Appendix C

Air quality and greenhouse gas assessment

EMM
creating opportunities

HVO NORTH MODIFICATION 8

Air Quality and Greenhouse Gas Assessment

Final | Revision 0

19 November 2024

Project: 22019

HVO North Modification 8

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Acronyms and definitions

Abbreviation	Definition
BoM	Bureau of Meteorology
DPHI	Department of Planning, Housing and Infrastructure
EPA	NSW Environment Protection Authority
GHG	Greenhouse gas
GWP	Global Warming Potential
HVO	Hunter Valley Operations
HVO Complex	Hunter Valley Operations North and South Operations
Mtpa	Million tonnes per annum
NEPM	National Environment Protection Measure
NEPC	National Environment Protection Council of Australia
NGER	National Greenhouse and Energy Reporting
NSW	New South Wales
NO	Nitric oxide
NO_2	Nitrogen dioxide
NO_x	Oxides of nitrogen
OEH	Office of Environment and Heritage
$PM_{2.5}$	Particulate matter with equivalent aerodynamic diameters less than 2.5 microns
PM_{10}	Particulate matter with equivalent aerodynamic diameters less than 10 microns
POEO Act	*Protection of the Environment Operations (POEO) Act 1997*
ROM	Run-of-mine
SO_2	Sulphur dioxide
SSD	State Significant Development
TEOM	Tapered Element Oscillating Microbalance
TSP	Total suspended particulate matter

1 Introduction

This report provides an assessment of the potential air quality and greenhouse gas (GHG) impacts of a proposed modification to the HVO North mine and associated Development Consent DA 450-10-2003.

1.1 Existing Operations

Hunter Valley Operations (HVO) North is an existing multi-pit open cut coal mining operation approximately 24 kilometres (km) northwest of Singleton in the Hunter Valley of New South Wales (NSW) and within the Singleton and Muswellbrook Local Government Areas (LGAs) (Figure 1). HVO North operates under development consent DA 450-10-2003, which was granted on 12 June 2004 by the then NSW Minister for Infrastructure, Planning and Natural Resources under Part 4 of the EP&A Act. DA 450-10-2003 has since been modified on seven occasions, the most recent being modification (MOD) 7 granted on 28 July 2017.

HVO North comprises the approved mining areas of West Pit, Mitchell Pit, Carrington Pit and North Pit, as well as the Hunter Valley and Howick Coal Preparation Plants (CPP) and the Howick and HVO North Mine Infrastructure Area (MIA). The development consent allows extraction of up to 22 million tonnes per annum (Mtpa) of run of-mine (ROM) coal until 12 June 2025, comprised of:

- 12 Mtpa from West Pit / Mitchell Pit
- 10 Mtpa from Carrington Pit.

Product coal is approved to be transported to three loading points on the northern side of the New England Highway, Hunter Valley Load Point (HVLP), Newdell Load Point (NLP) and Ravensworth Coal Terminal (RCT). Coal from the Hunter Valley CPP is predominantly transported to the HVLP and NLP by overland conveyor, whereas coal from Howick CPP is trucked to the NLP. The approval allows for intermittent haulage of coal between Hunter Valley CPP and the three load points, and transport between the load points. After the coal has reached the load points, it is transported to the Port of Newcastle by rail. Product coal may also be transported directly from the Howick CPP via conveyor to the AGL Bayswater Power Station.

HVO North is owned by subsidiary companies of Yancoal and Glencore, as participants in the unincorporated HVO Joint Venture (JV). HV Operations Pty Ltd is the appointed manager of the JV. In November 2022, HV Operations Pty Ltd submitted two new State significant development (SSD) applications and a supporting Environmental Impact Statements (EIS) for the HVO North Open Cut Coal Continuation Project (SSD-11826681) and the HVO South Open Cut Coal Continuation Project (SSD-11826621) (the Project). The Project broadly seeks approval for the continuation of mining operations at both HVO North and HVO South beyond the dates currently approved under the HVO North Consent and the existing Project Approval for HVO South.

The Project is currently progressing through the assessment process; however, due to the timeframes associated with the assessment, determination may not be received prior to the date on which mining operations are required to cease under the existing HVO North Consent i.e. by 12 June 2025. Therefore, HVO is seeking to modify the HVO North Consent to authorise the continuation of mining until 31 December 2026 while the assessment of the Project progresses through to determination. Except for the continuation of mining operations at HVO North for an additional 18 months to 31 December 2026, all other aspects of the existing operations at HVO North will remain unchanged. The proposed Modification is being pursued under section 4.55(2) of the EP&A Act on the basis that the development to which the consent as proposed to be modified relates is substantially the same development as that currently approved under the HVO North Consent.

1.2 Proposed Modification

HVO is seeking to modify DA 405-10-2003 under section 4.55(2) of the *Environmental Planning and Assessment Act 1979* (EP&A Act) to extend the life of mining operations at HVO North under the development consent by a period of approximately 18 months, from 12 June 2025 to 31 December 2026 (the Modification). Apart from an extension of time for mining operations to be carried out, all activities that are currently approved under DA 450-10-2003 are intended to continue and will remain the same under the Modification, including mining methods, approved annual coal extraction rates, coal processing and handling activities, surface infrastructure, workforce numbers and hours of operation. The proposed Modification does not require any additional surface disturbance beyond the areas that have already been assessed and approved to be disturbed. In addition, the proposed Modification will involve the extraction of coal that has been previously assessed and approved to be extracted. As a result, the Modification will not alter the total GHG emissions previously assessed and approved. However, the proposed extension of time will result in some emissions occurring between June 2025 and December 2026, rather than prior to June 2025 as currently approved.

The proposed Modification relates to HVO North only. No changes are proposed to HVO South, with the existing Project Approval (PA 06-0261) in place until 24 March 2030, however the operation of HVO South has some dependencies on the operation of HVO North, which make it relevant to also consider as part of this assessment.

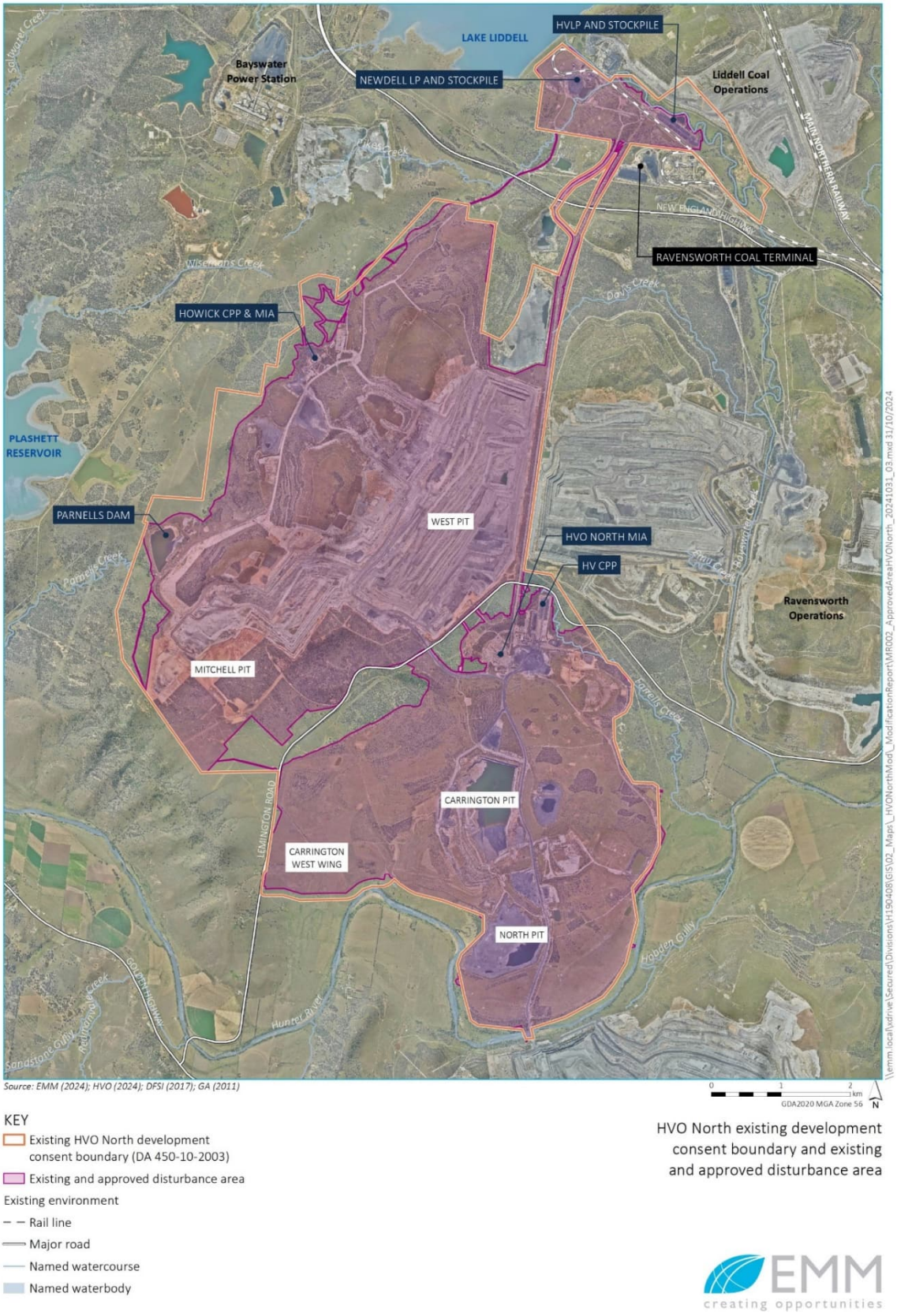

Figure 1 Components of the existing HVO Complex

2 Key Issues

Air quality issues can arise when emissions from an industry or activity lead to deterioration in the ambient air quality. Emissions from HVO North (both as approved and as proposed for the Modification) will occur from a variety of activities including material handling, material transport, processing, wind erosion, blasting and potentially, from the spontaneous combustion of coal. These emissions will mainly comprise of particulate matter in the form of total suspended particulates (TSP), particulate matter with equivalent aerodynamic diameter of 10 microns or less (PM_{10}) and particulate matter with equivalent aerodynamic diameter of 2.5 microns or less ($PM_{2.5}$). There would also be relatively minor emissions from machinery exhausts such as carbon monoxide (CO), oxides of nitrogen (NO_x) and particulate matter. Spontaneous combustion of coal has historically not been an issue at HVO North.

MOD 8 does not involve any activity that will change the nature of air quality issues at HVO North, relative to the Approved Operations. In particular, the key issues have been identified, and will remain, as:

- Dust (that is, particulate matter in the form of TSP, deposited dust, PM_{10} or $PM_{2.5}$) from the general mining activities;
- Fume (that is, NO_x emissions) from blasting;
- Emissions of substances from machinery exhausts, that is, diesel exhaust emissions; and
- GHG emissions e.g. carbon dioxide equivalent gases (CO_2-e).

The initial review indicates that it is appropriate to assess the potential air quality impacts of the Modification in a qualitative manner. This is primarily because the proposed production volume and related impacts (including GHG) have previously been approved, the maximum approved production will not increase and there will be no change to the way in which mining is carried out (i.e. machinery, hours, transport etc.). The Modification relates only to an extension of the mine life by approximately 18 months. GHG emissions have been quantified to determine whether the Modification would represent a "significant modification to an existing facility", as per the draft "EPA Guide for Large Emitters" (EPA, 2024a).

3 Policy Setting

3.1 Air Quality Criteria

Air quality is typically quantified by the concentrations of substances in the ambient air. Air pollution occurs when the concentration (or some other measure of intensity) of one or more substances known to cause health, nuisance and/or environmental effects, exceeds a certain level. With regard to human health and nuisance effects, the substances most relevant to HVO North have been identified, from Section 2, as particulate matter and NO_2.

Schedule 3, Condition 4A of DA 450-10-2003 requires HVO to "ensure that all reasonable and feasible avoidance and mitigation measures are employed so that particulate matter emissions generated by the development do not exceed the criteria listed in Tables 2, 3 and 4 at any residence on privately-owned land, or on more than 25% of any privately-owned land". Table 1 shows the air quality criteria from DA 450-10-2003. Schedule 3, Condition 4 of DA 450-10-2003 also requires HVO to "implement all reasonable and feasible measures to minimise the release of greenhouse gas emissions from the site to the satisfaction of the Secretary". HVO has a network of air quality and meteorological monitoring equipment around HVO North which is designed to meet the relevant conditions of DA 450-10-2003.

