Appendix E

Air quality impact assessment

Blast Furnace No. 6 Reline Project

Air Quality Impact Assessment

BlueScope Steel (AIS) Pty Ltd

7 March 2022

→ **The Power of Commitment**

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Executive summary

GHD has conducted an air quality impact assessment to assess the construction, commissioning and operation of the No. 6 Blast Furnace at the Port Kembla Steelworks. The assessment was undertaken in accordance with relevant legislation and government guidance.

A qualitative based approach was adopted to assess the construction and commissioning of the project. The construction assessment identified a low risk of potential air quality impacts as there will be a large separation distance between construction activities and sensitive receptors, and emissions to air during construction are expected to be relatively minor.

The commissioning assessment concluded that there is potential for elevated emission of combustion products including carbon monoxide, carbon dioxide, and particulates to occur for a relatively short period of time during commissioning. As the commissioning procedure aligns with the industry standard approach and adopts best practice methods where possible, emissions during commissioning are considered to be minimised as far as reasonably practicable. Due to the relatively short duration of commissioning and implementation of industry standard and best practice methods, although the potential impact for any elevated emissions to air cannot be quantified, the commissioning process is considered to pose a low risk of potential adverse air quality impacts to surrounding receptors.

The quantitative operational air quality assessment consisted of three parts, an emission limit assessment, an air quality impact assessment and a best practice assessment.

The emission limit assessment identified that all No. 6 Blast Furnace air quality emission sources assessable to the standard of concentration limits will comply with the standard of concentration limits stipulated in the POEO Clean Air Regulation.

The air quality impact assessment used air quality dispersion modelling to predict incremental and cumulative pollutant concentrations from the existing and proposed future operating scenarios. The findings of the dispersion modelling are summarised below:

– Existing scenario (operation of 5BF and PKSW) findings:
  - A minor cumulative exceedance of the 24 hour PM_{10} criteria was predicted for one 24 hour period in the modelled year at R05. This exceedance was primarily attributed to elevated background concentrations which accounted for 93% of the criteria while existing scenario incremental concentrations accounted for 7% of the criteria.
  - Compliance was predicted for 1 hour and annual NO_2 concentrations against both EPA and NEPM assessment criterions at sensitive receptor locations.
  - Compliance was predicted for 1 hour and 24 hour SO_2 concentrations against the EPA assessment criteria at sensitive receptor locations.
  - An incremental exceedance of the 1 hour SO_2 NEPM criteria was predicted at R06 and cumulative exceedances were predicted at R05 and R06. These exceedances of the NEPM criteria require interpretation in the context that the 1 hour SO_2 standard was reduced in a recent revision (May 2021) of the Air NEPM.
  - Exceedance of the 1 second H_2S criteria was predicted at R05 and R06. Compliance was predicted for the 1 hour H_2S criteria at all sensitive receptors.

– Future scenario (operation of 6BF and PKSW) findings:
  - Minor cumulative exceedance of the 24 hour PM_{10} criteria were predicted at R03 and R05 for one day of the year only. These exceedances were primarily attributed to elevated background concentrations which accounted for 91% and 93% of the criteria, while future scenario incremental concentrations accounted for 9% and 7% of the criteria for receptors R03 and R05 respectively. 6BF sources account for approximately 1% and 3%of the maximum cumulative 24 hour PM_{10} contribution at R03 and R05 respectively.
  - Compliance was predicted for 1 hour and annual NO_2 concentrations against both EPA and NEPM assessment criterions at sensitive receptor locations.

- Compliance was predicted for 1 hour and 24 hour SO_2 concentrations against the EPA assessment criteria at sensitive receptor locations.
- An incremental and cumulative exceedance of the 1 hour SO_2 NEPM criteria was predicted at R06. This exceedance of the NEPM criteria requires interpretation in the context that the 1 hour SO_2 standard was reduced in a recent revision (May 2021) of the Air NEPM. These exceedances are attributed mostly to existing sources on the PKSW site and predicted concentrations comply with the existing NSW EPA criteria. 6BF sources account for approximately 21% of the maximum cumulative 1 hour SO_2 contribution at R06.
- An exceedance of the 1 second H_2S criteria was predicted at R06 only. Compliance was predicted for the 1 hour H_2S criteria at all sensitive receptors. The predicted incremental H_2S concentration from 6BF only, shows that it contributes about one third of total H_2S emissions at the receptor locations (contributions range from 28% to 33% depending on receptor). Given that modelled emissions from 6BF are conservative, the project is unlikely to lead to offsite odour impacts and is predicted to reduce odour impacts at the sensitive receptor locations compared to the existing scenario. 6BF sources account for approximately 28% of the maximum 1 second H_2S contribution at R06.

Comparatively, the future scenario was predicted to result in a reduction of all pollutant concentrations (NO_2, SO_2 and H_2S) except for particulate matter, in relation to which a minor increase was predicted due to assumptions in the assessment. The project includes a number of measures anticipated to reduce particulates compared to the existing scenario.

The best practice assessment benchmarked proposed No. 6 Blast Furnace emissions control measures against European Union Best Available Techniques. The best practice assessment concluded that the project conforms with best available techniques and for each BAT requirement offers a beneficial or at least neutral impact compared with existing No. 5 Blast Furnace operations.

From an air quality perspective, the project is generally considered an improvement (reduction in pollutant concentrations) compared with existing operations.

This report is subject to, and must be read in conjunction with, the limitations set out in Section 1.3 and the assumptions and qualifications contained throughout the Report.

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Terms and abbreviations

Term/acronym	Definition
$\mu g/m^3$	Micrograms per cubic metre
5BF	No. 5 Blast Furnace
6BF	No. 6 Blast Furnace
AMO	Aeronautical Meteorological Office
AQIA	Air Quality Impact Assessment
AQMS	Air Quality Monitoring Station
Background concentrations	Ambient pollutant concentrations
BFG	Blast Furnace Gas
BlueScope	BlueScope Steel (AIS) Pty Ltd
BoM	Bureau of Meteorology
CALMET	CALMET is a meteorological model which includes a diagnostic wind find generator containing objective analysis and parameterised treatments of slope flows, kinematic terrain effects, terrain blocking effects, a divergence minimisation procedure, and a micro-meteorological model for overland and overwater boundary layers.
CALPUFF	CALPUFF is a non-steady-state Lagrangian Gaussian puff model which contains modules for complex terrain effects, overwater transport, coastal interaction effects, building downwash, wet and dry removal, and simple chemical transformation.
CO	Carbon Monoxide
CO_2	Carbon Dioxide
Cumulative impact	Incremental impact plus background
DPIE	Department of Planning, Industry and Environment
EPA	NSW Environment Protection Authority
GHD	GHD Pty Ltd
H_2S	Hydrogen Sulfide
Incremental impact	Predicted impact from the PKSW site (includes 5BF and PKSW sources for existing scenario and includes 6BF and PKSW sources for future scenario).
NO_2	Nitrogen Dioxide
NOx	Oxides of Nitrogen - a mixture of nitric oxide and nitrogen dioxide
Pasquill-Gifford	Stability classification used in atmospheric dispersion models to define the turbulent state of the atmosphere
peak-to-mean ratio	A conversion factor that adjusts mean dispersion-model predictions to the peak concentrations perceived by the human nose
PKSW	Port Kembla Steel Works
PM_{10}	Particulate matter with an equivalent aerodynamic diameter of 10 micrometres or less
$PM_{2.5}$	Particulate matter with an equivalent aerodynamic diameter of 2.5 micrometres or less
POEO Act	Protection of the Environment Operations Act 1997
SEARs	Requirements and specifications for an environmental assessment prepared by the Secretary of the Department of Planning, Industry and Environment
Sensitive receptor	A location where people are likely to work or reside; this may include a residential dwelling, school, hospital, office or public recreational area. An odour assessment should also consider the location of known or likely future receptors.
SO_2	Sulphur Dioxide

Term/acronym	Definition
SS projects	State Significant projects
TAPM	TAPM is an air pollution model that predicts three-dimensional meteorology and air pollution concentrations.
TSP	Total Suspended Particulates
UTM	Universal Transverse Mercator coordinate system
WRF	Weather Research and Forecast model is a next-generation mesoscale numerical weather prediction system designed for both atmospheric research and operational forecasting applications

1. Introduction

1.1 Background and project overview

BlueScope Steel (AIS) Pty Ltd (BlueScope) is one of Australia's leading manufacturers and with its parent company, BlueScope Steel Limited, 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 manufacture 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. 5BF will be decommissioned prior to operation of 6BF commencing such that there will be no concurrent ironmaking from both 5BF and 6BF.

The project enables critical steelmaking operations to continue whilst BlueScope evaluates innovative "green steel" technologies that are starting to be piloted globally but will not be commercialised at scale in time to maintain production once the current campaign of the 5BF concludes. 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).

This air quality 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 project approval and addresses the environmental assessment requirements of the Secretary's Environmental Assessment Requirements (SEARs) pertaining to air quality.

1.2 Purpose of this report

GHD Pty Ltd (GHD) has been commissioned by BlueScope to prepare an Air Quality Impact Assessment (AQIA). This report will support the preparation of an Environmental Impact Statement (EIS) under the EP&A Act for the project.

This report addresses the relevant criteria in the NSW Secretary's Environmental Assessment Requirements (SEARs) for the project issued in July 2021 (as outlined in Section2.2) and assesses the potential air quality related impacts associated with construction and operation of the project.

The purpose of this report is to document the results of the AQIA which included:

– Review of project information related to sources of emissions to air. This includes construction methodology, operation of the project and emission controls, process drawings and flow and emission rates.
– Definition of the existing environment at the project site, including identification of air quality sensitive receptors, and completing a review of available ambient air quality monitoring data for the previous 5 years.
– Preparation of a site-representative meteorological data set based on review of site-based weather station, and local Bureau of Meteorology data. Meteorological modelling was completed using the Weather Research and Forecast model (WRF) and CALMET models.
– Air dispersion modelling using the CALPUFF model for existing and future scenarios to quantitatively predict the change in ground level pollutant concentrations for comparison against the EPA criteria.
– Conducting a Best Available Techniques Assessment (BAT) for the proposed design and operation of the relined blast furnace and associated infrastructure.

– Discussion of the findings of dispersion modelling and an overview of proposed mitigation measures and controls associated with the project.
– A qualitative construction air quality assessment of potentially emission generating construction activities and providing management measures to minimise potential air quality impacts at sensitive receptors during project construction activities.

1.3 Limitations

The preparation of this AQIA relied on the following assumptions or was limited by the following:

– Project description including details of the construction, commissioning and operation of the project were provided by BlueScope.
– An emissions inventory for the existing and proposed operation of the project was provided by BlueScope.
– Meteorological and dispersion modelling was undertaken in accordance with the methodology outlined in Section 3.3.
– Cumulative impacts with the Port Kembla Gas Terminal project including ship and Floating Storage and Regasification Unit (FSRU) configuration (including fuel type) has been assumed based on best available information however is subject to change. GHD has assumed a moderate worst case of FSRU using gas and a LNG carrier running on marine diesel oil. Some LNG carriers may run on gas which has lower emissions and the FSRU can run on marine diesel oil for up to 72 hours per year only.

This report has been prepared by GHD for BlueScope Steel (AIS) Pty Ltd and may only be used and relied on by BlueScope Steel (AIS) Pty Ltd for the purpose agreed between GHD and BlueScope Steel (AIS) Pty Ltd as set out in Section 1.2 of this report.

GHD otherwise disclaims responsibility to any person other than BlueScope Steel (AIS) 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.

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 (including the presence of air emissions) 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.

GHD has prepared this report on the basis of information provided by BlueScope Steel (AIS) 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.

2. Legislative and policy context

2.1 Secretary's Environmental Assessment Requirements

The SEARs relevant to air quality, together with a reference to where they are addressed in this report, are outlined in Table 2.1.

Table 2.1 Air quality SEARs

Requirement	Where address in report
Planning Secretary's Environmental Assessment Requirements (SEARs) (SSI-22545215)	
Air quality and odour – including:	
– a quantitative assessment of the potential air quality, dust and odour impacts of construction, commissioning and operation, in accordance with relevant Environment Protection Authority guidelines	This report
– cumulative assessment of air quality emissions from operation of the site as a whole and comparison with background data and impact assessment criteria	Section 9
– details of all air quality and odour control equipment, benchmarked against best practice, and monitoring for all discharge points and fugitive emissions	Section 10
– an assessment of the greenhouse gas emissions of the project and any measures to minimise emissions intensity, improve energy efficiency and adopt new technologies to reduce emissions in the medium to long term	Refer GHG chapter of the EIS
– details of proposed mitigation, management and monitoring measures.	Section 11

2.2 Legislative and policy context to the AQIA

The relevant legislation and government guidance for the air quality assessment of the project are:

- NSW *Protection of the Environment Operations Act 1997* (POEO Act)
- NSW Protection of the Environment Operations (Clean Air) Regulation 2021 (POEO Clean Air Regulation)
- National Environment Protection Council (NEPC) National Environment Protection (Ambient Air Quality) Measure 2021 (the Air NEPM)
- Approved Methods for the Sampling and Analysis of Air Pollutants in New South Wales (DEC, 2007)
- Technical framework - Assessment and management of odour from stationary sources in NSW (the Technical Framework), NSW Department of Environment and Conservation (DECC 2006)
- NSW EPA Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales (2017) (the Approved Methods)
- Guidance on the assessment of dust from demolition and construction, Institute of Air Quality Management (2016) (IAQM guidance)

The POEO Act provides the statutory framework for managing pollution in NSW, including the procedures for issuing licences for environmental protection on aspects such as waste, air, water and noise pollution control. The POEO Act requires that no occupier of any premises causes air pollution (including odour) through a failure to maintain or operate equipment or deal with materials in a proper and efficient manner. For point source emissions where no standard of concentration and/or rate has been set, and for non-point source emissions, the operator must also take all practicable means to minimise and prevent air pollution (sections 124, 125, 126 and 128 of the POEO Act). The POEO Act includes the concept of 'offensive odour' (section 129) and states it is an offence for scheduled activities to emit 'offensive odour', subject to limited defences.

The POEO Clean Air Regulation provides regulatory measures to control emissions from motor vehicles, fuels, and industry.

The National Environment Protection Council of Environmental Ministers, now the National Environment Protection Council (NEPC), set uniform national standards for ambient air quality in February 2016. The document containing these standards is known as the Air NEPM, which also contains goals for the identified relevant pollutants inclusive of particulates and concentration limits, averaging periods and number of allowed exceedances for each of the identified pollutants.

The Approved Methods for the Sampling and Analysis of Air Pollutants in New South Wales (DEC, 2007) lists the methods to be used for the sampling and analysis of air pollutants in NSW for statutory purposes. While no emission sampling was conducted as part of this assessment, BlueScope has a responsibility to undertake, where possible, all sampling in accordance with requirements outlined in the Approved Methods for the Sampling and Analysis of Air Pollutants in New South Wales (DEC, 2007). This includes sampling type, duration, location and a number of other requirements.

The Technical Framework provides a legislative context for the control of odour and presents odour assessment criteria guidelines. It provides a framework for different levels of odour assessment, strategies to mitigate odour, and guidance for performance monitoring, regulation and enforcement.

The Approved Methods lists the statutory methods for modelling and assessing emissions of air pollutants from stationary sources in NSW. It considers the above-mentioned legislation and guidance to provide pollutant assessment criteria.

The IAQM guidance provides guidance on the assessment of dust from demolition and construction activities. It provides a qualitative step by step process to assess the risk of dust impacts.

2.3 Emission limits

2.3.1 POEO Clean Air Regulation

The POEO Clean Air Regulation outlines air quality standards of concentration that apply to general and specific activities and plant for both scheduled and non-scheduled premises. Standards of concentration relevant to the project have been reproduced in Table 2.2 and were sourced from the Iron and steel: primary production (Group 6) category. Emissions to air from relevant project operations must comply with these emission limits.

Table 2.2 Relevant standards of concentration

Air impurity	Plant	Standard of concentration (Dry, 273 K, 101.3 kPa)
Iron and steel: primary production (group 6)		
Solid particles (Total)	Any fuel burning equipment Any sinter plant Any kiln Any power-generating plant Any furnace	50 mg/m^3
	Any crushing, grinding, separating or materials handling activity	20 mg/m^3
Nitrogen dioxide (NO_2) or nitric oxide (NO) or both, as NO_2 equivalent	Any fuel burning equipment Any sinter plant Any kiln Any power-generating plant Any furnace	500 mg/m^3

Air impurity	Plant	Standard of concentration (Dry, 273 K, 101.3 kPa)
Hydrogen sulfide (H_2S)	Any fuel burning equipment Any sinter plant Any kiln Any power-generating plant Any furnace Any reduction control system not followed by combustion	5 mg/m^3
Volatile organic compounds (VOCs), as n-propane equivalent	Any activity or plant using a non-standard fuel	40 mg/m^3 VOCs or 125 mg/m^3 CO
Type 1 substances and Type 2 substances (in aggregate)	Any activity or plant	1 mg/m^3
Cadmium (Cd) or mercury (Hg) individually	Any activity or plant	0.2 mg/m^3
Dioxins or furans	Any sinter plant	0.1 ng/m^3
Smoke	Any fuel burning equipment Any sinter plant Any kiln Any power-generating plant Any furnace	Ringelmann 1 or 20% opacity

2.3.2 Environmental Protection Licence conditions

The PKSW site operates under NSW EPA issued Environmental Protection Licence (EPL) number 6092, which establishes conditions and discharge limits that the site must operate in accordance with. The EPL conditions relevant to the project and air quality have been identified below.

Under special condition E1 (Approval for Alternative Standard of Concentration for Hydrogen Sulphide Emissions) of EPL6092, the EPA authorises use of an alternative standard of concentration for H_2S from the processes carried out at the 5BF slag granulators. The limit conditions stipulated in condition E1.2 are reproduced in Table 2.3.

Table 2.3 EPL limit conditions

Discharge Point	Pollutant	Unit of Measure	100% Limit	Averaging Period
Discharge Point 10, No.5 Blast Furnace, No.2 Slag Granulator	H_2S	g/s	1.2	Block average (Minimum of 15 minutes)
Discharge Point 11, No.5 Blast Furnace, No.1 Slag Granulator	H_2S	g/s	1.2	Block average (Minimum of 15 minutes)
Discharge Point 129, No.5 Blast Furnace, No.3 Slag Granulator	H_2S	g/s	1.2	Block average (Minimum of 15 minutes)

As part of the project and proposed future operations of PKSW, H_2S emissions will no longer be released from slag granulator stacks however, some H_2S emissions may be released via the 6BF slag granulation cooling tower. For this assessment, a conservative approach to modelling of the 6BF slag granulation cooling tower emissions was used, applying the current emissions from the 5BF slag granulator stack. This is anticipated to be an overestimation of future emissions.

2.4 Air quality impact assessment

Assessment criteria for the project was predominantly taken from the NSW EPA's Approved Methods, with the exception of NO_2 and SO_2 which were sourced from the Air NEPM air quality objectives as they represent the most recent and stringent standards for protection of the air quality environment. The outcome of the criteria is ambient air quality that minimises the risk of adverse health impacts from exposure to air pollution. Achieving compliance with the impact assessment criteria will help demonstrate the project will operate in a manner that protects human and environmental health.

An alternative 1 hour H_2S criteria was sourced from the California Ambient Air Quality Standards for comparative purposes. This additional hourly H_2S criteria has been included based on an earlier review at the site by Environ (2012) which concluded that the Californian EPA 1 hour average (public welfare) criterion of 42 ug/m^3 should be considered for adoption for the assessment of cumulative impacts due to other H_2S sources in the region including PKSW. Environ states that given the uncertainty in short-term measured and modelled concentrations, the longer 1 hour averaging period is considered to provide a more robust basis for a criterion. It is noted that this approach was previously submitted to and accepted by the NSW EPA. GHD therefore has included both the short-term NSW H_2S criteria for odour nuisance and the hourly criterion for health impacts.

The adopted air quality assessment criteria are summarised in Table 2.4.

The application of each impact assessment criteria is variable for each pollutant based on the following factors:

– **Averaging period** – the period over which modelled concentrations are averaged.
– **Statistic** – the statistic of the modelled concentrations. As an example for a 1-hour averaging period, the 'maximum statistic' would be the highest predicted value at any receptor for the entire modelling period. The 99.9th percentile statistic would be (approximately) the ninth highest hour in a one year modelling period.
– **Impact location** – the location at which the impacts are to be assessed. For some pollutants, impacts are assessable only at sensitive receptor locations, while some impacts are assessable at and beyond the boundary of the site. The criteria apply at ground level where receptors are likely to be exposed.
– **Impact type** – the type of impact assessed. For some pollutants, the impacts are assessable only for the project's and PKSW contribution to pollutant concentrations at the relevant impact location (referred to as 'incremental impacts'). For other pollutants, the cumulative impact (which includes both the incremental concentration as well as the background concentration) is assessed.

Table 2.4 Air quality impact assessment criteria

Pollutant	Averaging period	Statistic	Impact location	Impact type	Criteria (µg/m^3)	
					EPA Assessment Criteria	Air NEPM
Airborne particulate matter and common gaseous pollutants						
TSP	Annual	Maximum	Sensitive receptor	Cumulative	90	-
PM_{10}	24 hour	Maximum	Sensitive receptor	Cumulative	50	50
	Annual	Maximum	Sensitive receptor	Cumulative	25	25
NO_2	1 hour	Maximum	Sensitive receptor	Cumulative	246	164
	Annual	Maximum	Sensitive receptor	Cumulative	62	31
SO_2	1 hour	Maximum	Sensitive receptor	Cumulative	570	286 (planned to be reduced to 215 in 2025)
	24 hour	Maximum	Sensitive receptor	Cumulative	228	57

Pollutant	Averaging period	Statistic	Impact location	Impact type	Criteria (µg/m³)	
					EPA Assessment Criteria	Air NEPM
Principal air toxics						
Benzene	1 hour	99.9th percentile	At or beyond site boundary	Incremental	29	-
Dioxins and furans	1 hour	99.9th percentile	At or beyond site boundary	Incremental	2.00E-06	-
Individual air toxics						
Ammonia	1 hour	99.9th percentile	At or beyond site boundary	Incremental	330	-
Benzo[a]pyrene equivalent	1 hour	99.9th percentile	At or beyond site boundary	Incremental	0.4	-
Chlorine	1 hour	99.9th percentile	At or beyond site boundary	Incremental	50	-
Cyanide (as CN)	1 hour	99.9th percentile	At or beyond site boundary	Incremental	90	-
Ethyl-benzene	1 hour	99.9th percentile	At or beyond site boundary	Incremental	8000	-
Odorous air pollutants						
H_2S	1 second	99.9th percentile	Sensitive receptor	Incremental	1.38	-
	1 hour	Maximum	Sensitive receptor	Cumulative	42	-
Phenol	1 hour	99.9th percentile	Sensitive receptor	Incremental	20	-
Styrene	1 hour	99.9th percentile	Sensitive receptor	Incremental	120	-
Toluene	1 hour	99.9th percentile	Sensitive receptor	Incremental	360	-
Xylene	1 hour	99.9th percentile	Sensitive receptor	Incremental	190	-

3. Methodology

3.1 General

This AQIA of the construction, commissioning and operation of the project was completed in accordance with EPA and contemporary guidance to assess air quality impacts from the project. Atmospheric dispersion modelling was undertaken to evaluate the potential worst-case impacts from the project under routine operations and inform recommendations of appropriate mitigation measures to minimise any potential impacts.

3.2 Approach

3.2.1 Air quality species of interest

The air pollutants examined in this report include:

– Airborne particulate matter (‘particulates’), including Total Suspended Particulates (TSP) and particulate matter with diameter smaller than 10 microns (PM_{10})
– Common gaseous pollutants including nitrogen dioxide (NO_2) and sulphur dioxide (SO_2)
– Odour in the form of hydrogen sulphide (H_2S)

PKSW emits air toxics including ammonia, benzene, benzo[a]pyrene, chlorine, cyanide (as CN), dioxins and furans, ethyl-benzene, polycyclic aromatic hydrocarbon (as benzo[a]pyrene equivalent) and xylene, however the blast furnaces are not a significant source of these emissions. These pollutants have therefore not been included in the assessment of 6BF as the project will not contribute to cumulative emissions.

While the PKSW site will emit fine particulates ($PM_{2.5}$), the project is replacing the operation of 5BF with the newer 6BF, and therefore $PM_{2.5}$ emissions are not likely to increase due to the project. Ambient air quality including $PM_{2.5}$ concentrations are discussed in Section 5.4. A review of the last five years of data shows annual average $PM_{2.5}$ levels below the ambient air quality goal of 8 µg/m^3 at the three nearest DPIE sites (Kembla Grange, Albion Park South and Wollongong) for all years except 2019 which was heavily influenced by bushfires.

Improvements on current operations proposed as part of the project, such as the operation of a secondary dedusting hood to capture emissions at tapholes, are expected to result in a reduction of particulate emissions from the cast house which would otherwise be anticipated to be one of the primary sources of fine particulates. It is noted that $PM_{2.5}$ is not identified as a substance likely to trigger NPI reporting thresholds in the *National Pollutant Inventory Emission Estimation Technique Manual for Iron and Steel Production (1999)*. $PM_{2.5}$ from the project and has therefore not been included in the emission inventory or dispersion modelling.

3.2.2 Construction and commissioning assessment methodology

Construction assessment

Based on a review of the proposed construction methodology, agency requirements, and identification of emissions to air that could occur during construction, a qualitative-based approach that focused on management was adopted to assess the construction of the project. A risk-based approach in accordance with IAQM guidance was adopted to assess potential particulate impacts during the construction of the project.

Commissioning assessment

Emissions to air during commissioning will occur for a relatively short period of time at the beginning of the project’s operational phase. Where possible, engineering controls will be used to reduce any emissions during this period. No air emissions sampling data from commissioning was available at the time of this assessment and therefore emissions to air during commissioning cannot be accurately quantified. On this basis, a qualitative approach that focused on management was adopted to assess the commissioning of the project.

3.2.3 Operation assessment methodology

The quantitative assessment of the operation of the project comprised of three parts:

- Air quality impact assessment
- Emission limit assessment
- Best practice assessment

3.2.3.1 Air quality impact assessment

A quantitative air quality assessment utilising air quality dispersion modelling was undertaken to assess potential worst case air quality impacts from operation of the project in accordance the Approved Methods. The modelling methodology adopted for this assessment is outlined in Section 3.3.

Air quality dispersion modelling was undertaken for two scenarios:

- **Existing operations (Existing)** – includes operation of 5BF, sources associated with operation of 5BF, and general site operations and does not include sources associated with the operation of 6BF. The existing scenario was included to provide a 'baseline' that allows a comparative assessment of the project against existing PKSW operations.
- **Future operations (Future)** – includes operation of 6BF, sources associated with operation of 6BF, and general site operations and does not include sources associated with the operation of 5BF.

Potential cumulative air quality impacts with existing industry and facilities in the area were accounted for by including background air quality data recorded from Department of Planning, Industry and Environment (DPIE) Air Quality Monitoring Stations (AQMS). It is noted that monitoring data at these AQMS include emissions from the existing PKSW operations. Using these as a baseline will at times double up the predicted cumulative emissions, and it is a complex process to determine the ambient air quality without PKSW in operation. To be conservative, and unless stated later in this report, GHD has added the ambient air quality data to predicted concentrations from PKSW to predict a total cumulative level for comparison with criteria.

Potential cumulative air quality impacts with proposed and approved major projects in the area were reviewed on a case by case basis and potential cumulative impacts were incorporated where considered appropriate.

3.2.3.2 Emission limit assessment

An assessment of air emission concentrations against the relevant air emission limits was carried out for the operation of the project. Emission limits which are considered relevant to assessment of the project were sourced from the POEO Clean Air Regulation.

The findings of the emission limit assessment are summarised in Section 7.

3.2.3.3 Best practice assessment

The best practice assessment was carried out with consideration of the European Union Best Available Techniques (BAT) Reference Document (BREF) for Iron and Steel Production Industrial Emissions Directive 2010/75/EU (Integrated Pollution Prevention and Control).

The best practice assessment benchmarked the proposed operations for the project against industry best practices. The findings of the best practice assessment are summarised in Section 10.

3.3 Modelling methodology

3.3.1 Dispersion model selection

A review of the surrounding terrain, air quality emission sources and distance to nearby receptors was undertaken to inform the choice of dispersion model used for this assessment.

Given the site's location which may be subject to coastal fumigation events, and the scale of the site where non-steady state wind fields will likely be occurring (i.e. the 10 m high weather station is not likely representative at all areas of the model domain, including heights) GHD found CALPUFF to be the most appropriate dispersion modelling software to use for the project.

CALPUFF is an advanced non-steady-state, Gaussian puff dispersion model that uses a three dimensions spatially varying wind field that is capable of accounting for complex terrain features and varying wind fields.

3.3.2 Emission inventory development

A detailed air emissions inventory for the site was provided by BlueScope. It is understood that the emissions inventory was developed based on sampling data where available and Load Base Licencing approved emission factors or National Pollutant Inventory emissions estimation techniques where sampling data was not available. Emissions data used in the assessment represents the site operating under typical operating conditions.

Emissions used for 6BF operation are based on historical sampling data.

H_2S emissions applied to the 6BF slag granulation cooling tower are based on emissions measured at the 5BF slag granulatior stacks and are expected to be an over-estimation of actual future emissions.

It is considered likely that upgrades to the stoves will result in an improvement (reduction) of emissions to air. The improvements cannot be quantified until the project is operational and sampling can be undertaken. As such, historical data from 6BF was used and is expected to be conservative.

A review of historical sampling data of 6BF sources was undertaken for Type 1 and 2 substances, mercury and cadmium. Measured concentrations were very low and were found to represent less than 1% of the emission standard of concentration limits stipulated in the POEO Clean Air Regulation for mercury and cadmium, and 4% for Type 1 and 2 substances. These have been assessed in the emissions limit assessment in Section 7, however were not included in dispersion modelling.

3.3.3 Dispersion modelling

Predicted air quality impacts were modelled in accordance with the Approved Methods using an approved computer software model CALPUFF.

CALPUFF model settings were selected based on the recommendations provided in the *Generic Guidance and Optimum Model Settings for the CALPUFF Modelling System for Inclusion into the Approved Methods for the Modelling and Assessments of Air Pollutants in NSW, Australia* (J Barclay and J Scire, Atmospheric Studies Group TRC Environmental Corporation, 2011), with the exception of the MDISP parameter for which the model default value was used.

For this assessment, the CALPUFF dispersion model was used to predict ground-level concentrations from the project. The CALPUFF dispersion model utilised a meteorological dataset of one year in duration. The grid size used in the CALPUFF model was equivalent to the CALMET domain (use of CALMET further discussed in Section 3.3.4). The same grid resolution of 250 metres used for the CALMET model was used in CALPUFF.

Building wake effects from existing buildings and large structures on site were included through use of the Building Profile Input Program (BPIP) PRIME algorithm. The dispersion model accounted for wake effects from approximately 1,400 building and structures.

The source properties and emission rates utilised in the dispersion modelling are detailed in Section 6.

The dispersion model was configured to predict pollutant concentrations at identified sensitive receptor locations and for a sampling grid centred on the PKSW site. Impacts at and beyond the site boundary were calculated using the sampling grid.

3.3.4 Meteorological modelling

Local meteorology including long term wind speed and direction, as well as atmospheric stability, influence how air pollutants are dispersed into the local environment.

Site specific meteorological data used to drive the dispersion model was generated by use of the WRF and CALMET meteorological models to produce a three-dimensional wind field which also accounts for local variations in the terrain. Prognostic WRF data was used as an 'initial guess field' for the CALMET meteorological model.

A representative year was chosen for modelling purposes based on review of Southern Oscillation Index (SOI) for the past 10 years and an analysis of BoM data recorded at Port Kembla Automatic Weather Station (AWS) for the last 5 calendar years (01/01/2016 – 31/12/2020). The review resulted in the selection of the 2017 calendar year (01/01/2017 – 01/01/2018) as the representative year for modelling purposes.

Details of the procedure undertaken to produce the site-specific meteorology are provided in Appendix A.

4. Description of the project

4.1 Project overview

This section provides a high level summary of the project from an air quality context. The EIS should be referred to for more detailed description. Additional details of air emissions from the project are provided in Section 6 and details on emission controls and the best practice review are provided in Section 10.

The project includes the reline of 6BF over a period of approximately three years to return it to service and commence ironmaking shortly after 5BF ceases operation.

The reline of the furnace initially involves removal of remaining burden material and iron skull, followed by stripping of the staves, refractories and hearth from inside the shell. In places, repairs to the furnace shell will be required. Once stripped, installation of the new hearth, sidewall refractories and staves will be completed, together with repairs/replacement of the tuyeres, tapholes, furnace cooling systems and instrumentation. Significant work will also be required to prepare each of the 6BF ancillary systems for continuous operation across the length of the new campaign. Following construction, 6BF will be commissioned and ramped up for operation. Cold commissioning of 6BF will occur while 5BF remains operational, however ironmaking at 5BF will conclude prior to ironmaking commencing at 6BF.

The project will see advances in technology being used including several improvements in 6BF compared to the currently operating 5BF, resulting in lower overall emissions from the site.

A summary of the project relevant to the assessment of construction and operational air quality is provided in Table 4.1.

Table 4.1 Project summary

Project element	Summary
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.
Ironmaking components and systems	– Raw materials handling – Sinter plant – Blast furnace – Stockhouse and charging system – Blast furnace vessel – Cooling system – Casthouse – Hot blast system – Off gas system – Slag handling
Air emissions	– Flue gas discharged from the stoves waste heat stack – Filtered and unfiltered air from the casthouse and stockhouse – Steam and H_2S from the slag granulation cooling tower – Blast furnace gas (BFG) from furnace top bleeders during maintenance and overpressure events – BFG discharged through primary relief valve via a silencer during charging – H_2S and SO_2 from slag pits – SO_2 from casthouse – Dust from the raw materials and charging conveyors, off gas system, dust handling system, and traffic

Project element	Summary
Blast furnace slag	Two types of slag are produced from the blast furnace, granulated slag and rock slag. Slag is sold for use in other products, such as cement and road base.
Commissioning	Commissioning involves the following: – All services brought back into live condition – Various parts of plant re heated – Pressure and leak tests conducted – Cooling systems filled and flushed – Furnace dried out and charged with kindling and burden material – Gas system purged and furnace 'blown in' – Furnace progressively heated until regular casting of iron and slag commences – Full production reached within one to two months
Operations	Operation of 6BF will be generally the same as existing operations utilised at 5BF, 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 use 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). Further, 24 hour construction may be required for an extended period if 6BF is required online earlier than 2026.
Construction duration	Approximately 3 years
Operational duration	Approximately 20 years

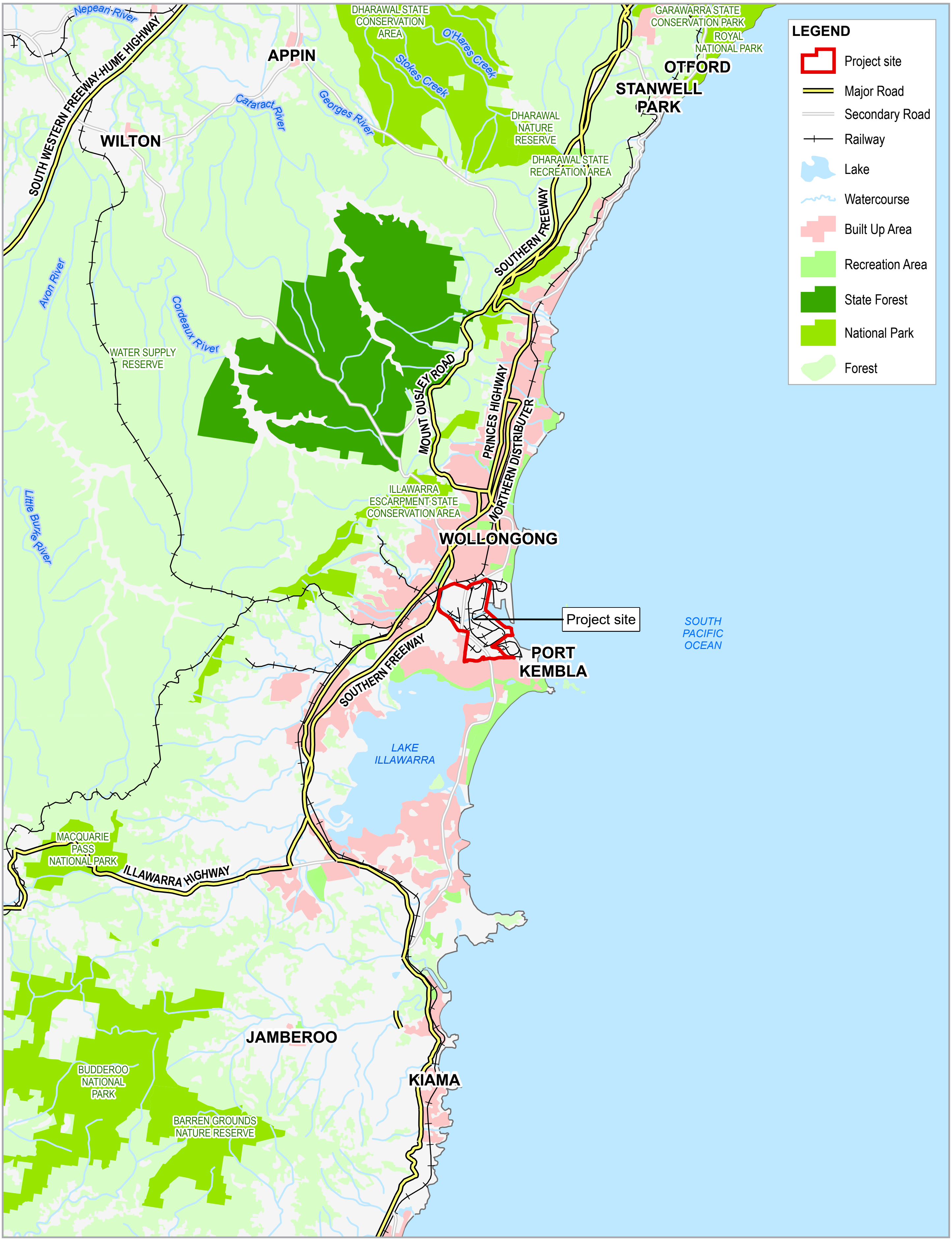
5. Existing environment

5.1 Project location

PKSW is located within an industrial site of approximately 750 hectares in the Wollongong Local Government Area (LGA), approximately 80 kilometres from Sydney and 2.5 kilometres from the City of Wollongong (refer to Figure 5.1).

