7 AIR QUALITY

7.1 EPA OBJECTIVE

The EPA Objective for this Key Environmental Factor is to maintain air quality and minimise emissions so that environmental values are protected.

7.2 POLICY AND GUIDANCE

Relevant EPA and Commonwealth Government guidance documents for Air Quality are summarised in Table 7-1.

Table 7-1: Policy and guidance relevant to the Air Quality Key Environmental Factor

Policy and Guidance	How guidance has been considered
WA Government	
Key EPA documents	
Statement of Environmental Principles, Factors, Objectives and Aims of EIA (EPA, 2023a)	This document was considered in the preparation of this Supplementary Document and to inform EIA. It was used identify the Key Environmental Factors likely to be impacted by the Proposal and the EPA's objective for each factor.
EIA (Part IV Divisions 1 and 2) Procedures Manual (EPA, 2024a)	This document has been considered in planning for the Part IV approval process and has been used to inform the preparation of this Supplementary Document.
EIA (Part IV Divisions 1 and 2) Administrative Procedures (EPA, 2024b)	This document has been considered in planning for the Part IV approval process and has been used to inform the preparation of this Supplementary Document.
Relevant EPA Factor Guidelines	
Environmental Factor Guideline – Air Quality (EPA, 2020c)	This document was considered in the preparation of this section (Section 7) of the Supplementary Document.
Relevant EPA Technical Guidance	
Guidance for the Assessment of Environmental Factors – Separation Distances between Industrial and Sensitive Land Uses No. 3 (EPA, 2005)	This document was used to inform the survey effort required to undertake EIA for the Proposal and is referenced throughout the Air Quality Assessment (Ramboll, 2024; Appendix 5) and Dust Modelling (ETA, 2024; Appendix 6).
Other Policy and Guidance	
WA Environmental Offsets Policy (EPA, 2011)	This document was considered during EIA for Air Quality however it was determined to not be relevant as offsets were not required.
WA Environmental Offsets Guidelines (EPA, 2014a)	This document was considered during EIA for Air Quality however it was determined to not be relevant as offsets were not required.
WA Environmental Offsets Template (EPA, 2014b)	This document was considered during EIA for Air Quality however it was determined to not be relevant as offsets were not required.
National Environmental Protection Measure for Ambient Air Quality (NEPC, 2021)	This legislation was considered in the preparation of this section (Section 7) of the Supplementary Document.
Management of fibrous minerals in WA mining operations – guideline (DMP, 2015)	This document was considered in the provision of this section (Section 7) of the Supplementary Document, although deemed not relevant to the Proposal.

Policy and Guidance	How guidance has been considered
Guidance Note on Public Health Risk Management of Asbestiform Minerals Associated with Mining (DoH, 2013)	This document was considered in the provision of this section (Section 7) of the Supplementary Document, although deemed not relevant to the Proposal.
Guideline – Dust Emissions, draft for external consultation (DWER, 2021a)	This document was used to inform the survey effort required to undertake EIA for the Proposal and is referenced throughout the Dust Modelling (ETA, 2024; Appendix 6).
Guideline – Air Emissions, draft for external consultation (DWER, 2019c)	This document was used to inform the survey effort required to undertake EIA for the Proposal and is referenced throughout the Air Quality Assessment (Ramboll, 2024; Appendix 5).
Commonwealth Government	
Key Documents	
Significant Impact Guidelines 1.1 – Matters of National Environmental Significance (DotE, 2013)	This document was considered in determining whether the Proposal is likely to have a significant impact on a matter protected under the EPBC Act.
EPBC Act Condition Setting Policy (DAWE, 2020)	This document was used as guidance for the referral process and EIA of the Proposal.
Relevant Technical Guidance	
Air Quality Modelling Guidance Notes (DotE, 2006)	This document was considered in the provision of this section (Section 7) of the Supplementary Document.
United States Environmental Protection Agency (USEPA, 2011) Air Emissions Factors and Quantification: AP-42 Compilation of Air Emission Factors	This document was considered in the preparation of this section (Section 7) of the Supplementary Document.
National Pollutant Inventory (2008) Emission Estimation Technique Manual for Combustion Engines. Version 3.0	This document was used to inform the survey effort required to undertake EIA for the Proposal and is referenced throughout the Air Quality Assessment (Ramboll, 2024; Appendix 5).
New South Wales Environmental Protection Authority (NSW EPA) (2017) Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales, Sydney, NSW	This document was considered in the preparation of this section (Section 7) of the Supplementary Document.

7.3 RECEIVING ENVIRONMENT

Information in the following section is sourced from Ramboll Australia Pty Ltd (Ramboll) (2024; Appendix 5) Air Quality Assessment and Environmental Technologies & Analytics Pty Ltd (ETA) Dust Emissions Assessment (2024; Appendix 6), unless otherwise referenced.

7.3.1 PREVAILING WINDS

ETA (2024) completed the air dispersion modelling using AERMOD which is a steady state Gaussian (plume) model and is the recommended regulatory model for short range (<50 km) air dispersion in the United States. AERMOD is used in widely in Australia for regulatory approvals applications and is accepted for use by the DWER. AERMOD is a current-generation air dispersion model that incorporates concepts such as planetary boundary layer theory and advanced methods for handling complex terrain. The utilization of AERMOD is consistent with the considerations of EIA outlined in the EPAs Environmental Factor Guideline for Air Quality (EPA, 2020c).

A model-ready meteorological dataset based on the PHIC Cumulative Air Model (CAM) was provided by the PHIC and used for input into AERMOD. The annual average wind rose derived from the Port Hedland Airport meteorological dataset (2013) provides an overview of wind speed and direction patterns and is presented in Figure 7-1.

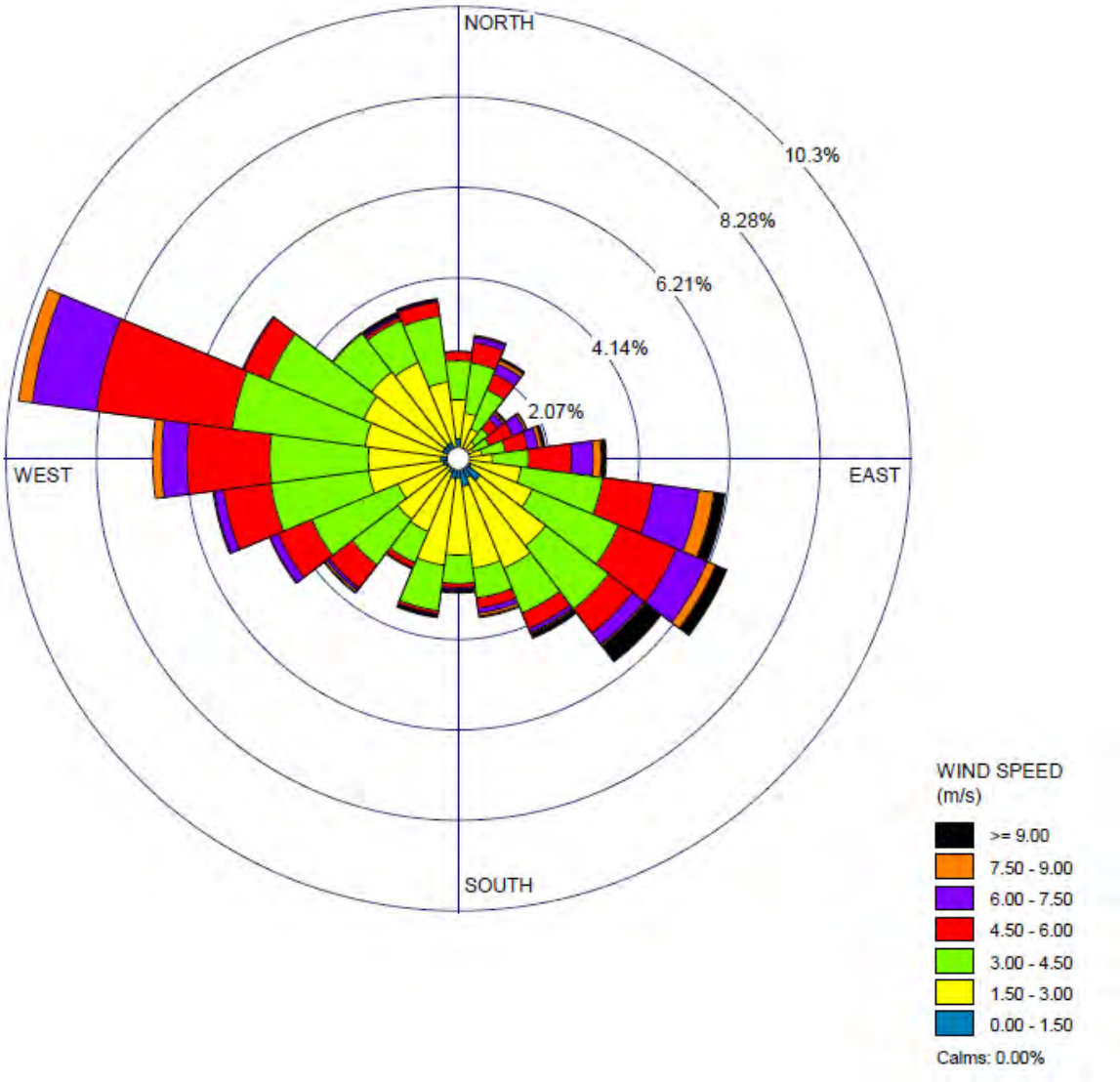


Figure 7-1: Windrose for Port Hedland Airport

7.3.2 TERRAIN

The Proposal is located in the Roebourne subregion within the Pilbara bioregion of WA, characterised by Quaternary alluvial and older colluvial coastal and sub-coastal plains. The Proposal and surrounding landscape is relatively flat with terrain-induced effects on local winds not expected to be significant. Proximity to the ocean is likely to have an effect on wind and humidity.

7.3.3 BACKGROUND DUST

Particulate matter (PM) is generally defined as particles that can remain suspended in the air by turbulence for an appreciable length of time. PM can consist of a range of matter including crustal material, pollens, sea salts and smoke from combustion products. PM is commonly defined by the size of the particles including the following:

- Total suspended particulates (TSP), which is all PM with an equivalent aerodynamic particle diameter below 50 µm diameter;
- PM_{10} is PM below 10 µm in equivalent aerodynamic diameter; and
- $PM_{2.5}$ is PM below 2.5 µm in equivalent aerodynamic diameter.

TSP contains PM_{10} and $PM_{2.5}$ fractions and is normally associated with amenity and nuisance impacts. PM_{10} and $PM_{2.5}$ are generally associated with the potential for health impacts as particles this size and below may enter the lungs.

It has long been recognised that the Pilbara region, due to its semi-arid climate, is a naturally dusty environment. This was highlighted in the aggregated emission study undertaken by SKM in 2000 (SKM, 2003) which calculated that the Pilbara region emitted approximately 170,000 tonnes of windblown particulates for the financial year 1999/2000. The naturally dusty environment is also apparent from the monitoring data from the PHIC Yule River monitor. This monitor is located approximately 42 km south-west of Port Hedland and is indicative of regionally representative concentrations of particulates. The number of excursions of the 50 µg/m^3 National Environment Protection Measure (NEPM) criteria for particulates (as PM_{10}) for each financial year since 2012/2013 (FY13) are presented in Table 7-2.

It is apparent that there can be a large annual variation in the number of excursions of the NEPM PM_{10} criteria ranging from 24 in FY13 down to 1 in FY17 and FY22. This indicates that the quantity of particulates can vary significantly from year to year and that the background file used in the assessment should be considered as indicative only.

Table 7-2: Number of annual excursions of the PM_{10} NEPM criteria at Yule River

Financial year	FY13	FY14	FY15	FY16	FY17	FY18	FY19	FY20	FY21	FY22	FY23
Number of Excursions	24	8	18	5	1	8	15	13	8	1	20

Whilst dust levels in the Pilbara region can be higher than other areas in the state, the dust levels in Port Hedland are an issue for the community. The Port of Port Hedland is used to handle hundreds of millions of tonnes of iron ore each year – with unloading from trains and trucks, stockpiling and ship loading activities being major sources of airborne dust. This prompted to Government of WA to take steps to manage the issue.

The Port Hedland Dust Management Taskforce (Taskforce) was established in May 2009 to plan for and provide effective dust management strategies in Port Hedland. A health risk assessment was undertaken in Port Hedland and finalised by the Department of Health in 2016 (DoH, 2016). This investigation focused on the potential impacts on human health from PM10 (dust) inhalation by residents. A key finding from this study was the establishment of an air guideline value (AGV) for PM10 of 70 µg/m3 averaged over a 24-hour period from midnight to midnight.

The Port Hedland AGV was derived using established human health risk assessment techniques and assumptions and is considered to be protective of the health of a 'general population' (provided the overall population for the Port Hedland peninsula does not exceed 17,000. This is the modelled population in the Health Risk Assessment, as advised by the DoH).

The Taskforce also released the "Port Hedland Dust Management Taskforce Report" to Government in August of 2016. Final recommendations of the Taskforce included:

- The interim guideline of 24-hour PM10 of 70 µg/m3 (+ 10 exceedances to accommodate natural events) continues to apply to residential areas of Port Hedland and measures should be introduced to cap (and if possible, reduce) the number of permanent residents in dust-affected areas of Port Hedland; and
- PHIC continues operating and maintaining its air quality network, with responsibility for oversight of the network, including data verification, storage and publication, transferred to the Department of Environmental Regulation (now DWER).

In October 2018, the State Government released its response to the Port Hedland Dust Management Taskforce's Report, in particular endorsing the recommendation that an air guideline value of 24-hour PM10 of 70 µg/m^3 (excluding natural events) continues to apply where people live on a permanent basis.

DWER also released the *Port Hedland Regulatory Strategy* (Regulatory Strategy) in 2021. The Regulatory Strategy recognised, amongst other things, the key role that Part V of the EP Act should play in regulating dust emissions in Port Hedland.

PHIC has developed a CAM for the Port Hedland airshed which includes the cumulative modelling results for all approved facilities within the airshed. The PHIC CAM was utilised by PHI in recognition of the concerns regarding cumulative dust emissions in Port Hedland.

For the dust assessment of the Proposal the PHIC CAM background file was utilised. The methodology for the development of this file is outlined in Pacific Environment Limited (PEL) (2015). The PEL (2015) report also noted that due to the way the file was calculated there is a high probability that not all fugitive sources within the Port Hedland region were accounted for. This provides further indication that the file should be considered as indicative only. The 24-hour statistics for the PHIC CAM background file are presented in Table 7-3 and presented graphically in Figure 7-2. It is apparent that the maximum 24-hour concentration is higher than the criteria (183 vs 70 µg/m^3) which will affect the analysis of the modelling results, particularly when the maximum predicted concentrations, with background, are presented.

Table 7-3: Statistics of 24-hour PM_{10} PHIC CAM background file

Pollutant	Concentration (µg/m³)
Maximum	183
99th Percentile	53
95th Percentile	36
90th Percentile	32
70th Percentile	25
Average	22
Count >50 µg/m³	5
Count >70 µg/m³	1

As outlined in PEL (2015) the background file developed for the PHIC CAM was only for PM_{10} and the model has only been validated for this particle size. To assist in determining a potential $PM_{2.5}$ background file the PM_{10} to $PM_{2.5}$ ratio was calculated for the monitoring data from the Bureau of Meteorology (BoM) from the PHIC annual monitoring reports for the periods 2016/2017 through to 2019/2020. This data is presented in Table 7-4 where it is apparent that there is some inter-annual variation in the ratio of PM_{10}:$PM_{2.5}$ an overall average ratio of 0.28 would be applicable.

To obtain an indicative assessment of $PM_{2.5}$ in this assessment the PM_{10} model results, for both the existing and approved operations and the Project, were scaled using a factor of 0.28.

Table 7-4: Determining background $PM_{2.5}$ from PM_{10} concentrations.

Reporting Year	PM_{10} Concentration		$PM_{2.5}$ Concentration		Ratio	
	Maximum	Annual Average	Maximum	Annual Average	Maximum	Annual Average
2016/2017	80.3	21.4	24.2	6.3	0.30	0.29
2017/2018	54.5	23.8	20.2	6.9	0.37	0.29
2018/2019	107.1	31.5	22.2	8.9	0.21	0.28
2019/2020	293.2	32.1	55.3	7.9	0.19	0.25
				AVERAGE	0.27	0.28

PM_{10}

The isopleths for the cumulative predicted maximum PM_{10} 24-hour concentrations for Scenario 1 (background) are presented in Figure 7-2 and the annual average concentrations are presented in Figure 7-3. Noting that:

- Most maximum predicted daily average PM_{10} values occurred on the same date, 14 December 2013, where the background concentration was 183 µg/m³;
    - As a result, the features in the contour plot largely reflect the modelled dust characteristics on a single date;
    - A comparison to the 50th percentile (i.e. median) indicates that emissions features are broadly consistent, the contours are presented in;

- The contour plot indicates that industry emissions are concentrated over the western side of the harbour with significant emissions over Port Hedland. Noting that maximum daily average emissions may look different without background.

$PM_{2.5}$

The isopleths for the cumulative predicted maximum $PM_{2.5}$ 24-hour concentrations for Scenario 1 are presented in Figure 7-4 and the cumulative predicted annual average PM2.5 concentrations are presented in Figure 7-5. Noting that:

- These results were determined by scaling down the PM_{10} concentrations and should only be considered as indicative;
- As with the PM_{10} concentrations these results are influenced by a single elevated background concentration which occurred on the 14th of December 2013. As a result, the features in the contour plot largely reflect the modelled dust characteristics on a single date; and
- The contour plot indicates that industry emissions are concentrated over the western side of the harbour with significant emissions over Port Hedland. Noting that maximum daily average emissions may look different without background.

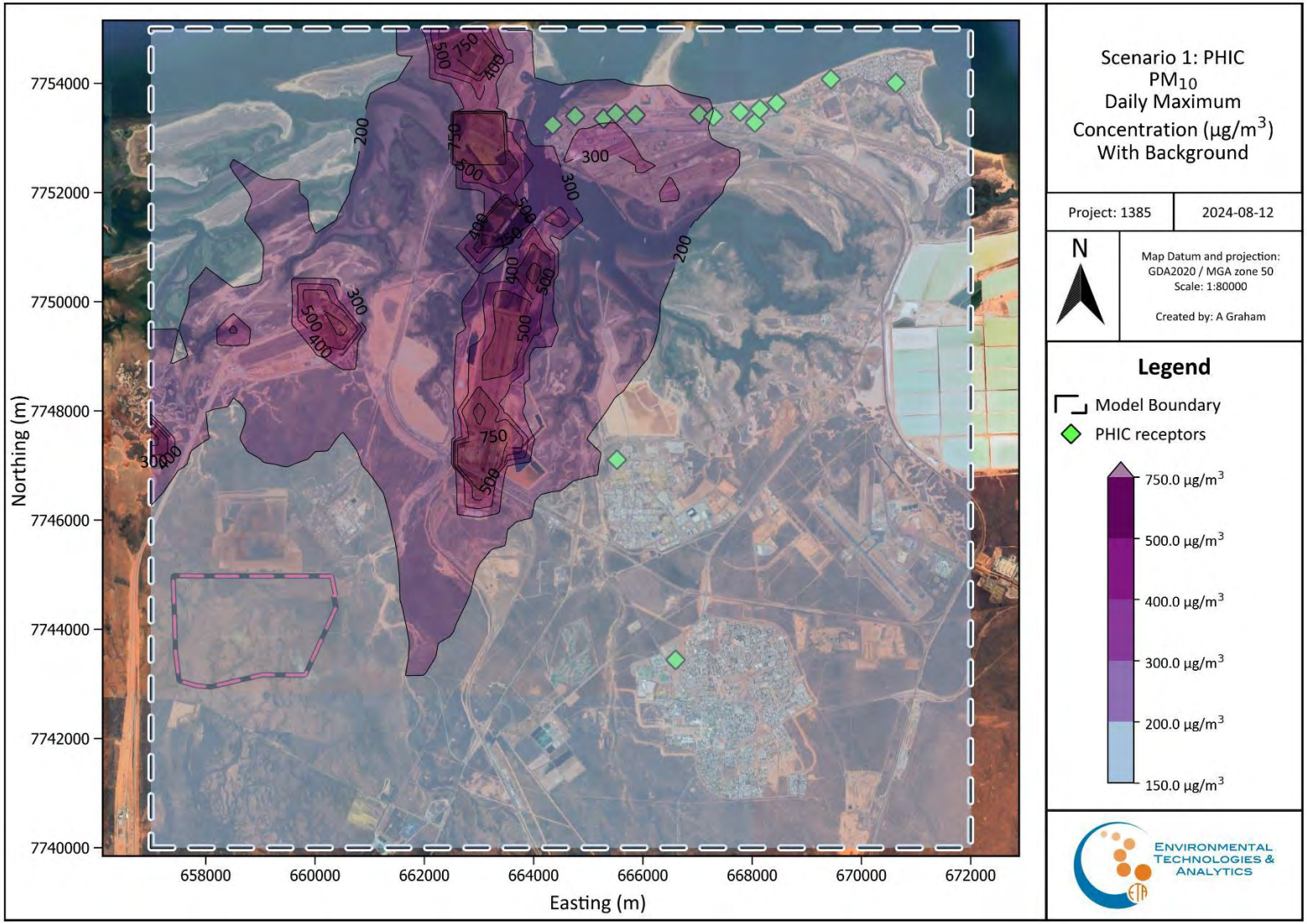


Figure 7-2: Maximum 24-hour PM_{10} concentrations for PHIC existing and cumulative model

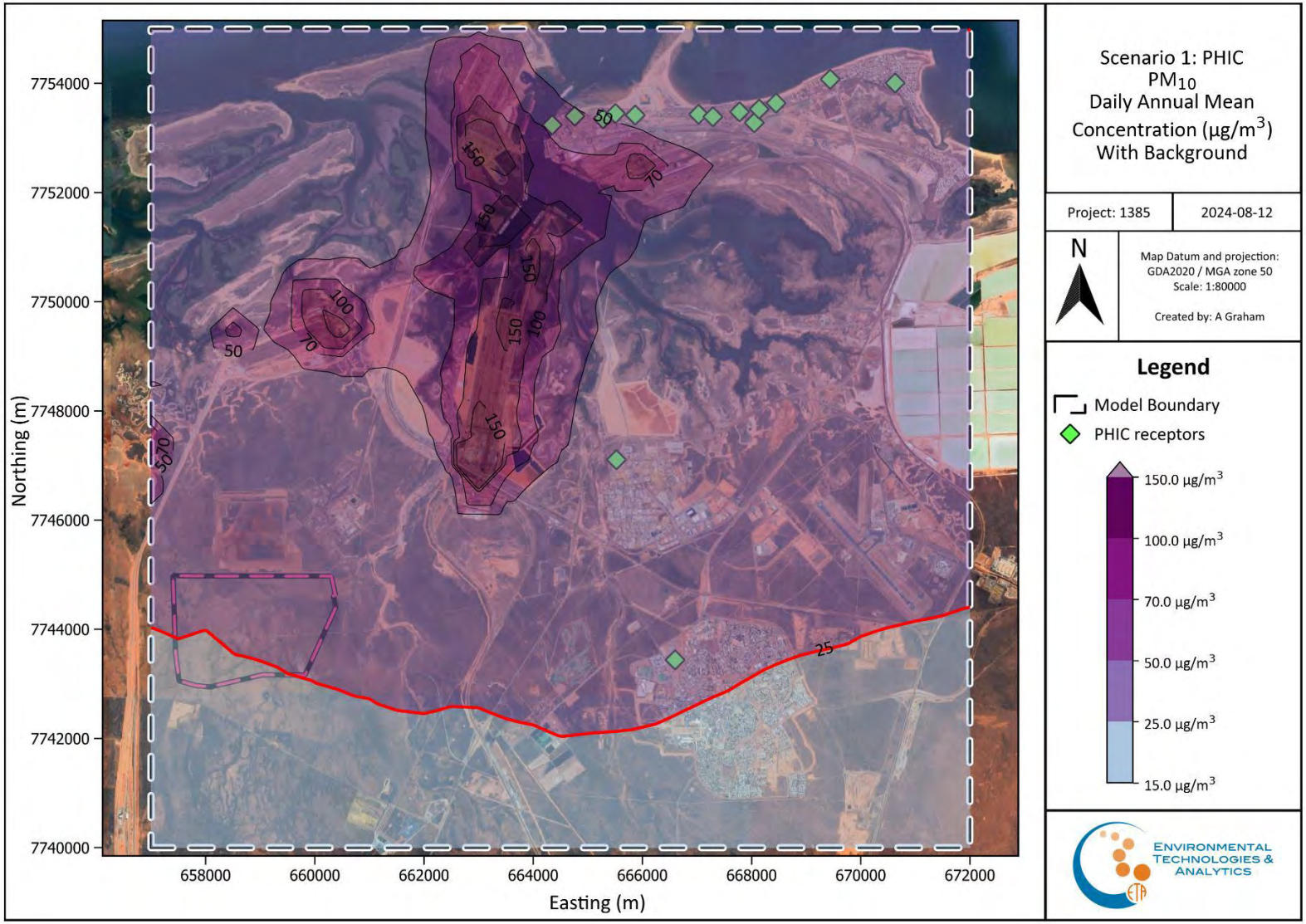


Figure 7-3: Annual average PM_{10} concentrations for PHIC existing and cumulative model

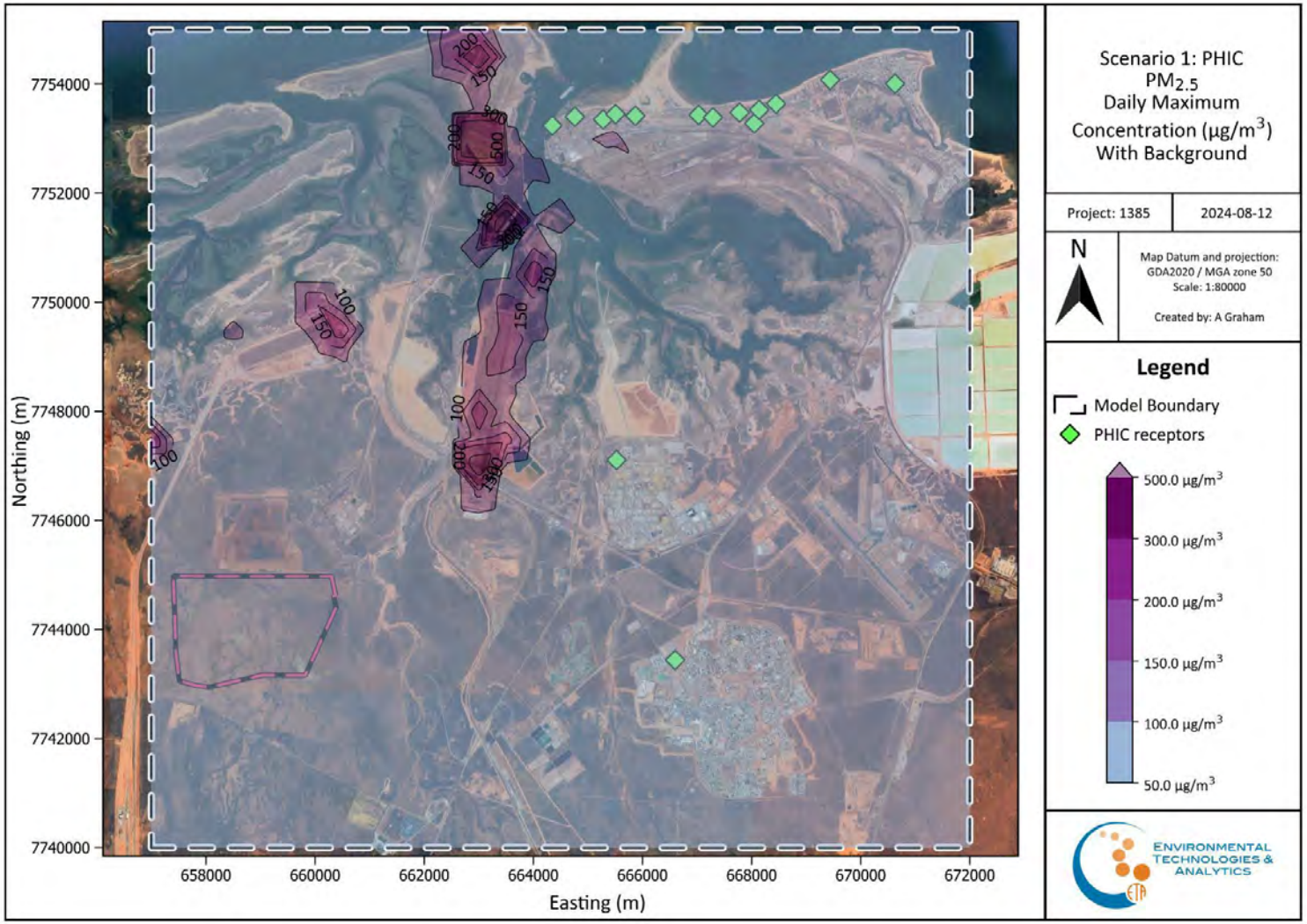


Figure 7-4: Indicative maximum 24-hour $PM_{2.5}$ concentration for PHIC existing and cumulative model

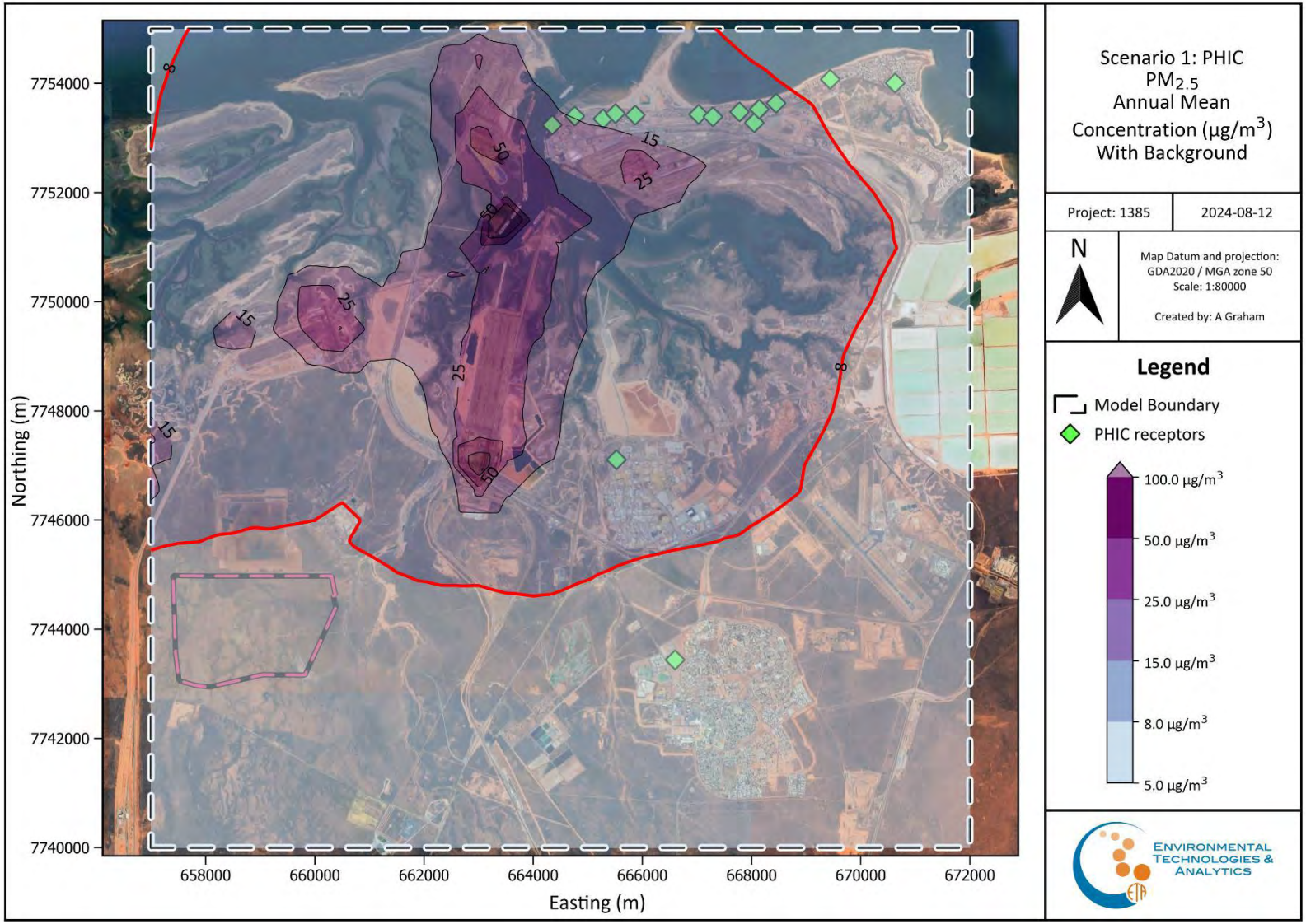


Figure 7-5: Indicative annual average $PM_{2.5}$ concentrations for PHIC existing and cumulative model

7.3.4 Background Air Quality

The PHIC has established a network of ambient air quality monitoring stations around the Port Hedland area. The network has been established to ensure that dust generated by port and industry operations does not adversely impact the Port Hedland community. The focus of the monitoring network is therefore on the measurement of particulates, however ambient NO_2 and SO_2 are being monitored at a number of locations to determine the relative change in the ambient concentration of these pollutants over time.

Live and historical data is available on Port Hedland air quality monitoring network website. The Taplin Street station data provided the five-minute average concentration of the relevant background air quality data. The 70th percentile 1-hour and 24-hour average as well as the annual average concentrations for the pollutants of interest were obtained and are presented in Table 7-5.