Table 1 Air quality criteria from DA 450-10-2003

Air quality indicator	Averaging time	[d] Air quality criteria from DA 450-10-2003
Particulate matter (PM_{10})	24-hour	[b] 50 µg/m³
	Annual	[a] 30 µg/m³
Particulate matter (TSP)	Annual	[a] 90 µg/m³
Deposited dust [c]	Annual (maximum increase)	[b] 2 g/m²/month
	Annual (maximum total)	[a] 4 g/m²/month

[a] *Total impact (i.e. incremental increase in concentrations due to the development plus background concentrations due to all other sources).*
[b] *Incremental impact (i.e. incremental increase in concentrations due to the development on its own).*
[c] *Deposited dust is to be assessed as insoluble solids as defined by Standards Australia, AS/NZS 3580.10.1:2003: Methods for Sampling and Analysis of Ambient Air – Determination of Particulate Matter – Deposited Matter – Gravimetric Method.*
[d] *Excludes extraordinary events such as bushfires, prescribed burning, dust storms, sea fog, fire incidents, illegal activities or any other activity agreed by the Secretary.*

The EPA has developed assessment criteria for a range of air quality indicators including particulate matter. These criteria are outlined in the "Approved Methods for the Modelling and Assessment of Air Pollutants in NSW" (EPA, 2022), hereafter referred to as the Approved Methods. Most of the EPA criteria referred to in this report have been drawn from national environment protection standards for ambient air quality set by the National Environmental Protection Council of Australia (NEPC) as part of the National Environment Protection Measures (NEPMs) (NEPC, 1998 and updates to 2021).

The Modification has been assessed in terms of its ability to comply with the relevant air quality criteria set by the EPA as part of the Approved Methods. These criteria are outlined in Table 2 and apply to existing and potentially sensitive receptors, where the Approved Methods defines a sensitive receptor as including "a location where people are likely to work or reside; this may include a dwelling, school, hospital, office or public recreational area".

Table 2 Air quality assessment criteria for all relevant air quality indicators

Air quality indicator	Averaging time	Criterion	Application
Particulate matter (PM_{10})	24-hour	50 µg/m³	Cumulative, at sensitive receptors
	Annual	25 µg/m³	Cumulative, at sensitive receptors
Particulate matter ($PM_{2.5}$)	24-hour	25 µg/m³	Cumulative, at sensitive receptors
	Annual	8 µg/m³	Cumulative, at sensitive receptors
Particulate matter (TSP)	Annual	90 µg/m³	Cumulative, at sensitive receptors
Deposited dust (insoluble solids)	Annual (maximum increase)	2 g/m²/month	Incremental, at sensitive receptors
	Annual (maximum total)	4 g/m²/month	Cumulative, at sensitive receptors

Source: EPA, 2022.

3.2 Greenhouse Gas

3.2.1 Overview

GHG is a collective term for a range of gases that are known to trap radiation in the upper atmosphere, where they have the potential to contribute to the greenhouse effect (global warming). GHGs include:

- Carbon dioxide (CO_2); by far the most abundant GHG, primarily released during fuel combustion.
- Methane (CH_4); generated from the anaerobic decomposition of carbon-based material (including enteric fermentation and waste disposal in landfills).
- Nitrous oxide (N_2O); generated from industrial activity, fertiliser use and production.
- Hydrofluorocarbons (HFCs); commonly used as refrigerant gases in cooling systems.
- Perfluorocarbons (PFCs); used in a range of applications including solvents, medical treatments and insulators.
- Sulphur hexafluoride (SF_6); used as a cover gas in magnesium smelting and as an insulator in heavy duty switch gear.

It is common practice to aggregate the emissions of these gases to the equivalent emission of carbon dioxide. This provides a simple figure for comparison of emissions against targets. Aggregation is based on the potential of each gas to contribute to global warming relative to carbon dioxide and is known as the global warming potential (GWP). The resulting number is expressed as carbon dioxide equivalents (or CO_2-e).

GHG emissions that form an inventory can be split into three categories known as 'Scopes'. Scopes 1, 2 and 3 are defined by the Greenhouse Gas Protocol (WRI, 2004) and can be summarised as follows:

- Scope 1 – Direct emissions from sources that are owned or operated by the organisation (examples include combustion of diesel in company owned vehicles or used in on-site generators).
- Scope 2 – Indirect emissions associated with the import of energy from another source (examples include importation of electricity or heat).
- Scope 3 – Other indirect emissions (other than Scope 2 energy imports) which are a direct result of the operations of the organisation but from sources not owned or operated by them (examples include business travel, by air or rail, and product usage).

The purpose of differentiating between the scopes of emissions is to avoid the potential for double counting, where two or more organisations assume responsibility for the same emissions.

3.2.2 Federal Policy

Paris Climate Conference COP 21

The 21st yearly session of the Conference of Parties (COP), held in Paris in 2015, was pivotal for developing an international treaty on climate change. It resulted in "The Paris Agreement", an agreement 'to achieve a balance between anthropogenic (human induced) emissions by sources and removals by sinks of greenhouse in the second half of this century'. Subsequent COPs have sought to develop policy architecture to deliver on the commitments of COP21. In particular, following COP21, international agreements were made to:

- Keep global warming well below 2.0 degrees Celsius, with an aspirational goal of 1.5 degrees Celsius (based on temperature pre-industrial levels).
- From 2018, countries are to submit revised emission reduction targets every five years, with the first being effective from 2020, and goals set to 2050.
- Define a pathway to improve transparency and disclosure of emissions.
- Make provisions for financing the commitments beyond 2020.

The *Climate Change Act 2022* operates as 'umbrella' legislation to implement Australia's net-zero commitments and codifies Australia's net 2030 and 2050 GHG emissions reductions targets under the Paris Agreement including targets to cut emissions by 43% by 2030 from 2005 levels and achieve net zero emissions by 2050.

National Greenhouse and Energy Reporting Act 2007

The Federal Government uses the *National Greenhouse and Energy Reporting Act 2007* (NGER Act) for the measurement, reporting and verification of GHG emissions in Australia. This legislation is used for a range of purposes, including international GHG reporting. Under the NGER Act, constitutional corporations in Australia which exceed thresholds for GHG emissions or energy production or consumption are required to measure and report data to the Clean Energy Regulator (CER) on an annual basis. The *National Greenhouse and Energy Reporting (Measurement) Determination 2008* (Measurement Determination) identifies several methodologies to account for GHGs from specific sources relevant to the Modification. This includes emissions of GHGs from direct fuel combustion (fuels for transport energy purposes), emissions associated with consumption of power from direct combustion of fuel (e.g. diesel generators used during construction), and from consumption of electricity from the grid.

The Measurement Determination provides methods, criteria, and measurement standards for calculating and reporting GHG emissions and energy data under the NGER Act. It covers scope 1 and scope 2 emissions and energy production and consumption. The Measurement Determination is primarily used for historical reporting of activities. The calculation methodologies for HVO North have been based on the National Greenhouse Accounts (NGA) Factors as the NGA Factors are used for the purposes of project assessment. The NGA Factors is not published for the purposes of reporting under the NGER Act.

Safeguard Mechanism

The Safeguard Mechanism has been in place since 1 July 2016 and is a legislated framework that applies to all facilities that emit more than 100,000 tonnes of CO_2-e of Scope 1 emissions (emissions produced on-site) in a year. The Safeguard Mechanism places a limit on the amount of greenhouse gases Australia's largest industrial facilities can emit by assigning each facility covered by the Mechanism a 'baseline'. Each year, every large facility within the Safeguard Mechanism reports their emissions to the CER. Any facility that emits more greenhouse gases than allowed by their baseline has to take actions to reduce their emissions. For example, through purchasing Australian Carbon Credit Units.

Reforms to the Safeguard Mechanism took effect from 1 July 2023. Under these reforms, new baseline emissions numbers ('baselines') for designated large facilities are set on a declining trajectory aligned with achieving Australia's emissions reduction targets set out in the *Climate Change Act 2022* (Cth) and its Nationally Determined Contribution (NDC) under the Paris Agreement which are currently as follows:

a) reducing Australia's net greenhouse gas emissions to 43% below 2005 levels by 2030;

b) reducing Australia's net greenhouse gas emissions to zero by 2050.

The decline rate for Safeguard baselines is currently as follows:

a) 4.9% per year to 2030, followed by

b) 3.285% per year thereafter

HVO is a Safeguard facility and will need to reduce its emissions in accordance with the Mechanism's emissions reduction targets.

3.2.3 State Policy

The NSW government has developed a Climate Change Policy Framework which sets the objective of achieving net-zero emissions by 2050. The policy does not impose any specific requirements on the public, nor on developments undertaken by private companies but intends to achieve net-zero emissions through a combination of consultative policy development intended to avoid duplication of Commonwealth frameworks, The *Climate Change (Net Zero Future) Act 2023* legislates the NSW approach to addressing climate change and delivering net zero by 2050. The Act sets a path to 2050 with emissions reduction targets. The Act legislates:

- guiding principles for action to address climate change that consider the impacts, opportunities and need for action in NSW.
- net emissions reduction targets for NSW (50% reduction on 2005 levels by 2030, 70% reduction on 2005 levels by 2035, and net zero by 2050).
- an objective for NSW to be more resilient to a changing climate.
- establishing an independent, expert Net Zero Commission to monitor, review, report on and advise on progress towards these targets.

In May 2024, the EPA issued a draft policy on climate change assessment requirements for large emitters (EPA, 2024b) (draft CCARs) and a draft "NSW EPA Guide for Large Emitters" (EPA 2024a) (draft Guide). The draft CCARs outline the requirements for "new projects likely to have large emissions and proposed modifications of existing facilities likely to significantly increase their GHG emissions". There are two main tests to determine the applicability of the draft CCARs and associated draft Guide. These consider whether the project is a large emitter, and if these emissions will be "significant" based on the development type. Figure 2 shows the tests and outcomes.

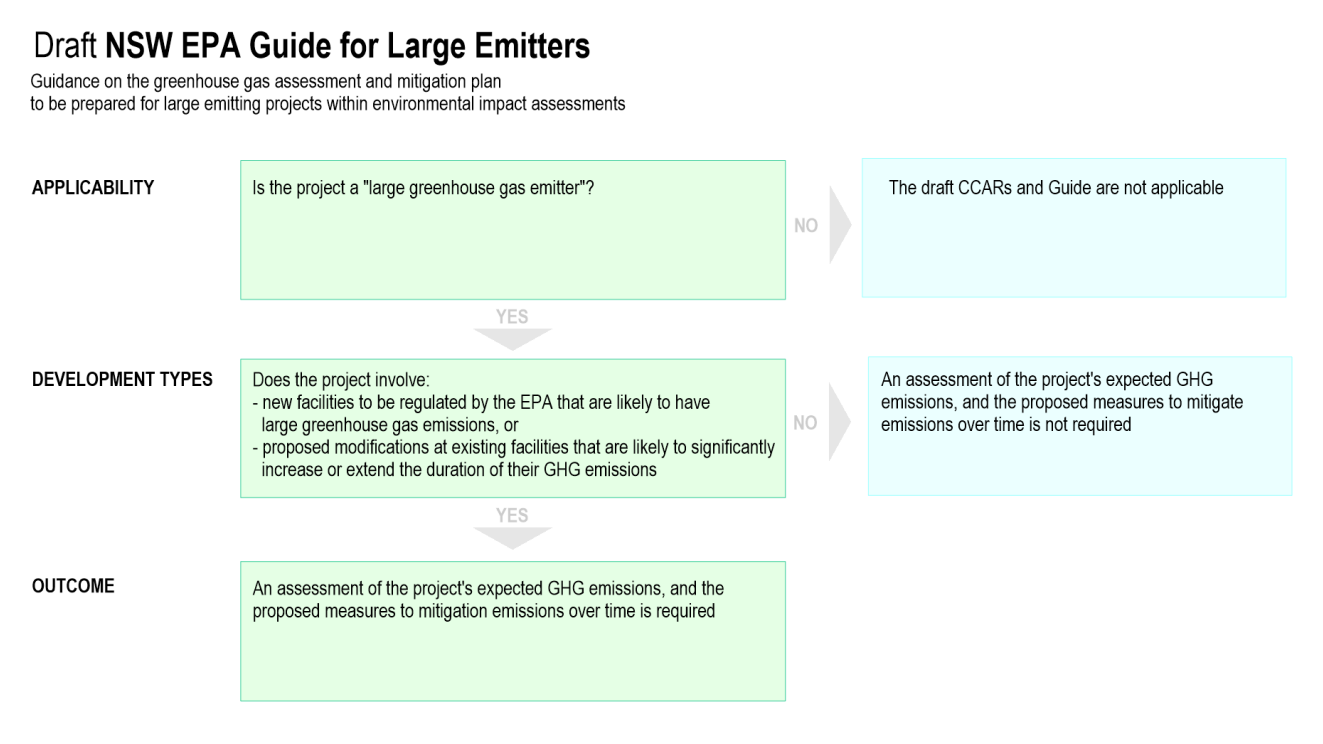

Figure 2 Applicability of the NSW EPA Guide for Large Emitters

The draft Guide (EPA 2024b) is a "draft for consultation" however the Department of Planning, Housing and Infrastructure (DPHI) is requesting the draft Guide be considered for new applications and Modifications. As per the draft Guide, each project proposal is to be considered on its own merits.

The potential applicability and requirements of the draft Guide has been discussed (see Section 6). It should be noted that the proposed production and emissions have previously been approved and the current assessment provides re-estimation of these previously approved emissions during the proposed additional 18-month period of mining.

4 Existing Environment

The existing environment can be characterised from local meteorological and ambient air quality data. HVO has a network of meteorological and ambient air quality monitoring equipment that is used to collect data for supporting the management of daily operations at the HVO Complex. The data are also used for determining compliance against the relevant development consent conditions.