The PKSW site comprises the No.1 Works, No.2 Works, Steelhaven and the Recycling area. The No.2 Works is divided into two sections by Allans Creek. The southern half of the No.2 Works comprises the Cokemaking, Ironmaking and Steelmaking facilities, while the northern half includes the Rolling Mills and Recycling Area. All sectors of PKSW are internally linked by road and rail and are currently supplied with electricity, water and gas services.

The land to which this project applies, including all connecting infrastructure and materials handling elements that require upgrades as part of the project, is within the southern section of the No.2 Works, being part of the land on which ironmaking facilities are located. The relevant land title is Lot 1 DP 606434. Ancillary construction facilities will also be required and will be located within the wider PKSW site as shown in Figure 5.2.



Paper Size ISO A4

0 1.5 3 4.5 6

Kilometres

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

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No.6 Blast Furnace Reline and Operations
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Regional Location

FIGURE 5.1

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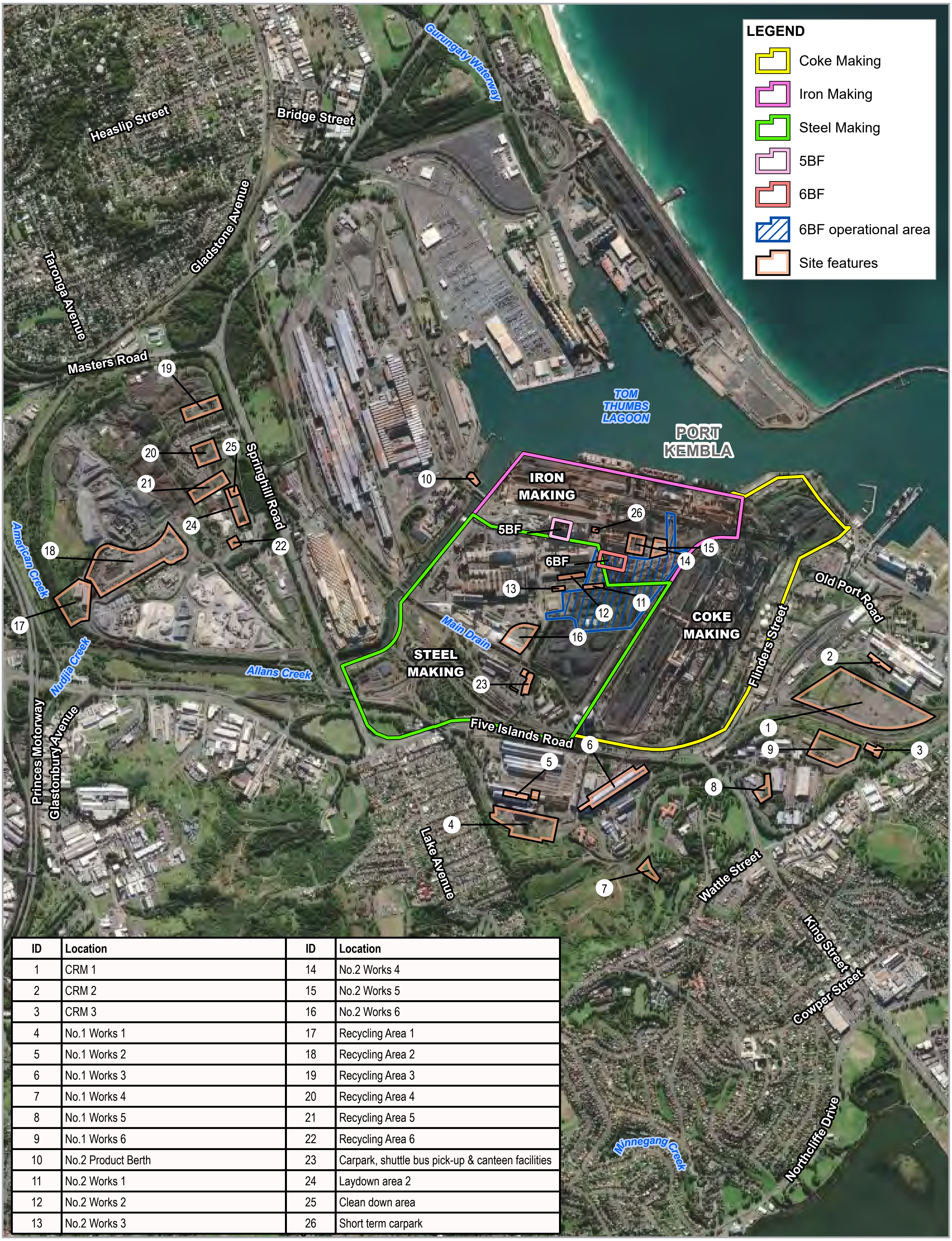
Print date: 15 Oct 2021 - 09:24

Data source: Commonwealth of Australia (Geoscience Australia): 250K Topographic Data Series 3, 2006. .
Created by: tmorton



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

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Key project features

FIGURE 5.2

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Print date: 15 Oct 2021 - 09:25

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

5.2 Receiving environment

The receiving environment plays a critical role in the potential for air emissions to lead to air impacts. The terrain and land use within the receiving environment have an influence on the local meteorological conditions and subsequently impact how air pollutants disperse within an environment. The location and densities of land uses sensitive to air quality impacts (sensitive receptors) relative to the source of air emissions plays a significant role in the magnitude and extent of potential impacts.

The land use, terrain and sensitive receptors surrounding the project location are discussed in the following report sections.

5.2.1 Land use

The PKSW site is zoned IN3 – Heavy Industrial under *State Environmental Planning Policy (Three Ports) 2013* (Three Ports SEPP). PKSW and the adjacent Springhill Works together comprise the largest site in the Port Kembla industrial area, occupying approximately 750 ha, and are mostly built around the western and northern side of Port Kembla’s Inner Harbour. The PKSW site is a multi-use 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 port of Port Kembla is located between the Pacific Ocean and the Port Kembla heavy industrial area and is zoned SP1 – Special Activities. The Inner Harbour, specifically developed as an all-weather shipping port, covers approximately 60 ha with around 2,900 m of commercial shipping berths. BlueScope operates five berths in the Inner Harbour that supply materials for the PKSW.

The area surrounding the Port Kembla industrial area is primarily occupied by residential development. These urban areas provide small and large-scale retail outlets, community services (e.g. medical facilities, hospital, schools and sporting facilities) and commercial facilities (e.g. banking and post office). 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. The urban area of Cringila is located adjacent to the No. 1 Works and No. 2 Works areas and is nearest to the project area, being approximately 1.2 kilometres to the southwest.

5.2.1 Terrain

The PKSW site is generally flat and resides upon a base of artificial fill, including dredged sand and mud, rocks and local soil materials. The terrain within 10 km of the PKSW site is considered complex due to a land-sea interface bordering the site to the east and the Illawarra escarpment which is located approximately 6 kilometres to the northwest.

5.2.2 Sensitive receptors

The Approved Methods defines a sensitive receptor as:

‘A location where people are likely to work or reside; this may include a dwelling, school, hospital, office or public recreational area. An air quality impact assessment should also consider the location of known or likely future sensitive receptors.’

The selection of identified sensitive receptors is consistent with the previous air quality assessment undertaken by *BlueScope Steel, Port Kembla Site Air Emissions Modelling – PRP131* (Environ, 2012) to readily allow comparison of predicted impacts between assessments and to analyse changes in predictions over time.

The locations of identified sensitive receptors are listed in Table 5.1 with universal transverse Mercator coordinates (eastings and northings), receptor type, locality with respect to the project and description. The locations of representative sensitive receptors in the surrounding area are shown in Figure 5.2.

ERM (2021) also conducted a peer review of the BSL Air Emission Site Wide Model produced in 2011. In its review ERM states that there have been no material changes to land use or occupancy surrounding the facility since the production of the 2011 model. Based on this, ERM concluded that sensitive receptor locations did not require significant review or amendment.

In addition to the identified sensitive receptor locations, the assessment predicted pollutant concentrations for a sampling grid centred on PKSW so that results can be determined at any location within the sampling grid.

Table 5.1 Location of identified sensitive receptors

Receptor ID	UTM coordinates (m)		Receptor type	Approximate distance and direction from project boundary	Description
	Easting	Northing			
R01	303054	6186079	Residential	~410 m northwest	Residence 1
R02	304458	6186662	Residential	~180 m north	Residence 2
R03	305835	6187128	Educational	~360 m northwest	Coniston Primary School
R04	301769	6185029	Residential	~1,630 m west	Unanderra Community Centre
R05	304332	6183457	Educational	~460 m west	Cringila Primary School
R06	307138	6182455	Residential	~400 m south	Warrawong Community Centre

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

GHD

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Location of identified sensitive receptors

FIGURE 5.3

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Print date: 21 Oct 2021 - 19:03

Data source: LPI: DCDB/DTDB, 2017. Commonwealth of Australia (Geoscience Australia) 250K Topographic Data Series 3, 2006. World Imagery: Earthstar Geographics
World Imagery: Maxar. Created by: tmorton

5.3 Existing and future sources of air pollutants

5.3.1 Facilities reporting to the NPI

The National Pollutant Inventory (NPI), operated under the *National Environment Protection (National Pollutant Inventory) Measure 1998*, provides publicly available information about emissions of 93 pollutants throughout Australia. Facilities that exceed prescribed threshold values are required to report their emissions to the NPI on a yearly basis.

A review of facilities reporting to the NPI in the area surrounding the project site revealed 18 facilities within a 5 km radius of the site; of these, five were identified to emit emissions of relevant pollutants that are assessable as cumulative impacts (pollutants including oxides of Nitrogen ($NO_{x)}$ and SO_2). These five facilities are described in Table 5.2. Annual emissions of relevant pollutants from each facility are presented in Table 5.3.

Table 5.2 Existing operations reporting emissions to the NPI

Name of operation	Proximity to the PKSW boundary	Description of operation
Bisalloy Steels Unanderra	~550 m west	Manufacture of quenched and tempered steel plate
BOC Gases Port Kembla	~50 m west	Refines atmospheric gases to produce saleable products.
Boral Asphalt Port Kembla	Within PKSW site boundary	Hot mix asphalt manufacturing
IXOM Port Kembla Site	~1,500 m southeast	Sulfuric acid regeneration/manufacture, sodium bisulfite manufacture, sulfuric acid import, storage and despatch
Port Kembla Milling	~50 m southeast	Cement milling

Table 5.3 Annual emissions reported to NPI for each facility for the 2019/2020 reporting period (kg/year)

Name of operation	NO_X	SO_2
Bisalloy Steels Unanderra [Unanderra-NSW]		67
BOC Gases Port Kembla [Cringila-NSW]		10
Boral Asphalt Port Kembla [Port Kembla-NSW]		0.5
IXOM Port Kembla Site [Port Kembla-NSW]	3,189	23,567
Port Kembla Milling [Port Kembla-NSW]		2,130

5.3.2 State significant projects

A review of the DPIE Major Projects website was completed to understand future sources of air pollutants which may contribute to cumulative impacts with the project. New state significant projects (SS projects), that is, both State Significant Developments and State Significant Infrastructure, with potential for air emissions are summarised in Table 5.4.

Table 5.4 Summary of nearby state significant projects with emissions to air

Name of SS project	Proximity to the PKSW boundary	Project status	Description of project	Expected impact on air quality at project sensitive receptors
Port Kembla Gas Terminal	~500 m east	Approved	Development of a liquefied natural gas (LNG) import terminal to receive and distribute LNG shipments sourced from global suppliers.	Emissions of particulates, combustion pollutants (NOx and SO_2) and volatile organic compounds from engines on board the Floating Storage and Regasification Unit (FSRU) and LNG carrier vessels.
Tallawarra B Power Station	~8 km southwest	Approved	Construction and operation of the proposed Tallawarra Stage B Gas Turbine Power Station. The power station will consist of 2 or 3 open cycle gas turbine generators with a nominal capacity of 300-450MW, or one combined cycle gas turbine generator with a nominal capacity of 400MW.	Emissions of particulates, combustion pollutants (NOx and SO_2) and volatile organic compounds from operation of gas turbine(s).
Name unknown, project proposed by Australian Industrial Power (AIP) / Squadron Energy group	N/A	N/A	Development of a dual-fuel (gas and green hydrogen) power station at Port Kembla.	Project is in its early stages and information about the anticipated emissions is not yet available.

Based on a review of project characteristics, the following was determined for each SS project:

– Port Kembla Gas Terminal – there is potential for cumulative impacts from the Port Kembla Gas Terminal due to close proximity of the 6BF reline project. Background pollutant concentrations from the Port Kembla Gas Terminal project should be included in the cumulative assessment.
– Tallawarra B Power Station – it is considered unlikely that cumulative impacts will occur from the Tallawarra B Power Station project due to significant separation distance between projects and relative location of sensitive receptors with respect to both projects (i.e. sensitive receptors are located between both projects, therefore receptors will only be impacted by one project at a time based on prevailing meteorological conditions). No allowance for pollutant concentrations from the future operating Tallawarra B Power Station is considered necessary.

It is noted that a sub-project of the No. 6 Blast Furnace Upgrade is the Commodity Logistics and Import Project (CLIP), which involves an upgrade of the raw materials unloading berth infrastructure at PKSW. The CLIP is a critical component of the No. 6 Blast Furnace Upgrade. Installation and commissioning of the infrastructure is required as early as November 2024. As it is a separate stage of the overall project, CLIP will be assessed separately (in a separate EIS) and is not included in this assessment.

5.4 Background air quality

An assessment of the total impact, which includes the project impact as well as the background concentrations, is required for the following pollutants:

– TSP
– PM_{10}
– $PM_{2.5}$
– NO_2
– SO_2
– H_2S

To assess the total impact, representative background levels of each pollutant must be established.

5.4.1 Background DPIE AQMS data

DPIE operates air quality monitoring stations (AQMS) in many locations across NSW. A summary of data available from the nearest DPIE AQMS is provided in Table 5.5.

Table 5.5 Summary of data reviewed as part of the assessment

Station name	Distance to the PKSW boundary	Pollutants of interest that are measured
Wollongong	~4 km north	PM_{10}, $PM_{2.5}$, NO_2, O_3 and SO_2
Kembla Grange	~6.5 km west	PM_{10}, $PM_{2.5}$, NO_2 and O_3
Albion Park South	~17 km southwest	PM_{10}, $PM_{2.5}$, NO_2, O_3 and SO_2

Based on proximity to the PKSW site, use of data from the Wollongong AQMS was prioritised, followed by Kembla Grange, then lastly data from Albion Park South.

A summary of the ambient air quality data recorded at each AQMS over the last 5 years is provided in Table 5.6.

Table 5.6 5 year summary of available background air quality data recorded by DPIE

Pollutant	Averaging period	Recorded background concentration by year (µg/m³)				
		2016	2017	2018	2019	2020
Wollongong						
PM_{10}	24 hour maximum	52.9	55.2	59.7	117.6	121.6
	Maximum 24 hour (below assessment criteria)	49.5	47.2	47.3	48.7	48.1
	70th percentile	20.7	20.6	23.1	25.1	20.4
	Annual average	17.3	18.1	19.8	22.6	18.8
$PM_{2.5}$	24 hour maximum	33.7	24.7	47.6	81.5	100.9
	Maximum 24 hour (below assessment criteria)	20.1	24.7	21.8	24.5	22.0
	70th percentile	8.3	8.3	8.3	9.0	7.4
	Annual average	7.4	7.1	7.3	9.0	7.8
NO_2	1 hour maximum	88.2	116.9	88.2	82.0	84.1
	Annual average	13.0	12.9	13.8	12.2	13.2
SO_2	1 hour maximum	57.2	134.4	65.8	97.2	57.2
	24 hour maximum	13.1	10.5	10.5	13.1	23.6
	Annual average	1.7	2.3	2.6	2.6	1.7
Kembla Grange						
PM_{10}	24 hour maximum	56.3	67.7	71.8	115.8	187.7
	Maximum 24 hour (below assessment criteria)	47.3	48.0	49.1	49.8	48.3
	70th percentile	23.9	23.5	26.4	29.5	22.5
	Annual average	20.0	20.5	22.7	25.5	21.5
$PM_{2.5}$	24 hour maximum	32.0	21.3	21.9	70.1	100.4
	Maximum 24 hour (below assessment criteria)	18.2	21.3	21.9	24.6	22.6
	70th percentile	7.8	8.0	8.0	8.9	6.5
	Annual average	6.6	6.9	7.1	8.8	6.8
NO_2	1 hour maximum	80.0	75.9	75.9	86.1	77.9
	Annual average	10.0	9.2	10.0	10.3	8.2
SO_2	1 hour maximum	-	-	-	-	-
	24 hour maximum	-	-	-	-	-
	Annual average	-	-	-	-	-

Pollutant	Averaging period	Recorded background concentration by year (µg/m³)				
		2016	2017	2018	2019	2020
Albion Park South						
PM_{10}	24 hour maximum	43.1	44.6	94.4	104.3	153.3
	Maximum 24 hour (below assessment criteria)	43.1	44.6	49.9	47.0	45.4
	70th percentile	18.3	17.5	20.4	21.3	17.7
	Annual average	14.9	15.3	17.8	19.5	17.1
$PM_{2.5}$	24 hour maximum	30.7	19.3	29.4	49.4	96.3
	Maximum 24 hour (below assessment criteria)	20.8	19.3	20.6	24.8	21.4
	70th percentile	8.0	7.3	7.7	9.4	6.5
	Annual average	7.2	6.6	6.8	8.6	6.8
NO_2	1 hour maximum	88.2	77.9	80.0	84.1	80.0
	Annual average	7.7	7.4	8.1	7.8	5.8
SO_2	1 hour maximum	62.9	85.8	88.7	71.5	62.9
	24 hour maximum	15.7	21.0	21.0	21.0	13.1
	Annual average	1.7	1.9	2.0	2.2	0.8
"-" indicates pollutant not monitored						

5.4.2 Background BlueScope collected data

BlueScope currently operates two air quality monitoring stations, North Gate and Scouts Hall, and has undertaken historic air quality sampling in a number of locations. North Gate AQMS is located approximately 2 km northwest of the 6BF and has been in operation since December 2015. Scouts Hall AQMS is located approximately 1.8 km southwest of the 6BF and has been in operation for approximately 34 years. Refer Figure 5.3 for station locations.

A summary of the ambient PM_{10} data recorded at North Gate AQMS and Scouts Hall AQMS over the last 5 years is provided in Table 5.7. It is noted that the air quality monitoring stations are not fully compliant with the Australian Standard, and therefore are included for comparative purposes only.

Table 5.7 5 year summary of available background PM_{10} data recorded by BlueScope[1]

Pollutant	Averaging period	Recorded background concentration by year (µg/m³)				
		2016	2017	2018	2019	2020
North Gate						
PM_{10}	24 hour maximum	176.5	499.7	205.8	499.7	499.4
	Maximum 24 hour (below assessment criteria)	49.0	49.7	49.5	48.8	49.1
	70th percentile	26.0	24.4	29.2	31.4	27.1
	Annual average	22.6	26.2	27.8	39.1	37.4
Scouts Hall						
PM_{10}	24 hour maximum	63.1	76.2	79.5	109.5	131.2
	Maximum 24 hour (below assessment criteria)	48.3	47.9	49.6	48.1	49.1
	70th percentile	21.2	21.4	27.1	28.7	21.3
	Annual average	17.6	18.8	22.7	24.2	19.9

[1] Extraneous data was removed from dataset. Due to unrepresentative 'spikes' identified in the recorded data, any 3 minute average PM_{10} concentration greater than 500 ug/m³ was filtered out of dataset.

The maximum and average 1 hour averaged H_2S concentrations recorded by BlueScope at Cringila and Scouts Hall for the most recent three years of data are summarised in Table 5.8 and Table 5.9 respectively.

Based on the recorded average 1 hour averaged H_2S concentrations, a background 1 hour H_2S concentration of 2 μg/m^3 (equal to the highest monthly average H_2S concentration recorded) was adopted.

Table 5.8 Maximum 1 hour averaged H_2S concentration

Month	Maximum 1 hour average H_2S concentration recorded (μg/m^3)					
	Cringila			Scouts Hall		
	2013	2014	2015	2013	2014	2015
Jan	10.6	15.2	7.9	30.3	7.8	20.4
Feb	3.5	10.1	2.6	9.2	9.7	9.4
Mar	4.3	7.8	1.4	12.8	7.1	9.5
Apr	5.0	35.7	-	9.7	83.2	-
May	14.5	5.4	4.4	3.4	79.8	5.5
Jun	31.0	9.6	10.6	6.1	3.9	5.3
Jul	9.0	3.6	4.2	5.4	2.5	5.5
Aug	3.0	3.9	7.8	6.1	3.2	4.8
Sep	10.9	4.7	-	8.9	4.0	2.6
Oct	12.3	4.0	-	8.7	50.7	7.1
Nov	5.6	5.2	-	7.5	12.7	13.2
Dec	7.2	5.7	-	5.7	9.6	-
"-" denotes sampling was not undertaken during this time period.						

Table 5.9 Average 1 hour H_2S concentration

Month	Average 1 hour H_2S concentration recorded (μg/m^3)					
	Cringila			Scouts Hall		
	2013	2014	2015	2013	2014	2015
Jan	1.8	1.1	1.0	1.6	0.9	0.8
Feb	0.8	1.4	0.5	0.9	1.0	0.7
Mar	0.8	1.8	1.3	0.8	0.9	1.1
Apr	1.0	1.6	-	0.6	0.8	-
May	1.0	1.0	0.7	0.6	0.7	0.7
Jun	2.0	0.9	0.9	0.6	0.6	0.6
Jul	1.1	0.9	1.0	0.7	0.5	0.6
Aug	1.1	0.8	1.2	0.7	0.4	0.5
Sep	1.2	0.9	-	0.9	0.5	0.6
Oct	1.4	0.9	-	0.8	0.9	0.9
Nov	1.0	1.1	-	0.9	0.8	0.9
Dec	1.1	1.0	-	0.8	0.8	-
"-" denotes sampling was not undertaken during this time period.						

5.4.3 Adopted background data

A summary of the background air quality data adopted in this assessment is provided in Table 5.10. As noted in Section 3.2.3.1, inclusion of background data is considered conservative as the background data contains contributions from existing PKSW operations. Using the background data may result in a 'doubling up' of concentrations from PKSW, however it was decided to include the background data in this assessment to provide a conservative assessment.

Table 5.10 Adopted background air quality data

Pollutant	Averaging period	Adopted background value
TSP	Annual	36.2 µg/m^3, equal to twice the annual PM_{10} concentration recorded at Wollongong AQMS for the modelling period
PM_{10}	24 hour	Daily variable from Wollongong AQMS (i.e. a different value was used for each 24 hour period, refer to Table 5.6 for general statistics including; 24 hour maximum, maximum 24 hour (below assessment criteria), 70th percentile and annual average)
NO_2	1 hour	Hourly variable from Wollongong AQMS, if unavailable then from Kembla Grange AQMS, if unavailable from either station then from Albion Park South AQMS (refer to Table 5.6 for general statistics including; 1 hour maximum and annual average)
O_3	1 hour	Hourly variable from Wollongong AQMS, if unavailable then from Kembla Grange AQMS, if unavailable from either station then from Albion Park South AQMS
SO_2	1 hour	Hourly variable from Wollongong AQMS (refer to Table 5.6 for general statistics including; 1 hour maximum, 24 hour maximum and annual average)
	24 hour	Daily variable from Wollongong AQMS (refer to Table 5.6 for general statistics including; 1 hour maximum, 24 hour maximum and annual average)
H_2S	1 hour	2 µg/m^3, equal to the highest monthly average H_2S concentration recorded by BlueScope

5.5 Climate and meteorology

The local climate and meteorology (weather) within the study area is of critical importance when assessing the potential for air quality impacts at sensitive receptors.

The meteorological environment relevant to a project site is best understood through review of data collected from long-running monitoring weather stations, most commonly operated by the Bureau of Meteorology (BoM) as well as state authorities (DPIE in this case) and in some instances private entities (such as BlueScope). Simulation of the meteorological environment (modelling) is a useful tool in understanding the environment where suitable meteorological observations are not available.

5.5.1 Available observations

The BoM operates a network of Automatic Weather Stations (AWS) across Australia. A BoM AWS typically measure critical meteorological parameters including wind speed, wind direction, temperature, relative humidity, and pressure, with some stations also measuring cloud coverage.

The nearest AWS to the project site include:

– Port Kembla AWS (068253) – 2 km southeast
– Bellambi AWS (068228) – 11 km north
– Albion Park (Shellharbour Airport) (068241) – 15 km southwest

It is noted that long term climate statistics of temperature and rainfall are not available from the closest BoM station (Port Kembla AWS), therefore climate statistics were sourced from the second closest station (Bellambi AWS).

BlueScope's Northgate and Scouts Hall air quality monitoring stations record wind speed and direction, however they do not include temperature or rainfall and are not fully compliant with Australian Standards for wind speed and direction and therefore weren't referenced in this section. A review of the wind roses recorded at BlueScope's Northgate and Scouts Hall air quality monitoring stations is provided in Appendix A.

5.5.1.1 Temperature

Figure 5.4 shows monthly temperature statistics for data measured at BoM Bellambi AWS for the period 1997 through 2021. The median monthly maximum temperature and median monthly minimum temperature are used to show the typical temperature range for each month of the year. This is shown along with the monthly average temperature.

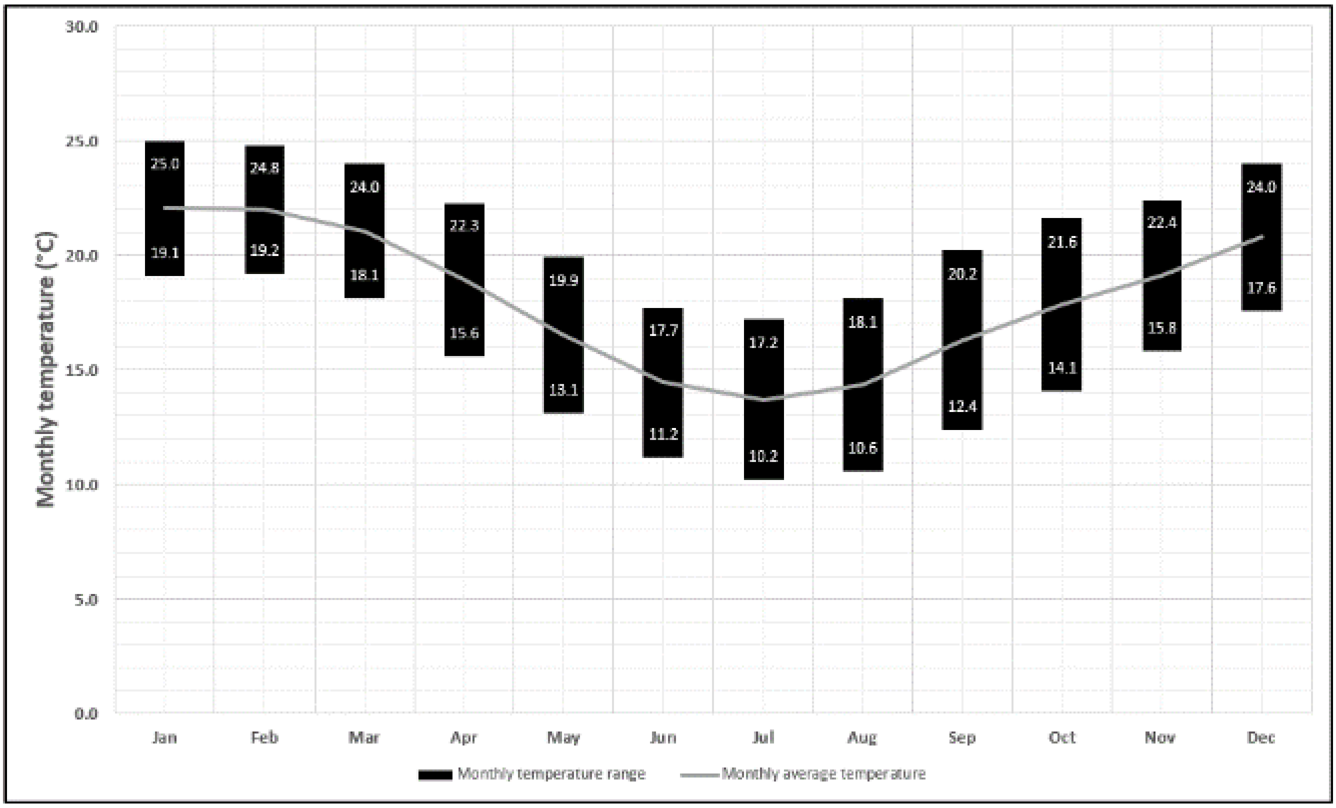


Figure 5.4 Monthly climate temperature statistics from BoM Bellambi AWS (1997-2021)

5.5.1.2 Rainfall

Figure 5.5 shows monthly rainfall statistics for data measured at BoM Bellambi AWS for the period 1997 through 2021. The statistics shown include average monthly rainfall amount (mm) and average number of days per month where rainfall is greater than 1 mm (number of 'rain days').

The data shows that the number of rain days and the total rainfall amounts are greater during the summer and autumn months.

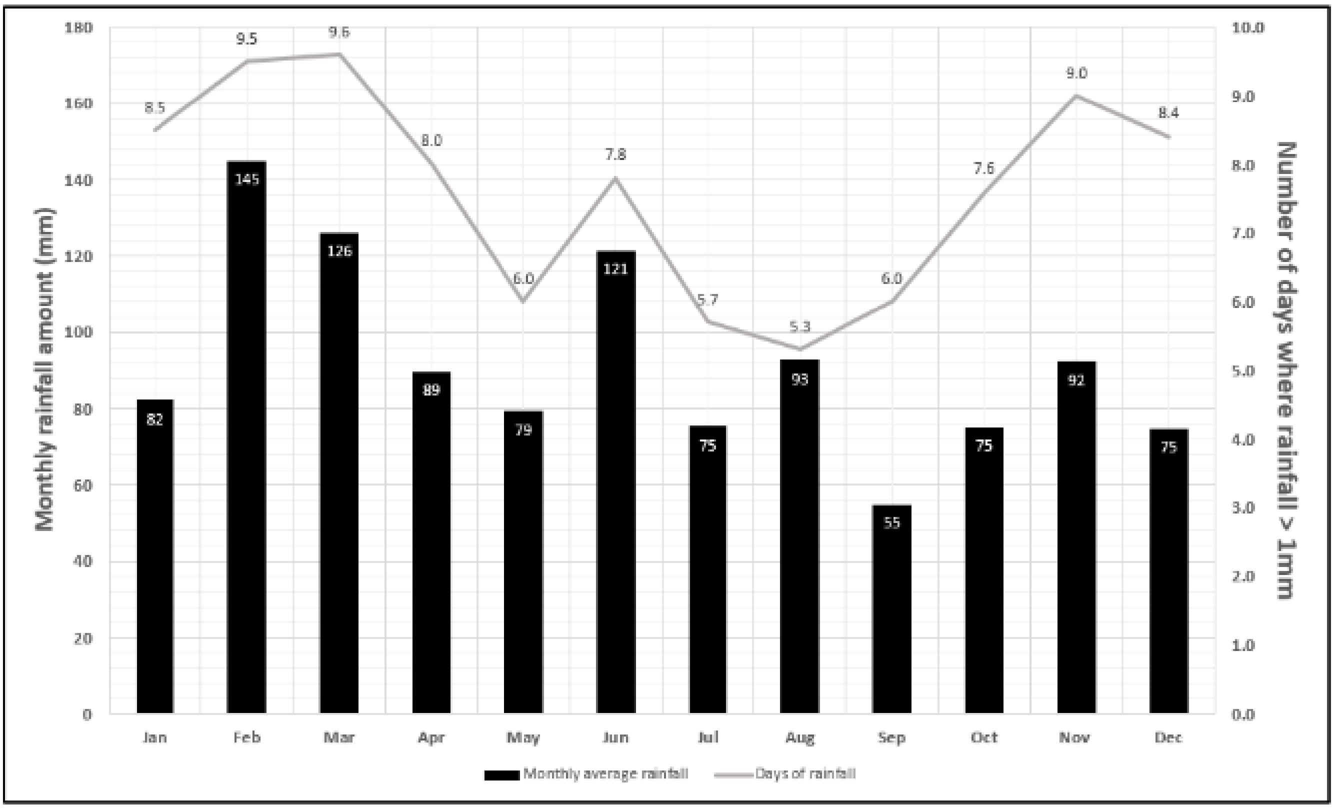


Figure 5.5 Monthly climate rainfall statistics from BoM Bellambi AWS (1997-2021)

6. Project air emissions

6.1 Project construction

6.1.1 Construction 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 factors including the operational performance of the 5BF facility, and the timing of when furnace condition requires that it be decommissioned.

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.

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
- 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
- Installation of a new slag granulation system

A list of indicative equipment required for the reline construction activities is presented in Table 6.1.

Table 6.1 Indicative equipment list at Blast Furnace and surrounding facilities

Indicative 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
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	Rock-breaker
Piling Rigs	Concrete saw		

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.

The final construction phase will require 24 hour construction (estimated to be a period of 5 months). Further, 24 hour construction may be required for an extended period if 6BF is required to be online earlier than 2026.

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 5.2.

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 6.2.

