	15	-	104	-	SWL_Bluescope (Table 6.3)
Stockhouse	SS5 Conveyor Drive	131	306280.0459	6184244.674	28	104	15	-	104	-	SWL_Bluescope (Table 6.3)
Stockhouse	SS6 Conveyor Drive	132	306284.7935	6184237.764	11.5	104	15	-	104	-	SWL_Bluescope (Table 6.3)
Stockhouse	SS7 Conveyor Drive	133	306284.5852	6184227.917	4.3	104	0	-	104	-	SWL_Bluescope (Table 6.3)
Stockhouse	SNT-B01-VBFDR	135	306219.6378	6184206.031	15.86	99	12	-1.0	98	109	GHD measurements 2021, corrected to appropriate machine size
Stockhouse	SNT-S01-Screen	136	306219.6378	6184206.031	12.4	102	12	-1.0	101	112	GHD measurements 2021
Stockhouse	SNT-B02-VBFDR	137	306224.5064	6184197.295	15.86	99	12	-1.0	98	109	GHD measurements 2021, corrected to appropriate machine size
Stockhouse	SNT-S02-Screen	138	306224.5064	6184197.295	12.4	102	12	-1.0	101	112	GHD measurements 2021
Stockhouse	SNT-B03-VBFDR	139	306233.2419	6184202.164	15.86	99	12	-1.0	98	109	GHD measurements 2021, corrected to appropriate machine size
Stockhouse	SNT-S03-Screen	140	306233.2419	6184202.164	12.4	102	12	-1.0	101	112	GHD measurements 2021
Stockhouse	SNT-B04-VBFDR	141	306228.3734	6184210.899	15.86	99	12	-1.0	98	109	GHD measurements 2021, corrected to appropriate machine size
Stockhouse	SNT-S04-Screen	142	306228.3734	6184210.899	12.4	102	12	-1.0	101	112	GHD measurements 2021
Stockhouse	SNT-W01-VBFDR	143	306222.0738	6184201.669	3.3	99	10	-1.8	97	109	GHD measurements 2021, corrected to appropriate machine size
Stockhouse	SNT-W02-VBFDR	144	306230.8094	6184206.538	3.3	99	10	-1.8	97	109	GHD measurements 2021, corrected to appropriate machine size
Stockhouse	COK-B01-VBFDR	145	306265.9361	6184231.834	15.49	96	8	-3.0	93	106	GHD measurements 2021, corrected to appropriate machine size
Stockhouse	COK-S01-Screen	146	306265.9361	6184231.834	12.6	99	8	-3.0	96	109	GHD measurements 2021, corrected to appropriate machine size
Stockhouse	COK-B02-VBFDR	147	306270.8046	6184223.099	15.49	96	8	-3.0	93	106	GHD measurements 2021, corrected to appropriate machine size