4.1 Meteorology

Meteorological conditions are important for determining the transport and dispersion of emissions from the source to receptors locations, and the potential influences on air quality. There is an extensive meteorological monitoring network in the Hunter Valley and most mining companies are required to operate at least one meteorological station as part of their development consent. HVO operates two meteorological stations, referred to as "HVO Corporate" and "Cheshunt". The DPHI also conducts meteorological monitoring in the Hunter Valley as part of their Upper Hunter Air Quality Monitoring Network. Figure 3 shows the location of the HVO and DPHI meteorological stations in the region.

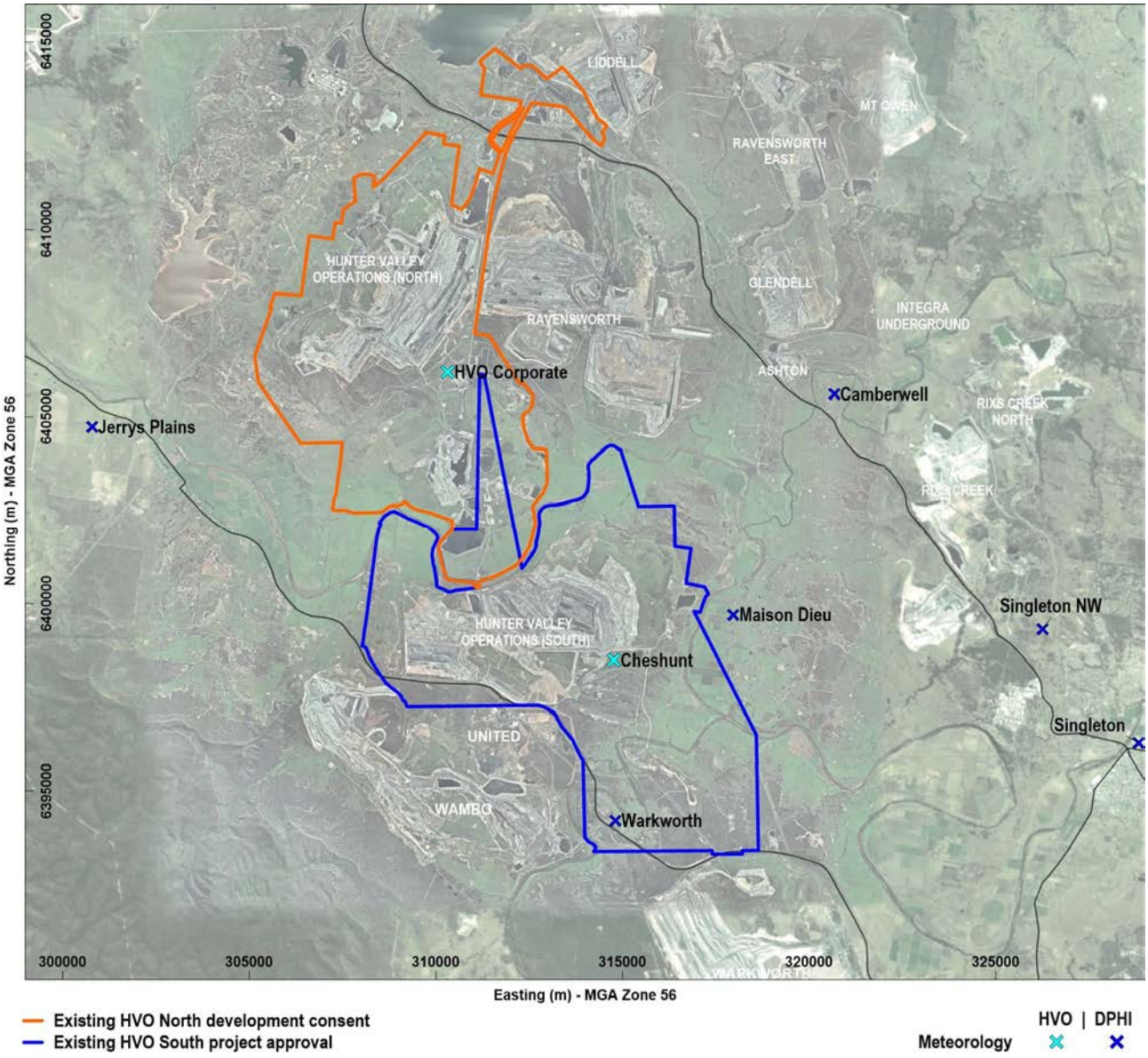

Figure 3 Location of meteorological stations

The HVO Corporate meteorological station is positioned to collect data which are most representative of conditions at and around HVO North. Figure 4 shows the wind-roses from data collected in 2023. Winds are predominantly from the west or east-southeast, depending on the season. Summer winds are mainly from the east-southeast while winter winds are mainly from the west. This pattern of winds is common for many parts of the Hunter Valley and reflects the northwest-southeast alignment of the valley. These winds mean that any emissions from HVO North would typically be transported to the west-northwest or east of the site.

A detailed review of the local meteorological conditions air quality was presented in the air quality assessment for the HVO North Open Cut Coal Continuation Project (SSD-11826681) (Jacobs, 2022). This review showed very similar wind patterns to those presented in Figure 4. It also demonstrated that wind patterns do not vary significantly from year to year.

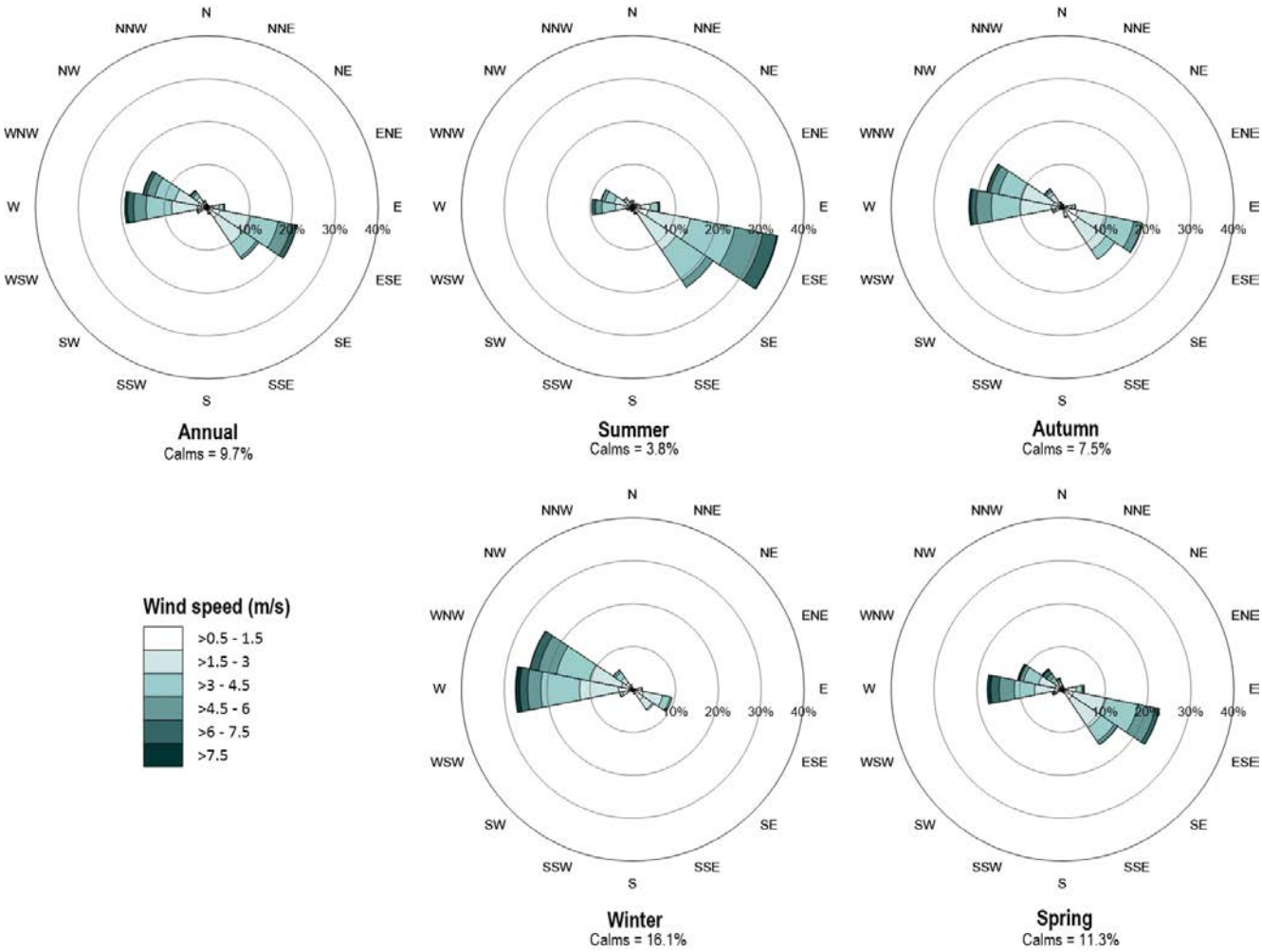

Figure 4 Wind-roses from data collected at the HVO Corporate meteorological station in 2023

Rainfall can also influence air quality conditions, particularly dust levels. The Bureau of Meteorology (BoM) operates many rainfall stations across Australia. One of the closest stations is located to the south of HVO North at Bulga (Station Number 061143). Figure 5 shows the annual rainfall from 2011 to 2023. The drought conditions were evident in the period from 2017 to 2019 data with annual rainfall well below the long-term average (based on 83 years of records). This was followed by a period of above average rainfall conditions in the period from 2020 to 2022.

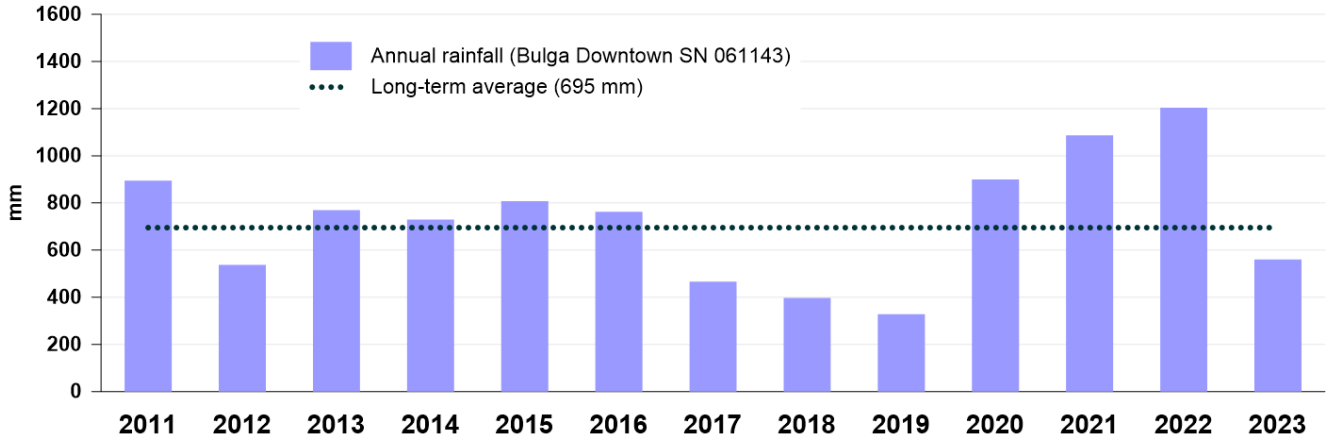

Figure 5 Annual rainfall

4.2 Air Quality

There is an extensive air quality monitoring network in the Hunter Valley and most mining companies (including HVO) are required to operate multiple monitoring stations as part of their development consent or project approval. The DPHI also conducts monitoring as part of their Upper Hunter Air Quality Monitoring Network.

HVO has a network of air quality monitors around HVO North to assist with operations management and to determine ongoing compliance with the HVO North development consent. This network includes various technologies (by approved methods) to measure PM_{10}, TSP and deposited dust. HVO also monitors $PM_{2.5}$ for additional data collection purposes and in accordance with PA 06_0261. The air quality monitoring data represent the contributions from all sources of particulate matter that have at some stage been upwind of each monitor. In the case of PM_{10} for example, a measurement may contain contributions from many sources such as from construction works, bushfires, agricultural activities, industry, vehicles, roads, wind-blown dust from nearby and remote areas, pollens and moulds.

A detailed review of the existing air quality environment was presented in the air quality assessment for the HVO North Open Cut Coal Continuation Project (SSD-11826681) (Jacobs, 2022). This assessment identified PM_{10} as one of the main existing air quality issues, based on measured concentrations that have historically approached or exceeded the assessment criteria noted by the EPA.

The historical trends in regional PM_{10} concentrations have been examined. Figure 6 to Figure 8 show the historical data at the DPHI monitoring locations. These data show that PM_{10} concentrations increased significantly between 2017 and 2019, coinciding with drought conditions, lower than average rainfall, and widespread bushfires. The DPHI noted these as extraordinary events (DPE, 2020) and not representative of the usual air quality conditions. The increases in PM_{10} concentrations were observed across many locations in NSW and were not unique to the Hunter Valley. Concentrations decreased from mid-2020 as rainfall returned to, or exceeded, average levels.