Table 7-5: Background monitoring concentrations – Port Hedland Taplin Street monitoring station

Pollutant	Averaging Period	70th Percentile Concentration (µg/m³)
SO_2	1-hour	2.6
	24-hour	2.6
	Annual	2.5
CO	1-hour	154
	8-hour	155
NO_2	1-hour	33.2
	Annual	12.2

The cumulative impact due to background pollutant levels and other emission sources in the region needs to be taken into account to enable an assessment of overall compliance with the ambient criteria.

The approved and existing NOx gaseous emission sources in the region are included into the assessment to calculate the cumulative NOx concentrations as they are major sources of NOx gaseous emissions. These sources are South Hedland Power Station (existing), Port Hedland Power Station (existing), and New Energy Boodarie Waste to Energy and Materials Recovery Facility (This has been approved but not built yet). The emissions information for these approved and existing facilities has been sourced from publicly available sources.

TransAlta built, own and operate the South Hedland Power Station. This is 150-megawatt (MW) power station, generated by two Combined Cycle Gas Turbines (CCGT) units (108 MW combined), and one Open Cycle Gas Turbines (OCGT) unit (42 MW). T. New Energy has environmental regulatory approval for the Boodarie Waste to Energy and Materials Recovery Facility proposed to be located on a site adjacent to the South Hedland Power Station power station premises boundary.

APA Group operates the Port Hedland Power Station, which is comprised of three 30 MW gas turbines (in the Boodarie SIA) and two 30 MW gas turbines located just north of the Boodarie SIA. The emissions information and stack release parameters sources has been sourced from previous air dispersion modelling reports. The Port Hedland Power Station is being considered for expansion. However, there is not currently sufficient publicly available emissions information and stack release parameters to enable inclusion of the expansion of the Port Hedland Power Station into the cumulative air quality model.

7.4 SENSITIVE RECEPTORS

7.4.1 DUST MODELLING

The modelling undertaken as part of this assessment utilised the same receptors, and their locations, as that contained within the PHIC CAM report (PEL, 2015). These receptors, and their coordinates, are listed in Table 2-1 of Appendix 6 and presented in Figure 7-6. Note that due to the number of receptors within the ToPH the name of each receptor was not incorporated into the figure, instead each receptor has been assigned a number. These numbers correspond to those listed in Table 2-1 of Appendix 6.

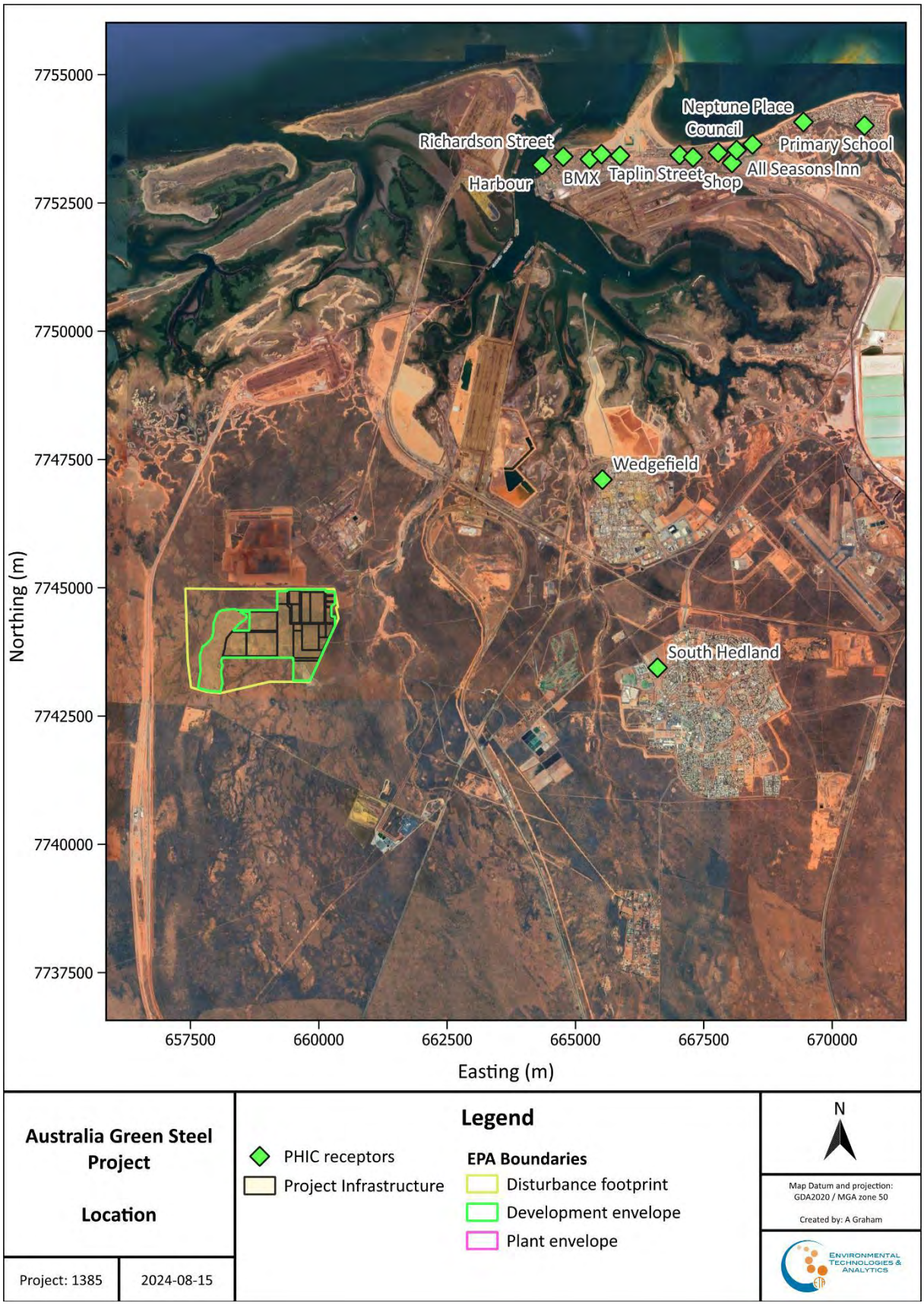


Figure 7-6: Sensitive receptors – Dust Modelling

7.4.2 Air Quality Modelling

A summary of the receptor grid for air dispersion modelling is presented in Table 7-6. In addition to the grid, ten discrete receptor locations, representing the sensitive receptor locations were also included.

Table 7-6: Receptor grid for all air dispersion modelling

Parameter	Grid
Dimensions	13 km x 10 km
Spacing	200 m
SW Easting[1] (mE)	656,500
SW Northing[1] (mN)	7,738,500
No. of Points	65 x 50

Notes:

1. MGA94

Terrain elevation data for the model domain were obtained from the US National Aeronautics and Space Administration's (NASA) Shuttle Radar Topography Mission (SRTM3/SRTM1) and incorporated into AERMOD using the AERMAP terrain processor.

Discrete receptors were positioned throughout the modelled domain to represent residential dwellings and recreational locations. These discrete receptors are summarised in Table 7-7.

Table 7-7: Discrete Receptors

ID	Receptor
R1	Quartz Quarry Road, South Hedland Rural Estate
R2	Port Hedland Golf Club
R3	Wedgefield
R4	South Hedland Sports Complex
R5	Scadden Rd, South Hedland
R6	Colebatch Way, South Hedland
R7	Wambiri St, South Hedland
R8	Steamer Ave, South Hedland
R9	Cottier Dr (roundabout), South Hedland
R10	Parker St, South Hedland

7.5 Environmental Values

Based on the information provided in Section 7.3, the local airshed and associated sensitive receptors was determined to require assessment for this factor.

7.6 POTENTIAL IMPACTS

Table 7-8 outlines the potential impacts (direct, indirect and cumulative) from the Proposal in relation to the Air Quality factor in a local context. These impacts are informed by the results of studies described in Sections 7.3. Assessment of the potential impacts is provided in the following sections.

Table 7-8: Potential impacts on Air Quality

Environmental value and current extent	Potential direct impact	Potential indirect impact	Impacts associated with other proposals	Total cumulative impact
Local airshed – Dust and air emissions Sensitive receptors	Exceeding recognised air quality standards at sensitive receptors for: • Dust emissions; and • Air emissions.	No indirect impacts identified.	The Proposal occurs in a Strategic Industrial Area with multiple Projects in the vicinity. Impacts associated with other Projects have been considered int eh cumulative air model in Section 7.7.	• Dust emissions; and • Air emissions.

7.7 ASSESSMENT OF IMPACTS

This section assesses the potential impacts of the Proposal on the environmental value identified in Section 7.3.

The potential air quality impacts of the Proposal were determined based on considerations of:

- The nature and scale of the Proposal;
- Key pollutants of concern and potential emission sources;
- Separation distance to surrounding sensitive receptors (residences);
- Proposed dust controls incorporated into the design of the Proposal and management practices that will be available to minimise dust generation; and
- Other relevant factors that could potentially influence the extent of impacts, such as terrain, prevailing meteorology, and dust characteristics.

7.7.1 DUST EMISSIONS

Modelled ground level concentrations for particulates have been compared to ambient air quality assessment criteria to determine the potential changes in impact resulting from the Proposal.

The assessment criteria adopted for dust modelling (particulates) are primarily based on the DWER (2019; 2021) guidelines, which also reference the numerical values from the ambient air quality standards specified in the Ambient Air Quality NEPM (NEPC, 2021).

In their current draft form, the DWER (2019) guidelines for PM_{10}/$PM_{2.5}$ (defined as criteria pollutants in the guideline) require the criteria to generally be 'met at all existing and future offsite sensitive receptors in the modelling domain'. DWER (2021) draft guidelines address the settling or deposition of dust, noting that at time of this assessment the guideline is draft and subject to public consultation. The guidelines also state that the department may approve deviations to the assessment criteria on a case-by-case basis.

For Port Hedland specifically, the Port Hedland Regulatory Strategy (DWER, 2021) adopted the Dust Management Taskforce (Taskforce) interim guideline value of 70 µg/m³ for PM_{10} (24-hour average) as an AGV. This AGV applies to residential areas in Port Hedland, wherever people live on a permanent basis.

The ambient air quality assessment criteria adopted in this study are shown in Table 7-9.

Table 7-9: Ambient air quality standards and goals

Pollutant	Air Quality Assessment Criteria					Reference
	Concentration [1]	Concentration [2]	Averaging Period	Allowable Exceedances	Environmental value protected	
PM_{10}	25 µg/m³	23 µg/m³	Annual	None	Human Health	DWER (2021) consistent with NEPM (NEPC, 2021)
	70 µg/m³	-	24-hour	Not more than 10 days a year		Taskforce criteria (DSD, 2016)
$PM_{2.5}$	25 µg/m³	23 µg/m³	24hour	Exception ecent		DWER (2021) consistent with NEPM (NEPC, 2021)
	8 µg/m³	8 µg/m³	Annual	None		

[1] Concentrations referenced to 0ºC
[2] Concentrations referenced to 25ºC

Significant PM sources identified through the fugitive dust assessment component of the air quality assessment include:

- Unloading ore from trucks into the operations;
- Handling and transferring, including stacking and reclaiming;
- Loading ore; and
- Wind erosion at the HBI yard.

A single scenario of 3.5 Mtpa ore in-take was modelled. This was then compared to the existing PHIC network scenario. The specific scenarios considered were:

- Scenario 2: Proposal standalone without background; and
- Scenario 3: Cumulative operations (PHI, BHP, Fortescue, PPA, Roy Hill, and NWI included) with background.

Modelling Outcomes

Scenario 2: Proposal Only PM_{10}

The predicted 24-hour predicted ground level concentrations of PM_{10} for three receptors: Taplin Street, Wedgefield, and South Hedland concentrations in isolation (without background concentrations) indicate that:

- At the Taplin St receptor all of the predicted 24-hour averaged PM_{10} concentrations are below 1 µg/m³; and
- The highest predicted impact will be 3.2 µg/m³ at the South Hedland receptor, with the lower percentile results being significantly lower.

The isopleths for the cumulative predicted maximum PM_{10} 24-hour concentrations for Scenario 2 are presented in Figure 7-7 with the annual average PM_{10} concentrations presented in.

Scenario 2: Proposal Only $PM_{2.5}$

The isopleths for the cumulative predicted maximum $PM_{2.5}$ 24-hour concentrations for Scenario 2 are presented in Figure 7-9 and the cumulative predicted annual average $PM_{2.5}$ concentrations are presented in Figure 7-10. Noting that:

- These results were determined by scaling down the PM concentrations and should only be considered as indicative.

The modelling predicted that at the Taplin St receptor all of the predicted 24-hour averaged $PM_{2.5}$ concentrations are well below 1 µg/m^3.

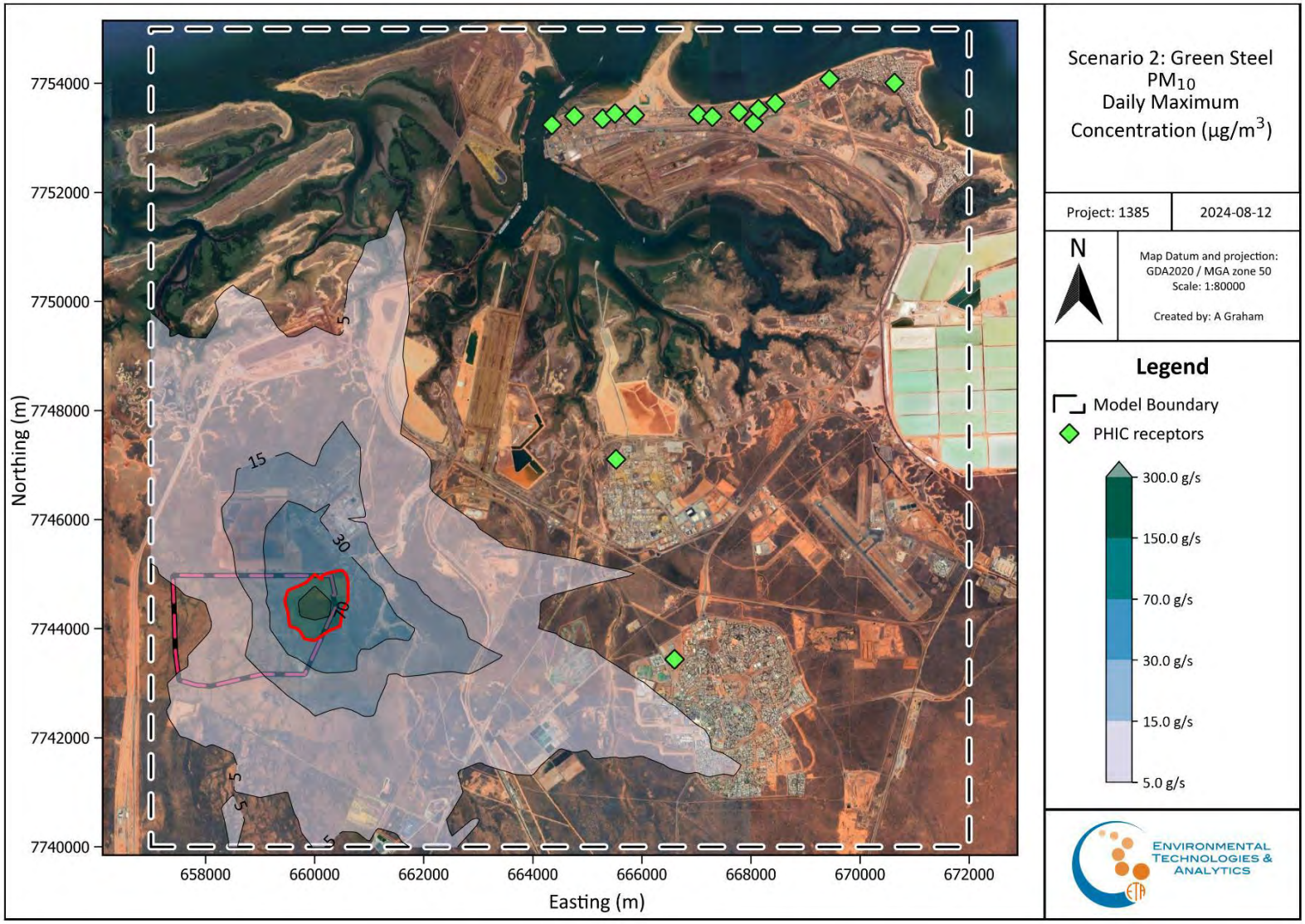


Figure 7-7: Maximum 24-hour PM_{10} concentrations for Scenario 2 (µg/m³)

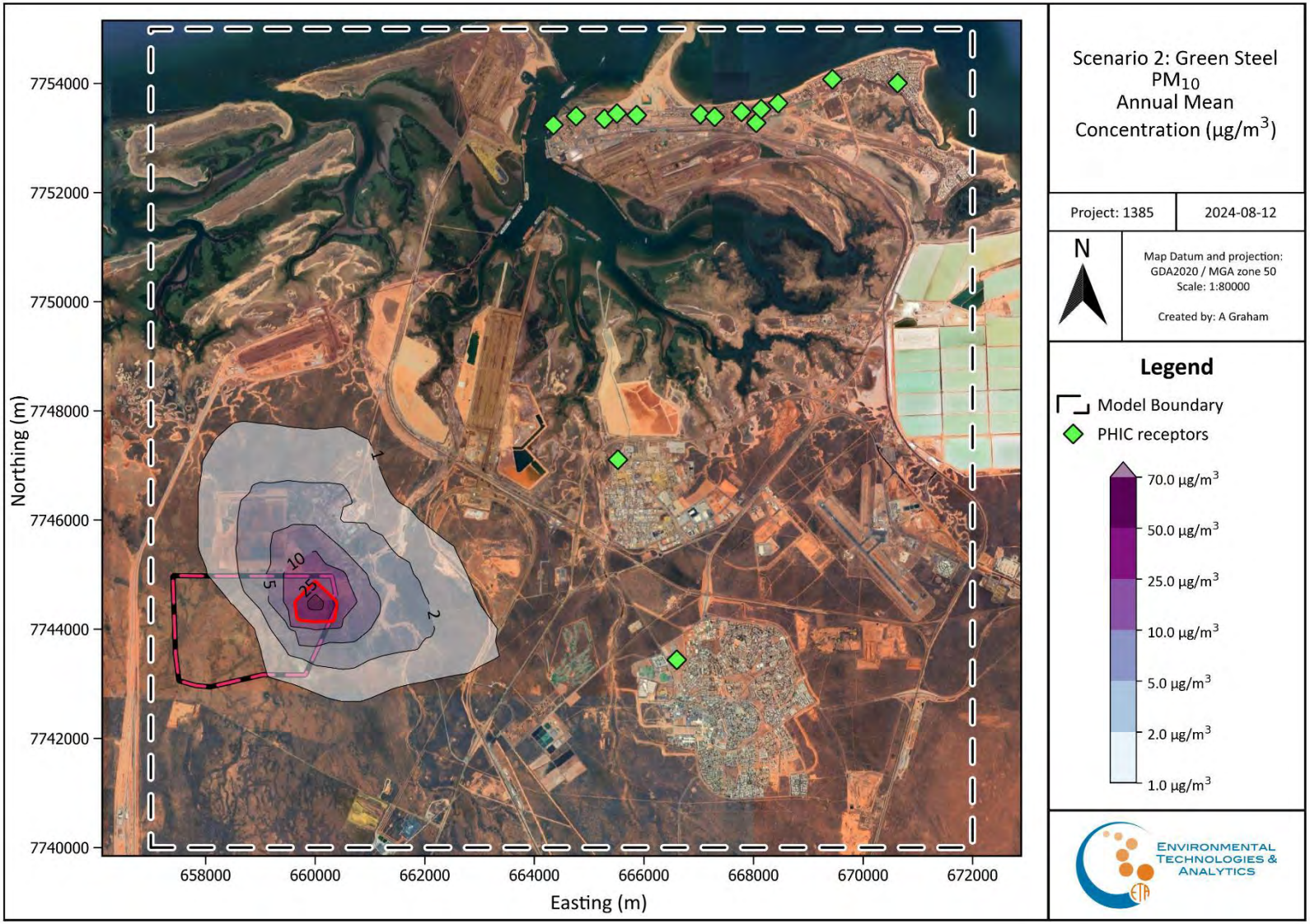


Figure 7-8: Annual average PM_{10} concentrations for Scenario 2: the Project (µg/m³)

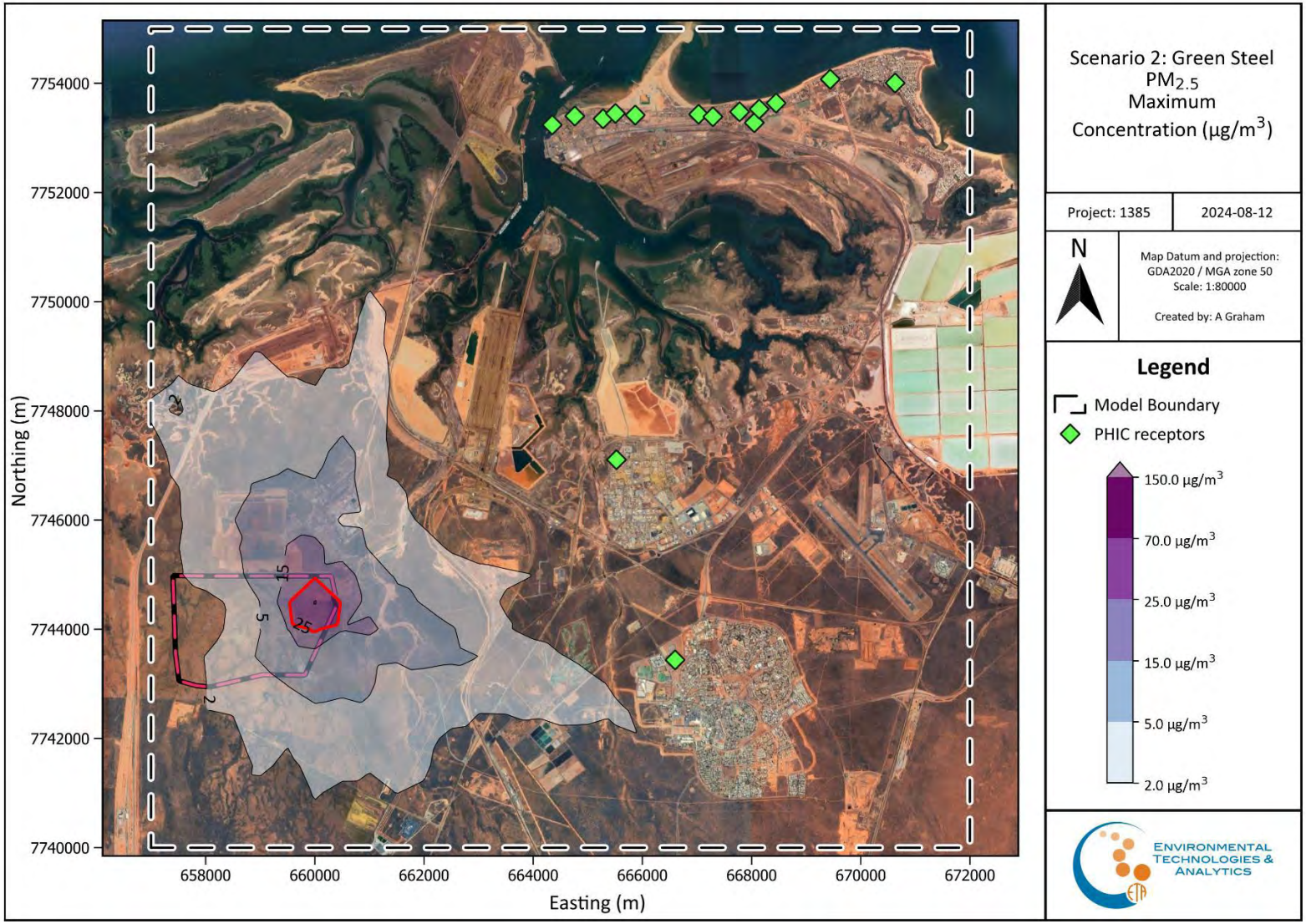


Figure 7-9: Indicative maximum 24-hour $PM_{2.5}$ concentrations for Scenario 2: the Project (µg/m³)

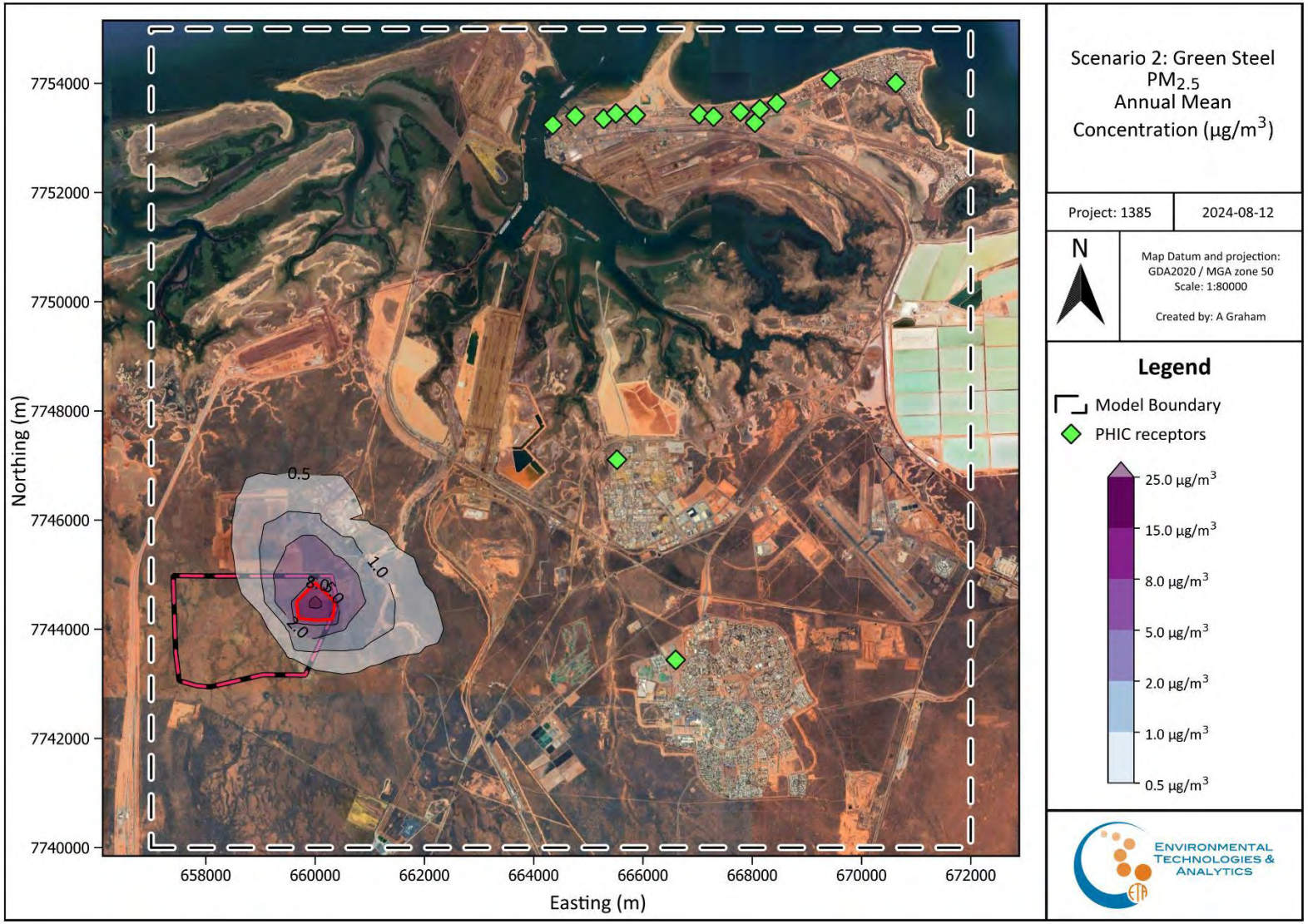


Figure 7-10: Indicative annual average $PM_{2.5}$ concentrations for Scenario 2: the Project (µg/m³)

Scenario 3: Cumulative Operations PM_{10}

Scenario 3 combines the existing and approved facilities with background (Scenario 1) and the modelled Proposal impact (Scenario 2) to evaluate the cumulative effect of the Proposal in the broader context of Port Hedland.

The predicted ground level concentrations at three receptors; Taplin Street, Wedgefield, and South Hedland indicate that:

- There is no predicted change to the number of excursion of the criteria at the Taplin Street receptor;
- There is no predicted change to the maximum predicted 24-hour PM_{10} concentration at the Taplin St receptor; and
- There are no predicted changes to the maximum predicted 24-hour PM_{10} concentration at either the Wedgefield or South Hedland receptors.

The isopleths for the cumulative predicted maximum PM_{10} 24-hour concentrations for Scenario 3 are presented in Figure 7-11 and predicted annual average PM_{10} concentrations are presented in Figure 7-12.

Scenario 3: Cumulative Operations $PM_{2.5}$

The isopleths for the cumulative predicted maximum $PM_{2.5}$ 24-hour concentrations for Scenario 3 are presented in Figure 7-13 and the cumulative predicted annual average $PM_{2.5}$ concentrations are presented in Figure 7-14. Noting that:

- These results were determined by scaling down the PM_{10} concentrations and should only be considered as indicative; and
- As with the PM_{10} concentrations these results are influenced by a single elevated background concentration which occurred on the 14th of December 2013. As a result, the features in the contour plot largely reflect the modelled dust characteristics on a single date.

The predicted ground level concentrations at three receptors; Taplin Street, Wedgefield, and South Hedland indicate that:

- There is no predicted change to the number of excursion of the criteria at the Taplin St receptor;
- There is no predicted change to the maximum predicted 24-hour concentration at the Taplin St receptor; and
- There are no predicted changes to the maximum predicted 24-hour concentration at either the Wedgefield or South Hedland receptors.