Table 6.2 Ancillary facilities

ID	Location	Activity	Size (m^2)	Indoor/Outdoor	Comments
4	No.1 Works 1	Storage	28,500	Outdoor	Currently used as coke storage (rarely used)
5	No.1 Works 2	Storage	5,000	Indoor	No change to the use of the space as it is used today
6	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
7	No.1 Works 4	Storage	6,400	Outdoor	-
8	No.1 Works 5	Storage	4,000	500 indoor 3,500 outdoor	-

ID	Location	Activity	Size (m²)	Indoor/Outdoor	Comments
9	No.1 Works 6	Storage	17,000	Outdoor	No change to the use of the space as it is used today
1	CRM 1	Storage	80,000	Outdoor	-
2	CRM2	Storage	3,000	Indoor	Operations indoor
3	CRM3	Storage	2,800	Indoor	Operations indoor
11	No.2 Works 1	Construction	1,000	Outdoor	-
12	No.2 Works 2	Construction	3,000	Outdoor	-
13	No.2 Works 3	Construction	1,500	Outdoor	-
14	No.2 Works 4	Storage	3,000	Outdoor	-
15	No.2 Works 5	Storage	7,000	Outdoor	-
16	No.2 Works 6	Storage	7,000	Outdoor	-
10	No.2 Products Berth	Storage	2,500	Outdoor	-
17	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
18	Recycling Area 2	Processing	88,000	Outdoor	No change to the use of the space as it is used today
19	Recycling Area 3	Processing	25,000	Outdoor	No change to the use of the space as it is used today
20	Recycling Area 4	Storage / Processing	11,000	Outdoor	-
21	Recycling Area 5	Storage / Processing	20,000	Outdoor	
22	Recycling Area 6	Storage	4,500	Outdoor	No change to the use of the space as it is used today
23	Springhill Electrical	Storage	3,000	Indoor	Operations indoor

6.1.2 Construction emissions

The key emissions to air from the construction of the project were identified upon review of the construction methodology. It is anticipated that particulates (TSP and PM_{10}) including some contaminants and vehicle exhaust emissions may occur during construction.

Relatively minor particulate emissions are expected from removal, demolition, repair and installation activities with the use of localised emission controls such as watering. Construction particulate emissions will vary based on the specific activities being undertaken at any time (i.e. particulate emissions will not occur at all times).

It is anticipated that some particulate emissions may include contaminants and heavy metals from removal of infrastructure. With dust management measures in place, contaminant emission will be relatively minor and will be controlled at the source.

Some activities will have a higher potential for particulate emissions including blasting, heavy demolition and use of rock breaking equipment. Activities with a higher potential for particulate emissions will be managed by implementation of a construction dust management plan including management measures outlined in Section 11.

Minor vehicle exhaust emissions are expected throughout the construction period however, sources will be discontinuous, transient, and mobile, and therefore the air quality risk associated with vehicle emissions during construction is low.

An overview of potential emissions to air that could occur during construction of the project is summarised in Table 6.3.

Table 6.3 Summary of potential construction emissions to air

Construction activity	Activity description	Overview of emission sources
Removal activities including removal of remaining burden materials, iron skull, worn carbon block refractories, worn refractories in the remainder of the vessel	– Use of mobile plant and equipment to remove burden materials – Iron skull demolition using explosives (noting that only small sections of the skull will be blasted away at any one time to minimise the amount of explosive used) – Jack picking and breaking up refractory material into smaller pieces for extraction – Removal of material by the telescopic boom excavator	– Minor particulate emissions from use of plant/equipment – Particulate emissions from blasting and heavy demolition
Demolition activities including demolition of cooling staves, hot blast main refractory lining, clarifier tank and associated equipment where required	– Use of power tools and mobile plant/equipment to undertake demolition as required	– Minor particulate emissions from use of plant/equipment
Repair, maintenance and upgrade activities including repairs to the blast furnace shell and repair, maintenance and/or upgrade of ancillary equipment	– Use of power tools and mobile plant/equipment to undertake repairs, maintenance and upgrades as required	– Minor particulate emissions from use of plant/equipment
Installation activities including installation of a new clarifier tank (and associated equipment), the new hearth, sidewall refractories and staves and a new slag granulation system	– Use of power tools and mobile plant/equipment to install new equipment as required	– Minor particulate emissions from use of plant/equipment
General construction activities and preparation of construction areas including stockpiles, storage and laydown	– Use of power tools and mobile plant/equipment to install new equipment as required	– Minor particulate emissions from use of plant/equipment

It is anticipated that the majority of particulate emissions will occur from:

– Construction areas (No.2 Works 1, No.2 Works 2 and No.2 Works 3)
– Processing areas (Recycling Area 4 and Recycling Area 5)

Material and plant storage areas (which account for majority of ancillary areas) are not expected to emit significant particulate emissions. It is assumed that any material with potential to release particulate emissions will be stored in designated storage areas away from the site boundary.

6.2 Project commissioning

6.2.1 Commissioning overview

Prior to operation, the project will undergo a period of commissioning, a once off procedure that is necessary to allow commencement of operation. It is anticipated the commissioning process will take several months to occur, after which, the furnace will be blown in and then gradually uprated over a period of approximately 6 weeks until full production is achieved.

The commissioning process is outlined as follows:

– Quality assurance documentation checked.
– Handover from construction to commissioning.
– Cooling systems filled and flushed.
– Hydraulic and lubrication systems filled and flushed.
– System pressure and leak tests conducted.
– All services brought back into live condition.

- Cold commissioning of all equipment e.g. running of conveyors, drives, vibro-feeders, screens, probes, stockrods, tapping drills, clayguns, manipulators, tilting spouts, tilting platforms, fans, blowers, pumps, stroking valves and cylinders, setting limits, speeds and flows, etc.
- Control system commissioning including interlock and functionality testing for each plant area.
- Furnace pressure and leak tests conducted. Various parts of plant reheated.
- The furnace proper will be dried out using hot blast at limited temperatures, then charged with kindling (comprising firewood/railway sleepers and coke) and filled with a mix of burden material (coke and iron ore).
- The gas systems will be purged ready for use and the furnace will be 'blown in'. This involves the introduction of hot blast air through the tuyeres, with gas initially discharged through the furnace bleeders until its composition is satisfactory for internal use, at which time the gas is then diverted into the gas cleaning system.
- The furnace is progressively heated until regular casting of iron and slag commences, although the iron quality is not usable initially and it will take several days to produce useable iron which can be converted to steel.
- The furnace is then uprated to target production over the following weeks, reaching full production after a period of approximately 6 weeks.

6.2.2 Commissioning emissions

During commissioning, the primary emissions to air are expected to comprise of combustion pollutants including carbon monoxide (CO), carbon dioxide (CO_2), hydrogen (H_2), and particulates, that will occur during charging, purging and heating of the furnace.

During blow-in, gas generated during the initial combustion period varies slightly in composition when compared to blast furnace gas and is unable to be re-used in other areas at PKSW. As a result, this gas will be vented through the furnace top bleeders being directed through the gas cleaning system. This will result in visible emissions for a period of approximately two to three hours. Once the composition of the blast furnace gas is suitable for re-use in other areas at PKSW, it will be reintroduced to the interworks gas system and the bleeding to atmosphere will stop.

During blow-in, the tapholes at the bottom of the blast furnace are open allowing the escape of combusting gas mixtures, which will be ignited, until enough slag is generated to seal the tapholes. As soon as the tapholes are sealed off, ironmaking will commence and runner covers will be installed as operations allow. Molten liquids will be diverted to temporary pits external to the casthouse until such time as the quality is deemed sufficient to return to normal ladle operations. It is estimated it will take 3-4 days before the normal de-dusted casthouse cover arrangement can be adopted. Casthouse dedusting system will be operating throughout the recovery with reduced capacity initially due to the removal of the runner covers.

It is noted that emissions control at 6BF is expected to be an improvement over that of 5BF due to the presence of the secondary dedusting hood, including during commissioning.

No air emissions sampling data from commissioning was available at the time of this assessment and therefore emissions to air during commissioning were not able to be quantified.

6.3 Project operation

6.3.1 Operational overview

Normal operation of PKSW will result in emissions to air from stacks, flares, and fugitive emissions from buildings and outdoor sources. Emissions to air are created by various operational activities 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

The ironmaking process produces a number of point-source and fugitive air emissions, including:

– Flue gas discharged from the stoves waste heat stack
– Filtered and unfiltered air from the casthouse and stockhouse
– Steam and H_2S from the slag granulation cooling tower
– BFG from furnace top bleeders during maintenance and overpressure events
– BFG and nitrogen gas discharged through primary relief valve via a silencer during charging
– H_2S and SO_2 from slag pits
– SO_2 from the casthouse
– Dust from the raw materials and charging conveyors, off gas system and traffic

Surplus gases produced from the blast furnace vessel are directed from the top of the furnace to be treated by the gas cleaning system.

The gas cleaning system comprises a raw gas main, dust collector and a high energy scrubber. Collected dust is periodically discharged into a hopper, and agglomerated for transfer to the sinter plant feed beds via trucks.

Impurities are removed from the gas via washing with high velocity, recycled, closed loop water. This creates a slurry which is thickened and transferred via a pipeline to the sinter plant dewatering plant. The cleaned gas, BFG, is then piped to the 6BF hot blast stoves for use as a heating fuel, or to the BFG gas main to be used as an energy source for other processes throughout PKSW.

6.3.2 Operation emissions

A detailed emissions inventory including source properties and pollutant mass emissions for the site was provided by BlueScope based on site sampling data and NPI estimation techniques. The detailed emission inventory is provided across the following tables:

– Table 6.5 – Source properties for stack sources
– Table 6.6 – Mass emission rates for stack sources
– Table 6.7 – Source properties for fugitive sources
– Table 6.8 – Mass emission rates for fugitive sources

The 'scenario' column indicates which scenario the source was modelled in. An explanation of scenario naming is provided below:

– **PKSW** – Sources located within the wider PKSW site. These sources are unaffected by the project and occur during the existing scenario and will continue to occur during the future scenario.
– **5BF** – 5BF sources related with use of 5BF, these sources will cease operation when 6BF starts operating.
– **6BF** – 6BF sources related with use of 6BF, these sources will be operating when 5BF has ceased ironmaking operation.

Sources unique to 5BF or 6BF scenarios are identified in Table 6.4.

Table 6.4 Summary of sources exclusive to 5BF or 6BFscenarios

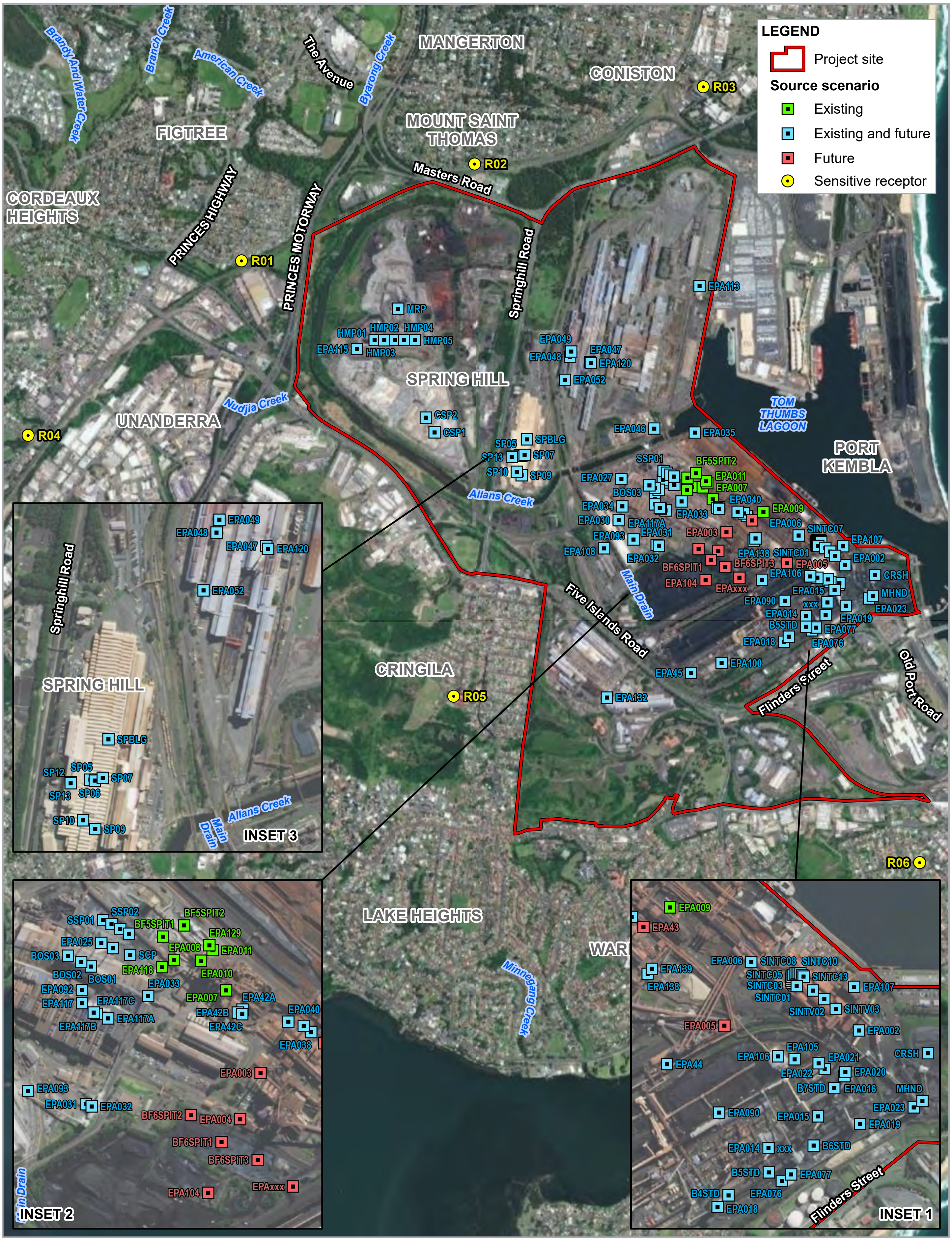
5BF scenario sources	6BF scenario sources
Stack sources: – EPA007 – No 5 Blast Furnace Stove Heating Stack – EPA008 – No 5 Blast Furnace Cast House Dedusting Stack 1 – EPA009 – No 5 Blast Furnace Stock House Dedusting Stack – EPA010 – No 5 Blast Furnace - No 2 Slag Granulator Stack – EPA011 – No 5 Blast Furnace - No 1 Slag Granulator Stack	Stack sources: – EPA003 – No 6 Blast Furnace Stove Waste Gas Stack – EPA004 – No 6 Blast Furnace Cast House Dedusting Stack – EPA005 – No 6 Blast Furnace Stock House Dedusting Stack – EPA43 – 6BF BFG excess gas bleeder stack A – 6BF BFG excess gas bleeder stack B – 6BF Slag Granulation Cooling Towers

5BF scenario sources	6BF scenario sources
– EPA129 – No 5 Blast Furnace - No 3 Slag Granulator Stack – EPA118 – No 5 Blast Furnace Casthouse Dedusting Stack – EPA42A – BFG Flare Stack A – EPA42B – BFG Flare Stack B – EPA42C – BFG Flare Stack C	
Fugitive sources: – BF5SPIT1 – Blast Furnace 5 Slag Pit 1 – BF5SPIT2 – Blast Furnace 5 Slag Pit 2	Fugitive sources: – BF6SPIT1 – Blast Furnace 6 Slag Pit 1 – BF6SPIT2 – Blast Furnace 6 Slag Pit 2 – BF6SPIT3 – Blast Furnace 6 Slag Pit 3 – BF6SPIT4 – Blast Furnace 6 Slag Pit 4 – BF6SPIT5 – Blast Furnace 6 Slag Pit 5
The following sources do not yet have an assigned ID: – Gas Processing VRS Outlet (Nº5 WHS) – 6BF BFG excess gas bleeder stack B – 6BF Slag Granulation Cooling Tower	

The slag granulating system proposed for 6BF includes a condensing unit which uses water sprays to condense steam generated during granulation. This condensate is collected and circulated through a cooling tower with the water from slag dewatering. H_2S emissions from the granulation process may be emitted from the slag granulation cooling tower. It is expected that a reduction in H_2S concentration will be achieved by this process in comparison to existing operations, as the H_2S will be dissolved into the cooling tower water. H_2S emissions for this source were based on sampling of 5BF and no reductions were applied, which is likely to be conservative.

6.3.3 Site layout

The location of all sources are shown on Figure 6.1.



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
Air Quality Impact Assessment

PKSW layout and source locations

Project No. 12541101
Revision No. 0
Date 14/10/2021

FIGURE 6.1

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Print date: 14 Oct 2021 - 16:33

Data source: LPI: DCDB/DTDB, 2017. Commonwealth of Australia (Geoscience Australia) 250K Topographic Data Series 3, 2006. World Imagery: Maxar. Created by: tmorton

Table 6.5 Source properties for stack sources

Scenario	ID	Description	Source properties					
			X coordinate (m)	Y coordinate (m)	Stack height (m)	Diameter (m)	Exhaust velocity (m/s)	Exhaust temperature (K)
PKSW	EPA002	Sinter Machine Room Dedusting Stack	306690	6184247	45	5.0	12.1	329
6BF	EPA003	No 6 Blast Furnace Stove Heating Stack	305975	6184445	70	4.0	7.6	400
6BF	EPA004	No 6 Blast Furnace Cast House Dedusting Stack	305926	6184334	36	3.7	25.2	337
6BF	EPA005	No 6 Blast Furnace Stock House Dedusting Stack	306339	6184260	26	3.0	28.3	304
PKSW	EPA006	No 6 Blast Furnace Highline Dedusting Stack	306409	6184426	30	1.8	26.8	303
5BF	EPA007	No 5 Blast Furnace Stove Heating Stack	305892	6184645	61	5.9	3.5	400
5BF	EPA008	No 5 Blast Furnace Cast House Dedusting Stack 1	305767	6184718	23	3.3	13.0	337
5BF	EPA009	No 5 Blast Furnace Stock House Dedusting Stack	306197	6184569	25	2.4	13.9	300
5BF	EPA010	No 5 Blast Furnace - No 2 Slag Granulator Stack	305832	6184716	70	4.0	3.3	340
5BF	EPA011	No 5 Blast Furnace - No 1 Slag Granulator Stack	305859	6184741	70	4.0	3.3	340
5BF	EPA129	No 5 Blast Furnace - No 3 Slag Granulator Stack	305852	6184753	70	4.0	3.3	340
PKSW	EPA014	No 5 Coke Oven Battery Heating Stack	306454	6183941	90	2.6	14.4	442
PKSW	EPA015	No 6 Coke Oven Battery Heating Stack	306583	6184023	90	2.8	16.5	447
PKSW	EPA016	No 7a Coke Oven Battery Heating Stack	306653	6184128	140	7.7	2.2	423
PKSW	EPA018	No 4/5 Coke Oven Battery Quench Tower Stack	306321	6183786	52	5.5	14.7	338
PKSW	EPA019	No 6 Coke Oven Battery Quench Tower Stack	306693	6184003	52	5.1	15.4	339
PKSW	EPA020	No 7a Coke Oven Battery Quench Tower Stack	306655	6184139	35	14.0	2.0	339
PKSW	EPA021	No 7a Battery Fume Suppression Plant No 1 Stack	306601	6184147	26	3.0	9.9	315
PKSW	EPA022	No 7a Battery Fume Suppression Plant No 2 Stack	306585	6184162	26	3.0	11.4	312
PKSW	EPA023	Coke Screen House Dedusting Stack	306833	6184047	17	1.8	17.1	301
PKSW	EPA024	BOS No 1 Vessel Flare Stack	305620	6184746	114	8.0	20.4	1273
PKSW	EPA025	BOS No 2 Vessel Flare Stack	305591	6184759	114	8.0	20.4	1273
PKSW	EPA027	BOS No 2 Secondary Dedusting Stack	305342	6184766	30	4.5	23.7	327
PKSW	EPA030	Lime Kiln Waste Heat Stack	305326	6184519	28	2.4	18.9	434
PKSW	EPA031	Lime Kiln Storage bins - Enacon Baghouse Stack	305554	6184370	11	0.6	10.9	303
PKSW	EPA032	Lime Kiln Storage bins - Bahco Baghouse Stack	305568	6184365	3	0.7	11.5	297
PKSW	EPA033	Lime Kiln Transfer House Stack	305704	6184631	56	0.4	7.6	295
PKSW	EPA034	Slab Handling - Slab Scarfing Machine Stack	305348	6184602	37	2.6	5.6	301
PKSW	EPA035	Raw Material Road Rail Dump Station Stack	305784	6185046	52	1.7	14.5	299

Scenario	ID	Description	Source properties					
			X coordinate (m)	Y coordinate (m)	Stack height (m)	Diameter (m)	Exhaust velocity (m/s)	Exhaust temperature (K)
PKSW	EPA038	No 2 Blower Station 23 Boiler Stack	306097	6184544	60	3.7	8.9	400
PKSW	EPA039	No 2 Blower Station 24 Boiler Stack	306079	6184559	60	3.7	8.9	400
PKSW	EPA040	No 2 Blower Station 25 Boiler Stack	306042	6184569	61	3.7	8.9	400
PKSW	EPA046	Hydrogen Reformer Furnace Stack	305540	6185070	32	0.5	20.7	979
PKSW	EPA047	No 1 Walking Beam Furnace Stack	305153	6185471	97	4.7	5.5	400
PKSW	EPA048	3500mm Furnace No 1 Stack	305033	6185503	25	2.5	19.5	400
PKSW	EPA049	3500mm Furnace No 2 Stack	305040	6185534	19	3.2	11.9	353
PKSW	EPA052	GEGA M/C Cut to Length Stack	305002	6185364	15	1.2	16.9	304
PKSW	EPA076	No 4/5 Battery Fume Control Stack	306489	6183855	24	2.8	10.7	318
PKSW	EPA077	No 6 Battery Fume Control Stack	306513	6183872	24	2.8	9.7	317
PKSW	EPA090	No 5 & 6 Hammer Mills Dedusting Stack	306326	6184033	12	0.6	12.0	294
PKSW	EPA092	CAS Baghouse Stack	305544	6184645	30	0.7	10.6	330
PKSW	EPA093	Lime Kiln Discharge Building Baghouse Stack	305415	6184402	5	0.7	17.1	313
PKSW	EPA100	Gas Processing Sulphate Plant Stack	305946	6183659	18	0.9	8.6	344
PKSW	EPA105	PCI Hot Gas Exhaust Stack	306522	6184172	62	1.3	8.4	435
PKSW	EPA106	PCI Facility - Stacks Serving Depressurising Bag Filters	306479	6184180	55	0.5	8.1	404
PKSW	EPA107	Sinter Plant Waste Gas Cleaning	306678	6184361	100	6.5	16.7	414
PKSW	EPA108	Scrap Cutting Dust Collector Baghouse	305238	6184349	15	1.0	10.5	337
PKSW	EPA113	Ecocem Slag Dryer Dust Collector	305813	6185928	10	0.8	14.5	375
PKSW	EPA115	Metserv Iron Dumping/Cutting Shed Baghouse Stack	303749	6185549	20	1.6	12.3	315
PKSW	EPA117	No 1, 2 & 3 Slab Caster Stacks	305545	6184614	40	0.4	50.0	330
PKSW	EPA117A	No 1, 2 & 3 Slab Caster Stacks	305608	6184577	40	0.4	50.0	330
PKSW	EPA117B	No 1, 2 & 3 Slab Caster Stacks	305580	6184588	40	0.4	50.0	330
PKSW	EPA117C	No 1, 2 & 3 Slab Caster Stacks	305573	6184591	40	0.4	50.0	330
5BF	EPA118	No 5 Blast Furnace Casthouse Dedusting Stack	305737	6184700	22	2.8	17.0	335
PKSW	EPA120	No 2 Walking Beam Furnace Stack	305158	6185464	45	3.1	10.1	548
PKSW	EPA132	OzRock Rotary Kiln Drier Stack	305255	6183450	25	0.6	16.0	358
PKSW	EPA138	No2 Blower Station Package Boiler No. 11	306139	6184395	30	1.9	4.5	397
PKSW	EPA139	No2 Blower Station Package Boiler No. 12	306150	6184408	30	1.9	4.5	397
PKSW	EPA44[2]	COG Flare Stacks (42" Bleeder)	306189	6184159	57	0.6	20.0	1273
PKSW	EPA45[2]	COG Flare Stacks (30" Bleeder)	305762	6183599	29	0.8	20.0	1273
5BF	EPA42A[2]	BFG Flare Stack A	305931	6184598	85	1.6	20.0	1273
5BF	EPA42B[2]	BFG Flare Stack B	305920	6184591	85	1.6	20.0	1273
5BF	EPA42C[2]	BFG Flare Stack C	305931	6184587	85	0.9	20.0	1273
PKSW		Gas Processing VRS Outlet (Nº5 WHS)	306454	6183941	90	0.5	2.9	348
PKSW	SP05	Springhill 5 (MCL1 Selas Stack)	304730	6184908	39	1.6	5.6	479

[2] Due to modelling constraints, model default velocity and temperature were adopted for flare sources

Scenario	ID	Description	Source properties					
			X coordinate (m)	Y coordinate (m)	Stack height (m)	Diameter (m)	Exhaust velocity (m/s)	Exhaust temperature (K)
PKSW	SP06	Springhill 6 (MCL2 Selas Stack)'	304740	6184906	39	1.7	13.0	813
PKSW	SP07	Springhill 7 (MCL2 Selas Stack)	304759	6184912	28	1.5	9.9	1440
PKSW	SP09	Springhill 9 (MCL2 Passivation Stack)	304741	6184789	10	0.4	6.3	307
PKSW	SP10	Springhill 10 (MCL1 Passivation Exhaust)	304712	6184810	10	0.4	9.9	296
PKSW	SP12	Springhill 12 (CPL3 Prime Oven Incinerator)	304682	6184902	35	1.2	11.3	650
PKSW	SP13	Springhill 13 (CPL3 Finish Oven Incinerator)	304682	6184899	35	1.2	14.8	641
6BF	EPA43	6BF BFG excess gas bleeder stack A	306128	6184517	88	1.6	20.0	1273
6BF		6BF BFG excess gas bleeder stack B	306131	6184514	88	1.6	20.0	1273
6BF		6BF Slag Granulation Cooling Tower	306053	6184172	35	15.6	3.8	323

Table 6.6 Mass emission rates for stack sources

Scenario	ID	Description	Pollutant emission rates (g/s)				
			TSP	PM_{10}	SO_2	NOx	H_2S
PKSW	EPA002	Sinter Machine Room Dedusting Stack	1.1	0.64			
6BF	EPA003	No 6 Blast Furnace Stove Heating Stack	1.1	0.85	20	6.1	0.02
6BF	EPA004	No 6 Blast Furnace Cast House Dedusting Stack	3.7	1.6			
6BF	EPA005	No 6 Blast Furnace Stock House Dedusting Stack	3	0.59			
PKSW	EPA006	No 6 Blast Furnace Highline Dedusting Stack	0.036	0.036			
5BF	EPA007	No 5 Blast Furnace Stove Heating Stack	0.88	0.29	23	9.8	
5BF	EPA008	No 5 Blast Furnace Cast House Dedusting Stack 1	0.68	0.3			
5BF	EPA009	No 5 Blast Furnace Stock House Dedusting Stack	1.4	0.28			
5BF	EPA010	No 5 Blast Furnace - No 2 Slag Granulator Stack		0.13			0.16
5BF	EPA011	No 5 Blast Furnace - No 1 Slag Granulator Stack		0.13			0.16
5BF	EPA129	No 5 Blast Furnace - No 3 Slag Granulator Stack		0.13			0.16
PKSW	EPA014	No 5 Coke Oven Battery Heating Stack	0.84	0.46	6.3	20	0.0017
PKSW	EPA015	No 6 Coke Oven Battery Heating Stack	1.9	1.2	7.4	24	0.0024
PKSW	EPA016	No 7a Coke Oven Battery Heating Stack	1.1	0.76	10	17	0.0019
PKSW	EPA018	No 4/5 Coke Oven Battery Quench Tower Stack	2.4	0.37	0.14	0.08	0.24
PKSW	EPA019	No 6 Coke Oven Battery Quench Tower Stack	3.4	0.53	0.2	0.12	0.24
PKSW	EPA020	No 7a Coke Oven Battery Quench Tower Stack	3.2	0.5	0.19	0.11	0.24
PKSW	EPA021	No 7a Battery Fume Suppression Plant No 1 Stack	0.051	0.033	0.45	0.13	0.0089
PKSW	EPA022	No 7a Battery Fume Suppression Plant No 2 Stack	0.051	0.033	0.45	0.13	0.0089
PKSW	EPA023	Coke Screen House Dedusting Stack	0.25	0.2			
PKSW	EPA024	BOS No 1 Vessel Flare Stack	0.16	0.16	0.045	0.52	0.00091
PKSW	EPA025	BOS No 2 Vessel Flare Stack	0.33	0.33	0.04	0.52	0.00091
PKSW	EPA027	BOS No 2 Secondary Dedusting Stack	0.68	0.21	1.3	0.61	
PKSW	EPA030	Lime Kiln Waste Heat Stack	0.15	0.077	3.9	7.1	
PKSW	EPA031	Lime Kiln Storage bins - Enacon Baghouse Stack	0.037	0.023			
PKSW	EPA032	Lime Kiln Storage bins - Bahco Baghouse Stack	0.019	0.011			
PKSW	EPA033	Lime Kiln Transfer House Stack	0.0015	0.00072			
PKSW	EPA035	Raw Material Road Rail Dump Station Stack	0.26	0.063			
PKSW	EPA038	No 2 Blower Station 23 Boiler Stack	0.57	0.18	13	5.4	
PKSW	EPA039	No 2 Blower Station 24 Boiler Stack	0.57	0.18	13	5.4	
PKSW	EPA040	No 2 Blower Station 25 Boiler Stack	0.28	0.28	20	9.5	
PKSW	EPA047	No 1 Walking Beam Furnace Stack	0.11	0.1	13	7.2	
PKSW	EPA048	3500mm Furnace No 1 Stack	0.028	0.028	3.6	1.9	
PKSW	EPA049	3500mm Furnace No 2 Stack	0.028	0.028	3.6	1.9	
PKSW	EPA052	GEGA M/C Cut to Length Stack	0.07	0.06	0.05	0.04	
PKSW	EPA076	No 4/5 Battery Fume Control Stack	0.037	0.032	0.21	0.11	0.0062
PKSW	EPA077	No 6 Battery Fume Control Stack	0.037	0.032	0.21	0.11	0.0062
PKSW	EPA090	No 5 & 6 Hammer Mills Dedusting Stack	0.045	0.022			
PKSW	EPA092	CAS Baghouse Stack	0.022	0.021			
PKSW	EPA093	Lime Kiln Discharge Building Baghouse Stack	0.1	0.014		1.2	
PKSW	EPA100	Gas Processing Sulphate Plant Stack	0.066	0.045			

Scenario	ID	Description	Pollutant emission rates (g/s)				
			TSP	PM_{10}	SO_2	NOx	H_2S
PKSW	EPA105	PCI Hot Gas Exhaust Stack	0.053	0.033			
PKSW	EPA106	PCI Facility - Stacks Serving Depressurising Bag Filters	0.0056	0.014			
PKSW	EPA107	Sinter Plant Waste Gas Cleaning	1.2	0.84	46	82	
PKSW	EPA113	Ecocem Slag Dryer Dust Collector		0.074		0.051	
PKSW	EPA115	Metserv Iron Dumping/Cutting Shed Baghouse Stack	0.086	0.046		0.1	
PKSW	EPA117	No 1, 2 & 3 Slab Caster Stacks	0.21	0.18			
PKSW	EPA117A	No 1, 2 & 3 Slab Caster Stacks	0.21	0.18			
PKSW	EPA117B	No 1, 2 & 3 Slab Caster Stacks	0.21	0.18			
PKSW	EPA117C	No 1, 2 & 3 Slab Caster Stacks	0.21	0.18			
5BF	EPA118	No 5 Blast Furnace Casthouse Dedusting Stack	0.85	0.36			
PKSW	EPA120	No 2 Walking Beam Furnace Stack	0.55	0.55	15	8	
PKSW	EPA132	OzRock Rotary Kiln Drier Stack	0.27				
PKSW	EPA138	No2 Blower Station Package Boiler No. 11	0.00051	0.00038	0.0026	0.039	0.00079
PKSW	EPA139	No2 Blower Station Package Boiler No. 12	0.00051	0.00038	0.0026	0.039	0.00079
PKSW	EPA44	COG Flare Stacks (42" Bleeder)	0.022	0.022	2.9	0.38	
PKSW	EPA45	COG Flare Stacks (30" Bleeder)	0.022	0.022	2.9	0.38	
5BF	EPA42A	BFG Flare Stack A	0.047	0.0095	0.32	0.012	
5BF	EPA42B	BFG Flare Stack B	0.047	0.0095	0.32	0.012	
5BF	EPA42C	BFG Flare Stack C	0.047	0.0095	0.32	0.012	
PKSW		Gas Processing VRS Outlet (Nº5 WHS)	0.00094	0.00094	0.0098		0.038
PKSW	SP05	Springhill 5 (MCL1 Selas Stack)				0.16	
PKSW	SP06	Springhill 6 (MCL2 Selas Stack)'				0.25	
PKSW	SP07	Springhill 7 (MCL2 Selas Stack)				0.11	
PKSW	SP09	Springhill 9 (MCL2 Passivation Stack)	0.0017	0.0031			
PKSW	SP10	Springhill 10 (MCL1 Passivation Exhaust)	0.000021				
PKSW	SP12	Springhill 12 (CPL3 Prime Oven Incinerator)	0.03	0.03	0.31	0.19	
PKSW	SP13	Springhill 13 (CPL3 Finish Oven Incinerator)	0.05	0.05	0.058	0.29	
6BF	EPA43	6BF BFG excess gas bleeder stack A	0.14	0.029	0.96	0.036	
6BF		6BF BFG excess gas bleeder stack B	0.14	0.029	0.96	0.036	
6BF		6BF Slag Granulation Cooling Tower					0.48