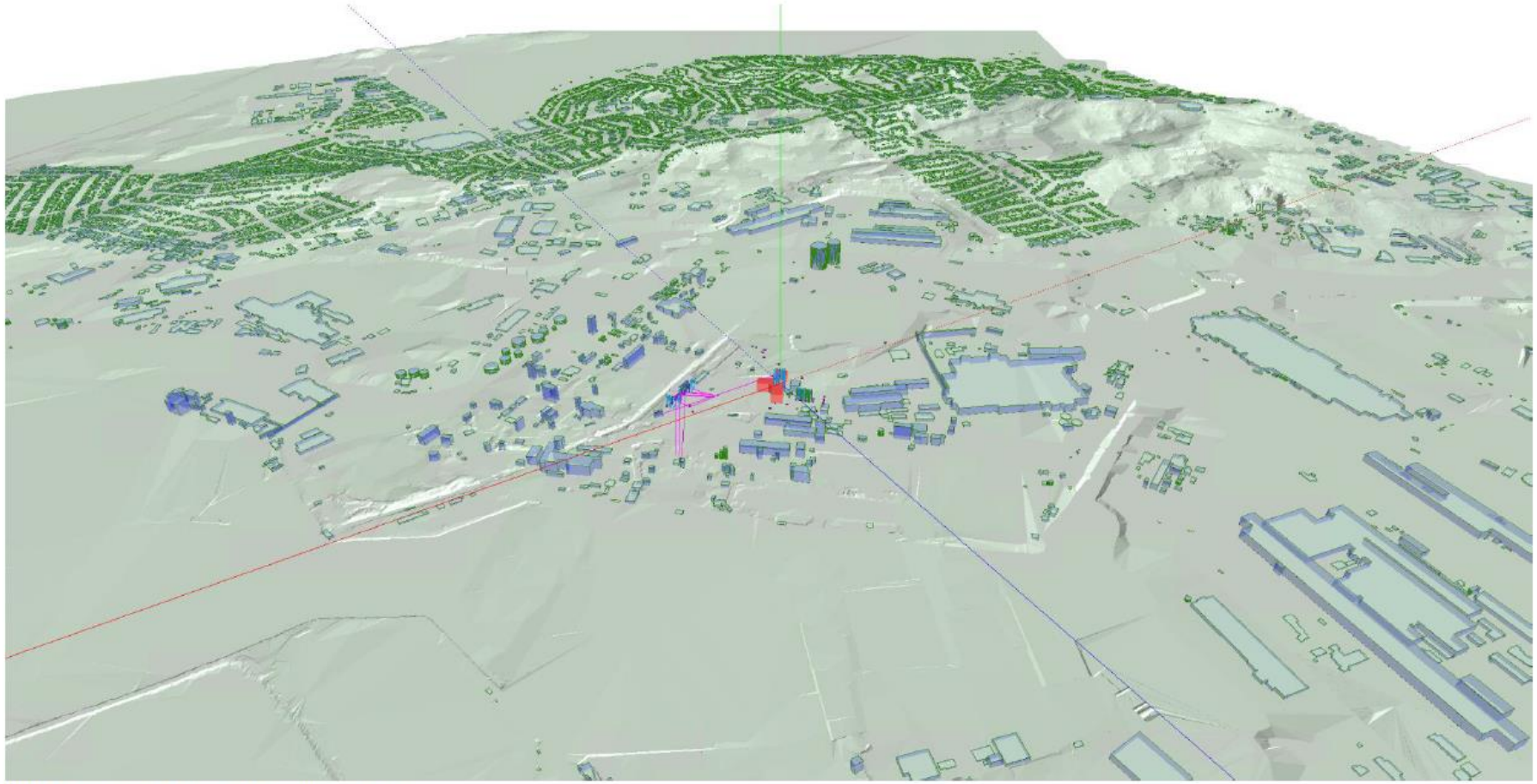
Area	Equipment name	6BF location ID	MGA Location - Easting	MGA Location - Northing	Heigh above ground, metres	LAeq1min noise level, dBA	Operating time per 15 minute period, minutes	Time correction, dB	LAeq15min noise level, dBA	LAmax noise level considered in assessment, dBA	Noise level source
Stockhouse	COK-S02-Screen	148	306270.8046	6184223.099	12.6	99	8	-3.0	96	109	GHD measurements 2021, corrected to appropriate machine size
Stockhouse	COK-B03-VBFDR	149	306279.5401	6184227.967	15.49	96	8	-3.0	93	106	GHD measurements 2021, corrected to appropriate machine size
Stockhouse	COK-S03-Screen	150	306279.5401	6184227.967	12.6	99	8	-3.0	96	109	GHD measurements 2021, corrected to appropriate machine size
Stockhouse	COK-B04-VBFDR	151	306274.6716	6184236.703	15.49	96	8	-3.0	93	106	GHD measurements 2021, corrected to appropriate machine size
Stockhouse	COK-S04-Screen	152	306274.6716	6184236.703	12.6	99	8	-3.0	96	109	GHD measurements 2021, corrected to appropriate machine size
Stockhouse	SST-H01-VBFDR	153	306175.7936	6184265.712	6	96	15	-	96	106	GHD measurements 2021, corrected to appropriate machine size
Stockhouse	SST-H02-VBFDR	154	306175.0451	6184261.833	6	96	15	-	96	106	GHD measurements 2021, corrected to appropriate machine size
Stockhouse	SST-S01-Screen	155	306176.1741	6184267.681	5	96	15	-	96	106	GHD measurements 2021, corrected to appropriate machine size
Stockhouse	SST-S02-Screen	156	306175.4253	6184263.802	5	96	15	-	96	106	GHD measurements 2021, corrected to appropriate machine size
Stockhouse	SST-BSL-VBFDR	157	306281.0359	6184244.514	13	96	15	-	96	106	GHD measurements 2021, corrected to appropriate machine size
Stockhouse	FER-B01-VBFDR	158	306236.2377	6184214.415	8.5	96	3	-7.0	89	106	GHD measurements 2021, corrected to appropriate machine size
Stockhouse	FER-W01-VBFDR	159	306236.2377	6184214.415	2.5	96	3	-7.0	89	106	GHD measurements 2021, corrected to appropriate machine size
Stockhouse	FER-B02-VBFDR	160	306242.2821	6184217.784	8.5	96	3	-7.0	89	106	GHD measurements 2021, corrected to appropriate machine size
Stockhouse	FER-W02-VBFDR	161	306242.2821	6184217.784	2.5	96	3	-7.0	89	106	GHD measurements 2021, corrected to appropriate machine size
Stockhouse	FER-B03-VBFDR	162	306248.397	6184221.192	8.5	96	3	-7.0	89	106	GHD measurements 2021, corrected to appropriate machine size
Stockhouse	FER-W03-VBFDR	163	306248.397	6184221.192	2.5	96	3	-7.0	89	106	GHD measurements 2021, corrected to appropriate machine size
Stockhouse	FER-B04-VBFDR	164	306254.4414	6184224.561	8.5	96	3	-7.0	89	106	GHD measurements 2021, corrected to appropriate machine size
Stockhouse	FER-W04-VBFDR	165	306254.4414	6184224.561	2.5	96	3	-7.0	89	106	GHD measurements 2021, corrected to appropriate machine size
Stockhouse	FLX-B01-VBFDR	166	306245.6371	6184210.574	8	96	2	-10.0	86	106	GHD measurements 2021, corrected to appropriate machine size
Stockhouse	FLX-W01-VBFDR	167	306245.6371	6184210.574	2.5	96	2	-10.0	86	106	GHD measurements 2021, corrected to appropriate machine size
Stockhouse	FLX-B02-VBFDR	168	306250.8485	6184211.493	8	96	2	-10.0	86	106	GHD measurements 2021, corrected to appropriate machine size
Stockhouse	FLX-B03-VBFDR	169	306252.9035	6184215.634	8	96	2	-10.0	86	106	GHD measurements 2021, corrected to appropriate machine size
Stockhouse	FLX-W02-VBFDR	170	306247.4025	6184215.781	2.5	96	2	-10.0	86	106	GHD measurements 2021, corrected to appropriate machine size