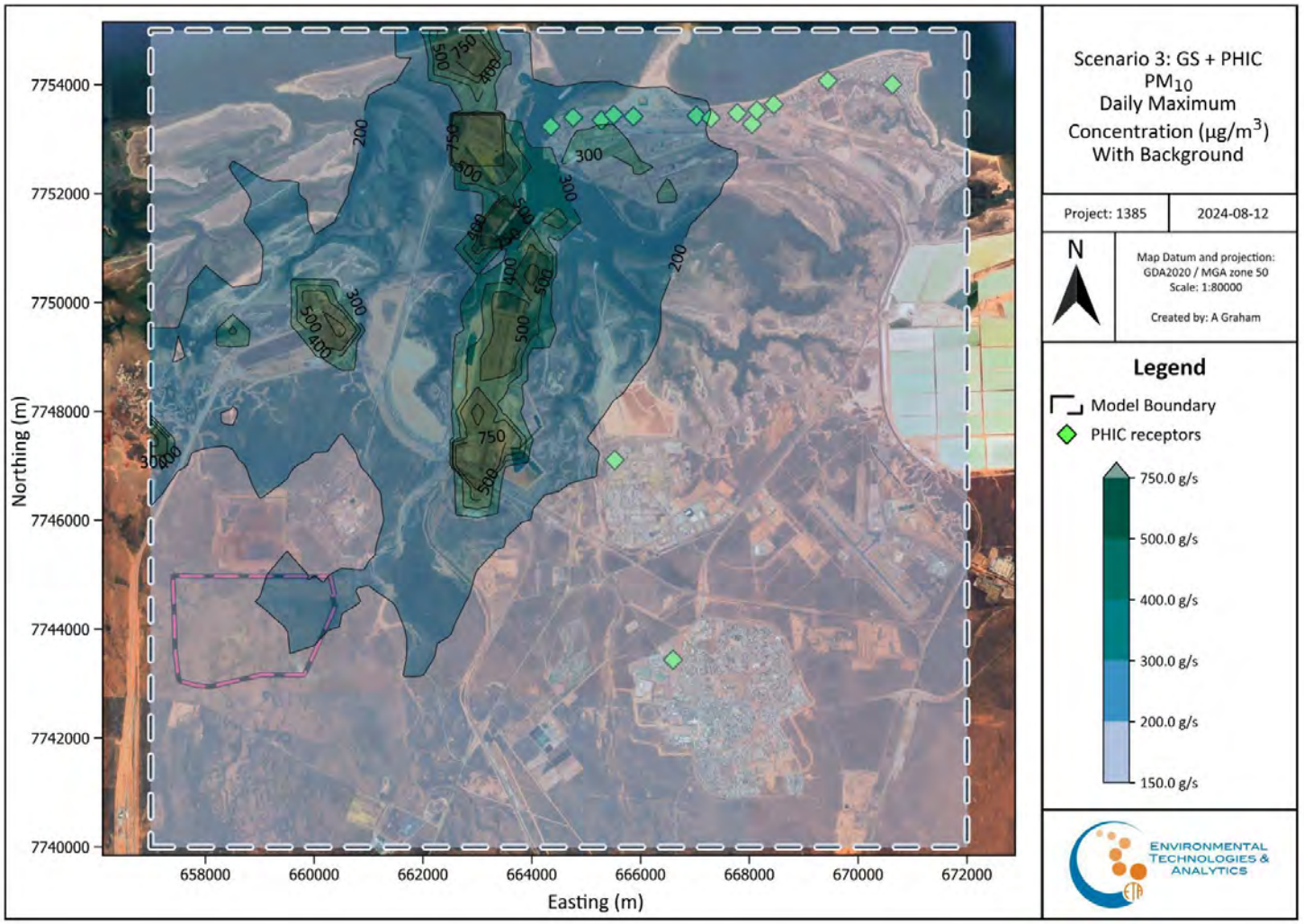


Figure 7-11: Maximum 24-hour PM_{10} concentrations for Scenario 3 (µg/m³)

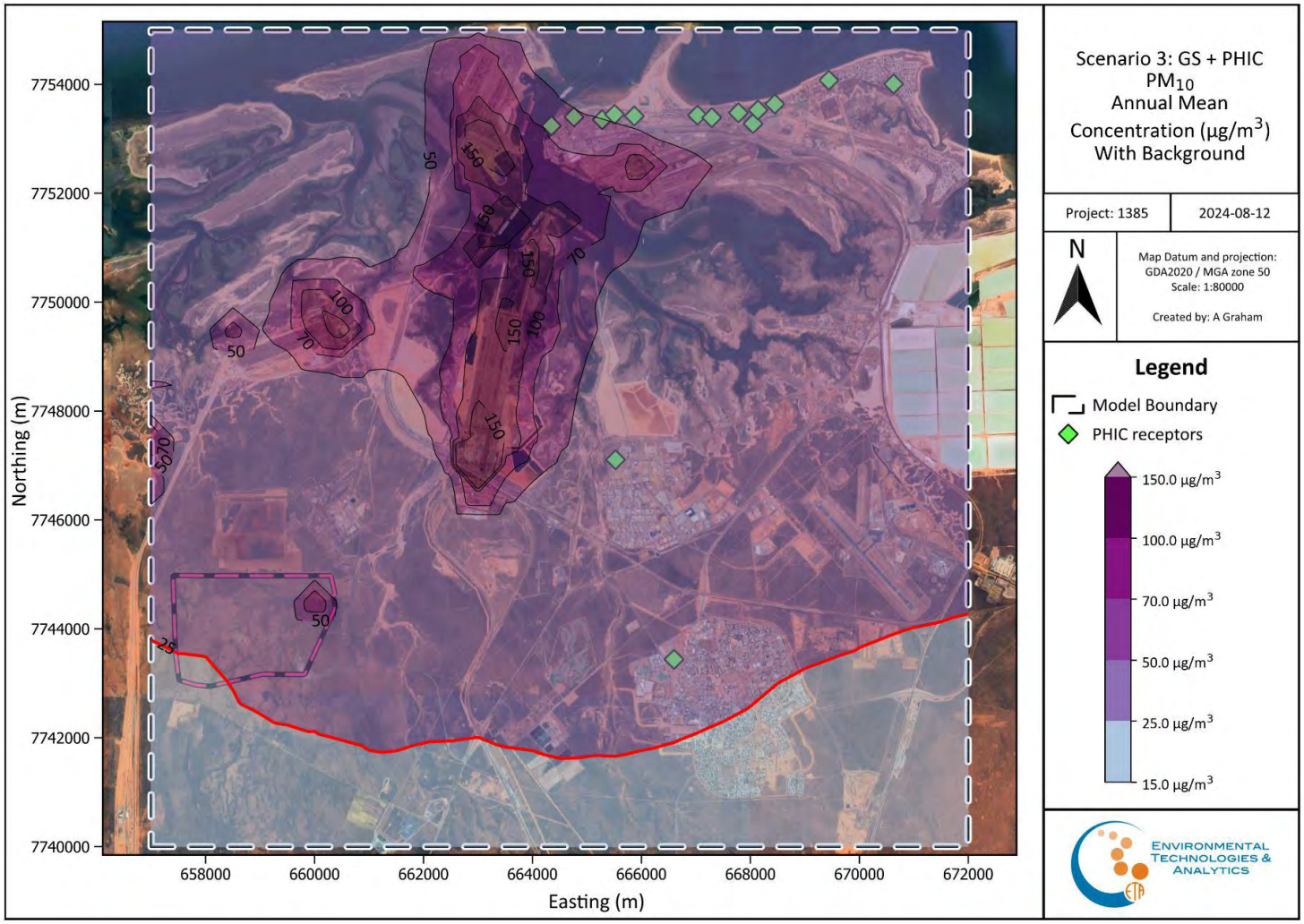


Figure 7-12: Annual average PM_{10} concentrations for Scenario 3: PHI + PHIC (µg/m³)

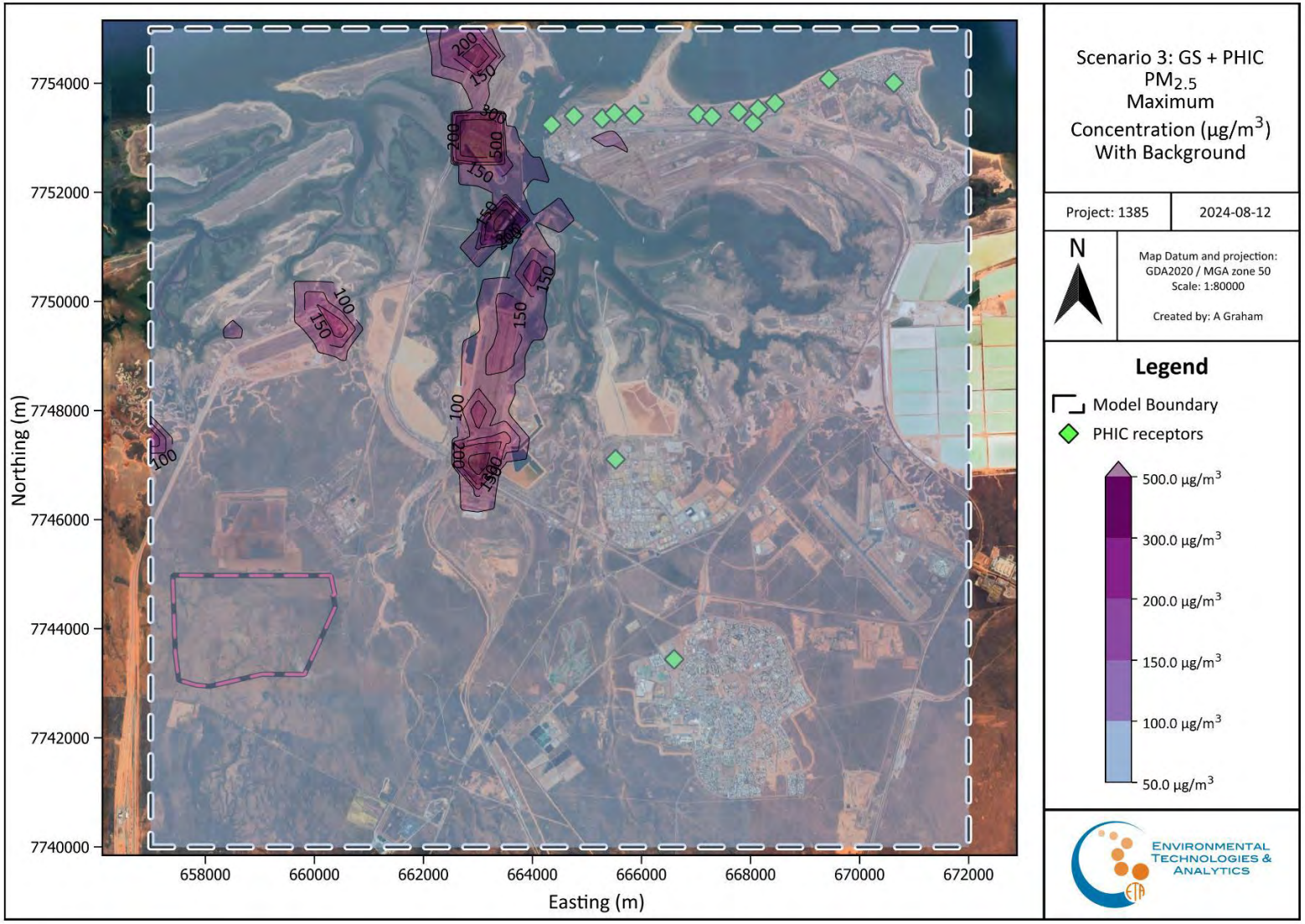


Figure 7-13: Indicative maximum 24-hour $PM_{2.5}$ concentrations for Scenario 3 (µg/m³)

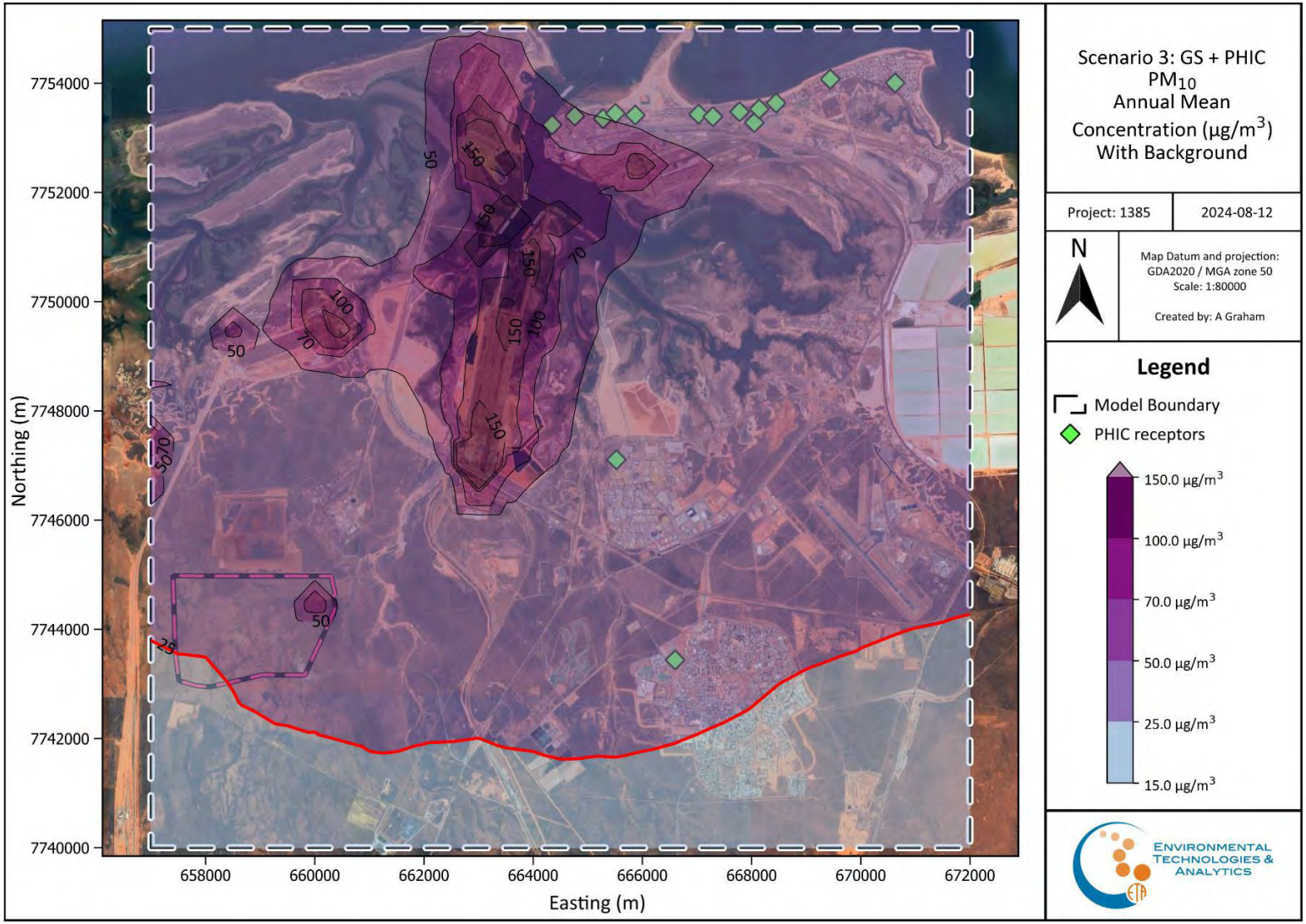


Figure 7-14: Indicative annual average $PM_{2.5}$ concentrations for Scenario 3: PHI + PHIC (µg/m³)

7.7.2 AIR EMISSIONS

The predicted ground level concentrations (GLCs) for each of the modelled scenarios was compared with the relevant ambient air quality criteria which included consideration to relevant guidance namely the Air Quality Modelling Guidance Notes (Department of Environment, March 2006), the draft Guideline: Air Emissions (DWER, October 2019c) and the NEPMs. The criteria included in this assessment are presented in Table 7-10.

It should be noted that on the 18th of May 2021, the National Environment Protection Council (NEPC) modified ambient standards for several pollutants, based on international guidance (NEPC, 2021). Relevant changes to the standards impacting the reporting of NO_2 include significantly strengthening NO_2 reporting standards for 1-hour and annual average NO_2 to 150.4 ppb and 28.2 ppb respectively, bringing forward standards initially proposed for 2025.

Table 7-10: Relevant air quality standards

Pollutant	Averaging Period	Guideline (µg/m³) [1]	Reference
Carbon monoxide (CO)	1-hour	30,000	DWER (2019c)
	8-hours	10,000	NEPC (2021)
Nitrogen Dioxide (NO_2)	1-hour	151	NEPC (2021)
	Annual	28	NEPC (2021)
Sulphur Dioxide (SO_2)	1-hour	262	NEPC (2021)
	24-hour	52	NEPC (2021)
	Annual	52	DWER (2019c)
Particles as $PM_{2.5}$	1-hour	2,800	DWER (2019c)
	24-hour	150	DWER (2019c)
	Annual	2	DWER (2019c)
Ammonia (NH_3)	1-hour	330	DWER (2019c)

1. Reference 25°C and 101.3 kPa

Modelling Outcomes

Proposal in Isolation

The results of the modelling indicate that the air quality impacts due to emissions from the Proposal in isolation are predicted to be well below the relevant ambient criteria at the receptor locations. No exceedances were predicted at any of the sensitive receptors for the compounds of interest.

Cumulative Impact Assessment

Where ambient monitoring data is available for the pollutants of interest, this has been used to determine the cumulative impacts of the Proposal at the sensitive receptor locations. Background monitoring data was available for NO_2, SO_2 and CO.

The cumulative impact of NO_x emissions from the Proposal and other sources and other approved sources within the region have been evaluated using air dispersion modelling results. Ambient monitoring data available for NO_2 was used, together with model predictions, to determine the cumulative impacts of the Proposal at the receptor locations.

No exceedances of the maximum 1-hour average and annual average NO_2 guideline were predicted. The maximum predicted cumulative 1-hour average GLCs at sensitive receptor (R1) for NO_2 was 36 µg/m3 (23.7% of the 1-hour NO_2 ambient air quality guideline). The maximum predicted cumulative annual average GLCs at sensitive receptor (R1) for NO_2 was 12.8 µg/m^3, which was 45.7% of the ambient air quality guideline.

Model predictions indicate that the GLCs of NO_2 at the receptor locations will increase marginally due to emissions from the Proposal. The increase in the maximum 1-hour average GLCs of NO_2 at receptor locations is predicted to be less than 3 µg/m^3. This increase is not considered to be significant when compared to existing air quality and the relevant ambient air quality criteria.

For SO_2 and CO, only the background data was used to calculate the cumulative impacts as there are no other major point sources of SO_2 and CO in the region. No exceedances of the CO short-term (1-hour) or mid-term (8-hour) averaging period guidelines were predicted. Similarly, no exceedances of the SO_2 1-hour, 24 -hour average and annual averaging period guidelines were predicted.

Contour plots of the cumulative predicted NO_2, SO_2 and CO GLCs are in presented in Figure 7-15 to Figure 7-21.

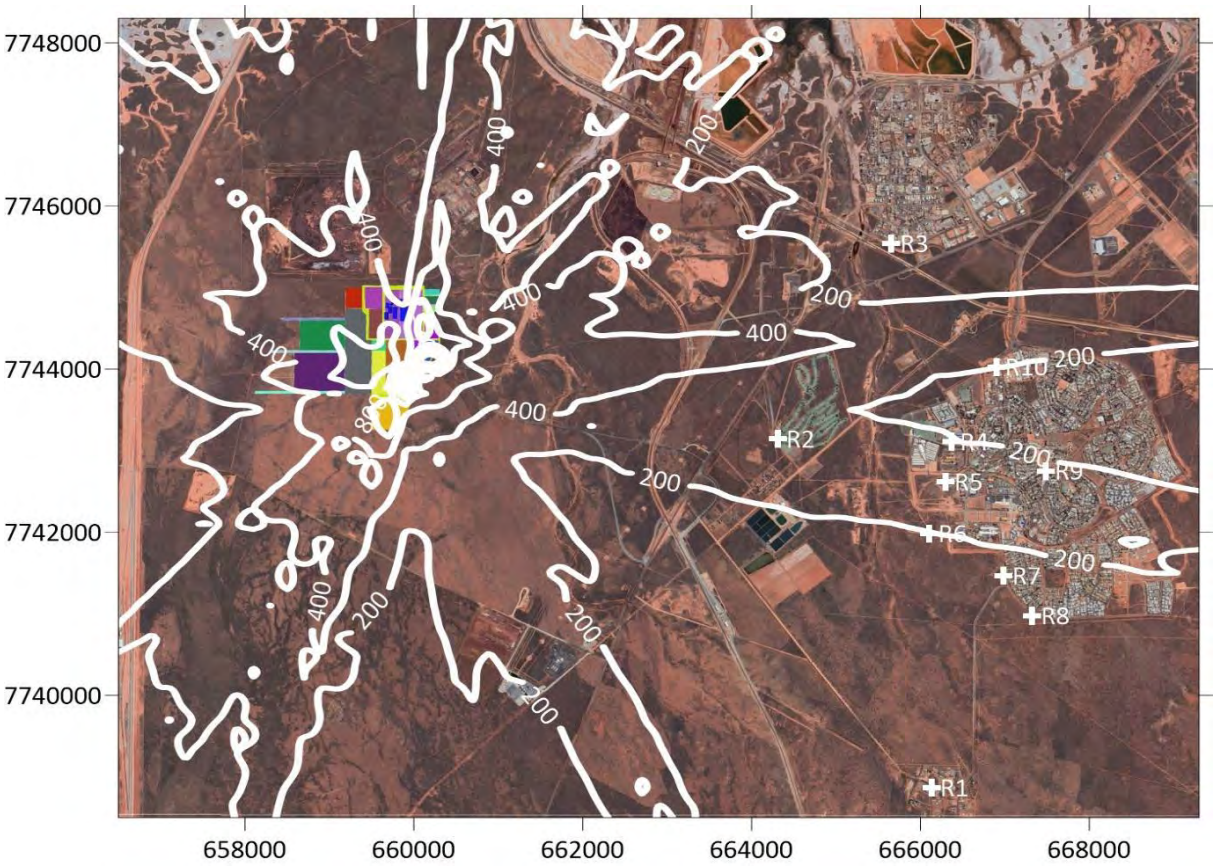


Figure 7-15: Cumulative 8-hr Max Average CO GLC (µg/m³) Contour Plot (Guideline: 10,000 µg/m³)

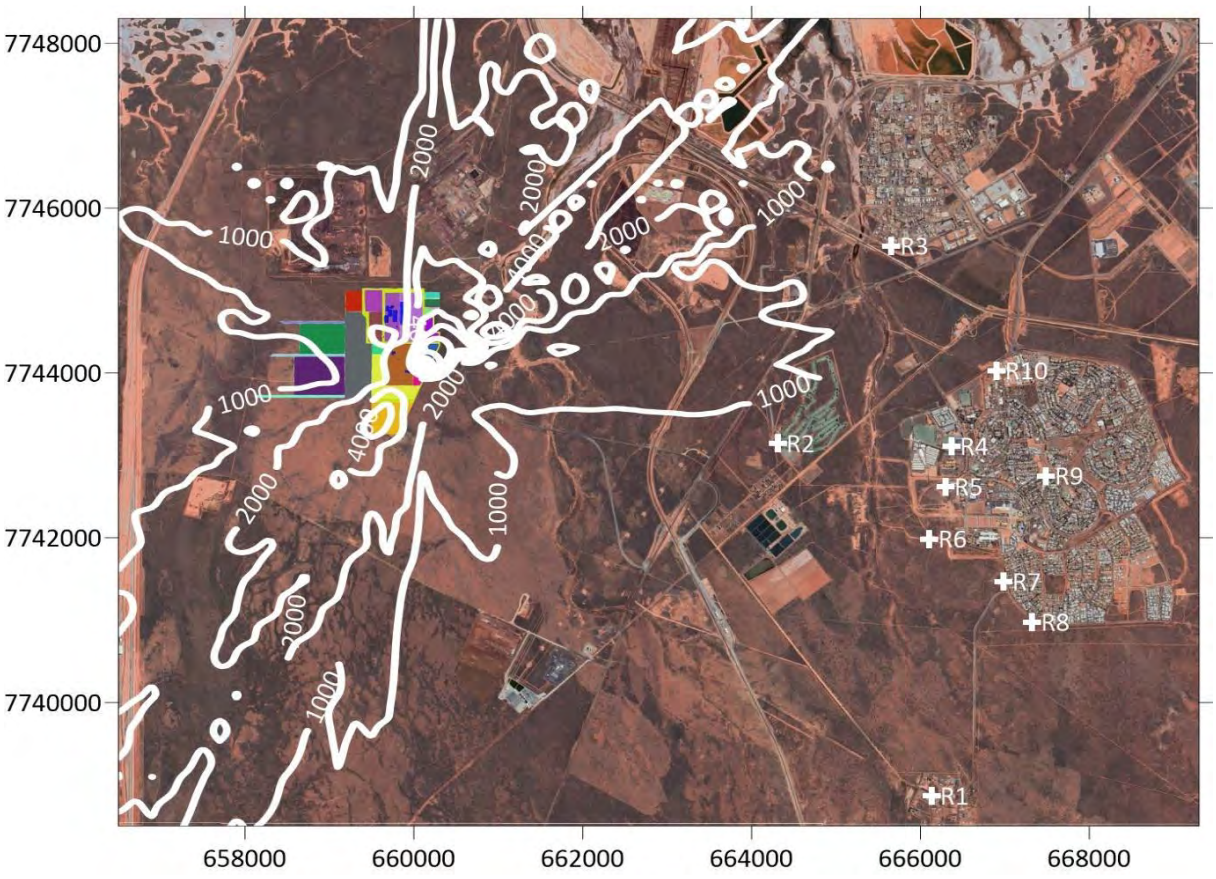


Figure 7-16: Cumulative 1-hr Max Average CO GLC (µg/m³) Contour Plot (Guideline: 30,000 µg/m³)

Figure 7-17: Cumulative 1-hr Max Average NO_2 GLC (µg/m³) Contour Plot (Guideline: 151 µg/m³)

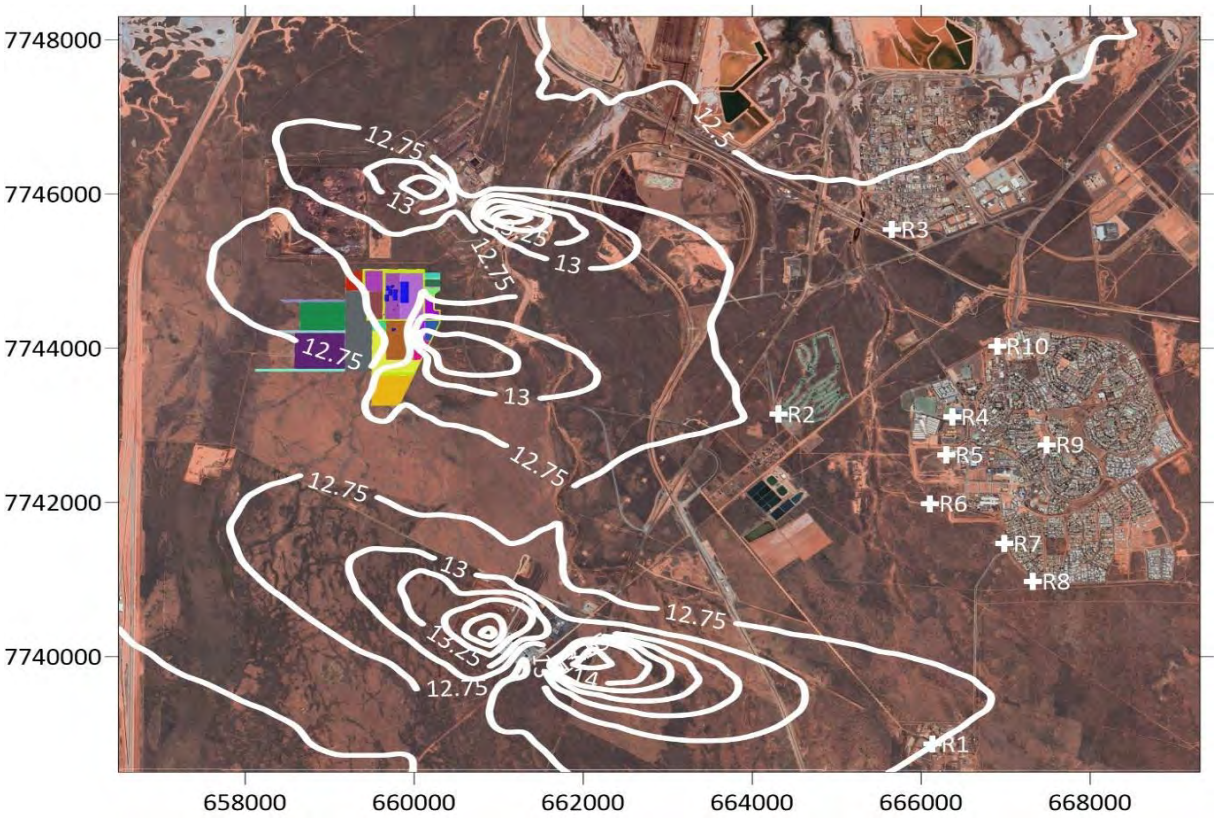


Figure 7-18: Cumulative Annual Average NO_2 GLC (µg/m³) Contour Plot (Guideline: 28 µg/m³)

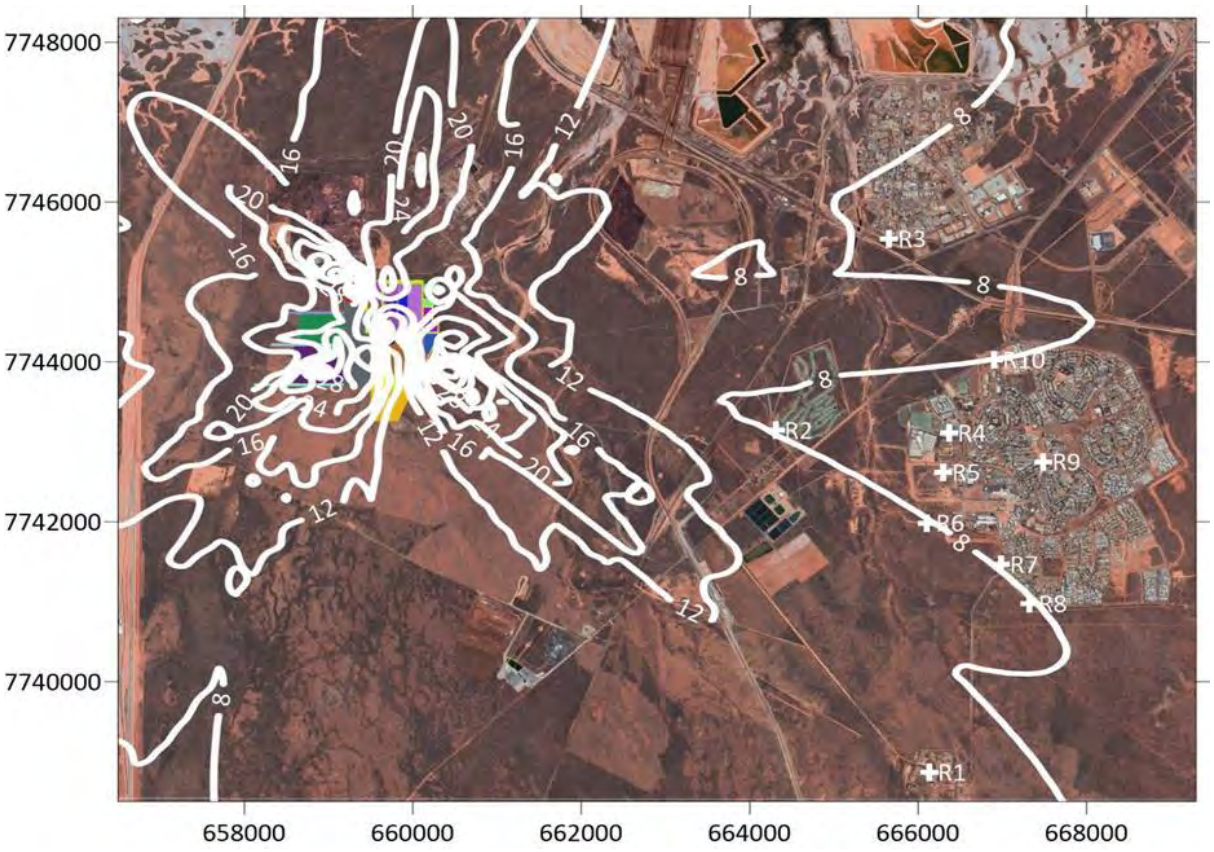


Figure 7-19: Cumulative 1-hr Max Average SO_2 GLC (µg/m³) Contour Plot (Guideline: 262 µg/m³)

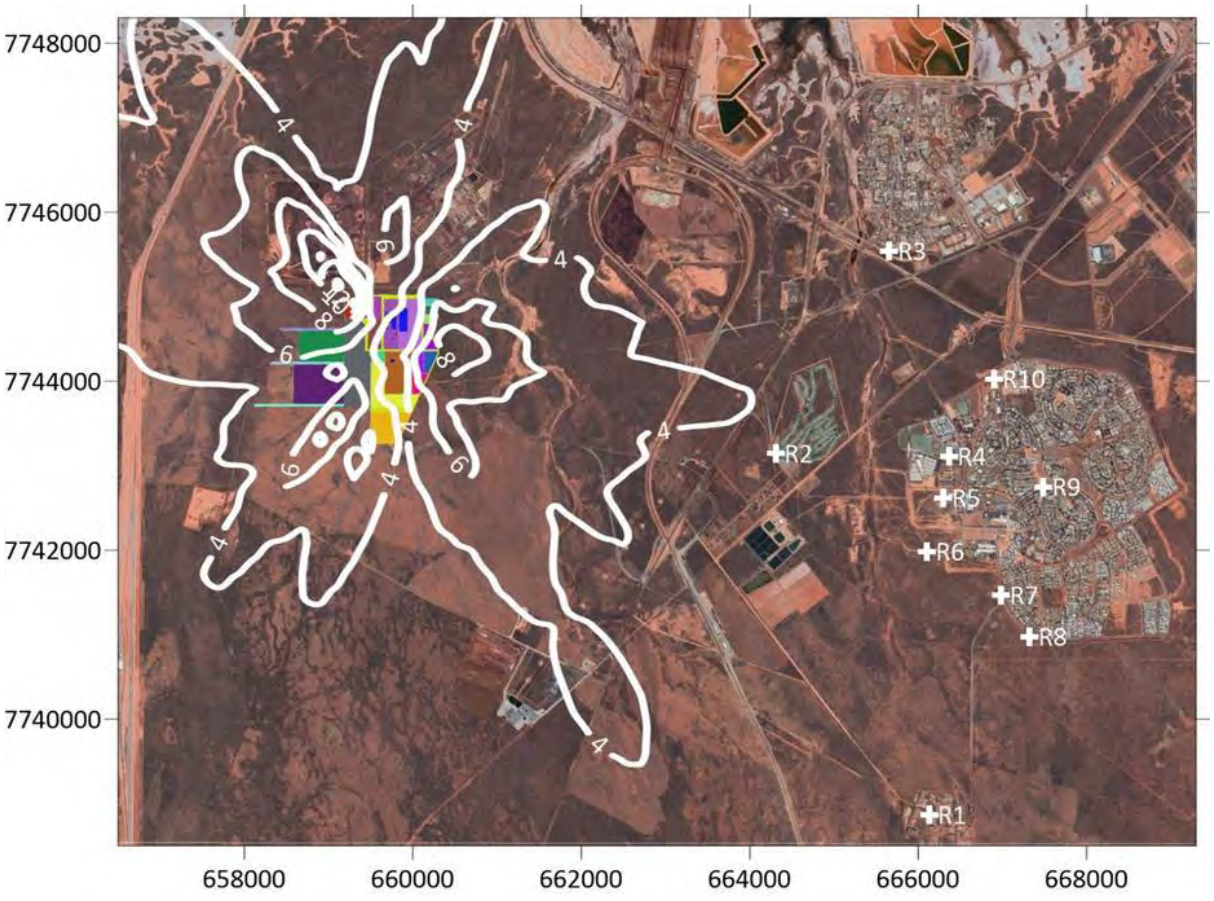


Figure 7-20: Cumulative 24-hr Max Average SO_2 GLC (µg/m³) Contour Plot (Guideline: 52 µg/m³)

Figure 7-21: Cumulative Annual Average SO_2 GLC (µg/m³) Contour Plot (Guideline: 52 µg/m³)

7.8 MITIGATION

PHI has mitigated the potential impacts to this factor according to the mitigation hierarchy; avoid, minimise, rehabilitate, offset. Offsets are not expected to be required for this factor. The proposed mitigation measures are technically and practically feasible.

7.8.1 EMISSION CONTROLS

The pellet plant will convert high grade iron ore into heat hardened pellets, suitable for direct reduction. The process steps in the core plant will consist of receiving iron ore concentrate, receipt and preparation of additives, blending and mixing of raw materials into a pelletising mix, green pellet formation, heat hardening of the pellets, and screening and conveying of the final pellet product. Raw materials will include ground iron ore with the following additives: bentonite and limestone. Additives will be mixed with the concentrate to facilitate the process and to influence the product quality. The burner fuel for pelletising will be natural gas.