Table 6.7 Source properties for fugitive sources

Scenario	ID	Description	Source properties								
			Source type	X coordinate (m)	Y coordinate (m)	Stack or volume height (m)	Diameter (m)	Exhaust velocity (m/s)	Exhaust temperature (K)	Sigma Y (m)	Sigma Z (m)
PKSW	SINTC01	Sinter Cooler Fugitive Emissions 01	POINT	306521.7	6184365.07	10.0	6.2	4.0	579		
PKSW	SINTC02	Sinter Cooler Fugitive Emissions 02	POINT	306517.7	6184368.07	10.0	6.2	4.0	579		
PKSW	SINTC03	Sinter Cooler Fugitive Emissions 03	POINT	306514.7	6184372.07	10.0	6.2	3.0	487		
PKSW	SINTC04	Sinter Cooler Fugitive Emissions 04	POINT	306512.7	6184377.07	10.0	6.2	3.0	487		
PKSW	SINTC05	Sinter Cooler Fugitive Emissions 05	POINT	306512.7	6184383.07	10.0	6.2	3.0	487		
PKSW	SINTC06	Sinter Cooler Fugitive Emissions 06	POINT	306514.7	6184388.07	10.0	6.2	3.0	487		
PKSW	SINTC07	Sinter Cooler Fugitive Emissions 07	POINT	306517.7	6184392.07	10.0	6.2	3.4	459		
PKSW	SINTC08	Sinter Cooler Fugitive Emissions 08	POINT	306522.7	6184396.07	10.0	6.2	3.4	459		
PKSW	SINTC09	Sinter Cooler Fugitive Emissions 09	POINT	306527.7	6184397.07	10.0	6.2	3.4	459		
PKSW	SINTC10	Sinter Cooler Fugitive Emissions 10	POINT	306532.7	6184397.07	10.0	6.2	3.4	459		
PKSW	SINTC11	Sinter Cooler Fugitive Emissions 11	POINT	306537.7	6184396.07	10.0	6.2	1.6	409		
PKSW	SINTC12	Sinter Cooler Fugitive Emissions 12	POINT	306542.7	6184392.07	10.0	6.2	1.6	409		
PKSW	SINTC13	Sinter Cooler Fugitive Emissions 13	POINT	306545.7	6184388.07	10.0	6.2	1.6	409		
PKSW	SINTC14	Sinter Cooler Fugitive Emissions 14	POINT	306527.7	6184363.07	10.0	6.2	4.0	579		
PKSW	SINTV01	Sinter Building Fugitive Emissions 01	VOLUME	306570.4	6184351.6	10.0				9.3	9.3
PKSW	SINTV02	Sinter Building Fugitive Emissions 02	VOLUME	306600	6184329.3	10.0				9.3	9.3
PKSW	SINTV03	Sinter Building Fugitive Emissions 03	VOLUME	306629.7	6184303.7	10.0				9.3	9.3
PKSW	BOS01	BOS01 Roof Vent Fugitive Emissions	VOLUME	305566	6184702	41.2				3.7	1.2
PKSW	BOS02	BOS02 Roof Vent Fugitive Emissions	VOLUME	305543	6184713	41.2				3.7	1.2
PKSW	BOS03	BOS03 Roof Vent Fugitive Emissions	VOLUME	305511	6184728	41.2				3.7	1.2
PKSW	CRSH	Crusher	VOLUME	306870	6184188	2.5				1.2	2.3
PKSW	HMP01	Hot Metal Pit 01	VOLUME	303856	6185603	2.5				12.0	2.3
PKSW	HMP02	Hot Metal Pit 02	VOLUME	303914	6185602	2.5				12.0	2.3
PKSW	HMP03	Hot Metal Pit 03	VOLUME	303980	6185603	2.5				12.0	2.3
PKSW	HMP04	Hot Metal Pit 04	VOLUME	304033	6185603	2.5				12.0	2.3
PKSW	HMP05	Hot Metal Pit 05	VOLUME	304099	6185603	2.5				12.0	2.3
PKSW	MHND	Materials Handling - VE	VOLUME	306856	6184063	5.0				2.3	4.7

Scenario	ID	Description	Source properties								
			Source type	X coordinate (m)	Y coordinate (m)	Stack or volume height (m)	Diameter (m)	Exhaust velocity (m/s)	Exhaust temperature (K)	Sigma Y (m)	Sigma Z (m)
PKSW	CSP1	Recycling Area - Crushing/Screening Plant 01 - VE	VOLUME	304217	6185047	2.5				27.7	2.3
PKSW	CSP2	Recycling Area - Crushing/Screening Plant 02 - VE	VOLUME	304164	6185136	2.5				27.7	2.3
PKSW	MRP	Recycling Area - Metal Recovery Plant - VE	VOLUME	303998	6185792	2.5				25.4	2.3
PKSW	SCP	Slag Cooling Pot	VOLUME	305661	6184730	2.5				7.7	2.3
PKSW	SSP01	Slag Stockpile 01	VOLUME	305596	6184814	2.5				4.7	2.3
PKSW	SSP02	Slag Stockpile 02	VOLUME	305616	6184804	2.5				4.7	2.3
PKSW	SSP03	Slag Stockpile 03	VOLUME	305637	6184792	2.5				4.7	2.3
PKSW	SSP04	Slag Stockpile 04	VOLUME	305658	6184781	2.5				4.7	2.3
PKSW	SPBLG	Springhill Building Fugitives	VOLUME	304773	6185005	8.9				26.5	46.2
PKSW	B4STD	Battery 4 (standpipe emissions)	POINT	306350	6183817	15.0	0.5	6.0	923		
PKSW	B5STD	Battery 5 (standpipe emissions)	POINT	306455	6183877	15.0	0.5	6.0	923		
PKSW	B6STD	Battery 6 (standpipe emissions)	POINT	306572	6183947	15.0	0.5	6.0	923		
PKSW	B7STD	Battery 7A (standpipe emissions)	POINT	306626	6184097	15.0	0.5	6.0	923		
5BF	BF5SPIT1	Blast Furnace 5 Slag Pit 1	VOLUME	305740	6184774	2.5				3.5	2.3
5BF	BF5SPIT2	Blast Furnace 5 Slag Pit 2	VOLUME	305791	6184801	2.5				3.5	2.3
6BF	BF6SPIT1	Blast Furnace 6 Slag Pit 1	VOLUME	305881	6184279	5.0				13.7	4.7
6BF	BF6SPIT2	Blast Furnace 6 Slag Pit 2	VOLUME	305807	6184344	5.0				13.7	4.7
6BF	BF6SPIT3	Blast Furnace 6 Slag Pit 3	VOLUME	305968	6184236	5.0				13.7	4.7
6BF	BF6SPIT4	Blast Furnace 6 Slag Pit 4	VOLUME	305925	6184255	5.0				13.7	4.7
6BF	BF6SPIT5	Blast Furnace 6 Slag Pit 5	VOLUME	305843	6184312	5.0				6.8	2.3
PKSW	DG01	Diffuse gas COG, BFG & NG EF's 01	VOLUME	306291.52	6183877.23	1.0				4.7	0.5
PKSW	DG02	Diffuse gas COG, BFG & NG EF's 02	VOLUME	306334.84	6183894	1.0				4.7	0.5
PKSW	GPF01	Gas Processing Fugitives01	VOLUME	305843.82	6183726.98	1.0				11.6	0.5
PKSW	GPF02	Gas Processing Fugitives02	VOLUME	306243.07	6183941.56	1.0				11.6	0.5
PKSW	GPF03	Gas Processing Fugitives03	VOLUME	306608.9	6184145.58	1.0				11.6	0.5
PKSW	GPF04	Gas Processing Fugitives04	VOLUME	306044.33	6184458.65	1.0				11.6	0.5
PKSW	GPF05	Gas Processing Fugitives05	VOLUME	305528.99	6184701.36	1.0				11.6	0.5
PKSW	GPF06	Gas Processing Fugitives06	VOLUME	305319.72	6185124.59	1.0				11.6	0.5
PKSW	GPF07	Gas Processing Fugitives07	VOLUME	305373.63	6185636.73	1.0				11.6	0.5
PKSW	GPF08	Gas Processing Fugitives08	VOLUME	305461.23	6186078.12	1.0				11.6	0.5
PKSW	COF01	Coke Ovens Fugitives01	VOLUME	306444.43	6183871.87	1.0				4.7	0.5
PKSW	COF02	Coke Ovens Fugitives02	VOLUME	306538.94	6183928.09	1.0				4.7	0.5
PKSW	COF03	Coke Ovens Fugitives03	VOLUME	306630.2	6183983.09	1.0				4.7	0.5
PKSW	COF04	Coke Ovens Fugitives04	VOLUME	306573.98	6184064.16	1.0				4.7	0.5
PKSW	COF05	Coke Ovens Fugitives05	VOLUME	306613.08	6184085.75	1.0				4.7	0.5

Table 6.8 Mass emission rates for fugitive sources

Scenario	ID	Description	Pollutant emission rates (g/s)				
			TSP	PM_{10}	SO_2	NOx	H_2S
PKSW	SINTC01	Sinter Cooler Fugitive Emissions 01	0.14	0.033			
PKSW	SINTC02	Sinter Cooler Fugitive Emissions 02	0.14	0.033			
PKSW	SINTC03	Sinter Cooler Fugitive Emissions 03	0.14	0.033			
PKSW	SINTC04	Sinter Cooler Fugitive Emissions 04	0.14	0.033			
PKSW	SINTC05	Sinter Cooler Fugitive Emissions 05	0.14	0.033			
PKSW	SINTC06	Sinter Cooler Fugitive Emissions 06	0.14	0.033			
PKSW	SINTC07	Sinter Cooler Fugitive Emissions 07	0.14	0.033			
PKSW	SINTC08	Sinter Cooler Fugitive Emissions 08	0.14	0.033			
PKSW	SINTC09	Sinter Cooler Fugitive Emissions 09	0.14	0.033			
PKSW	SINTC10	Sinter Cooler Fugitive Emissions 10	0.14	0.033			
PKSW	SINTC11	Sinter Cooler Fugitive Emissions 11	0.14	0.033			
PKSW	SINTC12	Sinter Cooler Fugitive Emissions 12	0.14	0.033			
PKSW	SINTC13	Sinter Cooler Fugitive Emissions 13	0.14	0.033			
PKSW	SINTC14	Sinter Cooler Fugitive Emissions 14	0.14	0.033			
PKSW	SINTV01	Sinter Building Fugitive Emissions 01	0.14	0.033			
PKSW	SINTV02	Sinter Building Fugitive Emissions 02	0.14	0.033			
PKSW	SINTV03	Sinter Building Fugitive Emissions 03	0.14	0.033			
PKSW	BOS01	BOS01 Roof Vent Fugitive Emissions	4.3	0.8			
PKSW	BOS02	BOS02 Roof Vent Fugitive Emissions	4.3	0.8			
PKSW	BOS03	BOS03 Roof Vent Fugitive Emissions	4.3	0.8			
PKSW	CRSH	Crusher	1	0.42			
PKSW	HMP01	Hot Metal Pit 01	0.002	0.0016			
PKSW	HMP02	Hot Metal Pit 02	0.002	0.0016			
PKSW	HMP03	Hot Metal Pit 03	0.002	0.0016			
PKSW	HMP04	Hot Metal Pit 04	0.002	0.0016			
PKSW	HMP05	Hot Metal Pit 05	0.002	0.0016			
PKSW	MHND	Materials Handling - VE	0.039	0.039			
PKSW	CSP1	Recycling Area - Crushing/Screening Plant 01 - VE	0.27	0.14			
PKSW	CSP2	Recycling Area - Crushing/Screening Plant 02 - VE	0.27	0.14			
PKSW	MRP	Recycling Area - Metal Recovery Plant - VE	0.68	0.35			
PKSW	SCP	Slag Cooling Pot	5.5	2.9			
PKSW	SSP01	Slag Stockpile 01	1.4	0.73			
PKSW	SSP02	Slag Stockpile 02	1.4	0.73			
PKSW	SSP03	Slag Stockpile 03	1.4	0.73			
PKSW	SSP04	Slag Stockpile 04	1.4	0.73			
PKSW	SPBLG	Springhill Building Fugitives	0.059	0.059			
PKSW	B4STD	Battery 4 (standpipe emissions)	0.082	0.082	0.83	0.15	0.0019
PKSW	B5STD	Battery 5 (standpipe emissions)	0.082	0.082	0.83	0.15	0.0019
PKSW	B6STD	Battery 6 (standpipe emissions)	0.082	0.082	0.83	0.15	0.0019
PKSW	B7STD	Battery 7A (standpipe emissions)	0.082	0.082	0.83	0.15	0.0019
5BF	BF5SPIT1	Blast Furnace 5 Slag Pit 1					0.003

Scenario	ID	Description	Pollutant emission rates (g/s)				
			TSP	PM_{10}	SO_2	NOx	H_2S
5BF	BF5SPIT2	Blast Furnace 5 Slag Pit 2					0.003
6BF	BF6SPIT1	Blast Furnace 6 Slag Pit 1					0.0046
6BF	BF6SPIT2	Blast Furnace 6 Slag Pit 2					0.0046
6BF	BF6SPIT3	Blast Furnace 6 Slag Pit 3					0.0046
6BF	BF6SPIT4	Blast Furnace 6 Slag Pit 4					0.0046
6BF	BF6SPIT5	Blast Furnace 6 Slag Pit 5					0.0046
PKSW	DG01	Diffuse gas COG, BFG & NG EF's 01	0.044	0.022	0.99	0.79	
PKSW	DG02	Diffuse gas COG, BFG & NG EF's 02	0.044	0.022	0.99	0.79	
PKSW	GPF01	Gas Processing Fugitives01					0.0011
PKSW	GPF02	Gas Processing Fugitives02					0.0011
PKSW	GPF03	Gas Processing Fugitives03					0.0011
PKSW	GPF04	Gas Processing Fugitives04					0.0011
PKSW	GPF05	Gas Processing Fugitives05					0.0011
PKSW	GPF06	Gas Processing Fugitives06					0.0011
PKSW	GPF07	Gas Processing Fugitives07					0.0011
PKSW	GPF08	Gas Processing Fugitives08					0.0011
PKSW	COF01	Coke Ovens Fugitives01	0.63	0.32	0.92	0.13	0.013
PKSW	COF02	Coke Ovens Fugitives02	0.63	0.32	0.92	0.13	0.013
PKSW	COF03	Coke Ovens Fugitives03	0.63	0.32	0.92	0.13	0.013
PKSW	COF04	Coke Ovens Fugitives04	0.63	0.32	0.92	0.13	0.013
PKSW	COF05	Coke Ovens Fugitives05	0.63	0.32	0.92	0.13	0.013

6.4 Comparison of existing to future emissions

A comparison of emissions to air for the existing and future scenarios is provided in Table 6.9.

To simplify data interpretation and for comparative purposes, emissions were summarised by the following classifications:

- Source type:
  - Stack sources
  - Fugitive sources
  - All sources
- Scenario:
  - **PKSW** – sources that are unaffected by the project that occur during the existing scenario and will continue to occur during the future scenario (i.e. background emissions from the remainder of plant)
  - **5BF** – source related to 5BF operation only (i.e. emissions from 5BF only)
  - **6BF** – sources related to the project (6BF) operation only (i.e. emissions from 6BF only)
  - **Existing** – includes PKSW sources and 5BF sources (i.e. the current PKSW plant operation including 5BF)
  - **Future** – includes PKSW sources and 6BF sources (i.e. the future PKSW plant operation including the relined 6BF)

The comparison between existing and future scenarios identified the following trends with regard to pollutant mass emission rates:

- Particulate – minor increase (~7% increase) in particulate emissions. This is attributed to increased particulate emissions from 6BF stack sources (6BF stove heating stack, 6BF cast house dedusting stack, 6BF stockhouse dedusting stack). It is noted that emission rates from 6BF stack sources were estimated based on historic sampling data during the previous 6BF campaign. It is considered likely that upgrades to 6BF as part of the project will result in an improvement (reduction) of emissions to air. The improvements cannot be quantified until the project is operational and sampling can be undertaken. Therefore, using historic sampling data to estimate emissions from 6BF is considered conservative.
- Common gaseous pollutants (SO_2 and NO_x) – slight decrease (~1% decrease) in common gaseous pollutant emissions.
- H_2S – minor increase (~3% increase) in H_2S emissions. This is attributed to use of historic sampling data for 6BF slag pits. It is understood that 6BF slag pits are also larger and more exposed (no buildings for barriers) compared to 5BF slag pits, contributing to the minor increase in expected H_2S emissions.

Table 6.9 Emissions summary

Scenario	Pollutant emission rates (g/s)				
	TSP	PM_{10}	SO_2	NOx	H_2S
Stack sources					
PKSW	21.1	9.1	165.1	194.8	0.78
5BF	3.9	1.7	24.2	9.9	0.48
6BF	8.1	3.1	21.9	6.1	0.50
Existing	25.0	10.7	189.2	204.7	1.27
Future	29.1	12.2	186.9	201.0	1.29
Change from existing to future (%)	16%	13%	-1%	-2%	2%
Fugitive sources					
PKSW	32.1	11.9	9.9	2.82	0.0814
5BF					0.006
6BF					0.0230
Existing	32.1	11.9	9.9	2.82	0.0874
Future	32.1	11.9	9.9	2.82	0.104
Change from existing to future (%)	0%	0%	0%	0%	20%
All sources (stack and fugitive sources)					
Existing	57.2	22.6	199.1	207.5	1.35
Future	61.3	24.1	196.8	203.8	1.39
Change from existing to future (%)	7%	6%	-1%	-2%	3%

6.5 Other than normal operating conditions

During other than normal operating conditions, for example, upset furnace conditions, there may be short periods of higher emissions.

Potential events that may result in higher short term emissions are presented in Table 6.10. These events are difficult to anticipate and the likelihood of any of these occurring is very low; events associated with the bleeders or casthouse floor have a very short duration. Given the short duration, significant ground level impacts at sensitive receptors are not anticipated.

Table 6.10 Potential events with elevated emissions

Plant section	Emission	Duration	Frequency
Bleeders opening	Bleeders opening as a safety mechanism when there is excessive pressure in the furnace, releasing blast furnace gas. Also include steam and particulates.	About 10 seconds	This event will occur during commissioning. On average, bleeders opening occurs twice per year.
Casthouse floor	Elevated particulate matter in significant fugitive emission. Highly visible to community.	From 30 seconds up to 5 minutes	These emissions can occur several times per year however, the secondary dedusting hood is expected to reduce this frequency.
	Local release of BFG through the taphole at the casthouse floor.	From 30 seconds up to 5 minutes	These emissions can occur several times per year however, the secondary dedusting hood is expected to reduce this severity.
Pollution control device	Baghouse trip or extraction hood failure presents a heightened risk of casthouse floor emissions.	Extended period	This is a rare event that may occur during the furnace campaign.
	Failure of filters in baghouse could result in exceedance of licence limits for particulate matter at cast house dedusting or stock house dedusting stacks.	Extended period	This is a rare event that may occur during the furnace campaign.

7. Emissions limit assessment

7.1 Methodology

The emissions limit assessment assessed air emission concentrations from the project against the relevant air emission standard of concentration limits stipulated in the POEO Clean Air Regulation.

Project air emission concentrations were calculated based on pollutant mass emission rates and stack volumetric flowrates provided in the emissions inventory. A review of the POEO Clean Air Regulation identified that standards of concentration listed for Iron and steel: primary production (Group 6) were most appropriate to assess the project. Standards of concentration are listed for TSP, NO_2 and H_2S.

7.2 Emissions limit assessment

The emissions limit assessment was undertaken for the following sources that are proposed as part of the project:

– EPA003 – No 6 Blast Furnace Stove Waste Gas Stack
– EPA004 – No 6 Blast Furnace Cast House Dedusting Stack
– EPA005 – No 6 Blast Furnace Stock House Dedusting Stack

The 6BF BFG excess gas bleeder stack A (EPA43) and 6BF BFG excess gas bleeder stack B are considered to be flare sources (emergency use). No POEO standard of concentration exists for this type of source. Consequently, 6BF BFG excess gas bleeder stack A and B were not considered in the emissions limit assessment. Similarly, no POEO standard of concentration exists for 6BF slag granulation cooling tower and there are significant logistical constraints associated with sampling air emissions from a cooling tower. Therefore, the 6BF slag granulation cooling tower was not considered in the emissions limit assessment.

A summary of normalised exhaust flowrates for project sources is provided in Table 7.1. The findings of the emissions limit assessment are summarised in Table 7.2, noting that concentrations were only shown for pollutants where an applicable standard of concentration exists. For type 1 and 2 substances, mercury and cadmium historical emission sampling of 6BF in 2009 was used as a conservative estimate of emission concentrations.

The project is compliant with the relevant POEO standards of concentration listed for Iron and steel: primary production.

Table 7.1 Normalised exhaust flowrate for project stack sources

ID	Description	Source properties		
		Actual exhaust flowrate (m^3/s)	Actual flowrate to normalised flowrate ratio	Normalised exhaust flowrate (Nm^3/s, 273 K, 101.3 kPa, dry)
EPA003[3]	No 6 Blast Furnace Stove Waste Gas Stack	95.5	1.63	58.4
EPA004	No 6 Blast Furnace Cast House Dedusting Stack	271.2	1.24[4]	218.2
EPA005	No 6 Blast Furnace Stock House Dedusting Stack	200.3	1.12[4]	178.9

[3] A ratio of actual to normalised flowrate was not available for EPA003. BlueScope provided an estimated of exhaust moisture between 6 – 15%. Normalisation calculation were based on an exhaust temperature of 399.5 K, pressure of 101.3 kPa and moisture of 10.5% (average of advised range).
[4] The ratio of actual flowrate to normalised flowrate was determined from the average of historical sampling data

Table 7.2 Summary of emission limit assessment

ID	Description	Pollutant concentration (mg/Nm^3)					
		TSP	NOx	H_2S	Type 1 substances and Type 2 substances (in aggregate)[5]	Cadmium (Cd)[5]	Mercury (Hg)[5]
POEO standard of concentration for Iron and steel: primary production (Group 6)		**50**	**500**	**5**	**1**	**0.2**	**0.2**
EPA003	No 6 Blast Furnace Stove Waste Gas Stack	0.019	0.10	0.0003	-	-	-
EPA004	No 6 Blast Furnace Cast House Dedusting Stack	0.02	-	-	-	-	-
EPA005	No 6 Blast Furnace Stock House Dedusting Stack	0.02	-	-	0.040	0.00042	0.00023

[5] Normalised flowrate calculated based on most recent available sampling data

8. Construction and commissioning air quality assessment

8.1 Construction assessment

A risk-based approach in accordance with IAQM guidance was adopted to assess potential particulate impacts during the construction of the project.

The IAQM guidance recommends a detailed risk assessment be undertaken where there is a human receptor within 350 m, or an ecological receptor within 50 m of the construction footprint, or where there is a human or ecological receptor within 50 m of any haulage routes up to 500 m from the site entrance.

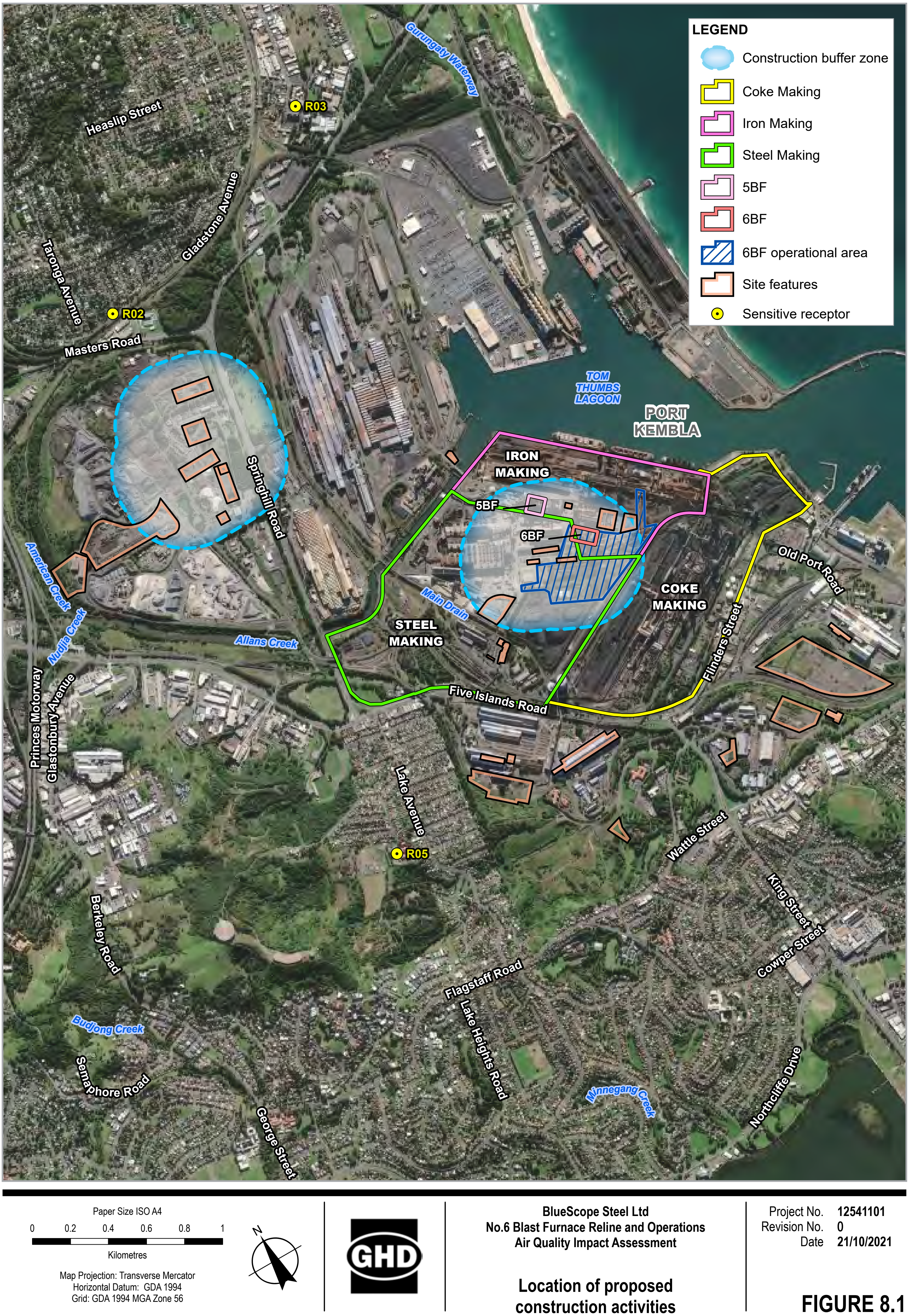
It is noted that construction activities will occur on the eastern portion of the PKSW site away from any identified sensitive receptors. The locations of identified sensitive receptors with respect to the site boundary and the construction activities area are provided in Table 8.1 and a 350 metre buffer distance from the construction areas (No.2 Works 1, No.2 Works 2 and No.2 Works 3) and processing areas (Recycling Area 4 and Recycling Area 5) is shown on Figure 8.1. All sensitive receptors were identified to be located outside the buffer distance (>350 m from construction activities) of the 6BF construction area and ancillary facilities construction areas.

Table 8.1 Location of identified sensitive receptors with respect to construction activities

Receptor ID	Receptor type	Approximate distance and direction from the PKSW boundary	Approximate distance and direction from 6BF construction area	Approximate distance and direction from nearest ancillary facilities construction areas
R01	Residential	~410 m northwest	~3400 m northwest	~640 m northwest
R02	Residential	~180 m north	~2700 m north	~520 m north
R03	Educational	~360 m northwest	~2700 m northwest	~1500 m northwest
R04	Residential	~1630 m west	~4300 m west	~1800 m west
R05	Educational	~460 m west	~1900 m west	~560 m west
R06	Residential	~400 m south	~2200 m south	~490 m south

As all sensitive receptors are located outside the construction area buffer distance (>350 m from construction activities) and particulate emissions during construction are expected to be relatively minor (refer Section 6.1.2), it is considered that there is low risk of particulate impacts and no further assessment is considered necessary in accordance with IAQM guidance.

Emissions to air during construction should be managed and reduced by implementation of the mitigation measures outlined in Section 11.1 to minimise the likelihood and severity of any potential air quality impacts.



BlueScope Steel Ltd
No.6 Blast Furnace Reline and Operations
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Location of proposed construction activities

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FIGURE 8.1

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

8.2 Commissioning assessment

A qualitative management-based approach was adopted to assess project commissioning, as commissioning is a once-off process that is necessary for operations to commence and no commissioning air emissions sampling data was available at the time of this assessment.

During blow-in, runner covers are not initially installed (because the flow characteristics of the initial liquids are variable and require manual intervention) and consequently, there is potential for elevated emissions to air to occur for a relatively short period of time due to the casthouse dedusting system initially operating with a reduced effective capacity. The proposed commissioning procedure aligns with the industry standard approach that is adopted at similar facilities around the world. In addition, best practice methods (refer Section 11) will be implemented to minimise emissions to air where possible.

Due to relatively short duration of commissioning and implementation of industry standard and best practice methods, although the potential impact for any elevated emissions to air cannot be quantified there is considered to be a low risk of potential air quality impacts.

Emissions to air during commissioning should be managed and reduced by implementation of the mitigation measures outlined in Section 11.2 to minimise the likelihood and severity of any potential air quality impacts.

9. Operational air quality assessment

9.1 Operational assessment overview

Air quality dispersion modelling was undertaken to predict potential worst-case scenario air quality impacts from the project in accordance with the methodology outlined in Section 3. The assessment results have been compared with the relevant state and national air quality criteria and standards which exist to protect human health and the environment from air pollution.

The model predictions for existing and future scenarios are presented as tabulated results providing ground level concentrations at each sensitive receptor (with criteria exceedances highlighted) and as contour plots to illustrate the predicted pattern of dispersion and allow interpretation of predicted model results at any location within the sampling grid. The averaging period, statistic/percentile, impact location and impact type presented for each pollutant was chosen to align with assessment criteria (refer Section 2.3.2) for that particular pollutant species.

Predicted pollutant concentrations were presented for the following cases:

– **6BF** – predicted concentrations from 6BF sources only.

– **Incremental** – predicted concentrations from the PKSW site (includes 5BF and PKSW sources for existing scenario and includes 6BF and PKSW sources for future scenario).

– **Cumulative with DPIE AQMS** – cumulative concentrations were calculated using background pollutant concentrations recorded by DPIE AQMS in accordance with Table 5.10. This scenario accounts for potential cumulative impacts with existing facilities (noting inclusion of DPIE AQMS data may conservatively overestimate cumulative impacts by ‘double counting’ the impact from current PKSW operations).

– **Cumulative with DPIE AQMS and SS projects** – cumulative concentrations were calculated using background pollutant concentrations recorded by DPIE AQMS in accordance with Table 5.10 (as above) and contributions from SS projects (refer Section 5.3.2). Contributions from the Port Kembla Gas Terminal project were accounted for by including additional sources in the dispersion model in accordance with scenario 1 presented in *East Coast Gas Project Modification Air Quality Assessment* (GHD, 2019). Scenario 1 was considered the worst-case scenario operational situation that will likely occur, consisting of two gas fuelled engines active on board the Floating Storage and Regasification Unit and two liquid engines active on board the fuelled LNG carrier. This case accounts for potential cumulative impacts with existing facilities and future projects.

The following methodologies specific to a particular pollutant were adopted:

– A contemporaneous approach to calculating cumulative particulate concentrations was adopted. Predicted incremental concentrations were added to recorded daily variable background concentration for the same 24-hour period to calculate predicted cumulative particulate concentration.

– 1 second H_2S concentrations were estimated by applying a peak to mean factor of 2.3. H_2S emissions from slag granulation (5BF slag granulator stacks and 6BF slag granulation cooling tower) were scaled to 60% and H_2S emissions from slag pits (5BF slag pits and 6BF slag pits) were scaled to 40% to align with the typical operating scenario, i.e. the H_2S emissions are spread between the two sources depending on operating conditions at the time. As discussed in Section 10, there are a number of additional processes in place which aim to further reduce H_2S emissions associated with 6BF.

– Chemical transformations were not modelled within CALPUFF, however the ozone limiting method (OLM) which is listed as Method 2 for estimating total NO_2 in the Approved Methods was adopted. Method 1 (Section 8.1.1) in the Approved Methods assumes 100 % of NO will be converted to NO_2. This is considered extremely conservative as in reality, only a fraction of NO will be converted to NO_2. Therefore, a more detailed assessment has been undertaken for all receptors using Method 2 (Section 8.2.2) of the Approved Methods. Method 2 is based on NO reacting with ozone in the atmosphere to form NO_2. Hourly variable background ozone and NO_2 data was sourced from nearby DPIE AQMS in accordance with Table 5.10.

Predicted pollutant concentrations for the existing and future scenarios are presented in Sections 9.2 and 9.3 respectively.

9.2 Existing

9.2.1 Particulates and common gaseous pollutants

Predicted incremental and cumulative particulate concentrations are presented in Table 9.1 and a contour dispersion plot of incremental 24 hour PM_{10} is shown on Figure 9.1. An exceedance of the 24 hour PM_{10} criteria was predicted at R05 for the 'Cumulative with DPIE AQMS and other SS projects' scenario. This predicted exceedance comprised an incremental concentration of 3.6 µg/m^3 and a background concentration of 46.6 µg/m^3 resulting in a cumulative concentration of 50.2 µg/m^3. Therefore, the exceedance was primarily attributed to elevated background concentrations.

Table 9.1 Predicted particulate concentrations (existing scenario)

Receptor	Predicted particulate concentrations (µg/m^3)								
	Incremental			Cumulative with DPIE AQMS			Cumulative with DPIE AQMS and other SS projects		
	TSP	PM_{10}		TSP	PM_{10}		TSP	PM_{10}	
	Annual	24 hour	Annual	Annual	24 hour	Annual	Annual	24 hour	Annual
Criteria	**90**	**50**	**25**	**90**	**50**	**25**	**90**	**50**	**25**
R01	0.6	5.8	0.4	36.9	47.2	18.1	36.9	47.2	18.2
R02	1.1	8.7	0.8	37.4	47.5	18.5	37.4	47.5	18.5
R03	1.5	6.9	0.9	37.7	50.0	18.6	37.7	50.0	18.7
R04	0.4	6.3	0.3	36.7	47.2	18.0	36.7	47.2	18.0
R05	3.1	19.6	1.8	39.4	50.1	19.5	39.4	50.2	19.5
R06	1.9	7.7	1.2	38.1	48.1	18.9	38.1	48.2	19.0

The top 10 ranked cumulative PM_{10} values for the worst impacted receptor (R05) are summarised in Table 9.2. An exceedance of the 24 hour PM_{10} criteria is predicted for one 24 hour period at R05 (equivalent to 0.3% of the time).

Table 9.2 Top 10 ranked cumulative PM_{10} values for R05

Rank	Date of predicted concentration	Breakdown of predicted concentration components (µg/m^3)		
		Incremental	Background	Cumulative
1	20/12/2017	3.6	46.6	50.2
2	10/02/2017	1.7	46.3	48.0
3	19/12/2017	3.8	44.2	48.0
4	24/09/2017	0.3	47.2	47.5
5	09/01/2017	1.6	45.6	47.2
6	13/01/2017	0.8	45.8	46.6
7	26/03/2017	19.6	23.9	43.5
8	17/01/2017	3.3	40.1	43.4
9	13/03/2017	7.4	35.7	43.1
10	02/12/2017	2.5	40.4	42.9

Predicted incremental and cumulative NO_2 concentrations are presented in Table 9.3 and a contour dispersion plot of incremental 1 hour NO_2 is shown on Figure 9.2. No exceedances of the EPA or NEPM assessment criteria were predicted at sensitive receptor locations.

An area of off-site incremental exceedance of the NEPM criteria was predicted to the southeast of PKSW (refer Figure 9.2), near Adaptalift Group warehouse (which is located approximately 30 m southeast of the PKSW boundary).

Table 9.3 Predicted NO_2 concentrations (existing scenario)

Receptor	Predicted NO_2 concentrations (µg/m^3)					
	Incremental		Cumulative with DPIE AQMS		Cumulative with DPIE AQMS and other SS projects	
	1 hour	Annual	1 hour	Annual	1 hour	Annual
EPA criteria	**246**	**62**	**246**	**62**	**246**	**62**
NEPM criteria	**164**	**31**	**164**	**31**	**164**	**31**
R01	75.5	1.5	107.2	13.1	107.2	13.5
R02	77.2	2.8	107.2	14.4	107.2	15.0
R03	71.4	4.4	107.2	16.0	107.2	17.1
R04	62.3	1.2	107.2	12.8	107.2	13.1
R05	92.6	4.7	108.9	16.3	108.9	17.0
R06	68.4	2.6	113.8	14.1	116.2	15.0

Predicted incremental and cumulative SO_2 concentrations are presented in Table 9.4 and a contour dispersion plot of incremental 1 hour SO_2 is shown on Figure 9.3.

Compliance was predicted against the EPA criteria for all sensitive receptors.

The following exceedances of the NEPM criteria were predicted:

– An incremental exceedance of the 1 hour criteria at R06
– Cumulative exceedances of the 1 hour criteria at R05 and R06

An area of off-site incremental exceedance of the EPA criteria was predicted to the southeast of PKSW (refer Figure 9.3), near the Ampol Port Kembla Diesel Stop (which is located approximately 30 m southeast of the PKSW boundary).

The exceedances of the NEPM criteria require interpretation in the context that the 1 hour and 24 hour SO_2 standards were strengthened in the recent revision (May 2021) of the Air NEPM. The 1 hour SO_2 criteria was strengthened from 570 µg/m^3 to 286 µg/m^3 (representing a 50% reduction) while the 24 hour criteria was strengthened from 228 µg/m^3 to 57 µg/m^3 (representing a 75% reduction). The NEPC notes that the strengthened SO_2 standards are now among the tightest in the world.