The PM_{10} monitoring data are reviewed by HVO as part of annual reporting and with consideration of extraordinary events. These reviews have shown that HVO has complied with the PM_{10} criteria specified in the HVO North development consent from 2012 to 2023 at all times except on three occasions when the short term 24-hour PM_{10} criteria were exceeded; Cheshunt East (12 September 2021), Cheshunt East (6 March 2023) and Cheshunt East (20 September 2023). Compliance is reported for the HVO Complex although it can be inferred that only the Cheshunt East monitoring informs the HVO North compliance outcomes, based on the monitoring location.

In summary, the air quality monitoring shows that air quality conditions are strongly correlated to the climatic conditions, and mining contributions occur from time-to-time.

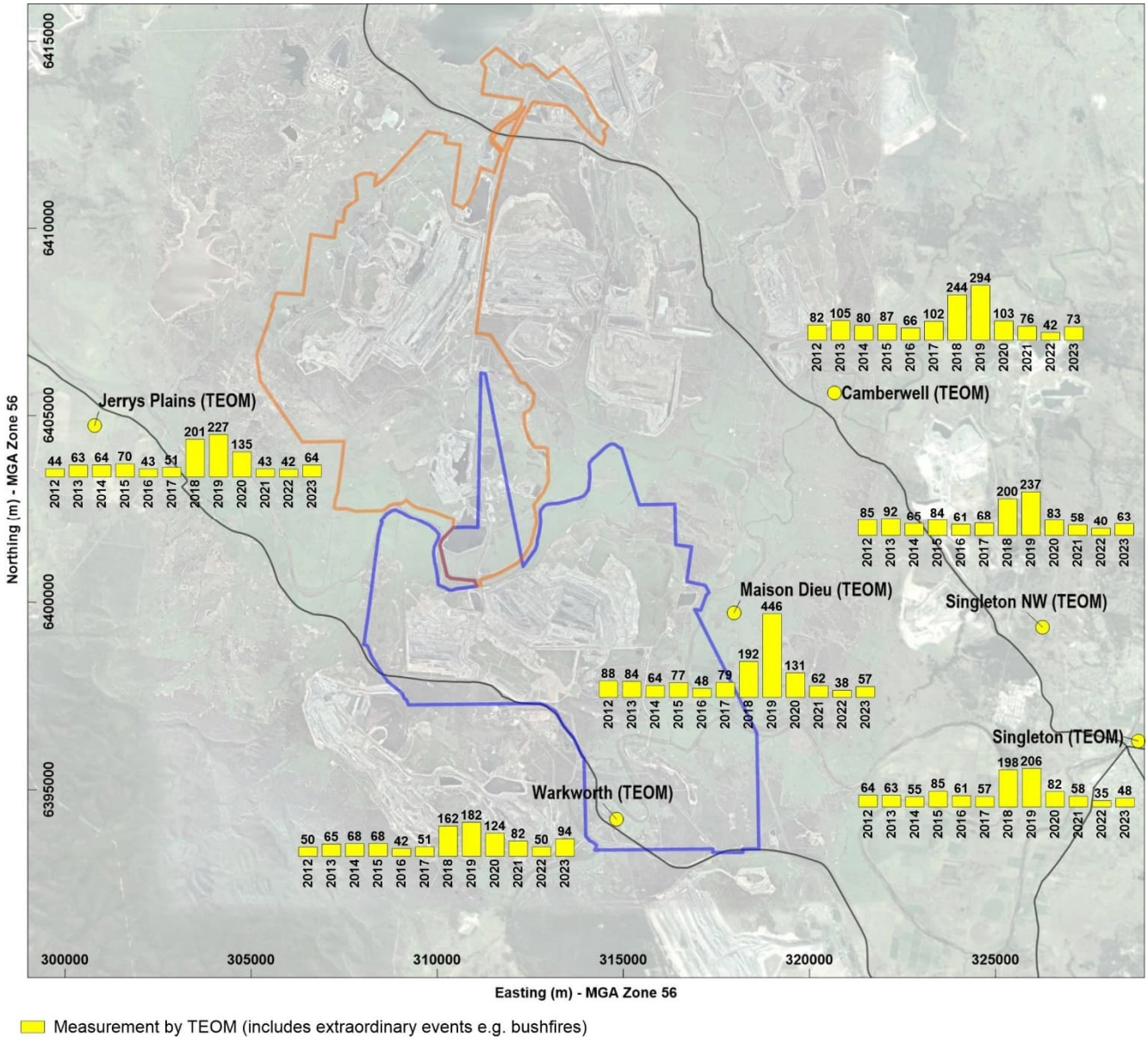

Figure 6 Maximum 24-hour average PM_{10} concentrations (µg/m^3)

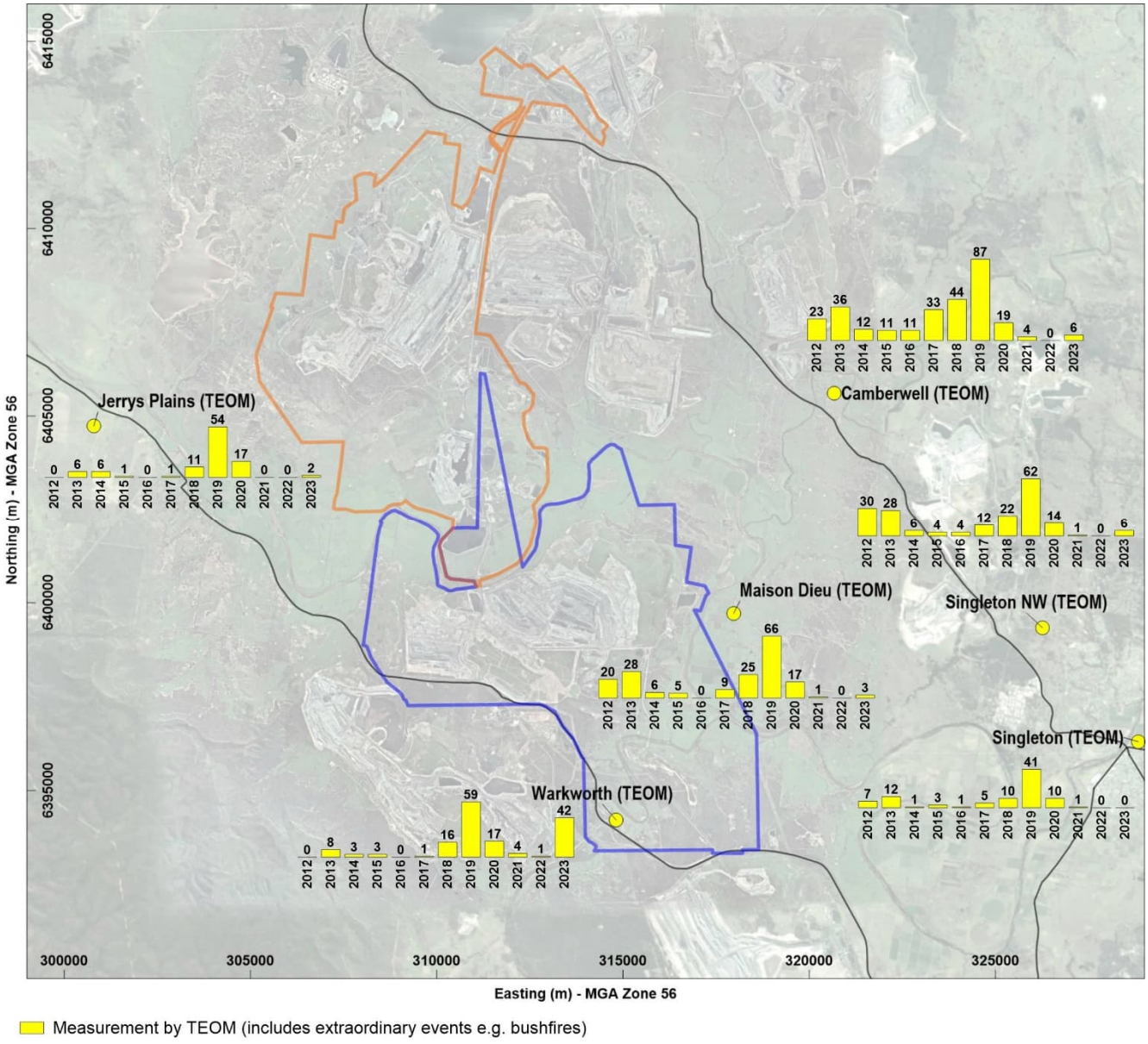

Figure 7 Number of days above 50 µg/m^3 PM_{10} (days)

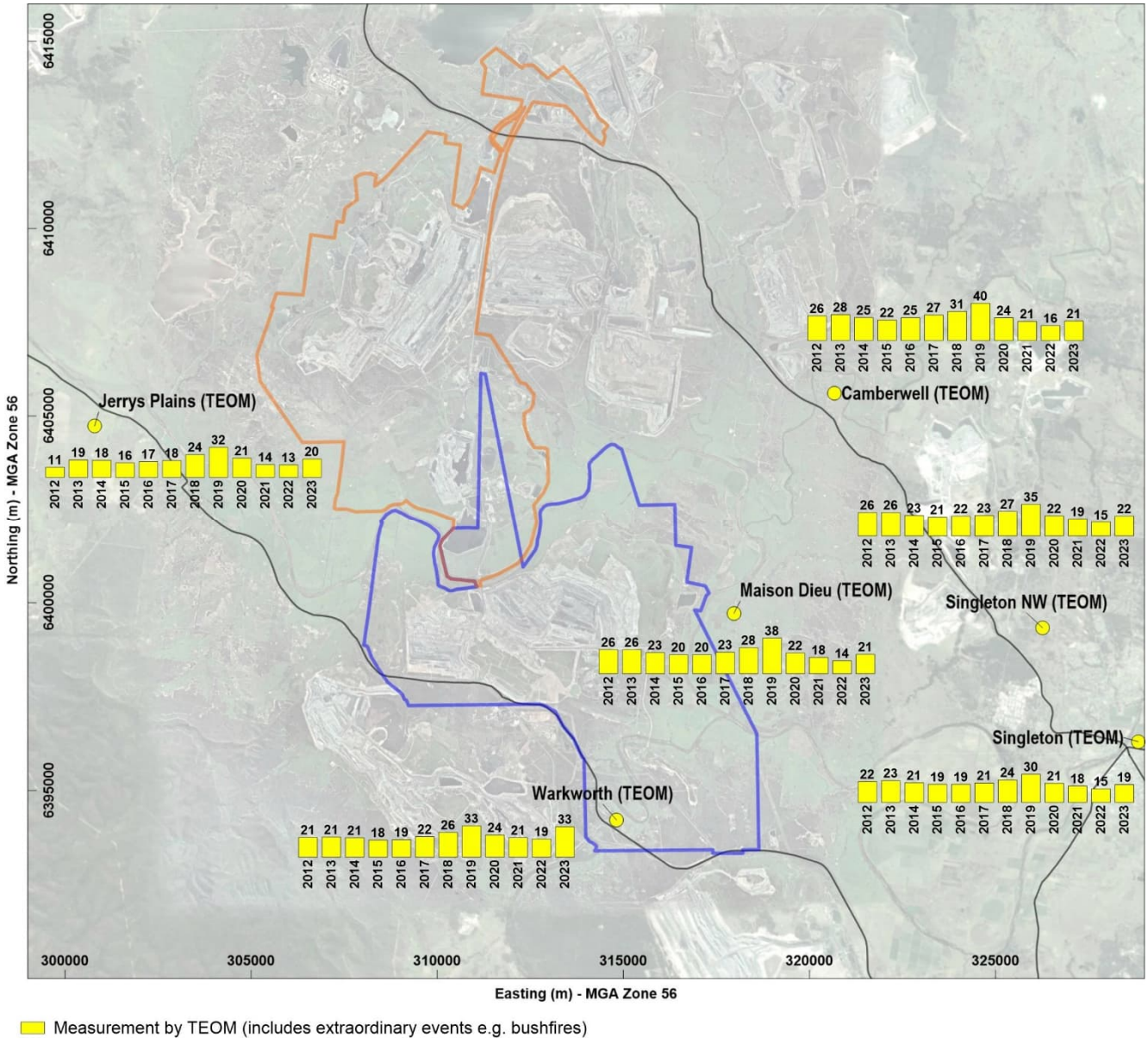

Figure 8 Annual average PM_{10} concentrations (µg/m^3)

5 Air Quality Assessment

5.1 Potential Impacts

The emissions and existing extent of air quality impacts due to the existing HVO North operations have been quantified by PAEHolmes (2010). Changes to air emissions and potential impacts (i.e. ambient concentrations) due to the Modification may, most significantly, result from:

- Changes to coal and overburden haulage distances;
- Changes to the extent of exposed areas;
- Changes to the proximity of emission sources to sensitive receptors;
- Changes to the duration of activities; and
- Background air quality conditions.