Particulate in the exhaust gases will be collected in electrostatic precipitators (ESPs) to meet environmental standards.

The collected process gas ESP dust will be recycled back into the process. Pneumatic conveying systems will transport the dust to a storage bin in the mixing area for recycle to the process.

A housekeeping baghouse will be used to collect fugitive dust from the Annular Cooler Discharge Area from dust hoods incorporated into the design of the annular cooler. A housekeeping baghouse is also placed at the entry end of the traveling grate to pick any fugitive dust generated from the double deck roller screen and transfer to the feed end of the traveling grate.

All housekeeping baghouse collected dust will be recycled back to the process. Pneumatic conveying systems will transport the process gas ESP dust and the dusts from the housekeeping baghouses to a storage bin in the mixing area where it will be recycled to the mixer feed blend.

The coarse limestone receiving bin in the additive preparation area will have a baghouse for de-dusting. The collected dust will be recycled to the limestone bin.

Similarly, the pre-ground bentonite bin area will have a baghouse. Collected dust will be discharged into the pre-ground bentonite storage bin.

Ground additive, dust recycle, and reground chips bins in the blending and mixing area will each have an associated baghouse to recycle collected dust back to their respective bins.

Gaseous Emissions

Products of combustion will be discharged from the indurating waste gas stack. The indurating waste gas stack will also contain CO_2 resulting from the calcination of carbonates in the green pellets and SO_x from combustion of the sulphur-containing compounds in the green pellets. Other compounds in the flue gases will include low concentration NO_x, carbon monoxide, and volatile organic compounds, as well as water vapour, nitrogen, and oxygen.

A lime (CaO) or limestone ($CaCO_3$) based scrubber system to absorb SO_x is included in the design.

An anhydrous ammonia (NH_3) based selective catalytic reactor (SCR) system to reduce NOx is included in the design.

7.8.2 AVOID

The Proposal is also located within the Boodarie SIA. Boodarie SIA has an industrial buffer zone which is recognised as a Special Control Area under the Town of Port Hedland's Local Planning Scheme (Figure 7-22). The Special Control Area prevents the establishment of any new sensitive receptors within this area and avoids land use conflicts.

The design and operation of the Proposal will ensure the receptors are not exposed to exceedances of relevant health criteria.

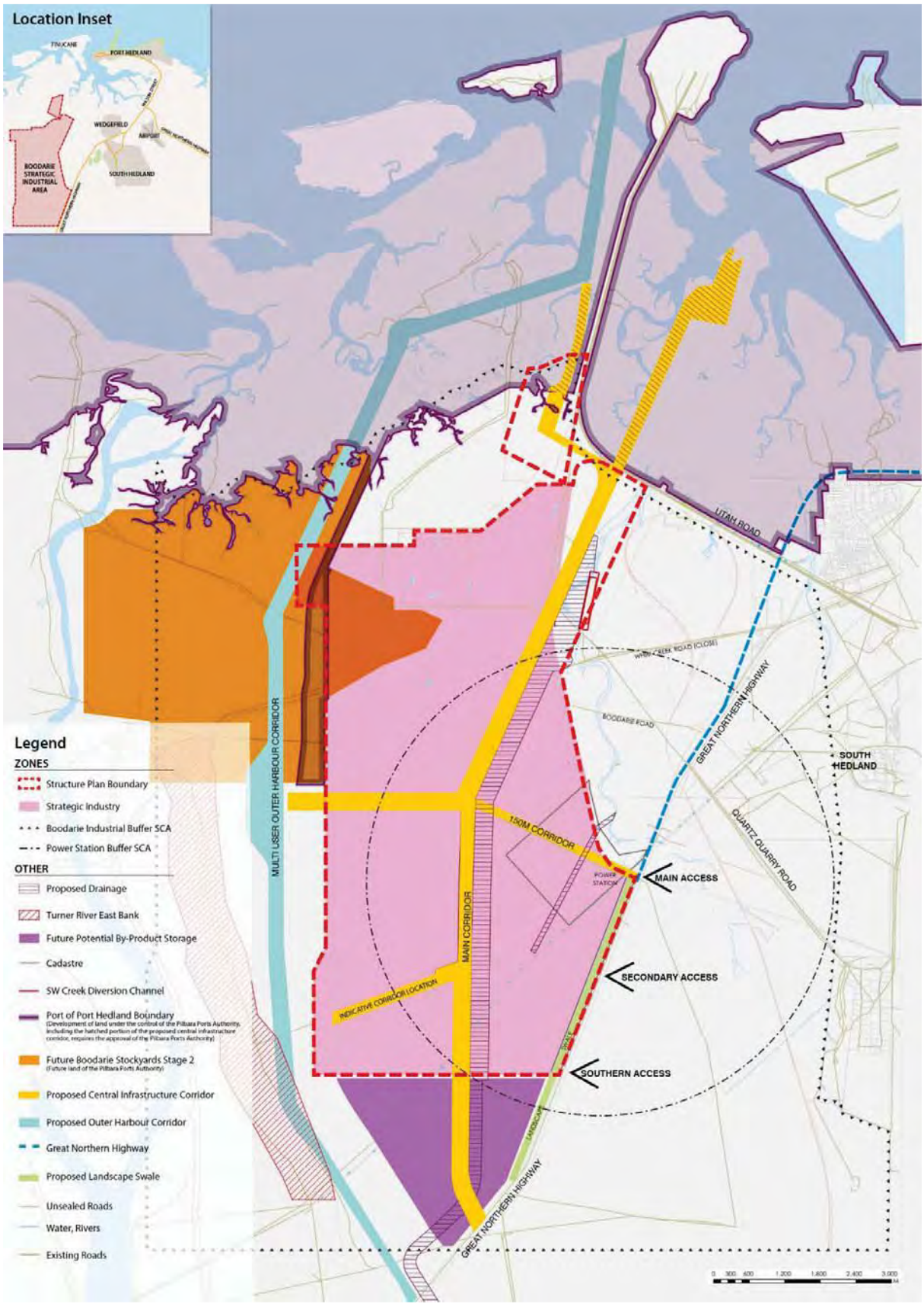


Figure 7-22: Boodarie SIA Buffer

7.8.3 MINIMISE

1. **Obtain and comply with Works Approval and Licence issued under Part V of the EP Act**. A Works Approval and Licence will be required for the Proposal, specifically for the processing plant. The Works Approval and Licence is the primary mechanism for ensuring the design and operation of the Proposal is conducted in a manner that minimises impacts to air quality and is expected to specify limits on air emissions to ensure air quality standards for NO_2, SO_x, CO and PM_{10} are met. The Licence will also be able to regulate the management of dust at Port Hedland to meet currently regulatory standards for the Port Hedland air shed. The Works Approval and Licence will ensure that the following mitigation measures are implemented at a minimum:
    a. Routinely inspect the condition and performance of infrastructure and dust suppressing systems, to ensure they are in acceptable condition and / or operating appropriately;
    b. The following controls will be implemented to minimise the risk of impact from air emissions:
        i. Routine air emissions (NO_x) monitoring will be conducted on site;
        ii. Routine dust monitoring (dust deposition and opportunistic dust observations) will be conducted;
        iii. Water or dust suppressants will be applied to disturbed areas and product transfer/ storage areas as required to minimise dust generation;
        iv. Investigations will be conducted into the cause of any excessive air emissions;
        v. Implement emission controls mentioned in Section 7.8.1.
2. **Obtain and comply with the Ministerial Statement to be issued under Part IV of the EP Act;**
3. **Implement industry best practice management measures for air quality:**
    a. Product handling and transport will be based on the International Iron Metallics Association's *Hot Briquetted Iron (HBI): A Guide to Shipping, Handling & Storage* (May 2020);
    b. The Proposal has been designed using the best available technology (MidREX Flex) for iron production. The chosen technology allows flexibility in the proportion of reductants in the iron reduction process;
    c. Water or dust suppressants will be applied to disturbed areas and product transfer/storage areas as required to minimise dust generation;
    d. Vegetation clearing will be managed through internal ground disturbance procedures;
    e. All major roads will be sealed;
    f. The disturbance footprint will be developed to the minimum required to ensure minimal disturbance;
    g. Boundaries of areas to be cleared or disturbed will be identified by GPS coordinates and maps of boundaries will be provided to the dozer operator to minimise clearing;
    h. Limit the number and height of soil stockpiles;
    i. The surface of unsealed roads will be regularly maintained to retain surface integrity; and

j. Vehicle speeds will be limited on unsealed roads to minimise wheel generated dust.

4. **Maximise electrical efficiency**. The following activities will be managed to maximise electrical efficiency, minimise power demand and therefore minimise emissions:
   a. Regular monitoring of electrical load on the processing equipment and investigation whenever the load falls outside optimal parameters;
   b. Regular maintenance and inspection of processing equipment to optimise efficiency;
   c. Regular electrical calibration checks on the processing equipment; and
   d. Use of variable speed drive pumps, compressors and other processing equipment.

7.8.4 REHABILITATE

The key rehabilitation measures that relate to Air Quality are summarised below:

1. All infrastructure will be removed; and
2. The development envelopes will be revegetated with local native species.

The Proposal is required to sign a Lease with the State Government under the LAA. PHI expects that the terms and conditions of the lease will require decommissioning and rehabilitation of the Proposal at the end of its operational life, which will ensure rehabilitation measures are implemented.

7.9 PREDICTED OUTCOME

The EPA's environmental objective for this factor is "to maintain air quality and minimise emissions so that environmental values are protected" (EPA, 2020c).

With the implementation of these mitigation measures, it is predicted that dust emissions will not:

- Change the number of excursions of the criteria at the Taplin Street receptor;
- Change the maximum predicted 24-hour PM_{10} or $PM_{2.5}$ concentration at the Taplin St receptor; and
- Change the maximum predicted 24-hour PM_{10} or $PM_{2.5}$ concentration at either the Wedgefield or South Hedland receptors.

The Proposal has been designed to ensure that impacts arising from air emissions are avoided and minimised where possible. The Proposal has designed to include a buffer, to ensure air quality at sensitive receptors is not significantly impacted. The Proposal activities have been optimised to keep product handling and energy requirements low, subsequently minimising emissions from combustion products.

The environmental outcome proposed for this factor is: air quality at occupied receptors maintained at current concentrations. This proposed outcome is consistent with the EPA's objective for this factor, and can be assured by the following:

1. Works Approval and Licence under Part V of the EP Act; and
2. Clearing limits and PDE boundaries implemented by the Ministerial Statement.

The proposed environmental outcome could potentially be applied as an outcomes-based condition in the Ministerial Statement (if approved).

Air quality monitoring will be conducted to ensure that the proposed outcome is being met.

The predicted outcome for Air Quality is therefore:

- No change in concentration or excursions of the existing air quality standards.

Based on the above, PHI considers that the Proposal can be implemented such that there are no significant residual impacts to this factor, and the EPA objective can be met.

8 GREENHOUSE GAS EMISSIONS

8.1 EPA OBJECTIVE

The EPA Objective for this Key Environmental Factor is to reduce net GHG emissions in order to minimise the risk of environmental harm associated with climate change.

8.2 POLICY AND GUIDANCE

Relevant EPA and Commonwealth Government guidance documents for GHG emissions are summarised in Table 8-1.

Table 8-1: Policy and guidance relevant to the Greenhouse Gas Emissions Key Environmental Factor

Policy and Guidance	How guidance has been considered
WA Government	
Key EPA documents	
Statement of Environmental Principles, Factors, Objectives and Aims of EIA (EPA, 2023a)	This document was considered in the preparation of this Supplementary Document and to inform EIA. It was used identify the Key Environmental Factors likely to be impacted by the Proposal and the EPA's objective for each factor.
EIA (Part IV Divisions 1 and 2) Procedures Manual (EPA, 2024a)	This document has been considered in planning for the Part IV approval process and has been used to inform the preparation of this Supplementary Document.
EIA (Part IV Divisions 1 and 2) Administrative Procedures (EPA, 2024b)	This document has been considered in planning for the Part IV approval process and has been used to inform the preparation of this Supplementary Document.
Relevant EPA Factor Guidelines	
Environmental Factor Guideline for Greenhouse Gas Emissions (EPA, 2024)	This document was considered in the preparation of this section of the Supplementary Document.
Commonwealth Government	
Key Documents	
Significant Impact Guidelines 1.1 – Matters of National Environmental Significance (DotE, 2013a)	This document was considered in determining whether the Proposal is likely to have a significant impact on a matter protected under the EPBC Act.
EPBC Act Environmental Offsets Policy (EPA, 2011) – including the Offset Assessment guide	This document was determined to not be required as biodiversity offsets for the GHG environmental factor are not required.
EPBC Act Condition Setting Policy (DAWE, 2020)	This document was used as guidance for the referral process and EIA of the Proposal.
Technical Guidelines for the Estimation of Emissions by Facilities in Australia (DotEE, 2017a)	This document was used to inform the study effort required to undertake EIA for the Proposal.

8.3 RECEIVING ENVIRONMENT

8.3.1 BACKGROUND

The receiving environment for GHG emissions is the global atmosphere. The impact of GHG emissions is felt globally. The reason for the Proposal is to commence the transition to net zero emissions by 2050. Steel making represents between 7% and 9%. of global anthropogenic CO_2 emissions (https://worldsteel.org/climate-action/climate-change-and-the-production-of-iron-and-steel/ accessed 11/12/24). The iron making step is the most energy intensive and hence locating iron making in locations with access to cheap renewable energy is likely to be an effective strategy to move toward low emissions steel. Thus, the receiving environment is not just the Port Hedland airshed, the State of WA or the Commonwealth of Australia.

Information in the following sections has been sourced from Wood Australia Pty Ltd (Wood) (Wood, 2024; Appendix 7) unless otherwise referenced.

8.3.2 NATIONAL AND STATE GHG EMISSIONS

The Quarterly Update of Australia's National Greenhouse Gas Inventory: March 2021 (DISR, 2024) estimated Australia's GHG emissions for the year to September 2024 to be 441 million tonnes (Mt) of carbon dioxide equivalent (CO_2-e). Australia's emissions have declined 28.2% below emissions for the year to June 2005.

A sectoral breakdown of Australia and WA GHG emissions for 2024 is provided in Table 8-2.

Table 8-2: Sectoral breakdown of National and State GHG emissions

Sector	Australian emissions (DISR, 2024) (Mt CO_2-e)	WA Emissions[1] (DCCEEW, 2024) (Mt CO_2-e)	Contribution to national emissions (%)
Energy	399.8	81.7	20.4
Industrial Processes	32.8	5.1	15.5
Agriculture	85.5	9.7	11.4
Waste	13.9	1.9	13.6
Land use, land use change and forestry	-88.4	-15.9	-17.9
Inventory Total	**443.6**	114.3	25.7

[1]Emissions data is from 2022

8.3.3 ENVIRONMENTAL VALUES

Based on the information provided in Section 8.3, the following environmental values were determined to require assessment for this factor:

- The Proposal's GHG contribution to WA's (State) annual GHG emissions; and
- The Proposal's GHG contribution to Australia's (National) annual GHG emissions.

8.4 POTENTIAL IMPACTS

Wood was commissioned by PHI to undertake a GHG assessment for the Proposal (Wood, 2024; Appendix 7).

Under section 15 of the EP Act, the EPA has the objective to use its best endeavours to protect the environment and to prevent, control and abate pollution and environmental harm. The section 15 objective, combined with the established link between cumulative sources of GHG emissions and the risk of climate change, and the broad acknowledgement that the warming climate will impact the WA environment, means it is appropriate for the EPA to consider the effects of proposals that contribute to the state's GHG emissions. The EPA's objective for GHG emissions is to "minimise the risk of environmental harm associated with climate change by reducing greenhouse gas emissions as far as practicable".

The EPA considers that global warming should be limited to no more than 1.5 degrees Celsius (1.5°C) above pre-industrial levels to minimise the risk of environmental harm to WA's environment. In order to contribute to this goal, the EPA's view is that there should be a deep, substantial and sustained reductions in WA's emissions this decade, and achievement of net zero emissions no later than 2050 through a straight-line trajectory (at a minimum) from 2030.

8.4.1 EMISSION SOURCES

Scope 1 Emissions

Scope 1 GHG emissions are defined as the emissions from sources the reporting company owns or controls. The Scope 1 emissions of the PHI are summarised in Table 8-3 below.

Table 8-3: Scope 1 GHG emissions Sources

Source	Description
Land Clearing	Land clearing will produce GHG emissions through the loss of carbon sinks and decay of organic material. Up to 387.1 ha of disturbance is proposed. A land clearance emission factor of 78.52 tCO_2-e / ha was used to calculate the overall land clearance emissions. This factor is an estimate from the full carbon accounting model (FullCAM) and is based on the Project being in a vegetation area of mainly hummock grasslands and eucalypt open woodlands. The overall emissions due to land clearance is 30,395.1 tCO_2-e for the Proposal.
Process Emissions	There are six-point sources from which GHGs are emitted. GHG emissions from the pellet plant are discharged through the main stack. The identified point source emissions in the HBI plant and pellet plant are listed below. Point Source 1 – Flue Gas Stack: This is the main source of process emissions in the HBI plant. Flue gas is withdrawn from the reformer in two flue gas headers located on either side of the reformer and is released into the atmosphere. The flue gases leaving the reformer at a temperature of about 1150°C are fed to the recuperator for waste heat recovery. CO_2 is emitted as a result of using natural gas as the reducing agent in the Midrex process. Point Source 2 – Bottom seal gas dedusting: The bottom seal gas system supplies and exhausts seal gas for sealing the bottom of the shaft furnace. The bottom seal gas is vented through the product discharge chamber vent line, collected in the dilution hood, cleaned in the dust collection scrubber, and exhausted through the bottom seal dust collection fan and stack. The gas stream exhausted from the stack is mainly composed of CO and CO_2. Point Source 3 – Briquetter dedusting: The dust collection system is designed to minimise the escape of dust at the briquette machines. The gas passes through a venturi scrubber and then is pulled by the exhaust fan and discharged into the atmosphere through the stack.

Source	Description
	Point Source 4 and 5 – Degasser Top Gas Weir Drain and Cone Drain: The top gas scrubber receives hot, dust-laden gases from the furnace. The degasser system (CO_2 stripper) is used to liberate dissolved gases from the top gas scrubber weir drain and cone drain water. Point Source 6 – Degassing unit Process Water Clean – The degasser unit is used to liberate dissolved gases from the reformed gas cooler and sealed gas cooler. Point Source 7 – Main Stack – GHG gases generated during limestone addition and natural gas combustion are channelled to the main stack and subsequently released into the atmosphere.
Process Combustion – Natural Gas	The sources of stationary combustion in the PHI are the areas where natural gas is used as the fuel source in pellet and HBI plants. It has been assumed that natural gas is supplied to the processing plant via a lateral gas pipeline with a pressure let down and metering station.
Stationary Combustion – Diesel	Diesel consumption will occur in the operation of one fire water pump and three emergency diesel generators during construction years, while four emergency diesel generators will be utilised during operational years. This consumption will either be in line with their intended operation or when conducting tests to ensure their fitness for service.
Mobile Combustion – Construction Vehicles	Emissions from mobile equipment that is "owned or controlled" are accounted as Scope 1 emissions. The emissions estimation assumes that all construction vehicles use diesel. Annual consumption of diesel is either assumed values from the Wood's Database or has been collected from the vehicles' datasheet and specifications. The type of vehicles and machinery for the construction years are provided by PHSG.
Mobile Combustion - Plant Operation Vehicles	It has been assumed that all the plant operation vehicles use diesel over Stage 1 of the operation years. Annual consumption of diesel has been calculated using Wood's database. It was assumed that a total of 50 light vehicles (a combination of light trucks, forklifts, cranes, lighting towers, etc.) and six 30-seater buses would be used. Annual consumption of diesel is either assumed values from the Wood's Database or has been collected from the vehicles' datasheet and specifications.
Product Transport to the Port	For the Purposes of this assessment, transportation of products from the processing plant to the Lumsden Port and Utah Port are considered to be Scope 1 emission. It is assumed that the products are transported to the port via triple road trains. In the Base Case scenario, diesel consumption by triple road trains contributes to Scope 1 emissions. The average annual emissions from the transport of products from the processing plant to Lumdsen / Port during the Stage 1 operating phase is approximately 1,886 t CO_2-e / a. The emissions reported for product transport in Q1-Q3 CY29 are attributed to pellet production. Additionally, during the ramp-up period, emissions arise from both full pellet production and the production of HBI.
Biogenic Impact	The Project is expected to include a wastewater treatment plant. An assessment of the biogas emissions has been estimated from the chemical oxygen demand estimated to be released from wastewater treatment. The amount of wastewater generated during construction years and an average year of operation has been estimated using the number of personnel on-site during operations. The biogenic emissions will vary over the project life depending on the number of people on-site. During construction, emissions vary depending on the number of personnel on-site while during operation, emissions are expected to be stable at approximately 131.2 tCO2e/a.

Scope 2 Emissions

Scope 2 GHG emissions are defined as the emissions from the generation of purchased electricity that is consumed in a Company's owned or controlled equipment or operations.

The Project may be connected to the Northwest Interconnected System (NWIS) electricity grid in WA. The NWIS is currently supplied by non-renewable generation resources (open-circuit or combined-cycle gas-fired turbines).

According to the publicly available information from the power generators, the power supplier has an emissions factor of 0.52 t CO_2-e / MWh as of 2022.

In the Pilbara region, there are ongoing developments and plans for the construction of renewable energy sources, coupled with the expansion of a high-voltage distribution network. Several power providers are dedicated to executing additional renewable energy generation projects and have set ambitious targets to achieve net-zero greenhouse gas emissions by 2050. The emission reduction objectives declared by these power suppliers should be incorporated into the emission factors utilised for Scope 2 emissions once PHI makes a final decision regarding their power procurement.

Scope 3 Emissions

Scope 3 GHG emissions are the result of activities from assets not owned or controlled by the reporting company, but that the organisation indirectly affects in its value chain.

The GHG Protocol Corporate Value Chain (Scope 3) Standard (Greenhouse Gas Protocol, 2011) categorises the Scope 3 emissions into 15 distinct categories. Section 2.6.2 summarises the Scope 3 emissions from the indirect upstream and down-stream activities and outlines a brief description of each category.

8.4.2 EMISSIONS ESTIMATE METHODOLOGY

The GHG emissions calculation method is:

$$Activity\ Data\ \times Emission\ Factor\ = GHG\ Emissions$$

Where:

- Activity data is quantity or usage data in t/a, Gigajoule (GJ)/a, etc. It can be measured (e.g. from data received from a plant in operation) or calculated (e.g. from a mass balance model or stoichiometric chemical balance) or estimated (e.g. from published specifications on a vehicle type);
- Emission Factor is a factor or ratio that has been calculated by relating GHG emissions to a measure of activity at an emissions source. Emissions factors can be determined by experimental measurement, or published, generic emissions factors can be used from reputable organisations globally or locally. Published emissions factors can vary slightly; and
- GHG Emissions are the mass of carbon dioxide and / or all equivalent GHG over a period of time, in units such as t $CO_{2\text{-}e}$/a.

Emission Factors

The National Greenhouse and Energy Reporting (NGER) emissions factors for stationary and mobile combustion are summarised in Table 8-4.

Table 8-4: NGER emissions factors

Emissions Source	Emissions Factor (kg/GJ)		
	CO_2	CH_4	N_2O
Stationary Combustion – Natural Gas	51.4	0.1	0.03
Stationary Combustion – Liquid Petroleum Gas (LPG)	60.2	0.2	0.2
Stationary Combustion – Diesel	69.9	0.1	0.2

Mobile Combustion – Diesel	69.9	0.01	0.5

Additional emissions factors and their sources can be found in Appendix C of Appendix 7.

Limitations

While every attempt has been made to ensure accuracy in calculations performed in this report, the following sources of uncertainty have been identified:

- The Emission Factors for some reagents are not well-publicised therefore assumptions were made where required. All emissions factors are shown in Appendix C of Appendix 7;
- Physical properties used in the assessment, such as gas calorific values and diesel density are only specific to Australia where available;
- Mass balance of the HBI plant is based on vendor data and is restricted to the emission points;
- The electrical power demand has been calculated using the overall consumption rate for HBI and pellet plants;
- Testing and operation protocols for firewater diesel pump and standby generators – operating phase of the Proposal is based on 1% availability. This can be seen as a conservative assumption and might need to be updated in later stages; and
- Reagent suppliers are yet to be confirmed, any changes may affect the transportation distance and emissions.

Assumptions

The following key assumptions have been applied to the calculation and modelling of GHG emissions for the Proposal. A comprehensive list of assumptions can be found in Table 3.1 of Appendix 7.

General Assumptions

- The pellet plant will have a general 90.4% operating availability, i.e. will operate for 7,919 hours/yr, with the balance being planned and unplanned downtime;
- The HBI plant will have a general 89% operating availability, i.e. will operate for 7,796 hours/yr;
- The Bulk Materials handling will have a 95% operating availability, i.e. will operate for 8,322 hours/yr; and
- NGER fuel emissions factors have been used in the calculations (Table 8-4).

Scope 1

- Vegetation types were advised by the flora consultant for the Proposal (Phoenix Environmental Sciences Pty Ltd, 2024);
- It is assumed that the majority of vegetation clearing (390 ha) will occur in Year 1, as part of the construction phase;
- Land clearing emissions factors have been sourced from FullCAM (78.52 t $CO_{2\text{-}e}$/ha);
- The diesel fire water pump and diesel generators will have 1% availability (88 h/a);
- The emergency diesel generator fuel consumption is based on an average emergency power demand requirement of 3 MW; and

- Six borefield pumps are required. The availability of borefield pumps was assumed to be 67% or 5,869 hours.

Scope 2

- Electricity may be sourced from a third-party power supplier with an 'islanded' power station or from the NWIS grid. For the purposes of this estimate, it has been assumed power will be from the NWIS;
- It is assumed the NWIS emission factor will start to reduce from 2027. It is assumed to reduce by 40% from the initial factor by 2030, followed by a steady decline to 0 t $CO_{2\text{-}e}$/Megawatt (MW) by 2050. This assumption has been made in an attempt to align the NWIS emission factor forecasts with the WA Government's emissions reductions targets, which includes the target of 80% reduction in the WA Government's emissions by 2030 (compared to 2020) and net zero emissions for WA by 2050; and
- The electrical load will increase as the uptake of electric vehicles increase over the operating phase.

Scope 3

- Natural graphite is used as the coating material for HBI production;
- All the mechanical equipment and vehicles consist of steel only;
- Embodied carbon in construction materials and equipment are to be purchased in 2025;
- All light/service vehicles (except for buses) are purchased in 2027;
- The Scope 3 emissions factor for the South West Interconnected System (0.04 t $CO_{2\text{-}e}$/MW hour) has been used as there is no reported factor for the NWIS;
- 6,370 employee flights/annum (90% fly-in-fly-out workers on an 8/6 roster);
- Shipping of product to overseas customers – assumes that product is shipped to Japan, via Lumsden Port in a Panamax shipping bulk vessel;
- Bentonite will be shipped from a supplier in India (Port of Chennai), limestone will be shipped from Korea (Port of Busan); and
- Diesel will be sourced in Port Hedland and will be trucked to site.

Exclusions

The following sources of emissions are excluded from the Proposals emissions estimate:

- PHI's other facilities outside of the Proposal (e.g. offices in Perth, etc.) are not included in this assessment;
- Specific Scope 3 emissions including:
    - Business Travel;
    - Upstream leased assets;
    - Downstream leased assets; and
    - Franchises and investments.
- Fugitive emissions – e.g. equipment leaks from joints, seals, packing, and gaskets; hydrofluorocarbon emissions during the use of refrigeration and air conditioning equipment; and CH_4 leakages from gas transport have also been excluded.

8.4.3 GHG Emission Estimates

A summary of the estimated Proposal Scope 1, 2 and 3 emissions for all phases inclusive of carbon abatement is provided in Table 8-5. Annualised Scope 1, 2 and 3 emissions are provided in Table 8-6.

Table 8-5: Estimate of emissions for the Proposal

Scope	Emissions (t CO_{2-e})				
	Construction	Operation	Total	Annual Average	Annual Peak
Scope 1	288,120	18,551,930	**18,840,050**	185,616	735,099 (2030)
Scope 2	50,329	2,291,460	**2,341,789**	23,072	204,378 (2030)
Scope 3	4,478,760	511,810,175	**516,288,935**	5,086,590	5,152,071 (2030 onwards)

Table 8-6: Annual Proposal emission estimates

Year	Stage	Emissions (t CO_{2-e})		
		Scope 1	Scope 2	Scope 3
2025 (Q2-Q4)	Construction	41,907	0	79,328
2026		81,479	0	97,743
2027		55,845	0	92,039
2028 (Q1-Q3)		108,889	50,329	4,209,650
2028 (Q4)	Operations	199,635	46,453	1,755,146
2029		735,099	204,378	5,152,071
2030		639,623	195,563	5,152,071
2031		682,319	188,596	5,152,071
2032		594,535	181,260	5,152,071
2033		593,940	173,554	5,152,071
2034		593,940	162,707	5,152,071
2035		593,940	151,860	5,152,071
2036		593,940	141,013	5,152,071
2037		593,940	130,166	5,152,071
2038		496,388	119,318	5,152,071
2039		496,388	108,471	5,152,071
2040		496,388	97,624	5,152,071
2041		496,388	86,777	5,152,071
2042		398,835	75,930	5,152,071
2043		398,835	65,083	5,152,071
2044		398,835	54,236	5,152,071
2045		301,282	43,389	5,152,071

Year	Stage	Emissions (t CO_{2-e})		
		Scope 1	Scope 2	Scope 3
2046		301,282	32,541	5,152,071
2047		301,282	21,694	5,152,071
2048		203,729	10,847	5,152,071
2049		106,853	0	5,152,071
2050		106,853	0	5,152,071
2051 onwards		106,853	0	5,152,071

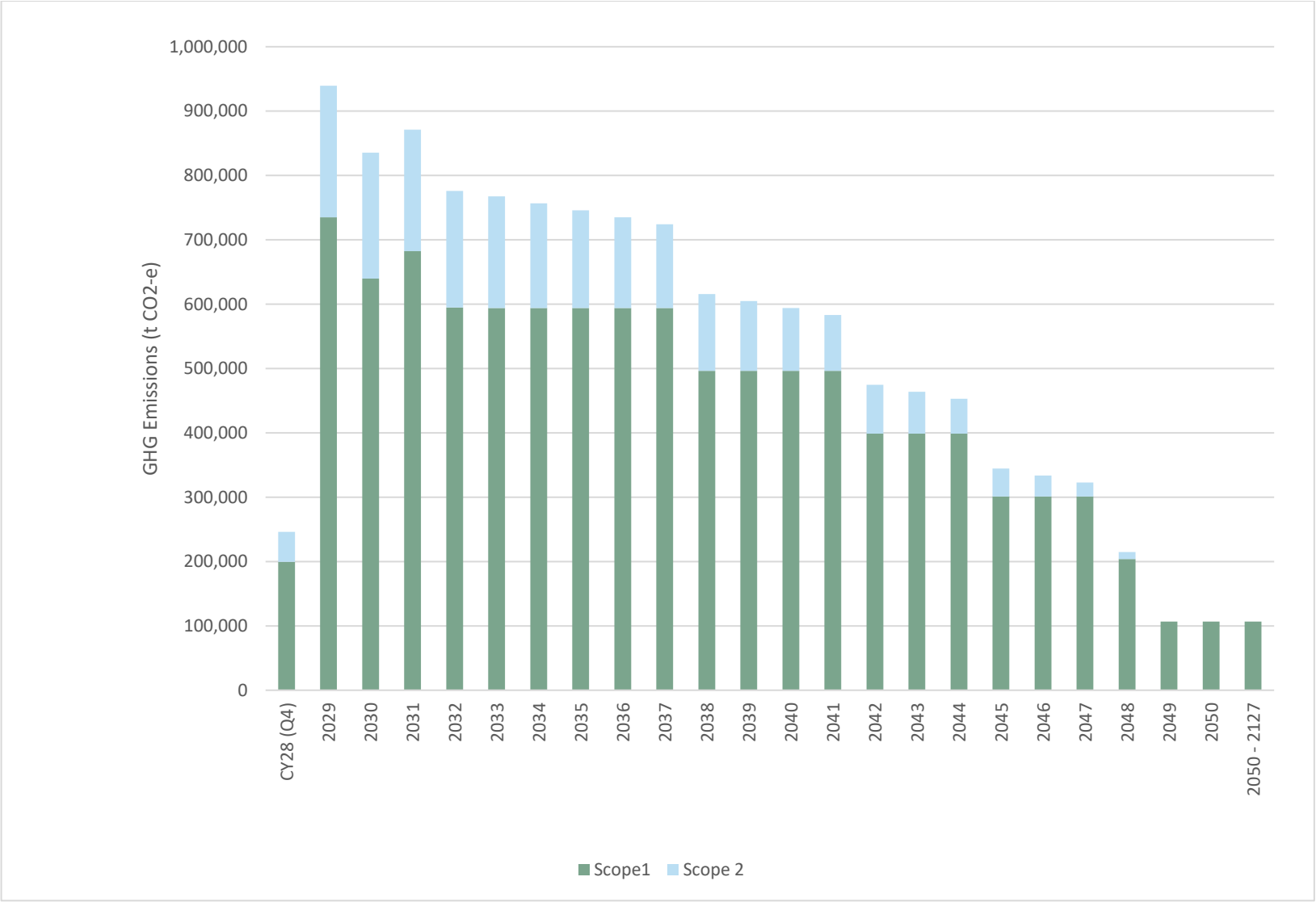


Figure 8-1: Estimated Scope 1 and Scope 2 emissions over the life of the Proposal

Summary

A summary of the estimated emissions inventory (construction and operations) for the life of the Proposal is provided in Table 8-7.