Stockhouse	SST-BSB-VBFDR	171	306241.0412	6184206.504	10	96	3	-7.0	89	106	GHD measurements 2021, corrected to appropriate machine size
Stockhouse	Recycles Surge Bin Vibro Feeder	172A	306241.0412	6184206.504	4	96	3	-7.0	89	106	GHD measurements 2021, corrected to appropriate machine size
Stockhouse	Recycles Surge Bin Weigh Feeder	172B	306241.0412	6184206.504	3	96	3	-7.0	89	106	GHD measurements 2021, corrected to appropriate machine size
Stockhouse	SST-WHP-VBFDR	173	306285.2802	6184236.891	2.5	99	8	-3.0	96	109	GHD measurements 2021, corrected to appropriate machine size
Stockhouse	SCK-WHP-VBFDR	174	306289.7419	6184239.51	2.5	96	8	-3.0	93	106	GHD measurements 2021, corrected to appropriate machine size
Stockhouse	SCK-S01-Screen	175	306176.6695	6184283.436	5	96	15	-	96	106	GHD measurements 2021, corrected to appropriate machine size
Stockhouse	SCK-S02-Screen	176	306175.8824	6184279.36	5	96	15	-	96	106	GHD measurements 2021, corrected to appropriate machine size
Stockhouse	SCK-HSG-VBFDR	177	306257.2295	6184277.857	5.7	96	8	-3.0	93	106	GHD measurements 2021, corrected to appropriate machine size
Stockhouse	SCK-BSL-VBFDR	178	306295.4017	6184252.521	10	96	10	-1.8	94	106	GHD measurements 2021, corrected to appropriate machine size
Stockhouse	SCK-BNT-VBFDR	179	306258.5379	6184217.407	10	96	8	-3.0	93	106	GHD measurements 2021, corrected to appropriate machine size
Hydraulic Rooms	Furnace Hydraulics Room	60	306034.2151	6184431.332	0	81	15	-	81	-	SWL_Hatch (Table 6.2)
TRT	Turbine and Alternator	70	306040.1894	6184412.92	8	-	-	-	-	-	Not contributing to noise emission
TRT	Hydraulics and Lubrication	71	306036.2896	6184421.566	1.2	-	-	-	-	-	Not contributing to noise emission
Bag Houses	61 Stockhouse Fan	180	306342.3264	6184254.723	2	104	15	-	104	-	SWL_Hatch (Table 6.2)
Bag Houses	Baghouse blowers	181	306334.2816	6184251.287	1	101	8	-3.0	98	-	GHD measurements 2021
Bag Houses	61 Casthouse Fan	61	305939.2652	6184333.935	2	98	15	-	98	-	SWL_Bluescope (Table 6.3)
Bag Houses	62 Casthouse Fan	62	305935.6928	6184325.456	2	100	15	-	100	-	SWL_Bluescope (Table 6.3)
Bag Houses	Baghouse Blowers * 2	63	305948.028	6184323.33	1	101	8	-3.0	98	-	GHD measurements 2021
Granulator	61 Slag Gran Cooling Tower Fan	80	305976.372	6184139.92	14	88	15	-	88	-	SWL_Hatch (Table 6.2)
Granulator	62 Slag Gran Cooling Tower Fan	81	305983.0758	6184128.781	14	98	15	-	98	-	SWL_Hatch (Table 6.2)
Granulator	61 Granulation Pump	82	305964.4485	6184156.29	1.7	91	8	-3.0	88	-	SWL_Hatch (Table 6.2)
Granulator	62 Granulation Pump	83	305966.5592	6184152.639	1.7	93	8	-3.0	90	-	SWL_Hatch (Table 6.2)
Granulator	61 Condensation Pump	84	305953.5106	6184149.97	1.7	91	8	-3.0	88	-	SWL_Hatch (Table 6.2)
Granulator	62 Condensation Pump	85	305955.6203	6184146.318	1.7	91	8	-3.0	88	-	SWL_Hatch (Table 6.2)
Granulator	61 Cooling Circuit Pump	86	305974.4825	6184179.348	0.5	91	8	-3.0	88	-	SWL_Hatch (Table 6.2)
Granulator	62 Cooling Circuit Pump	87	305976.9181	6184178.034	0.5	91	8	-3.0	88	-	SWL_Hatch (Table 6.2)
Slag Handling	Spray Pumps	88	306063.9964	6184182.741	0.5	91	15	-	91	-	SWL_Hatch (Table 6.2)
Slag Handling	Sump Pumps	89	305875.1914	6184181.41	0.5	91	15	-	91	-	SWL_Hatch (Table 6.2)
Slag Handling	Truck Wash	90	305732.812	6184303.688	0	-	-	-	-	-	Not contributing to noise emission
Slag Handling	Knocking Block	91	305981.62	6184251.77	2	110	15	-	110	120	GHD database