Each of these elements has been considered in order to determine whether the Modification will lead to an increased potential for air quality impacts, over the potential that is currently approved. It is relevant to consider the production profile when assessing potential impacts. Figure 9 shows this profile. Production rates associated with the Modification are proposed to stay well below the approved extraction limit of 22 Mtpa.

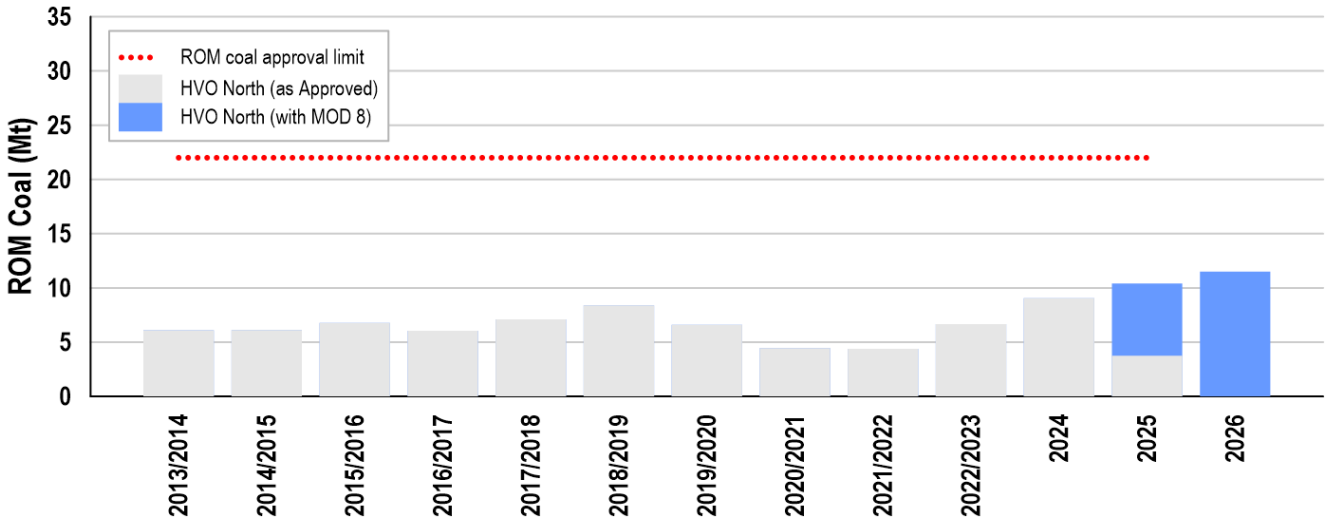

Figure 9 Approved and proposed ROM coal production profile

A risk-based assessment has been undertaken, given that all approved activities will remain consistent under the Modification, including mining methods, approved annual coal extraction rates, coal processing and handling activities, surface infrastructure, employee numbers and hours of operation. The risk assessment was undertaken to identify potential construction hazards, impact pathways, consequences to air quality values and likelihood of impacts. The risk to values was determined as the combination of the consequence and likelihood.

The overall risk assessment process adopted was based on AS/NZS ISO 31000:2018 *Risk management – Guidelines*. Table 3 shows the likelihood rating criteria used for the risk assessment. The determination of the likelihood for each potential hazard was informed by changes due to the Modification and other factors.

Table 3 Likelihood rating criteria

Level	Description
Rare	The event is very unlikely to occur but may occur in exceptional circumstances.
Unlikely	The event may occur under unusual circumstances but is not expected.
Possible	The event may occur once within a five-year timeframe.
Likely	The event is likely to occur several times within a five-year timeframe.

Level	Description
Almost certain	The event is almost certain to occur one or more times a year.

Table 4 shows the consequence rating criteria used for the risk assessment.

Table 4 Consequence rating criteria

Level	Description
Negligible	Undetected changes to ambient air quality, beyond the site boundaries.
Minor	Detected changes to air quality, but no exceedances of air quality criteria beyond the site boundaries. Changes can be managed by mitigation measures (i.e. reversible).
Moderate	Detected changes to air quality, emissions from site cause limited exceedances of air quality criteria beyond the site boundaries e.g. PM_{10} greater than daily criteria less than 5 times in 1 year.
Major	Detected changes to air quality, emissions from site cause exceedances of air quality criteria beyond the site boundaries e.g. PM_{10} greater than daily criteria more than 5 times in 1 year.
Severe	Detected changes to air quality, emissions from site cause exceedances of air quality criteria beyond the site boundaries e.g. PM_{10} greater than daily criteria more than 5 times in 1 year, and emissions from Project cause clearly observed air pollution that causes air quality impacts.

Table 5 shows the risk assessment matrix that was used to determine levels of risk from the likelihood and consequence ratings.

Table 5 Risk matrix

		Consequence rating				
		Negligible	Minor	Moderate	Major	Severe
Likelihood ratings	Rare	Very Low	Very Low	Low	Medium	Medium
	Unlikely	Very Low	Low	Low	Medium	High
	Possible	Low	Low	Medium	High	High
	Likely	Low	Medium	Medium	High	Very High
	Almost certain	Low	Medium	High	Very High	Very High

Table 6 presents the air quality risks. From this assessment it has been concluded that the changes due to the Modification are unlikely to result in an increase in the currently approved air quality impacts of HVO North, based on the "Low" air quality risk, and further, quantitative assessment would not be required. Continued implementation of the mitigation measures in the approved "Air Quality and Greenhouse Gas Management Plan" (HVO, 2019) would be appropriate.

Table 6 Air quality risk assessment

Element	Hazard	Considerations	Risk of increased impacts		
			Likelihood	Consequence	Risk
Haulage	Changes to haul distances	Mining associated with the Modification will occur within the existing and approved disturbance area. Haul distances from pit to emplacement areas will remain unchanged to those previously assessed and approved. There will be no change to the machinery used for transporting coal and overburden on haul roads. There will be no change to the hours when machinery transport coal and overburden on haul roads. There will be no change to the maximum approved annual extraction rates of coal and overburden transported on haul roads.	Unlikely	Minor	Low
Wind erosion	Changes to exposed areas	The Modification does not require any additional surface disturbance beyond the areas that have already been assessed and approved to be disturbed. Consequently, emissions from exposed areas are unlikely to increase due to the Modification.	Unlikely	Minor	Low

Element	Hazard	Considerations	Risk of increased impacts		
			Likelihood	Consequence	Risk
Sensitive receptors	Changes to the proximity of mining to sensitive receptors	Mining associated with the Modification will occur within the existing and approved disturbance area. The approved distance from mining to sensitive receptors at Jerrys Plains will not change over the Modification period. The approved distance from mining to sensitive receptors at Maison Dieu will not change over the Modification period. Any potential movement of mining in the Modification period would be within the extent previously approved and would not be significant in the context of distances from HVO North to nearest sensitive receptors, which are at least 5 km to Jerrys Plains and 10 km to Maison Dieu.	Possible	Minor	Low
Duration of activities	Changes in climatic conditions and background air quality conditions	Emissions from mining operations at HVO North will continue for an additional 18 months as a result of the Modification predominantly in 2026. Air quality monitoring in the Hunter Valley (Section 4.2) shows that air quality conditions are strongly correlated to the climatic conditions, and mining contributions can occur from time-to-time. The potential for HVO North to cause an exceedance may increase or decrease depending on climatic factors, such as rainfall. It is not possible to reliably forecast rainfall amounts for the 18-month period of the Modification however the historical rainfall trends (Figure 5) generally show 2 to 3 years of below average rainfall followed by 2 to 3 years of above average rainfall.	Possible	Minor	Low

The HVO North development consent (DA 450-10-2003) does not include criteria for $PM_{2.5}$ however assessments carried out after 2016 are required to consider $PM_{2.5}$, where relevant. Air dispersion modelling is typically used to quantify potential air quality conditions due to existing and proposed sources of $PM_{2.5}$. No air quality modelling has been undertaken specifically for the proposed Modification, as all key activities that are currently approved will remain the same. However, the modelling caried out for the Hunter Valley Operations Continuation Project (EMM, 2022) Air Quality and Greenhouse Gas Assessment Report (Jacobs, 2022) can be used to provide an indication of expected $PM_{2.5}$ levels in the region.

Figure 10 shows the modelled number of days above the 24-hour average $PM_{2.5}$ criterion, and modelled annual average $PM_{2.5}$ concentrations, due to all sources of $PM_{2.5}$ in 2025, the closest year to the proposed Modification timeframe. These results have been adapted from the HVO Continuation Project (Jacobs, 2022). It should be noted that the modelling for the HVO Continuation Project will represent conservative estimates of outcomes for the proposed Modification due to differences in assumed production rates.

Detailed analysis of the modelling for multiple scenarios out to 2044 has been documented by Jacobs (2022) and Airen (2024). These studies, and results from Figure 10, can be used to infer the following conclusions:

- The proposed Modification will not cause exceedances of the EPA criterion for 24-hour average $PM_{2.5}$ at private sensitive receptors not subject to existing air quality acquisition rights.
- The proposed Modification will not cause exceedances of the EPA criterion for annual average $PM_{2.5}$ at private sensitive receptors not subject to existing air quality acquisition rights.

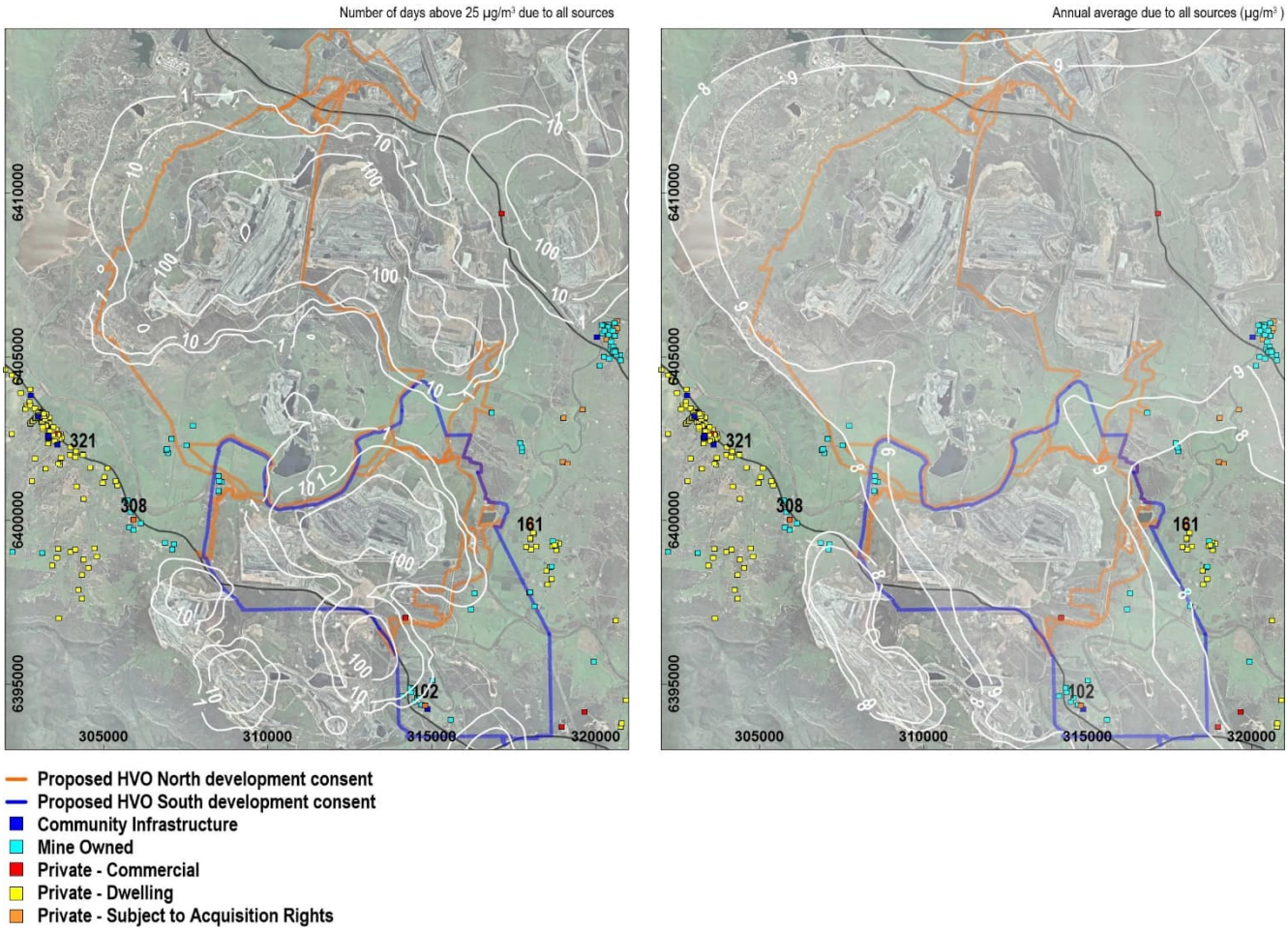

Figure 10 Modelled $PM_{2.5}$ in 2025 from the HVO Continuation Project

5.2 Mitigation Measures

Table 7 summarises the air quality management measures, currently implemented as part of the existing Air Quality and Greenhouse Gas Management Plan, that will continue to be adopted as part of the proposed Modification. In addition to these measures, HVO implements both proactive and reactive dust control strategies. Reactive air quality management include the modification or suspension of activities in response to the visual, meteorological or ambient air quality triggers. These triggers are defined in the HVO Air Quality and Greenhouse Gas Management Plan and are linked to specific actions for managing dust at both private and mine-owned residences.