Table 8-7: GHG Emissions summary (construction and operations)

Emissions Source	Emissions (t CO_{2-e})	
	Annual Average	Total
Scope 1		
Process Emissions	178,512	18,118,941
Diesel Plant Stationary	2,762	280,362
Land Clearing	302	30,623
Diesel Mobile	1,546	156,912
Biogenic Impact	138	14,010
Product Transportation to the Port	1,796	182,281
Total	**185,055**	**18,783,129**
Scope 2		
Stationary Electrical Load	23,072	2,341,789
Total	**23,072**	**2,341,789**
Scope 3		
Purchased Goods and Services	2,738,854	275,254,861
Capital Goods	2,572	258,456
Fuel and Energy	25,434	2,556,145
Upstream Transportation	11,286	1,134,278
Waste Generation and Disposal	860	86,460
Employee Commute	713	71,656
Downstream Transportation	40,872	4,107,682
Sold Products	2,316,611	232,819,434
Total	**2,779,720**	**516,288,972**

Table 8-8: Predicted GHG emissions

Environmental value	Potential direct impact	Potential indirect impact	Impacts associated with other proposals	Total cumulative impact
GHG emissions	Up to 18,118,941 tCO_2 -e over the life of the Proposal averaging 178,512 tCO_2-e per year	Up to 204,378 t CO_2-e of Scope 2 GHG emissions per year Up to 5,152,041 t CO_2-e of Scope 3 GHG emissions per year	Total annual State GHG emission of approximately 114.3 Mt CO_2-e (5.1 Mt CO_2-e of which are Scope 1 GHG emissions from industrial processes) Total annual National GHG emissions of approximately 443.6 Mt CO_2-e (32.8Mt CO_2-e of which are Scope 1 GHG emissions from industrial processes)	Total annual State GHG emission of approximately 114.5 Mt CO_2-e (5.3 Mt CO_2-e of which are Scope 1 GHG emissions from industrial processes) Total annual National GHG emissions of approximately 443.8 Mt CO_2-e (33 Mt CO_2-e of which are Scope 1 GHG emissions from industrial processes)

8.5 Assessment of Impacts

An estimate of the expected annual Scope 1 GHG emissions from the Proposal was calculated by Wood (2024). A maximum (peak) of 735,099 t CO_2-e per annum is estimated in 2030 prior to proposed incremental increases to hydrogen use in the reductant mix. The annual average Scope 1 emissions are 185,616 t CO_2-e.

The Proposal is predicted to increase WA's annual GHG emissions from Industrial Processes on average by approximately 3.5% and represents a 0.15% increase to WA's annual GHG emissions (DCCEEW, 2024b). At a national scale, the Proposal is predicted to increase annual GHG emissions from Industrial Processes on average by 0.5%, and 0.04% overall (DISR, 2024).

8.5.1 Comparison with other Projects

Wood conducted a benchmarking exercise whereby the estimated emissions from the operations phase of the Proposal were compared against other iron producers. Comparisons were made of Scope 1 emissions per unit of production – where data was publicly available. There is no current similar production of iron to the Proposal in Australia, so only overseas facilities can be considered for benchmarking.

The accuracy and reliability of the benchmarking data is based upon the transparency and consistency of reporting among the suppliers included in the analysis. Discrepancies in methodologies, data availability, and reporting practices may impact the comparability of emission intensity metrics. Furthermore, this benchmarking analysis may not encompass the entirety of the environmental impacts linked to steel production, such as water consumption, land use, and waste management.

The Proposal is fairly unique in that it does not continue the steel making process on site. This will lead to a lower emissions intensity when compared to other steel producers as the Proposal is producing iron in isolation. It was determined that that the most relevant metric for comparison of GHG emission performance is emissions per tonne of iron ore processed. This data is separated into pellets and direct reduced iron (DRI) presented in Table 8-9 and Table 8-10, respectively.

The data shows that the Proposal compares favourably against other iron producers with regard to GHG emissions intensity (Figure 8-2 and Figure 8-3).

Table 8-9: Pellet GHG emissions benchmarking

Company	Location	Year	Production (Mt Pellet)	t CO_2-e/t product
LKAB	Sweden	2022	25	0.02644
LKAB	Sweden	2021	26.7	0.0267
Research paper	China	2019	NS	0.0585
U.S. Steel	USA	2021	23.4	0.09
U.S. Steel	USA	2022	21.9	0.09
Samarco	Brazil	2021	7.68	0.083
Samarco	Brazil	2022	9.288	0.052
PHI	Australia	2024	3.5	0.04

Table 8-10: DRI GHG emissions benchmarking

Company	Production (Mt HBI or DRI)	t CO_2-e/t HBI or DRI	Reductant	Process Type
Research Paper	Not Specified (DRI)	0.413	Natural Gas	Midrex (Shaft furnace)
tkSE (modelling)	Not Specified (DRI)	0.41-0.5	Natural Gas	Not stated
Research Paper	Not Specified (DRI)	0.0066	86% hydrogen	Midrex (Shaft furnace)
Research Paper	Not Specified (HBI)	0.4965	Natural Gas	Energiron (Shaft furnace)
Research Paper	Not Specified (HBI)	0.0015	96% hydrogen	Energiron (Shaft furnace)
Worldsteel Report	Not Specified (DRI)	1.50	Not Stated	Not Specified
Kobelco	2.93 (DRI)	0.597	Hydrogen Rich Gas	Midrex (Shaft furnace)
Nucor	4.5 (DRI)	0.43	Not Stated	Midrex (Shaft furnace)
Nucor	4.5 (DRI)	0.41	Not Stated	Midrex (Shaft furnace)
PHI	2.0 (HBI)	0.49	Natural Gas	Midrex (Shaft furnace)
		0.0534	100% hydrogen	Midrex (Shaft furnace)

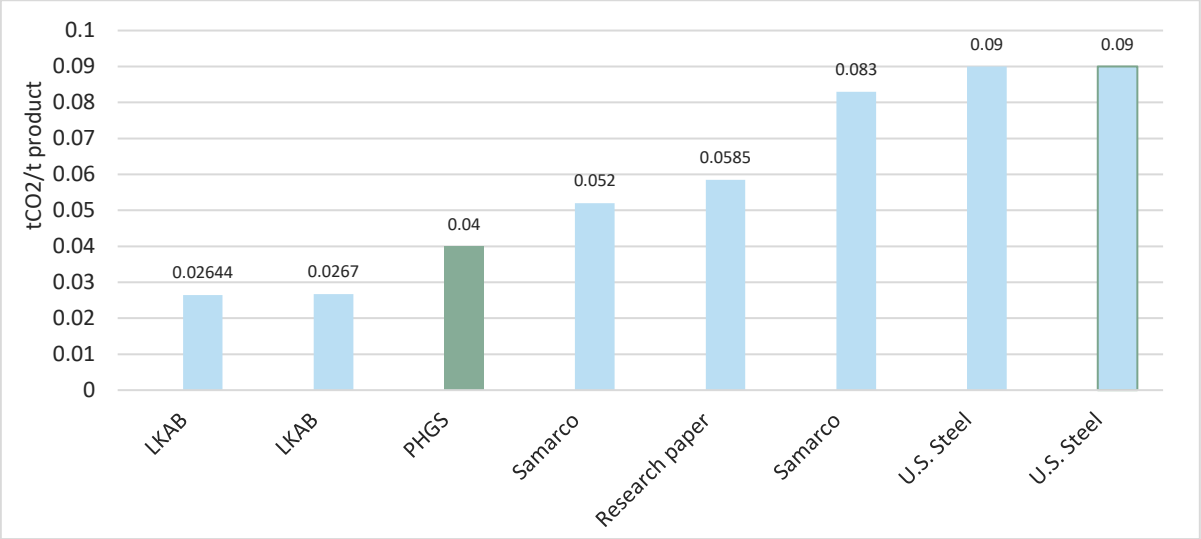


Figure 8-2: Pellet GHG emissions benchmarking

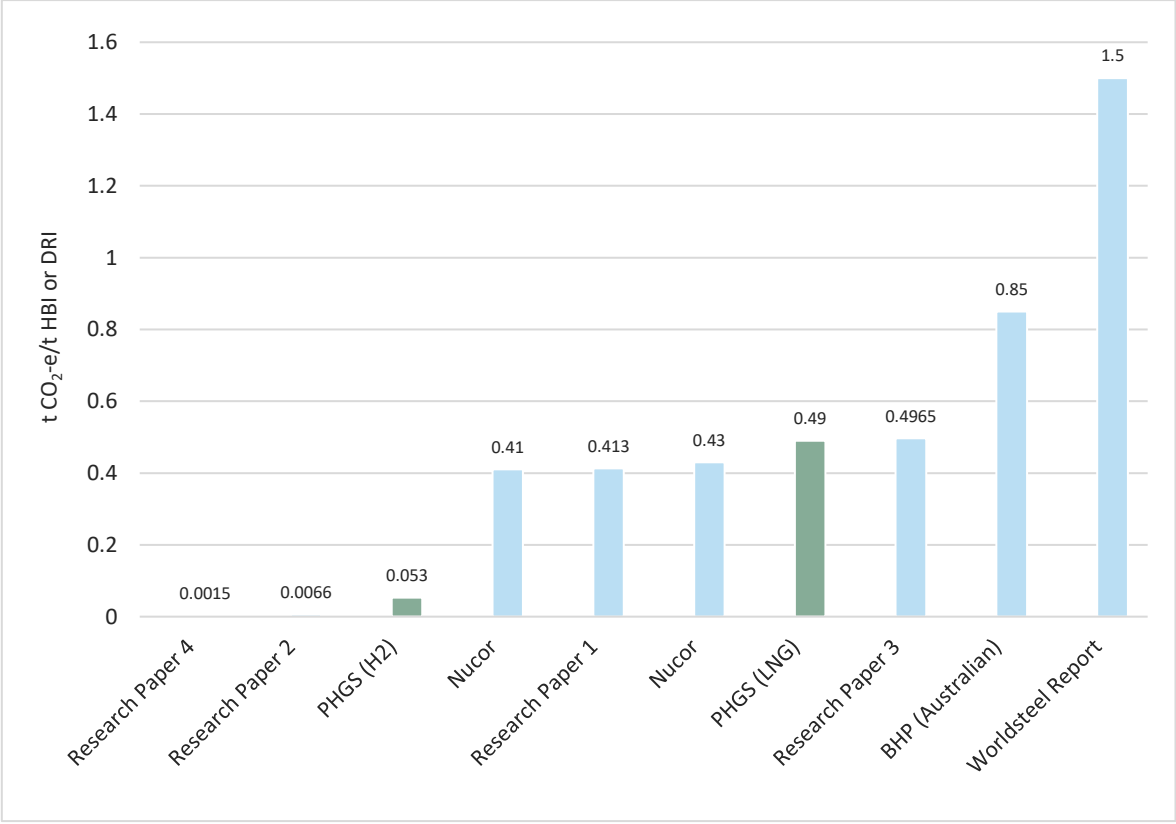


Figure 8-3: DRI GHG emissions benchmarking

PHI also acknowledges that the benchmarking comparisons presented are not necessarily comparing like-for-like, due to the assumptions and projections applied to the emissions estimates for the Proposal. The emissions estimates assume that the grid electricity emissions factor reduces from its current factor to zero by 2050, to reflect the WA Government's 2050 target of carbon neutrality. Emissions for other Projects assessed in the benchmarking exercise are presented as current emissions, with no provision for future reductions, which are likely to occur.

8.6 Mitigation Measures Adopted to Avoid, Reduce or Offset Scope 1 Emissions

PHI is investigating and implementing a wide range of short to long-term carbon abatement initiatives. The following sections detail the mitigation measures that will be implemented over the life of the Proposal.

8.6.1 Best Practice Technology

A key objective of the Proposal is to enable decarbonisation of the steel making process. During the design phase, PHI investigated several international technology options to identify the best practice technology that would achieve this objective while being suitable for the Australian conditions.

POSCO is the major Joint Venture partner (51% ownership) for the Proposal and is committed to pioneering steel production decarbonisation projects and upholds ambitious emissions reduction targets. Joint venture partners Marubeni and China Steel are also committed to decarbonisation with commitments that align with global decarbonisation efforts. POSCO, a global leader in steel making and foundational leader of 'Responsible Steel' was among the first three major steel companies to publicly commit to 'Net Zero by 2050', along with ArcelorMittal and Nippon Steel. As an example of its commitment, POSCO has been developing the FINEX process to enable production of reduced iron from iron ore fines, particularly hematite. POSCO is intention is to further develop this technology into HyREX, which uses hydrogen as a reductant to process iron ore fines into reduced iron. This aspiration demonstrates POSCO's commitment to decarbonisation and gives substance to its desire to utilise best practice technology where possible.

As the Project produces HBI that feeds into the steel making process, it needs to meet certain physical and chemical parameters (i.e., degree of metalisation and purity) to ensure it is suitable for further processing into steel. In steel making, the requirements can be specific to the facilities within which the feedstock will be processed into steel. On this basis, the selection of potential best practice technology is constrained by the standard of HBI required for processing.

Best practice technology, strictly speaking, considers technologies from an international scope. What is considered best practice in the Australian context will differ greatly for various reasons including but not limited to, geography, climate and availability of inputs like reductant and ore grade. By way of example, a facility that uses 100% hydrogen as a reductant to produce HBI would be considered best practice however this is not possible in Australia where a commercially competitive and stable supply of hydrogen is not available.

Several technology options were identified and shortlisted during the project planning phase. A review process evaluating the suitability of the options for adoption in the Australian context was undertaken. PHI determined that a co-located GK pellet plant and MIDREX shaft furnace were best practice for the production of HBI in WA. The key considerations and justification in the chosen technology is provided below.

Pellet Plant

Two different pelletising technologies were studied and compared. In this analysis a SG and GK were considered in detail.

In a SG plant, green pellets are fed as a bed onto pallet cars which then travel through several drying, pre-heating, firing, and cooling zones to produce heat-hardened fired pellets. With the GK technology, separate sub-processes are required, between which the pellets must be transferred. These include a short traveling grate for drying and pre-heating, a rotary kiln where the pellets are evenly heated to the peak firing temperature and a separate rotary pellet cooler. The main firing of the pellets occurs in the rotary kiln, which applies heat evenly across all pellets.

There are clear pros and cons between the two types of pelletising technologies in terms of facility management, fuel consumption, and power consumption.

PHI based its selection decision regarding the Pellet Plant design by considering the following criteria:

- Production capacity;
- Energy efficiency;
- Quality of pellet;
- Maintenance schedule; and
- Operating expenditure.

Considering the criteria mentioned above, PHI selected the GK technology based on the following:

- GK pellet plants produce fired pellets with better and more consistent quality compared to SG plants. The rotating action of the rotary kiln exposes all pellets to the same firing temperature. In SG furnaces, edge effects at the side and bottom of each pallet car increases the variability of the fired pellet quality;
- GK plants provide fired pellets with greater cold crushing strength, lower abrasion index (an indicator of fines generation), and a higher tumble strength. These improved pellet properties will benefit the direct reduction plant regarding productivity and natural gas consumption;
- SG type pellet plants have firing thermal deviations (higher and lower), while GK type plants have uniform firing which leads to superior pellet quality. According to the results of the overseas shaft reduction furnace technology survey conducted by POSCO in 2022, high fines in the shaft reduction furnace could be caused by poor pellet quality; and
- In the case of Vale, the SG type is applied in Brazil where BF pellets are mainly produced, and the GK type is applied in Oman where DR pellets are produced.

HBI Plant

Two different HBI plant technologies were studied and compared for the Project: MIDREX and Energiron. Both are established technologies and can produce HBI and HDRI. The Energiron process has never commercially produced HBI because of inherently higher carbon in product associated with the in-situ reforming principle of operation. For HBI production, the Energiron process is not a suitable technology.

The criteria considered for selecting the HBI plant are as follows:

- Energy efficiency and greenhouse gas emissions;
- Licensor;

- Year commercialised/Market Share;
- Raw Material/Fuel;
- Operation Pressure;
- Gas Reform;
- Product; and
- Transportation.

The difference between the shaft furnace and the fluidised furnace was also considered.

Considering the assessment criteria above, PHI decided to select MIDREX shaft furnace technology on the following basis:

- MIDREX has an advantage over Energiron due to easy operation and maintenance (relatively low pressure);
- Due to differences in natural gas reforming, DRI producted from the MIDREX shaft furnace has a lower carbon content compared to Energiron, which is beneficial for briquetting into HBI (high carbon content reduces HBI moldability as it combines with Fe to make it hard and brittle);
- If fluidised bed technology is adopted, a pellet plant is not required and mid- or low-grade iron ore fines can be used as feedstock (the main iron ore in the world and Australia). However, MIDREX shaft furnace technology produces HBI with higher metallisation rates and lower impurity levels because it normally uses high grade iron ore pellet as feedstock;
- MIDREX technology is highly scalable, allowing for the construction of plants with various capacities, making it suitable for both large-scale (up to 2.5 Mt/a) and smaller-scale operations; and
- MIDREX technology has been widely used in the industry for several decades and has a proven track record of successful operation, while fluidised bed technology is not widely used due to difficulties in handling iron ore fines and high pressures in the furnace.

8.6.2 HYDROGEN UTILISATION

Natural gas is necessary early in the life of the Proposal as hydrogen will not be available in the quantities and at a cost appropriate to satisfy 100% of the reductant blend from start-up. However, given the key driver for the Proposal is the decarbonisation of the steelmaking process and a reduction in emissions intensity of around 55% is achieved starting with gas, the Proposal mitigates GHG emissions from start up. The intent is to move to 100% hydrogen as the reductant as quickly as practicable. As the target for the Proposal is net zero iron production by 2050, there is a strong driver to increase hydrogen consumption as soon as it becomes available. The Proposal is hydrogen enabler for WA.

Short term supply

PHI is considering different supply options for hydrogen, either self-supply through onsite plant or from a third-party supplier. The Proposal includes scope to build and operate an onsite electrolyser to supply the initial 1% or 2,000 tonnes per annum of hydrogen for the Proposal. However, if an immediate and cost-effective source of hydrogen becomes available PHI may utilise third party supplied hydrogen instead of the electrolyser.

Long Term Hydrogen Plan

There are several potential sources of green hydrogen to increase the hydrogen contribution to the ultimate goal of 100% by 2050. PHI is reviewing all supply options, including AREH. The AREH has the potential to develop significant wind and solar power and develop electrolysis at a scale that could satisfy the Proposal requirements. Approximately 300 km of water and hydrogen pipelines connect AREH and Boodarie SIA. At this scale, the transport of hydrogen is the optimal solution as opposed to building transmission infrastructure for hydrogen production at Boodarie SIA.

Hydrogen Injection

PHI has taken a strategic approach that involves incremental integration of H_2 throughout the Proposal's lifecycle, aimed at significantly mitigating CO_2 footprint associated with HBI production. The proposed schedule for substituting natural gas with H_2 is outlined in Table 8-11.

Table 8-11: HBI H_2 injection rate

Year	Phase	H_2 Injection
2025 (Q2) – 2028 (Q3)	Construction	0%
2028 (Q4)	Operation	0%
2029 – 2031		1%
2032 – 2037		10%
2038 – 2041		30%
2042 – 2044		50%
2045 – 2047		70%
2048		90%
2049 – 2128		100%

The integration of H_2 into the HBI production process results in a significant reduction in HBI plant's CO_2 emissions. According to projections illustrated for Scope 1 emissions in Figure 8-4, the implementation of H_2 is expected to lead to a clear decrease in carbon emissions over time as opposed to the Proposal continuing their production using 100% Natural Gas.

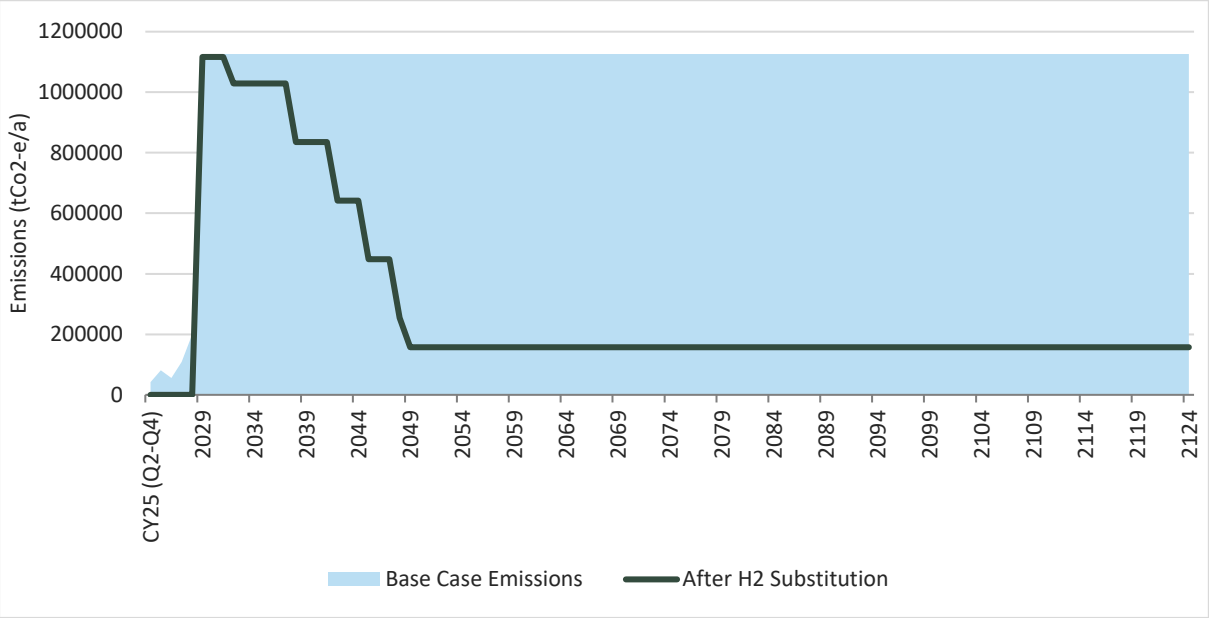


Figure 8-4: Emissions reductions achieved using H_2 injection

8.6.3 Carbon Capture and Storage

There are two possible points for pre-combustion and post-combustion capture of CO_2 (Figure 8-5). Top gas fuel separated from the gas can capture up to 44% of the CO_2 before combustion, and post-reformer flue gas can capture up to 84% of the CO_2 before leaving the flue gas stack. Wood (2024) assumed that CO_2 is captured after reformer before leaving the flue gas stack. The reformer flue gas contains approximately 0.92 million t (Mt) CO_2 at a concentration of 15%, based on a flow rate of 400,000 normal cubic metre/hour.

The CCUS rates are provided in Table 8-12. The application of CCUS technology to further reduce emissions, complementing the already abated levels through H_2 substitution, is illustrated in Figure 8-5.

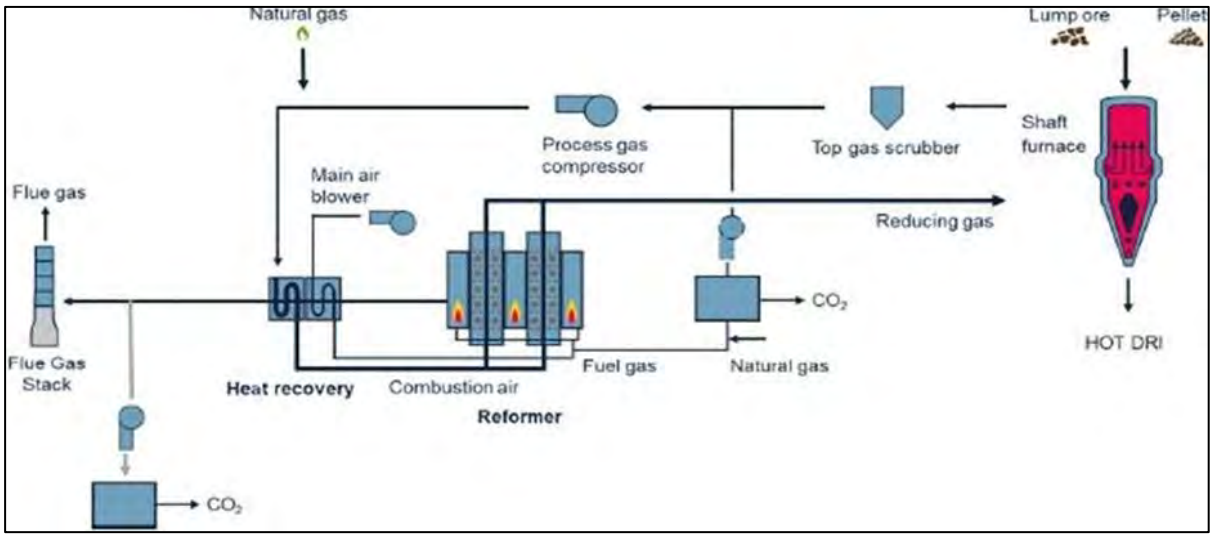


Figure 8-5: Potential CO_2 capture points

Table 8-12: CCUS rate

Year	Phase	Emissions captured with CCUS (t CO_2/a)
2025 (Q2) – 2028 (Q3)	Construction	0
2028 (Q4)	Operation	0
2029		380,952
2030		476,190
2031 – 2037		432,900
2038 – 2041		336,700
2042 – 2044		240,500
2045 – 2047		144,300
2048 – 2128		48,100

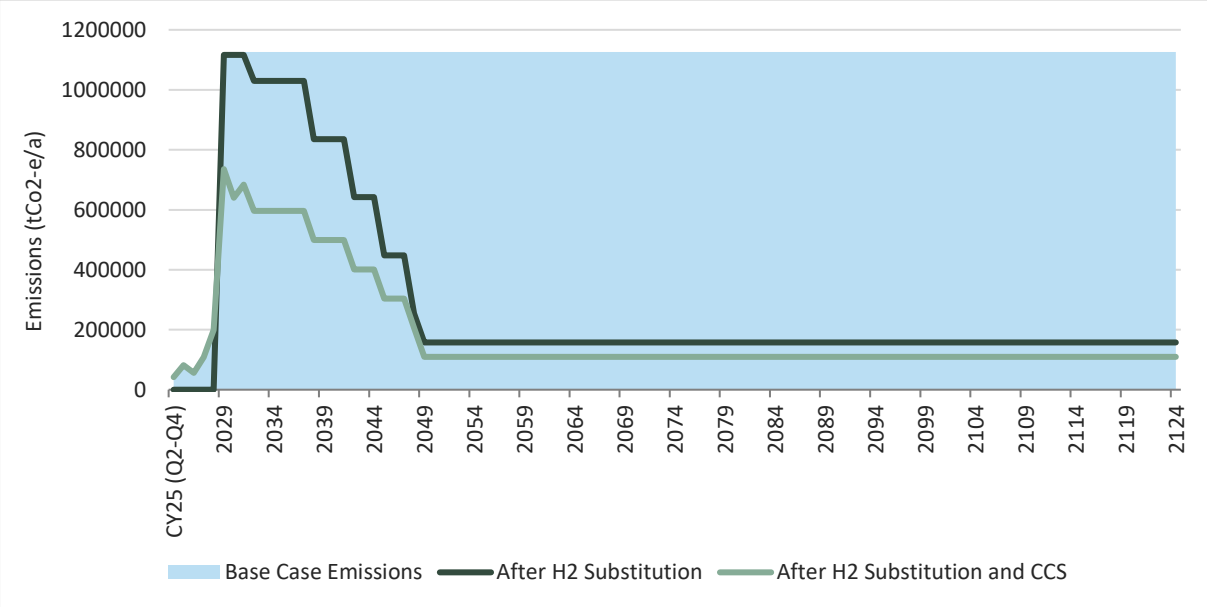


Figure 8-6: Emissions reductions achieved using H_2 injection and CCUS

8.6.4 Electrification of Fleet

Figure compares t $CO_{2\text{-}e}$ emissions from mobile combustion for the Base Case and Low-carbon Case. No carbon is expected to be emitted from operation vehicles in the Low-carbon Case after 2034 as vehicles may be electrified.

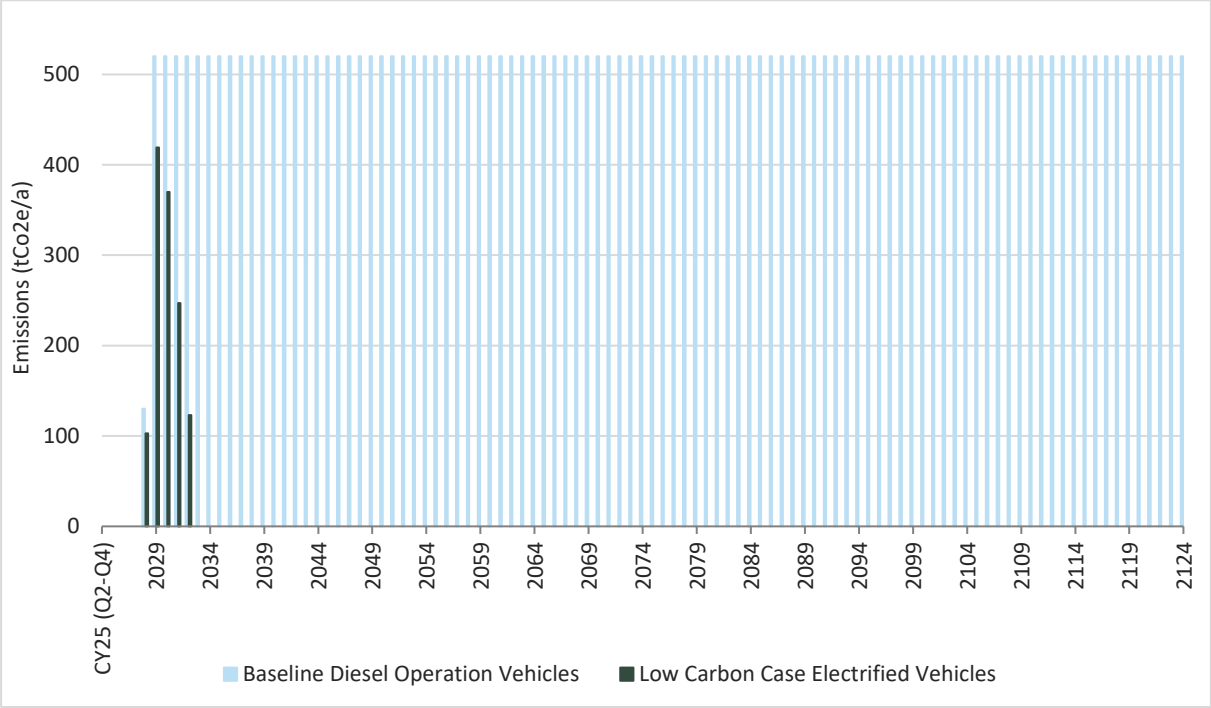


Figure 8-7: Emissions reductions achieved from fleet electrification

8.6.5 Other Abatement Opportunities

In addition to the decarbonisation strategies evaluated in the previous sections, there are other opportunities that can be assessed in the future, especially for abating Scope 3 emissions. At a very high-level, some of these opportunities are listed below:

- Waste heat recovery;
- Optimising equipment choice, redundancy and sizing;
- Sustainable buildings;
- Using less emission intensive reagents;
- Using green ammonia or biofuels for bulk transport via shipping; and
- Using sustainable aviation fuel.

8.7 Mitigation Measures Adopted to Avoid, Reduce or Offset Scope 2 Emissions

The WA Government is also planning to significantly the boost the share of renewable energy generation sources in the NWIS and close all government owned coal-fired power plants by 2029. The $3 billion 'Rewiring the Nation' deal signed in 2023 will allow for major upgrades to the transmission in the NWIS and finance the increase of renewable energy. As a result of these changes, the GHG emissions intensity of power supplied into the NWIS will lower substantially in coming years.

The State Government released the SERS in December 2023 (Government of WA, 2023) which outlines the key priorities, benchmarks and milestones for WA's transition to net zero emissions while supporting the decarbonisation of our region. As of 2023, less than two percent of power from the NWIS is currently generated from renewable sources. However, the NWIS is assumed to

reach renewable energy percentages of around 60% in 2030, and 75% in 2040; in line with forecasts from APA Group for expected renewable supply in the Pilbara and reflects recent announcements from mining communities. Additionally, the Pilbara Independent System Operator has been implemented to oversee the NWIS as part of a new "light handed" access regime will improve system security and reliability. With these proposed changes, emissions are projected to decline by <1 Mt $CO_{2\text{-}e}$ from 2023 to 2035 as renewable supply makes up a growing share of generation (DCCEEW, 2023).

Scope 2 GHG emissions will continually decrease over the life of the Proposal through the overall emissions reductions from the NWIS, although there is some uncertainty at the rate this will be achieved. The SERS notes the need to ensure substantial increase in transmission infrastructure and increase the renewable generation capacity in the NWIS to satisfy current and future demand of renewable energy sources (Government of WA, 2023).

Further reductions in Scope 2 emissions will also be achieved by maximising the electrical efficiency of the Proposal including by:

- Regular monitoring of electrical load on the processing equipment and investigation whenever the load falls outside optimal parameters;
- Regular maintenance and inspection of processing equipment to optimise efficiency;
- Regular electrical calibration checks on the processing equipment;
- Use of high efficiency electrical motors throughout the mine site; and
- Use of variable speed drive pumps, compressors and other processing equipment.

8.8 Mitigation Measures Adopted to Reduce Scope 3 Emissions

Scope 3 emissions for the Proposal include downstream processing of HBI into steel, purchased goods, capital goods, upstream and downstream transport, fuels, waste generation and personnel travel to and from site.