For assessment purposes, it is considered unrealistic to expect existing industry to be able to comply with the strengthened NEPM SO_2 criteria immediately. It is noted that compliance is predicted when comparing the 1 hour and 24 hour SO_2 predictions against the superseded NEPM criteria.

Therefore, a comparative approach (refer Section 9.4.1) was adopted to assess the relative impact of the project on predicted SO_2 concentrations.

Table 9.4 Predicted SO_2 concentrations (existing scenario)

Receptor	Predicted SO_2 concentrations (µg/m³)					
	Incremental		Cumulative with DPIE AQMS		Cumulative with DPIE AQMS and other SS projects	
	1 hour	24 hour	1 hour	24 hour	1 hour	24 hour
EPA criteria	**570**	**228**	**570**	**228**	**570**	**228**
NEPM criteria	**286**	**57**	**286**	**57**	**286**	**57**
R01	171.1	25.1	171.1	29.6	173.0	30.0
R02	167.5	48.4	167.5	54.1	168.5	54.3
R03	180.4	29.3	233.0	42.9	233.1	43.3
R04	135.9	28.3	135.9	28.3	139.5	29.6
R05	283.1	31.1	285.9	45.4	304.4	46.6
R06	341.9	36.0	341.9	36.0	342.1	36.6

Paper Size ISO A4 0 0.5 1 1.5 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 Air Quality Impact Assessment **Predicted incremental 24 hour PM_{10} concentration for existing scenario ($\mu g/m^3$, 100th percentile)**

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Revision No. 0
Date 14/10/2021

FIGURE 9.1

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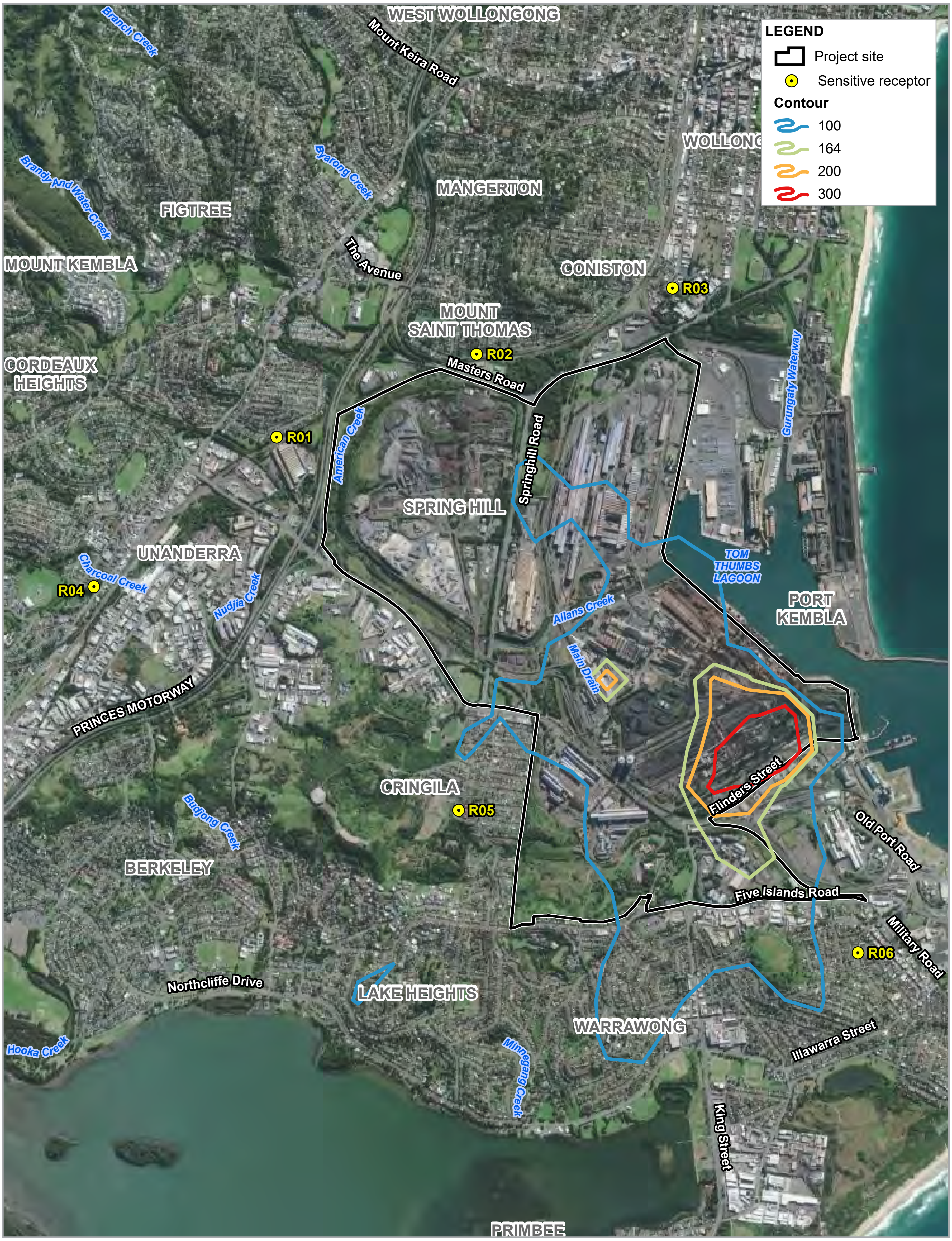

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Kilometres

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
Air Quality Impact Assessment

Predicted incremental 1 hour NO_2 concentration for existing scenario ($\mu g/m^3$, 100th percentile)

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Date 14/10/2021

FIGURE 9.2

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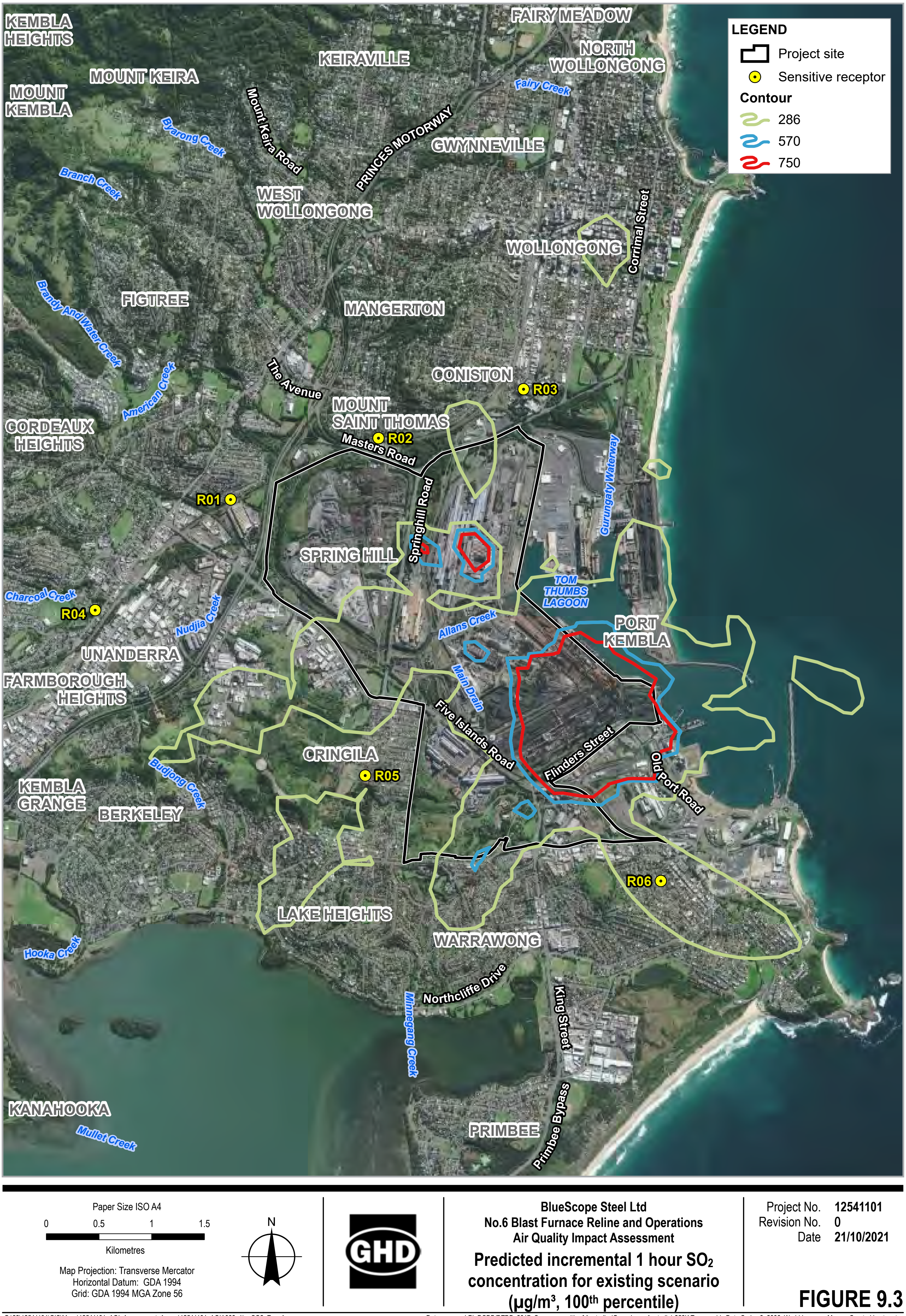

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Air Quality Impact Assessment

Predicted incremental 1 hour SO_2 concentration for existing scenario ($\mu g/m^3$, 100th percentile)

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FIGURE 9.3

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Data source: LPI: DCDB/DTDB, 2017. Commonwealth of Australia (Geoscience Australia) 250K Topographic Data Series 3, 2006. World Imagery: Maxar. Created by: tmorton

9.2.2 Odorous air pollutants (H_2S)

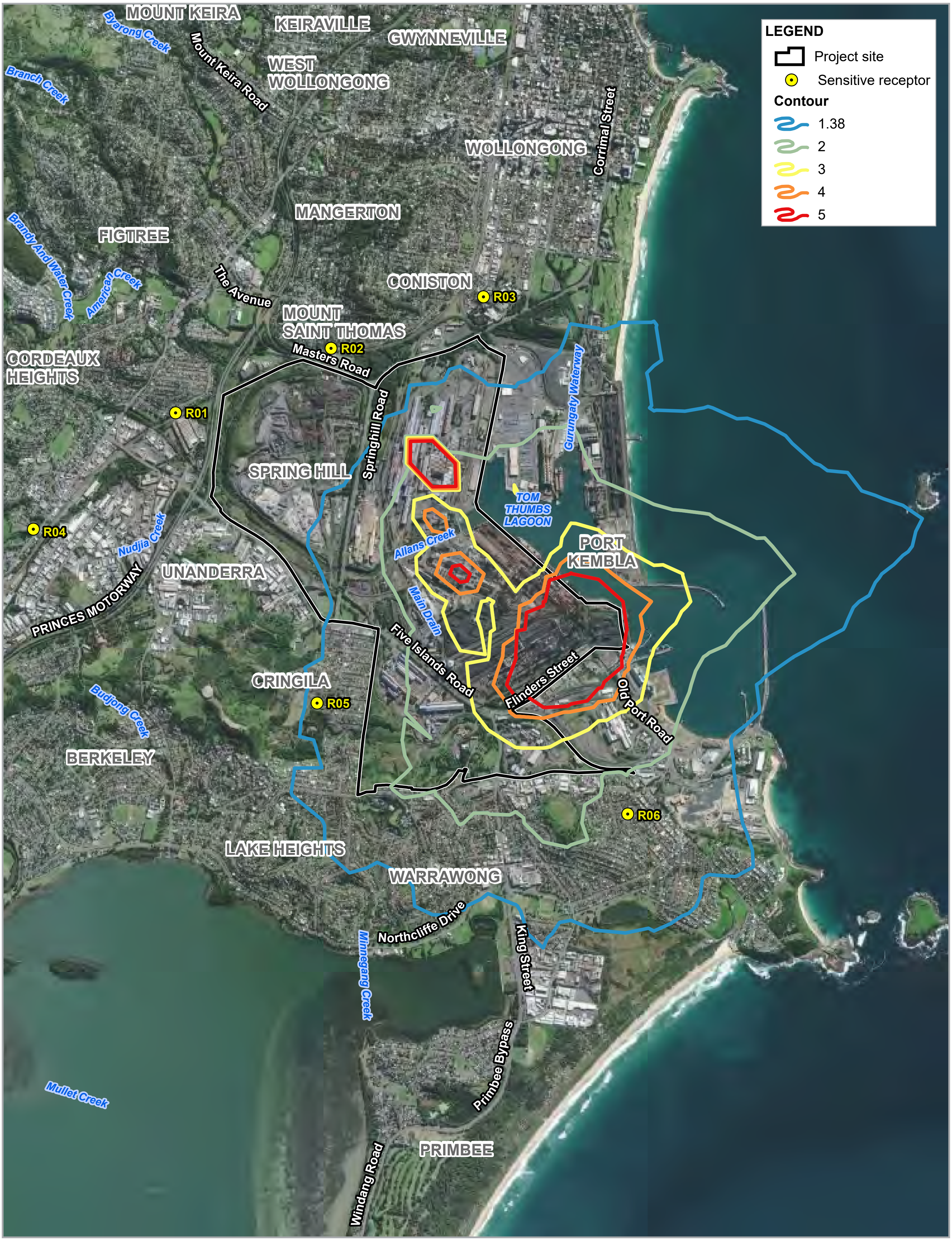
Predicted H_2S concentrations are presented in Table 9.5 and a contour dispersion plot of incremental 1 second H_2S is shown on Figure 9.4. Exceedance of the 1 second H_2S criteria were predicted at R05 and R06. Compliance with the 1 hour criteria was predicted at all sensitive receptors.

An area of off-site incremental exceedance of the 1 second H_2S criteria was predicted to the south and east of PKSW (refer Figure 9.4). The NSW EPA criteria for H_2S (1 second, 99th percentile) allows for 88 hours per year (1% of the time) where the concentration may exceed 1.38 µg/m^3. At receptor R06, the 99th percentile criteria is exceeded, with the model predicting 98 additional hours per year (1.1% of the time) where the concentration is above the criteria level.

As discussed in *BlueScope Steel, Port Kembla Sub-hourly Modelling of Hydrogen Sulphide* (Environ, 2011) and *BlueScope Steel, Port Kembla Site Air Emissions Modelling – PRP131* (Environ, 2012), the 1 second H_2S criteria is considered very stringent and therefore the Californian EPA 1 hour (public welfare) criterion of 42 ug/m^3 was included for comparative purposes. It is noted that this approach was previously submitted to and accepted by the NSW EPA. The predicted maximum 1 hour H_2S concentrations are significantly below the Californian criteria.

Table 9.5 Predicted H_2S concentrations (existing scenario)

Receptor	Predicted H_2S concentrations (µg/m^3)	
Averaging period	**1 second**	**1 hour**
Statistic	**99.9th percentile**	**Maximum**
Impact type	**Incremental**	**Cumulative**
Criteria	**1.38**	**42**
R01	0.68	3.3
R02	0.96	3.5
R03	1.08	3.5
R04	0.59	3.1
R05	1.44	5.4
R06	1.82	4.2



Paper Size ISO A4

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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
Air Quality Impact Assessment

Predicted incremental 1 second H_2S concentration for existing scenario ($\mu g/m^3$, 100th percentile)

Project No. 12541101
Revision No. 0
Date 10/11/2021

FIGURE 9.4

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Print date: 10 Nov 2021 - 15:31

Data source: LPI: DCDB/DTDB, 2017. Commonwealth of Australia (Geoscience Australia) 250K Topographic Data Series 3, 2006. World Imagery: Maxar. Created by: tmorton

9.3 Future

9.3.1 Particulates and common gaseous pollutants

Predicted incremental and cumulative particulate concentrations are presented in Table 9.6 and a contour dispersion plot of incremental 24 hour PM_{10} is shown on Figure 9.5. Exceedance of the 24 hour PM_{10} criteria was predicted at R03 and R05 from the site.

The exceedance at R03 comprised an incremental concentration of 4.5 µg/m^3 and a background concentration of 45.6 µg/m^3 resulting in a cumulative concentration of 50.1 µg/m^3.

The exceedance at R05 comprised an incremental concentration of 3.7 µg/m^3 and a background concentration of 46.6 µg/m^3 resulting in a cumulative concentration of 50.3 µg/m^3.

For both predicted exceedances, the incremental contribution was relatively minor (<10% of assessment criteria) whilst background concentrations were elevated (>90% of assessment criteria). Therefore, the exceedances were primarily attributed to elevated background (off-site) concentrations.

As previously discussed, the background concentration used in the assessment already includes some increment from PKSW therefore the results of this assessment are conservative. The proposed 6BF has a number of additional controls (refer Section 10) when compared to 5BF and additional particulate impacts from the project are considered to be unlikely.

Table 9.6 Predicted particulate concentrations (future scenario)

Receptor	Predicted particulate concentrations (µg/m^3)											
	Incremental						Cumulative					
	Only 6BF sources			All PKSW future sources			Cumulative with DPIE AQMS			Cumulative with DPIE AQMS and other SS projects		
	TSP	PM_{10}		TSP	PM_{10}		TSP	PM_{10}		TSP	PM_{10}	
	Annual	24 hour	Annual	Annual	24 hour	Annual	Annual	24 hour	Annual	Annual	24 hour	Annual
Criteria	**90**	**50**	**25**	**90**	**50**	**25**	**90**	**50**	**25**	**90**	**50**	**25**
R01	0.1	0.6	0.04	0.7	6.1	0.5	36.9	47.2	18.2	36.9	47.2	18.2
R02	0.2	0.8	0.1	1.3	8.8	0.8	37.5	47.5	18.5	37.5	47.5	18.5
R03	0.3	0.7	0.1	1.6	6.8	1.0	37.9	50.1	18.7	37.9	50.2	18.7
R04	0.1	0.6	0.03	0.5	6.4	0.3	36.7	47.2	18.0	36.7	47.2	18.0
R05	0.4	1.3	0.1	3.3	19.7	1.8	39.6	50.2	19.5	39.6	50.3	19.6
R06	0.5	1.1	0.1	2.2	8.1	1.3	38.4	48.3	19.0	38.4	48.4	19.0

The top 10 ranked cumulative PM_{10} values for the worst impacted receptor (R05) are summarised in Table 9.7. An exceedance of the 24 hour PM_{10} criteria is predicted for one 24 hour period at R03 and R05 (equivalent to 0.3% of the time).

Table 9.7 Top 10 ranked cumulative PM_{10} values for R05

Rank	Date of predicted concentration	Breakdown of predicted concentration components (µg/m³)			
		Incremental – only 6BF sources	Increment – All PKSW future sources	Background	Cumulative with DPIE AQMS and other SS projects
1	20/12/2017	0.2	3.7	46.6	50.3
2	10/02/2017	0.0	1.7	46.3	48.0
3	19/12/2017	0.2	3.8	44.2	47.9
4	24/09/2017	0.0	0.3	47.2	47.5
5	09/01/2017	0.2	1.7	45.6	47.3
6	13/01/2017	0.0	0.8	45.8	46.6
7	26/03/2017	0.6	19.7	23.9	43.6
8	17/01/2017	0.0	3.3	40.1	43.4
9	13/03/2017	0.7	7.5	35.7	43.2
10	02/12/2017	0.0	2.3	40.4	42.7

Predicted incremental and cumulative NO_2 concentrations are presented in Table 9.8 and a contour dispersion plot of incremental 1 hour NO_2 is shown on Figure 9.6. No exceedances of the EPA or NEPM assessment criteria were predicted at sensitive receptor locations.

An area of off-site incremental exceedance of the NEPM criteria was predicted in an industrial area to the southeast of PKSW (refer Figure 9.6), near Adaptalift Group warehouse (which is located approximately 30 m southeast of the PKSW boundary). It is noted that the exceedance area predicted for the future scenario is smaller than that for the existing scenario and therefore the project is anticipated to have a beneficial impact on ambient NO_2 concentrations (net reduction) compared to existing operations (refer to Section 9.4 for a detailed comparison between predicted existing and future concentrations).

Table 9.8 Predicted NO_2 concentrations (future scenario)

Receptor	Predicted NO_2 concentrations (µg/m³)							
	Incremental				Cumulative			
	Only 6BF sources		All PKSW future sources		Cumulative with DPIE AQMS		Cumulative with DPIE AQMS and other SS projects	
	1 hour	Annual	1 hour	Annual	1 hour	Annual	1 hour	Annual
EPA criteria	**246**	**62**	**246**	**62**	**246**	**62**	**246**	**62**
NEPM criteria	**164**	**31**	**164**	**31**	**164**	**31**	**164**	**31**
R01	6.8	0.1	75.2	1.5	107.2	13.1	107.2	13.5
R02	7.9	0.1	74.8	2.7	107.2	14.3	107.2	14.9
R03	9.8	0.2	68.2	4.3	107.2	15.8	107.2	17.0
R04	6.3	0.05	60.6	1.2	107.2	12.8	107.2	13.1
R05	13.2	0.2	92.7	4.5	108.9	16.1	108.9	16.8
R06	19.6	0.2	68.3	2.5	113.8	14.1	116.2	15.0

Predicted incremental and cumulative SO_2 concentrations are presented in Table 9.9 and a contour dispersion plot of incremental 1 hour NO_2 is shown on Figure 9.7.

Compliance was predicted against the EPA criteria for all receptors.

The following exceedances of the NEPM criteria were predicted:

– An incremental exceedance of the 1 hour criteria at R06

– Cumulative exceedances of the 1 hour criteria at R06

An area of off-site incremental exceedance of the EPA criteria was predicted in an industrial area to the southeast of PKSW (refer Figure 9.7), near the Ampol Port Kembla Diesel Stop which is located approximately 30 m southeast of the PKSW boundary. It is noted that the exceedance areas predicted for the future scenario are smaller than those predicted for the existing scenario. Therefore the project is anticipated to have a beneficial impact on ambient SO_2 concentrations (net reduction) compared to existing operations (refer to Section 9.4 for a detailed comparison between predicted existing and future concentrations).

The exceedances of the NEPM criteria require interpretation in the context that the 1 hour and 24 hour SO_2 standards were strengthened in the recent revision (May 2021) of the Air NEPM. The 1 hour SO_2 criteria was strengthened from 570 µg/m^3 to 286 µg/m^3 (representing a 50% reduction) while the 24 hour criteria was strengthened from 228 µg/m^3 to 57 µg/m^3 (representing a 75% reduction). The NEPC notes that the strengthened SO_2 standards are now among the tightest in the world.

For assessment purposes, it is considered unrealistic to expect existing industry to be able to comply with the strengthened NEPM SO_2 criteria immediately. It is noted that compliance is predicted when comparing the 1 hour and 24 hour SO_2 predictions against the superseded NEPM criteria.

Therefore, a comparative approach was adopted to assess the relative impact of the project on predicted SO_2 concentrations.

Incremental SO_2 emissions from new sources related to this project only (i.e. 6BF on its own) are well below the EPA and NEPM criteria (refer Table 9.11).

Table 9.9 Predicted SO_2 concentrations (future scenario)

Receptor	Predicted SO_2 concentrations (µg/m^3)							
	Incremental				Cumulative			
	Only 6BF sources		All PKSW future sources		Cumulative with DPIE AQMS		Cumulative with DPIE AQMS and other SS projects	
	1 hour	24 hour	1 hour	24 hour	1 hour	24 hour	1 hour	24 hour
EPA criteria	**570**	**228**	**570**	**228**	**570**	**228**	**570**	**228**
NEPM criteria	**286**	**57**	**286**	**57**	**286**	**57**	**286**	**57**
R01	23.8	3.1	163.3	23.3	166.1	29.4	168.1	29.8
R02	27.7	5.5	150.6	47.1	160.5	52.8	161.0	53.0
R03	34.6	4.3	170.4	28.2	220.2	37.1	220.3	37.4
R04	22.3	3.8	125.5	26.2	134.9	26.2	134.9	27.5
R05	48.6	6.1	232.6	32.1	235.5	42.9	253.9	44.1
R06	66.7	6.1	312.0	35.5	312.0	35.5	312.1	37.1

The top 10 ranked cumulative SO_2 values for the worst impacted receptor (R06) are summarised in Table 9.11. Exceedances of the 1 hour SO_2 criteria are predicted for four 1 hour periods at R06 (equivalent to 0.05% of the time). Predicted 1 hour SO2 concentrations from the project (Incremental – only 6BF sources) are significantly below the EPA and NEPM assessment criterions.

Table 9.10 Top 10 ranked cumulative 1 hour SO_2 values for R06

Rank	Date and hour of predicted concentration	Breakdown of predicted 1 hour SO_2 concentration components ($\mu g/m^3$)			
		Incremental – only 6BF sources	Increment – All PKSW future sources	Background	Cumulative with DPIE AQMS and other SS projects
1	27/05/2017 7:00	66.7	312.0	0.1	**312.1**
2	5/06/2017 19:00	50.2	202.3	5.5	**207.9**
3	2/10/2017 0:00	27.6	184.5	0.1	**184.6**
4	31/01/2017 6:00	29.5	161.5	2.9	**164.4**
5	6/02/2017 3:00	26.0	126.5	34.9	161.4
6	25/07/2017 18:00	29.3	154.9	0.0	154.9
7	4/10/2017 2:00	6.4	129.8	8.9	138.8
8	3/07/2017 3:00	21.1	137.7	0.0	137.7
9	26/04/2017 4:00	23.1	135.4	0.0	135.4
10	16/12/2017 22:00	0.0	0.0	134.4	134.4

Paper Size ISO A4

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Kilometres

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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
Air Quality Impact Assessment

Predicted incremental 24 hour PM_{10} concentration for future scenario ($\mu g/m^3$, 100th percentile)

Project No. 12541101
Revision No. 0
Date 10/11/2021

FIGURE 9.5

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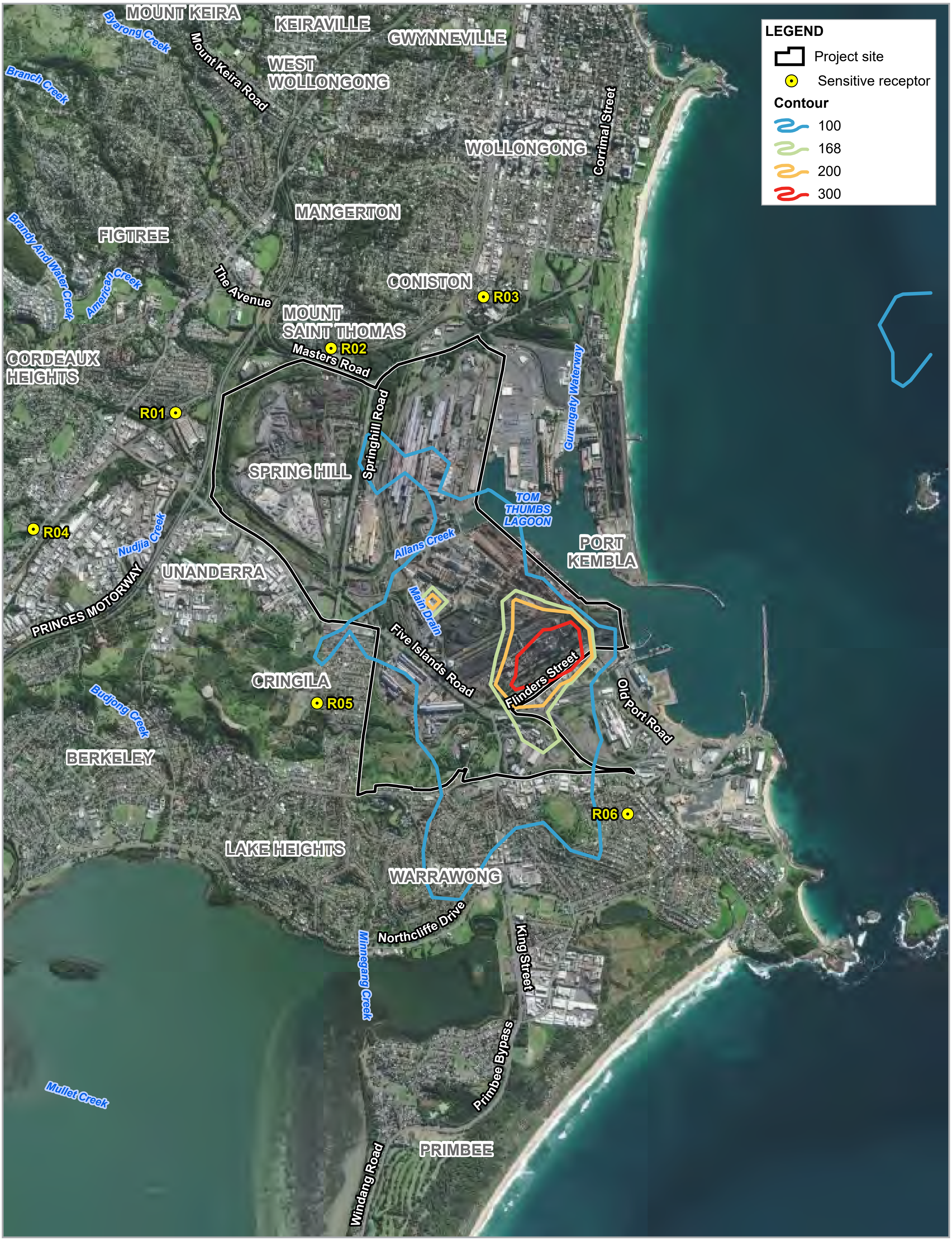

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Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

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BlueScope Steel Ltd
No.6 Blast Furnace Reline and Operations
Air Quality Impact Assessment

Predicted incremental 1 hour NO_2 concentration for future scenario ($\mu g/m^3$, 100th percentile)

Project No. **12541101**
Revision No. **0**
Date **10/11/2021**

FIGURE 9.6

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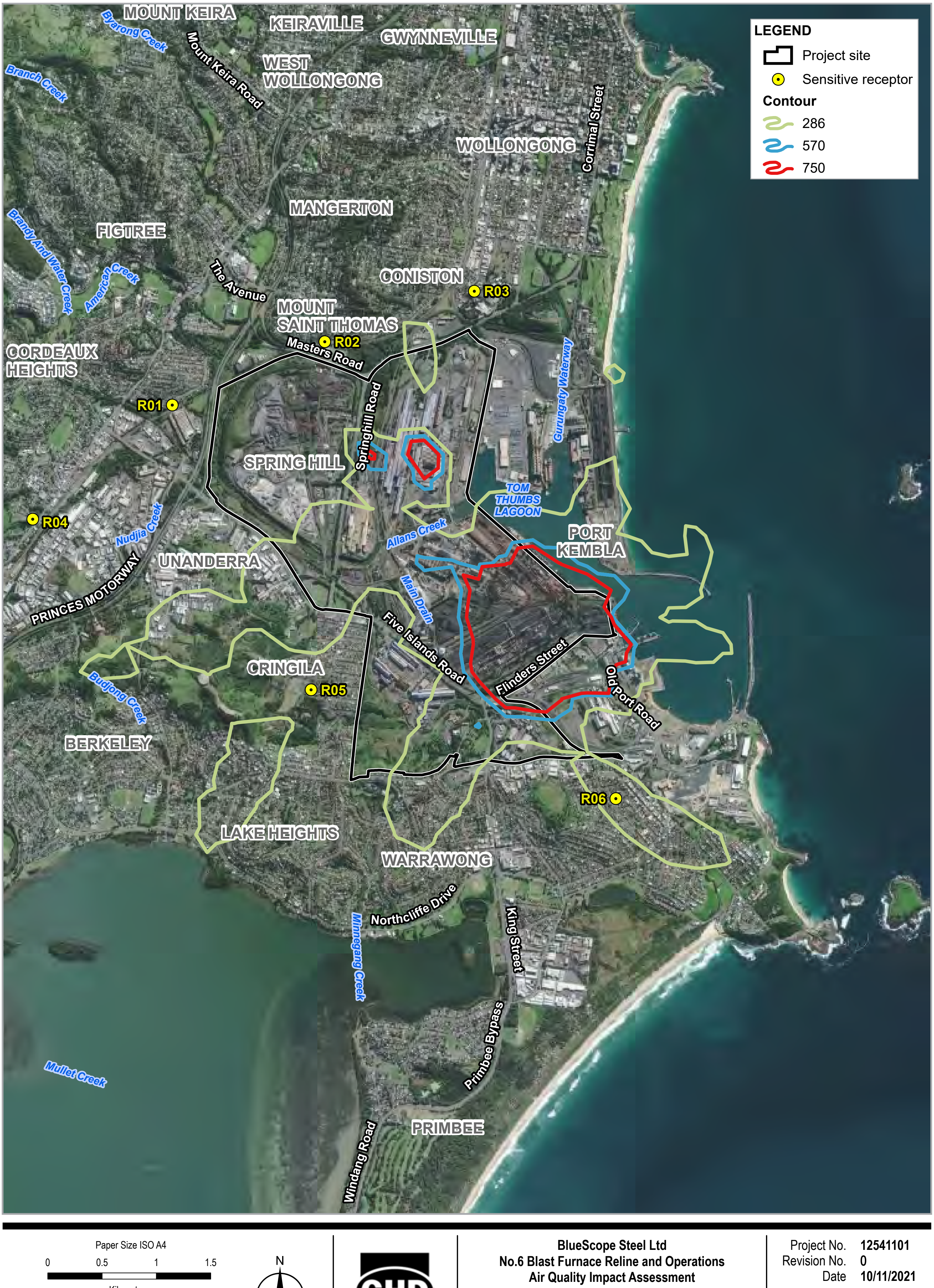

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

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BlueScope Steel Ltd
No.6 Blast Furnace Reline and Operations
Air Quality Impact Assessment

Predicted incremental 1 hour SO_2 concentration for future scenario ($\mu g/m^3$, 100th percentile)

Project No. 12541101
Revision No. 0
Date 10/11/2021

FIGURE 9.7

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Data source: LPI: DCDB/DTDB, 2017. Commonwealth of Australia (Geoscience Australia) 250K Topographic Data Series 3, 2006. World Imagery: Maxar. Created by: tmorton

9.3.2

9.3.2 Odorous air pollutants (H_2S)

Predicted H_2S concentrations are presented in Table 9.11 and a contour dispersion plot of incremental 1 second H_2S is shown on Figure 9.8. A minor exceedance of the 1 second H_2S criteria was predicted at R06, however there has been a reduction in concentration due to this project. As discussed in Section 3.2.1, 6BF is not anticipated to be a source of any other odorous pollutants, consequently only H_2S was considered.

The predicted incremental H_2S concentration, from 6BF only, shows that it contributes about one third of total H_2S emissions at the receptor locations. Given that modelled emissions from 6BF are likely conservative (as discussed in Section 6.3.2), the project is unlikely to lead to offsite odour impacts, and is predicted to reduce odour impacts at the sensitive receptor locations.

Compliance with the 1 hour criteria was predicted at all sensitive receptors.