Noise model – plan view



Noise model – 3D view close



Noise model – 3D view far

Appendix D

Full operational noise results

Receiver ID	Operational noise level LAeq(15min), dBA	Receiver Type	Operational noise criteria (NPfI discrete process assessment) Laeq(15min), dBA	Compliance?
ARR1	22	Active recreation	65	Yes
ARR2	20	Active recreation	65	Yes
ARR3	25	Active recreation	65	Yes
ARR4	32	Active recreation	65	Yes
ARR5	23	Active recreation	65	Yes
EDU1	18	Educational institute	55	Yes
EDU2	36	Educational institute	55	Yes
EDU3	28	Educational institute	55	Yes
EDU4	27	Educational institute	55	Yes
POW1	27	Place of worship	55	Yes
POW2	33	Place of worship	55	Yes
PRR1	20	Passive recreation	60	Yes
PRR2	28	Passive recreation	60	Yes
RES1	33	Residential - NCA04	38	Yes
RES2	34	Residential - NCA03	41	Yes
RES3	33	Residential - NCA03	41	Yes
RES4	22	Residential - NCA01	31	Yes
RES5	33	Residential - NCA04	38	Yes
RES6	35	Residential - NCA04	38	Yes
RES7	33	Residential - NCA04	38	Yes
RES8	38	Residential - NCA03	41	Yes
RES9	32	Residential - NCA04	38	Yes
RES10	33	Residential - NCA03	41	Yes
RES11	35	Residential - NCA04	38	Yes
RES12	34	Residential - NCA03	41	Yes
RES13	24	Residential - NCA02	31	Yes
RES14	33	Residential - NCA04	38	Yes
RES15	30	Residential - NCA04	38	Yes
RES16	35	Residential - NCA04	38	Yes
RES17	27	Residential - NCA02	31	Yes
RES18	35	Residential - NCA03	41	Yes
RES19	29	Residential - NCA03	41	Yes
RES20	31	Residential - NCA03	41	Yes
RES21	34	Residential - NCA04	38	Yes
RES22	31	Residential - NCA04	38	Yes
RES23	35	Residential - NCA03	41	Yes
RES24	39	Residential - NCA03	41	Yes
RES25	34	Residential - NCA03	41	Yes
RES26	34	Residential - NCA03	41	Yes
RES27	34	Residential - NCA03	41	Yes
RES28	38	Residential - NCA03	41	Yes
RES29	39	Residential - NCA03	41	Yes
RES30	27	Residential - NCA02	31	Yes
RES31	25	Residential - NCA02	31	Yes
RES32	24	Residential - NCA02	31	Yes
RES33	28	Residential - NCA02	31	Yes
RES34	27	Residential - NCA02	31	Yes
RES35	28	Residential - NCA02	31	Yes
RES36	20	Residential - NCA01	31	Yes
RES37	19	Residential - NCA01	31	Yes
RES38	26	Residential - NCA01	31	Yes
RES39	23	Residential - NCA01	31	Yes
RES40	23	Residential - NCA01	31	Yes
RES41	21	Residential - NCA01	31	Yes

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