Table 7 Air quality management measures

Activity	Description
Topsoil stripping	Watering of haul routes Restricting vehicle speeds Modifying operations when visible dust is generated Minimise advance clearing to reduce exposed area for wind erosion
Drilling	Use of water suppression during drilling Dust curtains Ceasing operations when excessive visible dust is sustained.
Blasting	Pre-blast checks including review of meteorological conditions

Activity	Description
Hauling overburden / coal	Watering of haul routes Regular maintenance of haul routes Restricting vehicle speeds Clearly marked haul routes Fleet optimisation to reduce vehicle kilometres travelled
Loading and unloading of overburden	Minimisation of material drop height during loading Having less wind exposed dump locations to use during high wind conditions Modifying or ceasing operations during adverse dust conditions
Unloading coal to ROM hoppers	Water sprays
Handling coal at CHPP	Water sprays
Dozers on coal stockpiles	Modify or cease operations during dusty conditions Reduced travel speed during dusty conditions
Conveyors	Covered / enclosure Belt cleaning Water sprays
Wind erosion	Primary rehabilitation and temporary seeding/ stabilisation of long-term inactive overburden dumps.
Wind erosion from product stockpiles	Water sprays used in adverse wind conditions

The meteorological and air quality monitoring network currently operated by HVO (refer to Section 4) is suitably setup with upwind and downwind monitors to measure the key air quality parameters, compliance with air quality criteria, and to allow for the contribution of mining activities to be determined. This monitoring network will continue to be operated as part of the proposed Modification.

6 Greenhouse Gas Assessment

6.1 Overview

The level of assessment of the proposed Modification has been informed by the draft "NSW EPA Guide for Large Emitters" (EPA 2024a) and draft CCARs (EPA, 2024b). The "NSW EPA Guide for Large Emitters" defines "large" emissions using three criteria, as follows:

- The project requires development assessments and approvals under the *Environmental Planning and Assessment Act 1979*, and
- The project involves one or more scheduled activities under Schedule 1 of the POEO Act and / or will be carried out at an existing licensed premises, and
- The project is likely to emit 25,000 tonnes or more of scope 1 and 2 emissions (CO_2-e) in any financial year during the operational life of the project (based on planned operational throughput and as designed).

The Modification meets the EPA's definition of a "large" emitter, so the "NSW EPA Guide for Large Emitters" is applicable. As per Figure 2, the "NSW EPA Guide for Large Emitters" also notes that the draft CCARs would be applicable to "proposed modifications at existing facilities that are likely to significantly increase or extend the duration of their GHG emissions". However, the term "significantly" is not defined. It is necessary to define "significantly" in the context of the proposed Modification. This is because the assessment requirements are dependent on whether the proposed project "significantly" increases emissions, or "significantly" extends the duration of emissions. The following aspects of the proposed Modification are relevant to determine whether it is likely to "significantly" increase or extend the duration of GHG emissions:

- The proposed production and emissions have previously been approved and the current assessment provides a re-estimation of these previously approved emissions during the proposed additional 18-month period of mining
- Extraction of coal at HVO North is permitted for a period of 21 years (from 12 June 2004 until 12 June 2025). The Modification would represent a relatively modest 7% extension to this extraction period (that is, 18 months).

The Modification is likely to result in more than 25,000 tonnes of scope 1 and 2 emissions (CO_2-e) for only one financial year. Based on the aspects listed above, the Modification meets the definition of a large emitter, but it is unclear whether a 7% extension to the duration of previously approved emissions, expected to be within historical emission rates and intensities, is "significant". Nevertheless, the requirements of the "NSW EPA Guide for Large Emitters" have been addressed. Section 3.3 of the "NSW EPA Guide for Large Emitters" outlines the assessment requirements for projects involving modification of existing facilities. This requires the GHG assessment to include:

- Inventoried emissions by source.
- Mitigation measures and offset strategies being implemented.
- Any obligations under the Safeguard Mechanism.
- Current and planned emissions goals.

Details are outlined below.

6.2 Emissions by Source

The GHG inventory in this document has been calculated in accordance with the principles of the GHG Protocol and the "Technical Guidelines for the Estimation of Greenhouse Gas Emissions by Facilities in Australia" (DEE, 2017). The initial actions for a GHG inventory are to determine the sources of GHG emissions, assess their likely significance and set a boundary for the assessment. Creating an inventory of the likely GHG emissions associated with HVO North has the benefit of determining the scale of the emissions and providing a baseline from which to assess options that may be reasonable and feasible for GHG reduction. The results of this assessment are presented in terms of the previously mentioned 'Scopes' to help understand the direct and indirect impacts of the project.

Table 8 shows the key emission sources that have been considered in this assessment as well as the estimation methodologies.

Table 8 GHG emission sources and estimation methodologies

Activity	Description	Scope(s)	Emission estimation methodology
Diesel usage (on-site equipment)	Combustion of diesel fuel from on-site mobile and stationary plant and equipment	1, 3	Emission factors from NGA Factors (DCCEEW, 2023).
Fugitive	Fugitive emissions from the extraction of coal	1	HVO calculations using Method 2 of Measurement Determination.
Blasting	Detonation of explosives used for blasting	1	Emission factors from NGA Factors (DCC, 2008). Blasting emissions are not reported in the more recent NGA Factors publications.
Electricity	Electricity usage	2, 3	Emission factor projections from DCCEEW (2022).
Transport (rail)	Transport of product coal by rail to port	3	Emission factors from the Department for Environment, Food and Rural Affairs (DEFRA) (2019) for "Freighting goods / freight train".
Transport (shipping)	Transport of product coal by ship to market	3	Emission factors from DEFRA (2019), based on "Freighting goods / cargo ship, bulk carrier". Approximate distance of 8,000 km from port to southeast Asia.
Energy production	Combustion of thermal coal in power generators by end users	3	Emission factors from NGA Factors (DCCEEW, 2023).
Coking coal use	Combustion of semi-soft coking coal by end users for steel production	3	Emission factors from NGA Factors (DCCEEW, 2023).

Table 9 shows the estimated GHG emissions due to all identified GHG generating activities associated with HVO North, other than emissions relating to operations at HVO South which are discussed separately below and shown in Figure 12. However, this table is to be read in conjunction with the HVO South emissions (Table 10 and Figure 12) that are dependent on the Modification. Appendix A which provides details on the calculations. The direct annual GHG emissions from the Modification are estimated to range from 0.17 to 0.24 Mt CO_2-e/y. Total additional (whilst previously approved) Scope 1 emissions for the Modification period are estimated to be 0.41 Mt CO_2-e. The highest incremental annual emission estimate (0.24 Mt CO_2-e) represents approximately 0.06% of Australia's estimated emissions (that is 432.62 Mt CO_2-e for 2022, the latest year of estimates available).

Table 9 Estimated GHG emissions from HVO North

Year	Annual emission (Mt CO_2-e)								
	HVO North (as Approved)*			HVO North (with the Modification)*			Increment of the Modification		
	Scope 1	Scope 2	Scope 3	Scope 1	Scope 2	Scope 3	Scope 1	Scope 2	Scope 3
2024	0.21	0.05	13.69	0.21	0.05	13.69	-	-	-
2025	0.09	0.02	4.48	0.27	0.05	13.81	0.17	0.03	9.33
2026	-	-	-	0.24	0.04	16.87	0.24	0.04	16.87

* at expected extraction rates for the listed years.

Note: excluding emissions associated with HVO South operations, which are discussed separately below.

Figure 11 shows the estimated Scope 1 and 2 GHG emissions from HVO North by source and year. The most significant emissions would likely be due to diesel consumption. The emission intensity is expected to decrease into 2026 with this trend being influenced by a range of factors including a variable fugitive emissions profile, diesel usage per tonne of coal moved and improved emissions from the electricity grid.

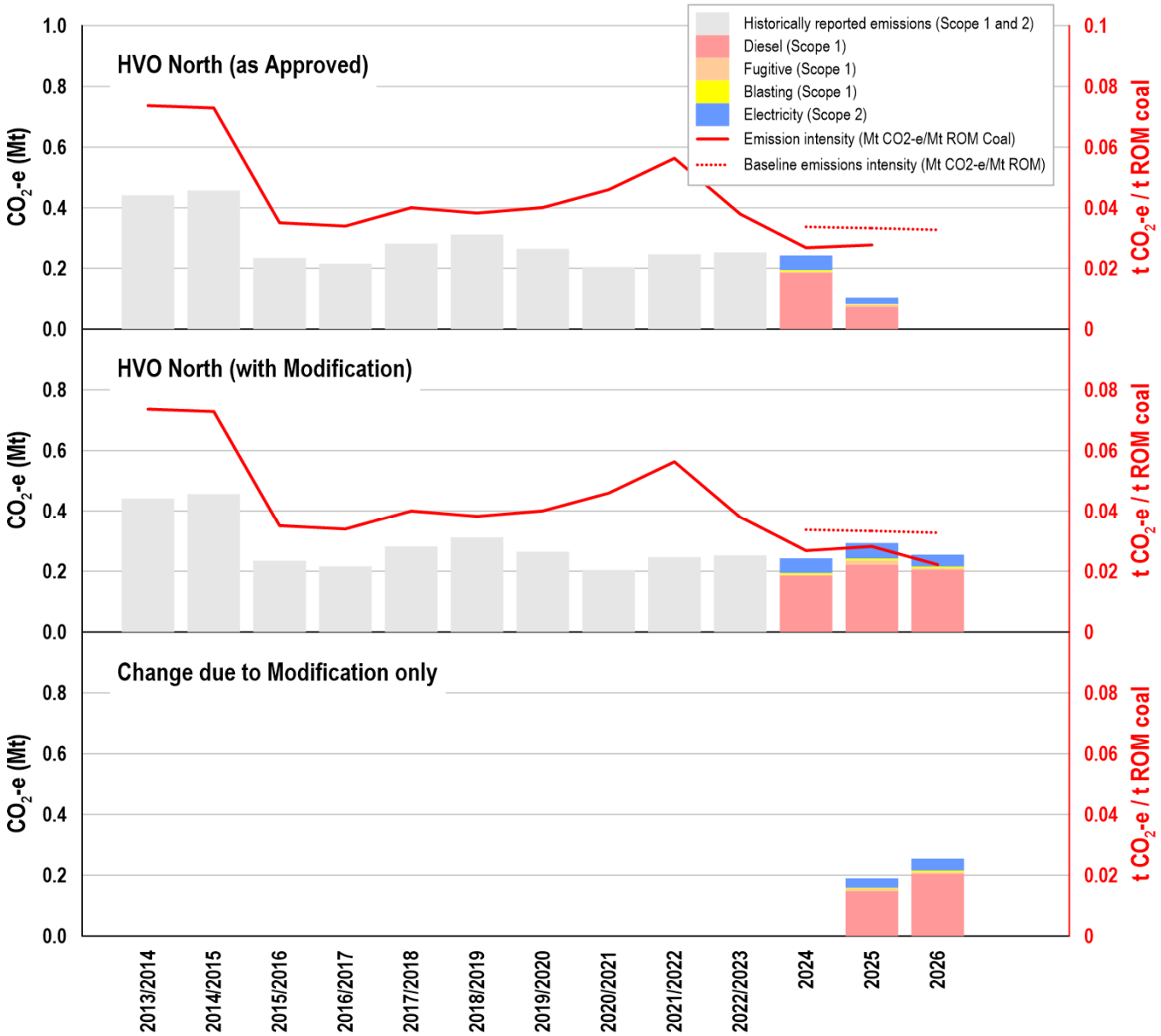

Figure 11 Estimated GHG emissions from HVO North by source

The NGER Act defines facility and corporate group emission thresholds. The facility thresholds are:

- 25,000 t or more CO_2-e (scope 1 and scope 2 emissions);
- production of 100 terajoules (TJ) or more of energy; or
- consumption of 100 TJ or more of energy.

The projected annual emissions of the HVO Complex (including HVO North with the Modification) are likely to exceed the facility emission threshold, so HVO will continue to have an obligation to report emissions from this facility under the NGER Act. The emissions intensity from HVO North with the Modification are expected to be within the range of historically reported emissions intensities. In addition, the Modification proposes an extension of the mine life by 18 months beyond the originally approved 21-year mine life (i.e. 7% extension of time). It is therefore suggested that the proposed Modification will not significantly extend the duration of emissions.

As noted in Section 1, HVO South operates in accordance with its existing Project Approval that permits coal extraction at HVO South through to 24 March 2030 however is reliant on some HVO North infrastructure. That is, coal from HVO South is currently processed at the Hunter Valley (HV) Coal Preparation Plant (CPP) and / or the Howick CPP (both at HVO North), from which product coal is predominantly transported via overland conveyor to the HV load point (HVLP) or Newdell LP and via rail to the Port of Newcastle for export. Given the reliance on the existing HVO North infrastructure, coal extraction at HVO South is unlikely to continue if the

Modification is not approved. Therefore, it is relevant to consider emissions from HVO South as they relate to the HVO North Modification timeframe.