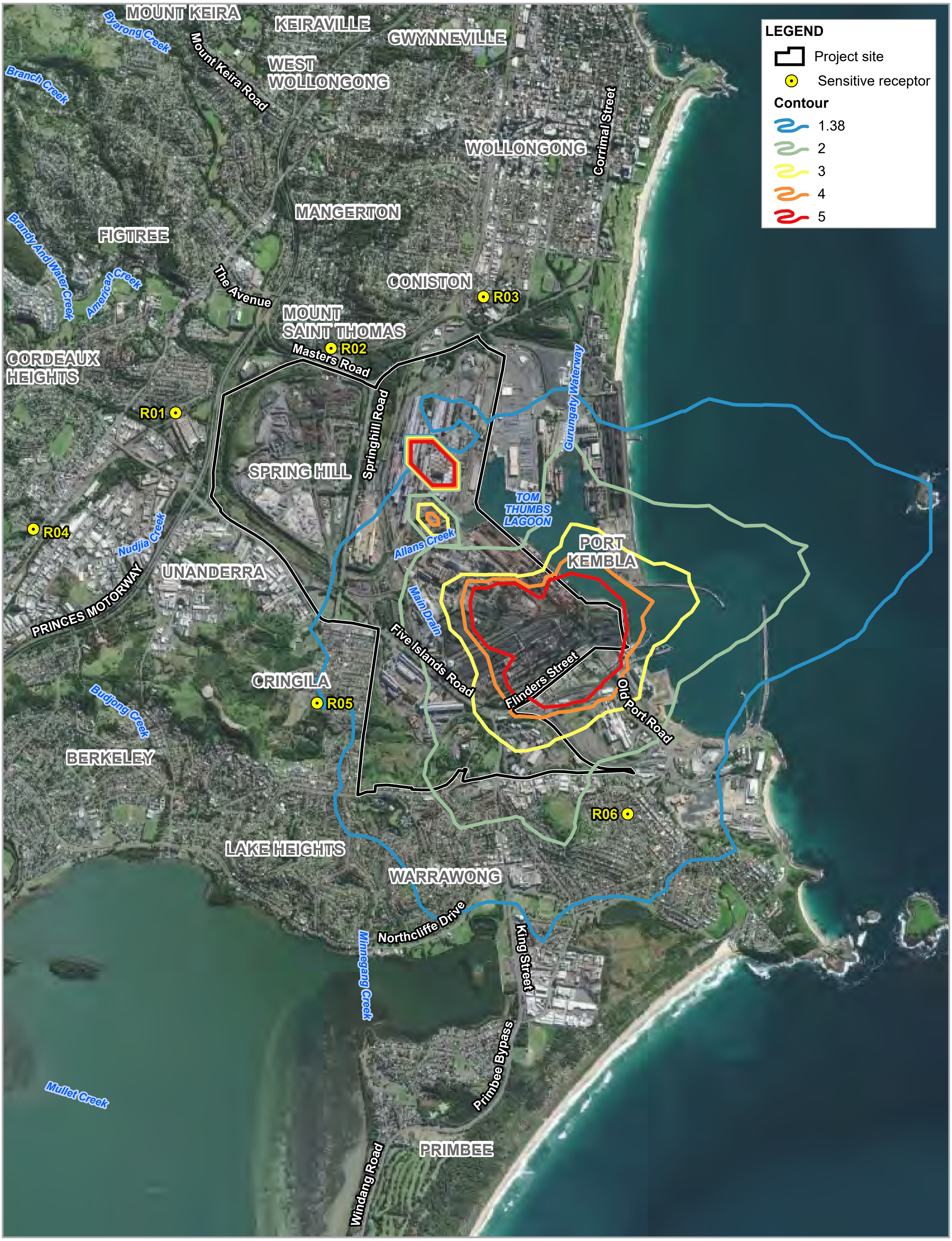
An area of off-site incremental exceedance of the 1 second H_2S criteria was predicted to the south and east of PKSW (refer Figure 9.8). This is a peak concentration that would only likely occur for a short time over any one year period. The EPA criteria for H_2S (1 second, 99th percentile) allows for 88 hours per year (1% of the time) where the concentration may exceed 1.38 µg/m^3. At receptor R06, the 99th percentile criteria is exceeded, with the model predicting only 53 additional hours per year (0.6% of the time) where the concentration is above the criteria level.

It is noted that the exceedance area predicted for the future scenario is smaller than that predicted for the existing scenario. Therefore, the project is anticipated to have a beneficial impact on ambient H_2S concentrations (net reduction) compared to existing operations (refer to Section 9.4 for a detailed comparison between predicted existing and future concentrations).

As discussed in *BlueScope Steel, Port Kembla Sub-hourly Modelling of Hydrogen Sulphide* (Environ, 2011) and *BlueScope Steel, Port Kembla Site Air Emissions Modelling – PRP131* (Environ, 2012), the 1 second H_2S criteria is considered very stringent and therefore the Californian EPA 1 hour (public welfare) criterion of 42 ug/m^3 was included for comparative purposes. The predicted maximum 1 hour H_2S concentrations are significantly below the Californian criteria.

Table 9.11 Predicted odorous air pollutant concentrations (future scenario)

Receptor	Predicted odorous air pollutant concentrations (µg/m^3)			
	Incremental – Only 6BF sources		All PKSW future sources	
Pollutant	H_2S		H_2S	
Averaging period	1 second	1 hour	1 second	1 hour
Statistic	99.9th percentile	Maximum	99.9th percentile	Maximum
Impact type	Incremental	Incremental	Incremental	Cumulative
Criteria	1.38	42	1.38	42
R01	0.19	0.3	0.64	3.0
R02	0.27	0.6	0.81	3.1
R03	0.31	0.8	0.94	3.4
R04	0.15	0.2	0.53	2.9
R05	0.38	1.5	1.35	7.0
R06	0.44	0.7	1.59	3.9



Paper Size ISO A4

0 0.5 1 1.5

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
Air Quality Impact Assessment

Predicted incremental 1 second H_2S concentration for future scenario ($\mu g/m^3$, 99th percentile)

Project No. 12541101
Revision No. 0
Date 10/11/2021

FIGURE 9.8

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Print date: 10 Nov 2021 - 15:29

Data source: LPI: DCDB/DTDB, 2017. Commonwealth of Australia (Geoscience Australia) 250K Topographic Data Series 3, 2006. World Imagery: Maxar. Created by: tmorton

9.4 Comparison of existing to future impacts

A comparative analysis of predicted incremental and cumulative air quality concentrations is provided in this section. The analysis examined the relative impact of the project by presenting the difference in model predictions between existing and future scenarios. The difference was expressed as the percentage change (rounded to one decimal place) from existing to future scenario (i.e. a positive percentage indicates increased impacts are predicted during the future scenario while a negative percentage indicates decreased impacts are predicted during the future scenario).

9.4.1 Particulates and common gaseous pollutants

The difference in predicted particulate concentrations is provided in Table 9.12.

A minor increase in incremental particulate concentrations was predicted as a result of the project. It is attributed to the minor increase in particulate emissions from the future scenario as discussed in Section 6.4.

A less than 1% change between scenarios is predicted for cumulative predictions. This is attributed to low site contributions relative to the background concentrations which account for the majority of the cumulative impact at receptors. As background concentrations remain constant for both scenarios, minor changes to predictions are observed.

Table 9.12 Predicted particulate concentrations (percentage change from existing to future scenario)

Receptor	Incremental			Cumulative with DPIE AQMS			Cumulative with DPIE AQMS and other SS projects		
	TSP	PM_{10}		TSP	PM_{10}		TSP	PM_{10}	
	Annual	24 hour	Annual	Annual	24 hour	Annual	Annual	24 hour	Annual
R01	10.3%	3.8%	3.2%	0.2%	0.0%	0.1%	0.2%	0.0%	0.1%
R02	9.2%	0.7%	2.9%	0.3%	0.0%	0.1%	0.3%	0.0%	0.1%
R03	12.3%	-0.7%	4.0%	0.5%	0.2%	0.2%	0.5%	0.2%	0.2%
R04	12.2%	1.6%	3.5%	0.1%	0.0%	0.1%	0.1%	0.0%	0.1%
R05	5.7%	0.3%	0.9%	0.5%	0.2%	0.1%	0.5%	0.2%	0.1%
R06	18.0%	5.2%	4.9%	0.9%	0.4%	0.3%	0.9%	0.4%	0.3%

The difference in predicted NO_2 concentrations is provided in Table 9.13. A decrease in incremental and cumulative NO_2 concentrations is predicted (i.e. the project is predicted to have a beneficial impact on ambient NO_2 concentrations (net reduction) compared to existing operations).

The following improvements were identified at sensitive receptor locations:

– Up to a 4.5% reduction of incremental 1 hour NO_2 concentrations
– Up to a 4.6% reduction of incremental 24 hour NO_2 concentrations
– No change in cumulative 1 hour NO_2 concentrations
– Up to a 1.2% reduction of cumulative (cumulative with DPIE AQMS and other SS projects) 24 hour NO_2 concentrations

Table 9.13 Predicted NO_2 concentrations (percentage change from existing to future scenario)

Receptor	Predicted NO_2 concentrations (µg/m^3)					
	Incremental		Cumulative with DPIE AQMS		Cumulative with DPIE AQMS and other SS projects	
	1 hour	Annual	1 hour	Annual	1 hour	Annual
R01	-0.3%	-2.2%	0.0%	-0.3%	0.0%	-0.2%
R02	-3.2%	-2.0%	0.0%	-0.4%	0.0%	-0.3%
R03	-4.5%	-2.9%	0.0%	-0.8%	0.0%	-0.7%
R04	-2.8%	-2.7%	0.0%	-0.3%	0.0%	-0.2%
R05	0.1%	-4.6%	0.0%	-1.3%	0.0%	-1.2%
R06	-0.2%	-1.3%	0.0%	-0.2%	0.0%	-0.2%

The difference in predicted SO_2 concentrations is provided in Table 9.14. Generally, a decrease in incremental and cumulative SO_2 concentrations is predicted (i.e. the project is predicted to have a beneficial impact on ambient SO_2 concentrations (net reduction) compared to existing operations).

The following improvements were identified at sensitive receptor locations:

- Up to a 17.8% reduction of incremental 1 hour SO_2 concentrations.
- Up to a 7.3% reduction of incremental 24 hour SO_2 concentrations.
- Up to a 16.6% reduction of cumulative (cumulative with DPIE AQMS and other SS projects) 1 hour SO_2 concentrations.
- Up to a 13.7% reduction of cumulative (cumulative with DPIE AQMS and other SS projects) 24 hour SO_2 concentrations.

Table 9.14 Predicted SO_2 concentrations (percentage change from existing to future scenario)

Receptor	Predicted SO_2 concentrations (µg/m^3)					
	Incremental		Cumulative with DPIE AQMS		Cumulative with DPIE AQMS and other SS projects	
	1 hour	24 hour	1 hour	24 hour	1 hour	24 hour
R01	-4.6%	-7.0%	-2.9%	-0.5%	-2.8%	-0.5%
R02	-10.1%	-2.8%	-4.2%	-2.5%	-4.4%	-2.5%
R03	-5.5%	-3.6%	-5.5%	-13.6%	-5.5%	-13.7%
R04	-7.6%	-7.3%	-0.8%	-7.3%	-3.3%	-7.0%
R05	-17.8%	3.4%	-17.6%	-5.4%	-16.6%	-5.2%
R06	-8.8%	-1.4%	-8.8%	-1.4%	-8.8%	1.5%

9.4.2 Odorous air pollutants

The difference in predicted H_2S concentrations is provided in Table 9.15.

A decrease in H_2S concentrations is predicted at all receptors with the exception of the indicative 1 hour maximum H_2S concentration at R05. This is due to future H_2S sources 'aligning' along a common wind direction so that worse case down wind impacts occur at R05 at the same time. Up to a 15.4% reduction in 1 second H_2SH2S concentrations was predicted.

It is noted that an exceedance of the 1 second H_2S criteria was predicted at R05 for the existing scenario. Based on improvements to site operations as part of the project, compliance with the 1 second H_2S criteria was predicted at R05 for the future scenario.

Table 9.15 Predicted odorous air pollutant concentrations (percentage change from existing to future scenario)

Pollutant	H_2S	
Averaging period	**1 second**	**1 hour**
Statistic	**99.9th percentile**	**Maximum**
R01	-6.1%	-9.9%
R02	-15.4%	-11.9%
R03	-13.2%	-3.4%
R04	-11.0%	-8.5%
R05	-6.3%	27.9%
R06	-12.5%	-6.9%

10. Best practice assessment and emissions controls

10.1 Best practice assessment

The purpose of this chapter is to present the Best Available Techniques (BAT) Assessment for the proposed design and operation of the new blast furnace and associated infrastructure. This is a requirement of the SEARS, specifically EPA's guidance to DPIE in the development of the SEARs.

The BAT assessment has been based on a review of available technology internationally. The generally accepted best practices for steel making are those adopted by the European Union under the BAT Reference Document (BREF) for Iron and Steel Production Industrial Emissions Directive 2010/75/EU (Integrated Pollution Prevention and Control).

Relevant conclusions from the BREF, and how these are being addressed by BlueScope, are summarised in Table 10.1 below. Responses below directly address BAT conclusions in Chapter 9.5 BAT Conclusions for Blast Furnaces from the BREF document with a focus on Air Emissions (Bat 59 to 65).

The review of emissions from the operation of 6BF compared to 5BF indicates that it will generally result in a reduction of pollutants. Reference is made to the existing emission profile outlined in Section 6 which has been improved by the best practice emission controls, as identified in the following sections, to be used on the project to improve emissions for the operation of 6BF.

When reviewing the BAT assessment in Table 10.1 it should be noted that BlueScope undertakes a constant review of emerging BAT for managing emissions and seeks to constantly improve controls where practical, reasonable and feasible to do so in regards to international best practice.

10.2 Additional emission controls

To meet the conclusions of the BREF, BlueScope intends to implement the following additional process and emission controls as part of the project:

- Cast house floor fugitives - Manipulator and trough covers, extraction from main trough, extraction at taphole with primary and secondary hood (noting that 5BF only has a primary hood), lowered tilting platforms during casting (also an improvement on 5BF).
- Iron Kish - Extraction at iron ladles and slag tilting spouts. Both the iron ladles and Slag Pots will have level sensors to ensure they are filled in a controlled manner.
- Slag Handling - Coldwater slag granulation with condensing unit. Slag pits – air cooling for up to 24 hours before applying water to minimise H_2S generation during watering.
- Dust catcher - A lock-hopper will be installed at the base of the dust catcher and will minimise BFG and dust emissions to the atmosphere.
- Dust suppression - Sealed roads, street sweepers and truck wheel washes from stockhouse and slag handling areas.

Table 10.1 Summary of best practice assessment

	EU BAT BREF	6BF Control	Conformance to BAT	Improvement status
Air emissions	59. BAT for displaced air during loading from the storage bunkers of the coal injection unit is to capture dust emissions and perform subsequent dry dedusting. The BAT-associated emission level for dust is <20 mg/Nm^3, determined as the average over the sampling period (discontinuous measurement, spot samples for at least half an hour).	Emissions from PCI plant are all below 20 mg/m^3. No changes to operation of this plant in relation to the project.	Conforms to BAT	Same as existing at 5BF
	60. BAT for burden preparation (mixing, blending) and conveying is to minimise dust emissions and, where relevant, extraction with subsequent dedusting by means of an electrostatic precipitator or bag filter.	Enclosed conveyors Dust suppression Dedusting at every material transfer in the Stockhouse via baghouse.	Conforms to BAT Current stockhouse stack testing at 5BF complies with Clean Air Act Group 6 limits	Same as existing at 5BF
	61. BAT for casting house (tap holes, runners, torpedo ladles charging points, skimmers) is to prevent or reduce diffuse dust emissions by using the following techniques: I. covering the runners II. optimising the capture efficiency for diffuse dust emissions and fumes with subsequent off-gas cleaning by means of an electrostatic precipitator or bag filter III. fume suppression using nitrogen while tapping, where applicable and where no collecting and dedusting system for tapping emissions is installed. When using BAT II, the BAT-associated emission level for dust is <1 – 15 mg/Nm^3, determined as a daily mean value.	Runners covered Primary dedusting damper and secondary dedusting hood to capture emissions at tapholes Dedusting at charging conveyor Dedusting with baghouse Tilting platforms to be lowered during casting	i. Conforms to BAT ii. Conforms to BAT iii. Not used and not applicable - Nitrogen fume suppression presents a safety hazard and is only applicable where no dedusting system is installed Current 5BF casthouse stack results comply with Clean Air Act Group 6 limits	Secondary dedusting hood is an improvement on 5BF and was in place for previous 6BF campaign. Lowered tilting platform during casting is an improvement on 5BF and was in place for previous 6BF campaign. The covered runners and dedusting are the same as existing at 5BF.
	62. BAT is to use tar-free runner linings.	Tar-free runner linings used	Conforms to BAT	Same as existing at 5BF and previous 6BF campaign
	63. BAT is to minimise the release of blast furnace gas during charging by using one or a combination of the following techniques: I. bell-less top with primary and secondary equalising II. gas or ventilation recovery system III. use of blast furnace gas to pressurise the top bunkers.	i. Bell-less top charging with equalising relief valves for material hopper. Primary equalisation with semi clean gas, secondary equalisation with nitrogen continuing to flow into the bin during material discharge. ii. Not applicable as a mixture of BFG and nitrogen is used to pressurise the furnace top bunkers.	Conforms to BAT	Same as existing at 5BF and previous 6BF campaign

	EU BAT BREF	6BF Control	Conformance to BAT	Improvement status
	Applicability of BAT II Applicable for new plants. Applicable for existing plants only where the furnace has a bell-less charging system. It is not applicable to plants where gases other than blast furnace gas (e.g. nitrogen) are used to pressurise the furnace top bunkers.	iii. Pressurisation using semi clean gas and nitrogen		
	64. BAT is to reduce dust emissions from the blast furnace gas by using one or a combination of the following techniques: I. using dry predusting devices such as: i. deflectors ii. dust catchers iii. cyclones iv. electrostatic precipitators. II. subsequent dust abatement such as: i. hurdle-type scrubbers ii. venturi scrubbers iii. annular gap scrubbers iv. wet electrostatic precipitators v. disintegrators. For cleaned blast furnace (BF) gas, the residual dust concentration associated with BAT is <10 mg/Nm^3, determined as the average over the sampling period (discontinuous measurement, spot samples for at least half an hour).	I. ii. Pre-dedusting with dust catcher II. iii. Subsequent abatement by annular gas scrubber	I. Conforms to BAT - ii. II. Conforms to BAT - iii. Gas cleaning complies with <10mg/m^3 BAT emission limit.	Same as 5BF with improvements compared to previous 6BF campaign
	65. BAT for hot blast stoves is to reduce emissions by using desulphurised and dedusted surplus coke oven gas, dedusted blast furnace gas, dedusted basic oxygen furnace gas and natural gas, individually or in combination. The BAT-associated emission levels, determined as daily mean values related to an oxygen content of 3 %, are: • sulphur oxides (SOx) expressed as sulphur dioxide (SO2) <200 mg/Nm3 • dust<10 mg/Nm3 • nitrogen oxides (NOx), expressed as nitrogen dioxide (NO2) <100 mg/Nm3	Stoves use dedusted BFG, dedusted COG (not desulphurised), and natural gas New design will improve combustion efficiency Installation of Waste Gas Heat Recovery	Conforms to BAT for gas re-use Stove emissions comply with Clean Air Act Group 6 limits Improved combustion efficiency will reduce CO emissions however, the extent of reduction is still being investigated. Current emissions do not comply to BAT-associated emission levels though it is anticipated that installation of WGHR will result in emission reductions.	Improvement on 5BF and previous 6BF campaign

	EU BAT BREF	6BF Control	Conformance to BAT	Improvement status
Production residues	68. BAT is to prevent waste generation from blast furnaces by using one or a combination of the following techniques: I. appropriate collection and storage to facilitate a specific treatment II on-site recycling of coarse dust from the blast furnace (BF) gas treatment and dust from the cast house dedusting, with due regard for the effect of emissions from the plant where it is recycled III. hydrocyclonage of sludge with subsequent on-site recycling of the coarse fraction (applicable whenever wet dedusting is applied and where the zinc content distribution in the different grain sizes allows a reasonable separation) IV. slag treatment, preferably by means of granulation (where market conditions allow for it), for the external use of slag (e.g. in the cement industry or for road construction).	i. Dust catcher, sludge dewatering ii. Flue dust is recycled at Sinter Plant iii. Potential for hydroclonage currently under investigation. Learnings will be applied to 6BF. iv. Slag granulation undertaken where possible, remainder formed as rock slag.	Conforms to BAT	Same as existing at 5BF
	69. BAT for minimising slag treatment emissions is to condense fume if odour reduction is required.	Cold slag granulation with condensing unit	Conforms to BAT	Improvement on 5BF and previous 6BF campaign
Energy	71. BAT is to maintain a smooth, continuous operation of the blast furnace at a steady state to minimise releases and to reduce the likelihood of burden slips.	Closed loop cooling water Use of stockrods for burden level detection and monitoring	Conforms to BAT	Same as existing at 5BF and previous 6BF campaign

	EU BAT BREF	6BF Control	Conformance to BAT	Improvement status
	74. BAT is to preheat the hot blast stove fuel gases or combustion air using the waste gas of the hot blast stove and to optimise the hot blast stove combustion process. Description For optimisation of the energy efficiency of the hot stove, one or a combination of the following techniques can be applied: • the use of a computer-aided hot stove operation • preheating of the fuel or combustion air in conjunction with insulation of the cold blast line and waste gas flue • use of more suitable burners to improve combustion • rapid oxygen measurement and subsequent adaptation of combustion conditions. Applicability The applicability of fuel preheating depends on the efficiency of the stoves as this determines the waste gas temperature (e.g. at waste gas temperatures below 250 °C, heat recovery may not be a technically or economically viable option). The implementation of computer-aided control could require the construction of a fourth stove in the case of blast furnaces with three stoves (if possible) in order to maximise benefits.	Hot stove operation is computer-aided Lagging used in cold blast main and waste gas flue is refractory lined. New burner design to improve combustion Waste gas oxygen measurement to be replaced	Conforms to BAT	Improvement on 5BF and previous 6BF campaign

11. Management and mitigation

Air quality management and mitigation measures to reduce emissions to air from the project and minimise any potential air quality impacts are provided in the Sections below. These controls will be in addition to the EPL fugitive dust emission controls detailed in Condition O3. The BlueScope “Fugitive Dust Management System” procedure (MA-ENV-02-02) will be applied throughout construction, commissioning and operation.

11.1 Construction

While general construction activities are not expected to exceed air quality goals at nearby receptors, the following mitigation measures are recommended:

- Prepare a dust management plan for use during construction activities.
- Regularly monitor existing ambient air quality stations during dust generating construction activities.
- During demolition of any contaminated areas, take extra precautions to prevent dust leaving the work area.
- Reduce or cease dust generating activities if clearly visible plumes of dust go off the site or monitoring shows excessive particulate levels.
- Blasting or heavy demolition which may lead to excessive dust will only be undertaken in conditions not likely to disperse dust towards sensitive receptors.
- Operations conducted in areas of low moisture content material will be suspended during high wind speed events and water sprays will be used.
- Aim to minimise the size of storage piles where possible. Development of any new stockpile areas must be in accordance with the BSL Risk Assessment Process.
- Limit cleared areas of land and stockpiles and clear only when necessary to reduce fugitive dust emissions. All material stockpiles will have appropriate stormwater and dust controls in place.
- Control on-site traffic by designating specific routes for haulage and access. Traffic on any unpaved construction areas should be limited to 25 kilometres per hour.
- All trucks carrying dry bulk material that is loaded on site must be loaded and operated so as to prevent spillage of any material from the load (which generates dust). Trucks must be covered prior to leaving the licenced site boundary.

These measures will assist in reducing impact on all areas off-site during construction activities.

11.2 Commissioning

The following mitigation measures are recommended during commissioning:

- Notify local residents about the proposed commissioning timetable of activities that could affect people off-site and provide advice on what they can expect regarding emissions including smoke.
- Where practicable, any commissioning activities that may lead to excessive emissions or visible smoke should be timed as much as possible to occur when winds are not blowing towards residential areas.

11.3 Operation

Operational air quality impacts are anticipated to be consistent with, or better than existing operations and no specific additional emission controls are recommended. It is recommended that BlueScope continue to reduce emissions of SO_2 with any future modifications as it continues to reduce its emission profile towards the updated 2021 NEPM standards. The following operational management and mitigation measures are recommended:

– Develop and implement an Air Quality Management Plan prior to commencement of operations including:
  - Identify all major sources of air emissions and associated proactive and reactive mitigation measures to ensure air pollution is prevented or minimised
  - Describe protocols for regular maintenance of plant and equipment
  - Outline procedures for monitoring and reporting air emissions
  - Describe measures to regularly review the effectiveness of air pollution control measures

Conduct post commissioning sampling of all new emissions sources in accordance with Approved Methods for the Sampling and Analysis of Air Pollutants in New South Wales (DEC, 2007). Point sources where sampling will be conducted includes:

  - EPA003 – No 6 Blast Furnace Stove Waste Gas Stack
  - EPA004 – No 6 Blast Furnace Cast House Dedusting Stack
  - EPA005 – No 6 Blast Furnace Stock House Dedusting Stack

Fugitive emission sampling to include where practicable:

  - Slag pits
  - 6BF Granulation Cooling tower

– Conduct ongoing emission sampling in accordance with conditions of Development Consent and the EPL.

– Investigate the use of online monitoring systems at the stoves stack, stock house dedusting stack, and cast house dedusting stack, such as opacity meters.

12. Conclusion

GHD has conducted an air quality impact assessment to assess the construction, commissioning and operation of the No. 6 Blast Furnace at the Port Kembla Steelworks. The assessment was undertaken in accordance with relevant legislation and government guidance.

A qualitative based approach was adopted to assess the construction and commissioning of the project. The construction assessment identified a low risk of potential air quality impacts as there will be a large separation distance between construction activities and sensitive receptors, and emissions to air during construction are expected to be relatively minor.

The commissioning assessment concluded that there was potential of elevated emissions to occur for a relatively short period of time during commissioning. As the commissioning procedure will align with the industry standard approach and adopt best practice methods where possible, emissions during commissioning are considered to be minimised as far as reasonably practicable. Due to relatively short duration of commissioning and implementation of industry standard and best practice methods, although the potential impact for any elevated emissions to air cannot be quantified, the commissioning process is considered to pose a low risk of potential adverse air quality impacts to surrounding receptors.

The quantitative operational air quality assessment consisted of three parts, an emission limit assessment, an air quality impact assessment and a best practice assessment.

The emission limit assessment identified that all No. 6 Blast Furnace air quality emission sources assessable to standard of concentration limits will comply with standard of concentration limits stipulated in the POEO Clean Air Regulation.

The air quality impact assessment used air quality dispersion modelling to predict incremental and cumulative pollutant concentrations from the existing and proposed future operating scenarios. The findings of the dispersion modelling are summarised below:

- Existing scenario (operation of 5BF and PKSW) findings:
  - A minor cumulative exceedance of the 24 hour PM_{10} criteria was predicted for one 24 hour period in the modelled year at R05. This exceedance was primarily attributed to elevated background concentrations which accounted for 93% of the criteria while existing scenario incremental concentrations accounted for 7% of the criteria.
  - Compliance was predicted for 1 hour and annual NO_2 concentrations against both EPA and NEPM assessment criterions at sensitive receptor locations.
  - Compliance was predicted for 1 hour and 24 hour SO_2 concentrations against the EPA assessment criteria at sensitive receptor locations.
  - An incremental exceedance of the 1 hour SO_2 NEPM criteria was predicted at R06 and cumulative exceedances were predicted at R05 and R06. These exceedances of the NEPM criteria require interpretation in the context that the 1 hour SO_2 standard was reduced in a recent revision (May 2021) of the Air NEPM.
  - Exceedance of the 1 second H_2S criteria was predicted at R05 and R06. Compliance was predicted for the 1 hour H_2S criteria at all sensitive receptors.
- Future scenario (operation of 6BF and PKSW) findings:
  - Minor cumulative exceedance of the 24 hour PM_{10} criteria were predicted at R03 and R05 for one day of the year only. These exceedances were primarily attributed to elevated background concentrations which accounted for 91% and 93% of the criteria while future scenario incremental concentrations accounted for 9% and 7% of the criteria for receptors R03 and R05 respectively. 6BF sources account for approximately 1% and 3% of the maximum cumulative 24 hour PM_{10} contribution at R03 and R05 respectively.
  - Compliance was predicted for 1 hour and annual NO_2 concentrations against both EPA and NEPM assessment criteria at sensitive receptor locations.

- Compliance was predicted for 1 hour and 24 hour SO_2 concentrations against the EPA assessment criteria at sensitive receptor locations.
- An incremental and cumulative exceedance of the 1 hour SO_2 NEPM criteria was predicted at R06. This exceedance of the NEPM criteria requires interpretation in the context that the 1 hour SO_2 standard was reduced in a recent revision (May 2021) of the Air NEPM. These exceedances are attributed mostly to existing sources on the PKSW site and predicted concentrations comply with the existing NSW EPA criteria. 6BF sources account for approximately 21% of the maximum cumulative 1 hour SO_2 contribution at R06.
- An exceedance of the 1 second H_2S criteria was predicted at R06 only. Compliance was predicted for the 1 hour H_2S criteria at all sensitive receptors. The predicted incremental H_2S concentration, from 6BF only, shows that it contributes about one third of total H_2S emissions at the receptor locations. Given that modelled emissions from 6BF are likely to be conservative, the project is unlikely to lead to off-site odour impacts and is predicted to reduce odour impacts at the sensitive receptor locations. 6BF sources account for approximately 28% of the maximum 1 second H_2S contribution at R06.

Comparatively, the future scenario was predicted to result in a general reduction of all pollutant concentrations (NO_2, SO_2 and H_2S), except for particulate matter, in relation to which a minor increase was predicted due to assumptions in the assessment. The project includes a number of measures anticipated to reduce particulates compared to the existing situation.

The best practice assessment benchmarked proposed No. 6 Blast Furnace emissions control measures against European Union Best Available Techniques (BAT). The best practice assessment concluded that the project conforms with the best available techniques and for each BAT requirement offers a beneficial or at least neutral impact compared with current No. 5 Blast Furnace operations.

From an air quality perspective, the project is considered an improvement (reduction in pollutant concentrations) compared with existing operations.

13. References

Australian Government, Department of Agriculture, Water and the Environment, *National Pollutant Inventory Emission Estimation Technique Manual for Iron and Steel Production (1999)*

Barclay J and Scire J (2011) *Generic Guidance and Optimum Model Settings for the CALPUFF Modelling System for Inclusion into the Approved Methods for the Modelling and Assessments of Air Pollutants in NSW, Australia*. Atmospheric Studies Group TRC Environmental Corporation.

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Environ (2012) *BlueScope Steel, Port Kembla Site Air Emissions Modelling – PRP131*

Environ (2011) *BlueScope Steel, Port Kembla Sub-hourly Modelling of Hydrogen Sulphide*

GHD (2019) *East Coast Gas Project Modification Air Quality Assessment*

– Institute of Air Quality Management (2016) Guidance on the assessment of dust from demolition and construction

National Environmental Protection Council (2021) *National Environment Protection (Ambient Air Quality) Measure - Variation 2021.*

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Appendices

Appendix A

Meteorological modelling methodology

A-1 Overview

Local meteorology, including long term wind speed and direction as well as atmospheric stability, can influence how pollutants are dispersed into the local environment.

This appendix outlines the methodology used to synthesise site-representative meteorology for the project. The meteorology is used in CALPUFF to drive the dispersion model.

A-2 Methodology

The meteorology modelling methodology is summarised below:

– Selection of a model period
– Development of coarsely gridded prognostic meteorological data set using the Weather Research and Forecast model (WRF) model
– Development of refined gridded meteorological data set which takes into account local terrain features using the CAMET diagnostic meteorological model
– Verification of model performance using data measured at BoM and BlueScope meteorological monitoring stations
– Extraction of predicted meteorological parameters from the CALMET model

A-2-1 Nearby BoM station review

A review of nearby BoM station is provided in Table A.1.

Table A.1 Nearby BoM station review

BoM station	Approximate distance from Site	Availability of meteorological data	BoM station setting
Port Kembla AWS (BoM ID: 68253)	0.5 km east of the Site	Began operation in 1990. All desired meteorological parameters except cloud data available.	Located on eastern most wharf in Port Kembla
Bellambi AWS (BoM ID: 68228)	12 km North of the site	Began operation in 1988. All desired meteorological parameters available.	Located on exposed headland
Albion Park (Wollongong airport) (BoM ID: 68241)	14 km southwest of the site	Began operation in 1999. All desired meteorological parameters available.	Located in cleared airport setting

Due to close proximity to the project, the Port Kembla AWS was selected for inclusion in the representative year analysis.

A-2-2 Representative year selection

A representative year was chosen for modelling purposes based on review of Southern Oscillation Index (SOI) for the past 10 years and an analysis BoM data recorded at Port Kembla AWS for the last year calendar years (01/01/2016 – 31/12/2020).

The SOI indicates the intensity of El Nino or La Nina events in the Pacific Ocean. A value of less than -7 often indicates El Nino episodes (typically accompanied by sustained warming of the central and eastern tropical Pacific Ocean, a decrease in the strength of the Pacific Trade Winds, and a reduction in winter and spring rainfall over much of eastern Australia and the Top End) while a value of greater than 7 often indicates La Nina episodes (typically associated with stronger Pacific trade winds and warmer sea temperatures to the north of Australia, waters in the central and eastern tropical Pacific Ocean become cooler during this time). Together, these give an increased probability that eastern and northern Australia will be wetter than normal[6].

[6] SOI data and description of El Nino and La Nina episodes sourced from Australian Government BoM, available online: http://www.bom.gov.au/climate/current/soi2.shtml

The SOI for the past 10 years is shown in Figure A.1.

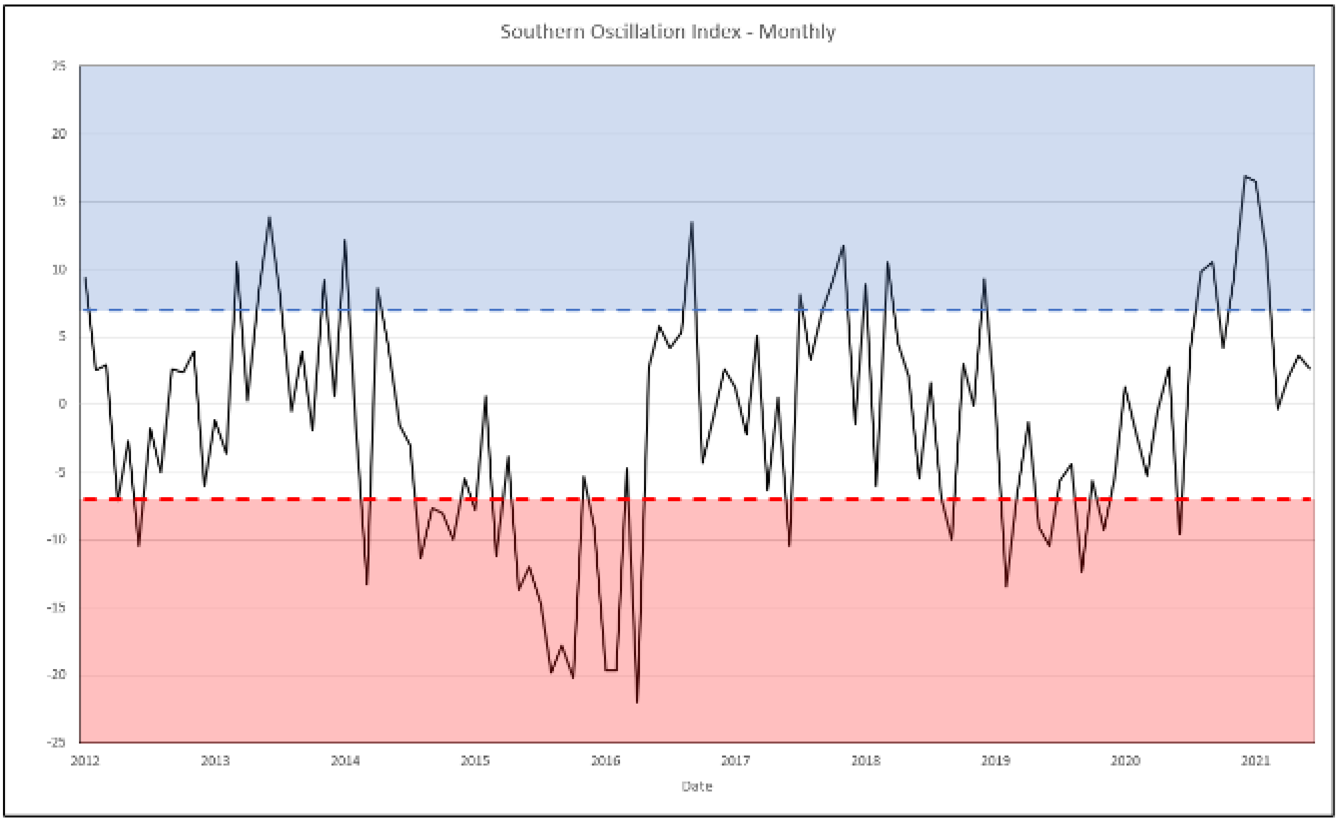


Figure A.1 Southern Oscillation Index for last 10 years (2012 – 2021)

Probability density function plots of Port Kembla AWS data (2016-2020) for wind speed, wind direction and temperature are provided in Figure A.2, Figure A.3 and Figure A.4 respectively.