Low emissions HBI produced by the Proposal will enable POSCO to replace a portion of its South Korean BF-BOF with EAF. EAFs can be powered by renewable energy and do not require coal as a reductant (compared to BF-BOF which relies on combustion of coal). Initially, the Proposal will enable a reduction in emissions by approximately 50% for every tonne of steel produced by using LNG as a reductant when compared to current methods that rely on coal. The Proposal plans to achieve a significant further reduction in GHG emissions (up to 92%) compared to current methods, once 100% of the reductant is hydrogen rather than LNG. The steel making processes and potential reductions in emissions intensity (t $CO_{2\text{-}e}$/t product) are shown in Figure 8-8.

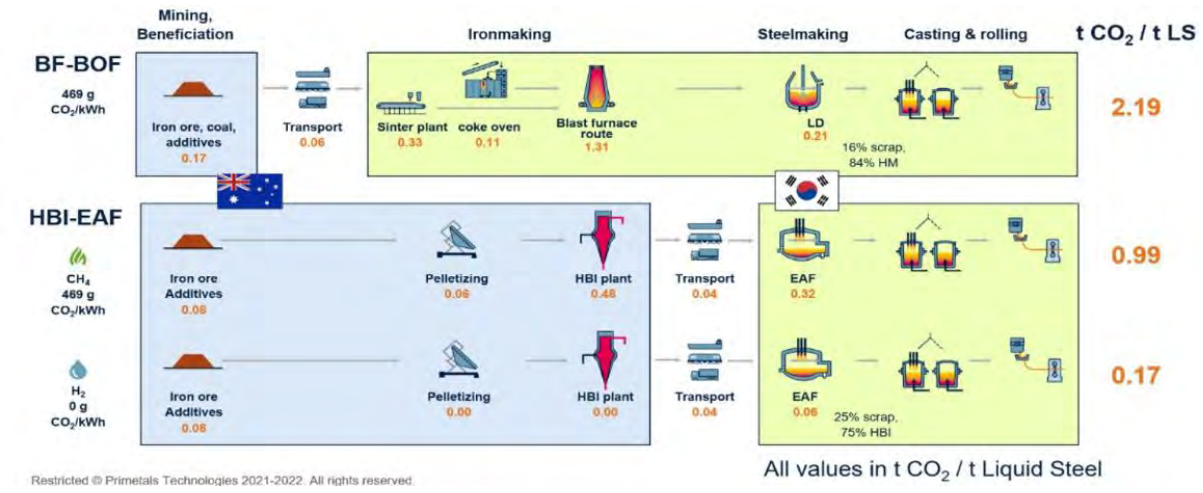


Figure 8-8: Comparison of $Co_{2\text{-}e}$ emissions BF-BOF vs. HBI-EAF

The Proposal will have the potential to reduce global GHG emissions from the current steel making operations by 2.4 Mt $CO_{2\text{-}e}$/a once using 100% hydrogen as the reductant. This reduction is the equivalent of 0.51% of Australia's total GHG annual emissions in 2023. The Proposal will temporarily increase Australia's GHG emissions by 0.9 Mtpa (0.2%) – as there is currently no downstream reduction of iron ore in Port Hedland, with all iron ore shipped without downstream processing.

The temporary increase in Australian GHG emissions will be mitigated (Section 2.7) so that the emissions intensity is progressively reduced, and the resulting emissions profile aligns with Australia's emission reduction targets.

There is no proven process route at an industrial scale to produce primary net zero steel today. As mentioned in Section 1, PHI has limited influence over the way the product is processed by external companies. However, POSCO, the seventh largest steel-producing company in the world, and the receiver of a significant portion of the HBI, will see a significant reduction in their emissions from steelmaking (this Proposal's Scope 3 emissions) (Worldsteel Association, 2023). POSCO's ambition to produce steel from HBI is a necessary, transitional step that allows incremental reductions in emissions intensity by up to 92% from steel made using high grade magnetite iron ore. The Proposal will prove that significant emissions reductions are possible with the use of hydrogen at a commercial scale and enable the transition to other technologies like HyREX, that will enable similar decarbonisation but from lower grade hematite iron ore.

PHI will also consider low carbon options when undertaking the procurement process for infrastructure and input suppliers. Preference will be given to those options with clear carbon accounting and lower carbon intensity where they are commercially competitive. PHI is also investigating additional alternatives such as the introduction of green ammonia or biofuels for bulk transport via shipping and using sustainable aviation fuel.

8.9 SAFEGUARD MECHANISM

The NGER Act legislates the Safeguard Mechanism, which is the key compliance mechanism for GHG emissions in Australia. The framework for the Safeguard Mechanism is set, and the pathway to net zero emissions will be regulated in Australia under the Safeguard Mechanism. The

Safeguard Mechanism is designed to encourage/force emitters to a net-zero situation by 2050 by adopting a market-based mechanism. Benchmark emission levels are combined with a decline rate to set a baseline target that is designed to progress to net zero emissions in Australia by 2050. Offsets are used to adjust for facilities being above or below target.

ACCUs or Safeguard Mechanism Credits (SMCs) are the principal means to offset for continued carbon emissions above the baseline. If facility emissions are above the baseline in any year, it must purchase and surrender SMCs or ACCUs. If below the baseline, the facility will generate SMCs which may be sold or used to meet the baseline. ACCUs and SMCs are both tradable financial products representing one t $CO_{2\text{-}e}$ emissions. Under the EPAs latest GHG guidance (EPA, 2024) the EPA considers that the Safeguard Mechanism presents an opportunity to streamline the information required for assessment. In the case where Proposal emissions are covered under the Safeguard Mechanism, the EPA now requires the following:

1. Information on expected scope 1 emissions covered by the Safeguard Mechanism, including expected baseline, and how these emissions are anticipated to reduce over the life of the proposal through compliance with the Safeguard Mechanism;
2. How best practice measures have been adopted to avoid or reduce a proposal's scope 1 emissions at commencement; and
3. Whether carbon offsets are proposed to be surrendered for more than 30% of the proposal's expected baseline scope 1 emissions.

Items 1 and 3 are addressed in the following sections. Item 2 has been addressed in Section 8.6.1.

8.9.1 Setting Baselines

Baselines are set for each facility and based on the production rate decline factor and emissions intensity for each product or output relevant to the facility. The products or outputs are referred to as production variables, an emissions intensity is set by DCCEEW for each production variable to use in calculating the baseline. The relevant production variables for the Proposal are 'Primary iron' (HBI) and 'Iron ore pellets'.

As the baseline is determined by its production rate it varies based on production levels for each relevant production variable. The baseline calculation formula is provided below:

$$\text{Facility baseline} = \sum \text{production} \times \text{emissions intensity} \times \text{decline factor}$$

Where:

- Production rate is the annual quantity of the applicable production variable for the facility; and
- Emission intensity is the GHG emissions per unit of the production variable. For new facilities this is set based on international best practice adapted for Australian circumstances.

Decline factor is the cumulative decline rate, defaulting at 4.9%/a from 1 July 2023, subject to adjustment for trade exposure.

8.9.2 Decline Rate

A standard baseline decline rate of 4.9%/a applies from 1 July 2023 to year 2029 - 2030 with an indicative decline rate of 3.285% thereafter. The decline rate results in a cumulative decline factor for each year as shown in Table 8-13. Decline rates for 2031 - 2050 will be determined in five-yearly blocks to maintain a trajectory to net zero emissions by 2050. A formal decline rate (that may be different to the 3.285% indicative rate) will be set in 2027 for the period 2030 - 2035.

Table 8-13: Cumulative Decline factors

	2023 – 24	2024 – 25	2025 – 26	2026 – 27	2027 – 28	2028 – 29	2029 – 30
Decline Factor	0.951	0.902	0.853	0.804	0.755	0.706	0.657

8.9.3 Production Variables

There are two production variables relevant to the Proposal, "Iron Ore Pellets" and "Primary Iron". DCCEEW has recently released updated best practice benchmarks for these production variables:

- Primary Iron: 1.77 t $CO_{2\text{-}e}$/t of metallic iron products; and
- Iron Ore Pellets: 0.0501 t $CO_{2\text{-}e}$/t of iron ore pellets.

8.9.4 Calculating a Baseline

The Proposal will produce 3.5 Mt/a of iron ore pellets, 2.8 Mt/a will be used as a pre-cursor to produce 2 Mt/a of HBI at the Proposal. The remaining 0.7 Mt/a of iron ore pellets will be a saleable product and is proposed to be exported.

Calculating a baseline for the Proposal will include the sum of both the iron ore pellets and primary iron components. In calculating a baseline for Primary Iron, the Safeguard Mechanism Rule states that the quantity of Primary Iron excludes any gangue (impurities) present in the product. PHI has identified that theThe final HBI product will include impurities that would eventually be removed from the steel making process. The proportion of impurities is subject to the quality of ore supply which has not yet been confirmed. For the purposes of calculating a Safeguard Mechanism baseline, PHGS has chosen to assume 10% gangue is present (Pilbara iron ore typically ranges from 5 – 15%; Minerals Council of Australia, 2021) and hence the production of HBI is reduced from 2 Mtpa to 1.8 Mtpa.

The planned throughput is 0.7 Mt/a of pellets and 1.8 Mt/a of HBI (adjusted for impurities), giving the Proposal an estimated Safeguard Mechanism facility baseline of 2,274,075 t $CO_{2\text{-}e}$ Scope 1 emissions at the commencement of operations (Figure 8-9).

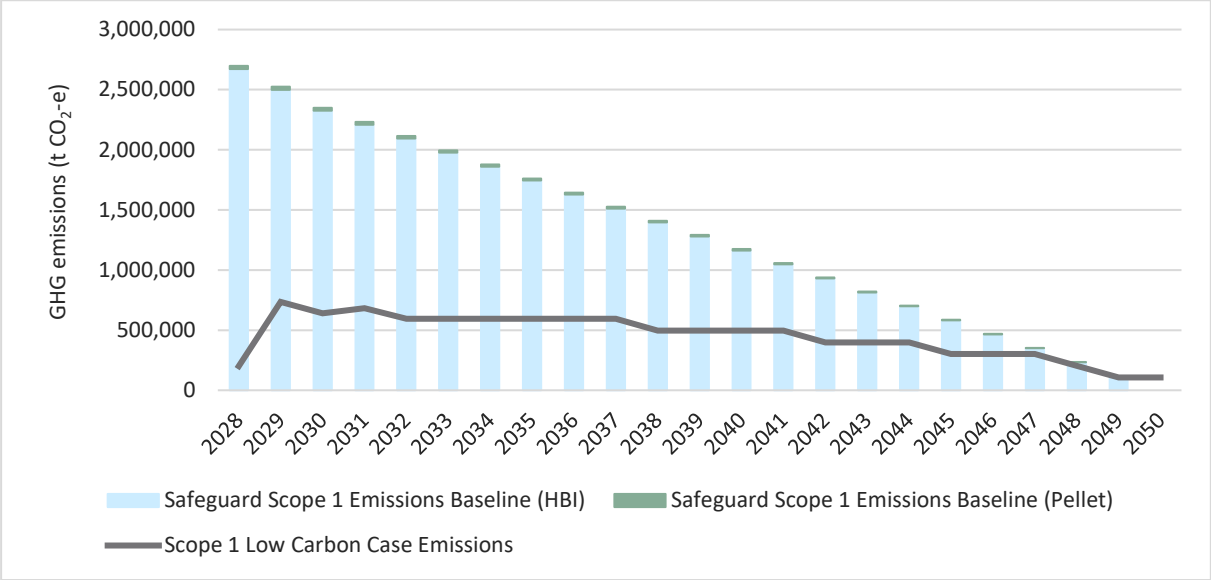


Figure 8-9: Safeguard baseline and emissions

8.9.5 GHG Emissions Offsets

PHI has is committed to reach net zero emissions by 2050 for this Proposal, with the intent of only using offsets (i.e., carbon credits) as a temporary solution while the technology or innovation required to completely decarbonise is developed.

In the event that PHI is not able to comply with the requirements of the Safeguard Mechanism, and/or where carbon emissions cannot be avoided or reduced to enable PHI to achieve its objectives, PHI will offset the remaining GHG emissions with tangible offsets. Potential tangible offset options include but are not limited to, investing in carbon offset projects and purchasing, and surrendering carbon offset credits that meet the Australian Government's integrity standards set out in the C*arbon Credits (Carbon Farming Initiative) Act 2011* (Cth).

Preference will be given to ACCUs and other Nature-Based Solutions carbon credits that aim to protect and enhance natural ecosystems, benefit local communities and improve biodiversity. The exact proportion of ACCUs and other credits within the overall offsets portfolio will be determined each period based on forecast residual emissions and monitoring of offset markets. Offsets will meet the certification requirements under relevant Australian legislation.

Based on the modelling in Section 8.9.4 emissions abatement measures adopted by PHI demonstrate the Proposal emissions will be below the baseline up until 2049, generating a substantial number of SMCs. After 2049, the Proposal emissions will be above the baseline and further abatement will be required. In the event additional emissions reductions measures cannot be implemented, PHI will offset excess emissions, initially with SMCs then with traditional offsets once SMCs are exhausted.

Based on the modelling against the Safeguard Mechanism, the Proposal will need to offset 1,040 t CO_2-e in 2049 and then 106,853 t CO_2-e / a in 2050 and for the subsequent years if no further emissions abatement is implemented. Over the life of the Proposal PHI will explore additional emissions reduction measures to avoid these emissions being above the baseline.

8.10 CONSISTENCY WITH OTHER GHG REDUCTION TOOLS

8.10.1 SECTORAL EMISSIONS REDUCTION STRATEGY

The sectoral pathways outlined in the SERS show the key priorities, benchmarks and milestones for WA's transition to net zero emissions while supporting the decarbonisation of the region. The pathways for different sectors are laid out in the SERS and include a pathways for the electricity, transport and industry sectors.

The SERS notes that under the pathway for industry, significant reduction of industry emissions can be achieved through CCUS and that WA presents a unique opportunity to decarbonise the steel making industry through production of green iron. The Proposal is designed to capitalise on the green iron opportunity and will utilise CCUS to decarbonise and therefore aligns with the SERS.

Additionally, PHI will engage with transport providers during procurement processes to ensure they are seeking to reduce emissions during transport for the Proposal to align with the pathway for transport in the SERS.

Carbon capture, utilisation and storage has an important role to play CCUS will be critical to address emissions from LNG production and to support the development of new low-carbon industries. A recent study commissioned by the WA LNG Jobs Taskforce sees potential for broad deployment of CCUS from the early 2030s with significant cuts to industry emissions. Modelling and engagement with industry has emphasised the importance of collaboration, and the value of industrial clusters and renewable energy hubs to reduce overall decarbonisation costs.

Green iron WA can help decarbonise global steelmaking and create new markets for WA iron ores. The State Government has investigated pathways to significantly reduce emissions from iron and steel production along with the significant infrastructure and investment required to realise this opportunity.

8.10.2 PILBARA ENERGY TRANSITION PLAN

In support of the SERS requirements for decarbonising the Pilbara, the State Government, through Energy Policy WA, has developed the Pilbara Energy Transmission Plan. The Pilbara Energy Transition Plan aims to help decarbonisation in the Pilbara region happen as soon as possible, largely through the development of common use transmission infrastructure to connect new renewable energy projects to where electricity is used.

Transmission infrastructure is critical for connecting renewable energy to where the demand for electricity is. New common use infrastructure in the Pilbara will reduce environmental impact by preventing unnecessary infrastructure duplication. It will also enable access to diverse renewable energy sources, support energy security and reliability and reduce the impact of industry on the environment (Government of WA, 2024).

Energy Policy WA has identified four Designated Priority Corridors, with two of these corridors (Hamersley Range and Great Sandy Desert) are specifically focused on delivering renewable energy to Port Hedland and the Boodarie SIA. The Pilbara Energy Transition Plan will therefore support the emissions reduction pathway of the Proposal.

8.11 PREDICTED OUTCOME

The Proposal is expected to contribute an annual average of 185,616 t CO_2-e per annum of Scope 1 emissions and 23,072 t CO_2-e per annum of Scope 2 emissions, increasing WA's emissions by 0.15%. Production of low carbon emissions steel making precursors is a key step for decarbonisation of the steel making process. GHG emissions from the Proposal will be counterbalanced by its contribution to GHG reductions realised in the complete steelmaking process.

Through the implementation of these measures, PHI anticipate that GHG emissions from the Proposal will be significantly reduced, and this will help to enable Caravel to achieve its objective of net zero GHG emissions by 2050.

The predicted outcomes for GHG are therefore:

- Total Scope 1 and Scope 2 emissions do not exceed emissions targets; and
- Net-zero emissions from the Proposal by 2050.

The implementation of design and operational mitigation measures is expected to ensure that the Proposal does not significantly impact this factor. The EPA objective for this factor is therefore able to be met.

9 SOCIAL SURROUNDINGS

9.1 EPA OBJECTIVE

The EPA Objective for this Key Environmental Factor is to protect social surroundings from significant harm.

9.2 POLICY AND GUIDANCE

Relevant EPA and Commonwealth Government guidance documents for social surroundings are summarised in Table 9-1.

Table 9-1: Policy and guidance relevant to the Social Surroundings Key Environmental Factor

Policy and Guidance	How guidance has been considered
WA Government	
Key EPA documents	
Statement of Environmental Principles, Factors, Objectives and Aims of EIA (EPA, 2023a)	This document was considered in the preparation of this Supplementary Report and to inform EIA. It was used identify the Key Environmental Factors likely to be impacted by the Proposal and the EPA's objective for each factor.
EIA (Part IV Divisions 1 and 2) Procedures Manual (EPA, 2024a)	This document has been considered in planning for the Part IV approval process and has been used to inform the preparation of this Supplementary Report.
EIA (Part IV Divisions 1 and 2) Administrative Procedures (EPA, 2024b)	This document has been considered in planning for the Part IV approval process and has been used to inform the preparation of this Supplementary Report.
Relevant EPA Factor Guidelines	
Environmental Factor Guideline – Social Surroundings (EPA, 2016e)	This document was considered in the preparation of this section (Section 9) of the Supplementary Report.
Relevant EPA Technical Guidance	
Guidance Statement 41 – Assessment of Aboriginal Heritage (EPA, 2004)	This document has been considered in the design and planning of the Proposal, it has also been considered in the preparation of mitigation measures for the Proposal.
Commonwealth Government	
Key Documents	
Generic guidelines for the content of a draft EPBC Act PER/EIS (including the objects and principles of the EPBC Act) (DotEE, 2016a)	Other Minister of the Environment (Cth) approval decision making considerations
EPBC Act Condition Setting Policy (DAWE, 2020)	This document was used as guidance for the EIA and the development of mitigation measures and likely regulation of the Proposal.
EPBC Act Outcomes-based conditions policy (DotE, 2016a)	This document was used as guidance for the EIA and the development of mitigation measures and likely regulation of the Proposal.
Relevant Technical Guidance	
Engage Early – Guidance for proponents on best practice Indigenous engagement	This document was used as guidance for assessment and management of physical and social impacts on Aboriginal Heritage.

Policy and Guidance	How guidance has been considered
for environmental assessments under the EPBC Act (DotE, 2016b)	

9.3 RECEIVING ENVIRONMENT

9.3.1 SENSITIVE RECEPTORS

The sensitive receptors identified for noise modelling are presented in Figure 9-1. The nearest potential sensitive premises, the Gateway Accommodation Village and South Hedland, to the Proposal were identified using the Town of Port Hedland TPS No 7 area map. Receivers at greater distances (>6 km) have not been included as if compliance is achieved at the closest location, it is assumed compliance at greater distances would also be achieved.

Figure 9-1: Noise sensitive receptors

9.3.2 Current Land Use

The Proposal is located within the Boodarie SIA in the ToPH, within the Kariyarra Native Title Determination. The Boodarie SIA comprises 4,000 ha of "Strategic Industry" zoned land. The Boodarie SIA is situated 4 km west of South Hedland townsite and approximately 12 km south of Port Hedland townsite in WA (Figure 2-2).

The Roebourne subregion of WA's Pilbara bioregion has a variety of land uses, including grazing, mining, conservation, and urban development.

9.3.3 Local Residents and Community

The Proposal is located entirely within a SIA with no perceived recreational or community uses. Recreational activities are limited within this area due to the zoning. Boodarie SIA has a buffer zone which is recognised as a Special Control Area (Figure 7-22). The Special Control Area prevents the establishment of any new sensitive receptors within this area and provides a buffer to ensure land use conflicts are avoided and amenity impacts are avoided or minimised.

Noise

PHI commissioned Herring Storer Acoustics (HSA; 2024; Appendix 8) to carry out an acoustic study of noise emissions for the Proposal. Key Proposal activities with the potential to emit noise include:

- Product handling;
- Reduction furnace area;
- Reformer facilities; and
- Utilities and water treatment

Environmental noise in WA is governed by the EP Act through the Environmental Protection (Noise) Regulations 1997 (the Regulations). The assigned levels (prescribed standards) for all premises are specified in regulation 8(3) and are shown in Table 9-2. The L_{A10} assigned level is applicable to noises present for more than 10% of a representative assessment period, generally applicable to "steady-state" noise sources. The L_{A1} is for short-term noise sources present for less than 10% and more than 1% of the time. The L_{Amax} assigned level is applicable for incidental noise sources, present for less than 1% of the time. The influencing factor is calculated for the usage of land within two circles, having radii of 100 m and 450 m from the premises of concern.

Table 9-2: Baseline assigned outdoor levels

Premises receiving noise	Time of the day	Assigned Level (dB)		
		L_{A10}	L_{A1}	L_{Amax}
Noise sensitive premises: highly sensitive area[1]	0700 to 1900 hours Monday to Saturday (Day)	45 + influencing factor	55 + influencing factor	65 + influencing factor
	0900 to 1900 hours Sunday and public holidays (Sunday)	40 + influencing factor	50 + influencing factor	65 + influencing factor
	1900 to 2200 hours all days (Evening)	40 + influencing factor	50 + influencing factor	55 + influencing factor

Premises receiving noise	Time of the day	Assigned Level (dB)		
		L_{A10}	L_{A1}	L_{Amax}
	2200 hours on any day to 0700 hours Monday to Saturday and 0900 hours Sunday and public holidays (Night)	35 + influencing factor	45 + influencing factor	55 + influencing factor
Noise sensitive premises: any area other than highly sensitive area	All hours	60	75	80
Commercial Premises	All hours	60	75	80
Industrial and Utility Premises	All hours	65	80	90

* Highly sensitive area means that area (if any) of noise sensitive premises comprising —
(a) a building, or a part of a building, on the premises that is used for a noise sensitive purpose; and
(b) any other part of the premises within 15 metres of that building or that part of the building.

The nearest potential highly noise sensitive premises, the Gateway Accommodation Village, South Hedland (Figure 9-1). The influencing factor at the closest identified highly Noise sensitive premises (R1), Industrial premises (I1 to I3) and Commercial premises (C1), has been assessed as 0 therefore the assigned noise levels would be as per those contained in Table 9-3.

It is assumed that the operational noise will not have a 'tonal' characteristic applicable, due to the distance and the noise approaching the existing background noise level, hence noise characteristics will be increasingly weak. At noise emission levels around 35 dB(A) it will generally be the case that the noise emission level is low enough that the influence of background noise will result in the noise emission not being 'technically tonal.

Where there is more than one industry that emits noise to a residence and the combined noise levels of all industries results in an exceedance to the assigned noise levels, each industry is required to be at least 5 dB less than these levels as documented below (Regulation 7(2)).

Baseline noise monitoring was undertaken to establish the existing ambient noise levels. An automatic noise data logger was located off Boodarie Drive, just north of the PDE. Additionally, short term observed noise level measurement were conducted during the site visit. The noise levels for each regulatory period are shown in Table 9-3.

Based on the measured noise levels within the Boodarie SIA, the daytime noise levels were around 54 dB(A), with the evening and night periods being an average of 41 dB(A). Given that the area is an Industrial Estate, this would be considered a low background noise level, with expectation being it would increase with further industrial development.

Table 9-3: Baseline monitored noise level dB(A)

Date	Time Period L_{Aeq} dB(A)		
	Day (07:00 to 19:00)	Evening (19:00 to 22:00)	Night (22:00 to 07:00)
5/9/2022	47	40	42
6/9/2022	55	42	42
7/9/2022	61	41	40
8/9/2022	55	43	43
9/9/2022	60	42	40
10/9/2022	43	42	39
11/9/2022	59	41	40
Average	54	41	41

9.3.4 European Heritage and Cultural Values

No European Heritage sites have been identified within the development envelopes. A search of WA databases (InHerit) identified that five European Heritage sites are located within 8 km of the Proposal (Table 9-4). The sites are located outside of the development envelopes, none of which are classified as a State Heritage Place.

Table 9-4: Registered European Heritage sites within 8 km of the Proposal

Place No.	Name	Approximate distance from development envelopes
18430	Port of Port Hedland	Immediately north of the EIDE
4002	Boodarrie Station Homestead	4 km west of the PDE
18422	Water Tank	7 km east of the EIDE
14642	South Hedland Fire Station	7 km east of the EIDE
18423	South Hedland Town Concept	8 km east of the EIDE

9.3.5 Aboriginal Heritage and Cultural Values

Native Title / Traditional Owners

The Proposal is located within the Kariyarra Native Title Determination Area (Figure 9-2). KAC and Kariyarra Traditional Owners are the relevant native title party to speak for this area, including Aboriginal heritage, Aboriginal sites and Kariyarra Social Surroundings (Aboriginal social and cultural heritage values). The Kariyarra People's native title claim (WAD 6169 of 1998) was lodged in 1998. The Determination Area covers about 17,354 m^2 of Kariyarra traditional country and encompasses the ToPH, the Aboriginal community of Yandeyarra, several pastoral leases and mining operations (YMAC, 2024).

All Kariyarra Country and waters are important to the Kariyarra People. Some areas of particular cultural, historical and environmental significance within the Determination Area include Yandeyarra Reserves, the Abydos homestead and Reserve (containing many ancient rock engravings), Mumbillina Bluff, Friendly Creek, Wamaranya, Marrapikurinya, Mt Dove, Kangan, Boodarie Station, Portree Pool, Mt Frisco and Munda Station. The Kariyarra claim area has many rivers, the largest being the Yule (Kakurrka Muri) and Turner (Kapankalanha) Rivers, which are major topographic features of the Determination Area and importantly, are home to the mythological water serpent – the Warlu (YMAC, 2024).

Aboriginal Heritage

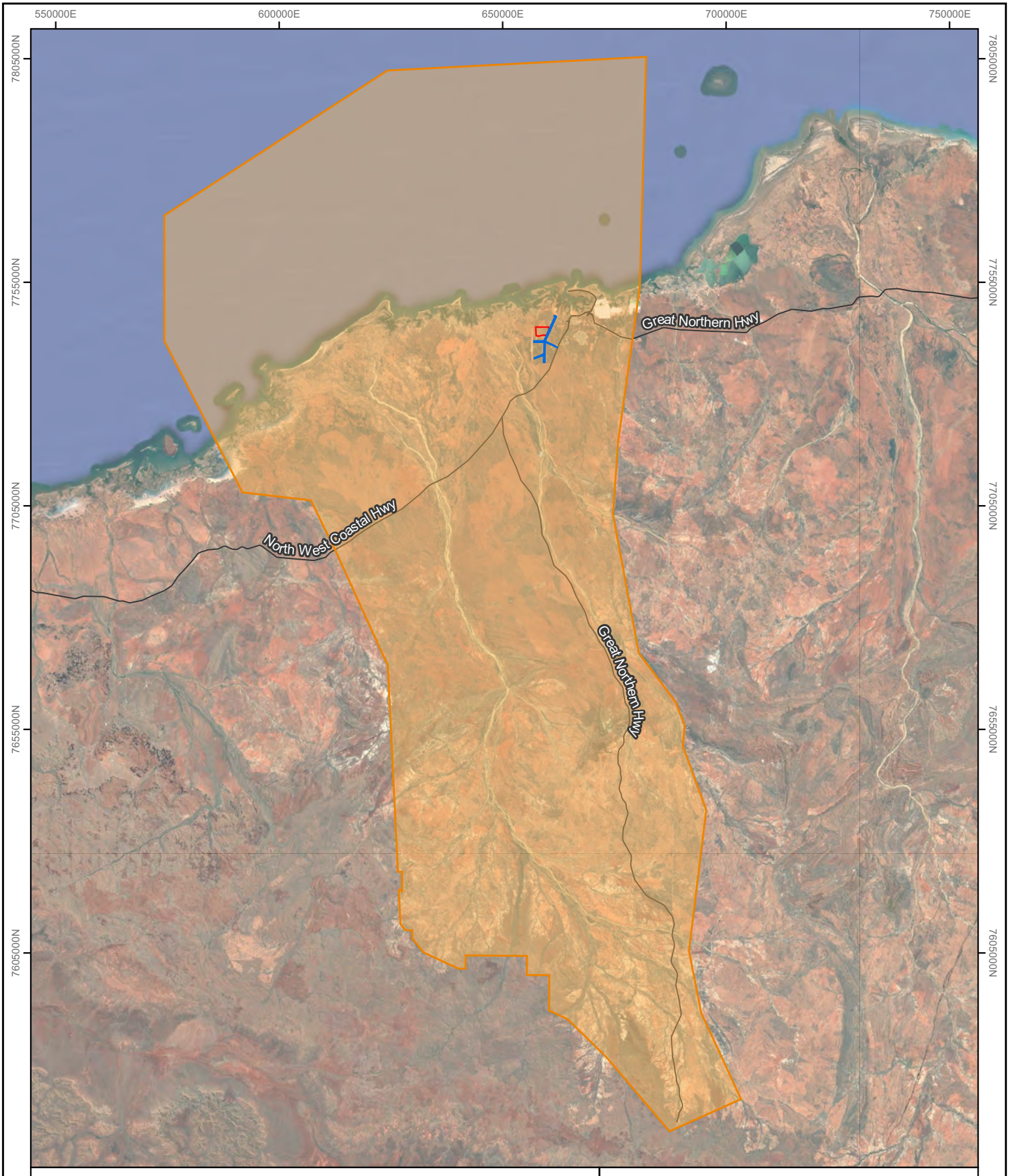
A search of the Aboriginal Cultural Heritage Inquiry System (ACHIS) was undertaken in November 2024 and did not identify any Registered Aboriginal sites within the PDE, but did identify four Registered Aboriginal sites within the EIDE (Figure 9-3), being:

- Midden (ID: 164);
- Artefacts / Scatter, Camp, Midden, Other (ID: 764);
- Artefacts / Scatter, Midden, Shell, Water Source (ID:17023); and
- Midden, Shell (ID: 25647).

An Aboriginal Site identification assessment was undertaken by RPS in 2012 across the Boodarie SIA. The survey identified three Aboriginal sites, all of which were artefact scatters. Two of these intersect the EIDE and were identified in the ACHIS search discussed above.

An archaeological heritage survey was completed PDE and did not identify any Aboriginal sites. Surveys within the EIDE have not be undertaken but are planned for Q1 2025 (Sticks and Stones Cultural Resources Management Pty Ltd (Sticks and Stones, 2024).

PHI plans to undertake dedicated Social Surroundings consultation with KAC and Kariyarra Traditional Owners in 2025. An increased focus on Social Surroundings has developed under the EP Act in WA in recent times that considers social and cultural values around traditional uses of the land and includes Aboriginal places, objects and social/cultural landscapes. Dedicated consultation is planned to be undertaken with KAC and Kariyarra Traditional Owners to understand potential impacts to Kariyarra Social Surroundings and Aboriginal cultural and social heritage values.