Table 10 and Figure 12 show the estimated GHG emissions from HVO South, for the timeframe of the Modification. The data include the approved HVO South emissions that would be avoided if the Modification was not approved (i.e. from June 2025 onwards) as they are dependent on coal processing and transport through HVO North. The most significant emissions would likely be due to the extraction of coal (i.e. fugitive) and from diesel consumption. It is important to note that the scope of HVO South emissions as they related to HVO North is Scope 3. That is, fugitive, diesel, blasting and electricity related emissions from HVO South will constitute Scope 3 emissions for HVO North Modification. These scopes are identified in Figure 12.

Table 10 Estimated GHG emissions from HVO South

Year	Approved and assessed annual emissions (Mt CO_2-e)					
	Not dependent on the Modification			Dependent on the Modification		
	Scope 1 (Scope 3 for HVO North)	Scope 2 (Scope 3 for HVO North)	Scope 3 (Scope 3 for HVO North)	Scope 1 (Scope 3 for HVO North)	Scope 2 (Scope 3 for HVO North)	Scope 3 (Scope 3 for HVO North)
2024	0.44	0.01	14.96	-	-	-
2025	0.27	<0.005	8.23	0.41	<0.005	11.52
2026	-	-	-	0.74	0.01	18.29

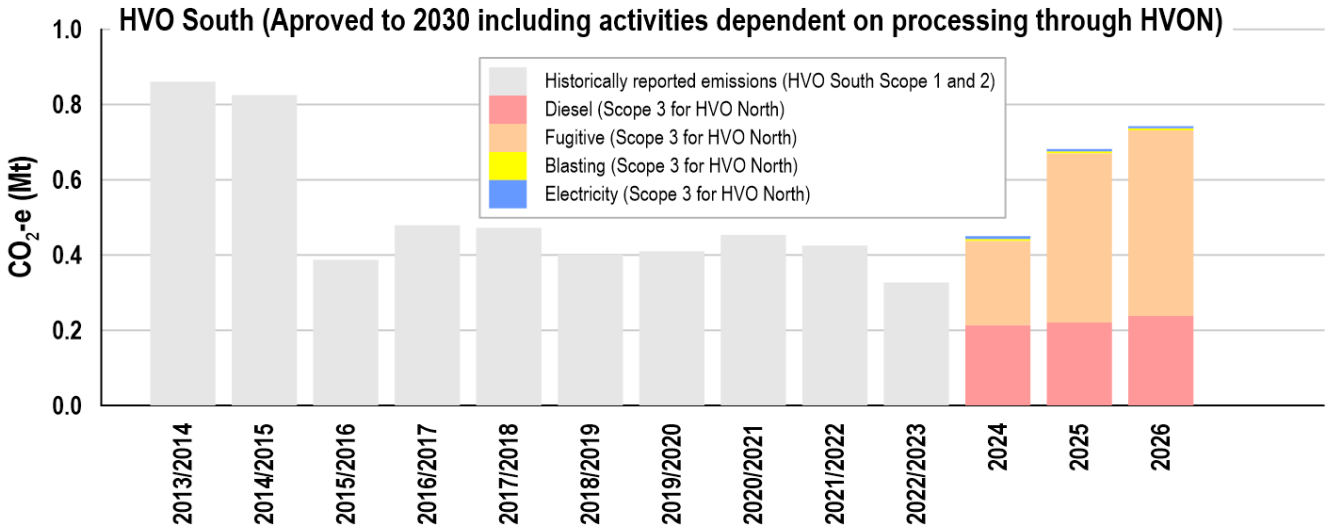

Figure 12 Estimated GHG emissions from HVO South by source

6.3 Mitigation Measures and Offset Strategies

Consideration of mitigation measures and offset strategies are embedded in the business planning processes of the mine. Annual business planning processes forecast GHG emissions, assess the feasibility of mitigation measures, and develop offset strategies where emissions are not feasible to abate.

For example, reducing fuel and electricity usage by mobile plant and fixed equipment is an objective of mine planning and / or good operational practice. The mitigation measures to reduce the level of future GHG emissions from HVO are documented in the Air Quality and Greenhouse Gas Management Plan (which would continue for the Modification) and include:

- Planning and designing of operations to minimise fuel usage and to maximise energy efficiency;
- Maintenance of plant and equipment to minimise fuel consumption and associated emissions; and
- Training staff on improvement strategies to minimise fuel usage and maximise energy efficiency.

HVO contributes to climate change solutions and invests in research and development initiatives to find ways to reduce greenhouse gas emissions throughout the coal chain. These initiatives include regular reviews of technologies and abatement measures to reduce GHG emissions.

For the period of the proposed Modification, HVO North is mining areas with low fugitive emissions which are currently not feasible to mitigate. Also, given the 18-month period of the proposed Modification, there are limited opportunities to implement material and feasible long-term GHG mitigation measures at HVO North, during the Modification period.

6.4 Safeguard Mechanism Obligations

The GHG emissions associated with the proposed Modification have been quantified by source (see Table 8, Table 9 and Appendix A). These results showed that:

- The direct annual GHG emissions from the proposed Modification are estimated to range from 0.17 to 0.24 Mt CO_2-e/y which represents up to approximately 0.06% of Australia's estimated emissions (that is 432.62 Mt CO_2-e for 2022, the latest year of estimates available).
- HVO will continue to have an obligation to report emissions from this facility under the NGER Act.

HVO is a Safeguard facility and will need to reduce its emissions in accordance with the Mechanism's declining baselines. The current estimates of emissions intensity from HVO North during the Modification period are below Safeguard Mechanism emissions intensity levels set for this facility, due to low fugitive emissions for the mining area targeted during the Modification period.

6.5 Current and Planned Emission Goals

HVO is a Safeguard facility and is subject to the declining emissions trajectory required by the Safeguard Mechanism, in support of Australia's NDCs, which are designed to deliver a 43% reduction in emissions (on a 2005 base year) by 2030, and next zero by 2050. As such HVO intends to continue to consider and assess the feasibility of mitigation measures to meet its compliance position under Safeguard or to generate Safeguard Mechanism Credits (SMCs).

HVO's emissions are also incorporated[1] in Glencore's corporate voluntary targets to reduce total emissions by 15% by 2026, 25% by 2030, 50% by 2035, and net zero by 2050 (on a 2019 base year).

[1] Glencore reports its equity share of HVO's emissions

7 Conclusions

This report has provided an assessment of the potential air quality impacts and GHG emissions of the proposed Modification to the HVO North development consent to provide an additional 18 months of mining operations through to 31 December 2026.

The assessment led to the following main conclusions:

- Air quality conditions are strongly correlated to the climatic conditions, and mining contributions occur from time-to-time.
- The changes due to the Modification are unlikely to result in any change in the currently approved air quality impacts of HVO North, other than the continuation of those impacts for a further 18 months, based on a determined "Low" air quality risk.
- The proposed Modification will only involve the extraction of coal that has been previously assessed and approved to be extracted. That is, the proposed Modification will not alter the total GHG emissions previously assessed and approved. However, the proposed extension of time will result in some emissions occurring between June 2025 and December 2026, rather than prior to June 2025 as currently approved.
- The direct (i.e. Scope 1) annual emissions from the Modification are estimated to range from 0.17 to 0.24 Mt CO_2-e/year. Total emissions from HVO North with the Modification are expected to be within the range of historically reported and approved emissions so the Modification would not represent a proposed modification that significantly increases emissions, or significantly extends the duration of emissions. Nevertheless, HVO will continue to have an obligation to report emissions from this facility under the NGER Act, and to manage emissions in accordance with its baseline under the Safeguard Mechanism, and will consider relevant initiatives to reduce greenhouse gas emissions in the timeframe of the proposed Modification.

The potential air quality and GHG impacts will continue to be managed in accordance with relevant approval conditions and with the existing proactive and reactive management processes currently implemented at HVO as outlined in the approved Air Quality and Greenhouse Gas Management Plan (HVO, 2019).

8 References

Airen (2024) “Hunter Valley Operations March 2024 request for additional information from the EPA”. Letter dated 12 April 2024.

DCC (2008) “National Greenhouse Accounts Factors”. Department of Climate Change.

DCCEEW (2022) “Australia’s emissions projections 2022”. Department of Climate Change, Energy, the Environment and Water. December 2022.

DCCEEW (2023) “National Greenhouse Accounts Factors August 2023”. Department of Climate Change, Energy, the Environment and Water.

DEE (2017) “Technical Guidelines for the Estimation of Greenhouse Gas Emissions by Facilities in Australia” Department of Environment and Energy.

DEFRA (2019) “UK Government GHG Conversion Factors for Company Reporting”.

DPE (2020) “Annual Air Quality Statement 2019”. Available from https://www.environment.nsw.gov.au/

EPA (2022) “Approved Methods for the Modelling and Assessment of Air Pollutants in NSW”. August 2022. Published by the Environment Protection Authority.

EPA (2024a) “NSW EPA Guide for Large Emitters”. Draft guideline, May 2024. Published by the Environment Protection Authority.

EPA (2024b) “EPA climate change assessment requirements for large emitters” May 2024, Published by the Environment Protection Authority.

HVO (2019) “Air Quality and Greenhouse Gas Management Plan”. Document number HVOOC-1797567310-2595, effective 12/09/2019.

Jacobs (2022) “Hunter Valley Operations Continuation Project – Air Quality and Greenhouse Gas Assessment”. Prepared for HV Operations Pty Ltd by Jacobs Group (Australia) Pty Ltd. Report dated 9 November 2022.

NEPC (1998 and updates) “Ambient Air – National Environment Protection Measure for Ambient Air Quality”, National Environment Protection Council, Canberra.

NSW Minerals Council (2000) “Particulate matter and mining”.

OEH (2019) “Annual Air Quality Statement 2018”. Available from https://www.dpie.nsw.gov.au/air-quality.

PAEHolmes (2010) “Air Quality Impact Assessment - Carrington West Wing”. Reported prepared by PAEHolmes for Coal & Allied Operations Pty Ltd. Job number 3412. Report dated 24 August 2010.

WRI (2004). “Greenhouse Gas Protocol A Corporate Accounting and Reporting Standard - REVISED EDITION”. The Greenhouse Gas Protocol is a collaboration between the World Resources Institute (WRI) and the World Business Council for Sustainable Development (WBCSD). The Protocol provides guidance on the calculation and reporting of carbon footprints.

Appendix A. Greenhouse gas calculations

HVO North (as Approved)

Diesel usage

			Emission factor (kg CO2-e/kL)			Emissions (t CO2-e/year)			
Year	ROM coal (t)	Usage (kL)	Scope 1	Scope 2	Scope 3	Scope 1	Scope 2	Scope 3	Total
2023	-	-	2709.72	0	667.78	-	-	-	-
2024	9,053,107	69,026	2709.72	0	667.78	187,042	-	46,094	233,136
2025	3,741,298	27,608	2709.72	0	667.78	74,809	-	18,436	93,245
2026	-	-	2709.72	0	667.78	-	-	-	-
2027	-	-	2709.72	0	667.78	-	-	-	-

Fugitive emissions

			Emission factor (t CO2-e/t ROM)			Emissions (t CO2-e/year)			
Year	ROM coal (t)	-	Scope 1	Scope 2	Scope 3	Scope 1	Scope 2	Scope 3	Total
2023	-	-	-	-	-	-	-	-	-
2024	9,053,107	-	-	-	-	2,010	-	-	2,010
2025	3,741,298	-	-	-	-	6,477	-	-	6,477
2026	-	-	-	-	-	-	-	-	-
2027	-	-	-	-	-	-	-	-	-

Blasting emissions

			Emission factor (t CO2-e/t Explosives)			Emissions (t CO2-e/year)			
Year	ROM coal (t)	Explosives (t)	Scope 1	Scope 2	Scope 3	Scope 1	Scope 2	Scope 3	Total
2023	-	-	0.17	0	0	-	-	-	-
2024	9,053,107	31,391	0.17	0	0	5,337	-	-	5,337
2025	3,741,298	12,501	0.17	0	0	2,125	-	-	2,125
2026	-	-	0.17	0	0	-	-	-	-
2027	-	-	0.17	0	0	-	-	-	-

Electricity usage

			Emission factor (kg CO2-e/kWh)			Emissions (t CO2-e/year)			
Year	ROM coal (t)	Usage (kWh)	Scope 1	Scope 2	Scope 3	Scope 1	Scope 2	Scope 3	Total
2023	-	-	0	0.7	0.05	-	-	-	-
2024	9,053,107	81,925,474	0	0.59	0.05	-	48,336	4,096	52,432
2025	3,741,298	41,613,106	0	0.49	0.04	-	20,390	1,665	22,055
2026	-	-	0	0.39	0.03	-	-	-	-
2027	-	-	0	0.34	0.02	-	-	-	-

Transport (Rail)