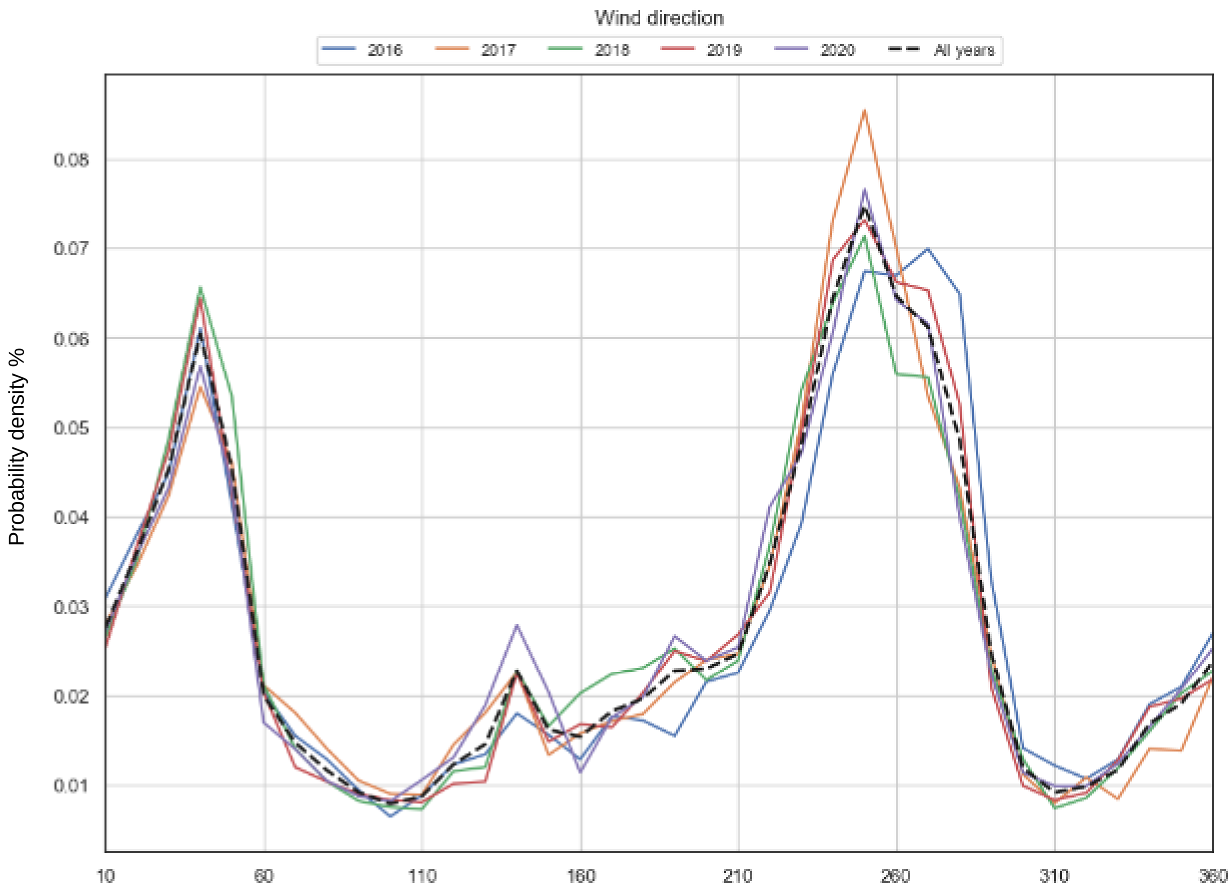


Figure A.2 *Wind direction plot, degrees (Port Kembla AWS, 2016 – 2020)*

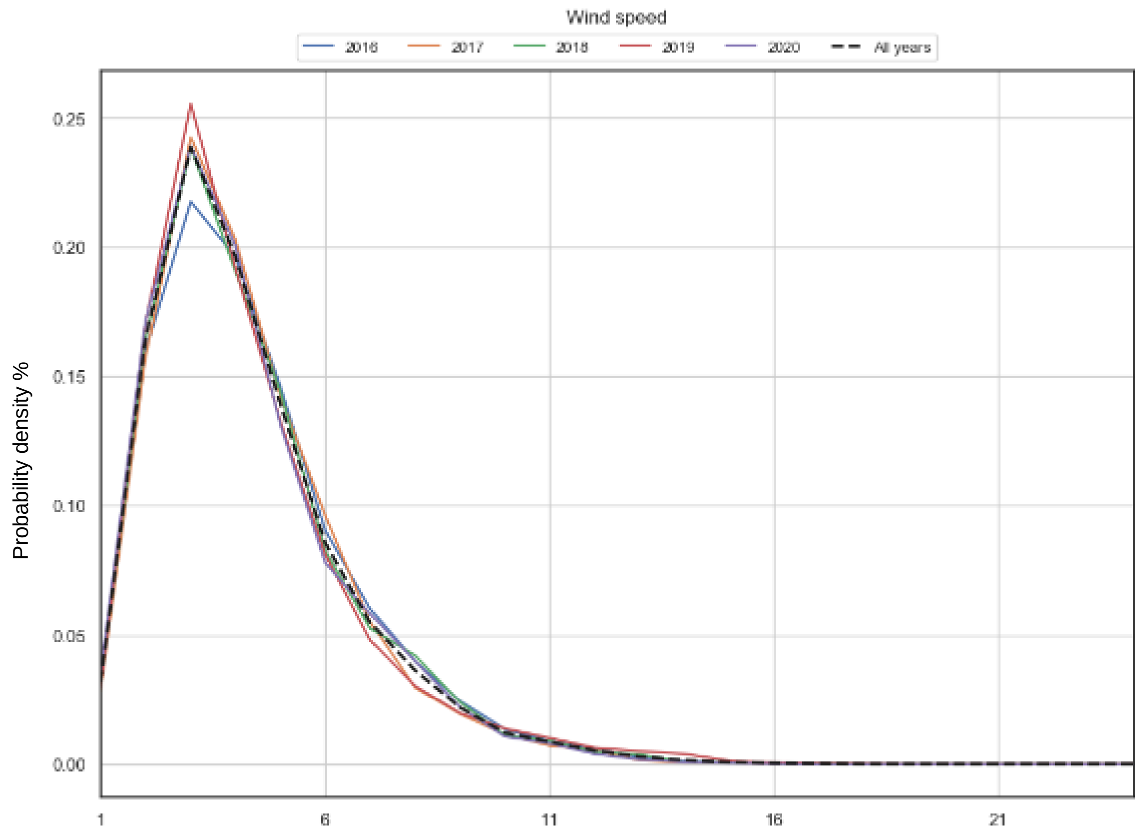


Figure A.3 *Wind speed plot, m/s (Port Kembla AWS, 2016 – 2020)*

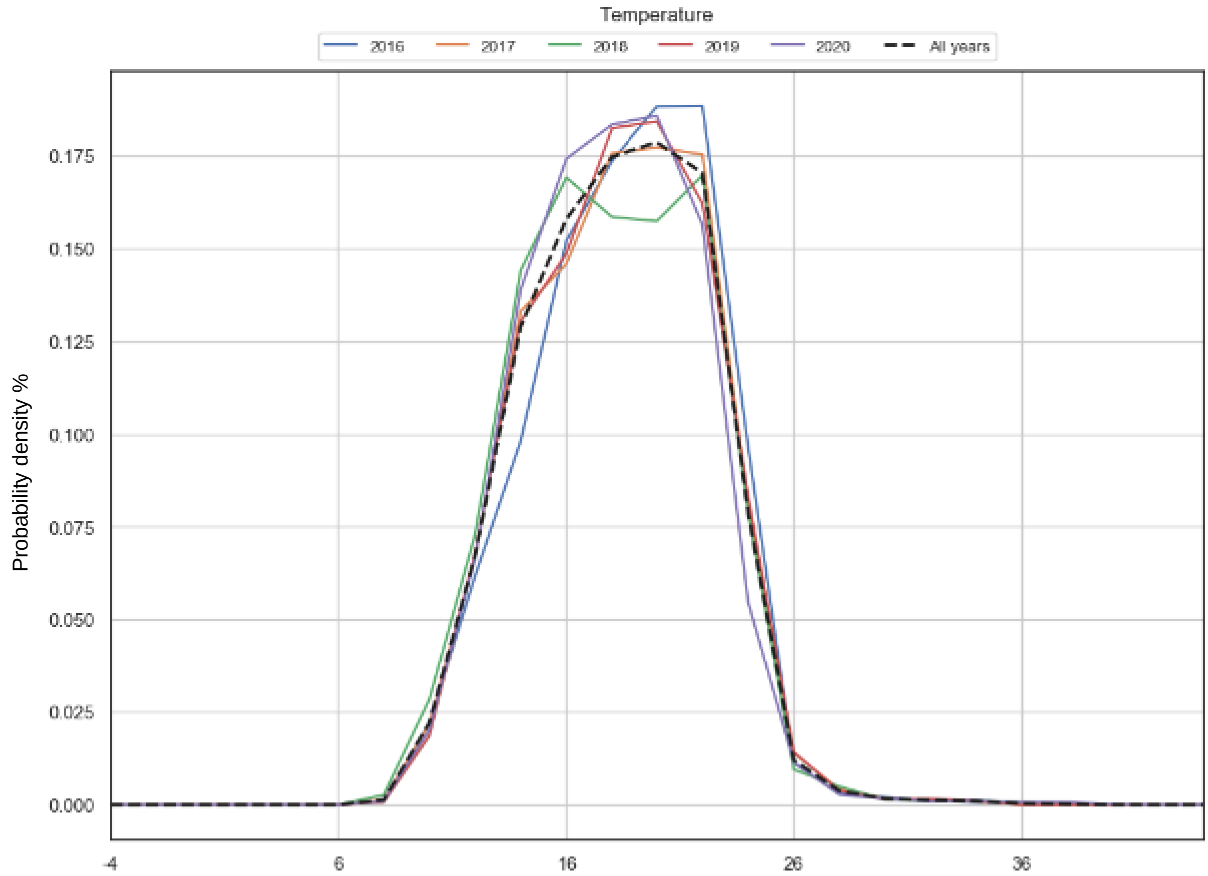


Figure A.4 Temperature plot, degrees celcius (Port Kembla AWS, 2016 – 2020)

Based on the review of SOI data and meteorological conditions recorded at Port Kembla AWS, the representative year selected for modelling purposes was 01 January 2017 through 01 January 2018.

A-2-3 Prognostic meteorology

The parameters for the prognostic WRF model are summarised in Table A.2.

Table A.2 WRF model parameters

Parameter	Value
Modelled period	1 January 2017 to 31 December 2017
Domain centre	Latitude: 34.602506 S Longitude: 150.6581 E
Domain grid spacing	1 km
Domain size	100 x 100 km
Number of vertical levels	25

A-3 CALMET modelling

CALMET (Version 7) was used to resolve the wind field around the subject site to 250 metres spatial resolution. The application of CALMET for this purpose is an approved modelling approach in NSW as per the Approved Methods with model guidance documentation provided.

Upon completion of the broad scale WRF modelling runs, a CALMET simulation was set up to run for the model period using the three-dimensional gridded data output from the WRF model as an initial guess field. This approach is consistent with guidance documentation.

CALMET was run using the ‘No-Obs’ mode (i.e. surface observational data was not included in the model). Given the site is located within a complex land-sea interface, it was deemed that introduction of observational data into the model would lead to inconsistencies/irregularities in the predicted wind field, where blending of the observations and initial guess field is carried out. This is especially true at wind field levels above the surface level on the coastline, which are critical in this instance when assessing dispersion of pollutants from the ship loading vent sources.

A comparison of the predicted and observed wind field was carried out which showed good agreement with respect to frequency and pattern of various wind speeds. The level of agreement is deemed sufficient for dispersion modelling purposes, especially where peak 1-hour averaging periods are of concern and further the error associated with the model prediction is deemed preferable in comparison to the errors associated with the introduction of surface data (as described above).

All model settings were selected based on the recommendations provided in the Generic Guidance and Optimum Model Settings for the CALPUFF Modelling System for Inclusion into the Approved Methods for the Modelling and Assessments of Air Pollutants in NSW, Australia (J Barclay and J Scire, Atmospheric Studies Group TRC Environmental Corporation, 2011) except for MDISP (parameter for dispersion coefficients) for which the default value was used.

The southwest corner of the CALMET domain, or the origin, was located at UTM Zone 56 coordinates 285 kilometres east and 6164 kilometres north. The CALMET domain extended 40 kilometres to the east and north.

The CALMET domain consisted of 160 grids in both the east and north directions, with a grid resolution of 0.25 kilometre.

The CALMET model parameters are summarised in Table A3. The TERRAD value was selected based on inspection of the terrain elevations in the immediate vicinity of the subject site. It should be noted that multiple TERRAD values were tested and the value producing the best results was selected.

Terrain and land use data used for the CALMET modelling are presented in Figure A5 and Figure A6.

Table A.3 Summary of CALMET model parameters

Parameter	Value
Modelled period	1 January 2017 to 31 December 2017
Mode	No obs (NOOBS = 2)
UTM zone	56
Domain origin (south-west corner)	Easting: 285 km Northing: 6164 km
Domain size	160 x 160 at 0.25 km resolution (40.0 km x 40.0 km)
Number of vertical levels	11
Vertical levels (m)	0, 20, 40, 80, 160, 320, 640, 1200, 2000, 3000, 4000,
CALMET settings for hybrid mode Settings selected in accordance with (OEH, 2011)	TERRAD = 1.75 km
Initial guess field	WRF .m3d file used as an initial guess field for CALMET
Surface data	N/A
Upper air data	No site-specific upper air data is used. Upper air data is included within the WRF .m3d initial guess field.
Land use and terrain data	Land use data was manually developed through assessment of aerial imagery to accurately reflect the land use in the area. High-resolution terrain data was sourced from the STRM 1-second (~30 m) database.

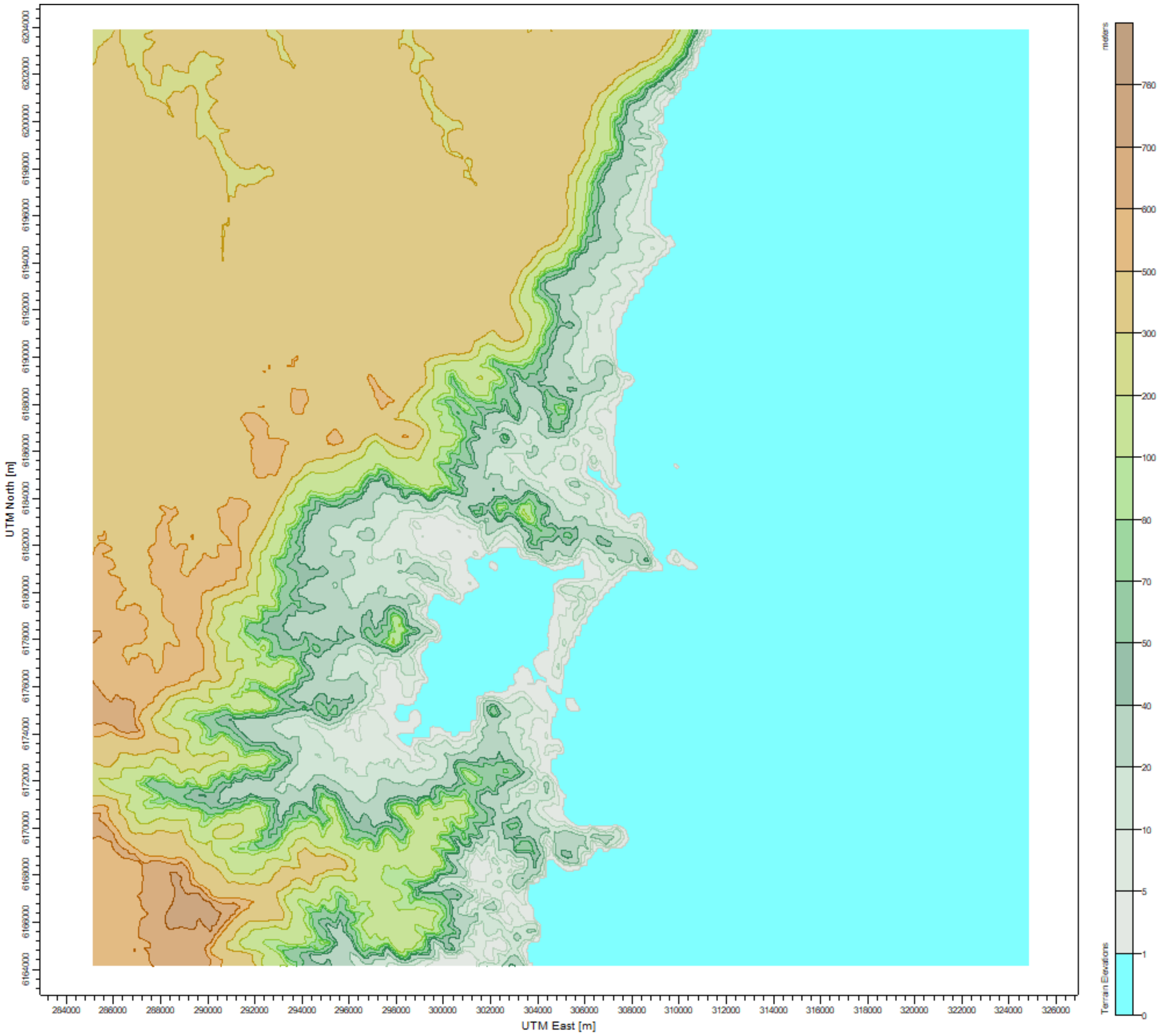


Figure A.5 Terrain data used for CALMET modelling

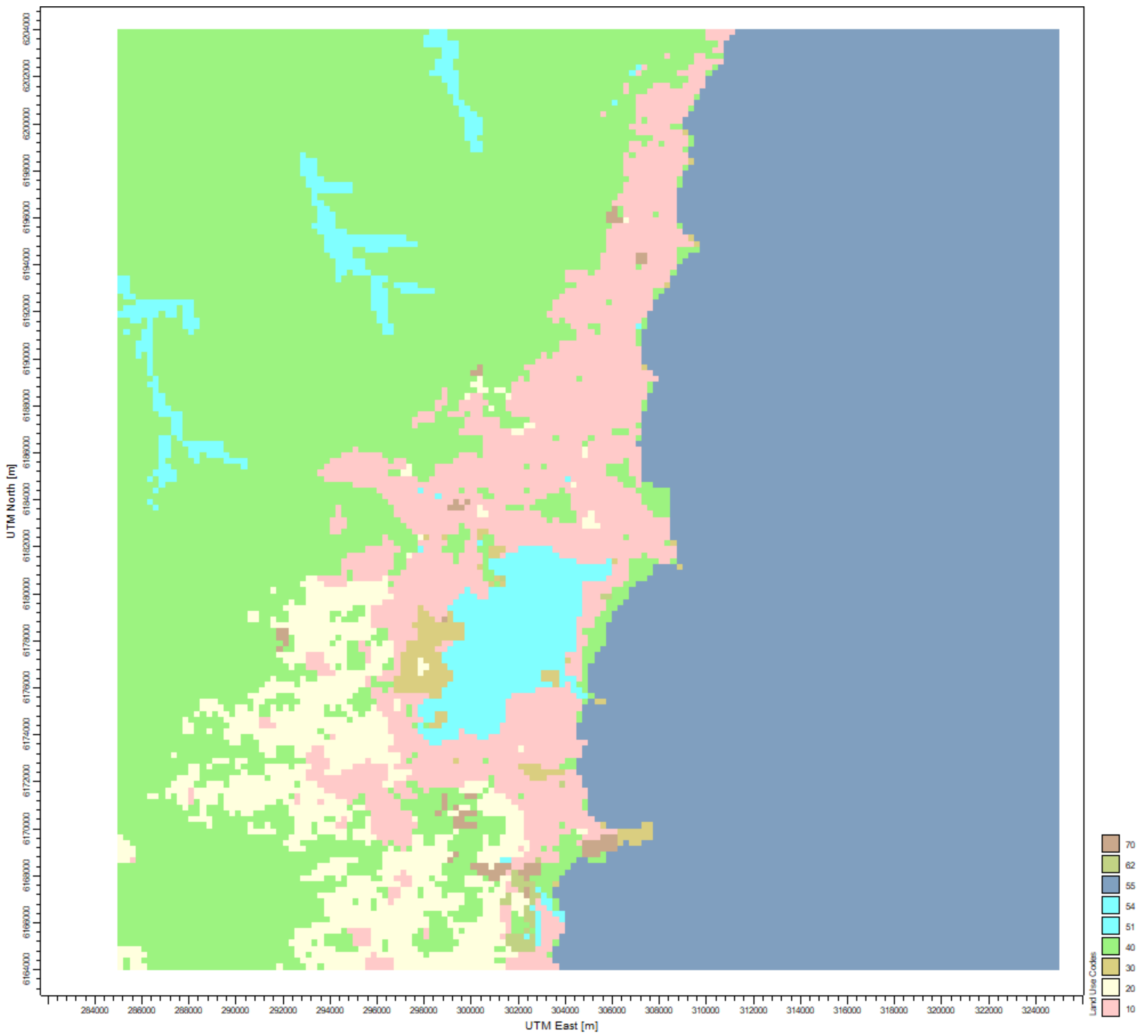


Figure A.6 ***Land use data used for CALMET modelling***

The local meteorology largely determines the pattern of off-site air quality impact on receptors (houses, businesses and industry). The effect of wind on dispersion patterns can be examined using the wind and stability class distributions at the site from the dataset that is produced by CALMET. The winds at the site are most readily displayed by means of wind rose plots, giving the distribution of winds and the wind speeds from these directions.

The features of particular interest in this assessment are (i) the dominant wind directions and (ii) the relative incidence of stable light wind conditions that yield minimal mixing (defines peak impacts from ground-based sources).

A-3-1 Annual wind patterns

The wind rose for the entire data period taken at the project site is shown in Figure A7 and shows the following features:

– The predominant annual average wind directions are from the west.

– Lower wind speeds (0.5 – 1 m/s) are rare but can occur from any direction.

– The average wind speed predicted was 5.2 metres per second.

– Calm conditions (wind speeds less than 0.5 m/s) occurred 0.3 per cent of the time.

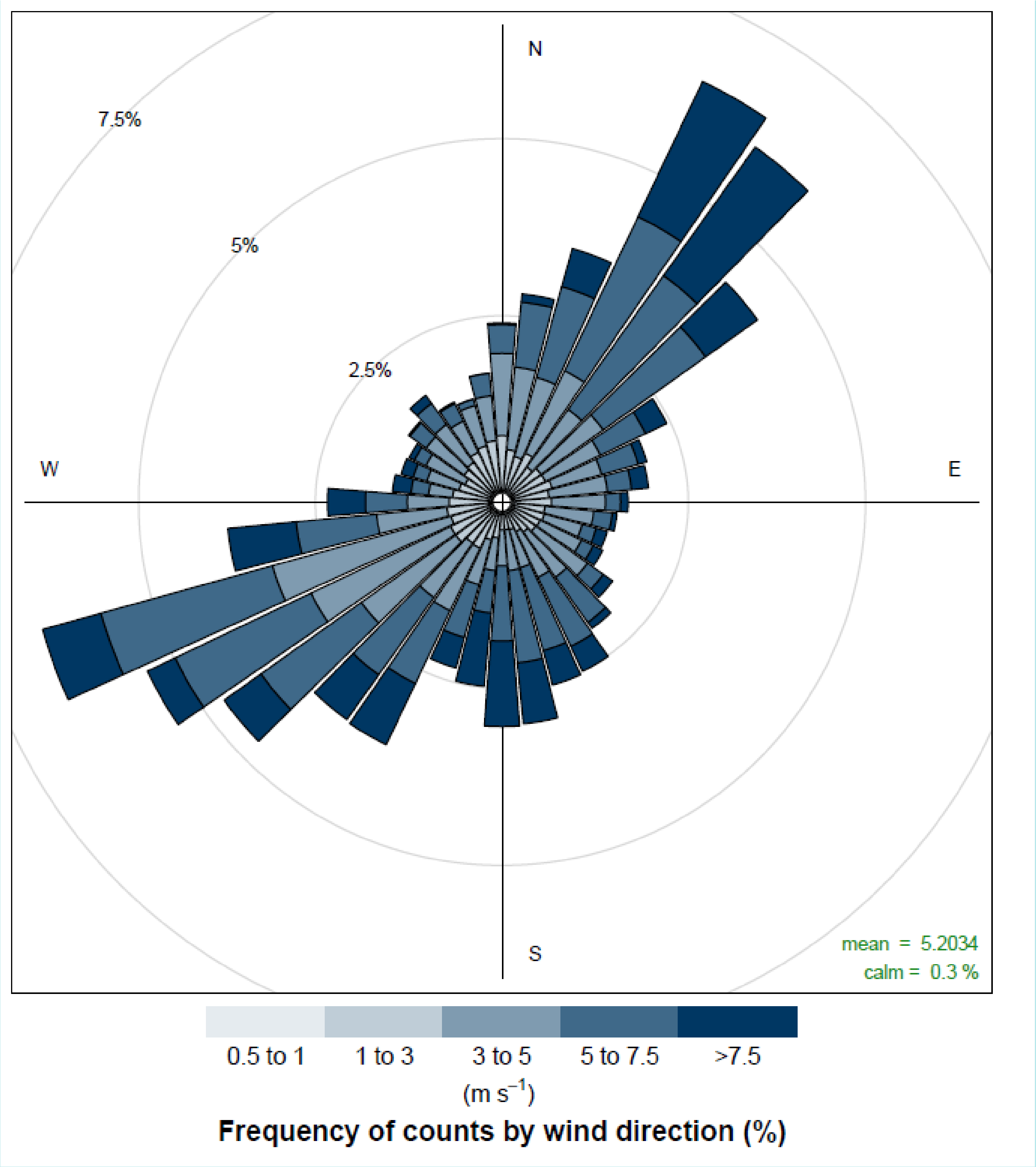


Figure A.7 Wind rose at site from CALMET (2017)

A-3-2 Pattern of atmospheric stability

Atmospheric stability substantially affects the capacity of a pollutant such as gas, particulate matter or odour to disperse into the surrounding atmosphere upon discharge and is a measure of the amount of turbulent energy in the atmosphere.

There are six Pasquill-Gifford classes (A-F) used to describe atmospheric stability and these classes are grouped into three stability categories; stable (classes E-F), neutral (class D), and unstable (classes A-C). The climate parameters of wind speed, cloud cover and insolation (solar radiation) are used to define the stability category as shown in Table A4. As these parameters vary from day to night, there is a corresponding variation in the occurrence of each stability category.

Stability is most readily displayed by means of stability rose plots, giving the frequency of winds from different directions for various stability classes A to F.

Table A.4 Stability category relationship to wind speed and stability characteristics

Stability category	Wind speed range (m/s)[a]	Stability characteristics
A	0 – 2.8	Extremely unstable atmospheric conditions, occurring near the middle of day, with very light winds, no significant cloud.
B	2.9 – 4.8	Moderately unstable atmospheric conditions occurring during mid-morning/mid-afternoon with light winds or very light winds with significant cloud.
C	4.9 – 5.9	Slightly unstable atmospheric conditions occurring during early morning/late afternoon with moderate winds or lighter winds with significant cloud.
D	≥6	Neutral atmospheric conditions. These occur during the day or night with stronger winds, during periods of total cloud cover or during the twilight period.
E	3.4 – 5.4 b	Slightly stable atmospheric conditions occurring during the night-time with significant cloud and/or moderate winds.
F	0 – 3.3 [b]	Moderately stable atmospheric conditions occurring during the night-time with no significant cloud and light winds.

Note: a Data sourced from the Turner's Key to the P-G Stability Categories, assuming a Net Radiation Index of +4 for daytime conditions (between 10:00 am and 6:00 pm) and –2 for night-time conditions (between 6:00 pm and 10:00 am)

b Assumed to only occur at night, during Net Radiation Index categories of –2.

Figure A.8 shows the frequency of stability class for all hours of the model generated dataset. The following observations were made:

- Unstable atmospheres (classes A, B and C) occur 21 per cent of the time
- Neutral atmosphere conditions (class D) are the dominant stability state of the atmosphere occurring 49 per cent of the time
- Stable conditions (classes E and F) occur 30 per cent of the time

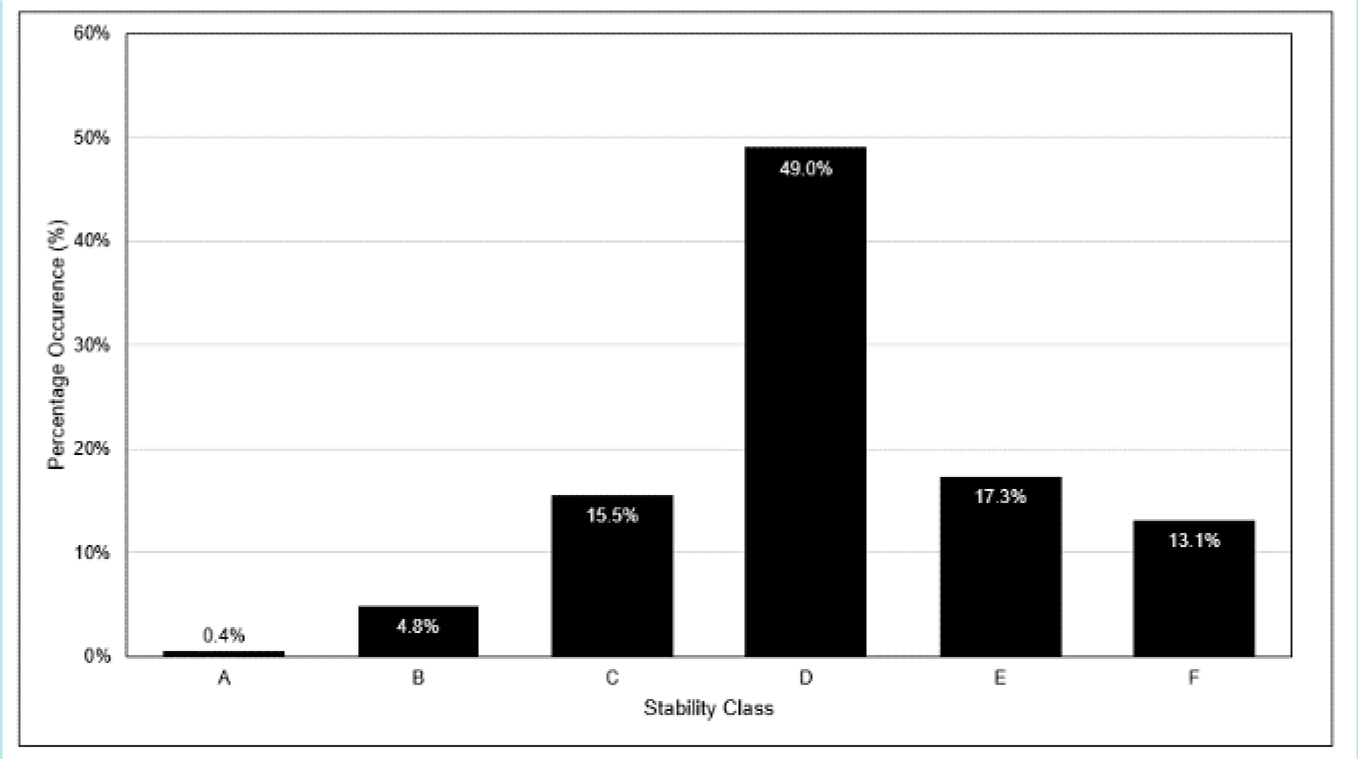


Figure A.8 Distribution of stability class for the model period

A-3-3 Mixing height

Mixing height signifies the height above the surface of the earth throughout which a pollutant can be dispersed. It is often associated with a sharp increase in temperature with height (inversion), and a sharp decrease in pollutant concentration.

A box plot of CALMET predicted mixing heights for the project is shown in Figure A.9. During the night and early morning hours, mixing heights are lower with an average of approximately 890 m (7:00 pm to 7:00 am), which then increase after sunrise to an average of approximately 1160 m during the day (7:00 am to 7:00 pm).

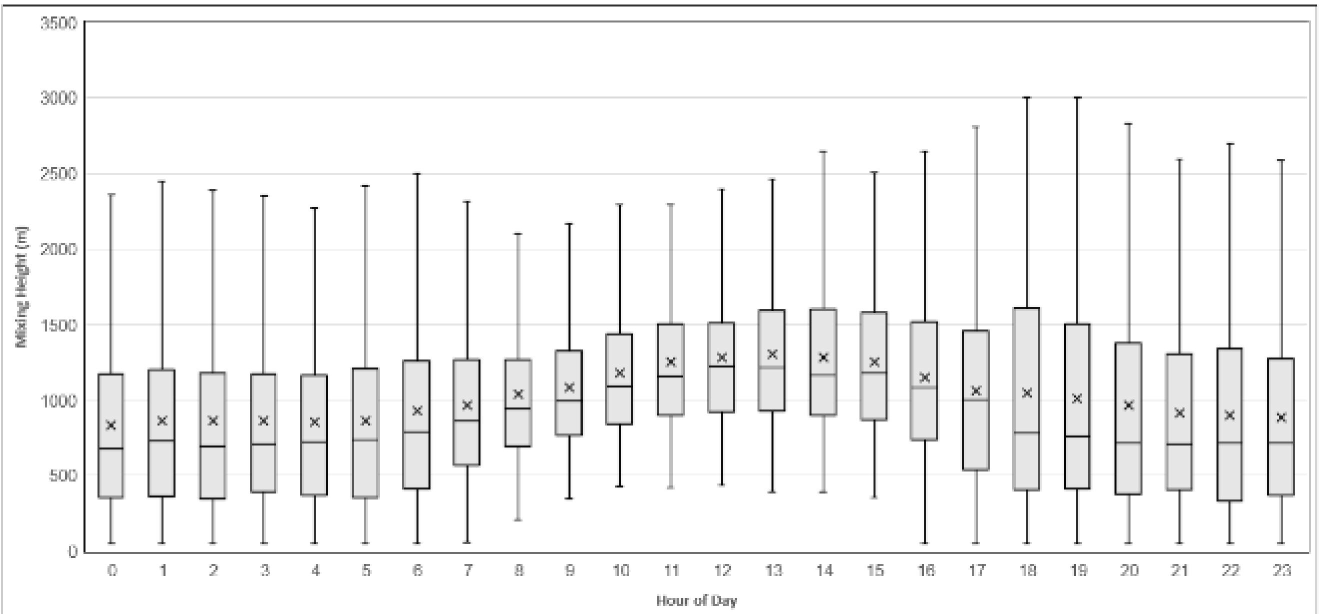


Figure A.9 Mixing heights predicted by CALMET at the project

A-4 Model verification

Verification of the meteorological model performance was carried out by comparison of model outputs to BOM observations at the Port Kembla AWS, Bellambi AWS and Albion Park (Wollongong airport) and BlueScope meteorological observations at Old Scout Hall and North Gate.

BoM and BlueScope observation data was sourced for the same time period as that of the CALMET model period (01/01/2017 through 01/01/2018) for verification.