Legend

- Plant Development Envelope
- External Infrastructure Development Envelope
- Kariyarra Native Title Determination Area (LGATE-066)

Imagery: Google Satellite

PHGS_0406_027

Figure 9-2: Kariyarra Native Title Determination Area

Preston Consulting

0 20 40 km

N

GDA 2020 (MGA Zone 50)

1:1,100,000 (A4)

AS

25/11/2024

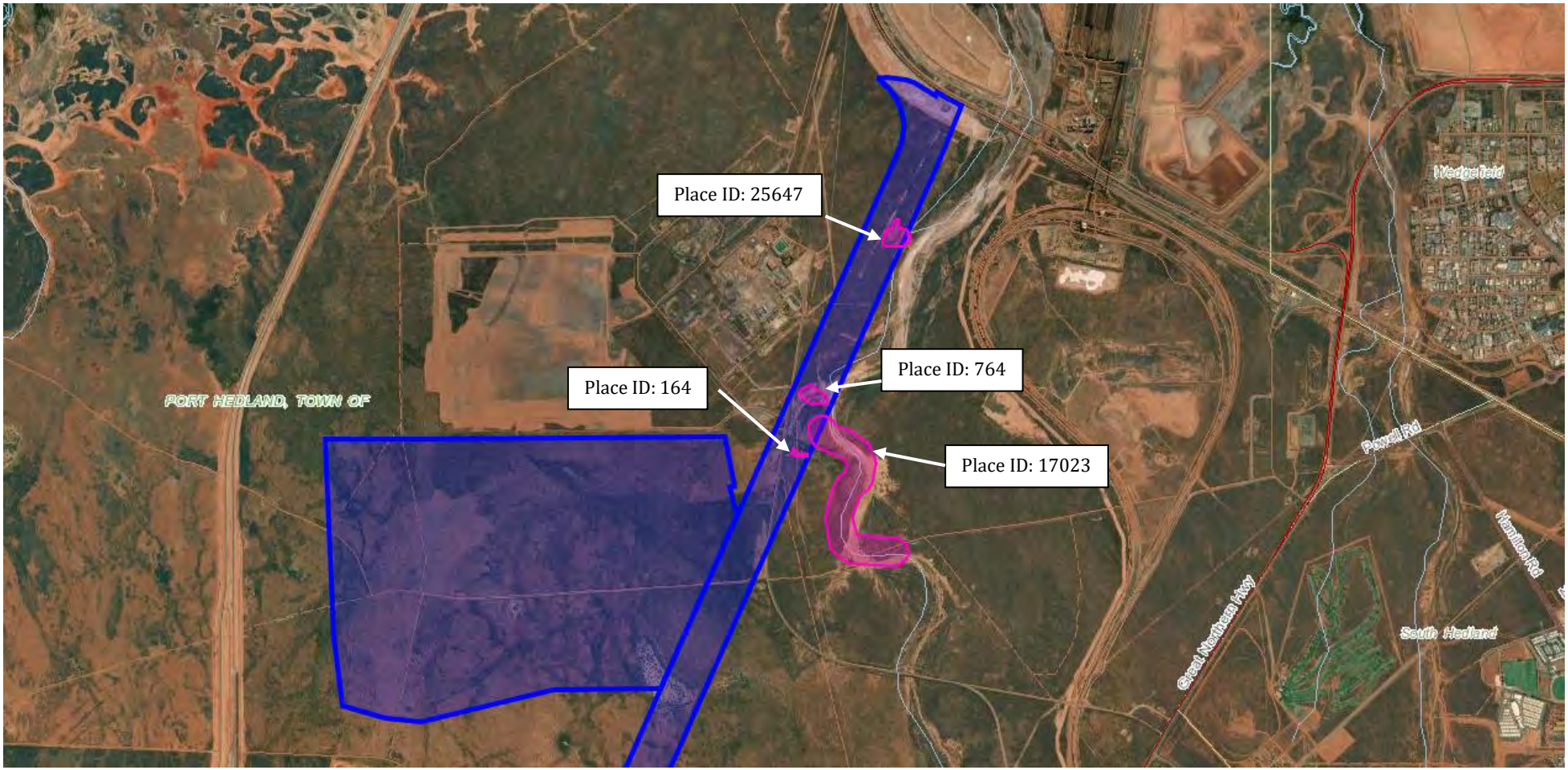


Figure 9-3: Aboriginal heritage sites recorded on the DPLH database within the development envelopes

9.3.6 Social Values

Based on the information provided above, the following social values were determined to require assessment for this factor:

- Local residents and community;
- Traditional uses of the land; and
- Aboriginal heritage sites.

9.4 Potential Impacts

The Proposal will have an unavoidable direct impact on 390 ha of land within an area that has been identified by the WA Government for industrial use. Thee development envelopes will largely become inaccessible to the public for safety reasons.

The Proposal may have indirect impacts associated with social aspects including access, traffic, visual impact, and dust emissions. The Proposal is not expected to emit any odours that would impact on local residents and the community.

Table 9-5 defines the potential impacts (direct, indirect and cumulative) on the social values for this factor in a local and regional context. These impacts are informed by the results of studies described in Sections 5 to 9. Assessment of the potential impacts is provided in the following sections.

Table 9-5: Potential impacts on social surroundings

Social value and current extent	Potential direct impact	Potential indirect impact	Impacts associated with other proposals	Total cumulative impact
Local Residents and Community	Access to the land will only be granted with appropriate safety measures.	Amenity impacts from visual, noise and dust emissions, traffic during construction or operation of the Proposal.	The Proposal occurs within the Boodarie SIA with land allocated to multiple proponents within the area. Impacts associated with other project are unknown at this stage however it is assumed that up to 80% of the SIA will eventually be developed/cleared.	• Restricted access to larger areas of BSIA. • Amenity impacts from noise and dust emissions, traffic during construction or operation of the Proposal. • Visual impacts from infrastructure and lighting at night.
Traditional Uses of the Land	Access to the land will only be granted with appropriate safety measures.	Amenity impacts from visual, noise and dust emissions, traffic during construction or operation of the Proposal.	The Proposal occurs within the Boodarie SIA with land allocated to multiple proponents within the area. Impacts associated with other project are unknown at this stage however it is assumed that up to 80% of the SIA will eventually be developed/cleared.	• Restricted access to larger areas of BSIA. • Amenity impacts from noise and dust emissions, traffic during construction or operation of the Proposal. • Visual impacts from infrastructure and lighting at night.
Aboriginal Heritage Sites	No sites are predicted to be directly	No registered Aboriginal Heritage	As above.	No direct or indirect impacts to previously

Social value and current extent	Potential direct impact	Potential indirect impact	Impacts associated with other proposals	Total cumulative impact
Four identified Aboriginal Heritage Sites are located within the EIDE.	impacted by the Proposal.	Sites are predicted to be affected by dust emissions from construction or operation of the Proposal.		recorded Aboriginal Heritage Sites.

9.5 Assessment of Impacts

9.5.1 Local Residents and Community

Access

Access within the Boodarie SIA has been considered through the structure planning process. Existing access through the Boodarie SIA has some constraints due to current development in and around the SIA including railways. A new access road will be constructed for the Proposal. This road will be a public road and will lead to the site, where access will be restricted for safety reasons. Whilst there will be localised restrictions on access due to the Proposal, the overall access into and through the Boodarie SIA compared to current access will not be impacted by the Proposal.

Noise

Noise emissions (noise received at a source) at the nearest neighbouring residential premises, due to noise associated with the proposed operations, were modelled using the computer programme SoundPlan. Sound power levels used for the noise modelling were based on manufacturer data levels of equipment proposed for use on site.

The sound power levels for individual equipment are shown in Table 4.1 of the Noise Modelling report (Appendix 8).

All equipment has been assumed to be operating at the same time under normal state operations. Due to the complexity of the plant, the individual noise sources are located in an open field situation, i.e. no barriers included for the structure of the plant. This would be highly conservative assessment of the noise emissions as the inclusion of the built form plant would attenuate a majority of the lower height noise sources.

A nighttime operating scenario was developed based on noise emissions from the equipment. This represents the worst-case scenario for operations. It is noted that as the plant would have some diversity in operations, therefore it is unlikely that all the equipment considered in the predictive noise model would be operating at the same time.

It is assumed that the operational noise will not have a 'tonal' characteristic applicable, due to the distance and the noise approaching the existing background noise level, hence noise characteristics will be increasingly weak. At noise emission levels around 35 dB(A) it will generally be the case that the noise emission level is low enough that the influence of background noise will result in the noise emission not being 'technically tonal', although that does not mean that some characteristics would not be audible. A summary of the noise level assessment is provided in Table 9-6 and illustrated in Figure 9-4.

For the most stringent time period (night) the assigned noise level is 35 dB(A) at the nearest highly noise sensitive receiver, The Gateway Accommodation Village. The highest predicted noise emissions for the nearest noise sensitive premise is 32 dB(A) for the same time period. This includes all noise sources associated with the Proposal. The operating scenarios consider all noise sources from the proposed facilities operating at the same time. The calculated noise levels have been assessed under the highest night-time propagation weather conditions. Therefore, the noise modelling is considered conservative, as it is unlikely that all noise sources would be operating at the same time under the worst-case propagation conditions and therefore the "significantly contributing" criteria would be met, allowing for future industry in the Industrial estate.

The acoustic assessment shows that in the worst case, that noise received at a premise is below the assigned noise level and therefore comply with the requirements of the Environmental Protection (Noise) Regulations 1997.

Table 9-6: Noise level Assessment

Receiver	Assessable Noise Level dB(A)	Applicable Times of Day	Applicable L_{A10} Assigned Noise Level (dB)	Exceedance to Assigned Noise Level L_{A01} (dB)
R1 – Gateway Village	32	Night (22:00 to 07:00)	35	Complies
C1 – Golf Course	37		60	Complies
Industry A	57		65	Complies
Industry B	60			Complies
Industry C	60			Complies

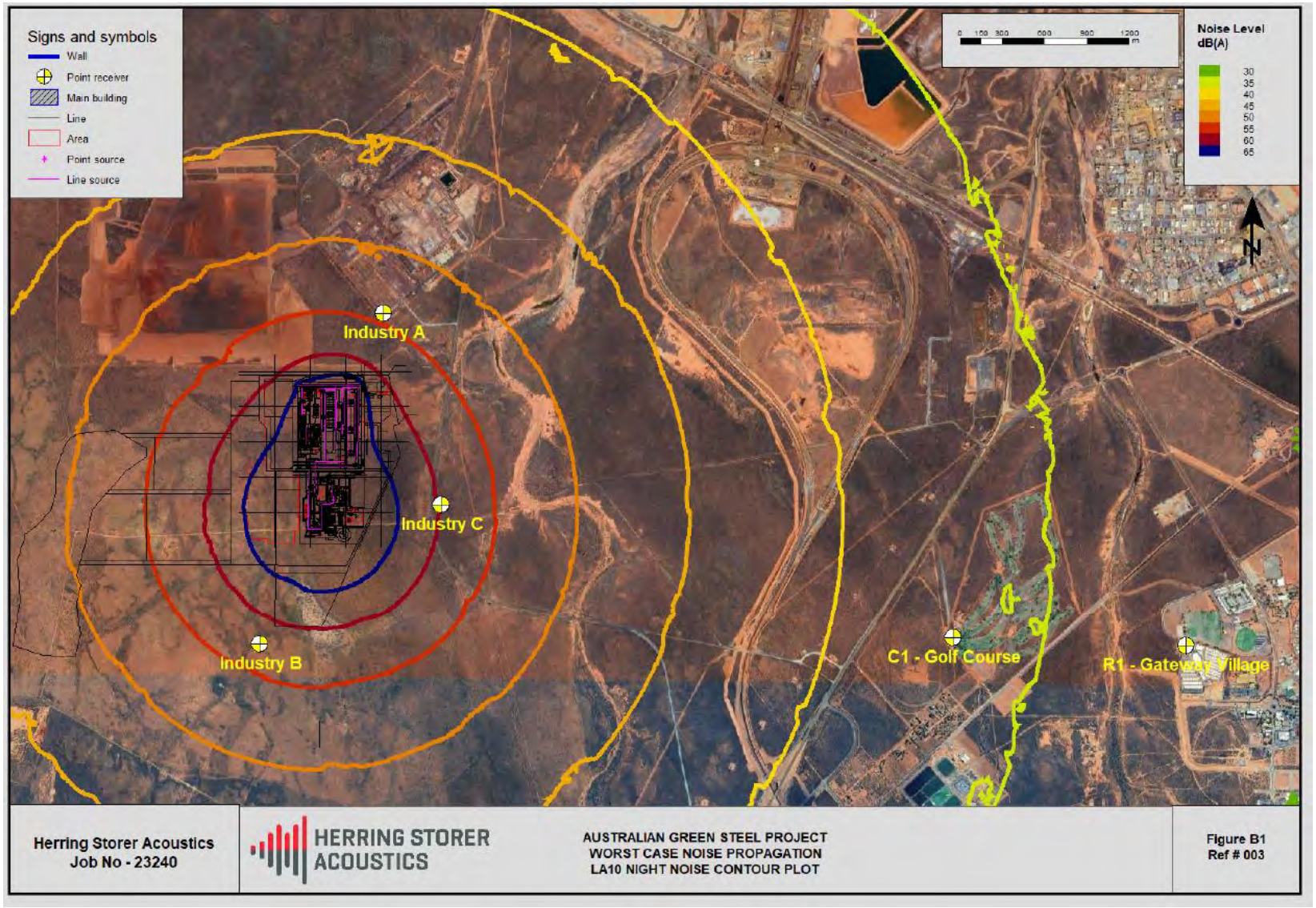


Figure 9-4: Predicted noise levels

Dust

Sensitive receptors have the potential to be impacted by dust and air quality emissions as a result of the Proposal. ETA (2024) completed a dust assessment for the Proposal which included an assessment of PM_{10}. Air quality impacts are discussed in Section 7.6. With the implementation of mitigation measures and controls described in Section 7.8. The Proposal is not expected to result in any significant impacts to sensitive receptors from dust emissions.

Lighting

Night works are proposed within the development envelopes and therefore there is the need for lighting to be installed, which could impact on the existing low light environment. PHI is committed to ensuring the Proposal light emissions are minimised as much as practicable while maintaining a safe work area.

Lighting design will be reviewed close to the commencement of the Proposal to ensure the design does not result in excessive light glow. However, all lighting for the Proposal will consider *Australian Standard 4282 – Control of the obtrusive effects of outdoor lighting* where applicable and practicable, with the *National Light Pollution Guidelines for Wildlife* also noting the need to consider this Australian Standard when managing light impacts on fauna (DCCEEW, 2023).

9.5.2 Traditional Uses of the Land

The Kariyarra People are represented by the Kariyarra Aboriginal Corporation – the prescribed Body Corporate for the Kariyarra People. Traditional uses of the land are understood to include hunting and gathering in the terrestrial and marine environments around the Proposal DEs.

The deep connection to the land, sea, skies, and all living things includes a spiritual, scared, and cultural connection which has been passed down through many generations and continues to be a source of identity, shaping beliefs, customs, and practices. The Proposal will potentially impact upon this connection.

Access to these environments close to the Port of Port Hedland and within the Boodarie SIA has already been impacted by the activities associated with the port, including rail, roads, stockpiles, wharves, conveyors and other infrastructure. The Proposal will result in restricted access to around 300 ha of land within the designated land allocation in the Boodarie SIA. New access roads to the site will provide all weather access to the plant site but will not result in any through-traffic to other terrestrial or marine environments to the east or west as access will continue to be constrained by existing rail lines.

9.5.3 Aboriginal Heritage

PHI plans to avoid all identified heritage places through the considered placement of development with the PDE. However, if additional surveys identify Heritage sites or Social Surroundings consultation identifies Aboriginal cultural heritage values that are unavoidable in the Plant DE, PHI will consult with the Kariyarra People.

Within the EIDE there are existing Aboriginal heritage sites. PHI will attempt to locate all infrastructure in the EIDE outside of Aboriginal heritage sites. However, final location of any infrastructure in the EIDE is subject to agreement with JTSI, who have ultimate say on where infrastructure is located within the EIDE. Therefore, it may not be possible to avoid disturbance of Aboriginal heritage sites.

9.6 MITIGATION

PHI has mitigated the potential impacts to this factor according to the mitigation hierarchy; avoid, minimise, rehabilitate. Offsets are not expected to be required for this factor. The proposed mitigation measures are technically and practically feasible.

9.6.1 AVOID

No Aboriginal heritage sites are located in the PDE. Within the EIDE, PHI intent is to work with JTSI to avoid Aboriginal heritage sites but acknowledge this may not be possible for all Aboriginal heritage sites.

As previously noted, the Proposal location has been chosen to be within a Special Control Area for the Boodarie SIA. The Boodarie SIA has an industrial buffer zone which is recognised as a Special Control Area under the Town of Port Hedland's Local Planning Scheme (Figure 7-22). The Special Control Area is intended to avoid land use conflicts and amenity impacts by preventing the establishment of incompatible land uses and sensitive receptors within proximity to the SIA.

9.6.2 MINIMISE

The following mitigation measures are proposed to ensure that direct and indirect impacts to social surroundings are minimised:

1. **Obtain and comply with Works Approval and Licence issued under Part V of the EP Act**. A Works Approval and Licence will be required for the Proposal, specifically for the pellet plant. The Works Approval and Licence is the primary mechanism for ensuring the design and operation of the Proposal is conducted in a manner that minimises impacts to social surroundings. The Works Approval and Licence will ensure that the following mitigation measures are implemented at a minimum:
    a. Routinely inspect the condition and performance of trommels, screens and dust suppressing systems, to ensure they are in acceptable condition and / or operating appropriately;
    b. The following controls will be implemented to minimise the risk of impact from dust emissions:
        i. Routine dust monitoring (dust deposition and opportunistic dust observations) will be conducted;
        ii. Dust suppressant systems (water cannons and sprayers) will be installed where required to minimise dust generation;
        iii. Investigations will be conducted into the cause of any excessive dust emissions;
2. **Obtain and comply with a Development Approval issued under the Planning and Development Act 2005 (WA)**. Construction of the Proposal is unlikely to result in

significant noise emissions and changes to traffic movements. The development approval application will assess the significance of noise emissions on surrounding land uses and determine what mitigation measures are required to obtain consent to undertake development of the Proposal. Road design and traffic management will be prepared in consultation with MRWA and ToPH. The ToPH Structure Plan for the Boodarie SIA includes a buffer zone to prevent impacts on surrounding land uses from industrial activity in the Boodarie SIA.

3. **Investigate and install screening if deemed necessary** where the visual impact is the greatest (subject to the ToPH);
4. **Minimise noise and light emissions.** At the detailed design stage, each significant noise and light source will be assessed in terms of its purpose, location and intensity in order to minimise noise emissions and light spill;
5. **Implement industry best-practice management measures for Aboriginal Heritage**:
    a. Further Aboriginal Heritage surveys to be completed across the EIDE define the heritage values;
    b. Corridor infrastructure design to avoid and minimise impacts to Aboriginal heritage sites;
    c. Clearing will be managed through internal ground disturbance procedures;
    d. Boundaries of areas to be cleared or disturbed will be identified by GPS coordinates and maps of boundaries will be provided to dozer operators;
    e. Progressive disturbance will be undertaken;
    f. The disturbance footprint will be developed to the minimum required to ensure safe and adequate construction and operation;
6. **If required, obtain and comply with approvals under the AH Act for any Aboriginal Heritage sites that are to be disturbed; and**
7. **If required, ensure Aboriginal 'cultural salvage areas' are appropriately managed (in agreement with KAC) to salvage and store or repatriate artefacts prior to disturbance.**

9.6.3 REHABILITATE

The key rehabilitation measures that relate to social surroundings are summarised below:

1. All infrastructure will be removed; and
2. The development envelopes will be revegetated with local native species.

The Proposal is required to sign a Lease with the State Government under the LAA. PHI expects that the terms and conditions of the lease will require decommissioning and rehabilitation of the Proposal at the end of its operational life, which will ensure rehabilitation measures are implemented.

9.7 PREDICTED OUTCOME

The EPA's environmental objective for this factor is to "protect social surroundings from significant harm" (EPA, 2016e).

The Proposal has incorporated avoidance, minimisation and rehabilitation measures into the Proposal design and operational processes to ensure that social surroundings impacts are minimised.

The Proposal is expected to result in minor impacts to Traditional Uses of the Land and Local Residents and Community given the small footprint, lack of direct uses of the land and the location of the Proposal in an SIA.

There are no listed European Heritage values which occur within the development envelopes and therefore impacts to European Heritage and values will be completely avoided.

PHI has completed Aboriginal Heritage investigations over the majority of the PDE. PHI intends to complete additional heritage surveys within the remainder of the PDE and within the EIDE in Q1 2025 and these will be used to further inform the detailed design. PHI will avoid all four registered heritage sites identified on the ACHIS within the EIDE.

The predicted outcomes for Social Surroundings are therefore:

- No disturbance to identified Aboriginal Heritage sites unless otherwise agreed to with KAC;
- All disturbance to be undertaken in accordance with the ACHMP;
- No change in the existing concentration and excursions of existing air quality;
- No significant amenity impacts at sensitive receptors unless otherwise agreed through an Amenity Agreement; and
- Compliance with the EP Act Noise Regulations.

Based on the above, PHI considers that the Proposal can be implemented such that there are no significant residual impacts to this factor, and the EPA objective can be met.

10 OFFSETS

Environmental offsets are actions that provide environmental benefits which counterbalance the significant residual impacts of a proposal. The EPA may apply environmental offsets where it determines that the residual impacts of a proposal are significant, after avoidance, minimisation and rehabilitation have been pursued. Consistent with the WA Environmental Offsets Guidelines (EPA, 2014a), the EPA will consider whether offsets can counterbalance, and are appropriate for, the Proposal's residual impacts.

Offsets are the last of the four steps in the mitigation hierarchy (Avoid, Minimise, Rehabilitate and Offset). They are only applied to counterbalance significant residual impacts when the other steps have already been applied to a Proposal.

PHI has commissioned numerous environmental surveys and studies for the Proposal. The surveys determined that there were key environmental values that required protection including terrestrial fauna habitat, flora and vegetation.

10.1 SUMMARY OF SIGNIFICANT RESIDUAL IMPACTS

The WA Environmental Offsets Guidelines (EPA, 2014a) states:

> *"In general, significant residual impacts include those that affect rare and endangered plants and animals (such as declared rare flora and threatened species that are protected by statute), areas within the formal conservation reserve system, important environmental systems and species that are protected under international agreements (such as Ramsar listed wetlands) and areas that are already defined as being critically impacted in a cumulative context. Impacts may also be significant if, for example, they could cause plants or animals to become rare or endangered, or they affect vegetation which provides important ecological functions".*

The assessments conducted in Sections 5 – 9 have utilised the findings of the numerous surveys and studies completed for the Proposal. PHI has assessed the residual impacts of the Proposal against the residual impact significance model provided in the WA Environmental Offsets Guidelines (EPA, 2014a). As described in the preceding sections of this Supplementary Document, the Proposal's predicted significant residual impacts on the environmental values are summarised in Table 10-1.

The planning phase will include a critical consideration of the location of environmental values with the intent to reduce the extent of the significant residual impacts further.

Table 10-1: Summary of significant residual impacts – Part IV EP Act Environmental Values

Environmental value	Other associated values	Residual Impacts
'Good' to 'Excellent' condition native vegetation	• *Tephrosia rosea* var. Port Hedland (A.S. George 1114); • Other significant flora which may be present; • Bilby habitat; • Grey Falcon foraging habitat; • Northern Quoll foraging/dispersal habitat; • Brush-tailed Mulgara; • Black Flacon; and • General fauna habitat.	Clearing of up to 387.1 ha of Good to Excellent condition native vegetation, which also provides habitat for native fauna.

PHI has assessed the residual impacts of the Proposal against the residual impact significance model provided in the WA Environmental Offsets Guidelines (EPA, 2014a). The findings of this assessment are provided in Table 10-2.

Table 10-2: Assessment against residual impact significance model

Relevant Part IV Environmental Factors	Vegetation and Flora			Terrestrial Fauna			
Part V Clearing Principles	**c –** Rare flora	**d –** TECs	**e –** Remnant vegetation	**f –** Wetlands and waterways	**h –** Conservation areas	**a –** High biological diversity	**b –** Habitat for fauna
Residual impact that is environmentally unacceptable and cannot be offset	No residual impacts are considered to meet this criteria.						
Significant residual impacts that will require an offset – *all significant residual impacts to species and ecosystems are protected by statute or where the cumulative impact is already at a critical level*	No residual impacts are considered to meet this criteria - up to two *Tephrosia rosea* var. Port Hedland (A.S. George 1114) records may be impacted as a result of the Proposal. This species has been recorded from 25 locations from Karratha to north of Nullagine. There were four additional records identified outside of the Survey Area which will not be impacted. Disturbance of two records is unlikely to result in a significant impact to this species.	No residual impacts are considered to meet this criteria – no TECs were recorded in the development envelopes.	Disturbance of up to 387.1 ha of native vegetation in Very Good to Excellent condition vegetation in the Pilbara bioregion is considered to meet this criteria. Both vegetation associations have over 97% of their pre-European extents remaining (586 and 647) even after the 387.1 ha of clearing associated with the Proposal.	No residual impacts are considered to meet this criteria as no wetlands or waterways that are protected by statute lie within the development envelopes or would be indirectly impacted by the Proposal.	No residual impacts are considered to meet this criteria as no conservation areas that are protected by statute lie within the development envelopes or are expected to be indirectly impacted by the Proposal.	No residual impacts are considered to meet this criteria.	Residual impacts to the following habitat is likely to meet this criteria: • 378.1 ha of sandplain habitat (26.8% of local extent) critical to Bilby populations; • 386.1 ha of open woodlands, sandplain and drainage area habitat (a combined 26.1% of local extent) which provides foraging habitat for the Grey and Black Falcon; • 1.6 ha of drainage area habitat (18% of local extent) which provides potential foraging/ dispersal habitat to the Northern Quoll; and • 378.1 ha of sandplain habitat (26.8% of local extent) which provides potential breeding and foraging habitat for the Brush-tailed Mulgara.
Significant residual impacts that may require an offset – *any significant residual impacts to potentially threatened species and ecosystems, areas of high environmental value or where the cumulative impact may reach critical levels if not managed*	Indirect impacts resulting from surface water and dust will managed to ensure that there are no impacts to rare flora.	No impacts are considered to meet this criterion – all impacts are discussed above.	Indirect impacts resulting from surface water and dust need to be managed appropriately to ensure that there are no impacts to remaining vegetation.	Indirect impacts resulting from surface water need to be managed appropriately to ensure that there are no impacts to South West Creek. Normal mitigation controls will need to be implemented throughout the Proposal to ensure flood levels are not a risk to the surrounding environment.	No residual impacts are considered to meet this criteria as the nearest conservation reserve is approximately 80 km from the Proposal.	No residual impacts are considered to meet this criteria. No vegetation types were specifically noted as having a high biological diversity.	Some indirect impacts have the potential to result in significant impacts to terrestrial fauna if not managed appropriately. These relate to the potential avoidance of breeding, foraging or dispersal habitat for fauna as a result of noise or light emissions.
Residual impacts that are not significant	There are five Priority Flora species that will not be disturbed by the Proposal. Habitat for these species (and others) may be disturbed however habitat will be retained outside the development envelopes.	No impacts are considered to meet this criterion – all impacts are discussed above.	No impacts are considered to meet this criterion – all impacts are discussed above.	Potential impacts to small waterways are unlikely to be considered significant as they are well represented throughout the region.	No residual impacts are considered to meet this criterion – all impacts are discussed above	Impacts to vegetation will occur, however the vegetation is not specifically noted to be of outstanding biodiversity value.	The disturbance of 45.1 ha of previously cleared/ disturbed fauna habitat is unlikely to be considered significant. Indirect impacts that are unlikely to result in significant residual impacts include: • Increased predation or competition from introduced fauna • Alterations to other fauna behaviour (including feeding or breeding characteristics) as a result of elevated light or noise emissions • Reduction in habitat health as a result of: o Alterations to fire regimes; o Dust; o Establishment or spread of weed species / populations; and o Hydrocarbon spills.

10.2 DETAILS OF PROPOSED OFFSET

PHI is proposing to counterbalance the significant residual impacts of the Proposal via contributions to the Pilbara Environmental Offsets Fund (PEOF). In the past, it has been difficult for companies to access land and implement their on-ground offsets because of complexities of working on Crown land with overlapping leases (DWER, 2019a). The PEOF aims to deliver environmental offsets in the Pilbara through a strategic landscape-scale approach, building on regional programs including ranger groups, so that environmental offset outcomes are greater than the sum of individual offset contributions. The fund was established following strategic advice from the EPA in 2014 regarding the cumulative impacts of development in the Pilbara region and a strategic coordinated approach to environmental offsets (EPA, 2014).

The PEOF will be supported by a monitoring and evaluation program involving a Program Stream that will aim to measure the general improvement of ecological conditions across the Pilbara resulting from the Fund, and a Strategy Stream, that will more specifically address the effectiveness of ecological management interventions. The PEOF allows multiple offset payments to be combined for larger conservation projects or to expand successful regional initiative, enabling landscape-scale projects with widespread environmental benefits (DWER, n.d.).

Within the EIA process in the Pilbara, the offset requirement is translated into a monetary cost, with companies obliged to pay a specified rate per hectare for the habitat they cannot avoid clearing or rehabilitate. The Ministerial Statement will document the per-hectare rate that Proposal proponent must contribute. The Proposal is located in the Roebourne sub-region and as of the 2023/2024 financial year, the rates in the Roebourne sub-region stand at $986/ha for clearing vegetation of good to excellent quality and $1,972/ha for clearing of significant fauna habitat or significant vegetation. These rates are annually adjusted for inflation based on Perth's Consumer Price Index (CPI). Given the presence of the Bilby it is expected that all clearing will be subject to the $1,972/ha rate.

The Proposal encompasses the clearing of up to 387.1 ha of native vegetation in total. Consequently, an estimated budget of $763,361 will likely be necessary for offset payments for the Proposal, with payments being made as the clearing activities are completed and not prior to approval being granted.

Table 10-3: Summary of proposed offset

Objective & intended outcome	Offset actions	Details	Success criteria	Risks and contingency measures	Governance / Responsibilities	Timing	Monitoring	Reporting
To counterbalance the significant residual impacts to up to 387.1 ha of Good to Excellent condition native vegetation.	Protect and maintain existing 'Good' to 'Excellent' condition native vegetation within a defined offset area.	PHI proposes to contribute $763,361 to the PEOF based on the 2023/2024 financial year rate for disturbance of significant fauna habitat or significant vegetation.	Delivery of the fund is consistent with the fund's governance framework (DWER, 2019a). Delivery of the fund builds on successful programs already underway, and with regional stakeholders including ranger groups (DWER, 2019a).	Weeds: • Targeted control of high impact weed species that may be present or may become established; and • Weed hygiene controls during site management and firebreak and fencing maintenance. Grazing and feral animals: • Monitor current use; and • Targeted control of high impact feral animal species if required. Unauthorised access (rubbish dumping: • Installation of fences where appropriate around the vegetation.	PHI: • Overall accountability for implementing the IRP; • Timely payments to the PEOF; • Provision of MNES offset funding to PEOF; and • Preparation of annual reports and compliance reports. PEOF Project Recommendation Group and Implementation Advisory Group: • Implementation of appropriate offset programs.	Payments to be made as the clearing activities are completed and not prior to approval being granted.	PEOF contributions will be monitored by payments made based on evidence of actual clearing starting from the date of commencement of the action and then for each subsequent 24-month period. PHI will submit to DWER evidence of each payment made within 10 business days of the date of payment.	PHI will report against agreed activities and outputs from their Proposal plan every six months, as well as submit an annual progress report to the department via a public online portal (DWER,2019a).

10.3 ASSESSMENT OF PROPOSED OFFSETS – EP ACT

10.3.1 ASSESSMENT AGAINST ENVIRONMENTAL OFFSETS PRINCIPLES

In WA, Government decision making processes in relation to the use of environmental offsets are underpinned by six principles. These are set out in the Environmental Offsets Policy (EPA, 2011). The Proposal and proposed offsets have been assessed against each of these principles, provided in Table 10-4.

Table 10-4: Assessment of the proposed offset against the six offset principles

No.	Principle	Assessment outcome
1	Environmental offsets will only be considered after avoidance and mitigation options have been pursued.	PHI has applied the mitigation hierarchy by identifying measures to avoid, minimise and rehabilitate. PHI's main action to meet this policy's requirements was to implement industry best practice management measures for flora and vegetation and terrestrial fauna. Furthermore, PHI will remove all infrastructure at the end of the Proposal's life and revegetate the area with local native species. Contributions to the PEOF will be made by PHI to offset remaining disturbances.
2	Environmental offsets are not appropriate for all projects.	It is acknowledged that offsets are not appropriate for all projects. As the Proposal will result in significant residual impacts due to impact on a threatened / protected fauna species, an offset is considered to be appropriate. None of the impacts are considered to be so significant that they cannot be offset. Noting that Proposal is located within an SIA that has been set aside by the State Government for development.
3	Environmental offsets will be cost-effective, as well as relevant and proportionate to the significance of the environmental value being impacted.	The proposed offset aligns with the rate requirements of the Roebourne sub-region ($1,972/ha for clearing of significant fauna habitat or significant vegetation). The total amount paid the PEOF corresponds to the number of hectares the Proposal intends to clear and is adjusted annually in accordance with the Consumer Price Index.
4	Environmental offsets will be based on sound environmental information and knowledge.	The proposed offset has been decided based on environmental surveys conducted within the area and is additional to the removal of infrastructure and revegetation planned at the end of the Proposal's life. Delivery of offsets under PEOF require ongoing engagement through an Implementation Advisory Group. The Implementation Advisory Group includes representatives from industry, Traditional Owners, State Government agencies, natural resource management groups and the WA Biodiversity Science Institute to ensure offsets are delivered using contemporary and sound environmental knowledge.
5	Environmental offsets will be applied within a framework of adaptive management.	The PEOF has been designed to be adaptive, payments will be monitored based on the evidence of actual clearing. PHI will submit to DWER evidence of each payment made within 10 business days of the date of payment. The structure of the PEOF, including establishment of an Implementation Advisory Group, is intended to ensure PEOF operates under an adaptive management approach.
6	Environmental offsets will be focused on longer term strategic outcomes.	The PEOF has been specifically established to provide environmental offsets in a long-term and strategic manner.

10.3.2 MONITORING

Routine monitoring is necessary to ensure the proposed offsets are effective in counterbalancing the significant residual impacts on the environmental values.

Contributions to PEOF will be monitored by payments made based on evidence of actual clearing starting from the date of commencement of the action and then for each subsequent 24-month period. PHI will submit to DWER evidence of each payment made within 10 business days of the date of payment.

The PEOF has an Implementation Plan which describes how the fund will be delivered over the next five years (DWER, 2019a). Monitoring, evaluation and reporting of project outputs and outcomes will be included in the delivery of all projects related to the PEOF.

10.3.3 FUNDING ARRANGEMENTS

Funding arrangements for the PEOF are expected to be established in the approval conditions in the Ministerial Statement.

10.3.4 MANAGEMENT, ROLES AND RESPONSIBILITIES

The overall accountability for implementing the offset IRP, and reporting on the implementation of the offsets IRP, rests with PHI. PHI will be responsible for the provision of offset funding to PEOF and the preparation of annual reports and compliance reports.

The PEOF will be adaptively managed to plan, implement, monitor, evaluate and adjust delivery over time. DWER and the DBCA, with advice from the Implementation Advisory Group, will define the desired outcomes for each environmental matter for the longer term and each funding round.