Factor	kg CO2-e/t.km	0.03333	DEFRA 2019 - Freighting goods - Freight train
Distance	km	150	Assumed distance to port

			Emission factor (kg CO2-e/t)			Emissions (t CO2-e/year)			
Year	Product coal (t)	-	Scope 1	Scope 2	Scope 3	Scope 1	Scope 2	Scope 3	Total
2023	-	-	0	0	5.00	-	-	-	-
2024	6,606,965	-	0	0	5.00	-	-	33,032	33,032
2025	2,369,952	-	0	0	5.00	-	-	11,849	11,849
2026	-	-	0	0	5.00	-	-	-	-
2027	-	-	0	0	5.00	-	-	-	-

Transport (Shipping)

Factor	kg CO2-e/t.km	0.00354	DEFRA 2019 - Freighting goods - Cargo ship, bulk carrier, average
Distance	km	8000	Assumed distance to market

			Emission factor (kg CO2-e/t)			Emissions (t CO2-e/year)			
Year	Product coal (t)	-	Scope 1	Scope 2	Scope 3	Scope 1	Scope 2	Scope 3	Total
2023	-	-	0	0	28.31	-	-	-	-
2024	6,606,965	-	0	0	28.31	-	-	187,056	187,056
2025	2,369,952	-	0	0	28.31	-	-	67,098	67,098
2026	-	-	0	0	28.31	-	-	-	-
2027	-	-	0	0	28.31	-	-	-	-

Energy Production

			Emission factor (kg CO2-e/t)			Emissions (t CO2-e/year)			
Year	ROM coal (t)	Thermal coal (t)	Scope 1	Scope 2	Scope 3	Scope 1	Scope 2	Scope 3	Total
2023	-	-	0	0	2436.48	-	-	-	-
2024	9,053,107	5,444,139	0	0	2436.48	-	-	13,264,535	13,264,535
2025	3,741,298	1,978,910	0	0	2436.48	-	-	4,821,575	4,821,575
2026	-	-	0	0	2436.48	-	-	-	-
2027	-	-	0	0	2436.48	-	-	-	-

Coking coal use

			Emission factor (kg CO2-e/t)			Emissions (t CO2-e/year)			
Year	ROM coal (t)	Coking coal (t)	Scope 1	Scope 2	Scope 3	Scope 1	Scope 2	Scope 3	Total
2023	-	-	0	0	2760.9	-	-	-	-
2024	9,053,107	1,162,826	0	0	2760.9	-	-	3,210,446	3,210,446
2025	3,741,298	391,042	0	0	2760.9	-	-	1,079,628	1,079,628
2026	-	-	0	0	2760.9	-	-	-	-
2027	-	-	0	0	2760.9	-	-	-	-

HVO North (with the Modification)

Diesel usage

			Emission factor (kg CO2-e/kL)			Emissions (t CO2-e/year)			
Year	ROM coal (t)	Usage (kL)	Scope 1	Scope 2	Scope 3	Scope 1	Scope 2	Scope 3	Total
2023	-	-	2709.72	0	667.78	-	-	-	-
2024	9,053,107	69,026	2709.72	0	667.78	187,042	-	46,094	233,136
2025	10,414,173	81,931	2709.72	0	667.78	222,011	-	54,712	276,724
2026	11,503,623	75,863	2709.72	0	667.78	205,568	-	50,660	256,228
2027	-	-	2709.72	0	667.78	-	-	-	-

Fugitive emissions

			Emission factor (t CO2-e/t ROM)			Emissions (t CO2-e/year)			
Year	ROM coal (t)	-	Scope 1	Scope 2	Scope 3	Scope 1	Scope 2	Scope 3	Total
2023	-	-	-	-	-	-	-	-	-
2024	9,053,107	-	-	-	-	2,010	-	-	2,010
2025	10,414,173	-	-	-	-	14,005	-	-	14,005
2026	11,503,623	-	-	-	-	4,345	-	-	4,345
2027	-	-	-	-	-	-	-	-	-

Blasting emissions

			Emission factor (t CO2-e/t Explosives)			Emissions (t CO2-e/year)			
Year	ROM coal (t)	Explosives (t)	Scope 1	Scope 2	Scope 3	Scope 1	Scope 2	Scope 3	Total
2023	-	-	0.17	0	0	-	-	-	-
2024	9,053,107	31,391	0.17	0	0	5,337	-	-	5,337
2025	10,414,173	36,058	0.17	0	0	6,130	-	-	6,130
2026	11,503,623	33,801	0.17	0	0	5,746	-	-	5,746
2027	-	-	0.17	0	0	-	-	-	-

Electricity usage

			Emission factor (kg CO2-e/kWh)			Emissions (t CO2-e/year)			
Year	ROM coal (t)	Usage (kWh)	Scope 1	Scope 2	Scope 3	Scope 1	Scope 2	Scope 3	Total
2023	-	-	0	0.7	0.05	-	-	-	-
2024	9,053,107	81,925,474	0	0.59	0.05	-	48,336	4,096	52,432
2025	10,414,173	104,839,691	0	0.49	0.04	-	51,371	4,194	55,565
2026	11,503,623	101,155,292	0	0.39	0.03	-	39,451	3,035	42,485
2027	-	-	0	0.34	0.02	-	-	-	-

Transport (Rail)

Factor	kg CO2-e/t.km	0.03333	DEFRA 2019 - Freighting goods - Freight train
Distance	km	150	Assumed distance to port

			Emission factor (kg CO2-e/t)			Emissions (t CO2-e/year)			
Year	Product coal (t)	-	Scope 1	Scope 2	Scope 3	Scope 1	Scope 2	Scope 3	Total
2023	-	-	0	0	5.00	-	-	-	-
2024	6,606,965	-	0	0	5.00	-	-	33,032	33,032
2025	7,309,584	-	0	0	5.00	-	-	36,544	36,544
2026	8,140,846	-	0	0	5.00	-	-	40,700	40,700
2027	-	-	0	0	5.00	-	-	-	-

Transport (Shipping)

Factor	kg CO2-e/t.km	0.00354	DEFRA 2019 - Freighting goods - Cargo ship, bulk carrier, average
Distance	km	8000	Assumed distance to market

			Emission factor (kg CO2-e/t)			Emissions (t CO2-e/year)			
Year	Product coal (t)	-	Scope 1	Scope 2	Scope 3	Scope 1	Scope 2	Scope 3	Total
2023	-	-	0	0	28.31	-	-	-	-
2024	6,606,965	-	0	0	28.31	-	-	187,056	187,056
2025	7,309,584	-	0	0	28.31	-	-	206,949	206,949
2026	8,140,846	-	0	0	28.31	-	-	230,484	230,484
2027	-	-	0	0	28.31	-	-	-	-

Energy Production

			Emission factor (kg CO2-e/t)			Emissions (t CO2-e/year)			
Year	ROM coal (t)	Thermal coal (t)	Scope 1	Scope 2	Scope 3	Scope 1	Scope 2	Scope 3	Total
2023	-	-	0	0	2436.48	-	-	-	-
2024	9,053,107	5,444,139	0	0	2436.48	-	-	13,264,535	13,264,535
2025	10,414,173	6,103,502	0	0	2436.48	-	-	14,871,061	14,871,061
2026	11,503,623	6,887,156	0	0	2436.48	-	-	16,780,417	16,780,417
2027	-	-	0	0	2436.48	-	-	-	-

Coking coal use

			Emission factor (kg CO2-e/t)			Emissions (t CO2-e/year)			
Year	ROM coal (t)	Coking coal (t)	Scope 1	Scope 2	Scope 3	Scope 1	Scope 2	Scope 3	Total
2023	-	-	0	0	2760.9	-	-	-	-
2024	9,053,107	1,162,826	0	0	2760.9	-	-	3,210,446	3,210,446
2025	10,414,173	1,206,081	0	0	2760.9	-	-	3,329,870	3,329,870
2026	11,503,623	1,253,690	0	0	2760.9	-	-	3,461,313	3,461,313
2027	-	-	0	0	2760.9	-	-	-	-

HVO South (for the period of the HVO North Modification)

These emissions represent upstream and downstream Scope 3 emissions, from the perspective of the HVO North proposed modification.

Diesel usage

			Emission factor (kg CO2-e/kL)			Emissions (t CO2-e/year)			
Year	ROM coal (t)	Usage (kL)	Scope 3	Scope 2	Scope 3	Scope 3	Scope 2	Scope 3	Total
2023	-	-	2709.72	0	667.78	-	-	-	-
2024	-	-	2709.72	0	667.78	-	-	-	-
2025	6,606,273	46,990	2709.72	0	667.78	127,329	-	31,379	158,708
2026	9,841,948	87,940	2709.72	0	667.78	238,293	-	58,725	297,017
2027	-	-	2709.72	0	667.78	-	-	-	-

Fugitive emissions

			Emission factor (t CO2-e/t ROM)			Emissions (t CO2-e/year)			
Year	ROM coal (t)	-	Scope 3	Scope 2	Scope 3	Scope 3	Scope 2	Scope 3	Total
2023	-	-	-	-	-	-	-	-	-
2024	-	-	-	-	-	-	-	-	-
2025	6,606,273	-	-	-	-	279,665	-	-	279,665
2026	9,841,948	-	-	-	-	492,961	-	-	492,961
2027	-	-	-	-	-	-	-	-	-

Blasting emissions

			Emission factor (t CO2-e/t Explosives)			Emissions (t CO2-e/year)			
Year	ROM coal (t)	Explosives (t)	Scope 3	Scope 2	Scope 3	Scope 3	Scope 2	Scope 3	Total
2023	-	-	0.17	0	0	-	-	-	-
2024	-	-	0.17	0	0	-	-	-	-
2025	6,606,273	16,546	0.17	0	0	2,813	-	-	2,813
2026	9,841,948	31,853	0.17	0	0	5,415	-	-	5,415
2027	-	-	0.17	0	0	-	-	-	-

Electricity usage

			Emission factor (kg CO2-e/kWh)			Emissions (t CO2-e/year)			
Year	ROM coal (t)	Usage (kWh)	Scope 1	Scope 3	Scope 3	Scope 1	Scope 3	Scope 3	Total
2023	-	-	0	0.7	0.05	-	-	-	-
2024	-	-	0	0.59	0.05	-	-	-	-
2025	6,606,273	8,176,450	0	0.49	0.04	-	4,006	327	4,334
2026	9,841,948	14,312,550	0	0.39	0.03	-	5,582	429	6,011
2027	-	-	0	0.34	0.02	-	-	-	-

Transport (Rail)

Factor	kg CO2-e/t.km	0.03333	DEFRA 2019 - Freighting goods - Freight train
Distance	km	150	Assumed distance to port

			Emission factor (kg CO2-e/t)			Emissions (t CO2-e/year)			
Year	Product coal (t)	-	Scope 1	Scope 2	Scope 3	Scope 1	Scope 2	Scope 3	Total
2023	-	-	0	0	5.00	-	-	-	-
2024	-	-	0	0	5.00	-	-	-	-
2025	4,571,271	-	0	0	5.00	-	-	22,854	22,854
2026	6,964,917	-	0	0	5.00	-	-	34,821	34,821
2027	-	-	0	0	5.00	-	-	-	-

Transport (Shipping)

Factor	kg CO2-e/t.km	0.00354	DEFRA 2019 - Freighting goods - Cargo ship, bulk carrier, average
Distance	km	8000	Assumed distance to market

			Emission factor (kg CO2-e/t)			Emissions (t CO2-e/year)			
Year	Product coal (t)	-	Scope 1	Scope 2	Scope 3	Scope 1	Scope 2	Scope 3	Total
2023	-	-	0	0	28.31	-	-	-	-
2024	-	-	0	0	28.31	-	-	-	-
2025	4,571,271	-	0	0	28.31	-	-	129,422	129,422
2026	6,964,917	-	0	0	28.31	-	-	197,191	197,191
2027	-	-	0	0	28.31	-	-	-	-

Energy Production

			Emission factor (kg CO2-e/t)			Emissions (t CO2-e/year)			
Year	ROM coal (t)	Thermal coal (t)	Scope 1	Scope 2	Scope 3	Scope 1	Scope 2	Scope 3	Total
2023	-	-	0	0	2436.48	-	-	-	-
2024	-	-	0	0	2436.48	-	-	-	-
2025	6,606,273	3,954,149	0	0	2436.48	-	-	9,634,206	9,634,206
2026	9,841,948	6,087,337	0	0	2436.48	-	-	14,831,676	14,831,676
2027	-	-	0	0	2436.48	-	-	-	-

Coking coal use

			Emission factor (kg CO2-e/t)			Emissions (t CO2-e/year)			
Year	ROM coal (t)	Coking coal (t)	Scope 1	Scope 2	Scope 3	Scope 1	Scope 2	Scope 3	Total
2023	-	-	0	0	2760.9	-	-	-	-
2024	-	-	0	0	2760.9	-	-	-	-
2025	6,606,273	617,122	0	0	2760.9	-	-	1,703,811	1,703,811
2026	9,841,948	877,580	0	0	2760.9	-	-	2,422,909	2,422,909
2027	-	-	0	0	2760.9	-	-	-	-