It is noted that comparisons against BlueScope meteorological observations were provided for high level indicative purposes only as they are not fully compliant with the Australian Standard for wind speed and direction due to insufficient height above ground and nearby obstructions that could influence recorded meteorology.

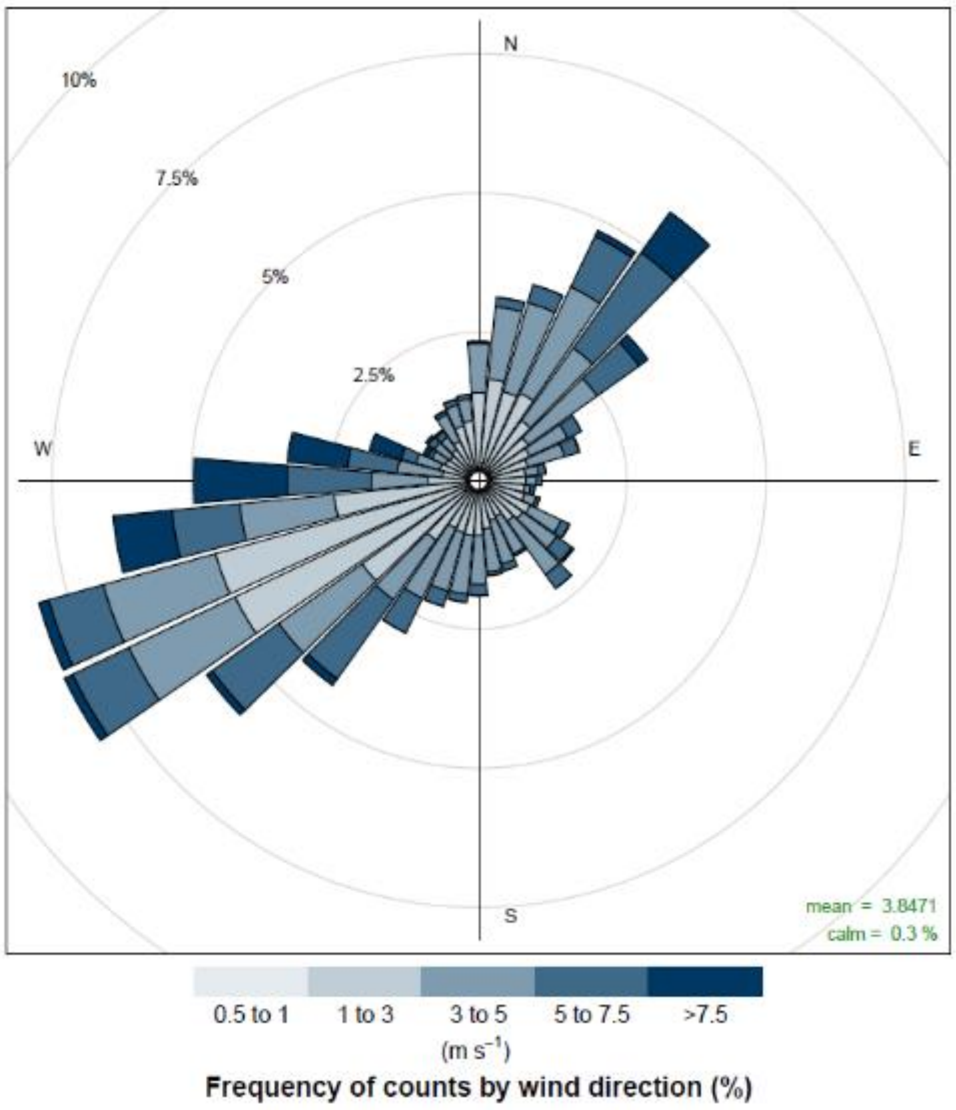
Figures comparing the BOM observations and the CALMET output are presented in Table A.5 and described below:

– Comparison to BoM stations shows relatively good agreement between the observed and modelled data set. The wind patterns including the primary wind directions (winds from the northeast and southwest at the Port Kembla AWS and Bellambi AWS and winds from the northeast and west at the Albion Park station) are replicated in the model outputs. The observed data contains a higher percentage of lower wind speeds than the CALMET output and consequently the CALMET output shows a higher mean wind speed. The frequency of calm winds (<0.5 m/s) predicted by the CALMET model aligns well with that observed at Port Kembla AWS and Bellambi AWS, while the model predicts slightly less occurrence of calms at Albion Park compared to BoM station observations.
– Comparison to BlueScope shows relatively good agreement of pattern direction patterns between the observed and modelled data set, however observed wind speeds are significantly lower than those predicted by the model. As noted above, BlueScope’s meteorological observations are not fully compliant with the Australian Standard for wind speed and direction as the anemometer is lower than 10 metres as specified by the Australian Standard and the nearby wind field is obstructed by buildings etc., which increase turbulent resulting in less/slower winds. Consequently, it is expected that the BlueScope observations have a greater percentage of lower wind speed compared to the modelled data set.
– The analysis demonstrates that the performance of the CALMET model is acceptable.

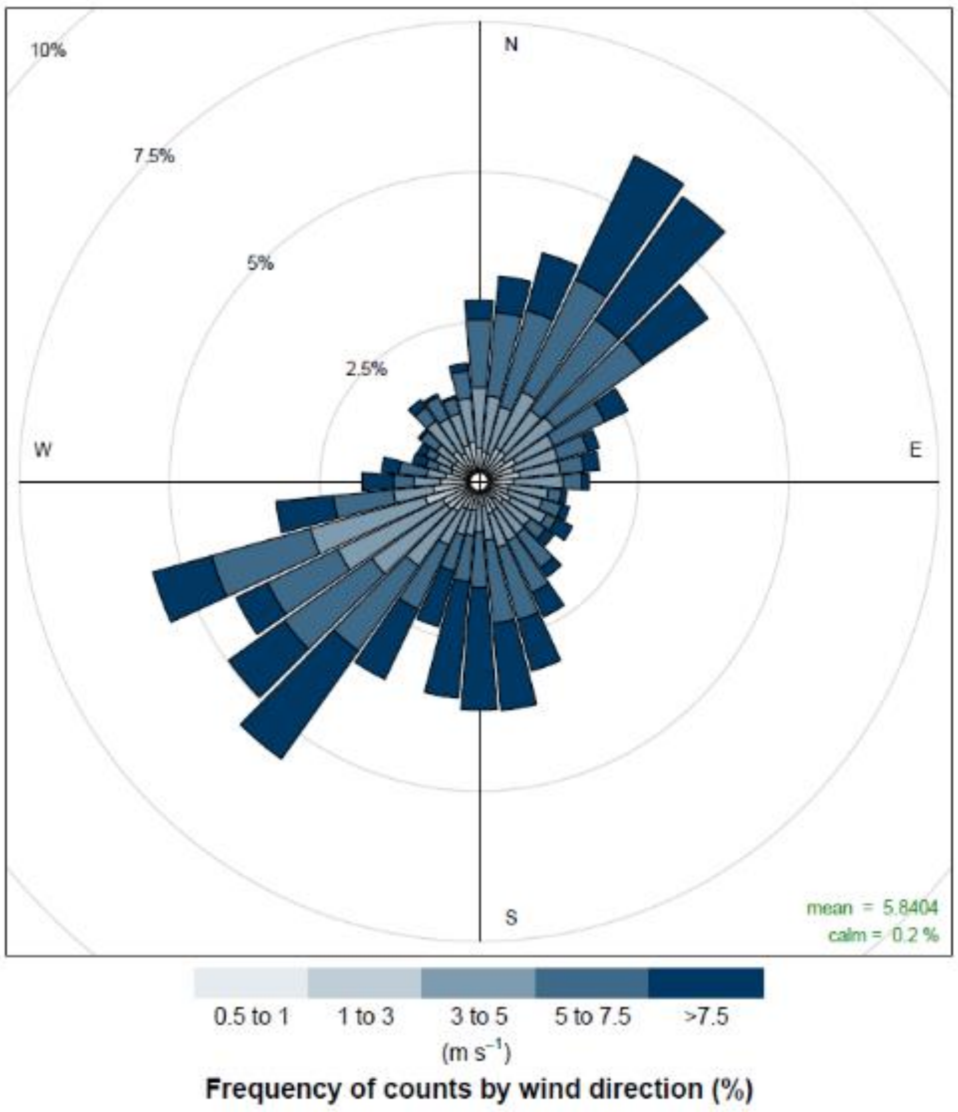
Table A.5 Model verification of CALMET model output compared to observation data

Observation	CALMET output
BOM observations	

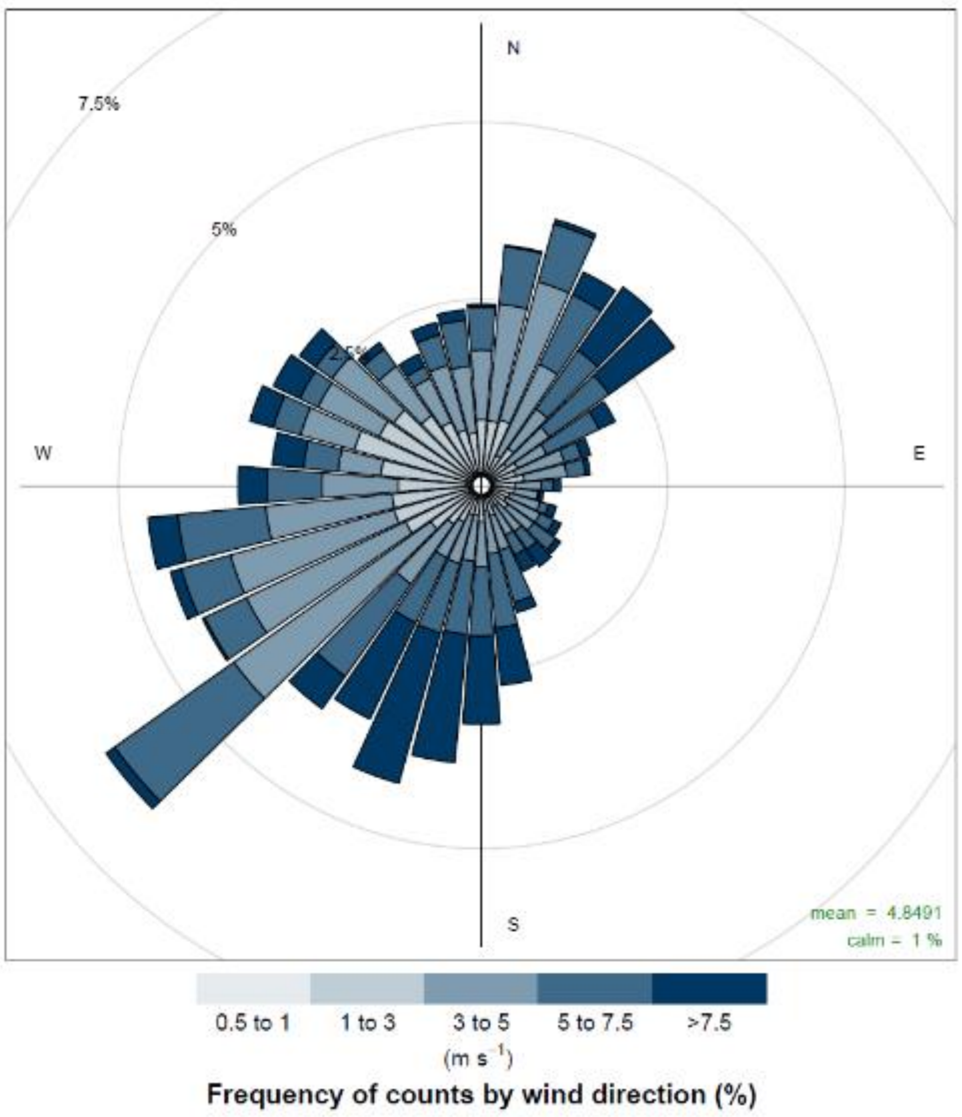
BOM observation – Port Kembla AWS – 01/01/2017-01/01/2018



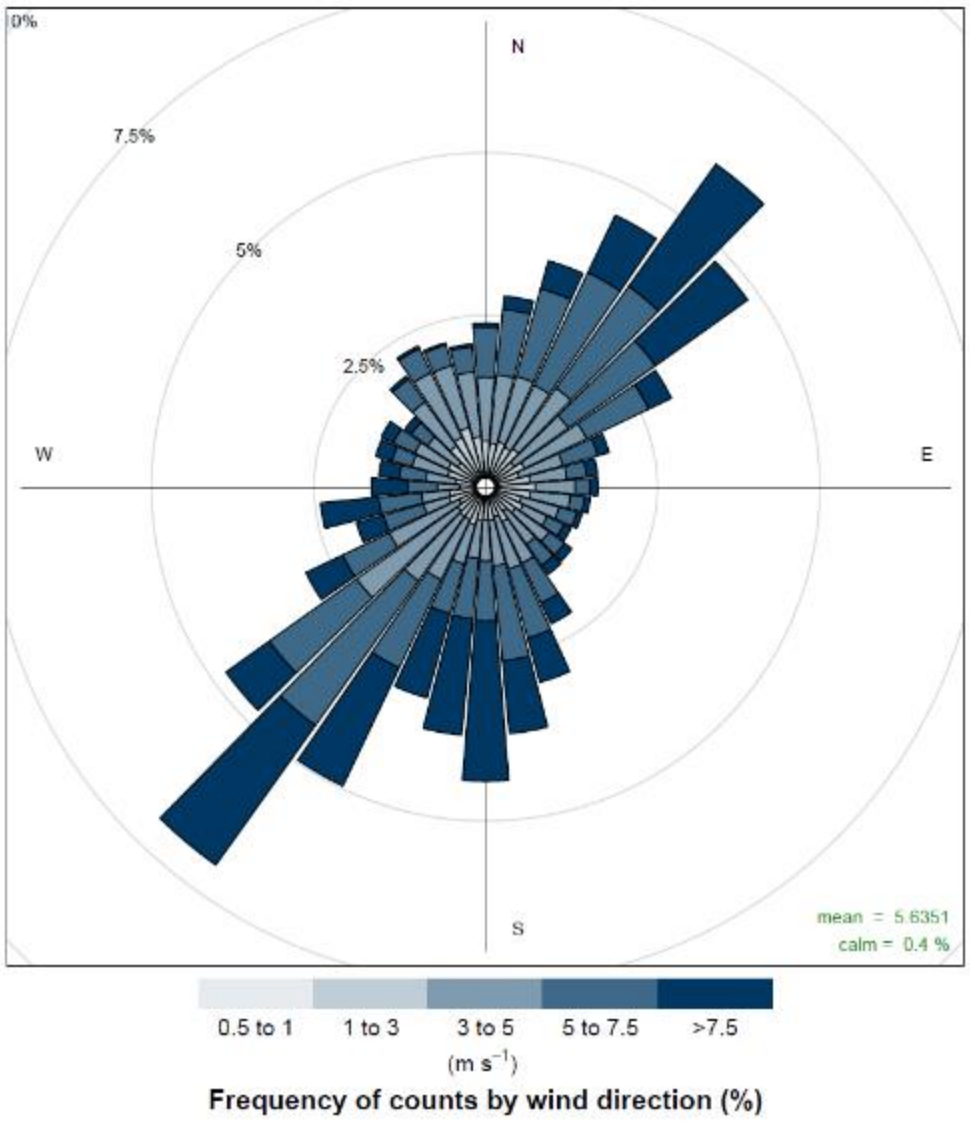
CALMET output – Port Kembla AWS – 01/01/2017-01/01/2018



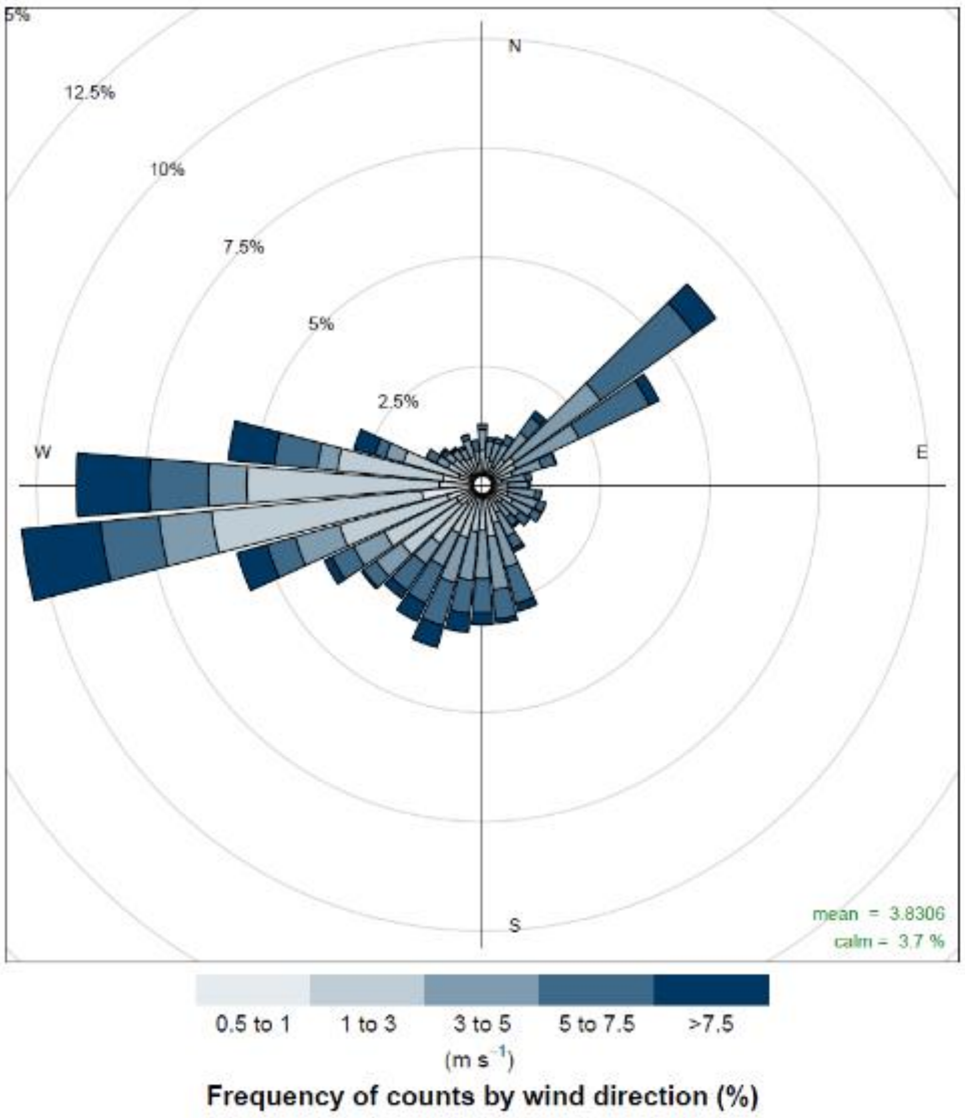
BOM observation – Bellambi AWS – 01/01/2017-01/01/2018

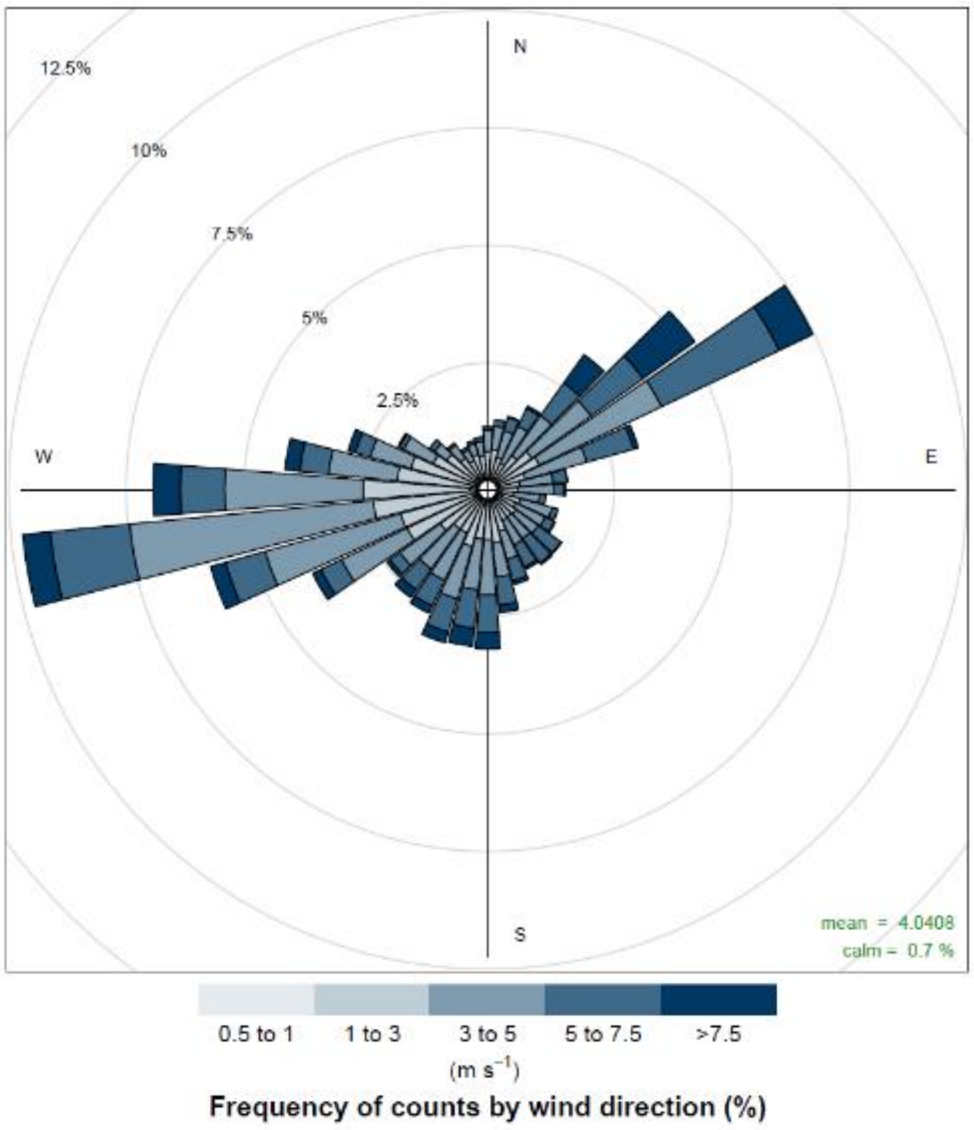


CALMET output – Bellambi AWS – 01/01/2017-01/01/2018



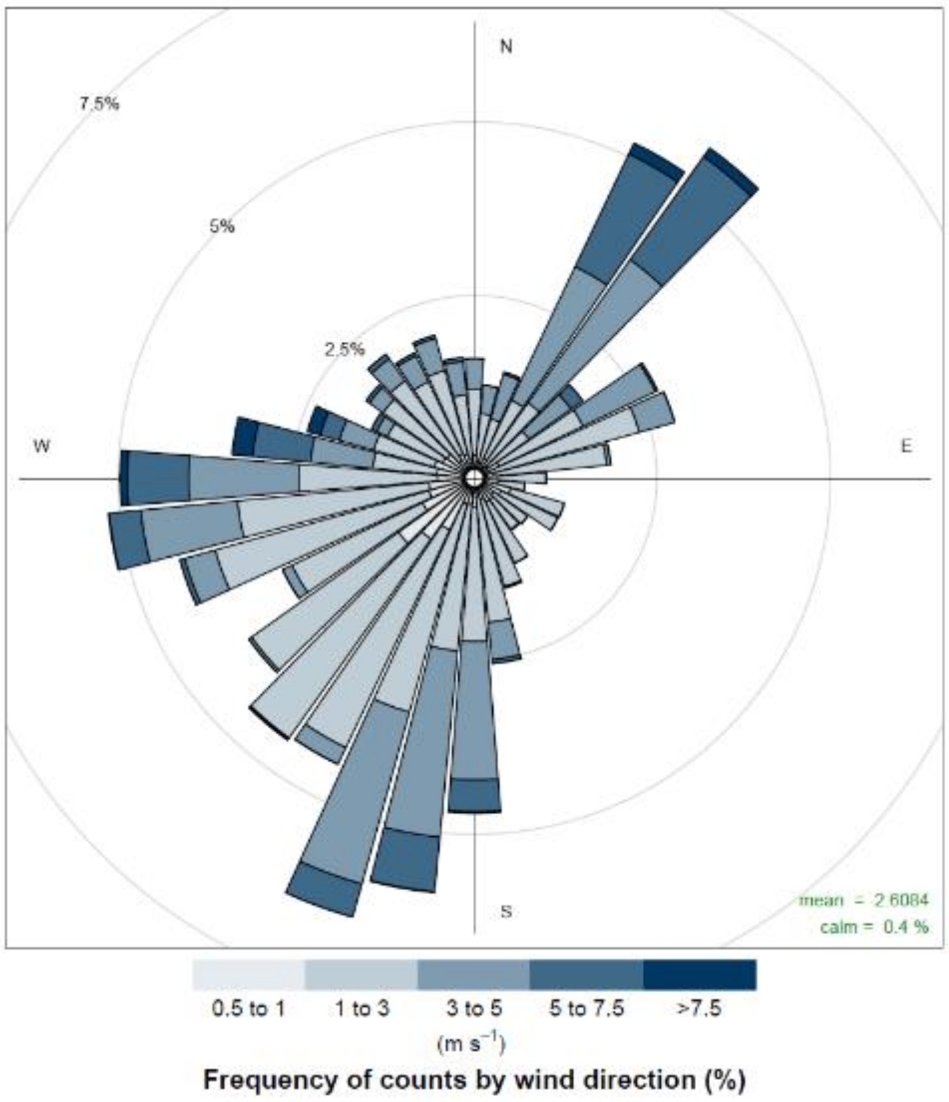
Observation	CALMET output
BOM observation – Albion Park (Wollongong airport) – 01/01/2017-01/01/2018	CALMET output – Albion Park (Wollongong airport) – 01/01/2017-01/01/2018

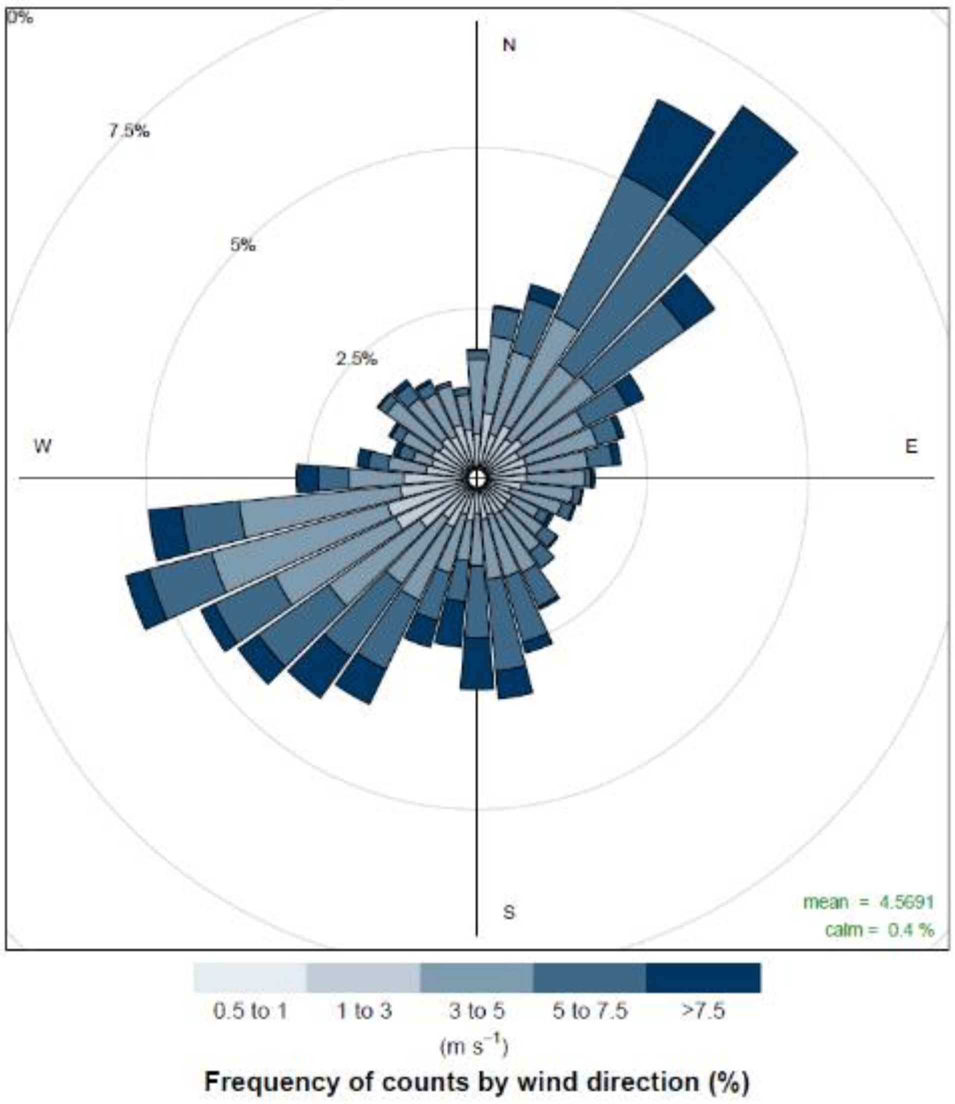




BlueScope observations

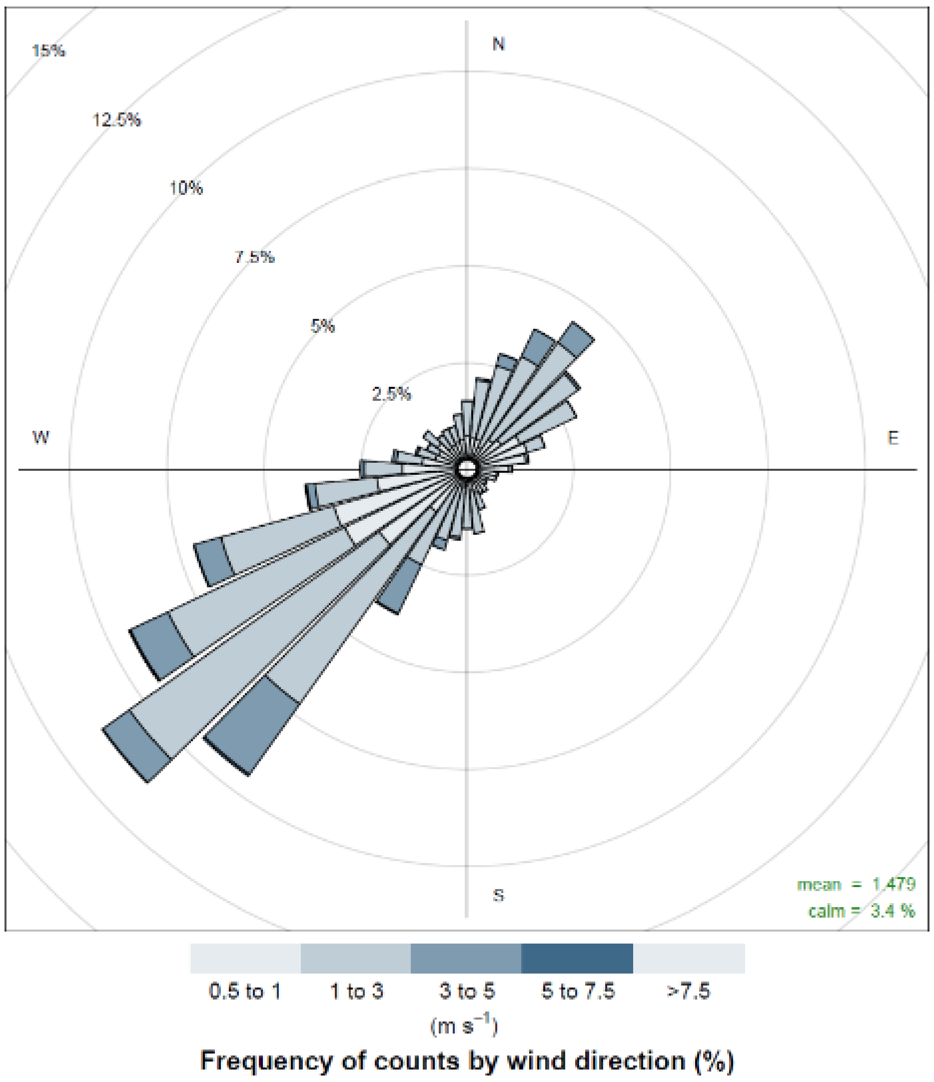
BlueScope observation – BlueScope Old Scout Hall – 01/01/2017-01/01/2018	CALMET output – BlueScope Old Scout Hall – 01/01/2017-01/01/2018





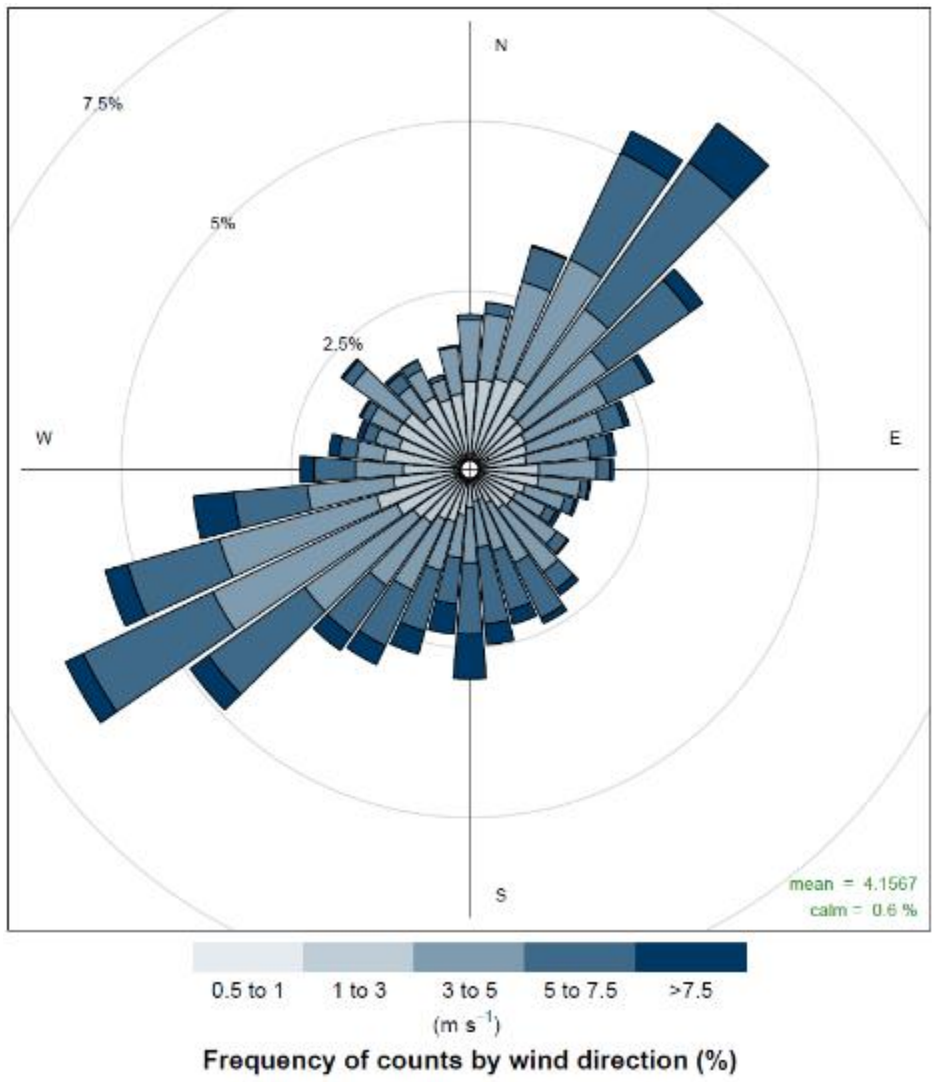
Observation

BlueScope observation – BlueScope North Gate – 01/01/2017-01/01/2018



CALMET output

CALMET output – BlueScope North Gate – 01/01/2017-01/01/2018



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