The PEOF Project Recommendation Group and Implementation Advisory Group would be responsible for the implementation of appropriate offset programs.

11 HOLISTIC IMPACT ASSESSMENT

For each relevant Key Environmental Factor, the Supplementary Report provides a detailed assessment of the potential impacts associated with the Proposal, application of the mitigation hierarchy and the management strategies proposed. The Key Environmental Factors relevant to the Proposal include:

- Flora and Vegetation;
- Terrestrial Fauna;
- Social Surroundings;
- GHG Emissions; and
- Air Quality

Each relevant Key Environmental Factor has been assessed separately in Sections 5 –9. Linkages of varying strengths exist between the relevant Key Environmental Factors. The potential impacts of the Proposal have been considered in a holistic context and a conceptual model demonstrating links between key environmental factors is provided in Figure 11-1. A linkage is considered to be present if any two Key Environmental Factors share the same impact. The strength of the links is based on the significance of the impact and the interconnectivity of each Key Environmental Factor with another. Linkages are represented by lines, strong linkages are shown as solid black lines and weaker linkages are represented by grey dotted lines.

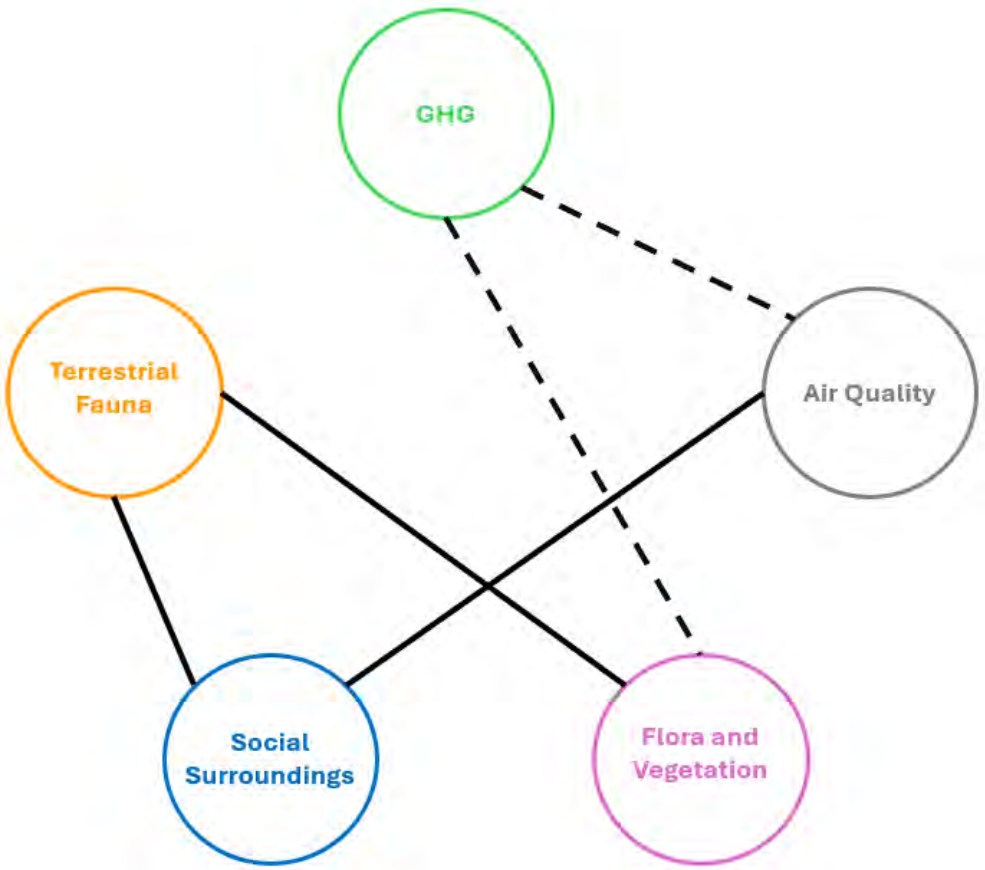


Figure 11-1: Conceptual model of linkages between Key Environmental Factors

Potential overarching impacts relevant to each Key Environmental Factor have been summarised in Table 11-1. While many potential impacts are shared between multiple factors, key impacts (those which have been identified as creating a strong linkage) have been identified with red ticks.

Table 11-1: Potential impacts shared by Key Environmental Factors

Key Environmental Factor	Relevant Potential Impacts				
	Clearing	Dieback/ Weeds	Dust Emissions	Air Emissions	Noise
Flora & Vegetation	✓	✓			
Terrestrial Fauna	✓	✓			✓
Social Surroundings	✓	✓	✓	✓	✓
Greenhouse Gas Emissions	✓			✓	
Air Quality			✓	✓	

The potential impacts from the Proposal with the largest scope for adverse effects to multiple factors appear to be those related to clearing.

Clearing will affect all factors except for Air Quality. PHI has recognised this potential and focussed heavily on improving its detailed design to ensure the smallest possible footprint. Any areas that are cleared for construction that are not required for operations will be progressively rehabilitated.

PHI acknowledges that other impacts of the Proposal (weeds, air emissions and noise) provide linkages between the other Key Environmental Factors however these impacts are likely to be able to be mitigated such that they are no longer significant for either factor and therefore linkages are not considered to be as strong as the others mentioned above. All linkages have been considered in the design of the Proposal, the application of the mitigation hierarchy and the development of proposed management measures.

11.1 Key Holistic Impacts

11.1.1 Clearing of Native Vegetation

Clearing of native vegetation is identified as a key impact as it will impact four Key Environmental Factors. Clearing will most significantly impact the Flora and Vegetation and Terrestrial Fauna Key Environmental Factors by removing or disturbing significant flora species and reducing the quality and availability of significant flora and fauna habitat. Clearing of native vegetation also has the potential to impact Social Surroundings and Greenhouse Gas Emissions. The details of these interactions have been provided in Table 11-2.

Table 11-2: Clearing of native vegetation and interaction with Key Environmental Factors

Key Environmental Factor	Potential Impacts
Flora and Vegetation	• Reduce the extent of flora and vegetation; • Increase fragmentation between remnant patches; and • Potential to introduce and spread weeds.
Terrestrial Fauna	• Reduce the amount of available fauna habitat; • Increase fragmentation between available habitats; and • Reduce the quality of habitats.
Social Surroundings	• Potential to remove land that may have cultural significance.
Greenhouse Gas	• Release of stored carbon dioxide into the atmosphere and reduced ability to store atmospheric carbon.

The clearing of native vegetation is considered significant across both the Flora and Vegetation and Terrestrial Fauna factors.

Clearing of native vegetation has been limited to 390 ha. This limitation on clearing will also limit the impacts to the other environmental factors. The implementation of mitigation measures outlined in Section 5.6 will also minimise impacts identified to the other factors in Table 11-2 as a result of clearing native vegetation.

The Proposal occurs within the range of the Bilby, Grey Falcon, Northern Quoll, Brush-tailed Mulgara, the Black Falcon and one significant Priority 1 flora species that was identified within the Survey Area. The Proposal has unavoidable impacts associated with vegetation clearing and habitat loss, therefore it was imperative that these impacts were avoided and minimised as far as practicable, and best practice rehabilitation methods will be implemented.

12 CUMULATIVE IMPACT ASSESSMENT

In preparation of the EIA, PHI has included a cumulative impact assessment to assess the Proposal's contribution to impacts on relevant environmental values. The activities, boundaries and values relevant for the cumulative impact assessment in relation to each relevant Key Environmental factor are summarised below:

PHI has completed a high-level review of the past, present, and reasonably foreseeable future activities in proximity to the Proposal.

The cumulative impacts must be considered in the context of the Proposal being located within a SIA. SIAs are set aside for industrial development in a sustainable manner with allowance for shared infrastructure corridors and a buffer zone to ensure development does not encroach on the industrial development. The SIA system is designed to avoid higher levels of cumulative impacts associated with multiple stand-alone industrial developments across a wider area. The Boodarie SIA Structure Plan states that industry clustering is a critical element to allow for the development of synergies within the Boodarie SIA and the surrounding region.

12.1 FLORA AND VEGETATION

Cumulative impacts have been identified in relation to Flora and Vegetation in Section 5. The Pilbara is one of Australia's development hotspots, of substantial economic importance to both WA and Australia (Government of WA, 2014). The region produced more than 27% of Australia's and 80% of the State's revenue from minerals and petroleum in 2012. Mining and infrastructure development has been rapid over the past decade, and the pace of development is forecast to continue. The EPA has provided strategic advice about the cumulative impacts in the Pilbara due to this increased development (EPA, 2014). Given the biodiversity values, economic importance, and rate of development in the region it is important that cumulative impacts are assessed to ensure the important values of the region are protected.

Section 5 assessed the predicted cumulative impacts to regional vegetation associations, which can be used at a high level to assess cumulative impacts to vegetation. When assessing the disturbance associated with the Proposal at a regional scale, disturbance will occur within vegetation association '589: Short bunch-grass savanna/ grass-steppe' and '647: Shrub-steppe'.

The current extent of vegetation association '589: Short bunch-grass savanna/ grass-steppe' at a State-wide, IBRA region and IBRA subregion level is outlined in Table 12-1. Up to 367.4 ha of this vegetation association intersects the disturbance footprint. EPA significant proposals not considered in the current extent of vegetation association 586 (Figure 12-1) (disturbance may not have been accounted for as clearing had not occurred when data was updated in 2020) include:

- 1,800 ha associated with the Sino Iron Mine Continuation;
- 800 ha of disturbance associated with the Balla Balla Magnetite Project;
- 576 ha of disturbance associated with the Ridley Magnetite Project;
- 469 ha of disturbance associated with the Algae Farm Processing Facilities, Karratha; and
- 200 ha of disturbance associated with the Port Hedland Solar Project;

The current extent of vegetation association '644: Shrub-steppe' at a State-wide, IBRA region and IBRA subregion level is outlined in Table 12-1. More than 97% of this vegetation association remains compared to pre-European settlement.

Up to 20.6 ha of this vegetation association intersects the disturbance footprint. Projects in the vicinity of the Proposal which also intersect vegetation association 142 are shown in Figure 12-1. EPA significant proposals not considered in the current extent of vegetation association 647 (disturbance may not have been accounted for as clearing had not occurred when data was updated in 2020) include:

- 160 ha of disturbance associated with the Balla Balla Rail and Conveyor Project; and
- 3,000 ha of disturbance associated with the Ridley Magnetite Project.

Table 12-1: Extent of vegetation association 589 and 647

Vegetation Association	Pre-European (ha)	Current extent (ha) (% of Pre-European)	Current extent after Proposal (ha) (% of Pre-European)	Current extent after Proposal and other Projects(ha) (% of Pre-European)
Statewide				
589	807,698.6	802,713.4 (99.4%)	802,346.0 (99.3%)	798,501.0 (98.9%)
647	195,860.9	191,711.4 (97.9%)	191,690.8 (97.9%)	188,230.8 (96.1%)
IBRA Region – Pilbara				
589	728,768.2	724,695.8 (99.4%)	724,328.4 (99.4%)	720,483.4 (98.9%)
647	195,860.0	191,710.9 (97.9%)	191,690.3 (97.9%)	188,530.3 (96.3%)
IBRA Subregion – Roebourne				
589	675,391.8	671,327.5 (99.4%)	670,960.1 (99.3%)	667,115.1 (98.8%)
647	188,901.3	184,774.7 (97.8%)	184,754.1 (97.8%)	181,594.1 (96.1%)

As described above, all vegetation associations will have over 96% of their pre-European extent remaining even after the implementation of future other Projects.

PHI also assessed the impacts of the Proposal against existing cumulative loss of native vegetation (Figure 12-2). PHI determined that the cumulative native vegetation clearing across the Proposal is estimated to be 387.1 ha, representing:

- 0.8% of the remaining vegetation extent within 10 km of the Proposal;
- 0.07% of the remaining vegetation extent within 50 km of the Proposal; and
- 0.02% of the remaining vegetation extent within 100 km of the Proposal.

Cumulative impacts from proposed Projects in the surrounding area is shown in Figure 12-2. There are a number of EPA Significant Proposed Projects within 100 km of the Proposal which are currently under assessment or have been approved for clearing. These Projects were not cleared when the native vegetation extent was last calculated in 2020 and include:

- Up to 5,830 ha of clearing associated with the Hemi Gold Project;
- Up to 7,406 ha of clearing associated with the Ridley Magnetite Project;
- Up to 58.4 ha of clearing associated with the Lumsden Point General Cargo Facility;

- Up to 603 ha of clearing associated with the Telfer-Havieron Gold Mining Project (significant amendment);
- Up to 1,500 ha of clearing associated with the Balla Balla Magnetite Project; and
- Up to 3,000 ha associated with the Balla Balla Infrastructure Rail and Convery Project.

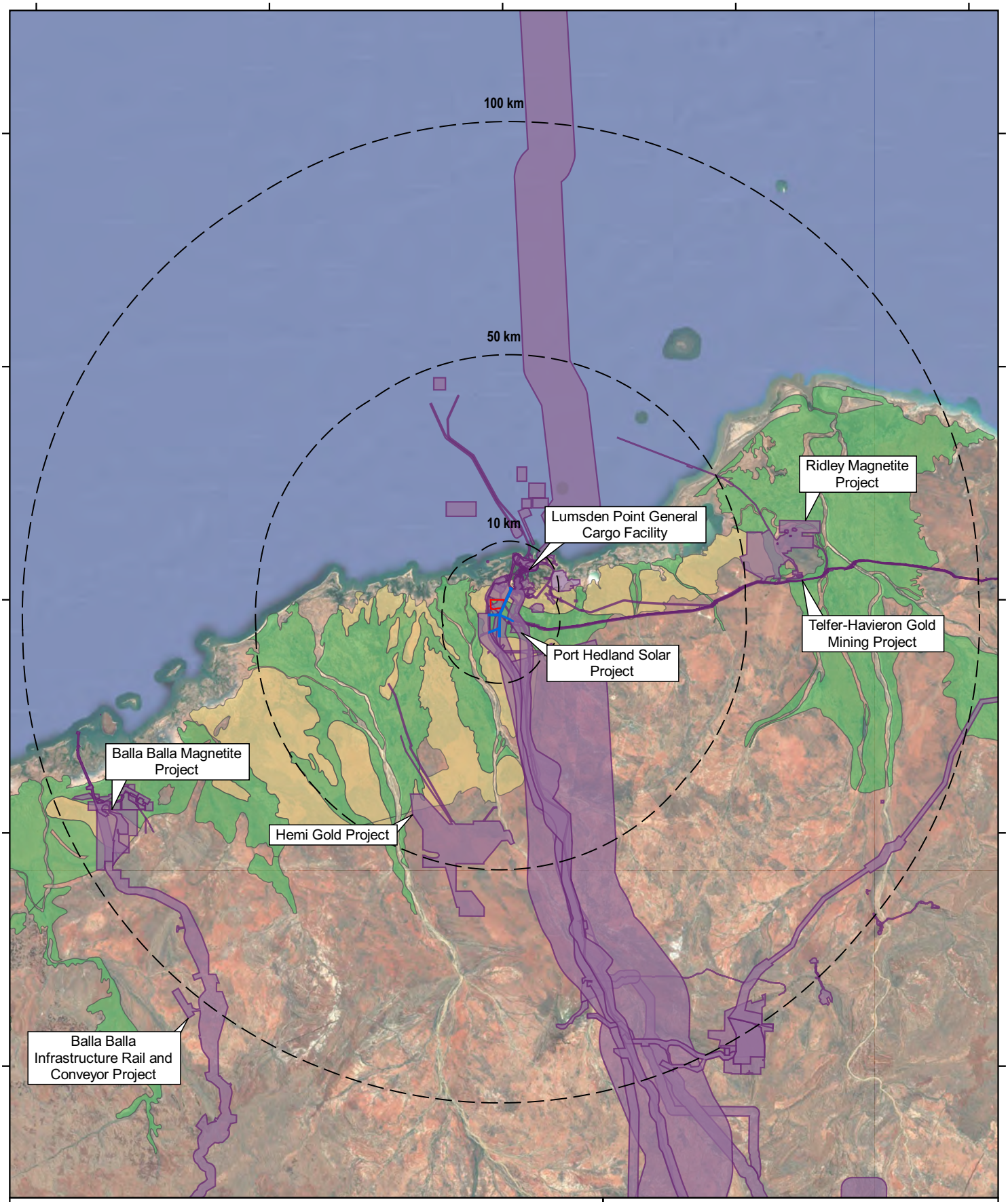
These disturbance calculations were collated from documentation lodged with the EPA. With clearing from these projects considered the cumulative impacts to native vegetation are predicted to be:

- 1,246.5 ha of the remaining vegetation extent within 10 km of the Proposal (1.7%);
- 7,076.5 ha of the remaining vegetation extent within 50 km of the Proposal (1.2%); and
- 18,982.5 ha of the remaining vegetation extent within 100 km of the Proposal (1.0%).

PHI has assessed the impacts to native vegetation as being a significant residual impact and offsets are proposed to counterbalance those impacts.

PHI also assessed the impacts of the Proposal against potential and existing cumulative clearing impacts to Priority flora. There is one Priority flora species predicted to be impacted by the Proposal, *Tephrosia rosea* var. Port Hedland (A.S. George 1114). A desktop search for the species identified additional clearing of twelve known individuals for the Lumsden Point Intersection and Acceleration Lane Upgrade on Great Northern Highway (Lumsden Clearing Permit) (CPS 818). The total cumulative impact on *Tephrosia rosea* var. Port Hedland (A.S. George 1114) only increases from two records (six individuals) to three records (18 individuals). A biological survey was completed for the Lumsden Clearing Permit which identified 3,379 individuals from the study (MRWA, 2021). Phoenix (2024a) identified a total of 49 individuals (24 of which occurred within the Survey Area).

As a result, the cumulative disturbance to this species is approximately 0.5%. PHI considers that disturbance of 0.5% of individuals identified across two surveys, is not significant.



Legend

- Plant Development Envelope
- External Infrastructure Development Envelope
- EPA Referred Significant Proposals (DWER-120)
- Buffers

Imagery: Google Satellite

Pre-European Vegetation (DPIRD-006)

- 589: Short bunch-grass savanna/grass-steppe
- 647: Shrub-steppe

PHGS_0406_028

Figure 12-1: EPA referred significant proposals and remaining pre-European vegetations impacted by the Proposal

Preston Consulting

0 20 40 km

N

GDA 2020 (MGA Zone 50)

1:1,100,000 (A4)

AS 12/12/2024

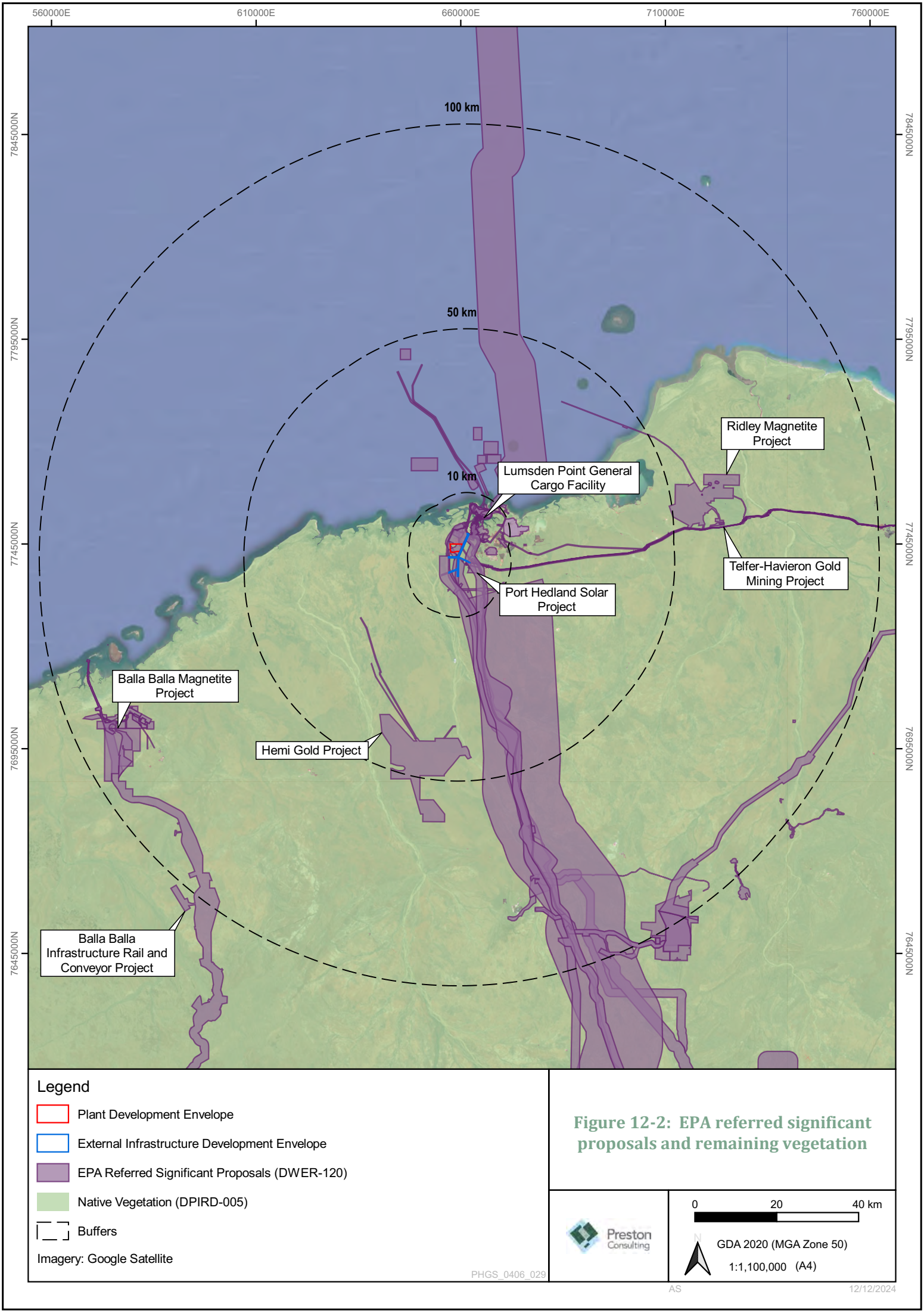


Figure 12-2: EPA referred significant proposals and remaining vegetation

12.2 TERRESTRIAL FAUNA

The majority of recorded fauna species have wide ranging foraging habitat and therefore cumulative impacts to general fauna habitat can be assessed at a high-level in terms of total remaining native vegetation, discussed in Section 12.1.

Given the Proposal's impact on Bilby habitat, an additional cumulative impact assessment was conducted for this species. Only projects with publicly available information on disturbance to Bilby habitat within 100 km of the Project were included. The Port Hedland Solar Project, Hemi Gold Project and Telfer Havieron Gold Mining Project will all result in additional impacts to Bilby habitat Table 12-2.

Table 12-2: Cumulative impacts to Bilby habitat

Disturbance (ha)					
Habitat	**This Proposal**	**Port Hedland Solar Project**	**Hemi Gold Project**	**Telfer – Havieron Gold Mining Project**	**TOTAL**
Sandplain habitat	378.1	200.0	5,900.0	493.6	6,971.7

Cumulative losses of Bilby habitat is considered a threat to the species (Commonwealth of Australia, 2023). PHI has assessed the loss of habitat as being a significant residual impact and offsets are proposed to counterbalance those impacts.

12.3 AIR QUALITY

Dust and air quality modelling was undertaken for the Proposal and was modelled for scenarios with and without background concentrations. Therefore, the scenarios incorporating background data are considered to provide the basis for assessing the cumulative impact from past and present emission sources (Ramboll, 2024; ETA, 2024).

ETA (2024) completed dust modelling using the PHIC CAM. This approach is consistent with the State Government approach for managing dust in Port Hedland. The PHIC model was established in 2010 and has been instrumental in the evaluation of dust impacts on the Port Hedland Community. The use of the PHIC CAM ensures that the assessment of dust emissions from the Proposal has been based on existing cumulative emissions. The modelling shows that on a cumulative basis:

- There is no predicted change to the number of exceedances of the criteria at the Taplin Street receptor;
- There is no predicted change to the maximum predicted 24-hour PM_{10} concentration at the Taplin St receptor; and
- There are no predicted changes to the maximum predicted 24-hour PM_{10} concentration at either the Wedgefield or South Hedland receptors.

12.4 GREENHOUSE GAS

The Proposal is expected to contribute an annual average of 185,616 t CO_2-e per annum of Scope 1 emissions and 23,072 t CO_2-e per annum of Scope 2 emissions, increasing WA's emissions by 0.15%. Production of low carbon emissions steel making precursors is a key step for decarbonisation of the steel making process. GHG emissions from the Proposal will be counterbalanced by its contribution to GHG reductions realised in the complete steelmaking process.

The Proposal provides transformative opportunities for reduction of cumulative GHG emissions at both national and international levels. It will help develop Australia's low emissions steel value chain and become a local demand centre for the emerging hydrogen industry. Both of which are necessary for improving the competitiveness of renewable energy technologies and facilitating the achievement of Australia's greenhouse gas emissions reduction targets.

The Proposal will accelerate the transition to a low emission steel value chain by helping to:

- Decarbonise domestic steelmaking – the Proposal, using existing proven MIDREX® technology, will produce HBI as a precursor for low emissions steel production in the Asian region. The Proposal will produce iron ore pellets and HBI using hydrogen (up to 100% by 2050).
- Early stages of the Proposal (using existing gas fields to supply natural gas) will reduce emissions by up to 55% in comparison to standard international steel-making processes. As the Proposal begins using hydrogen, the level of emissions reduction will increase significantly up to 92% when compared with international iron/steel-making processes. This is particularly significant in the context of the steel industry which accounts for approximately 8% of global carbon emissions.
- Secure the role of Australian iron ore in low emissions steel value chains – the Stage 1 Project would underpin the creation of green steel and hydrogen value chains in the Pilbara, as a significant offtaker and end user of locally produced iron ore and renewable energy. The Proposal can also be the catalyst for ancillary net zero economy industries and benefit the Pilbara region and local communities through creation of demand for green energy, green hydrogen and support services, as well as local goods and services.

Australia has the potential to be a key player in decarbonising the steel supply chain and PHI is committed to developing this new industry that will enhance Australia's competitiveness in global markets in an enduring and sustainable way.

12.5 SOCIAL SURROUNDINGS

The development envelopes lie within Kariyarra Native Title Determination Area (Figure 9-2). The Proposal will avoid all registered all identified Aboriginal Heritage sites unless otherwise agree to with KAC.

RPS were commissioned by LandCorp Pty Ltd to provide a site identification assessment over the Boodarie SIA in 2012. The assessment is comprised of two components: the desktop study and the field survey. The desktop study consisted of a search of previously registered Aboriginal sites in ACHIS database, a literature review and an assessment of the environmental context.

The field survey was conducted in November 2012. Due to the expansive size of the Boodarie SIA, the survey was divided into seven (7) Survey Units. A minimum of 5 - 10 % of each survey unit was assessed for Aboriginal material culture by walking a series of transects designed to cover changes in the landform unit. RPS identified three new Aboriginal sites, all of which were artefact scatters. The archaeological survey also identified ten (10) isolated finds which were recorded in full.

The seventeen (17) DAA AHIS sites within SU 4 and SU 7 of the Boodarie SIA were also assessed. Based on the research undertaken, RPS can confirm that five (5) of these sites have been deregistered because they do not meet the definition of a site under Section 5 of the AH Act (1972). Section 18 permits were granted to remove ten sites

There are a number of proponents which have been approved for land allocation within the SIA. Information on these developments is not publicly available to PHI and hence PHI is unable to determine cumulative impacts as a result of other projects in the vicinity. However, as PHI is intending to avoid all identified sites, the Proposal will not contribute to cumulative impacts on Aboriginal Heritage.

The Industrial Buffer Special Control Area will ensure appropriate separation distances between projects in the Boodarie SIA and surrounding sensitive receptors to prevent significant cumulative impacts on amenity from projects in the Boodarie SIA, including the Proposal.

GLOSSARY

Term	Meaning
ACCUs	Australian Carbon Credit Units
ACHIS	Aboriginal Cultural Heritage Inquiry System
AGV	Air Guideline Value
AH Act	*Aboriginal Heritage Act* 1972
AHD	Australian Height Datum
APA	APA Group
AREH	Australian Renewable Energy Hub
ARENA	Australian Renewable Energy Agency
AVH	Australasian Virtual Herbarium
BAM Act	*Biosecurity and Agriculture Management Act 2007*
BC Act	*Biodiversity Conservation Act* 2016
BF	Blast Furnace
BMP	Bushfire Management Plan
BOF	Basic Oxygen Furnace
BoM	Bureau of Meteorology
BWRO	Brackish Water Reverse Osmosis
Caespitose	Growing in dense tufts or clusters, or forming a dense turf
CAM	Cumulative Air Model
CCA	Climate Change Australia
CCUS	Carbon Capture, Use and Storage
CCGT	Combined Cycle Gas Turbines
CEF	Clean Energy Finance
CEFC	Clean Energy Finance Corporation
CO	Carbon monoxide
$CO_{2\text{-}e}$	Carbon dioxide equivalent
CPI	Consumer Price Index
Cth	Commonwealth
DAWE	Department of Agriculture, Water and the Environment
dB	Decibel
DBCA	Department of Biodiversity, Conservation and Attractions
DCCEEW	Department of Climate Change, Energy, the Environment and Water
DEMIRS	Department of Energy, Mines, Industry
DG	Dangerous Goods
DISR	Department of Industry, Science and Resources
DotE	Department of the Environment

Term	Meaning
DotEE	Department of the Environment and Energy
DPaW	Department of Parks and Wildlife (WA)
DPIRD	Department of Primary Industries and Regional Development (WA)
DPLH	Department of Planning, Lands and Heritage (WA)
DRI	Direct Reduced Iron
DSEWPaC	Department of Sustainability, Environment, Water, Population and Communities (Commonwealth)
DWER	Department of Water and Environmental Regulation
EAF	Electric Arc Furnace
EIA	Environmental Impact Assessment
EIDE	External Infrastructure Development Envelope
EIS	Environmental Impact Statement
EP Act	*Environmental Protection Act 1986* (WA)
EPA	Environmental Protection Authority (WA)
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999* (Cth)
ESA	Environmentally Sensitive Areas
ETA	Environmental Technologies & Analytics Pty Ltd
GHG	Greenhouse Gas
GJ	Gigajoule
GK	Grate Kiln
GLC	Ground Level Concentrations
ha	Hectares
Hancock	Hancock Prospecting
HBI	Hot Briquette Iron
HDRI	Hot DRI
Horizon	Horizon Power
IBRA	Interim Biogeographic Regionalisation for Australia
ILUA	Indigenous Land Use Agreement
IOPF	Iron Processing Facility
IRP	Impact Reconciliation Procedure
JTSI	Department of Jobs, Tourism, Science and Innovation (WA)
JV	Joint Venture
KAC	Kariyarra Aboriginal Corporation
kg	Kilogram
kL	Kilolitre
km	Kilometres
LAA	*Land Administration Act 1997* (WA)

Term	Meaning
LPG	Liquid Petroleum Gas
m	Metre
m^3	Cubic metre
mm	Millimetre
MNES	Matters of National Environmental Significance
Mt	Million Tonnes
Mtpa	Million Tonnes per Annum
MW	Megawatt
NAIF	Northern Australia Infrastructure Facility
NASA	National Aeronautics and Space Administration
NEPC	National Environment Protection Council
NEPM	National Environment Protection Measures
NGER	National Greenhouse and Energy Reporting
NGER Act	*National Greenhouse and Energy Reporting Act 2007* (Cth)
NH_3	Ammonia
NO_2	Nitrogen Dioxide
NO_x	Nitrogen oxides
NRFC	National Reconstruction Fund Corporation
NVCP	Native Vegetation Clearing Permit
NWIS	Northwest Interconnected System
NZEA	Net Zero Authority
OCGT	Open Cycle Gas Turbines
PDE	Plant Development Envelope
PEC	Priority Ecological Communities – plant communities listed as being potentially threatened under the *Biodiversity Conservation Act 2016*
PEL	Pacific Environmental Limited
PEOF	Pilbara Environmental Offsets Fund
PER	Public Environment Report
PFC	Percentage Foliage Cover
PHI	Port Hedland Iron Pty Ltd
PHIA	Port Hedland International Airport
PHIC	Port Hedland Industries Council
Phoenix	Phoenix Environmental Sciences Pty Ltd
PM	Particulate Matter
PoPH	Port of Port Hedland
PPA	Pilbara Ports Authority
Proposal	Port Hedland Iron Project

Term	Meaning
PV	Production Variable
Ramboll	Ramboll Australia Pty Ltd
RIWI Act	*Rights in Water and Irrigation Act* 1914
RL	Reduced Level
s91	Section 91
Santos	Santos Limited
SERS	Sectoral Emissions Reduction Strategy
SG	Straight Grate
SIA	Strategic Industrial Area
SMC	Safeguard Mechanism Credit
SO_2	Sulphur Dioxide
SRE	Short range endemic
tCO2-e	Tonnes of carbon dioxide equivalent
TEC	Threatened Ecological Communities – plant communities listed as being threatened and legally protected under the *Biodiversity Conservation Act 2016* and / or the *Environment Protection and Biodiversity Conservation Act 1999*
The Regulations	Environmental Protection (Noise) Regulations 1997
ToPH	Town of Port Hedland
TSP	Total Suspended Particulates
UF	Ultrafiltration
USEPA	United States Environmental Protection Authority
Vysarn Water	Vysarn
WA	Western Australia
WoNS	Weeds of National Significance
Wood	Wood Australia Pty Ltd
Woodside	Woodside Energy Pty Ltd
WWF	World Wildlife Fund

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